

BIOLOGICAL CONTROL STRATEGY FOR GREENHOUSE TOMATO PRODUCTION



GLOBAL HORTICULTURAL INC. CONTROL AGENTS FOR GREENHOUSE TOMATOES

PEST	BCA	PRODUCT	RATE		TIMING	COMMENTS
			m ²	ft ²		
Whitefly Greenhouse whitefly <i>(Trialeurodes vaporarum)</i> Silverleaf whitefly <i>(Bemisia tabaci)</i>	<i>Encarsia formosa</i>	<i>Encarsia</i> pupae	1.5-3	0.15-0.3	Start as soon as possible after plants arrive in the greenhouse. Release <i>Encarsia</i> weekly. Curative --> 5-10 / m ² every week until 80% parasitism (black pupae) is reached.	Hang <i>Encarsia</i> cards between 2 nd and 3 rd cluster from the top of the plant. Optimal time for <i>Encarsia formosa</i> is when temperatures are between 18-27°C (65-80°F).
	<i>Eretmocerus eremicus</i>	<i>Eretmocerus</i> pupae	3-5	0.3-0.5	Switch from <i>Encarsia</i> to <i>Eretmocerus</i> or use a mix product when climate conditions are getting warmer. Release <i>Eretmocerus</i> weekly. Curative --> 5-10 / m ² every week.	Optimal introduction method for <i>Eretmocerus</i> is blister packs. Keep blister packs (or cards) out of direct sunlight and open release flap on the back. <i>Eretmocerus</i> does significantly more host feeding than <i>Encarsia</i> .
	<i>Dicyphus hesperus</i>	<i>Dicyphus</i> adults	0.25-0.6	0.025-0.06	20-40 mullein plants per acre. Start introducing <i>Dicyphus</i> as soon as possible after planting. Feed 4 gram <i>Ephestia</i> eggs per week during establishment.	Generalist predator - will feed on eggs, larvae and pupae of whitefly, along with thrips, moth eggs and various species of mites. However, it's not a stand-alone control for any pest. Always use with parasitoids for whitefly control. Must use mullein banker plants to establish and maintain population.
Caterpillars / loopers (<i>Trichoplusia ni</i> and other species)	<i>Bacillus thuringiensis</i>	N/A	Follow label instructions		Little to no negative effect on other BCAs.	
	<i>Dicyphus hesperus</i>	<i>Dicyphus</i> adults	0.25-0.6	0.025-0.06	20-40 mullein plants per acre. Start introducing <i>Dicyphus</i> as soon as possible after planting. Feed 4 gram <i>Ephestia</i> eggs per week during establishment.	Control depends on population levels in greenhouse when moth lays eggs. An established population contributes significantly in controlling moth eggs.

