

# BIOLOGICAL CONTROL STRATEGY FOR INDOOR, GREENHOUSE AND OUTDOOR CANNABIS PRODUCTION



## GLOBAL HORTICULTURAL INC. CONTROL AGENTS FOR INDOOR, GREENHOUSE AND OUTDOOR CANNABIS

PEST	BCA	PRODUCT	RATE		TIMING	COMMENTS
			m <sup>2</sup>	ft <sup>2</sup>		
<b>Two-spotted spider mites</b> <b>(<i>Tetranychus urticae</i>)</b>  Note: <i>Amblyseius andersoni</i> / <i>Amblyseius californicus</i> will also help controlling broad mites and hemp russet mites. <i>P. persimilis</i> , <i>A. andersoni</i> and <i>A. californicus</i> can be used year round.	<i>Amblyseius andersoni</i> or <i>Amblyseius californicus</i>	<i>Andersoni</i> / <i>californicus</i> sachets	1 sachet per plant every 4-5 weeks.		Best results are achieved with sachets, but can also be released as loose application. Repeat introduction with heavy infestations.	Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes.  Can be a mixed application with <i>Amblyseius cucumeris</i> in propagation.
		<i>Andersoni</i> / <i>californicus</i> loose	4-6	0.4-0.6		
	<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 <sup>2</sup> 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. Early detection improves results. Consider using indicator plants (bush beans).
	<i>Neoseius fallaxis</i>		20-40	2-4	Release bi-weekly.	
<b>Broad mites</b> <b>(<i>Polyphagotarsonemus latus</i>)</b>	<i>Amblyseius cucumeris</i>	<i>Cucumeris</i> sachets	1 sachet per propagation tray or per plant		Place sachet at sticking and again when transplanting into pots.	Sachets typically release mites between 4-6 weeks, but it's recommended to re-introduce sachets every 4 weeks.
<b>Hemp russet mites (<i>Aculops cannabicola</i>)</b>	<i>Amblyseius andersoni</i>	<i>Andersoni</i> sachets	1 sachet per propagation tray or per plant		Place sachet at sticking and again when transplanting into pots.	Sachets typically release mites between 4-6 weeks, but it's recommended to re-introduce sachets every 4 weeks.
		<i>Andersoni</i> loose	4-6	0.4-0.6	Release in propagation.	Can be a mixed application with <i>Amblyseius cucumeris</i> in propagation.
<b>Thrips, Western Flower Thrips</b> <b>(<i>Frankliniella occidentalis</i>)</b> <b>&amp; others</b>	<i>Amblyseius cucumeris</i>	<i>Cucumeris</i> stick sachets	1 sachet per plant		Use stick sachets at transplanting at propagator.	Sachets typically release mites between 4-6 weeks, but it's recommended to re-introduce sachets every 4 weeks. Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes.
		<i>Cucumeris</i> hook sachets	1 sachet per 1-2 plants if you are using both <i>A. cucumeris</i> and <i>A. andersoni</i> alternating plants		Use later on sachets with hooks and hang the sachet on the plant 18-25 cm (6-8 inches) from the top. Release every 4 weeks.	
	<i>Amblyseius cucumeris</i>	<i>Cucumeris</i> loose	150-200	15-20	Release every week. Curative --> 400 / m <sup>2</sup> every week	Distribute evenly over leaf canopy.

