Crops/ fruits/ vegetables

Pests/ diseases/ weeds

African armyworm
African bollworm
African cassava mosaic virus (ACMV)
African

more Images

Turnip Mosaic Virus (TuMV)
Order/Family: Potyviridae: Potyvirus
Type: disease (viral)
Common names: cabbage A virus mosaic / Cabbage black-ringspot virus
Host plants: Cabbage/Kale, Brassicas Crucifers (Black mustard, cauliflower, broccoli, radish) / Beets / Tobacco

- maize stalkborer
- Anthracnose
- Aphids
- Bacterial wilt
- Bagrada bug
- Banana weevil
- Black rot
- Cabbage looper
- Cabbage moth
- Cabbage webworm
- Couch grass
- Cowpea seed beetle
- Cutworms
- Damping-off

General Information on Disease and Damage

Geographical distribution

Geographical Distribution of the Turnip Mosaic Virus in Africa *(red marked)*

Damage

Infested plants are stunted, with leaves coarsely mottled and distorted. Black spots develop on leaves which prematurely drop. Early infection of cabbage by this virus in the seedbed or soon after transplanting, can reduce yield by 75%, whereas late-season infection has little or no effect

diseases
Diamondback moth (DBM)
Downy mildew
Early blight
Fruit flies
Fusarium wilt
Larger grain borer
Late blight
Leafmining flies (leafminers)
Mango seed weevil
Mealybugs
Powdery mildew
Purple witchweed

on yield. It also reduces seed yield.

Host range

Turnip mosaic virus (TuMV) has a very wide host range infecting at least 318 species in 156 genera of 43 families. TuMV infects most cruciferous plants, but is most damaging in Chinese cabbage, turnip, mustard, and radish. It also attacks beets, spinach and tobacco.

Symptoms

On cabbage: Mosaic, black speckling or stippling of cabbage heads at harvest or during storage can be caused by the TuMV or the cauliflower mosaic virus occurring singly or together. The latter causes lumpy or warty growths on the veins on the undersurface of leaves and vein clearing. In stored cabbage, black sunken spots develop on leaves throughout the head. The spots are considerably larger than those caused by cauliflower mosaic virus. Its mode of transmission is similar to TuMV (i.e. aphids and mechanically). However, cauliflower mosaic virus has a restricted host range. It is infectious only to members of the cabbage family (brassicas).

Affected plant stages

Flowering stage, fruiting stage, seedling stage and vegetative growing

Root-knot nematodes
Snails (Giant East African Snail)
Spider mites
Spotted stemborer
Storage pests
Sweet potato weevil
Termites
Thrips
Tomato Yellow Leaf Curl Virus Disease (TYLCV)
Turnip

stage.

Affected plant parts

Leaves, seeds, stems and whole plant.

Symptoms by affected plant part

Leaves: lesions; abnormal colours; abnormal patterns; abnormal forms; yellowed or dead.
Seeds: empty grains; lesions.
Stems: external discoloration; abnormal growth; dieback.
Whole plant: plant dead; dieback; dwarfing; early senescence.

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Biology and Ecology of the Turnip Mosaic Virus

Transmission

TuMV is transmitted by aphids notably green peach aphid (*Myzus pericae*) and cabbage aphid (*Brevicoryne brassicae*) and is readily transmitted mechanically. The virus is transmitted by aphids in a non-persistent manner (short virus transmission period of 10 to 30 seconds) with no latent period (the time from start of an acquisition feeding until

Mosaic Virus (TuMV)
Weeds
Whiteflies
Medicinal plants
Fruit and vegetable processing
Natural pest control
Cultural practices

the vector can infect healthy plants with the virus). It can be acquired in less than one minute and can be inoculated in less than a minute. The transfer of viruses by aphids usually occurs over short distances (up to a few hundred metres), particularly down-wind and involves migrating alates (winged aphids). Weather conditions and temperature influence aphid activity and migration patterns which in turn affect dissemination of TuMV. Dry and warm conditions favour aphid reproduction and dissemination and hence early and increased spread of the virus. Cool, wet and windy conditions reduce the reproduction and movement of aphids and hence spread of the virus.
Once primary infections are established in fields, TuMV may spread relatively rapidly from plant to plant if aphids are not controlled. Seed transmission of the virus has not been observed.

Sources of Infection

Primary sources of TuMV infection are diseased host plants and weeds. Vectors can be introduced into field crops with infected transplants. Transplants can become infected during propagation in nursery beds. It is not seed transmitted.

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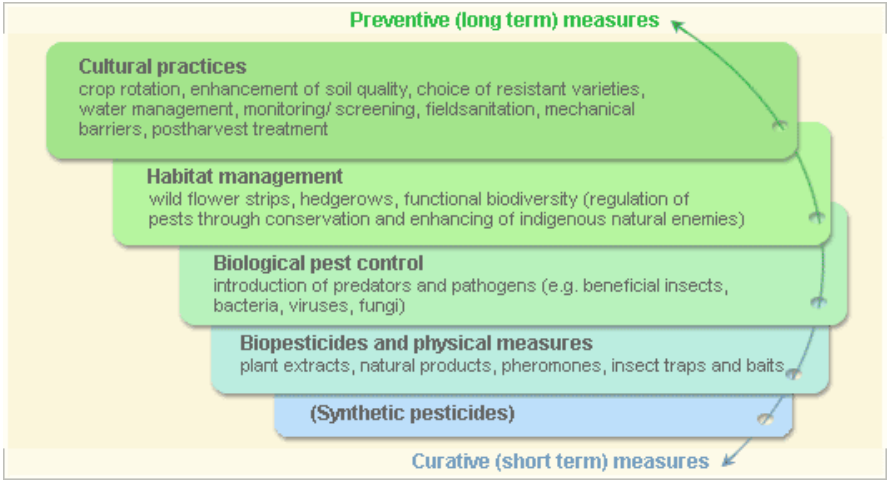
Pest and Disease Management

Pest and disease management: General illustration of the concept of *infonet-biovision*



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Further below you find concrete preventive and curative methods against TuMV.

