Biological Control Agents (BCAs): Greenhouse Tomato Insect Management

BCA Insect Control					
Pest	**BCA**	**Rate (Units/m^2)**	**Rate (Units/ft^2)**	**Release strategy**	**Application Notes**
Whiteflies Greenhouse whitefly (*Trialeurodes vaporariorum*); Sweet Potato Whitefly *(Bemisia tabaci)*	*Encarsia formosa*	1.5 - 6	0.3 – 0.6	Start releasing low rate immediately after planting. After first whiteflies are detected, increase rate to medium level.	Maintain releases every week until achieving control. A combination of both species can be used for better results. *Encarsia formosa* is not effective for controlling *Bemisia tabaci.* **Note:** Aggressive deleafing can have a significant impact on complete development of the wasps.
	Eretmocerus eremicus				
	Dicyphus hesperus[3]	3-4 per Mullein plant per week for 8 weeks		Introduce Mullein plants at 40 per acre. Apply *Ephestia* eggs weekly during establishment.	This generalist predator feeds on eggs, larvae, and pupae of whitefly. Also feeds on aphids, thrips, moth eggs and various species of mites.
					Only effective in a proactive system with banker plants. Populations needs to be established to be effective, (curative releases will not be effective).
Mites Two-spotted spider mite (*Tetranychus urticae*); Carmine mite (*T. cinnabarinus*)	*Phytoseiulus persimilis*	8 - 10	0.8 - 1	Release upon detection of first spider mite spots.	Repeat every week until achieving control. Minimum of 4 weeks of introduction
	Feltiella acarisuga[1]	250 ind./acre		At least two introductions weekly.	Avoid direct sunlight[2]
	Dicyphus hesperus[3]	Same as for whitefly control			
Tomato Russet mite (*Aculops lycopersici*)	*Amblyseius andersoni*	One sachet per plant		Release preventatively for best results.	Prevention is necessary to help at first arrival of Tomato Russet mite.
	A. californicus				Prevention is necessary to help at first arrival of Tomato Russet mite.
	Dicyphus hesperus[3]	Same as for whitefly control.			*Dicyphus hesperus* is found in Tomato Russet mite spots and will prey on them.

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Aphids (larger species) Potato aphid (*Macrosiphum euphorbiae*)	*Aphidius ervi*	0.5 - 2	0.05 – 0.2	Release preventatively.	Start at first sign of aphid presence.
	Aphelinus abdominalis	0.5 - 2	0.05 – 0.2	Alternate releases with *Aphidius* spp.	Release this species when low parasitism is achieved with *A. ervi* or if hyper-parasitism is confirmed on aphid populations.
	Aphidoletes aphidimyza[1]	1	0.1	Weekly releases upon aphid detection. Continue until control has been achieved.	Start at first sign of aphid presence. Keep carrier lightly humid to ensure *A. aphidimyza* emergence. **Note:** Growers utilizing lights be aware of diapause and natural sunset. [2]
Thrips Western flower thrips (*Frankliniella occidentalis);* Chili thrips (*Scirtothrips dorsalis*); and other species **Note:** Tomatoes produced in high tunnels appear to be more prone to Thrips due to soil exposure.	*Stratiolaelaps scimitus (= Hypoaspis miles)*	100	10	Release first on the organic substrate during propagation and repeat after planting to other containers containing organic material.	Release full rate during propagation. Release half rate after planting if full rate is used during propagation. Both species can be mixed and applied together. (Does not work in rockwool growing media.)
	Dalotia (=*Atheta*) *coriaria*	2	0.2		
	Steinernema feltiae (NemaShield)	250K -300K	25K -30K	Bi-weekly applications are recommended at the beginning of the crop.	Initiate treatments during the seedling stage. Keep suspension under constant agitation, remove filters and keep low pressure for better results. (Does not work in rockwool growing media.)
	Dicyphus hesperus[3]	Same as for whitefly control.			

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Fungus gnats (*Bradysia* spp.) and **Shore flies** (*Scatella* spp.)	*Stratiolaelaps scimitus (=Hypoaspis miles)*	100	10	Release on top of organic growing media at propagation and repeat if planting to other containers containing organic material.	Release full rate during propagation. Release half rate after planting if full rate is used during propagation. Both species can be mixed and applied together. (Does not work in rockwool growing media.)
	Dalotia coriaria (=*Atheta*) *coriaria*	2	0.2		
	Steinernema feltiae (NemaShield)	250K -300K	25K – 30K	Bi-weekly applications are recommended at the beginning of the crop.	Initiate treatments during the seedling stage. Keep suspension under constant agitation, remove filters and keep low pressure for better results. (Does not work in rockwool media.)
Lepidopterans Cabbage looper (*Trichoplusia ni)* and other species	*Dicyphus hesperus*[3]	Same as for whitefly control.			

NOTES:

[1]Both *Feltiella* and *Aphidoletes* are highly susceptible to the use of any sulfur products; it should be avoided when using these species.

[2]*Aphidoletes* and *Feltiella* both mate at dusk. If lights are utilized in the greenhouse, it is better to allow the natural sunset, and wait to turn on lights later, at 2 or 3 am. To avoid diapause (between October and early March), extend daylength to 12 hours.

[3]Use of a generalist predator such as *Dicyphus hesperus* helps act as a biocontrol stabilizer.

Contact your Biological Control Advisor for additional information.

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