



## BOTANICAL BASED MANAGEMENT OF MUSTARD APHID (*LIPAPHIS ERYSIMI* KALT.) POPULATION CAUSING MAJOR DAMAGE OF MUSTARD (*BRASSICA JUNCEA* L.) PLANTS AT WEST BENGAL, INDIA

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### ABSTRACT :

Mustard aphids (*Lipaphis erysimi* Kalt.) is one of the major pest of mustard plant which causes large scale loss of oilseed yielding in West Bengal. Management of mustard aphid population was studied using botanicals in the present work during the winter season (November-February) of 2014-2017. The effect of three different botanicals (*Azadirachta indica*, *Eucalypta globules* and *Carica papaya* leaf extracts) on mustard aphid's population alone and in combination with commonly used pesticide at reduced dose (dimethoate (rogor) @200ml/acre) were examined at field condition. The pesticide at recommended dose at 400ml/acre was used as control. The plants pretreated together with dimethoate @200ml/acre and *Azadirachta indica* leaf extract showed significant reduction of mustard aphid population (71.42% and 91.75% at 3DAS and 10DAS respectively) followed by *Eucalypta globulus* leaf extract (67.18% and 81.63% at 3DAS and 10DAS respectively) and *Carica papaya* leaf extract (65.37% and 80.92% at 3DAS and 10DAS respectively) in combination with dimethoate @200ml/acre. In untreated control (spraying with sterile distilled water) showed gradual increase of mustard aphids during experiments. Mustard plants pretreated together with dimethoate@200ml/acre and *Azadirachta indica* leaf extract showed highest oilseed yield (1285kg/acre) with net income Rs.28771 followed by *Carica papaya* leaf extract (1120kg/acre) with net income Rs.24021 and *Eucalypta globulus* (1108kg/acre) in combination with dimethoate @200ml/acre net income Rs.23861. The highest BCR (2.94) was obtained from dimethoate@200ml/acre supplemented with *Azadirachta indica* leaf extract pretreated plots. Untreated control plots showed lowest BCR (1.33).

**KEYWORDS :** Rapeseed Mustard, Aphid, Pesticide, Botanical, Mustard plant.

### INTRODUCTION

Indian mustard (*Brassica juncea* L.) is the major oilseed yielding cash crop of Northern part of West Bengal popularly known as North Bengal covering about 410.793 thousand hector land with total production 419.58 thousand tones and average productivity 1021 kg/hector in West Bengal (Anonymous 2011). It is reported that India being the world's third major mustard producing country after China and Canada (FAO 2009). Indian mustard plants are exposed to different 38 insect pests, which are reported to be associated



with reduction of oilseed yielding in India (Bakhetia & Sekhon 1989). Mustard aphid, *Lipaphis erysimi* (Kalt.) is the major destructive insect pests in North Bengal with quantitative and qualitative reduction of oilseed yielding. Mustard aphids cause 35.4 to 96 % yield loss, 30.9% oilseed weight loss and 2.75% oil production loss (Bakhetia & Sekhon 1989, Singh & Prem-chand 1995, Bakhetia & Arora 1986). Mustard plants are infested at all the stages by mustard aphid. Both nymph and adults

suck the cell sap from leaves, flowers, flower buds, pod and twigs of the mustard plants. They also secrete sticky good amount of honey dew which facilitates the growth of sooty mold fungus that makes the leaves and pods dirty black (Awasthi, 2002). In course of infestation of mustard aphid on mustard plants leaves and pod become curled, the young infested pods fail to mature and produce immature seeds, and most of the plants fail to develop pods resulting in the plant shows stunted growth, flowers wither and pod formation is hindered (Morzia and Huq, 1991) (**Figure -1**). Severe infestation of the aphid pest can sometimes cause complete loss of oilseed yielding, and plants often fail to bear siliqua or end up with very poor pods (Das and Islam, 1986). Farmers indiscriminately spray synthetic chemical pesticides to control mustard aphid population which causes resistance races of the pest due to their rapid reproduction and growth, polymorph nature and wide adaptation. In addition the synthetic chemical pesticides have deleterious effect on beneficial insects, birds and every naturally growing population (McIntyre *et al.*, 1989; Iqbal *et al.*, 2007; Newton, 1995). So, it is necessary to find out ecologically sound and environmentally safety control measures of pest and pathogens. Botanical pesticides are comparatively less expensive; perform low toxicity, naturally available, less hazardous, biodegradable and also safe for beneficial organisms. The present study was conducted to find out the relative effectiveness of three botanicals and commonly used insecticides to control the mustard aphid population.

