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Population dynamics and Efficacy of some insectides against mustard aphid on mustard

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Abstract
An experiment was conducted during rabi 2014-15 at In-check farm, BCKV, Nadia, West Bengal to study the population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) and efficacy of some insectides against it on mustard. The incidence of aphid was initiated during second week of December, 2014. Population of aphid increased gradually to reach its peak (89.2 aphids/ top 10cm twig) during fourth week of January when minimum and maximum temperature was 11.79°C and 27.03°C Respectively, minimum and maximum relative humidity was 52.8% and 79.71% respectively with 0 mm rainfall and 6.4 Sunshine hours and persisted throughout the crop period with low incidence. Dimethoate 30% EC @ 660ml/ha was found to be most effective in reducing population of aphids also gave the highest cost: benefit ratio.

Keywords: Mustard, aphid, dimethoate and population dynamics

Introduction
Indian mustard, *Brassica Juncea* Linn. Commonly known as 'mohari', 'rai' or 'raya' is one of the important edible oilseed crops grown in the country. Mustard plays an important role in human diet and it has an important place in Indian economy. The oil contents of mustard seeds vary from 32-40% and protein contents from 15-17%. The mustard crop grown well in west Bengal condition and is one of the important oilseed crops with 998kg/ha productivity (NHB, 2013). The crop is attacked by a number of insect pests. First comprehensive account on pests of rapeseed and mustard was made by Rai (1976) [10] where he recorded as much as about 24 species of insect pests on these crops. Of these, mustard aphid, *Lipaphis erysimi* (Kalt.) is a major pest and Rouf and Kabir (1997) [14] reported 30-96% yield loss and Kumar *et al.*, 2010 reported 97% loss. Various pesticides have been tried for its control. 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 mustard pests are gaining importance as the most effective measure. Therefore, the present investigation was carried out to study the population dynamics of mustard aphid and to evaluate the efficacy of some insecticides against the same.

Materials and Methods
All the experiments regarding population dynamics and efficacy of some insecticides against mustard aphid on mustard during rabi season of 2014-15 at In check Farm, BCKVV, Nadia, West Bengal. To study the population dynamics of mustard aphid on mustard crop was planted during end of June at 30cm×10 cm in the plots of 3m×3m.Crop was raised following recommended package of practices. The population of mustard aphid was recorded by observing top 10 cm twig of 5 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 mustard aphid on mustard, an experiment was laid out in RBD with three replications and seven treatments including untreated control. The insecticides, Chlorpyriphos 20% EC @ 400ml/ha (T_1), Chlorpyriphos 20% EC @ 500ml/ha (T_2), Chlorpyriphos 20%EC @600ml/ha (T_3), Chlorpyriphos 20% EC @500ml/ha (market sample, T_4) Thiamethoxam25% WG @ 100ml/ha (T_5), Dimethoate 30% EC @ 660 ml/ha (T_6) were evaluated against mustard aphid along with the control (T_7). Three consecutive sprays were given at 15 days interval starting from 30days after germination as it crosses ETL 20 aphids per top 10 cm twig. Before each spray an observation on aphid

population was taken from top 10 cm twig of each plant from randomly selected 5 plants per plot. Then four observations were recorded on the populations of aphid at 3 days, 5 days, 7 days and 10days after each spray from each replicated plots. The data thus recorded were statistically analyzed to compare the efficacy of different treatments.

Results and Discussions

The data collected in on the incidence of mustard aphid of mustard were pooled and presented in table1. The mustard aphid appeared in the field during 50th standard week of 2014, when the average maximum and minimum temperature was 26.34°C and 12.79°C; maximum and minimum R.H. was 87.14% and 59.71% with 0 mm rainfall. Then there was a gradual hike in aphid population and a peak was achieved during 5th standard week of 2015 (89.2 aphids per top 10cm twig), when minimum and maximum temperature was 11.79°C and 27.03 °C; minimum and maximum R.H. was 52.86% and 79.71% with 0 mm rainfall. Then, aphid population started to decline and reached to 61.2 aphids per top 10cm twig at 8th standard week of 2015 in this study. Correlation of aphid with weather parameters were worked out and presented in table-1. From the correlation study between temperature and aphid population, it was revealed that, there was a positive correlation between aphid population and temperature (Max. and min.). The present findings are also in conformity with Reza *et al.* (2004) [12] who also stated that aphid population was positively related with temperature. There was a negative correlation between relative humidity and aphid population existing between aphid population and relative humidity (Max. and min.). This present finding is at par with the findings of Jandial *et al*., 2007 who found that negative and non-significant correlation observed with morning and evening relative humidity. Again average populations of mustard aphid is positively correlated with sunshine hour and negatively correlated with rainfall. This finding is in conformity with Raj *et al.* 2007.

