

MANAGING INSECTS NATURALLY IN THE VEGETABLE GARDEN

by George Bushell*

The vast majority of insects in a vegetable garden do no harm, many are beneficial, while only a few are actually harmful. Moreover, the impact of most insect pests can be easily minimized by practising a little prevention, tolerance and management.

Healthy Plants

The best defence against insect pests and diseases is a good offence. Start by ensuring that your plants are healthy and growing vigorously. A healthy, strong plant can better tolerate or rebound from many types of insects and diseases. As Thomas Jefferson once wrote:

"I suspect that the insects which have harassed you have been encouraged by the feebleness of your plants; and that has been produced by the lean state of your soil."

Locate your garden in a sunny location, provide a loose, well-drained soil and add plenty of compost. If soil drainage is a problem, use raised beds (apply a compost mulch to conserve moisture). While the pH of a rich, organic soil is usually satisfactory, some acidic sandy soils may need some supplemental limestone.



Raised Beds Covered with Compost

Crop Rotation

If you rotate your vegetables or families of related vegetables each year, you may break

the reproductive cycle of some insects, particularly those relatively immobile species that over-winter in the ground or in specific host plants. Crop rotation is especially effective at discouraging several soil-borne diseases, including bean root rot, club root, bacterial diseases of tomatoes and various potato afflictions, all of which can weaken your plants and make them more susceptible to insect attack. In general, rotate the following plant families: brassicas (cabbage, cauliflower, broccoli, brussels sprouts, turnips, radish), solanaceous plants (tomato, pepper, eggplant, potato), roots (carrots, beets, parsnips), greens (lettuce, endive, spinach), legumes (beans, peas), cucurbits (cucumbers, melons, squashes) and corn.

Garden Sanitation and Composting

Garden sanitation is important for the control of many pests, so remove vegetable refuse from the garden and compost it to reduce the overwintering success of some insects.



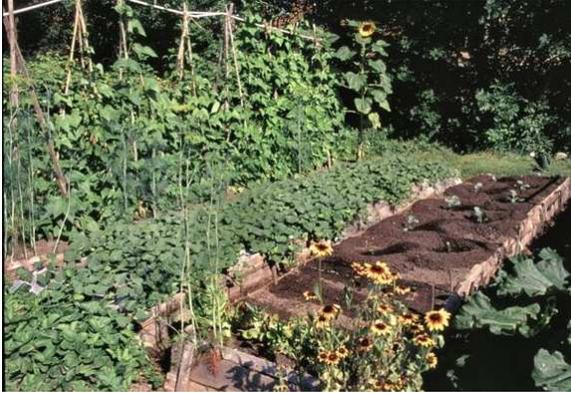
Homemade Compost Bin

Bio-Diversity

Increase bio-diversity by planting only small quantities of the same vegetable in any one

* Pictures used in this article were either taken by the author or obtained from University and Government websites (both Provincial and State).

place (usually this is the norm in a home vegetable garden). Small quantities of any one vegetable help ensure that pests which do find your garden remain few in number.



A Diverse Planting of Vegetables and Flowers

Interplanting and Succession Planting

Try not to interplant cultivars from the same family grouping (as already noted above). For example, it is much better to mix corn and lettuce than cabbages and turnips. A diversified mixture of plants, with differing colours, shapes and odours can sometimes help to reduce insect attacks. Succession planting is often effective in the fight against harmful insects as well as spreading the harvest over a longer period – for example, a succession of corn plantings will ensure that only one planting, at most, is attacked by the corn earworm (as there is usually only one short infestation of this pest per year in Canada).



*Successive Plantings of Corn
Interplanted with Lettuce, Radishes & Onions.*

Companion Planting

Books and guides dealing with companion planting recommend specific combinations of plants that are said to repel certain insects. For example, some claim that nasturtiums repel striped cucumber beetles, that marigolds discourage the imported cabbageworm butterfly and that catnip foils flea beetles (although, I have not found companion planting to be very successful).



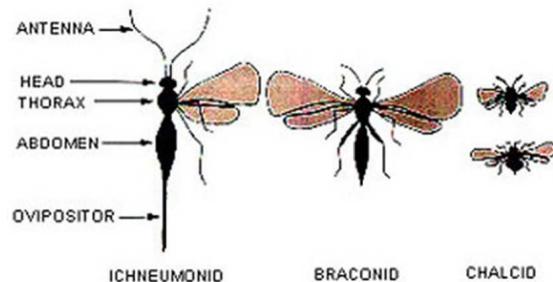
*Marigold Flowers
Placed on Cabbages*



Companion Planting of Cabbages & Marigolds

Predator Insects

Encourage predatory and parasitic insects. Members of the umbelliferae family, such as dill, are especially good at attracting parasitic wasps, which have three main groupings – chalcids, braconids and ichneumonids. They come in many shapes and sizes, from pin-head small chalcids to ichneumonids a few centimetres in length. They appear to have a stinger in the rear, but it is only an ovipositor. All lay eggs in other insects or their larvae, including tomato hornworms and aphids.