### MATERIALS AND METHODS

The experiment was conducted at mustard cultivated areas of Uttar Dinajpur, West Bengal, India during the winter season (November-February). Mustard seeds were sown on November 15, 2014 in 3m X 4m size plots with three replications. Fertilization and irrigation were done uniformly for raising the plants as per recommendation of Indian Agriculture Research Institute (ICAR), New Delhi. Three different plants locally available namely Neem (*Azadirachta indica* A. Juss; family-Meliaceae), Tasmanian blue gum (*Eucalyptus globulus* Labill.; family-Myrtaceae) and Papaya (*Carica papaya* L.; family- Caricaceae) are use as botanicals to control mustard aphid population. Eight different treatments/spraying were performed on mustard plants in different plots with three replication for each on January 15, 2015 namely- T1= Dimethoate (Rogor)@400ml/acre; T2= *Azadirachta indica* leaf extract; T3= Dimethoate@200ml/acre + *Azadirachta indica* leaf extract; T4= *Eucalyptus globulus* leaf extract; T5= Dimethoate@200ml/acre + *Eucalypta globulus* leaf extract; T6= *Carica papaya* leaf extract; T7= Dimethoate@200ml/acre + *Carica papaya* leaf extract; T8= Untreated Control (spraying with sterile distilled water). Five hundred gram (500g) of botanicals leaf extracts were crushed separately and added to 10litre sterile distilled water and kept overnight and sieved with fine muslin cloth. Then the supernatants were used for different treatments. Four hundred millilitre (400ml) commonly used pesticides, Dimethoate (rogor) added to 10litre water for direct spraying and 200ml Dimethoate added to 10ml botanical extract for combined spraying on mustard plants. Treatments were evaluated against mustard aphid on different plots under field condition. Randomly 5 mustard plants were selected per plot for counting mustard aphid populations. Both nymph and adult population was counted on the twigs or inflorescence of mustard plant following 3DAS (Day After Spray), 7DAS and 10DAS in all the treatments. One control was maintained without treatment (spray with sterile distilled water). The mustard oilseed was harvested on 10<sup>th</sup> of February 2015. Oilseed yield of different treatment were recorded. Data were compiled and analyzed statistically by using computer based software.

### RESULTS AND DISCUSSIONS

During our field survey years 2013-14 and 2014-15, appearance of mustard aphid was recorded from initial appearance to highest peak. It is mentionable that no mustard aphid was found to encounter mustard plant up to third week of December 2014. It was first found to encounter mustard plant on first week of January 2015 at the time of inflorescence and pod formation, and reached the height peak on second week of February in all the years. The height population of mustard aphid was found 16/cm apical twig of mustard plant on second week of January 2015 and then declined gradually. No mustard aphid was found to encounter mature mustard pod and siliqua on first week of February 2015. The correlation coefficient

between aphid population and weather parameters could not establish a clear cut trend in relationship of aphid population with weather factors (Sahoo, 2012). Moreover, the aphid population reached peak level during flowering stage of mustard plants. The observations are in conformity with the findings of Choudhury & Pal (2009), Singh & Lal (1999) Biswas and Das (2000), and Dogra *et al.* (2001) (**Figure-2**).

The significant variation of mustard aphid population was found to encounter before spraying synthetic pesticide and botanicals in range of 12-16/cm apical twig during our experiments. It was found to decline mustard aphid population after spraying pesticide, dimethoate (rogor) @400ml/acre in range of 6/cm and 3.2cm apical twig at 3DAS and 10DAS respectively. Mustard plant treated with *Azadirachta indica* leaf extract showed aphid population 6.3/cm apical twig at 7DAS followed by *Eucalypta globulus* and *Carica papaya* leaf extract. Percent of mustard Aphid population reduction over pretreatments with *Azadirachta indica* leaf extract at 10 DAS were 68 followed by *Eucalypta globulus* and *Carica papaya* leaf extract for 56 and 64 percent respectively. The plants treated together with dimethoate (rogor) @200ml/acre and *Azadirachta indica* leaf extract showed significant reduction of mustard aphid population (4.5/cm and 1.2/cm apical twig at 3DAS and 10DAS respectively) followed by dimethoate (rogor) @200ml/acre and *Eucalypta globulus* leaf extract (5.2/cm and 2.8/cm apical twig at 3DAS and 10DAS respectively) and dimethoate (rogor) @200ml/acre and *Carica papaya* leaf extract (5.5/cm and 2.9/cm apical twig at 3DAS and 10DAS respectively) in all the treated plots (Table---). Percent of mustard Aphid population reduction over combined pretreatment of dimethoate (rogor) @200ml/acre with *Azadirachta indica* leaf extract were 91 followed by *Eucalypta globulus* and *Carica papaya* leaf extract for 81 and 80 percent respectively (**Table-1 and 2**).