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Cultural practices

Control of Turnip Mosaic Virus is quite difficult due to the very wide host range of the virus, the ineffectiveness of insecticides in controlling the spread of non-persistently transmitted viruses, and the lack of immune crop cultivars.

Control options

Locate seedbeds away from weedy fields. Weeds and volunteer plants should be eliminated from seedbed areas and preferably from production fields. It may be helpful to discard plants from outside rows in seedbeds.

Hygiene

A very common method of transferring the virus from plant to plant is on contaminated hands and tools. When transplanting seedlings, wash your hands frequently and thoroughly with soap and water. Field equipment should be used in new fields first and then in older fields. Never attempt

to transplant a healthy plant into the soil from which a diseased plant was removed. Roots from diseased plants will remain in the soil and provide the virus source for the new transplant. Field sanitation, particularly, weed control is very important since the virus can infect many weed species.

Resistant cultivars

In areas where Turnip Mosaic Virus is serious and endemic, growing of Danish cabbage varieties should be considered. These varieties have been reported to have some resistance to TuMV (Sherf and Macnab, 1986).

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Crops/ fruits/ vegetables

Pests/ diseases/ weeds

Black rot
Scientific name: *Xanthomonas campestris pv. campestris*
Order/Family: Xanthomonadales: Xanthomonadaceae
Type: disease (bacterial)

African armyworm
African bollworm
African cassava mosaic virus (ACMV)
African maize stalkborer
Anthracnose
Aphids
Bacterial wilt
Bagrada bug
Banana weevil
Black rot
Cabbage looper

more Images **Host plants: Cabbage/Kale, Brassicas Sweet potato mustard / radish**

General Information on Disease and Damage
Biology and Ecology of Black Rot
Pest and disease management
Cultural practices
Information Source Links

General Information on Disease and Damage

Geographical distribution

Geographical Distribution of Black rot in Africa (red

The pathogen that causes black rot is widely distributed in Africa, Asia, Australia and Oceania, Europe, North America, Central America, the West Indies and South America. Black rot is endemic in Africa. It is the most important disease of brassicas in Kenya, Zimbabwe and Zambia (CABI, 2005).

marked)

Introduction

Black rot affects cabbage and related crops (brassicas, mustard & radish) worldwide and is caused by the bacterium *Xanthomonas campestris* pv. *campestris*. Black rot is one of the most serious cabbage / kale diseases in warm climates. Diseased plants may rot quickly before or after harvest because of secondary infection from bacterial soft-rot. Soft-rot bacteria may invade heads of black-rot-infected plants, causing tissue to become slimy and foul-smelling. The black rot bacterium can over-season on infected cabbage seeds, in weeds belonging to the Brassica family (including: black mustard, field mustard, wild turnip, wild radish, shepherd's purse, and pepper weed); or in infected plant material in the soil. The bacterium can persist in plant residue for 1-2 years or as long as the plant debris remains intact.

Damage

In Kenya, black rot is endemic and the cause of much damage (Onsando, 1988, 1992). The disease is considered of intermediate economic importance in Mozambique (Plumb-Dhindsa and Mondjane, 1984). Black rot is widespread in Zimbabwe where it is considered the most important disease of brassicas (Mguni, 1987, 1995).

flies (leafminers)
Mango seed weevil
Mealybugs
Powdery mildew
Purple witchweed
Root-knot nematodes
Snails (Giant East African Snail)
Spider mites
Spotted stemborer
Storage pests
Sweet potato

Host range

Black rot is a pathogen of most cultivated cruciferous plants and weeds. Cauliflower and cabbage are the most readily affected hosts in the crucifers, although kale is almost equally susceptible. Broccoliand Brussels sprouts have intermediate resistance and radish is quite resistant, but not to all strains. Kohlrabi, Chinese cabbage, rutabaga, turnip, collard, rape, jointed charlock (*Raphanus raphanistrum*) and mustard are also susceptible hosts.

Symptoms on cabbage

The plant can be infected at any time during its life cycle. On young seedlings a yellowing appears along the margin of the cotyledons, which later shrivels and drops off. On the margins of mature leaves, similar yellowing appears. Initially, a small V-shaped area develops, but as the diseased area enlarges, the veins become distinctly black. In contrast to *Fusarium* yellows the veins are brownish in colour. The affected stem, when cut crosswise, shows a characteristic black ring. In later stages the entire head may turn black and soft due to secondary infection by soft rot bacteria (*Erwinia carotovora* var.*carotovora*).

- weevil
- Termites
- Thrips
- Tomato Yellow Leaf Curl Virus Disease (TYLCV)
- Turnip Mosaic Virus (TuMV)
- Weeds
- Whiteflies

Medicinal plants

Fruit and vegetable processing

Natural pest control

Bacterial black rot. Note blackening of water-conducting tissues of the stem

© A. M. Varela, icipe

Black rot on cabbage. Black

Cultural practices

rot leaf internal symptom. Note blackening of veins

© A.A. Seif, icipe

Bacterial soft rot. Note slimy rot (whitish) of the centre of the cabbage head

© A. M. Varela, icipe

Affected plant stages

Seedling stage, vegetative growing stage and heading stage (cabbages).

