

Biological control strategy of mustard aphid

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Abstract

Mustard aphid *Lipaphis erysimi* is one of the most serious threat to the Indian mustard. Several pesticides are used to minimize the severity of aphid attack every year, which is not biologically safe according to many. There are reports that, *L. erysimi* can be managed in a biologically safe manner, using some aphid tolerant cultivars as well as by the use of some natural enemies this pest attack might be controlled. It is also highlighted in this article that, this bio-controlling of mustard aphids is safe to ecosystem and non-expensive for Indian farmers.

Keywords: Mustard aphid; *Lipaphis erysimi*; Indian Mustard; Bio-control; Aphid tolerance; Biologically safe.

Introduction

Indian mustard, *Brassica juncea* L. (Czern) is a very important oilseed crop for Indian cuisines (Figure 1). But a huge loss in oil yield occurs every year due to the attack of mustard aphids¹ [*Lipaphis erysimi* (Kaltenbach)] (Figure 2), and improper crop managements². Both nymph and adult suck the sap of leaf, inflorescence, stem and pod. Aphids prefer to make colony at the shady portions of the plant like the lower surface of leaf. Curling of leaf and inflorescence, immature pod and dryness of whole plant are the common symptoms of aphid attack. Often, this ultimately results in death of the plant. The nutritional quality of oil might be degraded at the time of aphid strike.



Figure 1: Full-bloomed *Brassica juncea* plant. (Bar = 20 cm)

