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Biocontrols for some of the key pests of greenhouse crops

Crops/Beneficials	Key Pests	Biocontrol
Lettuce	Aphid	AA, ant control, LW, Aphidius
	caterpillar	Bt, LW, path
Microgreens	Fungus gnat	Hypoaspis, nemas, Bt
	Drosophila	Bt, vinegar trap, S. feltiae nemas
Basil	Thrips	A.Cucumeris, Hypoaspis, Orius, LW, S. feltiae nemas
	Spider mite	P. persimilis, N. californicus, Stethorus, Feltiella, Met52 path
Strawberry		
Kale		
Green Onions		
Garlic		
Potato		
Spinach		
Chard		
Mint		
Cilantro		
Cabbage (pac choi, napa, Arugula etc)	caterpillar	Btk, Trichogramma, podisus, path,
	aphid	AA, ant control, LW, Aphidius
	Flea weevil	H. bacteriophora nemas, DE, Hypoaspis
Tomato	Thrips	A.Cucumeris, Hypoaspis, Orius, LW, S. feltiae nemas
	Spider mite	P. persimilis, N. californicus, Stethorus, Feltiella, Met52 path
Cucumber	Thrips	A.Cucumeris, Hypoaspis, Orius, LW, S. feltiae nemas
	Spider mite	P. persimilis, N. californicus, Stethorus, Feltiella, Met52 path
	Whitefly	Encarsia, Eretmocerus, ant control, Delphastus, LW, path
	Aphid	AA, ant control, LW, Aphidius
Mushroom	Fungus gnat	Hypoaspis, nemas, Bti
	slug	Beer Trap, iron phosphate bait, carabid
	House fly	Fly parasites
	Nematode	Rhizoboost

BANKER PLANTS		

Key: LW – lacewing, green or brown

Btk – *Bacillus thuringiensis*, var. *kerstaki*, for caterpillars

Bti – *Bacillus thuringiensis*, var. *israelensis* for caterpillars

AA – *Aphidoletes aphidimyza*, aphid midge

Path – pathogen, *Metarhizium*, *Beauveria*, *Isaria* (*Paecilomyces*) *fumosorosea*,

Chromobacterium subtsugae

<http://extension.psu.edu/plants/vegetable-fruit/news/2014/three-newer-biological-insecticides-for-vegetable-and-small-fruit-growers>

DE – Diatomaceous Earth

Ant control - to control ants, you just need boric acid, a low risk bait acceptable in safe school program and NOP organic...

http://www.rinconvitova.com/ant_bait_antpro.htm

<http://www.rinconvitova.com/gourmet%20ant%20bait.htm>

http://www.kmantpro.com/images/KM_Message_To_Growers.pdf

IPM tool kit

Refractometer – take brix readings (about \$80)

USB microscope – see little creatures, easily (about \$40)

Hand lens – see little creatures

Sticky cards, yellow – monitor pests and beneficials

Potato slices- ¼ inch thick, about 1 inch square – monitor fungus gnats

Beat sheet – white paper to find bugs, hold paper under plants, beat plants, look at bugs on paper

Greenhouse Biocontrol Resources

Applied Bio-Nomics Technical Manual – 40 pdf documents with protocols based on top quality (fresh) organisms

<http://www.appliedbio-nomics.com/technical-manual/>

Greenhouse Cucumbers, Guidelines for Biological Control

<http://www.appliedbio-nomics.com/wp-content/uploads/405-cucumbers.pdf>

Greenhouse Tomatos, Guidelines for Biological Control

<http://www.appliedbio-nomics.com/wp-content/uploads/410-tomato.pdf>

University of Pennsylvania Greenhouse IPM Manual – 108 pages, good on monitoring and overall program.

<http://extension.psu.edu/ipm/program/greenhouse/greenhouse-manual>

More references for the practice of commercial biocontrol:

- Bulletins on some of the main insects that are used commercially in the US
http://rinconvitova.com/bulletin_product.htm#
- Side effects of pesticides (many organic ones) on beneficial insects
<http://www.biobestgroup.com/en/side-effect-manual>
<http://side-effects.koppert.nl/>
- Vendors: Rincon-Vitova Insectaries sells all of the commercially available plant pest biocontrols <http://rinconvitova.com>
Biocontrol industry website for other vendors: <http://anbp.org/>
- Biocontrol resources: <http://anbp.org/index.php/biocontrol-links>