Affected plant parts

Leaves, seeds, stems, vegetative organs and whole plant.

Symptoms by affected plant part

Leaves: 'V' shaped lesions
Seeds: discolorations; lesions.
Stems: Internal discoloration (black in colour) .
Vegetative organs: internal discoloration (black in colour); dry rot.
Whole plant: plant death

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Biology and Ecology of Black Rot

Source of infection and spread

The bacteria survive in infected seed, in debris from diseased plants left in the field and in infested soil. Seed-borne bacteria can be disseminated long distances. Many cruciferous weeds can harbour the black-rot bacteria. In a new field, black rot is usually introduced via infected seed or diseased transplants.

Further spread is facilitated by water-splash, running water, and handling infected plants. The bacteria enter the plant mainly through water pores at the edges of leaves. They can also enter through the root system and

wounds made by chewing insects. They then move through the water vessels to the stem and the head. Black rot is favoured by warm (26-30°C) wet conditions.

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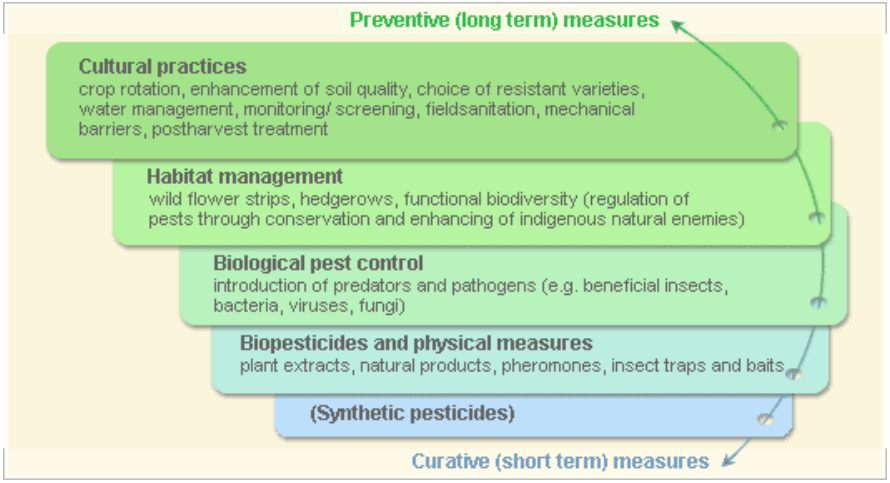
Pest and disease management

Pest and disease Management: General illustration of the concept of *infonet-biovision*



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Further below you find concrete preventive and curative methods against Black rot.

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Cultural practices

Control options

- **Use certified disease-free seed.**
- **Establish crops in seedbeds in black rot-free soils that have not grown crops from the family Crucifers for at least 3 years.**
- **Seedlings should not be crowded in the nursery.**
- **Transplants should not be dipped in water before transplanting.**
- **Mulching of the field crop, where practicable, is highly recommended.**
- **Black rot is usually most severe in wet, poorly-drained soils**
- **Avoid overhead irrigation.**

- **Field operations during wet weather should be discouraged.**
- **Keep the field free of weeds, particularly of the crucifer family.**
- **Growing cabbage on raised beds helps eliminate conditions that induce black rot.**
- **When possible, remove, burn, or plough down all crop debris immediately after harvest to reduce the amount of bacteria in the soil**
- **A crop rotation based on at least a 2-year break in cruciferous crops is advocated.**
- **Use of resistant/tolerant varieties, where commercially available, provides the most effective control of the disease.**

Hot water seed treatment

For information on hot water seed treatment click here.

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Crops/ fruits/ vegetables

Pests/

Cabbage webworm

Scientific name: *Hellula undalis*

diseases/ weeds
African armyworm
African bollworm
African cassava mosaic virus (ACMV)
African maize stalkborer
Anthracnose
Aphids
Bacterial wilt
Bagrada bug
Banana weevil
Black rot

Order/Family: Lepidoptera: Pyralida
Type: pest (insect/mite)
Common names: cabbage centre worm, cabbage borer
Host plants: Cabbage/Kale, Brassicas

more Images

General Information on Pest and Damage
Biology and Ecology of the Cabbage Webworm
Pest and Disease Management
Cultural practices
Biological pest control
Biopesticides and physical methods
Information Source Links
Reference addresses

General Information on Pest and Damage

Geographical distribution

The cabbage webworm *(Hellula undalis)* is an important pest of brassicas in many parts of the world. In Africa, it occurs in Eastern and Southern Africa region. In Malawi and Mozambique, it is considered a major pest.

- Cabbage looper
- Cabbage moth
- Cabbage webworm
- Couch grass
- Cowpea seed beetle
- Cutworms
- Damping-off diseases
- Diamondback moth (DBM)
- Downy mildew
- Early blight
- Fruit flies
- Fusarium wilt
- Larger grain borer

Geographical Distribution of the Cabbage webworm in Africa (red marked)

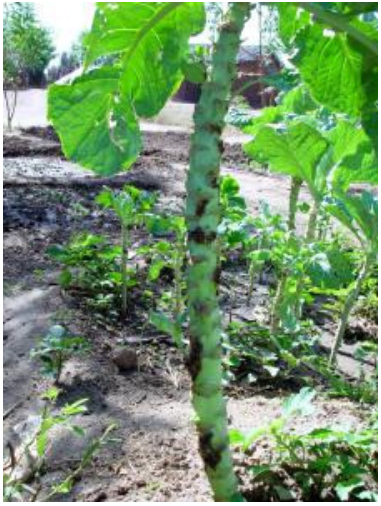
Damage

Young caterpillars mine the leaves while older caterpillars feed on the underside of rolled leaves within spun webs. Mature caterpillars (last instars) feed on leaves as well as stems and growing points. They are often hidden behind a web of silk and masses of frass (insect faeces). These are usually the first signs noticed.

