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## Effect of intercropping on aphid (*Lipaphis erysimi* Kalt.) and beneficial insects in mustard crop

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### Abstract

Mustard (*Brassica juncea*) is a winter season crop which ranks second after Ground nut not only in area but also in production. There are many insect pests of mustard crop like mustard aphid, sawfly and mustard leaf eating caterpillar. Among them, mustard aphid, *Lipaphis erysimi* (Homoptera: Aphididae) is the most destructive one. Many scientists proved that intercropping of mustard with spice crops, potato, and pulses reduces the incidence of major insect pests such as mustard aphid, flea beetle and saw fly. The present experiment was conducted in SHUATS field with following treatments T<sub>0</sub>-Mustard, T<sub>1</sub>-Mustard +Wheat, T<sub>2</sub>-Mustard+Onion, T<sub>3</sub>-Mustard+Garlic, T<sub>4</sub>-Mustard+Chick pea, T<sub>5</sub> Mustard+Coriander, T<sub>6</sub>-Mustard+Cow pea, T<sub>7</sub>-Thiamethoxam. In *in vivo* conditions infestation of aphid was significantly reduced in T<sub>5</sub>- Mustard+Coriander (131.67) with 60.3% reduction over control followed by T<sub>7</sub>-Thiamethoxam (58.33) and T<sub>0</sub>-Control (331.67).

**Keywords:** intercropping, aphid, beneficial, mustard

### Introduction

Mustard (*Brassica juncea* Czern and Casson) is a winter season crop. It ranks second after Ground nut not only in area but also in production. The total area, production and productivity of rapeseed/mustard in India 7.49 million hectare, 5-6.7 million tonnes and 1262 Kg per hectare respectively (Faostat, 2013) and 639 lakh hectares, 726 lakh tonnes and 1136 quintal/ha (Dacnet, 2013). The production of this energy rich crop is low as they are mostly grown in energy stress condition in India. Edible oil is energy rich item of our food, adds flavour to eat and makes it rather much palatable. Thus, importance of oilseeds as dietary fats, as an important raw material for agro based industry and for manufacturing various products like cosmetics, soaps, detergents, lubricants and laxatives, beside its medical and therapeutic values assumes particular significance. There are many insect pests of mustard crop like mustard aphid, sawfly and mustard leaf eating caterpillar. Among them, mustard aphid, *Lipaphis erysimi* (Kalt.) (Homoptera: Aphididae) is the most destructive one (Das, 2002) [10]. Mustard aphid is the most serious and destructive pest and limiting factors for successful cultivation of mustard in South Asia (Bakhetia, 1984) [4]. The rate of reproduction varies from 5-9 young in a single day by a single female and the total number of young produced by the female varies from 76-188. Both the nymph and adult aphid suck sap from leaves, stems, inflorescences and pods, as a result the plant show stunted growth, flowers wither and pod formation is hindered (Butani and Jotwani, 1984) [7].

Farmers usually spray chemical pesticides many times during the crop season to control insect pests. This leads to environmental pollution with a consequent of increased health hazard to the growers and consumers. The growing awareness of the shortcoming of the chemical insecticides has necessitated for the exploration for alternative methods of pest control, which is relatively free from adverse side effects. Among the various alternatives, the exploitation of host plant resistance is perhaps the most effective, convenient, economical and environmentally acceptable method of insect pest control. At present, effective control techniques other than insecticide application against insect pests of agricultural crops are highly demanding. Considering the above aspects, management of insect pests in mustard through agronomic manipulation that is intercropping may be considered as one of the 4 possible alternate options. An agronomic practice like intercropping of crop of diverse growth habit has been found as a very useful technique in controlling a large number of crop pests (Singh and Rathi, 2003) [29].

Intercropping is a simple and inexpensive strategy and has been recognized as a potentially benefitted technology to increase crop production due to its substantial yield advantage than sole cropping. If it is utilized correctly, it can contribute significantly to reduce pest problems. Intercropping can increase yields, more efficiently use available

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resources, reduce weed, insect and disease pressures and provide greater biological and economic stability. Intercropping has been an essential production method in tropical regions for hundreds of years and to a lesser extent in temperate regions (Li *et al.*, 2001). Intercropping increases yield, efficiently uses available resources, reduces weed, insect and disease incidence, and provides higher biological and economic stability (Vandermeer 1989) [31]. In this context, Tiwari *et al.* (2005) [30] reported that the intercropping of Indian mustard with potato, coriander, chickpea, wheat, linseed and fenugreek reduces the incidence of major insect pests such as mustard aphid, flea beetle (*Phyllotreta cruciferae* Goeze) and saw fly (*Athalia proxima* Klug). On the other hand, spice crops such as onion, garlic, ajwain, and coriander have medicinal properties, nutritional values and cooking uses. The annual production of edible oil in the country was only about 0.16 million metric tonnes against the demand of 0.5 million tonnes (Wahhab *et al.* 2002) [33].

