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Caterpillar Pests of Brassica Vegetables

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Do You Know?

- In Utah, there are three main caterpillar pests of cabbage and mustard family plants: imported cabbageworm, cabbage looper, and diamondback moth. The injury they cause is similar.
- Diamondback moth is the primary caterpillar pest in commercial brassica crops; cabbage looper and imported cabbageworm are common in home gardens.
- The cabbage looper has the broadest host range of the three caterpillars; in addition to cabbages and mustards, it attacks many vegetables and weeds.
- Biological insecticides, such as Bt and spinosad, are highly effective against cabbage caterpillars.
- Cultural and mechanical tactics, such as hand-picking caterpillars and row covers can be effective alternative management options.

Brassica crops are hosts to many different insect pests, including several caterpillar species. The three most common in Utah are:

Diamondback Moth (*Plutella xylostella*)
Cabbage Looper (*Trichoplusia ni*)
Imported Cabbageworm (*Pieris rapae*)

Fig. 1. Diamondback moth adult.

Fig. 2. Cabbage looper adult.

Fig. 3. Imported cabbageworm adult.

HOSTS

The **diamondback moth** attacks plants exclusively in the Brassicaceae family including broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, collards, kale, kohlrabi, mustard, radish, rutabaga, turnip, watercress, and many related weeds.

The **cabbage looper** causes damage to plants in the Brassicaceae family, and attacks other vegetable hosts including beet, celery, cucumber, lettuce, lima bean, parsnip, pea, pepper, potato, snap bean, spinach, squash, sweet potato, and tomato. Weed hosts include lambsquarters (*Chenopodium album*), wild lettuce (*Lactuca* spp.), dandelion (*Taraxacum officinale*), and curly dock (*Rumex crispus*).

The **imported cabbageworm** attacks plants exclusively in the Brassicaceae family including many related weeds.

DESCRIPTION AND LIFE HISTORY

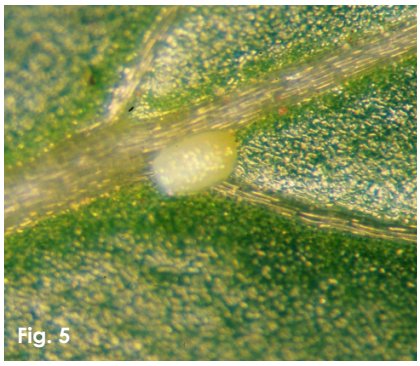
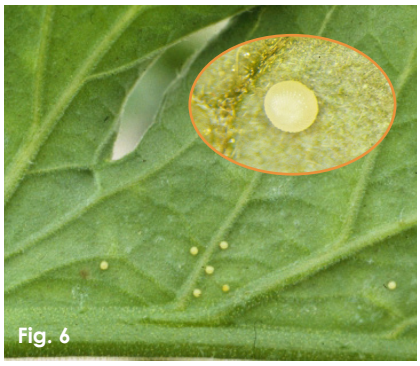
Life history characteristics and descriptions for the diamondback moth, cabbage looper, and imported cabbageworm. See life stage images on the next page.

Characteristic	Diamondback Moth	Cabbage Looper	Imported Cabbageworm
Utah status	migratory in the north and resident in south	migratory (some resident)	resident
overwintering stage and site	adult, in trash and debris in and around crop fields	pupa, see pupation site below	pupa, see pupation site below
# generations per year	4 to 6	1 to 3	3 to 4
Adult			
type	moth	moth	butterfly
activity period	dusk and dawn (crepuscular)	mostly night (seminocturnal)	day
color	grayish brown	grayish brown	white
wing marks	white/cream diamonds	silver "8"	females: 2 dark spots males: 1 dark spot
wingspan	0.75 inches (18 mm)	1.5 inches (38 mm)	2 inches (50mm)
Egg			
shape	round	dome	rocket/bullet
color	yellow	yellowish-white	yellow
size	0.02 inch (0.4 mm) wide	0.02 inch (0.4 mm) high	0.04 inch (1.0 mm) long
distribution	laid singly and in clusters	laid singly and in clusters	laid singly
Larva			
color	greenish gray	pale to dark green	green
texture	smooth, few sparse hairs	smooth, few sparse hairs	fuzzy/velvety due to dense short hairs
marks	no stripes	thin, white or light yellow stripes	thin, yellow stripe
shape	tapered at both ends	tapered at head	blunt ends
size	0.5 inch (12 mm)	1.5 inches (38 mm)	1.2 inches (31 mm)
behavior	wiggles (vigorously)	arches body into a loop	sluggish
# of instars (molts)	4	5	5
Pupa			
type	loose mesh cocoon	fuzzy cocoon	naked chrysalis
size	0.3 inch (8 mm)	1.2 inches (30 mm)	0.75 inch (19 mm)
pupation site	on leaves	on leaves, plant debris, and soil	on leaves, and occasionally on debris

INJURY

The caterpillars (larvae) chew holes in leaves (Fig. 4), and may occasionally cause serious defoliation. Initially, feeding is concentrated on outer leaves, but as the caterpillars mature, their feeding intensifies, and they often move into the developing heads, creating tunnels. Contamination of leaves and heads with bodies (larvae and pupae) and frass (fecal material) lowers produce quality.