In untreated control (spraying with sterile distilled water) showed gradual increase of mustard aphid during the entire experiments. Mustard plants treated together with Dimethoate and *Azadirachta indica* leaf extract showed highest rapeseed yield (1285kg/acre) with net income Rs.28771 followed by Dimethoate@200ml/acre and *Carica papaya* leaf extract (1120kg/acre) with net income Rs.24021 and Dimethoate@200ml/acre and *Eucalypta globulus* (1108kg/acre) with net income Rs.23861. The significantly lowest rapeseed yield was obtained from untreated plots due to higher infestation of mustard aphid. The highest BCR (2.94) was obtained from Dimethoate@200ml/acre and *Azadirachta indica* leaf extract treated plots followed by Dimethoate @200ml/acre and *Eucalypta globulus* leaf extract treated plots (2.54) and Dimethoate @200ml/acre and *Carica papaya* leaf extract treated plots (2.50). Untreated control plots showed lowest BCR (1.33) (**Table-3**).

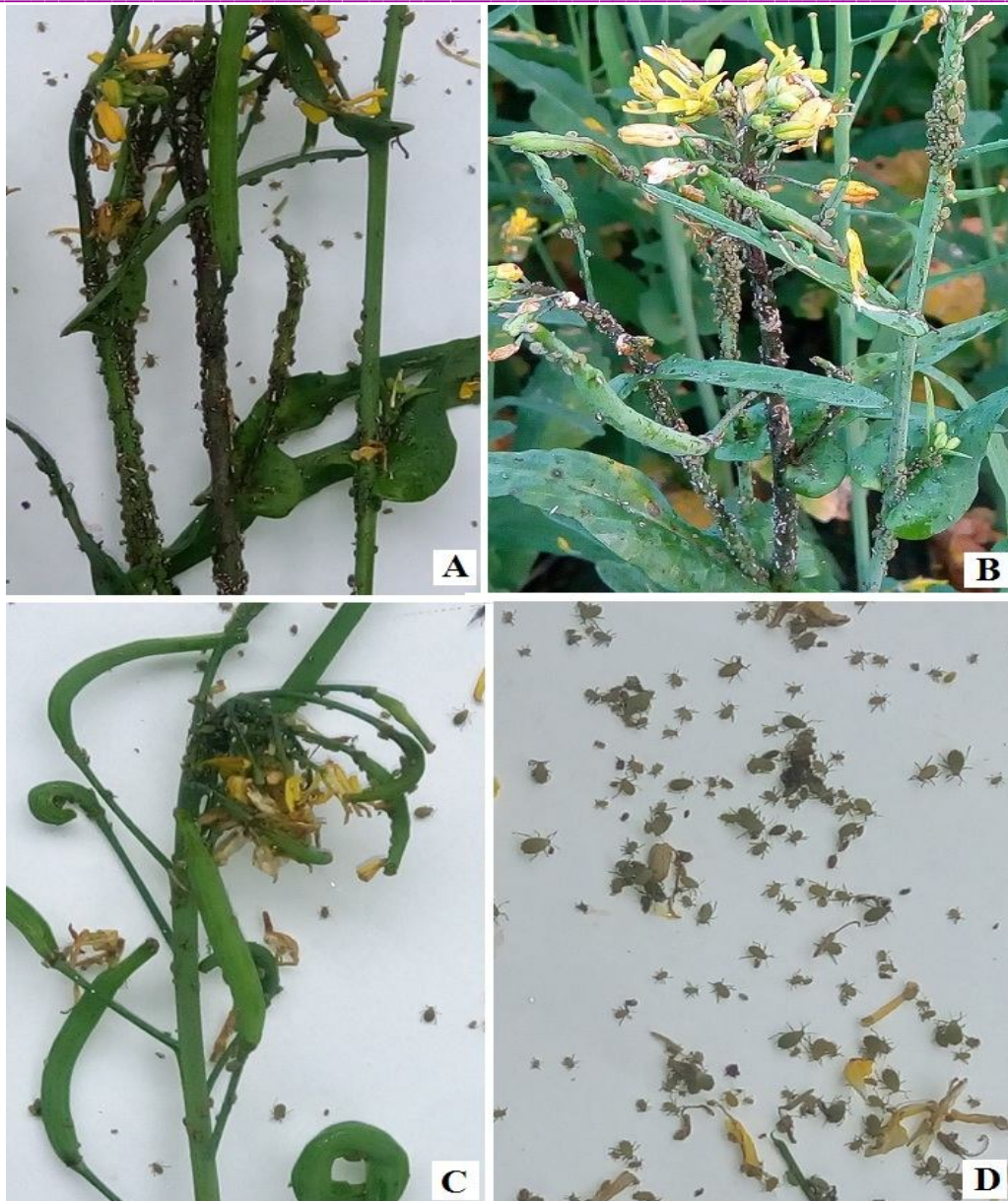
