Insect Pests of Cruciferous Vegetables and Their Management

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Crucifer vegetables are important cultivated crops and are widely grown in many parts of the world, including the highlands in most tropical countries. They are frequently attacked by a number of important insect pests. Some have been a problem for a long time while others have become important only recently. The present article gives emphasis on the identification, life cycle, nature of damage and sustainable management of major insect pests of the cruciferous vegetables.

Introduction
The crucifers are important rabi season vegetable crops consists of cabbage, cauliflower, knol khol, broccoli and radish. These vegetables play important role in balancing the vegetarian diet and also serves as important source of minerals, vitamins and crude fiber. India is one of the main producers of cruciferous vegetables worldwide, ranking number one and two in the world in production of cauliflower and cabbage, respectively. In spite the larger producer, productivity of these crops is low due to attack by insect pests and diseases. These vegetables are ravaged by major defoliating caterpillars like the diamondback moth (DBM), Plutella xylostella (L.) leaf webber, Crocidolomia binotalis. Cabbage webworm, Hellula undalis Cabbage butterfly, Pieris brassicae, Tobacco caterpillar, Spodoptera litura, Mustard sawfly, Athalia lugens proxima and sucking pests like aphids, Brevicoryne brassicae L. and painted bug, Bagrada hilaris resulting in significant losses in the yield. The present article emphasis on the identification, life cycle, nature of damage and sustainable management of major insect pests of the cruciferous vegetables.

1. Diamondback Moth, Plutella xylostella (Lepidoptera: Plutellidae): It is well known pest of cruciferous crops throughout the world.

Identification: The moth is greyish brown with narrow wings having pale white marking anteriorly which form diamond-like white patches dorsally when wings are folded over back at rest. When full grown, the larvae measure about 8 mm in length and are pale yellowish green with fine hair scattered all over the body.
**Life-cycle:** The adult female lays yellowish eggs singly or in groups of 5-57 eggs on the underside of the leaves. A female may lay 20-358 eggs in her life-time. The eggs hatch in 2-7 days. The newly hatched caterpillars bore into the tissue from the underside of leaves and feed in these tunnels. Third and fourth instar larvae feed from the underside of leaves, leaving intact a parchment-like transparent cuticular layer on the dorsal surface. They become full grown in 14-21 days. Before pupating, the larva constructs a barrel-shaped silken cocoon which is open at both ends and is attached to the leaf surfaces. The pupal stage lasts 4-5 days and the moths may live for as long as 17 days. The life-cycle is completed in 15-18 days during September-October and there are several generations in a year.

**Damage:** Small slender green caterpillars on emergence feed on the leaf epidermis and later make holes in the leaves. Severely affected leaves are completely skeletonised. Caterpillars damage the leaves of cauliflower, cabbage, knolkhol and rape-seed.

**Management**
- Spraying the crop with malathion (0.1%) or profenofos (0.25-0.5 kg a.i./ha) gives excellent control of the larvae.
- Grow mustard as trap crop at 2:1 ratio (cabbage: mustard) to attract DBM for oviposition at least 10 days ahead of planting of main crop. As the pest prefers mustard, major pest population is attracted towards it, which can be destroyed by spraying the crop with dichlorvos (1 ml/ litre of water).
- Remove and destroy all debris and stubbles after harvest of crop.
- Crop rotation with cucurbits, beans, peas, tomato and melon.
- Encourage the natural enemies *Diadegma semiclaustrum, Cotesia plutellae*, syrphid flies, coccinellids and spiders.
- Spray Neem seed kernel extract 5% in rotation with spinosad 2.5% SC @ 1 ml per litre of water.
- Spray cartap hydrochloride 0.5% at 10, 20 and 30 DAS (nursery) and primordial stage.
- Spray flufenoxuron 10% DC @ 0.8 ml per litre of water or chlorantraniliprole 18.5% SC or chlorfenapyr 10% SC or flubendiamide 20% WG @ 0.1 ml per litre of water or emamectin Benzoate 5% SG @ 0.4 gm per litre of water.
2. Leaf webber, Crocidolomia binotalis (Lepidoptera: Pyralidae)

**Identification:** The moth with light brownish forewings having distinct wavy lines and wavy spots and hind wings-semi hyaline colour. The larva is green with red head and it has longitudinal red strips on the body. It is 2 cm in length.

**Life-cycle:** The moth lays eggs on the underside of leaves in masses of 45-100 each. The eggs hatch in 5-15 days. In the early stages the larvae feed gregariously on the leaf parenchyma. As they grow, they spread out and start webbing the leaves and feeding on them. The larval stage is completed in 25-30 days in summer and about 50 days in winter. When full grown, the larva descends to the ground and pupates in the soil after making an earthen cocoon. The adult emerges in 14-40 days and the lifecycle is completed in 43-80 days. More than one generation may be completed in the season.