- Late blight
- Leafmining flies (leafminers)
- Mango seed weevil
- Mealybugs
- Powdery mildew
- Purple witchweed
- Root-knot nematodes
- Snails (Giant East African Snail)
- Spider mites
- Spotted stemborer
- Storage pests

First instar caterpillars of the cabbage webworm feeding in a leaf of kale.
© A. M. Varela, icipe

Caterpillars feeding on young plants frequently causes death of the plants, especially when the larvae feed on the growing point. In older cabbage plants, new shoots are produced and the attacked plants produce several small heads of little commercial value. Caterpillar feeding after heading may cause head stunting. In addition, insect feeding and the presence of caterpillars and/or their excrement reduce the market value of the produce. On kale, young caterpillars mine in the leaves and older caterpillars bore into the stem of the plants. Frass accumulated at the entrance of the tunnel along the stems is an indication of damage.



Damage by the cabbage webworm as stemborer on a kale plant

- Sweet potato weevil
- Termites
- Thrips
- Tomato Yellow Leaf Curl Virus Disease (TYLCV)
- Turnip Mosaic Virus (TuMV)
- Weeds
- Whiteflies

Medicinal plants

Fruit and vegetable processing

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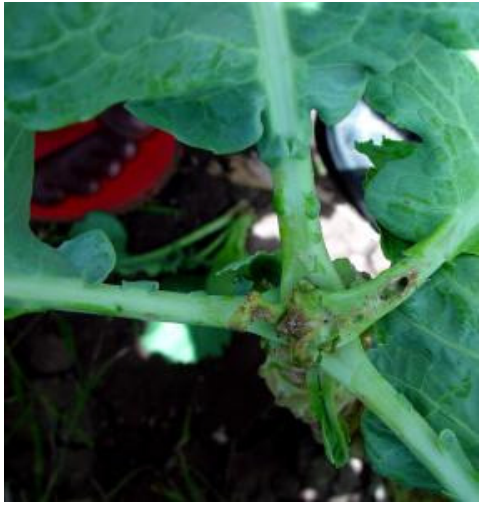

Damage to the growing tip of a kale plant caused by the cabbage webworm

© A. M. Varela, icipe

Host range

Principal host plants are cabbage, Kale and all other brassica crops (cauliflower, kohlrabi, broccoli etc). Cauliflowers appear to be the preferred food plant of the cabbage webworm. It is also found feeding on radish.

Natural pest control

Cultural practices

Symptoms

Young caterpillars mine leaves, bore stems and feed externally on the leaves; they then often penetrate the heart of the plant destroying the terminal bud, and prevent heading. While feeding they spin a silken tube. Plants wilt, and frass is exuded from the affected plant parts.

Affected plant stages

Flowering stage and vegetative growing stage.

Affected plant parts

Growing points, inflorescence, leaves, stems and whole plant.

Symptoms by affected plant part

Growing points: external feeding.
Inflorescence: wilt.
Leaves: external feeding; internal feeding; webbing.
Stems: internal feeding.
Whole plant: dead heart; wilt.

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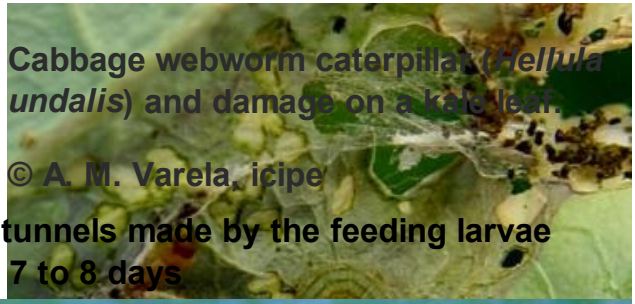
Biology and Ecology of the Cabbage Webworm

The eggs are small, oval and slightly flattened upon the plant surface. They are creamy white when freshly laid, become pinkish the next day and then turn brownish-red with the dark head of the caterpillar visible at one end just before hatching. The eggs are laid singly, or in groups or chains of 2 or 3 on the surface of leaves or on younger parts of the plant. At temperatures between 25 and 29°C, a single female moth lays as many as 150 eggs, which hatch in 4 to 5 days. In Hawaii, eggs hatch in 2 to 3 days at mean temperatures

Caterpillars are creamy white with light pinkish brown stripes along the body and have a black head. Mature caterpillars have faint stripes. They measure 15 mm when fully grown. Duration of larval development varies between 6 to 18 days, depending on temperature and on the host crops. Thus, on cabbage larval development is completed in 16

to 19 days, but on cauliflower it may require only 11 to 13 days.



Cabbage webworm caterpillar (*Hellula undalis*) and damage on a kale leaf.

© A. M. Varela, icipe

The pupae are shining pale brown with a dark dorsal stripe. Pupation occurs in leaf tissue, in tunnels made by the feeding larvae inside the stem. Adults emerge in 7 to 8 days

Adult moths are greyish-brown in colour, small and rather delicate with a wingspan of approximately 1 cm. Each front wing has a black spot and zigzagging pale brown lines.
The adult moth is capable of flying long distances and occasionally migrates to areas well outside its normal breeding range. Adult lifespan is about 4 to 8 days.

