# PESTS OF CABBAGE AND OTHER CRUCIFER CROPS IN MICRONESIA

R. Muniappan and Nelson Esguerra

**University of Guam**

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**Contributors**
Lee S. Yudin, IPM Coordinator
Wilson Ng, Layouts

**About the Authors**

R. Muniappan
Professor Emeritus of Entomology
College of Agriculture and Life Sciences
University of Guam,
Mangilao, Guam 96923

Nelson M. Esguerra
Researcher
Cooperative Research and Extension
Palau Community College
P.O. Box 9
Koror
Palau, PW 96940

For additional information, please contact an agricultural extension agent at the Guam Cooperative Extension, College of Agriculture and Life Sciences, University of Guam. You may call 735-2080 or write to the Guam Cooperative Extension, College of Agriculture and Life Sciences, University of Guam, UOG Station, Mangilao, Guam 96923.

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# Pests of Cabbage and Other Crucifer Crops in Micronesia

R. Muniappan and Nelson M. Esguerra

Crucifers are one of the common groups of vegetables grown in Micronesia. These crops include head cabbage, Chinese cabbage, radish, turnip and others. A number of pests attack and damage these crops. Control measures recommended elsewhere are frequently not applicable in Micronesia due to various reasons such as differences in pest species, climatic conditions, cultural practices, environmental factors and natural enemies.

An important factor for successful management of cruciferous crop pests is the identification of pests to the species level. Once identified, appropriate control methods can be implemented.

Distribution of the pests, a brief description of their life cycle, damage symptoms, and their natural enemies in Micronesia are given. Chemical control recommendations are provided in the updated version of the Guam Fruit & Vegetable Pesticide Guide.

This publication is intended to provide information to help farmers and the public recognize important cruciferous crop pests in Micronesia and to select and adopt the best methods of controlling them.

The common pests of cruciferous crops in Micronesia are: the cabbage webworm, *Hellula undalis* (F.); cabbage cluster caterpillar, *Crocidolomia pavonana* (F.); diamondback moth, *Plutella xylostella* (L.); cutworm, *Spodoptera litura* (F.); corn earworm, *Helicoverpa armigera* (Hübner); garden looper, *Chrysodeixis eriosoma* (Doubleday); garden fleahopper, *Halticus tibialis* (Reuter); mustard aphid, *Lipaphis pseudobrassicae* (K.); cabbage aphid, *Brevicoryne brassicae* (L.); fire ant, *Solenopsis geminata* (F.); leaf miners, *Liriomyza* spp.; silverleaf whitefly, *Bemisia argentifolii* (Bellows & Perring); southern green stink bug, *Nezara viridula* (L.); onion thrips, *Thrips tabaci* Lindeman; short horned grasshoppers, *Oxya hyla intricata* (Stål) and *Ailopus tamulus* C. Willemse; and spider mite, *Tetranychus* sp.

## Cabbage Webworm
### *Hellula undalis* (F.)

*Hellula undalis* is native to Europe but is now distributed throughout Africa, Asia and Micronesia (except Marshall islands).

The moth lays ovoid white eggs singly on the plants. Eggs become pinkish a day later and before hatching turn brownish-red. The larva bores, webs and feeds on the growing tips of the seedlings resulting in multiple heads in head cabbage or death of the seedlings. On mature head cabbage plants it bores into the midrib or veins of the outer leaves. On radish, larvae bore into the midrib and 6 to 8 bore holes are often found on a single leaf. On mustard, it bores into the midrib and into the stem at the leaf axils. In cabbages, the bore hole made by this insect often provides entry for bacterial soft rot organism. The larva is greyish yellow and exhibits 5 broad, irregular brownish-purple bands on its back, extending from its midsection to the terminal abdominal segment. Pupation occurs in the feeding tunnels, among rolled leaves, or in an earthen cell just below the soil surface. The life cycle is completed in less than a month.

No known natural enemies of this pest have been recorded in Micronesia.

## Cabbage cluster caterpillar
### *Crocidolomia pavonana* (F.)

*Crocidolomia pavonana* is native to Africa and Asia. It is currently distributed in the Marianas and Caroline Islands in Micronesia.