**Material and Methods**

The experiment was conducted at SHUATS agricultural university in Allahabad region, Uttar Pradesh during the Rabi season of November to March 2017-18. The site selected was uniform, cultivable with typical sandy loam soil having good drainage and temperature reaches up to 49°C in summer and drops down to 1.5°C in winter. The experimental plots were established in a randomized block design with plot size 2.0 × 2.0 m and spacing 30×15 cm. There were 8 treatments; mustard intercropped with wheat ; mustard intercropped with onion; mustard intercropped with garlic; mustard intercropped

with chickpea; mustard intercropped with coriander ; mustard intercropped with cowpea; mustard treated with thiamethoxam as check and mustard sole crop as control. Recommended fertilizer dose and irrigation was applied as required to all treatments during the crop season. Total number of aphids was counted between 5cm from the inflorescence of plant by visual observation without disturbing the colony. The percent reduction of aphids over control was calculated as follows

$$\frac{\text{value of sole crop} - \text{value of component crop(mustard)}}{\text{value of sole crop}} \times 100$$

**Results**

Infestation of aphids per 5 cm is shown in fig 1 below in which mustard inter cropping with coriander reduce the infestation of aphids as compared to control and the percent reduction over control is as follows

**Table 1:** Percent reduction of Aphids over control

| Treatments              | Mustard | Inter crop | Percent reduction over control |
|-------------------------|---------|------------|--------------------------------|
| T1- Mustard+Wheat       | 180.00  | 40.67      | 45.72                          |
| T2- Mustard+Onion       | 165.00  | 54.33      | 50.25                          |
| T3- Mustard+Garlic      | 208.33  | 50.00      | 37.18                          |
| T4- Mustard+Chickpea    | 255.00  | 13.67      | 23.11                          |
| T5- Mustard+Coriander   | 131.67  | 66.33      | 60.30                          |
| T6- Mustard+Cowpea      | 290.00  | 8.67       | 12.56                          |
| T7- Thiamethoxam        | 58.33   | -          | 82.41                          |
| T0- Control (untreated) | 331.67  | -          | -                              |
| F-test                  | S       | S          |                                |
| SE.d                    | 2.09    | 2.22       |                                |
| CD                      | 4.48    | 4.95       |                                |



Mustard + Wheat



Mustard + Onion



Mustard + Garlic



Mustard + Chick pea





Mustard + Coriander

Mustard + Cow pea

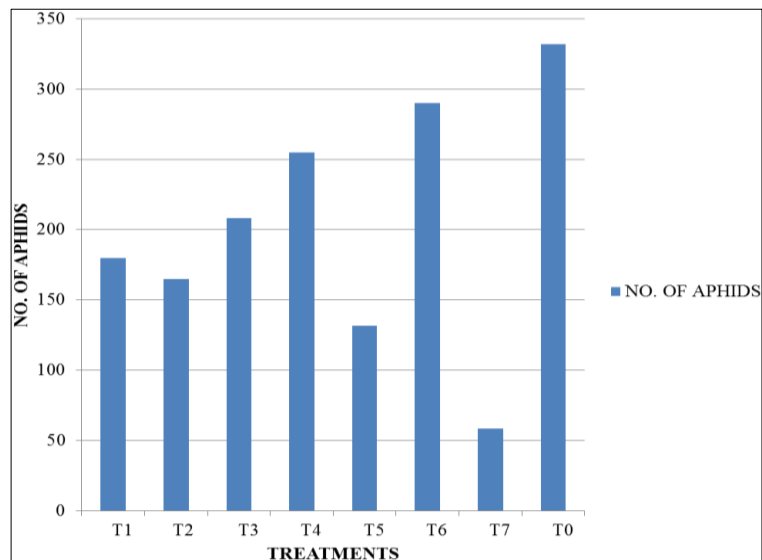


Fig 1: Infestation of Aphids at 75 days after sowing

Also natural enemies like *Coccinella septempunctata*, *Aphelinus abdominalis*, Syrphid larvae and *Harmonia axyridis* are observed in mustard field and the infestation of

