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Diamondback Moth (*Plutella xylostella* L.): Life Cycle and Integrated Management for Sustainable Cruciferous Production

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The diamondback moth (*Plutella xylostella* L.) is a serious pest of cruciferous crops, causing considerable yield and quality losses. Its rapid reproduction and resistance to insecticides make management highly challenging. This article reviews the pest's life cycle, damage symptoms and integrated management (IPM) strategies for sustainable control. Employing cultural, biological and mechanical and need based chemical measures can effectively lower pest incidence and ensure sustainable production of cruciferous crops.

Keywords: DBM, Cruciferous, Biological, IPM

Introduction

The diamondback moth (*Plutella xylostella* L.) is an oligophagous insect pest and the most damaging pest of cruciferous crops worldwide, causing severe losses to yield and quality. Due to its high reproductive potential, short life cycle, and remarkable ability to develop resistance to insecticides, the pest is now a major challenge for cruciferous crop production. First described in North America in 1854, the diamondback moth is now present in more than 128 countries (Vats *et al.*, 2026) and is one of the most widely distributed pests. It is a serious threat to the cultivation of cabbage, cauliflower, and mustard in India and causes considerable economic losses every year. Marketable yield loss could be 50–80% under severe infestations and some studies reported yield reductions up to 52% (Sawant *et al.*, 2022). The pest has several generations in one cropping season and easily adapts to a wide range of agro-climatic conditions. Hence, understanding its biology, damage symptoms and integrated management strategies is vital for sustainable production of cruciferous crops and minimization of economic losses.

Host plant

Diamondback moth larvae only feed on plants in the Brassicaceae family (Crucifers), which include cabbage, cauliflower, broccoli, kale, kohlrabi, turnip, Brussels sprouts, mustard, rapeseed, canola, radish, wild mustard, pepper weed, and winter cress.

Biology

Egg: Diamondback moth eggs are small, oval, flattened and pale yellow to yellowish white in colour. They are generally deposited singly or in small groups on the under-surface of leaves, especially near the leaf veins. A female moth lays 150-300 eggs in her lifetime. Eggs hatch in 3-6 days depending on temperature and environmental conditions (Sharma *et al.*, 2025).

Larvae: The larva is the damaging stage of the diamondback moth. The full-grown larvae are slender, light green in colour and about 8-12 mm long. Larvae can be distinguished by their tapered bodies at both ends, with a pair of posterior prolegs that form a characteristic V-shaped mark along their backs (Mac Donald *et al.* 2017). They wriggle very actively when

disturbed and often let themselves drop from the leaf like a silken thread. The larval stage usually takes 7-14 days depending on environmental conditions and passes through four instars before pupation.

Pupa: Diamondback moth (*Plutella xylostella*) pupae typically develop on the lower or outer leaves, enclosed within a loose, white body silken cocoon. They are often found hidden in cracks near the bud or attached to leaf surface, and pupation may also occur within the florets of broccoli and cauliflower. The pupal stage generally 5-15 days (Gowri and Manimegalai, 2016).

Adult: The adult diamondback moth is a small, slender moth, approximately 8-10 mm in length with a wingspan of 12-15 mm. It is greyish brown with narrow wings fringed with long hairs. At rest, when the wings are folded over the body, three pale cream-coloured markings along the back merge to form a series of diamond-shaped patterns, which has given the insect its common name of diamondback moth. Adults do not fly well but can be carried by wind currents for long distances. In one year, the moth can complete 6 to 7 lifecycles. Generations overlap throughout the warmer months of the year.

Nature of Damage

Diamondback moth larvae feed on leaf tissues and causes characteristic window like damage during the early stages. Older create irregular holes on leaves and severe infestations may leave only the leaf veins. This feeding reduces plant growth, lowers yield and significantly affects the market quality of cruciferous crops.

Management

Cultural control

- Follow crop rotation with non-cruciferous crops.
- Remove and destroy crop residues immediately after harvest.
- Eliminate cruciferous weeds that serve as alternate host.
- Maintain Proper field sanitation and balanced fertilizer application of nitrogenous fertilizer makes the plant more succulent and hence, more prone to pest attacks.
- Pinching and pruning infested plants help reduce pest populations.
- To attract diamondback moth for oviposition, mustard can be planted as a trap crop at a 2:1 ratio (mustard to cabbage), sown at least 10 days prior to the main crop.

Biological Control

- Spraying Azadirachtin 0.3% EC at 20 ml per 20 liters of water effectively reduces pest damage.
- Foliar application of Bio-Power® WP (*Beauveria bassiana* 1.15% at 1.0×10^8 CFUs/g) at 100 g per 20 liters of water is recommended.
- Foliar application of DiPel® DF (*Bacillus thuringiensis* subsp. *kurstaki*, Strain ABTS-351, 54% w/w) at 20 g per 20 liters of water is effective.
- Larval parasitoids: *Cotesia plutellae* at 20,000/ha-1 and *Diadegma semiclausum* at 100,000/ha-1, released 20 days after planting. The parasitoids frequently kill the large larvae, pre pupae, and pupae. Certain natural enemies of *Plutella xylostella* include *Diadegma insulare* (Ichneumonidae), *Microplitis plutellae* (Braconidae), and *Diadromus subtilicornis* (Ichneumonidae).
- Extracts of *Zingiber officinale* applied at 25% w/v provide an effective alternative to chemical pesticides for controlling DBM larvae. Unlike chemical treatments, which often lead to resurgence of larval populations, ginger extracts significantly suppress their numbers.

Mechanical Control

- Install pheromone traps (10-12 traps/ha) to monitor adult moth activity.
- Hand picking and Destroy larvae in regular.
- Remove and destroy severely damaged plants to prevent further spread.
- Inspection regular for crop eggs, larvae and pupa in feeding damage.

Chemical control

- Spinosad 45% SC, Indoxacarb 14.5% SC, and Emamectin benzoate 5% SG are among the most effective treatments for suppressing diamondback moth (DBM) larval populations.
- Spinosad 45% SC is the best insecticide against DBM and also improves the production by having higher benefit-cost ratio.

Conclusion

Integrated pest Management (IPM) offers an effective and sustainable approach for managing diamondback moth in cruciferous crops. Combining cultural, biological, mechanical and need based chemical control can minimize crop losses, delay insecticides resistance and ensure crop production.

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