RESOURCES for NON-CHEMICAL SOLUTIONS to GARDEN INSECTS

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IN GENERAL, when it comes to 'controlling' pests, the best perennial defense against so-called pests is HEALTHY nutritious garden SOIL. Compost! Grow cover crops in fall such as rye and/or buckwheat. In particular, I want to highlight a certain relation: most plants have a symbiotic relation with a white fungus on their roots called mycorrhizae. The mycorrhizae take the nutrients out of the soil and feed it to the plant; the plants feed their sugars (carbohydrates) from photosynthesis to them. Once you decide to use a chemical -- and that includes artificial fertilizers like Miracle-Gro, along with any "–ides" you're using such as pesticides, herbicides, or insecticides -- you have severed this delicate, important relation that is capable of providing you with healthy produce (thanks to JP Lamarche for information).

ROTATION is key! Don't plant the same kind of plants in the same place in your plot.

DIVERSITY is key! Use different varieties because the plants' susceptibility for potato beetles varies, even in time, for example (thanks to Thorsten Arnold and Kristine Hammel from Persephone Market Garden).

BIODIVERSITY is key! The more habitat for insects, birds and amphibians, the more balanced and healthy your system.

All the answers are found in nature, not in bottles of chemicals. Aim to achieve a harmonic balance of both pests and beneficial – really, these terms simply refer to different sides of the same coin – let Mother Nature take care of it for you! USE the relationships that exist -- predation, diseases, companion planting, trap planting, and others. If you don't have time to observe it, pick up books – the end of this document contains a list of resources for you to springboard your own adventures in chemical-free gardening.

FLEA BEETLES

You have to look closely to see these tiny creatures. The adults can be from 1/16 to 1/5 of an inch long, depending on the species.

Adults overwinter and lay eggs in early spring on or in the soil near the base of the host plant. The egg-larval-pupal stages take four to five weeks, after which the new adults emerge in search of fresh greenery. The thin, white larvae do some feeding on roots of the host plants and leave snaky markings on potatoes, but the adults are the hungriest competitors for our garden groceries, and most damage is done to the foliage. Adults are attracted to young plants and chew the typical "shot-holes" in the underside of leaves.

The easiest tactic for immediate defense is to use ROW COVER in the early spring. The beetles don't enjoy chewing on older plants, so the covers simply can be removed as the season progresses. Put the row cover down when you plant your seeds/seedling, securing it with rocks. You can leave it on your plants unless you need pollination (e.g. cucurbits like cucumbers, melons, squash, zucchini, etc), so remove it when flowers appear.

CROP ROTATION Presuming you are rotating crops, you won't trap beetles under the covers that remain from the same crop the previous year. Crop rotation, though obviously good for other reasons, does not fool the very mobile adult flea beetle. Shallow hoeing for weeds will do double duty as flea beetle eggs are exposed to the air and predators.

TRAP PLANT a few 'Chinese Daikon' or 'Snow Belle' radishes work well as a flea beetle catch-crop when interplanted with cole (*Brassica*) crops, luring the flea beetles away from more important crops. Since the root isn't harmed by the beetles, the radishes remain useful.

COMPANION PLANTS can be grown intercropped in a garden to benefit neighboring plants. For example, thyme, catnip, and other kinds of mint cover up the scent of nearby plants

PREDATORS To encourage Braconid wasps and Tachinid flies, some types of flowers can be planted between crops: umbels such as caraway, herb fennel, coriander and Queen Anne's Lace, and simple open flowers such as California poppies and pot marigolds, as well as yarrows. In both cases, the predator larval stage feeds on the flea beetle, while the adults feed on nectar and pollen; some species are even important pollinators. Queen Anne's Lace is also excellent plant to attract beneficials.

A second or third generation of flea beetles can appear in a single summer, so when putting out late plantings for fall, ROW COVER them when young, too.

Also - a market gardener friend has had luck with flea beetle this way: http://www.redpocketfarm.com/flea-beetles-traps/ (Thank you Angie Koch, Farmer at Fertile Ground Farm and Seed Library Coordinator at Seeds of Diversity).

POTATO BUGS

Overwintering beetles hibernate in soil, each female can lay 500 eggs over 5 weeks, dark red larvae eat foliage as do adults, become orange as they mature then they leave plant for soil to pupate and emerge several days later as adult. Life cycle about a month, with 1-3 generations per year.

Injury done is due to eating stems and leaves but potato plant can lose up to one-third of foliage without a loss in yield. 3-5" layer of straw added before potatoes emerge can help protect your plants -- the soil with be cooler with higher levels of moisture which leads to lower populations of potato bugs.

SQUISHING: Handpicking bugs and larvae and egg cluster will decrease the population significantly. Use your hand or a whisk/brush to sweep them into a bucket of water to drown (our colleague Angie Koch feeds them to the chickens!). The adults don't drown as easily so she steps on them or crushes them between two rocks (thanks to Thorsten Arnold and Kristine Hammel from Persephone Market Garden who also endorse handpicking).

TRAP PLANT they may like eggplant better than potatoes, so you can plant eggplant as a trap crop if it's the taters you want -- idea is to allow bugs to populate the trap plant, then remove the bugs from the plant or destroy the trap plant with the bugs on it.

PREDATORS see below, under cucumber beetles.