Fig. 4. Larval feeding causes irregularly shaped holes on leaves (left) and heavy feeding can cause stunted growth (right).

	Diamondback Moth	Cabbage Looper	Imported Cabbageworm
Egg	 Fig. 5	 Fig. 6	 Fig. 7
Larva	 Fig. 8	 Fig. 9	 Fig. 10
Pupa	 Fig. 11	 Fig. 12	 Fig. 13

MANAGEMENT

Cultural and Physical Control

Interplant. When brassica crops are inter-planted with unrelated plants, larval populations tend to be lower, and larval parasitism and predation by beneficial wasps increase. Predatory and parasitic wasps are attracted to the varied resources provided by a diversity of plants, including nectar and pollen in flowers, and diverse insect prey.

Start with clean transplants. In some regions of the country, brassica caterpillar populations have become resistant to certain insecticides. Inspect transplants carefully to ensure they are free of caterpillar eggs and larvae.

Use row covers to prevent oviposition (egg-laying) by adults. Place row covers over plants, or over metal hoops for support, just after planting or transplanting. Ensure that the edges of the row cover are securely buried in the soil along the crop row.

Hand-pick and destroy larvae.

Plant early or use early maturing varieties. Mature plants can tolerate feeding damage better than young seedlings.

Remove plant debris at the end of the growing season to eliminate overwintering sites.

Plant tolerant varieties. Mustard, turnip, and kohlrabi are among the more tolerant brassicas to the **diamondback moth**. Glossy-green brassica varieties that lack the normal

waxy, grayish-green bloom, are somewhat resistant because larvae spend more time searching, and less time feeding, on the glossy leaves. These varieties, however, tend to attract more cabbage flea beetles.

Studies in Wisconsin showed that **cabbage looper** adults are less likely to lay eggs on Chinese cabbage, mustard, rutabaga, and turnips than on headed cabbage, Brussels sprouts, and collards (Radcliffe and Chapman 1966).

Imported cabbageworm adults do not prefer Chinese cabbage, mustard, rutabaga, and turnip as well as kale. As with the diamondback moth, plants with dark green, glossy leaves are more resistant to imported cabbageworm.

Biological Control

Natural enemies can provide effective control of the **diamondback moth**. Some parasitoid wasps include the ichneumonids *Diadegma insularis* and *Diadromus subtilicornis*, the braconid *Microplitis plutellae*, and *Trichogramma pretiosum* which attack eggs. Generalist insect predators such as ground beetles, true bugs, syrphid fly larvae, lacewing larvae, paper wasps, and spiders also play a role in reducing diamondback moth numbers (Fig. 14).

Important **cabbage looper** parasitoid wasps include the egg parasites *Trichogramma pretiosum* and *Copidosoma truncatellum*, and the larval parasites *Hyposoter exiguae*ichneumonid and *Microplitis brassicae*braconid. The endoparasitic tachinid fly *Voria ruralis*, is another important natural enemy.

Parasitoids of the **imported cabbageworm** include the braconid wasps *Cotesia glomerata*, a gregarious wasp (Fig. 15), *Cotesia rubecula*, a solitary wasp, and *Apanteles glomeratus* which attacks early instars. *Trichogramma* spp., are egg parasitoids and *Pteromalus puparum* is a pupal parasitoid. General predators such as shield bugs, ambush bugs (Fig. 14), and vespid wasps also attack them, as do many birds.

Fig. 14. Natural enemies of brassica caterpillars include: ground beetles (top left), paper wasps (top right), lacewing larvae (bottom left), and ambush bugs (bottom right).

Insect-attacking fungi and viruses, including granulosis and nuclear polyhedrosis viruses (NPV), and *Trichoplusia ni* NPV, also play important roles in suppressing brassica caterpillar populations under certain circumstances.

Fig. 15. Cocoons of the larval parasitoid *Cotesia glomeratus* (braconid wasp) next to its host, imported cabbageworm.

Monitoring

Pheromone traps can be used to monitor adult populations of the diamondback moth and cabbage looper. Traps indicate when adults have arrived in an area and give an indication of their relative numbers. Experience with pheromone trapping for diamondback moth in northern Utah revealed that moth numbers can be very high in areas with commercial vegetable operations (Fig. 16). Place traps along the edge and just above the crop canopy. Traps and lures can be purchased online; see below for a list of retailers.