Parasitized Tomato Hornworm

Tachinid flies are rarely noticed in the garden as these bristly brown or grey insects resemble the somewhat larger housefly. They are most active on warm, sunny days and are parasites of corn borers, tent caterpillars, cutworms and other larvae.



Tachinid Fly

Yellow jackets and hornets are not welcomed by most gardeners, but they do collect caterpillars, insects and larvae for themselves and their young – in addition to animal matter, pollen and honey. Nevertheless, commercial traps are available if they become too much of a nuisance (or you can make one yourself using honey or sugar).



Yellow Jacket

Ground beetles are black or dark brown, but can appear bright metallic green or blue in sunlight. They usually hide under rocks, bark or other debris during the day and feed at night, eating all kinds of insects, larvae, cutworms, and snail and slug eggs, to mention only a few of their favourites.



Ground Beetle

Rove beetles are sometimes confused with earwigs, although they lack pincers. Black or dark brown in colour, they are mainly scavengers, often found in decaying matter. In addition, they parasitize cabbage root maggots and other small larvae during their reproductive cycle.



Rove Beetle

Assassin bugs are black or dark brown, as well, about one-half inch long and somewhat like a miniature praying mantis in appearance. They usually feed on the juices of other insects and larvae, including Japanese beetles and leafhoppers.



Assassin Bug

Damsel bugs should not be confused with damsel flies, which look like small dragonflies. Damsel bugs are small flattened bugs that prey on aphids, leafhoppers and caterpillars.



Damsel Bug

Spiders should not be forgotten as they have a voracious appetite for many kinds of insects. The Chinese still construct and use spider houses in their plots and fields. Made of bamboo, these small pyramid shaped containers provide a perfect living place for many kinds of spiders. When an outbreak of harmful pests occurs, the small bamboo houses are picked up and moved to the area of need.



Spider

Lady beetles must not be overlooked as they are the best known insect predator of all. While there are reportedly 3,000 species of ladybeetles, the convergent species is the most common. It has a black head, thorax and undercarriage, with a red-orange back showing a few black spots. Both the adults and their immatures eat soft-bodied pests such as mealybugs, scale and aphids.



Ladybug - Instar



Ladybug - Adult

Other predatory insects exist in our gardens, as well, with intriguing names like *syrphid fly*, *lacewing*, *soldier bug*, *tiger-beetle*, *pirate bug*, *hover fly*, *big-eyed bug* and *robber fly*. Become familiar with all of these insects that eat eggs, larvae and even other adults. Moreover, never kill an insect unless you know it is, or could become, a pest as you might mistakenly kill a beneficial. If you want to augment some of the predatory insects yourself, you can even buy a few species and release them (e.g., ladybugs).



Syrphid Fly



Lacewing

Birds, Toads and Frogs

While many *birds* resort to eating seeds and dried berries in the winter and early spring, they soon return to a high protein diet of insects and larvae for themselves and their young when these food sources reappear. And they rarely eat vegetables in our gardens although some do like a few cherries or berries (netting can protect vulnerable crops). Attract nature's insect eaters with water in the form of an attractive bird bath, and provide housing for your favourite species. In spring and summer, insects form 90% of the diet of chickadees (i.e., moths, caterpillars, flies, beetles, true bugs, plant lice, scale, leafhoppers and more). Wrens can be attracted by nesting boxes and because they often raise more than one brood each year, they must collect large quantities of insects. They will even forage in the evening and are reputed to catch earwigs which become active at this time of the day. Swallows and purple martins are legendary insect eaters making flying pests 99% of their diet (build a martin or swallow house to attract these gardening allies). Even starlings can be

appreciated as they are reputed to be one of the few birds that will eat tent caterpillars.



House Wren

Toads can consume large quantities of insects in the garden. Provide some water, a few cool hiding places and be careful when tilling and digging – toads often burrow into the soil during the daytime. If your garden is near a pond, or you have installed one in your garden, you will benefit from the insect appetite of *frogs*, as well.