The moth lays eggs in clusters overlapping each other on the lower surface of the leaves. Eggs are clear and devoid of scales. Newly emerged larvae remain in clusters and feed on the leaves. As they grow they usually remain on the same plant but disperse all over it. On cabbage they feed on the heart where they produce webbing and frass and riddle the plant. The larvae are green in color with white longitudinal stripes. Pupation takes place in the soil.

The only natural enemy of this pest observed in Micronesia are mud dauber wasps which pick up caterpillars in the field.

**Diamondback moth**
***Plutella xylostella* (L.)**

The diamondback moth occurs in the Marianas, Yap and Palau. It is absent in the East Caroline and Marshall Islands in Micronesia.

Adult moths lay oval but slightly flattened eggs singly or in small groups mostly on the upper surfaces of the leaves. Newly hatched larvae bore through the epidermis and mine the leaf. After the first instar, the larvae generally feed on the undersurfaces of leaves, chewing irregular patches and consuming all leaf tissue except the veins and upper epidermis. This produces a characteristic window effect. Feeding of mature larvae, which are green in color, cause holes in the leaves. When disturbed, larvae wriggle backwards very rapidly or drop from the leaf on a fine silken thread where they remain temporarily suspended or drop to the next lower leaf. The larvae spin silken cocoons on the lower leaves and pupate inside. The adult is a greyish brown moth. At rest, the moth's forewings lie close to the sides of the body and in profile present a slightly upturned posterior end. A creamy yellow dorsal band has three distinct constrictions, resulting in diamond shape that gives the moth its common name.

An egg parasitoid, *Trichogramma* sp. and the larval parasitoids, *Cotesia plutellae* (Kurdj.) and *Chelonus blackburni* Cameron occur in the Mariana Islands.

**Leafminers**
***Liriomyza* spp.**

*Liriomyza* leafminers are of neotropical origin, with *L. sativae* Blanchard and *L. trifolii* (Burgess) being the common species that occur in Micronesia.

The adult female flies pierce the leaf surface and lay a single egg in each hole. The emerging maggot tunnels in the leaf tissue causing a serpentine leaf mine. The mature maggot emerges from the tunnel and falls to the ground where it pupates in the soil.

A number of parasitoids have been introduced to Hawaii, Guam and Pohnpei. *Ganaspidium utilis* Beardsley, *Chrysonotomyia formosa* (Westwood) and *Hemiptarsenus semialbiclavus* Girault were effective in suppressing leafminers in Guam, while two parasitoids, *Diglyphus begini* (Ashmead) and *G. utilis* effectively reduced leafminer populations in Pohnpei.

**Cutworm**
***Spodoptera litura* (F.)**

This cutworm is a native to the South and Southeast Asia region. It has extended its distribution to the Pacific, except for the Hawaiian islands.

The female is a greyish brown moth which lays eggs at night in clusters on the outer leaves of cabbage. The eggs are covered with hair-scales from her body. Newly hatched larvae remain in groups and feed on the outside of the leaf, leaving thin window-like patches of epidermis on the upper surface of the leaf. Third instar larvae become gregarious and move out to neighboring plants. The larvae range from greenish to brownish in color. When mature they drop to the ground and form earthen cells a few centimeters below the soil surface where they pupate. The life cycle is completed in about a month.

Among cruciferous host plants, cutworm moths seem to prefer the thicker-leaved plants of head cabbage and broccoli rather than mustard, radish or Chinese cabbage.

The egg parasitoid, *Telenomus* sp. and the larval parasitoids, *Cotesia variventris* and *Euplectrus xanthocephalus* Girault are very common on cutworm in Guam.

**Corn earworm**
***Helicoverpa armigera* (Hübner.)**

In Micronesia the corn earworm occurs on Pohnpei, Yap, Palau and the Marianas.

