Imported Cabbageworm: Lifecycle, Damage and Pest Management in Missouri

COOPERATIVE EXTENSION
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This fact sheet is intended to provide readers with current information about the imported cabbageworm in Missouri. Please watch for more information as new research data becomes available. The author does not endorse brand name products mentioned in this fact sheet. The names are provided so the user may find the correct mode of action and any other legal information provided on the label. Using the stated product(s), the user assumes all associated risks.

Common names

USA: Imported cabbageworm

Other countries: Cabbage butterfly, common cabbageworm, standard white, rale white butterfly, small cabbage white, small garden white, small white butterfly

Scientific Name

Pieris rapae (Linn. 1758)

Fig. 1. Adult female cabbageworm.
(Photo credit: Clement Akotsen-Mensah)

Fig. 2. Male (left) and female (right). Male is a brighter yellow than female.
(Photo credit: Clement Akotsen-Mensah)

Fig. 3. Eggs of cabbageworm.

Fig. 4. Larva of cabbageworm (arrowed).
(Photo credit: Clement Akotsen-Mensah)

Introduction

The imported cabbageworm (Fig. 1), also known as the cabbage white butterfly, *Pieris rapae* (Linnaeus 1758), is believed to be native to Europe and currently has spread to every continent except South America and Antarctica as a result of human activities (Ryan et al., 2019). This butterfly belongs to the insect order Lepidoptera that as adults have four broad or lanceolate (narrow oval-shaped tapering to a point at each end) wings usually covered with minute overlapping and often brightly colored scales and larvae that are caterpillars. It was first reported in North America in 1860. The female lays eggs singly on members of the mustard family (also called the cabbage family, the brassicas, or cole crops). The crops include cabbage, broccoli, kale, cauliflower, and Brussels sprouts. Since its introduction, the imported cabbageworm has spread throughout most states in the U.S., including Missouri, and has elevated itself to be one of the most severe economic pests in the eastern, southern and central United States. In the summer of 2021, we conducted observational studies at Lincoln University George Washington Carver Farm to determine the critical pests of the brassica plant family in Missouri. We planted common varieties of cabbage, broccoli, cauliflower, Brussels sprout, and kohlrabi. Our results showed that imported cabbageworm is the most abundant and severe pest of cabbage, Brussels sprout, and broccoli in central Missouri. This insect poses a significant threat to cabbage and other brassicas throughout the growing season.

Life Cycle

The adult insect (Fig. 1) overwinters as pupa (Figs 5 & 6). Pupa is an insect in its inactive immature form between larva and adult. Adult *Pieris rapae* live for 5-20 days, which means that females should be able to mate and lay their eggs within this period to ensure successive generations. The female (Fig. 2) usually starts egg-laying within a day or two after emerging as an adult. It can lay 400-1000 eggs (Fig. 3) in its short lifespan (Suzuki, 1978). The adults emerge from the diapausing pupae when temperatures begin to warm up. Diapause is a period of suspended or arrested development during an insect's life cycle in response to regular and recurring periods of adverse environmental conditions. Mating occurs during the day within 24 hours of emergence, and egg-laying happens within 3-5 days, depending on weather conditions. The female lays eggs in singles on a host plant (Fig. 3). The eggs are yellowish to cream-colored, bullet-shaped, and deeply ridged; eggs are laid on the leaves of host plants. The larvae start to feed as soon as they emerge from eggs. It causes severe damage nearly every year to cabbage and similar crops. This butterfly is among the first insects that appear in spring. The larva is green with pale yellow stripes and is covered with short fine hairs (Fig. 4 arrowed). Both the larvae and pupa can blend well with the environment. The wingspan is about 1 1/4 to 1 3/4 inches (32 to 44 mm). The typical host plants are cabbage, broccoli, kale, Brussels sprout and other wild brassica plants. Depending on the temperature, eggs hatch between 4-10 days. After the eggs hatch, the larva begins to feed immediately; within 10-14 days, the larva will develop through 5 stages. The larva usually spends more time along the underside of the leaf rib and feeds on young leaves. In cabbage, the preferred leaves are those ready to curl into the head.