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<p>Note: <i>Amblyseius cucumeris</i> will also help controlling spider mites and broad mites. <i>A. cucumeris</i> can be used yearround.</p> <p>In areas where temperatures are consistently above 24 °C / 75°F, replace <i>Amblyseius cucumeris</i> with <i>Amblyseius swirskii</i>.</p>	<i>Stratiolaelaps scimitus (Hypoaspis miles)</i>	<i>Stratiolaelaps</i> loose	100	10	Apply at sticking / seeding and transplanting.	<i>Stratiolaelaps</i> is a soil dwelling mite that needs a moist environment for optimal development. If applied at rooting stage, a 2 <sup>nd</sup> application should be half rate at transplanting.
	<i>Dalotia coriaria (Atheta coriaria)</i>	<i>Dalotia</i> adults & larvae	2	0.2	Apply at sticking / seeding and transplanting.	If applied at rooting stage, a 2 <sup>nd</sup> application should be half rate at transplanting.
	<i>Orius insidiosus</i>	<i>Orius</i> adults	0.25-0.5	0.025-0.05	Release 4 consecutive weekly introductions, starting at the end of February under natural day length.	Earlier releases can be done as long as day length is increased with supplemental lighting for more than 12 hours to avoid diapause.
<p><b>Fungus gnats &amp; shore flies (Bradysia spp. &amp; Scatella spp.)</b></p>	<i>Stratiolaelaps scimitus (Hypoaspis miles)</i>	<i>Stratiolaelaps</i> loose	100	10	Apply at sticking / seeding and transplanting.	If applied at rooting stage, a 2 <sup>nd</sup> application should be half rate at transplanting.
	<i>Dalotia coriaria (Atheta coriaria)</i>	<i>Dalotia</i> adults / larvae	2	0.2	Apply at sticking / seeding and transplanting.	If applied at rooting stage, a 2 <sup>nd</sup> application should be half rate at transplanting.
	<i>Steinernema feltiae &amp; Steinernema carpocapsae</i>	<i>Steinernema feltiae</i> / <i>carpocapsae</i> sponge	20,000	2,000	Apply at sticking and repeat twice 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.
<p><b>Aphids - smaller species: Green peach aphid, Cotton melon aphid, Cannabis aphid, Black bean aphid (<i>Aphis gossypii</i>, <i>Myzus persicae</i>, <i>Phorodon cannabis</i>, <i>Aphis fabae</i>)</b></p> <p>Note: For Cannabis aphids a mix of <i>Aphidius spp.</i> is recommended.</p>	<i>Aphidius colemani</i>	<i>Colemani</i> adults / mummies	0.25-1	0.025-0.1	Release weekly. Curative --> 1 / m <sup>2</sup> weekly until control.	Use in combination with banker plants. In case of Cannabis aphids a mix product with <i>A. ervi</i> is recommended
	<i>Rhopalosiphum padi</i>	Aphid banker plants	Minimum 1 / acre (2.5 / ha)		Initial introduction is 2 banker plants per acre followed by 1 per acre every 2 weeks.	
	<i>Aphidoletes aphidimyza</i>	<i>Aphidoletes</i> pupae	1	0.1	Release at first signs of aphids. Release weekly until control of aphids has been achieved.	Be aware of diapause between Mid-October and beginning of March.
	<i>Chrysoperla spp.</i>	<i>Chrysoperla</i> larvae	10-20	1-2	Release in hotspots of aphids. Works as a quick knock down.	
	<i>Hippodamia convergens</i>	<i>Hippodamia</i> adults	10-20	1-2	Release in hotspots of aphids. Works as a quick knock down.	
<p><b>Aphids - larger species: Potato aphid, Foxglove aphid (<i>Macrosiphum euphorbiae</i>, <i>Aulacorthum solani</i>)</b></p>	<i>Aphidius ervi</i>	<i>Ervi</i> adults / mummies	0.5-2	0.05-0.2	Release weekly. Curative --> 1 / m <sup>2</sup> weekly until control.	In case of Cannabis aphids a mix product with <i>A. colemani</i> is recommended.
	<i>Aphidoletes aphidimyza</i>	<i>Aphidoletes</i> pupae	1	0.1	Release at first signs of aphids. Release weekly until control of aphids has been achieved.	Be aware of diapause between Mid-October and beginning of March.

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	<i>Hippodamia convergens</i>	<i>Hippodamia</i> adults	10-20	1-2	Release in hotspots of aphids. Works as a quick knock down.	
<b>Root aphids (<i>Pemigus spp.</i> and <i>Phylloxera spp.</i>)</b>	<i>Beauveria bassiana</i>	BotaniGard 22 WP™ Mycotrol™	N/A	N/A	Apply at first signs of aphids. Soak pot (preferred) or drench pots. Repeat every 3-5 days for a total of 3 applications.	See Bioworks <a href="http://www.bioworks.com">http://www.bioworks.com</a> for more information. They have a root aphid control sheet.
<b>Whitefly</b> <b>Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>)</b> <b>Silverleaf whitefly (<i>Bemisia tabaci</i>)</b>  Note: If <i>Amblyseius swirskii</i> is released for whitefly it will also help controlling thrips. <i>A. swirskii</i> requires temperatures >20°C (68°F) for good performance.	<i>Amblyseius swirskii</i>	<i>Swirskii</i> sachets	1	0.1	If plants are touching use 1 sachet per 3 plants, otherwise 1 sachet per plant. Start at first sign of whitefly. Release every 4 weeks.	Sachets typically release mites between 4-6 weeks, but recommended to re-introduce every 4 weeks. Hang sachets between the crop. Avoid hanging them in direct sunlight or close to heating pipes.
		<i>Swirskii</i> loose	100-150	10-15	Release every 1-2 weeks. Curative --> 300-400 / m <sup>2</sup> .	Distribute evenly over leaf canopy.
	<i>Encarsia formosa</i> & <i>Eretmocerus eremicus</i>	<i>Encarsia</i> / <i>Eretmocerus</i> mix	5-10	0.5-1	Start at first signs of whitefly. Release every week until whitefly is controlled. Curative --> min. 10 / m <sup>2</sup> every week until whitefly is controlled.	Optimal introduction method for wasps is blister packs. Keep blister packs (or cards) out of direct sunlight and open release flap on the back.
	<i>Delphastus catalinae</i>	<i>Delphastus</i> adults	In hotspots		Release in hotspots of whitefly.	<i>Delphastus</i> requires high numbers of whitefly.