## CONCLUSION

Infestation of mustard aphid can be managed by adopting foliar spraying of *Azadirachta indica* leaf extract as bio-pesticides in combination with reduced dose synthetic pesticides (Dimethoate @200ml/acre) during third week of December 2014 at the time of inflorescence and pod formation.

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**Figure-1: Infestation of Indian mustard (*Brassica juncea* L.) by mustard aphids (*Lipaphis erysimi*) at West Bengal:** A-Both nymph and adults suck the cell sap of leaves, flowers, flower buds, pod and twigs of the mustard plants; B- Secretion of sticky honey dew to facilitate growth of sooty mold fungus; C-Curling of pod and inflorescence; D- Mustard Aphids

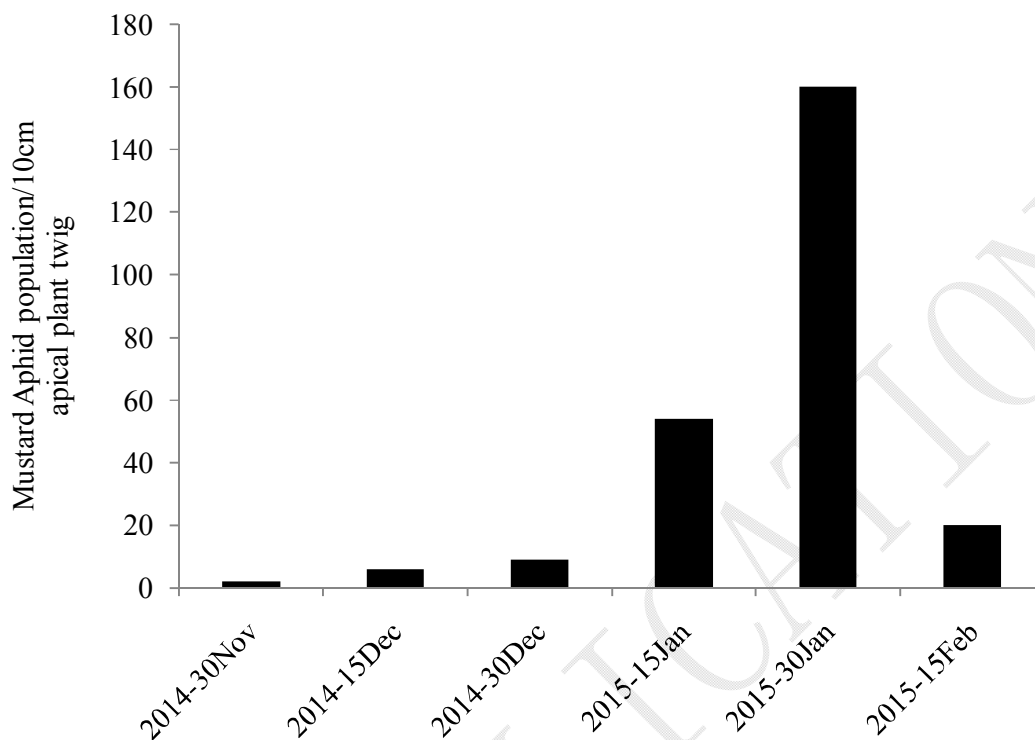


Figure-2: Showing mustard Aphid population on apical twig of mustard plants during the winter season (November-February) at West Bengal, India

Table-1: Efficacy of some botanicals against mustard aphid (*Lipaphis erysimi*) population reduction on Indian mustard plants (*Brassica juncea* L.) during winter 2014-2015 at West Bengal, India