Moth of the cabbage webworm *(Hellula undalis)*

© A. M. Varela, icipe

Cabbage webworm (*Hellula undalis*) feeding on a cabbage head

© A. M. Varela, icipe

Caterpillar of the cabbage webworm *(Hellula undalis)* feeding in the stem of a kale plant.

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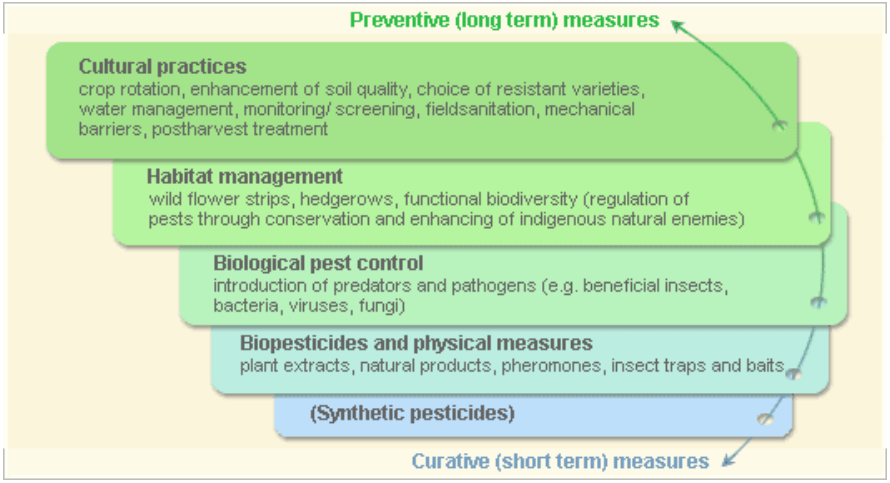
Pest and Disease Management

Pest and disease Management: General illustration of the concept of *infonet-biovision*



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Further below you find concrete preventive and curative methods against Cabbage webworm.

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Cultural practices

Monitoring

Regular monitoring of young plants in the nursery and after transplant is important. Inspect crops for the presence of caterpillars and damage symptoms.

Use clean planting materials: transplant only healthy, vigorous insect-free seedlings.

Field sanitation

Uprooting and burning of cabbage and kale stalks and crop rotation are

important to reduce field populations.

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Biological pest control

Natural enemies

Natural enemies of the cabbage webworm include parasitic wasps (such as braconid, ichneumonid and chalcidoid wasps).

Conservation of these natural enemies is important. Care should be taken when deciding on options to manage this or other cabbage pests. The cabbage webworm frequently occurs in the same areas where aphids and diamondback moths are major pests. This may complicate the control of cabbage webworm, since pesticides used to control aphids, and other pests, may kill natural enemies of the cabbage webworm resulting in outbreaks of this pest.

For more information on natural enemies click here.

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Biopesticides and physical methods

Bt (Bacillus thuringiensis)

***Bacillus thuringiensis* var. *aizawai* and *Bt* var. *kurstakiare* very effective in controlling infestations of the cabbage webworm. *Bt* var. *kurstakiis* widely used at a weekly interval and a rate of 0.5/ha. This type of strategy provides effective control of the cabbage webworm. However, continuous use of Bt can induce development of resistance.**

It is important to start control measures early when caterpillars are still young and have not yet penetrated plant tissue.

Bt is a naturally occurring soil bacterium that causes disease on insect pests. It is accepted as an alternative in organic farming and is considered ideal for pest management because it is host specific and is non-toxic on natural enemies and on humans.

Bt is commercially available in most agricultural suppliers. It is sold in various formulations (spray, dust, and granule) and strains (*Bt tenebrionis, Bt kurstaki, Bt israelensis, Bt aizawai, Bt san diego*).

Products: Bt products in Kenya are sold under the following commercial names: Dipel, Javelin, Thuricide and Xentari. They kill the cabbage

webworm and do not harm beneficial insects.

Application: Bt insecticides should be applied when the first L1-larvae are appearing. Sprays may need to be applied at intervals of 5 to 7 days when populations are high. Because Bt insecticides are UV-degraded treat crops in the late afternoon.

For more information on Bt click here.

Spinosad

Spinosad, a broad-spectrum insecticide derived from fermentation of the naturally occurring soil bacterium Saccharpolyspora spinosa, controls many caterpillars, leafmining flies, and thrips. It is useful for the management of caterpillar pests in brassicas, including the diamondback moth, the cabbage looper and the cabbage webworm. Spinosad has low activity against most beneficial insects.

Farmer experiences - homemade biopesticides

Farmers in some countries produce their own homemade biopesticides

by collecting diseased diamondback moth larvae (fat and white or yellowish or with fluffy mould on them), crushing them and mixing them with water in a blender. Large tissue clumps are filtered out and the liquid is sprayed onto the crop (Dobson et al, 2002).

Neem

Botanicals, especially neem-based insecticides give good control of the cabbage webworm. Weekly applications of simple neem products afforded good control in Togo (Ostermann and Dreyer, 1995). It is important to start control measures early when caterpillars are still young and before they have penetrated plant tissue.

For more information on Neem click here.