Common Toad

Other Controls

When direct control of a specific pest is needed, handpick (potato beetles), utilize pheromones (Japanese beetles), set out traps (crumpled newspaper for earwigs), use barriers (floating row covers such as Reemay fabric for onion maggot flies), apply natural repellent solutions (garlic and water), or use Bt sparingly in certain cases (for cabbage worms). Never use broad spectrum insecticides, even if from a natural source (e.g. rotenone), as such substances kill beneficial insects as well as the pests. Time your plantings to miss the first and usually most destructive generation of a pest if it is particularly bothersome in your garden (e.g.,

carrot rust fly). Keep a vigilant eye out for insect invaders and often look on the underside of plant leaves for signs of damage or disease (small insects can be shaken from plants onto a sheet or tray for sampling and identification). Always remove wilted plants and look for insects or larvae among their roots. And finally, practice tolerance: vegetables and fruit from the home garden need not look perfect – discard some produce, cut away insect damage, and enjoy the flavour and nutrition of produce grown organically in your own garden.

In spite of our best efforts, however, there are times when control must be directed toward a specific pest if we are to harvest enough produce to make our gardening worthwhile and rewarding. Gardening in an urban or allotment setting can be particularly challenging – our neighbours' gardens can sometimes be a source of bothersome insects, irrespective of our own good efforts and there are many "imported" insects with few natural controls that often need special attention. Some of the most troublesome are discussed below.

Imported Cabbageworm

This pest was brought from Europe and has few natural enemies in North America. The adult white butterflies with 2 or 3 black spots on each wing start appearing in late spring or early summer. They lay small eggs, singly, on all members of the brassica family – cabbages, cauliflower, broccoli, etc. With a number of generations each year, the larvae can be destructive throughout most of the growing season, eating and soiling leaves and brassica heads. If you are continuously diligent and only have a few plants, the larvae can be hand picked. A floating row cover, such as Reemay, can prevent the butterflies from depositing eggs on your plants in the first place. This is one of the few pests I recommend using Bt on as long as

you carefully apply the mixture to the centre of each plant, where the cabbage larvae almost always feed. The chance of harming other butterfly species is very small since cabbageworms are about the only caterpillars you will find in the centre of a brassica plant. The larvae of the cabbage looper moth can be controlled in a similar manner.



Imported Cabbage Worm - Larvae



Imported Cabbage Worm - Adult

Corn Earworm/European Corn Borer

The larvae of these two pests look alike and do the most noticeable damage to corn ears, although the borer can affect all parts of the corn plant, sometimes burrowing into the stalk and causing it to break over in the wind.

The corn earworm moth cannot overwinter in Canada but flies northward from the USA looking for host plants in summer. Earworm larvae enter the cob by way of the silk and do most of their damage at the tip of the ear. Earworm infestations can be lessened by selecting cultivars with tight fitting husks. A little vegetable oil on the silks just as they start to dry up after pollination is complete can lessen earworm damage (the sticky

substance stops the larvae from entering the cob).



Corn Earworm - Larva

As implied by the name, the European Corn Borer was imported from Europe (the adult is also a moth). Borer damage to the ear, when it occurs, is usually randomly located as the larvae can enter the cob at any point. Many corn varieties are resistant to stalk damage and lodging caused by the corn borer (search your seed catalogues for the appropriate varieties).



European Corn Borer – Larva

In addition, use succession planting to reduce damage from both worms – only the planting that coincides with the first and most destructive generation of larvae will likely be affected. And most important, practice a little tolerance – for home use, one can easily remove larvae and cut out any affected part of the cob.

Parsleyworm

These larvae, which can feed on the foliage of parsley, carrots, celery and dill, seem to prefer only dill in my garden. The 2-inch worms, which are coloured bright green with

a yellow-dotted black band across each segment, are rather striking, especially when disturbed – two bright orange feelers immediately protrude from their head (used as scent organs). They rarely are found in any significant concentration and can be easily hand-picked. And in this case, the adult is very striking, as well - it is the beautiful swallowtail butterfly.



Parsleyworm – Larva



Swallowtail Butterfly

Tomato Hornworm

I have observed this large worm, up to 4 inches long with an impressive horn, only once on my tomato plants during many years of gardening in the Ottawa area. Growing up in south-western Ontario, I remember seeing them more often. In Canada, they occur mostly in extreme southern Ontario and Quebec, and can be easily hand-picked when you detect foliage and/or tomatoes that have been eaten. The larvae are often parasitized by trichogramma wasps. You may want to save a worm in a jar with some tomato leaves and observe the transformation to our largest and most impressive moth, the sphinx, with a wingspan measuring up to five inches.