Fig. 5. Pupa of cabbageworm.
(Photo credit: Clement Akotsen-Mensah)

Fig. 6. Pupa before adult emergence.
(Photo credit: Clement Akotsen-Mensah)

Fig. 7. Damage of cabbageworm larva evidenced by massive frass (feces) (arrowed).
(Photo credit: ClementAkotsen-Mensah)

Fig. 8. Damage of cabbageworm larva evidenced by defoliation on cabbage.
(Photo credit: Clement Akotsen-Mensah

Damage

Cabbageworm has elevated itself as one of the most critical pests of brassica plants in Missouri. The adult shows feeding preferences for crops in the brassica family. Depending on the level of infestation, cabbageworm can cause 80-100% crop loss if not controlled. The 5th instar (phase between two periods of molting in the development of an insect), larva, is the most damaging stage. They feed and excrete large amounts of feces (secondary infection sites for pathogens). A pathogen is a bacterium, virus, or other microorganisms that can cause disease. Larva feeds on several plant species and can survive with sufficiently thick stems in herbaceous plants.

Monitoring and Scouting

Yellow, blue, and green sticky cards can be used to detect the presence of cabbageworm adults. However, these cards seem to be better at monitoring when the population is high. Because the most damaging stage of the insect (larva) can blend well with its environment, it is essential to make visual checks on selected plants. While checking the plants, observe feeding points, particularly on small, young tender leaves. The newly hatched larvae are tiny and may be challenging to see with the naked eye. Use a magnifying glass to examine the plants. The larvae can be found by inspecting the lower leaves of the host plants. The larval count will provide a better estimation of infestation. However, feeding damage and fecal material could also be used as signs of insect activity. The caterpillars cause varying amounts of damage depending on their numbers or population. Therefore, keeping good records of the different life stages and the percentage of insects and other plants infested is important. This will provide information on the population over time. Treatment thresholds are well established for this insect and are based on the percent infestation by any lepidopteran (Insect order for butterflies and moths) species and vary based on the stage of crop development. Cabbage, broccoli, and cauliflower are particularly susceptible to damage; therefore, 10% of the plants are contaminated with imported cabbage worms, cabbage loopers, and diamondback moths. The economic threshold (E.T.) is raised to 30% for cabbage between transplant and cupping (the process of cabbage head formation). When cabbages are first planted they initially produce lots of large broad leaves, but in the latter part of their growing season the inner leaves at the center of the plant begin curling inwards and cupping around a short-thick stem, growing tightly together to form the head of cabbage we are all familiar with. Once the plants have begun to cup, treatment is warranted until early heading if greater than 20% of plants are infested. From early heading until harvest, the threshold drops back to 10% to protect the market quality of the produce.

For broccoli and cauliflower, the threshold is increased to 50% between transplant and the first flower or curd. However, once flowers or curds begin to develop, the economic threshold drops back to 10% to maintain a high level of quality.

Fig. 9. Nymph of spine soldier bug feeding on pupa of cabbageworm.
(Photo credit: Rob Flowers, Oregon Department of Forestry, Bugwood.org)

Fig. 10. A parasitic wasp attacking larvae.
(Photo from Phys.org)

Pest Management

Cultural and mechanical control. Removing alternate host plants, such as wide cabbage, and contact weed control will keep the crop devoid of insects. Cabbageworm can also be removed physically or with the aid of a vacuum. Handpick if the numbers are few and when the area of cultivation or garden is small. For successful handpicking, frequent inspections should be done to find the insects. They usually blend with the environment, so looking for other secondary indicators like frass (insect fecal matter) on the leaves is essential. The worms are found mainly on the underside of leaves. The adult usually lays its eggs (Fig. 2) on the center vein and covers the plant with netting material. Other cultural control methods include covering crops to break the cycle. Also, hoop houses may be used to prevent cabbageworm.

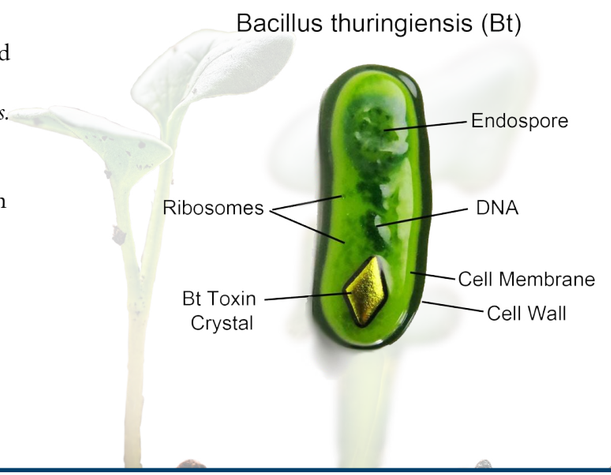
Resistance varieties. Some varieties have been developed to be resistant to cabbageworm and other caterpillars. However, red kale and purple cabbage varieties provide poor camouflage for the pest, which may be an option for growers. The green-colored larva cannot blend in because they are easily seen and attacked by predator insects.