Fig. 16. Adult diamondback moths caught in the liner of a pheromone trap in a northern Utah cabbage field.

Scout plantings for eggs and larvae on the undersides of leaves, especially on the innermost leaves. Feeding damage and excrement are also signs of an infestation. Examine at least 10% of the crop, checking random interior and edge areas. Also look for white butterflies (adults of imported cabbageworm) flying during the day among plants.

Insecticides

Insecticide resistance has become a challenge to management of brassica caterpillar pests, especially diamondback moth. Rotating insecticides with different modes of action can help slow the development of resistance. In general, insecticides are more effective against small (young) rather than large (older) caterpillars. Early timing of sprays will also help decrease contamination of plant heads with insect bodies and frass.

Once caterpillars penetrate a cabbage head, they are difficult to reach with treatments. A general treatment threshold for head-forming plants is very low: treat plants when 1 larva has been found in 25 to 50 plants (or when 10% of plants have at least 1 larva). Non-head forming plants can tolerate a higher population.

Bacillus thuringiensis var. *kurstaki* (Bt) is a microbial insecticide that targets caterpillars. It is a stomach poison that must be ingested by the caterpillar, and works best when caterpillars are young and actively feeding. It has a short residual and is non-toxic to mammals and beneficial parasitoids and predators. Most Bt formulations meet organic certification standards.

Examples of **COMMERCIAL USE** insecticides registered in Utah that are effective for control of diamondback moth, cabbage looper, and imported cabbageworm on brassica crops can be found in the **brassica chapter** of the **Utah Vegetable Production and Pest Management Guide**.

Examples of **HOME USE** insecticides registered in Utah that are effective for control of caterpillar on brassica plants.

Active Ingredient	Brand Name	Mode of Action*	Residual (days)	Diamondback Moth	Cabbage Looper	Imported Cabbageworm
malathion	Bonide Malathion	1B	7	X		
cyfluthrin	Bayer Vegetable & Garden Insect Spray	3	7-14	X	X	X
lamba-cyhalothrin	Bonide Beetle Killer; Bonide Caterpillar Killer	3	7-14	X	X	X
permethrin	Bayer Complete Insect Dust; Eight Vegetable, Fruit & Flower	3	7-14	X	X	X
pyrethrins	Natria Fruit & Vegetable; Bonide Pyrethrin Garden Insect Spray; Worry Free Insecticide & Miticide	3	3-4	X	X	X
pyrethrins + canola oil	Monterey Take Down Garden Spray	3 + physical	3-4	X		
acetamiprid	Ortho Flower, Fruit, & Vegetable	4A	7	X	X	
spinosad	Captain Jack's Deadbug Brew^{O}	5	7	X	X	X
Bacillus thuringiensis	Monterey B.t.^{O}; Bonide Thuricide	11A	5		X	X
oils: rosemary, clove, cottonseed, mineral	Monterey All Natural 3 in 1 Garden Insect Spray^{O}; Monterey All Natural Mite & Insect Control^{O}; Tri Trek	Physical	0	X	X	X
neem oil	Natria^{O}; Monterey^{O}	Antifeed-ant, Growth Regulator and Physical	0	X	X	X

*Insecticide mode-of-action (MOA) classification number based on guidelines from the Insecticide Resistance Action Committee. Rotate among insecticide classes to reduce the development of resistance; 1B = organophosphate, 3 = pyrethroids and pyrethrins, 4A = neonicotinoid, 5 = spinosyns, and 11A = bacterial microbe.

^{O}Organically certified insecticide products.

Note: All brand names are registered trademarks. Examples of brands may not be all-inclusive, but are meant to provide examples of insecticides registered on vegetables in Utah. The availability of insecticides and active ingredients in brands can change. Always check the label for active ingredient(s), registered uses, application and safety information, and protection and pre-harvest intervals.

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Additional Reading

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Opfer, P., D. McGrath. 2014. Cabbage White Butterfly. Oregon State University Department of Horticulture. horticulture.oregonstate.edu/content/cabbage-white-butterfly

Sources of Pheromone Traps and Lures

Great Lakes IPM, Inc.
greatlakesipm.com

Scentry Biologicals, Inc.
scentry.com

Trece (traps)
trece.com

Photo Credits

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[13] Russ Ottens, University of Georgia, Bugwood.org

[14] Ground beetle & Paper wasp: Joseph Berger, Bugwood.org; Lacewing larva: Whitney Cranshaw, Colorado State University, Bugwood.org

[15] Whitney Cranshaw, Colorado State University, Bugwood.org