Tomato Hornworm

Colorado Potato Beetle

In this case, the potato, or host, was imported to North America, and not the pest. Apparently, the Colorado Potato Beetle lived in obscurity in the foothills of the Rockies until it was introduced to the potato in the 1880s. It spread eastward and was soon found in association with potatoes wherever they were grown except in the southern USA.

Colorado Potato Beetle



Adult

This pest will eat other members of the solanaceae family (eggplants, peppers, tomatoes) if its favourite, the potato, is unavailable. However, in the home garden, it is relatively easy to control. The adults emerge from the soil in late spring or early summer, usually as the first potato leaves begin to push through the soil. At this time,

collect as many adults as possible to prevent them from laying eggs. The adults themselves do little damage to the foliage; it is their larvae that are destructive. While collecting adults, inspect the underside of the leaves for bright orange clusters of eggs and destroy them (simply rub them against the leaf). And if a few larvae do manage to hatch, it is a simple matter to hand pick them, as well.

Cabbage Maggot

These tiny white grubs can, on occasion, damage the roots of cabbages, broccoli, cauliflower and brussels sprouts to the extent that the plants wilt and eventually die. The adult flies, 1/4 inch long and similar to a housefly in appearance, emerge in spring (late May and early June in Ottawa) and lay their eggs at the base of young transplants. There is often a later generation, but it rarely does much damage. A piece of cereal box paper fitted snugly around the base of susceptible plants will prevent egg laying.



Cabbage Root Maggot Protection

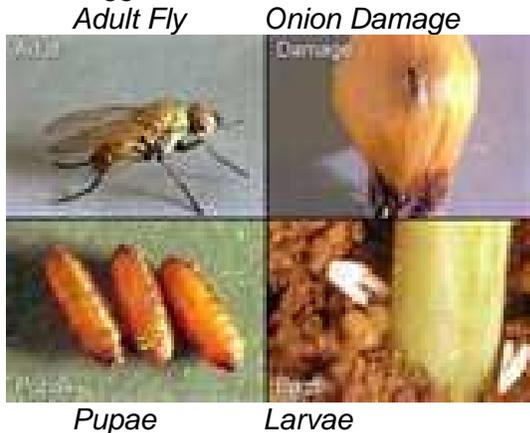
The same fly lays eggs on emerging radishes, turnips and rutabagas. Stagger your radish plantings throughout the season and you will likely only experience damage to one planting – or cover with Reemay (very effective). Delay planting rutabagas to early summer (about the middle of June in Ottawa) so as to miss the first and most destructive generation of grubs. Large rutabaga roots may suffer a little surface damage in August

or September when the second generation of grubs appears, but can easily be cut away for home consumption. The rutabagas will taste much better, as well, if planted later and allowed to mature during the cooler weather of September and October.

Onion Maggot

A small fly is also responsible for the tiny white grubs that can destroy onion plants or ruin their bulbs in southern Canada and the northern USA. Again, the flies emerge in spring (late May in Ottawa) and lay eggs near young onion plants. White onions appear more susceptible than yellow or red types. However, Reemay placed over the onion bed when plants or bulbs are set out and left in place until early June has been totally effective at preventing damage in my allotment garden (it is very important to rotate your onions every year). Later plantings usually suffer little damage, but an early start for onions produces larger bulbs.

Onion Maggot



Cutworms

Cutworms are the larvae of night flying moths. These moths deposit their eggs in the soil. Most larvae species remain buried in the ground during the day and only surface at night to eat the leaves of your plants. Normally, there are enough weeds and grass in the garden to keep them satisfied. However, when we enthusiastically weed our

gardens just before planting in the spring, we often remove all of the vegetation but not the cutworms. The larvae then attack the only food source around – young tomato and cabbage transplants, or newly emerging radishes. To protect transplants, place two or three toothpicks or tinfoil around plant stems to prevent the cutworm from chewing through the stalks. If you find a fallen plant, sift the soil with your fingers around the base of the plant until you find the worm – if you don't, it will probably eat another transplant the following night.



Cutworm and Fallen Transplant

You may want to leave a few weeds in your garden when transplanting – if given a chance, cutworms usually prefer these young succulent morsels to your "hardened" transplants.

Carrot Rust Fly and Carrot Weevil

The larvae of these two pests can damage the crown and/or roots of carrots, parsnips and celery. According to Agriculture Canada, the carrot weevil is most common in muck soils of southern Ontario and Quebec. The Carrot Rust Fly is most destructive in southern B.C. where three generations per season are possible. I have rarely experienced much damage from these pests as I do not plant carrots until the middle of June, thus missing the first and most destructive generation of these pests. Should you notice their tell-tale brown coloured tunnels on your carrot roots, a floating row cover is very effective if installed at planting time.