	Treatments/Spraying	Mustard Aphid population/10cm apical plant twig			
		Before Spray	3 DAS	7 DAS	10 DAS
T1	Dimethoate (Rogor) @400ml/acre	125.4	60.8	54.5	32.7
T2	<i>Azadirachta Indica</i> leaf extract	127.6	78.5	63.4	48.5
T3	Dimethoate @200ml/acre + <i>Azadirachta Indica</i> leaf extract	130.2	45.8	32.5	12.8
T4	<i>Eucalyptus globulus</i> leaf extract	126.7	82.7	72.6	67.6
T4	Dimethoate @200ml/acre + <i>Eucalypta indica</i> leaf extract	122.5	52.6	46.9	28.5
T6	<i>Carica papaya</i> leaf extract	129.6	75.9	77.8	54.8
T7	Dimethoate @200ml/acre+ <i>Carica papaya</i> leaf extract	127.8	55.5	34.6	29.6
T8	Control (Spraying water)	125.7	160.3	145.6	155.2
	SEm (±)	0.17	0.13	0.24	0.17
	CD (P=0.05)	NS	0.28	0.41	0.34

**Table 2: Percentage efficacy of some botanicals against mustard aphid (*Lipaphis erysimi*) population on Indian mustard plants (*Brassica juncea* L.) during winter 2014-2015 at West Bengal, India**

	Treatments/Spraying	Percent of mustard Aphid population reduction			
		Before Spray	3 DAS	7 DAS	10 DAS
T1	Dimethoate (Rogor) @400ml/acre	0	62.07	62.56	78.93
T2	<i>Azadirachta Indica</i> leaf extract	0	51.02	56.45	68.75
T3	Dimethoate @200ml/acre + <i>Azadirachta Indica</i> leaf extract	0	71.42	77.67	91.75
T4	<i>Eucalyptus globulus</i> leaf extract	0	48.4	50.13	56.44
T4	Dimethoate @200ml/acre + <i>Eucalypta indica</i> leaf extract	0	67.18	67.78	81.63
T6	<i>Carica papaya</i> leaf extract	0	52.65	46.56	64.69
T7	Dimethoate @200ml/acre + <i>Carica papaya</i> leaf extract	0	65.37	76.23	80.92
T8	Control (Spraying water)	0	2.3	4.3	2.8
	SEm (±)	0	0.17	0.18	0.21
	CD (P=0.05)	NS	0.18	0.36	0.25

Mean were recorded on average of 15 plants

DAS=Days after Spraying

NS-No Significant

**Table 3: Economics of botanicals in combination with pesticides spraying against mustard aphid's population control on Indian mustard plants during winter 2014-2015 at West Bengal, India**

	Treatment	Oilseed Yield over pretreatment (kg/hector)	Percent of yield increase over pretreatment (kg/hector)	Gross Income	Cost of insecticide, botanical and labour etc.	Additional Cost	Management Cost	Net Income (Rs.)	BCR
T1	Dimethoate (Rogor) @400ml/acre	1040	42.46	31200	2178	7000	9178	22022	2.39
T2	<i>Azadirachta Indica</i> leaf extract	860	17.8	25800	1965	7500	9465	16335	1.72
T3	Dimethoate @200ml/acre + <i>Azadirachta Indica</i> leaf extract	1285	76.02	38550	2079	7700	9779	28771	2.94
T4	<i>Eucalyptus globulus</i> leaf extract	830	13.69	24900	1965	7500	9465	15435	1.63
T4	Dimethoate @200ml/acre + <i>Eucalypta indica</i> leaf extract	1108	51.78	33240	2079	7300	9379	23861	2.54

T6	<i>Carica papaya</i> leaf extract	840	15.06	25200	1965	7900	9865	15335	1.55
T7	Dimethoate @200ml/acre + <i>Carica papaya</i> leaf extract	1120	53.42	33600	2079	7500	9579	24021	2.50
T8	Control (Spraying water)	530	0	15900	0	6800	6800	9100	1.33

BCR=Net income ÷ Management cost

Price of 100ml Dimethoate (v/v) 30% = Rs. 57.00

Price of Mustard seed = Rs. 30.00/Kg

Average cost of Botanicals = Rs. 15.00/kg

Cost of labour Rs. 250./labour /day, Six labours are being required for 1 hector of crop yield

100ml Dimethoate 30% (v/v) Rs.57.00

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