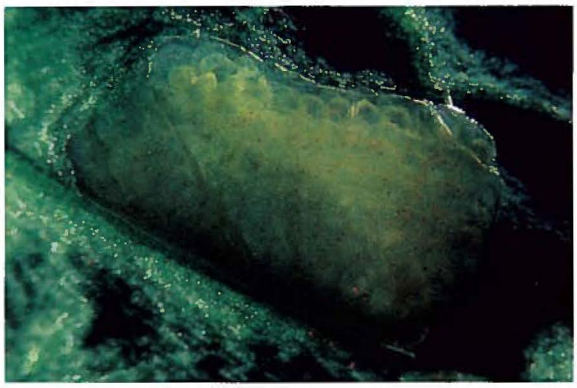
The corn earworm is a polyphagous pest, attacking tomato, tobacco, corn, cotton, beans, sorghum, head cabbage and Chinese cabbage. On cabbage, the larva bores into the succulent, compact head. The larva feeds inside the plant making it difficult to control with chemical sprays.

The female moth deposits spherical, ribbed, whitish eggs singly on the leaves of the host plants. The eggs turn greenish yellow to dark brown when ready to hatch. The larva is green and bores into the head of cabbage. Often only the frontal part of the larva is in the hole and the rest of the body remains outside. When fully grown, the larva crawls or drops to the ground where it pupates inside an earthen cell. The complete life cycle takes about a month to a month and a half.

**1.** Larva of cabbage webworm.

**2.** Larva of cabbage webworm in the petiole of a radish leaf (split opened).

**3.** Radish plant damaged by cabbage webworm.



**4.** Egg mass of cabbage cluster caterpillar.

**5.** Larvae of cabbage cluster caterpillar.

**6.** Cabbage cluster caterpillar damage on Chinese cabbage.

**7.** Diamondback moth.

**8.** Larva of diamondback moth.

**9.** Pupa of diamondback moth.

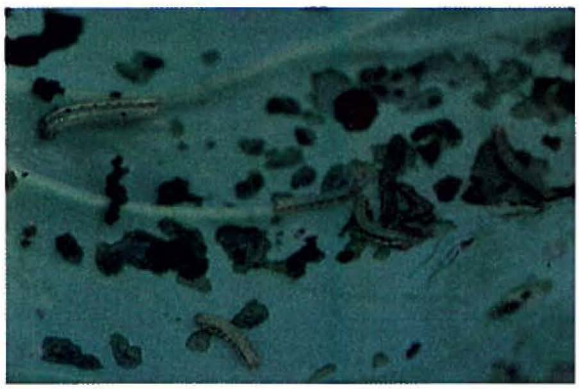
**10.** Pupa of the parasitoid, *Cotesia plutellae* next to a diamondback moth larva cadaver.

**11.** Leafminer damage.

**12.** Leafminer pupa.

**13.** Cutworm moth.

**14.** Egg mass of cutworm moth.

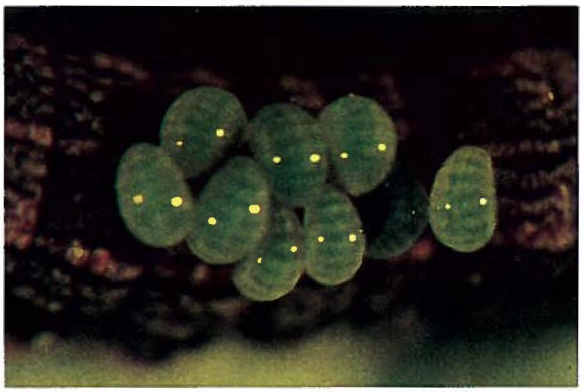


**15.** Second instar caterpillars of cutworm feeding on a cabbage leaf.

**16.** Cutworm damage to Chinese cabbage plant.

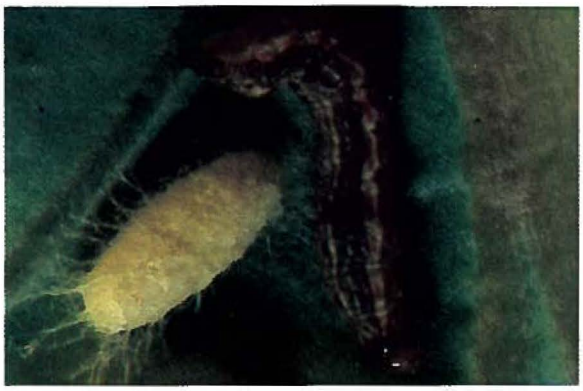
**17.** Parasitoid, *Telenomus* sp. parasitizing eggs of cutworm.