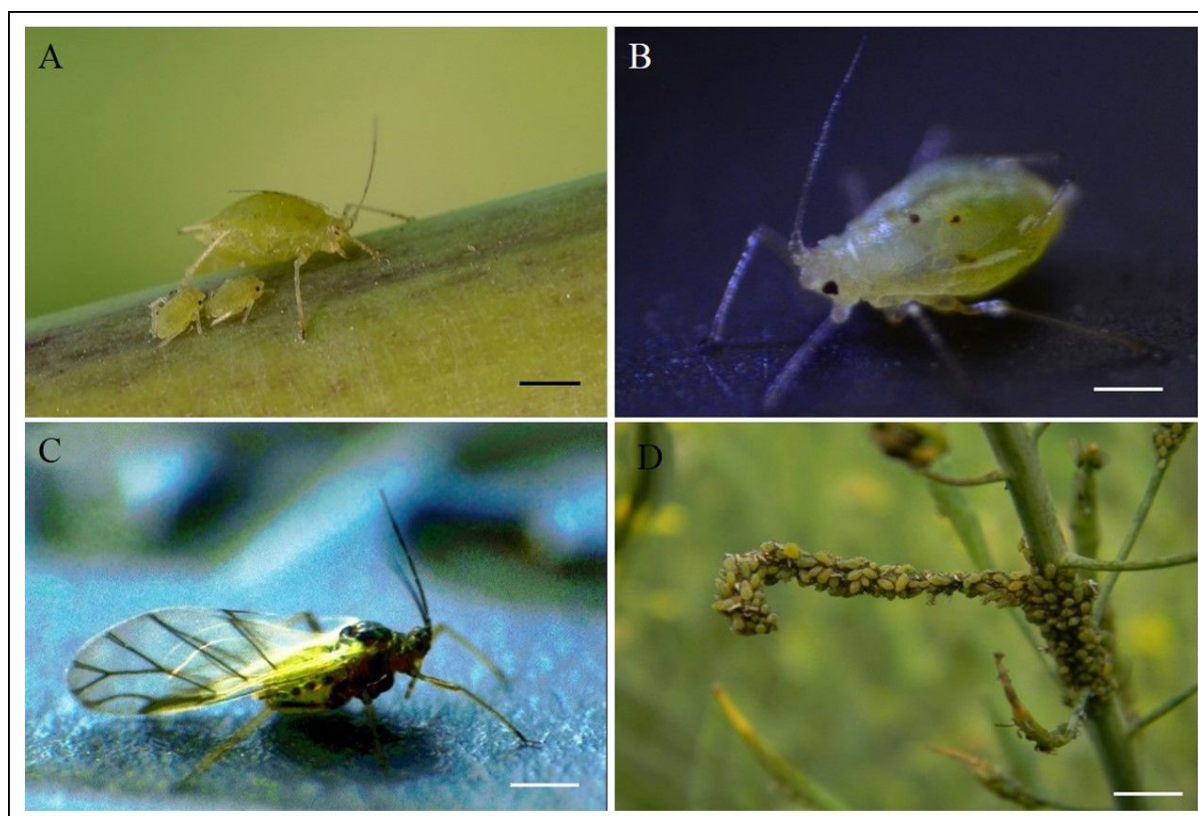


Figure 2: Mustard Aphid, *Lipaphis erysimi* (Kaltenbach.). A. Adult 4th instar nymph with 1st instar nymphs. B. 4th instar nymph stage. C. Alate or winged adult stage. D. Aphid colonies on *Brassica juncea* plant. (Bars: A, B and C = 1 mm, D= 5 mm).

Crop varieties

Many practices are available to protect the crop from this pest, including early cultivation; cultivation of more tolerant varieties like JM-1 and RK-9501. Ashirwad, B-85, CS-54, Gujarat Mustard-3, Kalyan, NRCD-601, Pusa Mahak, Pusa Tarak, Ragini, Sarama are very common varieties of mustard grown all over India³. Among these varieties, some are moderately resistant at leaf and pod stage for *Alternaria* blight and resistant, some are suitable for cultivation in salt affected soils and some are high yielding.

Suitable agro-climatic conditions

In India, mustard is grown in Andhra Pradesh, Assam, Bihar, Delhi, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal, from last week of September to middle of March of the year. Indian mustard is a cool-season, herbaceous crop, grown on a variety of soils with a preferring pH range from 5.5 to 6.8; it grows well in a monthly average temperature of 6° C-27° C and an average annual precipitation of 500 mm⁴.

Preparation of land

In Rabi season of each year, the seeds are sown in the field after ploughing. Each plot contains mustard plants with the spacing 20 cm between the plants and 30 cm between rows (Figure 3). Any one of the four side of the plot should be sloped so that, water cannot be clogged in the plot⁴.



Figure 3: *Brassica juncea* experimental plot. (Bar = 80 cm)

Application of fertilizers

Manures and nutrients are applied according to common practice. To protect plants from fungal attack, Bavistin (BASF) (2g/l) is generally applied once, after germination. Application of some insecticides are necessary during the growth phase. Sufala generally applied as fertilizer for N-P-K (80: 30: 20) source (kg/ha) and Urea is used as sole Nitrogen source (65 kg/ha). Cow dung was applied once as general manure (50 kg/ha)⁴.

Conventional practices to control mustard aphids

Many practices are available to protect the crop from this pest, including early cultivation; cultivation of more tolerant varieties like JM-1 and RK-9501³; application of pesticides and recommended dose of fertilizers etc. Some non-conventional practices like, mechanical control (destruction of affected plants) and biological control (use of Ladybird beetle, several species of syrphid fly and lacewings, which are known as aphid predators) are also been used to protect the crop⁵.

The use of pesticides are often harmful to both environment and human health and other practices are not well established due to improper crop/pest management. Therefore, to search for a permanent remedy, proper selection of aphid tolerant *Brassic*as and wild crucifers, molecular analysis of those plants to search the factors responsible for the tolerance and creation of transgenic crops by introducing those foreign factors (genes) are the mostly practiced researches going on from decades^{6, 7, 8, 9, 10}.