Carrot Rust Fly Damage



Carrot Weevil Damage

Leaf Miner

This pest was also introduced from Europe. The larva of the tiny adult fly, hatched from eggs deposited on host plants in early spring, tunnels between the upper and lower layers of the leaf surface producing yellow, brown or white patches. Damage is most significant when it occurs on the edible leaves of plants such as spinach, chard and beets.



Leaf Miner Damage Circled in Yellow

Cover your seed beds immediately after planting with a floating row cover if you have problems in your garden. Remove all infected leaves so that no larvae develop into adult flies. Later plantings (from early June onward in Ottawa), are rarely affected to any degree by this pest.

Cucumber Beetles

Striped or spotted cucumber beetles can be a serious pest in eastern North America. The yellow and black adults emerge in early summer (June in the Ottawa area) and eat the leaves and blossoms of cucumbers and melons, particularly. Squash plants are less affected in my garden. The adults can spread cucumber mosaic and bacterial wilt. They lay eggs at the base of their host plants – the larvae can weaken the plants later in the summer. A few plants can be covered by a floating row cover to prevent access but you will have to remove these covers after the first generation of adults has disappeared to allow cross pollination (or leave the covers on and hand-pollinate the female flowers with the pollen from a male flower, preferably in the morning). You can try to trap adults by placing yellow painted discs or boards covered with a sticky substance (e.g. tanglefoot, vaseline) among the vines, although I have not found this approach very effective.



Stripped Cucumber Beetle

Flea Beetles

This pest is a tiny black, brown or bronze-coloured beetle that jumps like a flea when disturbed. It chews tiny holes in its host plants, but usually only causes damage to young brassicas, turnips, rutabagas and eggplant. I have only experienced serious problems with eggplants – they have turned yellow and sickly on some occasions. However, a floating row cover for 3 or 4 weeks after transplanting has proven completely effective for me – in fact, the heat loving eggplant benefits from these covers.



Flea Beetles and Damaged Leaves

Japanese Beetles

This beetle, which is a serious pest in the eastern USA, the Niagara Peninsula, and other parts of southern Ontario and Quebec, was accidentally brought into New Jersey in 1916 from Japan. The metallic-looking beetle, similar in life cycle to the European Chafer (white grub) eats many kinds of foliage.



Japanese Beetle

They are most active in Canada on warm July days. Hand picking and floating row covers

are most effective where they are a problem. Pheromone traps can also be used to catch the male beetles and prevent fertilization of eggs.

Earwigs

Another import from Europe, with few natural enemies, earwigs have become a real pest in some localities of eastern North America. It is most active for a few hours after dusk, resting and hiding during the daytime. Its preference for small, dark, daytime hiding places allows one to trap considerable quantities – place sections of old pipe, bamboo, crumpled newspapers, etc., around the garden and remove the earwigs daily in the morning while they are hiding (a pail of hot or soapy water is very effective at destroying them). You can also trap them during the night when they are active – place half litre yoghurt or cottage cheese containers in the soil with their top edge at ground level. Half-fill with water and add a few drops of liquid from a sardine or salmon can. Earwigs will climb in and drown. A homemade repellent sprinkled on particularly susceptible plants, or rows of plants, can provide some protection until vegetation is large enough to be no longer desirable – experiment with garlic, pepper powder, mustard, etc. mixed with water, and see what works. However, I find crumbled newspaper the easiest to use and very effective.



Earwig

Slugs and Snails

These night feeders are especially troublesome in humid, moist climates – particularly in coastal British Columbia.

Again, try trapping them if they become a pest. They may hide under boards and pots placed around the garden, from where you can collect and destroy them daily. Trap in shallow containers placed in the soil that are filled with a water/malt/sugar mixture or with beer. Hunt at night with a flashlight, sprinkle a little wood ash on the soil, or place old copper strips on the ground (it makes them ill when they crawl over it).



Slug

Other Pests

Squash bugs and squash vine borers have never been a problem in my garden, although they are a real pest in parts of the U.S.A. and Southern Ontario.



Squash Vine Borer

Aphids, spider mites and whiteflies can be a serious problem in greenhouses but rarely cause any problems in a diversified and vigorous outdoor garden (an insecticidal soap mixture sprayed on infected plants is an effective deterrent).



Aphids



Red Spider Mites



White Fly

Conclusion

An organic garden, managed naturally, usually suffers little damage from insect pests, in spite of the long list of adversaries listed above. Nevertheless, a little knowledge of insect life cycles and habits will allow you to deal with any problems that do arise in a manner that does not harm the vast array of beneficial flora and fauna that also live in our gardens.

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