**Damage:** The leaves are skeletonized by the larva which remain on the under surface of leaves in webs and feed on them. They also attack flower buds and pods. Often it assumes serious proportions. It attacks cabbage, cauliflower, radish, mustard and other crucifers.

**Management:**
- Removal and destruction of webbed bunches of leaf help to check the further spread of the disease.
- Dusting the crop with carbaryl (4%) or spraying with malathion (0.05%) is effective.
- Encourage the activity of parasitoid: Cotesia crocidolomiae.
- Spray chlorfluazuron 5.4% EC @ 0.1 ml per litre of water or indoxacarb 14.5% SC @ 0.5 ml per litre of water.
- New chemistries mentioned for DBM management are also effective.

3. Cabbage Borer, Hellula undalis (Lepidoptera: Crambidae)

**Identification:** The adult moth is slender, pale yellowish-brown, having grey wavy lines on the fore wings. The caterpillar is yellow with a pinkish tinge and has seven purplish brown longitudinal stripes.

**Life-cycle:** The adult female lays eggs on the growing point or on the older leaves. The eggs hatch in 2-3 days. The caterpillars feed in the heart of the cabbage and become full-grown in 7-14 days, after undergoing four moltings. The full-grown caterpillar spins a cocoon among the leaves touching the ground or even inside the larval burrows. The pupal period is about 7 days and the life cycle is completed in 15-25 days.

**Damage:** The caterpillars first mine into the leaves. Later on, they feed on the leaf surface, sheltered within the silken passages. As they grow bigger they bore into the heads of the cauliflower and cabbage. When the attack is heavy, the plants are riddled with worms and outwardly the heads look deformed.
Management:
- Collect and destroy mechanically caterpillars in the early stages of attack helps to check the infestation.
- Spraying the crop with Malathion (0.1%) or dusting 4% Carbaryl gives excellent control of the larvae.
- Spray Bacillus thuringiensis @ 2g/lit at primordial stage.
- New chemistries mentioned for DBM management are also effective.

4. Cabbage butterfly, *Pieris brassicae* (Lepidoptera: Pieridae)

**Identification:** It is large 5.6-6.6 cm white coloured butterfly with black forewing tips and 2 prominent black spots on the forewings of females alone. Larvae are velvety bluish green in colour with black dots. Yellow dorsal and lateral stripes covered with white hairs.

**Life-cycle:** The butterflies lay, on an average 150 conical eggs in clusters of eggs in clusters of 40-50 eggs on the upper or lower side of a leaf. The eggs hatch in 3-14 days in October-April. The caterpillars feed gregariously during the early instars and disperse as they approach maturity. They pass through five stages and are full-fed in 16-25 days. Pupation occurs away from the host on fences or trees. The pupal stage lasts 8-25 days. The butterflies live for 3-14 days.

![Different life stages of cabbage butterfly](image)

** Damage:** The caterpillars alone cause the damage. First instar caterpillars only scrape the leaf-surface but later ones eat away the leaves at the margins inwards, leaving intact the major veins alone.

**Management:**
- Handpicking and destruction of caterpillars in the early stage of attack can reduce infestation.
- Conserve the parasitoids like *Cotesia glomeratus*.
- Spraying the crop with Malathion (0.1%) or dusting Carbaryl (0.15%) gives excellent control of the pest.
- New chemistries mentioned for DBM management are also effective.

5. Tobacco caterpillar, *Spodoptera litura* (Lepidoptera: Noctuidae)

**Identification:** The moths are about 22 mm long and measure 40 mm across the spread wings. The body is light down in colour while the forewings are greyish brown with white marking and hind wings white with a brown border.
**Life-cycle:** The female lays about 300 eggs in clusters and the eggs masses are covered with buff-coloured hairs obtained from the mother’s body. The eggs hatch in about 3-6 days. The larvae feed gregariously for the first few days and then disperse to feed individually. They pass through 6 stages and are full-fed in 16-30 days. The full grown larvae enter the soil where they pupate. The pupal stage lasts 7-14 days and the moth, on emergence, live for 7-10 days. The life cycle is completed in 30-50 days and the pest completes eight generations in a year.

**Damage:** The caterpillar causes the damage by feeding on tender leaves. They are mostly active at night and cause extensive damage, particularly in tobacco nurseries.

**Management:**
- Field sanitation and deep ploughing to kill the pupae in the soil.
- Grow castor along border and irrigation channel as trap crop.
- Handpicking and destruction of grown up larvae.
- Set up light trap @1/ha.
- Install pheromone traps @ 15/ ha to attract male moths.
- Collect and destroy egg masses in castor and tomato.
- Spray Sl/ NPV @ 1.5 X 1012 POB/ha + 2.5 Kg crude sugar + 0.1 % teepol.
- Spray chlorpyrifos 20 EC 2lit/ha or dichlorovos 76 WSC 1 lit/ha.
- Chemical mentioned for DBM management are also effective.