CUCUMBER BEETLES

If you find that the stems of your seedlings are being eaten off, yellowing and wilting leaves, and holes, you may have cucumber beetles ... cause much of the same damage as flea beetles do. Often, the Cucumber Beetles alone will not kill the plants or cause major damage, but the spread of disease will. Bacterial wilt is a common disease spread by cucumber beetles. Initially, a single stem wilts, followed by another, and within a week infected plants are barely alive. Cucumber beetles also carry the mosaic virus. It is characterized by leaves mottled with yellow, white, and light and dark green spots or streaks. Some of the most commonly infected plants include tomatoes, potatoes, squash, and cucumbers.

Striped cucumber beetles may lay 1,500 eggs in their two-month lifespan; spotted cucumber beetles lay 200 to 300 eggs per female. The cucumber beetle life cycle takes four to six weeks, and goes faster in warm weather. The tiny white larvae begin eating plant roots as soon as they hatch, though vigorous plants continue to grow despite this feeding. The

larvae change into pupae after feeding for about two weeks. It is not unusual for new waves of adult cucumber beetles to appear every three weeks or so through the first half of summer.

A good defense is to grow resistant varieties, such as 'County Fair' or 'Little Leaf,' or to protect plants with ROW COVER.

SQUISHING: as above for potato bugs.

Cilantro is an excellent REPELLENT PLANT. Many insects don't like the smell and/or it covers up the location of their target plants. This tip thanks to colleague Taarini Chopra, SoDC's Publication Coordinator. She says in India, cilantro is usually planted between all pest-heavy crop rows. Other repellent plants: broccoli, calendula, catnip, goldenrod, nasturtiums, radish, rue and tansy. If you want to try marigolds to repel them use the more pungent varieties like African, French or Mexican marigolds. The more common marigolds may actually attract them, therefore could be used as a trap crop.

PREDATORS: Natural predators include assassin bugs, some stink bugs, soldier beetles, Braconid wasps, some nematodes, and soldier beetles; lacewings and ladybugs eat the eggs. See above for plants attracting these predators, and further research.

TIMING OF PLANTING for cukes and zukes -- you can plant 2-3 times/season and just assume the first planting will get diseased from the mosaic virus for which they're a vector (thanks Angie Koch).

"Chemical fertilizers will disrupt the symbiotic relationship between the plant and the fungus on the roots known as mycorrhizone. But I also said that disrupting the balance of nature will cause even more problems with bad insects. If you the gardener decide to kill off the host food supply of bad bugs, be it the use of chemical or organic insecticides, then you also kill off the 99% of bugs that are beneficial, as you take away their food supply. My talk and book show the work by beneficial and predator insects lead to a balanced yard."
-- J Paul Lamarche, author of *Common Sense Ecolution*

Become further inspired ... may I suggest this film trailer for Symphony of the Soil http://www.symphonyofthesoil.com/
(Bee Friendly Farmer Paul Kaiser from Sebastopol, California is seen heaping compost)

REFERENCES

***Rodale's Ultimate Encyclopedia of Organic Gardening*.** Rodale Press, 2009. This is a new update with a climate change statement. NOTE: Rodale Press gardening books are always good ones! (Thank you Maureen Temme from Community Gardens London!) – this book is in the Kitchener Public Library system, but not the Waterloo system!

Rodale's Garden Insect, Disease and Weed Identification Guide. Rodale Press, 1988. (Maureen Temme)

Common Sense Ecolution. J Paul Lamarche (I heard this man speak at Canada Blooms – amazing!)
http://www.amazon.com/Common-ense-Ecolution-J-Paul-Lamarche/dp/1897528388/ref=sr_1_1?s=books&ie=UTF8&qid=1323884996&sr=1-1 or
http://www.jplbiz.ca/ComSenseEco2013.html

The Natural Food Garden: growing vegetables and fruits chemical-free. Patrick Lima. (LPL 635.0484 Lim London Public Library) No doubt out of print, but I love it (Maureen Temme)

The Market Gardener. Jean-Martin Fortier. Check out website http://www.themarketgardener.com/.

Organic Gardening Magazine. Rodale Press. Published monthly. Really useful magazine. (Maureen Temme)

Mother Earth News magazine. Published 6 times a year. Library has it. Absolutely useful magazine, and it has a terrific website. www.motherearthnews.com with a useable "search" function. (Maureen Temme)

Organic Agriculture Centre of Canada great online resource
http://www.organicagcentre.ca/Extension/ext_welcome.asp

The Canadian Organic Grower magazine http://www.cog.ca/our-services/magazine/cog-magazine/ and browsable archive here http://magazine.cog.ca/

Special Issue of The Canadian Organic Grower with great articles at this link
http://www.organicagcentre.ca/NewspaperArticles/tcog_2012/tcog_index.asp?mode=window&backgroundColor=#222222

Five Tips for Organic Pest Control http://www.organicauthority.com/organic-gardening/organic-gardening/5-secrets-to-vegetable-garden-companion-planting-revealed.html

Eliot Coleman and Barbara Damrosch Four Season Farm articles archive
http://www.fourseasonfarm.com/resources/articles.html

Some books by Eliot Coleman and/or his wife, Barbara Damrosch, also a garden writer:

- The Four Season Farm Gardener's Cookbook, Workman, 2013
- The Winter Harvest Handbook, Chelsea Green, 2009
- Four Season Harvest, Chelsea Green, 1999
- The New Organic Grower, Chelsea Green, 1995

Agroecology resources from UC Berkeley, Miguel Altieri http://agroeco.org/

Row Cover available lots of places now ... Home Hardware, Lee Valley, TSC Farm Stores and other farm supply stores

Have a reference we should know about? Please let us know info(at)pollinationcanada.ca