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Aphids

more Images

Downy mildew
Scientific name: *Albugo* spp., *Bremia* spp., *Peronospora* spp., *Pseudoperonospora* spp.,
Order/Family: Peronosporales: Peronosporaceae
Type: disease (fungal)
Host plants: Cabbage/Kale, Brassicas Cucumber Millet Onion Peas Pumpkin Soybean Spinach Zucchini/Courgette Grapes, hops

General Information on Disease and Damage
Biology and Ecology of Downy Mildew
Pest and Disease Management
Cultural practices
Biopesticides and physical methods
Information Source Links

General Information on Disease and Damage

Geographical distribution

Bacterial wilt
Bagrada bug
Banana weevil
Black rot
Cabbage looper
Cabbage moth
Cabbage webworm
Couch grass
Cowpea seed beetle
Cutworms
Damping-off diseases
Diamondback moth (DBM)
Downy

Geographical Distribution of Downy mildew in Africa (red marked)

Damage

Damage caused by downy mildews is usually associated with the sporulation of the fungus. Sporulation of *Peronospora destructor* can cause up to 55% reduction in the dry weight of onion leaves (Yarwood, 1941). The corresponding figures for *Pseudoperonospora humuli* on hops

mildew
Early blight
Fruit flies
Fusarium wilt
Larger grain borer
Late blight
Leafmining flies (leafminers)
Mango seed weevil
Mealybugs
Powdery mildew
Purple witchweed
Root-knot nematodes
Snails (Giant East

and *Peronospora farinose* on spinach were 17 and 48%, respectively.
Losses from downy mildews can be considerable. It is estimated that in 1962 downy mildew of tobacco (*Perenospora tabacina*) reduced yields in Europe by at least 100,000 metric tons (Peyrot, 1962).


Downy mildew on cabbage
© A.M. Varela, icipe

Symptoms

Plants can be infected at any time during their growing period. Symptoms of downy mildew infection include small, pale yellow spots with indefinite borders on the upper leaf surface. Purplish discoloration of the upper leaf surface is seen on some hosts. A downy growth (sporangiophores) may be seen directly under the spots on the underside of the leaf or on fruits or stems early in the morning or when foliage is wet. Young leaves and cotyledons may drop off when yellow. Thus, the disease can cause severe damage to seedlings in the seedbed. Older leaves usually remain attached, and affected areas enlarge, turning brown and papery. When the disease is severe, whole leaves die.

Affected plant stages

Seedling stage, vegetative growing stage, flowering stage and fruiting

African Snail)
stage.

Spider mites
Affected plant parts

Spotted stemborer
Leaves and whole plant.

Storage pests
Symptoms on affected plant part

Sweet potato weevil
Leaves: lesions; fungal growth.
Stems: fungal growth.
Flowers: fungal growth; flower abortion; flower drop.
Fruiting stage: fungal growth.

Termites

Thrips

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Tomato Yellow Leaf Curl Virus Disease (TYLCV)

Biology and Ecology of Downy Mildew

Turnip Mosaic Virus (TuMV)

Several different fungi cause downy mildew disease on vegetables, fruits, ornamentals, forages, field crops and blue mold of tobacco. These include *Albugo* spp. (on crucifers), *Bremia* spp. (on lettuce), *Peronospora* spp. (mildew on tobacco, spinach, soybeans, alfalfa, onion, many ornamentals), *Plasmopara* spp. (on grape and sunflower), *Pseudoperonospora* (on cucurbits), *Peronosclerospora* (on sorghum and corn), *Sclerospora* (on grasses, millet), and *Sclerophthora* (on maize, rice, wheat).

Weeds

Whiteflies

Medicinal plants

Fruit and vegetable processing

Natural pest control

Cultural practices

Downy mildew fungi are fairly host specific. The downy mildew fungus that infects one type of plant (e.g., rose) is not the same downy mildew fungus that infects another (e.g., grape). However, if you see downy mildew on one plant, then environmental conditions (i.e., cool, wet weather) are favourable for development of downy mildews on a wide range of plants.

Downy mildew of grape, spinach, and tobacco cause serious economic losses. It spreads rapidly through fields and is dependent on a wet, humid environment with cool or warm, but not hot, temperatures. A film of water is needed on plant tissue for spore germination and infection.

Conditions that favour development include:

- **Cool, moist weather conditions**
- **Host weeds found in between the crops**
- **Crop residues in the field**
- **Poor plant aeration**
- **Overcrowding (planting in high densities)**

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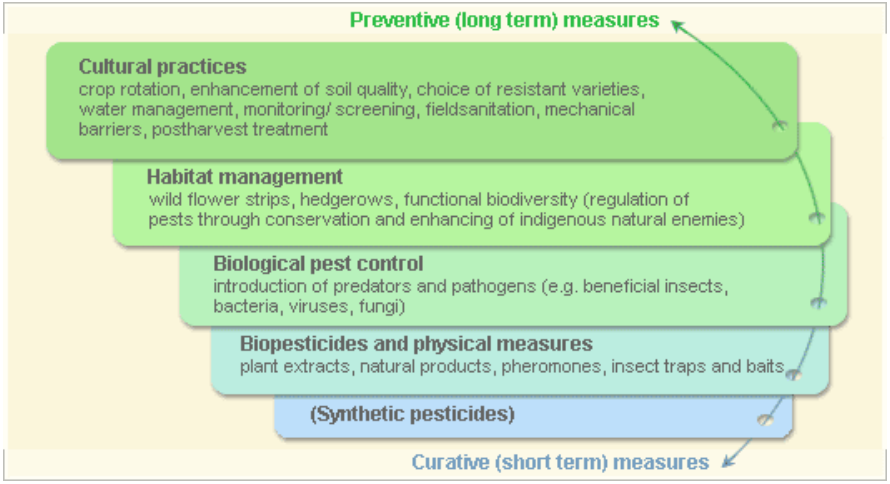
Pest and Disease Management

Pest and disease Management: General illustration of the concept of *infonet-biovision*



These illustration shows the methods promoted on infonet-biovision. The methods shown at the bottom have a long-term effect, while methods shown at the top have a short-term effect. In organic farming systems, methods with a long-term effect are the basis of crop production and should be used with preference. On the other hand methods with a short-term effect should be used in emergencies only. On infonet we do not

promote synthethic pesticides.