**18.** Parasitoid, *Euplectrus xanthocephalus*, grubs on a cutworm larva.



**19.** Parasitoid, *Euplectrus xanthocephalus*, grubs.

**20.** Pupae of the parasitoid, *Euplectrus xanthocephalus*, beneath a cutworm larva cadaver.



**21.** Pupa of the parasitoid, *Cotesia variventris*, next to cutworm larva cadaver.

**22.** Corn earworm larva.

**23.** Garden looper.

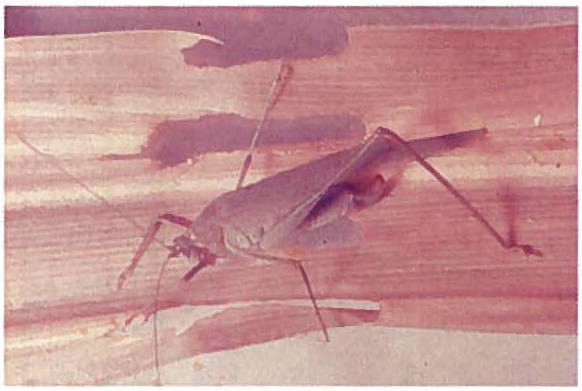
**24.** Parasitized larva of garden looper.

**25.** Garden fleahopper.

**26.** Fleahopper damage to radish.

**27.** Aphid.

**28.** Cabbage seedling damaged by ants.



**29.** Longhorned grasshopper.

**30.** A cabbage field with trap crops of radish, Chinese cabbage and mustard.

Adult moths are nocturnal and strongly attracted to light. No parasitoids have been reported in Micronesia.

**Garden looper**
***Chrysodeixis eriosoma* (Doubleday)**
The garden looper is a polyphagous pest of minor importance. Among the cruciferous crops it is encountered mostly on head cabbage, Chinese cabbage and broccoli. Eggs are laid individually on the outer leaves. Caterpillars feed on the foliage. Pupation takes place in a silken cocoon on the leaves.

A parasitoid, *Copidosoma* sp. has been recorded on this pest in Guam.

**Garden fleahopper**
***Halticus tibialis* Reuter**
The fleahopper is distributed throughout Micronesia. It is a small shiny black bug about 2 mm long with characteristic orange lines on the forewings. The wings are held folded over the abdomen. The hind legs are modified for jumping and the insect jumps readily when disturbed. Both nymphs and adults feed on the upper surfaces of leaves during the day. Nymphs resemble the adults except for the absence of wings and a reduced luster.

This insect attacks many crops. Aside from crucifers, it feeds on sweet potato, beans, okra, corn, onion, parsley, tomato, cucurbits and eggplant. Seedlings suffer most from fleahopper attack. Both nymphs and adults pierce the leaf tissue and suck the sap. The punctured areas on leaves appear as whitish spots.

The female fleahopper lays eggs by inserting them into the leaf tissue of the host plant. Newly emerged nymphs mostly remain on the undersurface of leaves. The life cycle is completed in about six weeks.

Fleahoppers prefer plants growing near the ground. In the case of cucumbers grown on trellises, only the mature leaves at the base are subjected to attack. On the other hand, on low growing crops such as crucifers and sweet potato, both mature and young leaves are attacked.

Fleahopper prefers radish and Chinese cabbage over head cabbage. Growing radish cv. Minowase Summer 3 and Chinese cabbage cv. Tempest as trap crops in head cabbage fields can effectively reduce fleahopper problems.

**Turnip aphid**
***Lipaphis pseudobrassicae* (K.)**
**Cabbage aphid**
***Brevicoryne brassicae* (L.)**
The populations of these aphids usually increase in the late stages of the crop. Sooty mold build up on the honeydew excreted by the aphids.

Mustard in the flowering stage is most attractive to aphids. Growing mustard as a trap crop in head cabbage fields effectively curtails the need to employ control measures.

No parasitoids have been recorded on these aphids in this region. Syrphid maggots, adults, and grubs of the lady beetles have been observed feeding on the aphids.