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Two-spotted spider mite (<i>Tetranychus urticae</i>) and Carmine mite (<i>Tetranychus cinnabarinus</i>)	<i>Phytoseiulus persimilis</i>	<i>Phytoseiulus</i> loose	8-10	0.8-1	Start when first spider mites are detected. Repeat weekly until <i>P. persimilis</i> is established and spider mites are controlled. Curative--> 100-150 / m ² in and around hotspots.	Twist the bottle slowly during use for a more even distribution of the mites. Sprinkle material on the bigger leaves and avoid introduction in bright sunlight. For Carmine mites double release rates. Early detection improves results.
	<i>Feltiella acarisuga</i>	<i>Feltiella</i> pupae	250 per acre		Minimum of 2 introductions weekly.	
	<i>Dicyphus hesperus</i>	<i>Dicyphus</i> adults	0.25-0.6	0.025-0.06	20-40 mullein plants per acre. Start introducing <i>Dicyphus</i> as soon as possible after planting. Feed 4 gram <i>Ephestia</i> eggs per week during establishment.	Control depends on population levels in greenhouse. An established population can contribute significantly in controlling spider mites.
Tomato russet mites (<i>Aculops lycopersici</i>)	<i>Amblyseius andersoni</i>	<i>Andersoni</i> sachets	1 sachet per plant. Repeat introduction every 4 weeks		Releasing preventatively gives best results. Hang sachets just above the infestation	Effective at slowing down development of Tomato russet mite (TRM) in hotspots if released directly after TRM has been observed. <i>Amblyseius</i> mites have difficulties of moving over great distances in tomato crop due to the presence of trichomes on the tomato plant. Early detection and releasing mites on the correct height in the plant improve results.
		<i>Andersoni</i> loose	100	10	Introduce loose material in and around hotspot and repeat every 1-2 weeks.	
Aphids - larger species: Potato aphid, Foxglove aphid (<i>Macrosiphum euphorbiae</i>, <i>Aulacorthum solani</i>)	<i>Aphidius ervi</i>	<i>Ervi</i> adults / mummies	0.25-1	0.025-0.1	Release at first signs of aphids for at least 3 weeks or until aphids are controlled. Curative --> 1-2 / m ² weekly until control of aphids has been achieved.	Most common aphid specie in tomato is Potato aphid.
	<i>Aphelinus abdominalus</i>	<i>Aphelinus</i> adults / mummies	5-10	0.5-1	Release at first signs of aphids for at least 3 weeks or until aphids are controlled.	
	<i>Aphidoletes aphidimyza</i>	<i>Aphidoletes</i> pupae	0.5-1	0.05-0.1		Be aware of diapause between Mid-October and beginning of March.

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Leafminers (<i>Liriomyza trifolii</i>)	<i>Diglyphus isaea</i>	<i>Diglyphus</i> adults	0.25-1	0.025-0.1	Start releasing at first signs of leafminer (feeding and ovoposition spots). Release weekly for 3-4 weeks until sufficient parasitism has been established. Curative --> 1 / m ² weekly until control of leafminers has been achieved.	Introduce <i>Diglyphus</i> early morning or later in evening to avoid stress.
Thrips, Western Flower Thrips (<i>Frankliniella occidentalis</i>) Note: <i>Amblyseius</i> mites have difficulties of moving over great distances in tomato crops due to the presence of trichomes on the tomato plant. The closer you can bring <i>A. cucumeris</i> to thrips the better the results will be.	<i>Dicyphus hesperus</i>	<i>Dicyphus</i> adults	0.25-0.6	0.025-0.06	20-40 Mullein plants per acre. Start introducing <i>Dicyphus</i> as soon as possible after planting. Feed 4 gram <i>Ephestia</i> eggs per week during establishment.	Main danger from thrips is virus transmission. If there is a history of thrips in greenhouse, use <i>Dicyphus hesperus</i> , however do not combine with <i>Beauveria</i> .
	<i>Amblyseius cucumeris</i>	<i>Cucumeris</i> sachets	1 sachet per plant. Repeat introduction every 4 weeks			Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes.
	<i>Beauveria bassiana</i>	N/A	Follow label instructions		Follow label instructions and rate.	
Fungus gnats & shore flies (<i>Bradysia</i> spp. & <i>Scatella</i> spp.)	<i>Stratiolaelaps scimitus</i> (<i>Hypoaspis miles</i>)	<i>Stratiolaelaps</i> loose	100	10	Release as soon as possible after planting out in the greenhouse. If applied during propagation stage, second release after planting can be at half rate.	Apply at planting to the growing media (soil or organic growing media). Does not do well in rockwool substrates.
	<i>Dalotia coriaria</i> (<i>Atheta coriaria</i>)	<i>Dalotia</i> adults / larvae	2	0.2		Can be mixed and applied together.
	<i>Steinernema feltiae</i> & <i>Steinernema carpocapsae</i>	<i>Steinernema feltiae</i> / <i>carpocapsae</i> sponge	20,000	2,000	Apply at sticking and repeat during rooting stage. Re-apply after transplanting.	Correct application is critical for efficacy. Make sure solution is agitated, fine filters are removed and pressure is kept low.

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