Further below you find concrete preventive and curative methods against Downy mildew.

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Cultural practices

Prevention

1. Use resistant varieties where available
2. Use only certified diseased-free seeds for sowing. Transplant only healthy seedlings.
3. Ensure proper land preparation to make sure that your soil is well drained.
4. Provide adequate plant spacing to reduce the density of the canopy and minimize humidity.
5. Pruning of new growth also helps proper plant's aeration.
6. Remove infected plants and prune infected shoots.
7. Properly dispose of collected diseased-parts either by burning or burying them.
8. Avoid overhead watering. It lengthens the duration of leaf wetness and

favours further development of the disease.
9. Plough-under all the plant debris after harvest.
10. Practice crop rotation.

Control options

Control should be emphasised in nurseries since downy mildew is particularly damaging in the seedbed.

1. Seedbeds should have well-drained soils and be sited away from hedges and windbreaks. The site should not have been under susceptible crops for at least the previous 2 years.
2. Seedlings should not be excessively watered.
3. Weeds should be eradicated in and near seedbeds and out in the production fields.
4. Crop residues should be removed from the field after harvest.
5. Avoid sprinkler irrigation.
6. Thin plants to reduce plant density and increase air movement.
7. Time irrigations so that they do not elongate leaf wetness.
8. Alter planting dates to avoid periods of high disease pressure.

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Biopesticides and physical methods

Copper

There are many copper compounds that are used as fungicides. The most common are derived from either copper hydroxide or copper oxychloride. These products are readily available in most third world countries and very reasonably priced. Copper products are still accepted in organic farming provided that the number of applications is strictly followed and a proper soil amendment is observed to prevent copper accumulation in the soil. For information on Copper click here.

Garlic bulb extract

For information on garlic bulb extract click here.

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Crops/ fruits/ vegetables

Pests/ diseases/ weeds

African armyworm
African bollworm
African cassava mosaic virus (ACMV)
African maize stalkborer
Anthracnose
Aphids
Bacterial wilt

more Images

Cabbage looper
Scientific name: *Trichoplusia ni*
Order/Family: Lepidoptera: Noctuidae
Type: pest (insect/mite)
Common names: semi-looper, cabbage semilooper
Host plants: Cabbage/Kale, Brassicas Tomato

General Information on Pest and Damage
Biology and Ecology of the Cabbage Looper
Pest and Disease Management
Cultural practices
Biological pest control
Biopesticides and physical methods
Information Source Links

General Information on Pest and Damage

Geographical distribution

Geographical Distribution of the Cabbage looper in Africa (red marked)

Introduction

The cabbage looper is widely distributed in the tropics and subtropics. It is a serious pest of cruciferous crops, but it also attacks other important crops such as tomato, lettuce, potatoes, sweet potatoes, cotton, cucurbits, etc. The cabbage looper is somewhat erratic in ocurrence, typically very abundant one year, and then scarce for two to three years.

- Fruit flies
- Fusarium wilt
- Larger grain borer
- Late blight
- Leafmining flies (leafminers)
- Mango seed weevil
- Mealybugs
- Powdery mildew
- Purple witchweed
- Root-knot nematodes
- Snails (Giant East African Snail)

Damage caused by cabbage looper on kales

Damage

Caterpillars feed primarily on leaves and cause irregular holes. Young caterpillars eat small holes, but older caterpillars feed on the tissue between the veins skelotinising the leaves (leaving only the midribs and veins) or giving them a ragged appearance. Plants can be severely defoliated and stunted, prodcing no heads or becoming unfit for consumption. They may also bore into the heads of lettuce and cabbage, contaminating them with frass. The presence of caterpillars and contamination of marketable plant parts will frass reduce the market value of the produce. Thus, large amounts of dark green pellets excreted

Spider mites
Spotted stemborer
Storage pests
Sweet potato weevil
Termites
Thrips
Tomato Yellow Leaf Curl Virus Disease (TYLCV)
Turnip Mosaic Virus (TuMV)
Weeds
Whiteflies

by te feeding looper may stain cauliflower heads. The presence of cabbage looper caterpillars in broccoli heads renders them unmarketable.

Host range

The cabbage looper has a wide host range that includes crucifers, beans, cotton and various vegetable crops. It is listed as feeding on over 160 species of plants in 36 families, but cultivated crucifers are preferred.

Affected plant stages

Vegetative growing stage.

Affected plant parts

Leaves and whole plant.

Symptoms by affected plant part

Leaves: external feeding; internal feeding; webbing; frass visible; shredding.
Whole plant: plant dead; dieback; dwarfing; internal feeding; external feeding; frass visible.

Medicinal

plants

Fruit and vegetable processing

Natural pest control

Cultural practices

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Biology and Ecology of the Cabbage Looper

The eggs are round or slightly dome-shaped with ridges, and about the size of a pinhead. They are pearly or silvery white and darken when they age. Eggs are laid singly usually on the undersides of leaves. A female moth can lay from 300 to 1600 eggs. Caterpillars hatch in 2 to 6 days after the eggs were laid.