Beneficial Insects: Predators and Parasitic Wasps: Several insects use cabbageworm for food or to lay their eggs. One good example is the spine soldier bug (Fig. 8). This insect feeds directly on the larvae of cabbageworm. Many insects, like the yellow jacket wasp and the paper wasp, also use cabbageworm as prey (food). Several other tiny wasps may lay their eggs inside or on insects, thus controlling their populations naturally. Once the eggs are laid on or inside the insect body hatch, the wasp larvae feed on the host caterpillar, killing it *instantly or after a few days.* The *Trichogramma* wasp (Fig. 9) is an excellent parasitic wasp for most pest caterpillars. These wasps do not sting humans, but growers must be cautious in introducing parasitic wasps. As parasites or parasitoids, these insects live inside or on another arthropod and ultimately kill it. Some of them can also attack good insects like the monarch butterfly larvae.

Chemical Control

Botanical insecticides: These are natural insecticides obtained from plant sources. Typical botanical insecticides are neem, also known as, Azadirachta indica (L.) and Adele (Meliaceae), along with homemade extracts from garlic, Allium sativum L. (Alliaceae) onion, *Allium cepa* (Alliacea) hot pepper, *Capsicum frutescens* L. (Solanaceae), and ashes from burnt wood. These botanicals have proven to be favorable against insect pest populations. They are valued because they are biodegradable, residue-free, eco-friendly, cost-effective, and sustainable.

Neem is a native plant of India. It also grows in many parts of Africa and other tropical regions. The seeds (kernel), leaves, and other parts contain an oil, which has a compound called Azadirachtin. This compound is non-synthetic. The oil works by preventing the insects from eating, causing starvation and death. Because of this feeding prevention property, neem oil is used to control insects that chew, such as caterpillars and beetles. Azadirachtin is unstable in sunlight. Neem oil should be applied to crops during late afternoon so that its effectiveness is not degraded by light. It is also advisable to re-apply neem following rain. Several neem products are available in different trade names and can be used to control cabbageworm. Contact your local pesticide sellers for product availability. Although botanical insecticides are considered safe, some may be toxic to beneficial insects such as bees and natural enemies of pests. Thus, some are restricted use in organic farming. A restricted-use insecticide is any insecticide that a certified person can apply. Examples of some botanicals with restricted use include tobacco (nicotine), pyrethrum (pyrethrins), and *Derris spp* (rotenone) (IFOAM 2011). Some reports have shown that neem can also reduce the population of bumblebees (Barbosa et al., 2015). Reduce the negative impact of the botanicals and other biopesticides on the beneficial insects by spraying them from the late afternoon to evening, whereby the beneficial insects may be inactive.



Microbial insecticides

Bacillus thuringiensis, also known as Bt, is a naturally-occurring, soil-dwelling bacteria. It is currently used as an organic biological pesticide to control many larvae of butterflies or moths such as cabbageworms and cabbage loopers. This bacterium is not toxic to humans or other

Top Photo: An image of neem, showing it's leaves and fruit. The compound leaves have toothed leaflets and are typically evergreen but do drop during periods of extreme drought.
Middle Photo: An example of Neem oil.
Bottom Photo: An image of *bacillus thuringiensis* (Bt) Bacteria.

mammals but could be harmful to certain insects when ingested. Bt occurs naturally on leaves and soil worldwide and has been used commercially in organic and conventional agriculture. Bt spray is available to purchase either as a pre-mixed or a concentrate that must be diluted before applying to plants. In terms of cost, the concentrates are the more cost-effective. Bt is considered safe for human consumption even if sprayed the same day as harvest. However, it is always advisable to give a few days to harvest after spray.

Synthetic insecticides.

Other commercial insecticides such as pyrethroids, organophosphates, and carbamates may be used. Refer to the current edition of the Midwest Vegetable Production Guide for Commercial Growers for specific insecticide recommendations.

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