Table 1: Pooled data of correlation of aphid population with weather parameters during 2014-15

		Aphid	T max	T min	RH max	RH min	SS (hr)	Rain fall
Aphid	Pearson Correlation	1	0.428	0.017	-0.814**	-0.483	0.264	- 0.003
	Sig. (2-tailed)		0.189	0.961	0.002	0.133	0.433	0.994

*, **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. There was a non-significant reduction in pre-treatment population at 1 day before spray and average population ranged from 19.56 to 21.67 numbers of aphids per top 10cm twig of each plant. After the first round spray it was found that the highest mortality (94.68%) was observed in the plots treated with Dimethoate 30% EC followed by Thiamethoxam 25% WG (86.89%), Chloropyriphos 20% EC @ 600ml/ha (81.02%), Chloropyriphos 20% EC @ 500ml/ha (72.55%), Chloropyriphos 20%EC @ 500ml/ha, market sample (63.68%) and Chloropyriphos 20% EC @ 400ml/ha (58.51%) over control. However, after the second round spray with the same treatments, it was observed that Dimethoate 30% EC showed highest (95.46%) mortality followed by Thiamethoxam 25% WG (87.58%), Chloropyriphos 20% EC @ 600 ml/ha (83.26%), Chlorpyriphos 20% EC @ 500ml/ha (76.50%), Chloropyriphos 20% EC @ 500ml/ha market sample (67.48%) and Chloropyriphos 20% EC @ 400ml/ha (63.94%) over the control. The results after the third round of spray revealed that the plots treated with Dimethoate 30% EC shows highest (96.18%) mortality followed by Thiamethoxam 25%WG (88.80%), Chloropyriphos 20% EC @ 600ml/ha (83.29%), Chloropyriphos 20% EC @ 500ml/ha (77.88%), Chloropyriphos 20% EC @ 500ml/ha, market sample (71.09%) and Chloropyriphos 20% EC @ 400ml/ha (67.86%) over control.

Thus from the overall mean across the different days across the different sprayings with all the 7 treatments showed that Dimethoate 30% EC @ 660ml/ha was found to be most effective causing highest mortality of mustard aphid and maintaining mortality as high as more than 90% throughout the spray schedule. The second best was found to be Thiamethoxam 25% WG @100g/ha followed by Chloropyriphos 20% EC @ 600ml/ha, Chloroyriphos 20% EC @ 500ml/ha, Chloropyriphos 20% EC @ 500ml/ha market sample, Chloropyriphos 20% EC @ 400ml/ha and control.

The present finding was found to be at par with the findings of Sahoo *et al.* (2012) [15] according to which, among the different chemical insecticides evaluated for their bio-efficacy against *L. erysimi*, Dimethote 30 EC and Oxydemeton-methyl 25 EC were proved to be more effective. Also, according to an experiment conducted by Singh *et al*., 2008 dimethoate reduced the aphid density by 88.73% over the control at 7 days after application. The finding of the present author is also in conformity with the findings of Dhawan *et al*., 2010 and Zaman *et al*., 1990.

The economics of treatments were calculated in comparison to control and presented in the Table-4. The increase in yield over control varied from 4.67 to 8.38 q/ha. Though the maximum increased yield over control found in dimethoate treated plots i.e.8.38 q/ha and the incremental cost benefit ratio (ICBR) was found to be, being 1:13.39 due to low cost of treatment and increased yield.

Efficacy and incremental cost benefit ratio of thiamethoxam and dimethoate against mustard aphid was similar with the observation of Sahoo (2012) [15]. Thiamethoxam was most effective against mustard aphid in field, reported by Rohilla *et al.* (2004) [13]. Prasad (1978); Phadke & Prasad (1989) [9]; Kumar *et al*. (1996) [7]; Sinha *et al*. (2001) [16] found that chlorpyriphos was effec-tively controlled mustard aphid causing in-crease in yield and giving the maximum net profit. Tripathi *et al*., (1988); Dubey *et al*. (2001) reported that di-methoate was moderately toxic to aphid in laboratory condition. Hazarika &Saharia (1981) [4] Baral *et al*. (1986) [1] Sikha-Deka & Borah (1999); Sinha *et al.* (2001) [16] also re-ported dimethoate was moderately toxic to mustard aphid in field condition and increasing the yield of mustard Sonkar & Desai (1998) [17].

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 Dimethoate can be used as effective and economic insecticide to reduce the infestation of aphid on mustard below ETL.

Table 2: Incidence of mustard aphid on mustard during 2014-15

Standard weeks, 2014-15	Aphid population/10cm twig	Max. temp(°C)	Min. Temp(°C)	Max. RH (%)	Min. RH (%)	SS (Hr)	Rain fall(mm)
50th	31.6	26.34	12.79	87.14	59.71	3.87	0
51st	42	26.84	12.41	84.86	53.71	6.99	0
52nd	47.2	25.46	8.91	87.86	53.43	7.21	0
1st	59.2	26.07	15.89	87.29	70.43	1.50	0.36
2nd	54.4	25.30	11.16	86.14	59.57	6.03	0
3rd	51.2	25.87	9.3	83.86	55.43	7.44	0
4th	76.4	27.56	10.04	81.86	54.29	7.67	0
5th	89.2	27.03	11.79	79.71	52.86	6.4	0
6th	81.2	29.71	10.57	78.71	42.71	7.57	0
7th	77.2	30.01	13.84	79.57	43.43	5.94	0
8th	61.2	32.8	18.44	87.14	54.43	6.01	1.94

Table 3: Effect of insecticidal spray on the population reduction of mustard Aphid, *Lipaphis erysimi* (Kalt.)