Biological control

Many insecticides have been recommended for mustard aphid's efficient control. These insecticides are known to cause mortality of the beneficial organisms, residue problems, hazards to man and animal and cause pollution of the environment¹¹. Most pesticides cause extensive damage to economically important crops, like mustard. Cruciferous oilseeds are attacked by a large number of insect pests. The Indian mustard aphid, *Lipaphis erysimi* is by far the most devastating insect on *Brassica* oilseeds in India¹. The aphid is reported to cause an average loss of about 50% in seed yield. *Bagradacruciferarum* and *Athaliaproxima* on germinating and young crop, and *Agrotis* sp. on rainfed crop, are other sporadic pests in India¹². Out of the 38 insect pests attacking rapeseed and mustard crops in India, ten are of particular economic significance. Five species of *Coccinellids* (ladybird beetle) have been reported to feed on the mustard aphid in India: however, two species *CocCineliaseptempunctataLinnaeus* and *CheilomenessexmaculatusFabricius* are most prevalent¹³. Sometimes, application of Neem oil is recommended for the aphid controlling¹¹. Nowadays, use of transgenic mustard is introduced for minimizing the aphid attack in mustard field, but as aphid stress is controlled by multiple genes, this method rarely works against aphid management.

Importance of aphid management

Low to moderate aphid population levels do not usually cause significant damage and rarely kill mature plants. However, large infestations can reduce plant yields and produce sticky "honeydew," warranting pest control. Aphids are best managed by working with nature's predators and utilizing low-impact approaches, such as washing or disposal of infested plants.

Aphid control is most valuable for new plantings, where excessive sap removal is more likely to affect general plant vigor. Established and otherwise healthy plants can tolerate moderate to heavy aphid infestations, although affected leaves may wilt and turn yellow and there may be some premature drop.

Good cultural practices, such as watering and fertilization, will help to reduce stress by these insects. Problems with honeydew and sooty mold may develop but tend to be temporary and disappear after the aphids are gone.

A few aphid species produce cupped or distorted leaves; these plants may lose some of their esthetic appeal for the season. Once the distortion occurs, the leaves will remain cupped and twisted until they fall off. Usually, the infestation is not noticed until the injury has occurred. Insecticide applications often are less effective because the aphids are protected in the gnarled leaves.

Plants that become infected with an aphid-borne virus may be severely stunted and may die. Preventive sprays are rarely effective in keeping viruses out of plantings but they may reduce the spread within a group of susceptible plants.

Low cost aphid management budget

Approximately, farmer can get a yield of 6 to 8 quintals from one acre of Mustard field. Average market price for Mustard is Rs. 3800 to 4200 per quintal depending upon the quality of the produce. Presently, as there are limited bio-control management for mustard aphid is available, initial establishment cost will be little higher. But a proper aphid management can increase this quantity to upto 10 quintals per acre. Indian farmers generally spend around Rs. 25000 per acre for mustard cultivation. If they adapt the bio-controlling of aphid management, the cost will be increased up to Rs.

30000. But this will also increase their benefits up to Rs. 42000. So, the net benefit will be increased from Rs. 8600 to Rs. 12000 per acre.

Conventional aphid management in 1 acre				Bio-controlled aphid management in 1 acre			
Cost (in Rs.)	Yield	Selling Price (in Rs.)	Profit (in Rs.)	Cost (in Rs.)	Yield	Selling Price (in Rs.)	Profit (in Rs.)
25000	8 quintal	4200 per quintal	8600	30000	10 quintal	4200 per quintal	12000

Conclusion

The use of pesticides may increase the yield but repeated use of hazardous pesticides also may cause the harmful effects on human. Biologically controlled pest management in Indian mustard gives us a safe and healthy oil crop which has no adverse effect on human population. Simultaneously, a regular use of bio-controlling agents is safe for ecosystem. Biological control can either be less or more expensive than pesticides. One can incur significant expense studying, choosing, testing and breeding a bio-agent. However, in cases in which bio-agents are applied to low-level pest populations, pest control can be long-term and inexpensive.

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