**Silverleaf whitefly**
***Bemisia argentifolii* (Bellows & Perring)**
Silverleaf whitefly is a recent introduction to this region. Whitefly populations build up on outer leaves first and eventually cover the whole plant. Honey dew and sooty mold also build up as a result of the whitefly population on the plants.

Two larval parasitoids, *Encarsia nigricephala* Dozier and *Eretmocerus* sp. have been observed on Guam.

**Fire ant**
***Solenopsis geminata* (F.)**
Fire ants live in colonies and they frequently build their nests under drip irrigation lines. During hot and dry days they riddle the young cabbage seedling causing heavy mortality.

**Green stink bug**
***Nezara viridula* (L.)**
Stink bugs occur on Pohnpei, Chuuk, Yap, Palau and the Marianas. Although its preferred hosts include soybean, other beans, cucurbits, tomato, tobacco, eggplant, bell pepper, sunflower and okra, the stink bug also attacks crucifers such as head cabbage and Chinese cabbage in Micronesia. Both nymph and adult stink bugs suck the sap from leaves. The damaged portions later show discoloration, malformation and stunting.

Barrel shaped eggs are laid at night in rafts on the surface of the leaf. Newly hatched nymphs stay together near the eggshells. Nymphs are multicolored but usually dark. Adults and nymphs are usually seen on surfaces of the plants. Adult bugs are green. The life cycle is completed in slightly over a month.

Introduced parasitoids have successfully controlled the stink bug in some parts of Micronesia. On Pohnpei, the introduction of *Trissolcus basalis*, an egg parasitoid introduced from Hawaii, considerably reduced the pest status of *N. viridula*. It is now seldom seen on vegetables on this island. The same potential benefits of biological control by *Trissolcus* may therefore be possible to other islands of Micronesia where *T. basalis* does not yet occur and where *N. viridula* is a pest.

**Onion thrips**
***Thrips tabaci* Lindeman**

This species of thrips occurs on Yap, Guam and Palau. Young cabbage plants are particularly susceptible to attack by onion thrips. Damaged leaves show discoloration and necrosis. Yields may be reduced.

This insect is parthenogenic. Whitish and kidney shaped eggs are inserted singly in the tissues of plants by the ovipositor. The yellowish larvae feed on the leaves. Mature larvae drop to the ground and enter the soil surface where they become prepupa, then pupa, and finally emerge as adults. Adults have fringed wings and are not considered active fliers. The life cycle is completed in 2-3 weeks. Although its preferred hosts are onions, the thrips also attack cotton, cucurbits, tobacco, tomato, cabbage and some weed species.

**Short horned grasshoppers**
***Oxya hyla intricata* (Stål)**
***Ailopus tamulus* C. Willemse**
**Long horned grasshopper**
***Conocephalus longipennis* Haan**

Both nymph and adult grasshoppers feed on the leaves of the host plants where they make large and irregular holes. Eggs of the short horned grasshoppers are laid in groups enclosed in capsule like substance and placed a few centimeters below the ground. Long horned grasshoppers insert their eggs in the edges of leaves or into the tender stems of the plants. The biologies of these grasshoppers are not well known in Micronesia.

**Spider mite**
***Tetranychus* sp.**

Spider mites are widely distributed throughout Micronesia. Although more than one species may be involved, spider mite infestation has been observed on Yap, Pohnpei, Kosrae, Marshall islands and Palau.

The head cabbage variety, KK Cross, sometimes experiences severe spider mite infestation when exposed to a short dry spell even in high rainfall areas such as Pohnpei. Leaf injury appears as small brownish spots and further examination under a dissecting microscope reveals colonies of red spider mites. Often damage to cabbage by spider mites occurs when papaya and cassava are grown nearby.

Spider mites are also common on eggplant, kangkong, sweet potato, okra and beans.

Mite eggs are laid on leaves. Upon hatching, the larva with 3 pairs of legs comes out. They then develop into a protonymph and deutonymph stage before becoming adults. Adult spider mites are reddish, sometimes greenish with dark spots on each side of the body. The life cycle is completed in two weeks.

The natural enemies of spider mites include coccinellid beetles, predaceous thrips and phytoseiid mites. In green house and field crops, two phytoseiid mites, *Phytoseiulus persimilis* and *Galendromus occidentalis* can be used to control spider mites.

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