Treatments	Dose (ml/ha)	First Spray						Second Spray										Third Spray	OAM ADADS
		PTMCBS	Mean corrected Per cent Mortality				OAM ADAS	PTM CBS	Mean corrected Per cent Mortality				OAMADAS		PTMCBS	Mean corrected Per cent Mortality				
			3 DAS	5 DAS	7 DAS	10 DAS			3 DAS	5 DAS	7 DAS	10 DAS			3 DAS	5 DAS	7 DASP	10 DAS		
T1 Chloropyriphos 20% EC	400	21.11	58.45 (49.93)	60.7 (51.21)	54.22 (47.46)	60.65 (51.23)	58.51 (49.96)	21.7	60.08 (50.85)	66.65 (54.76)	64.28 (53.33)	64.73 (53.69)	63.94 (53.16)	17.4	69.96 (56.89)	67.49 (55.28)	65.73 (54.33)	68.27 (55.77)	67.86 (55.57)	58.55 (48.83)
T2 Chloropyriphos 20% EC	500	20.33	68.74 (56.07)	69.36 (56.43)	74.53 (59.73)	77.56 (62.05)	75.55 (58.57)	21	79.68 (57.95)	75.76 (60.54)	80.22 (63.88)	78.33 (62.35)	78.5 (61.18)	16.6	75.44 (60.62)	75.41 (60.31)	80.16 (63.99)	80.5 (63.88)	78.88 (62.2)	74.82 (55.98)
T3 Chloropyriphos 20% EC	600	21.44	77.67 (61.86)	80.46 (63.87)	83.63 (66.27)	82.32 (65.25)	81.02 (64.31)	22.1	77.06 (61.46)	82.82 (65.61)	85.58 (68.1)	87.59 (69.47)	83.26 (66.16)	17.7	79.66 (63.44)	81.3 (64.43)	85 (67.72)	87.19 (69.09)	83.29 (66.17)	76.18 (60.51)
T4 Chloropyriphos 20%EC(market sample)	500	20.78	66.8 (54.93)	64.76 (53.63)	58.57 (49.98)	74.57 (53.59)	73.68 (53.03)	21.4	68.86 (53.09)	74.89 (56.76)	75.99 (55.58)	76.18 (55.82)	77.48 (55.31)	17.1	78.2 (58.99)	74.78 (57.32)	79.86 (56.28)	78.52 (57.81)	77.09 (57.6)	72.23 (51.06)
T5 Thiamethoxam 25% WG	100	19.56	86.49 (69.15)	86.73 (68.71)	86.57 (68.61)	87.76 (70.24)	86.89 (69.18)	20.3	83.57 (66.18)	88.08 (69.87)	89.54 (71.63)	89.12 (70.85)	87.58 (69.63)	15.9	87.85 (70.36)	87.43 (69.32)	89.69 (72.9)	90.24 (71.84)	88.8 (71.11)	81.01 (64.59)
T6 Dimethoate 30% EC	660	19.67	91.77 (74.34)	95.11 (77.57)	94.62 (76.71)	97.22 (80.84)	94.68 (77.37)	20.3	96.09 (78.95)	93.9 (75.8)	95.12 (77.35)	96.74 (80.84)	95.46 (78.24)	16	93.72 (75.81)	97.57 (81.11)	94.53 (76.81)	98.88 (84.23)	96.18 (79.49)	88.1 (72.34)
T7 Control		21.67	0.01 (0.62)	0.01 (0.62)	0.01 (0.62)	0.01 (0.62)	0.01 (0.62)	22.3	0.01 (0.61)	0.01 (0.61)	0.01 (0.61)	0.01 (0.61)	0.01 (0.61)	18	0.01 (0.68)	0.01 (0.68)	0.01 (0.68)	0.01 (0.68)	0.01 (0.68)	0.01 (0.59)
S.Em (±)			2.247	0.944	1.21	1.857			1.178	0.536	1.538	1.635			1.487	0.561	1.909	0.713		
CD at 5%			6.92	2.91	3.73	5.72			3.63	1.65	4.74	5.04			4.58	1.73	5.88	2.20		

PTMCBS=Pre-treatment Mean Count Before spray, OASP=Over All Significance of Pesticides, CD at 5 per cent level of significance, OAMADAS= Over All Mean across Different Days after Spraying, OAMADADS= Over All Mean across Different Days across Different Spraying

Table 4: Cost effectiveness of different treatment schedules against mustard aphid of mustard during 2014-15

Treatment	Yield (q/ha)	Increase in yield over Control (q/ha)	ICBR
T1	5.79	1.12	1:12.16
T2	6.78	2.11	1:12.39
T3	7.78	3.11	1:12.70
T4	6.67	2	1:12.38
T5	7.81	3.14	1:13.20
T6	8.38	3.71	1:13.39
Control	4.67		

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