natural enemies in different treatments are shown in table below

Table 2: Infestation of natural enemies in mustard field

| Treatments     | <i>Coccinella septempunctata</i> | <i>Aphelinus abdominalis</i> | Syrphid larvae | <i>Harmonia axyridis</i> |
|----------------|----------------------------------|------------------------------|----------------|--------------------------|
| T <sub>1</sub> | 2.00                             | 1.33                         | 1.67           | 2.00                     |
| T <sub>2</sub> | 1.67                             | 0.33                         | 0.67           | 1.00                     |
| T <sub>3</sub> | 2.33                             | 1.67                         | 0.67           | 2.33                     |
| T <sub>4</sub> | 2.67                             | 0.67                         | 1.33           | 1.33                     |
| T <sub>5</sub> | 0.67                             | 0.33                         | 0.33           | 0.67                     |
| T <sub>6</sub> | 3.00                             | 1.67                         | 1.00           | 1.67                     |
| T <sub>7</sub> | 0.33                             | 0.00                         | 0.00           | 0.33                     |
| T <sub>0</sub> | 3.33                             | 2.00                         | 2.00           | 2.67                     |
| F-test         | S                                | S                            | S              | S                        |
| SE.d           | 0.36                             | 0.36                         | 0.29           | 0.29                     |
| CD             | 0.78                             | 0.78                         | 0.62           | 0.62                     |

Mustard treated with thiamethoxam (check) gives maximum yield of 987 kg/ha when compared to mustard sole crop and mustard with intercropping. Mustard with coriander as intercropping shows maximum yield and also minimum

incidence of aphids while mustard sole crop shows maximum infestation of aphids and also heavy reduction in yield. The yield of different treatments are as shown below

Table 3: Yield of mustard and inter crops infested by aphids

| Treatments                           | Mustard Yield (kg/ha) | Inter Crops Yield (kg/ha) |
|--------------------------------------|-----------------------|---------------------------|
| T <sub>1</sub> – Mustard + Wheat     | 480                   | 575                       |
| T <sub>2</sub> – Mustard + Onion     | 336                   | 2370                      |
| T <sub>3</sub> – Mustard + Garlic    | 380                   | 620                       |
| T <sub>4</sub> – Mustard + Chick pea | 390                   | 360                       |

|                                      |     |     |
|--------------------------------------|-----|-----|
| T <sub>5</sub> – Mustard + Coriander | 650 | 585 |
| T <sub>6</sub> – Mustard + Cow pea   | 300 | 483 |
| T <sub>7</sub> – Thiamethoxam        | 987 | -   |
| T <sub>0</sub> – Control             | 332 | -   |

**Table 4:** Benefit cost ratio (per ha) for all treatments for different treatments

| Treatments              | Ratio | Cost of cultivation | Gross returns | BCR    |
|-------------------------|-------|---------------------|---------------|--------|
| T1- Mustard+Wheat       | 3:2   | 26445               | 199680        | 1:7.5  |
| T2- Mustard+Onion       | 3:2   | 23595               | 30000         | 1:1.27 |
| T3- Mustard+Garlic      | 3:2   | 25845               | 28620         | 1:1.10 |
| T4- Mustard+Chickpea    | 3:2   | 23795               | 45600         | 1:1.91 |
| T5- Mustard+Coriander   | 3:2   | 24070               | 33000         | 1:1.37 |
| T6- Mustard+Cowpea      | 3:2   | 24070               | 33000         | 1:1.37 |
| T7- Thiamethoxam        | 3:2   | 22795               | 29610         | 1:1.29 |
| T0- Control (untreated) | 3:2   | 23445               | 9900          | 1:0.42 |

## Discussion

The similar result was found by Goel and Tiwari (2004) <sup>[14]</sup> who worked on mustard with potato, wheat, gram (*Cicer arietinum*), linseed, fenugreek and coriander and counted aphid population. He found the lowest aphid number when mustard was intercropped with coriander, followed by linseed, fenugreek, gram, wheat and potato and the maximum aphid population was recorded when mustard was grown as a sole crop. Lasker *et al.* (2004) also reported that intercropping of mustard with various crops like wheat, radish, and barley, resulted in lower incidence of the aphid except in mustard–radish combination in which the incidence was highest with sole crop of mustard; the minimum incidence was found in mustard-wheat. The results agree with the findings of Monika *et al.* (2005) <sup>[21]</sup> who studied the effect of intercropping of Indian mustard with coriander and other crops and the incidence of the major insect pest, i.e. mustard aphid and found the lowest aphid population in mustard grown with coriander and the maximum population was observed on mustard as sole crops. Tiwari *et al.* (2005) <sup>[30]</sup> also found that the lowest aphid population was recorded in mustard grown with coriander and the maximum population was observed on mustard as sole crop.

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