The caterpillars go through five instars during development. very young caterpillars are white and almost clear with a black head capsule. Older caterpillars are green with a thin white line on each side just above the spiracles and two other white lines on the dorsum. Caterpillars have three pairs of legs near the head and three sets of prolegs (false legs) near its rear. They move in a "looping" manner, arching the

Young cabbage looper feeding on a

middle portion of the body as they move forward. Fully-grown caterpillars reach 3 to 4 cm in length.

kale leaf. Mature caterpillar reach 3 to 4 cm in length.

© A. M. Varela, icipe

Pupa. Caterpillars pupate in white loose cocoons attached to the underside of leaves, or in a folded webbed leaf or between two webbed leaves. The pupae are light green when young and gradually turn dark brown when mature. The moths are light green when young and gradually turn dark brown when mature. The moths emerge from the pupae 10 to 16 days after pupation.

Pupa of the cabbage looper. During its last larval stage the caterpillar spins a cocoon.

© A. M. Varela, icipe

The adult is a mottle, greyish-brown moth, about 2.5 cm long and with a wingspan of 4 cm. The front wings have two small silvery spots, one small and round, the other U-shaped (resembling an '8'), near the middle part of the wing. The hindwings are pale brown. Cabbage looper moths are strong fliers and are primarily nocturnal. During the day the moths can be

Moth of the cabbage looper. Real size: ca

found resting in foliage or in crop debris.

2.5 cm in length, wingspan is ca. 4 cm
© A. M. Varela, icipe

Development from egg to adult takes about 4 to 6 weeks.

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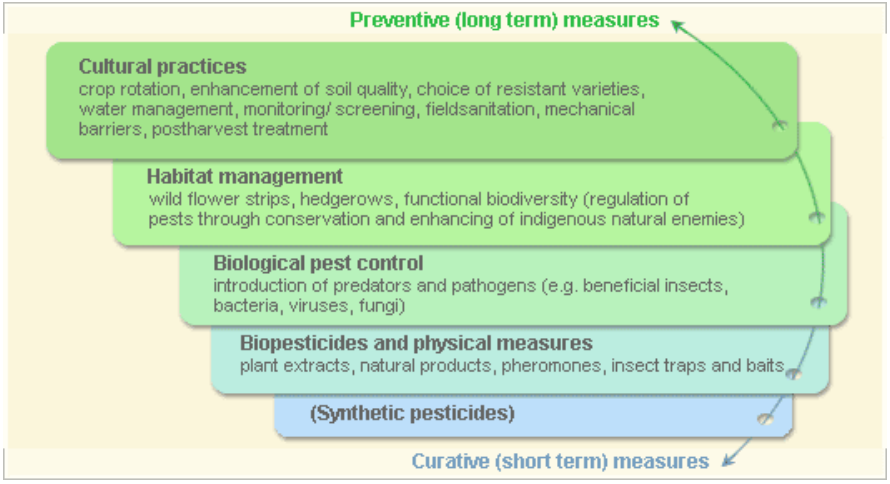
Pest and Disease Management

Pest and disease Management: General illustration of the concept of *infonet-biovision*



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Further below you find concrete preventive and curative methods against Cabbage looper.

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Cultural practices

Monitoring

Inspect plant regularly for the presence of caterpillars, leaf damage and the presence of frass. Caterpillars can be detected by scouting the crop, while adults can be monitored by using light- or pheromone-baited traps.

Monitor the presence of natural enemies. They play an important role in controlling the cabbage looper. Check plants twice a week once seedling

emergence begins. When populations appear to be increasing, check more often.

Treatment thresholds vary depending on the crop and location. Normally, spraying should not occur when there is less than one caterpillar per five plants (CABI, 2000). A control measure is not necessary unless you find more than nine small to medium-sized caterpillars per plant.

Management options

1. Plant resistant varieties, if available. Some resistant varieties are Mammoth Red Rock, Chieftan Savoy, and Savoy Perfection Drumhead. Ask for assistance from local agriculturist office to obtain cabbage looper resistant cultivars that are available in the local markets.
2. Remove and destroy all the plant debris after harvest. The pupae might still be present in the plants. Plough and harrow the field after harvest.
3. Clear the surrounding area of weeds, which may serve as alternative hosts for the pests.

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Biological pest control

Natural enemies

Natural enemies usually keep the pest populations at low levels and control measures are not often needed. Therefore, their conservation is very important. Avoid using broad-spectrum pesticides for the control of this or other pests. Cabbage looper infestations often increase after use of broad-spectrum pesticides due to elimination of natural enemies.

A wide range of natural enemies attacks the cabbage looper: predators, egg and larval parasitoids (parasitic wasps) and pathogens (Bt and viruses).

Egg predators and parasitoids are important since they kill eggs preventing any subsequent damage by caterpillars.

The nuclear polyhedrosis virus is particularly important in controlling this pest. The virus occurs naturally in the soil or on plants in most crop areas. Virus-infected insects can be reintroduced into the field by collecting diseased insects, mixing them in a blender, filtering out large tissue masses and then spraying the virus particles back onto the field.

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Biopesticides and physical methods

Bt (*Bacillus thuringiensis*)

Bt products give good control of the cabbage looper, and do not harm natural enemies. For optimum control, treatments should be applied when caterpillars are small. Frequent crop monitoring is helpful to know the optimal time to apply Bt and other insecticides.
For more information on Bt click here

Neem

Neem-based pesticides are reported to control the cabbage looper by interfering with the growth of young caterpillars. Fairly good control of this pest has been obtained with a 2% ethanolic extract of neem seeds (Ostermann and Dreyer, 2000). For more information on neem click here.

Physical control methods

1. Handpick the caterpillars and egg masses.
2. Use fine nylon nets as row covers to protect seedlings from egg-laying moths.

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