6. **Cabbage semilooper, Trichoplusia ni** (Lepidoptera: Noctuidae)

**Identification:** The cabbage semilooper is a pale green caterpillar with a white stripe down each side of the body. Adults are about 1 inch long, with wings folded over the back at rest. Adults are dark brown and gray moths, with a distinct figure “8” white pattern in the middle of the wings.

**Life-cycle:** The adult female lays whitish round eggs singly on the leaf surface. Larvae emerge from eggs within 3-7 days and develop for 16 to 19 days before pupating. The pupa turns from initially green to dark brown, and the adult emerges 9 to 10 days later. The entire life cycle lasts 32 to 37 days, allowing for one to two generations in a season.

**Damage:** Larvae bite holes and cause the severe damage by skeletonising the leaves.

**Management:**
- Handpicking and destruction of grown up larvae.
Set up light trap @ 1/ha.
Spraying the crop with malathion (0.1%).
New chemistries mentioned for DBM management are also effective.

7. Painted bug, Bagrada hilaris (Hemiptera: Pentatomidae)
**Identification:** The bugs are 3.7 mm long, sub-ovate black in colour with orange and yellow lines.
**Life-cycle:** The adult bugs lay oval, pale yellow eggs singly or in groups of 3-10 on leaves, stalks, pods and sometimes on soil. Eggs hatch in 3-15 days. Nymphal duration varies from 16-30 days. The pest completes nine generations in a year.
**Damage:** Both nymphs and adults do the damage by sucking plant sap, often in clusters. The painted bug appears at two stages of the crop growth at seedling and maturity. The nymphs and adults secrete a sort of resinous substance which spoils the plant parts. The attacked plants look sickly, dry up or get stunted.
**Management:**
- Clean cultivation and quick threshing of harvested crop in case of rape-seed mustard.
- Spraying the crop with Malathion (0.1%).

8. Aphids, Breviceoryne brassicae, Lipaphis erysimi, Myzus persicae (Hemiptera: Aphididae)
**Identification:** Yellowish green nymphs and adults suck cell sap and devitalize plants. These are minute (2-2.5mm) delicate, pear shaped, yellow or green winged or wingless insects.
**Life-cycle:** The adult female gives birth to 20-130 nymphs. They grow very fast and full fed in 7-10 days. About 45 generations are completed in a year. The winged forms are produced in autumn and spring, and they spread from field to field and from locality to locality.
**Damage:** Nymphs and adults suck cell sap and devitalize plants. Affected parts become discolored and malformed. High humidity favours rapid multiplication of this pest. The aphids are mostly observed on the lower surface of the leaves and terminal parts of the plant.
Management:

- Early sowing in case of rape-seed mustard.
- Set up yellow sticky trap to monitor aphid population.
- Spray dimethoate @ 2ml per litre of water.
- Spray Acetamiprid 20% SP @ 0.2 gm per litre of water.


**Identification:** The larva is dark green and has eight pairs of abdominal prolegs. The full grown larva measures 16-18 mm in length. The adults are small orange yellow insects with black markings on the body and have smoky wings with black veins.

**Life-cycle:** The adult female lays 30-35 eggs singly in slits made with saw like ovipositor along the underside of the leaf margin. The eggs hatch in 4-8 days and become full grown in 16-35 days and pupate in soil. Life-cycle completes in 30-35 days. The pest completes 2-3 generations.

**Damage:** The larva bite holes in the leaves preferring the young growth and skeletonise the leaves completely.

**Management:** Same as in case of painted bug.

10. Flea beetles: *Phyllotreta cruciferae* (Coleoptera: Chrysomelidae)

**Identification:** These small bluish black coloured beetles measuring 2-3mm (about 1/10in) in length, with the enlarged hind femur.

**Life-cycle:** The adult female beetle lays eggs in the soil hatch in 12-15 days depending on the temperature. The larvae are whitish and feed on the roots of the plant with out causing significant damage to the plant. The larvae completes it life cycle in 3-4 weeks. The beetle has single generation per year.

**Damage:** Adults feed on the cotyledons and first true leaves of seedlings causing bite holes and causes severe damage. The pest also attack on weed, *Gynandropsis pentophylla*. Attacked plants emits decaying odour.

**Management:**

- Seed treatment with imidacloprid @ 5gm/kg of seed for controlling the flea beetles at the seedling stage.
- Spray the crop with carbaryl @ 2gm/liter of water.

**Conclusion**

Among the important insect pests of cruciferous vegetable crops, diamondback moth (DBM), *Plutella xylostella* (L.) leaf webber, *Crocidolomia binotalis*. Cabbage webworm, *Hellula undalis*. Cabbage butterfly, *Pieris brassicae* and Tobacco caterpillar, *Spodoptera litura* are resulting in significant losses in the yield. The sustainable management by integrating different strategies of pests control will not only result reduced losses but also provides solution to the problems such as insecticide resistance, resurgence and residue.