















# Whiteflies

		Biological control agents					
		Parasitoids		Predatory mites		Other predators	
 Silverleaf whitefly  Greenhouse whitefly  Larva and pupa		Encarsia formosa (Ef)	Eretmocerus eremicus (Ee)	Amblydromalus limonicus (Al)	Amblyseius swirskii (As)	Dicyphus hesperus (Dh)	Delphastus catalinae (Dca)
	Greenhouse whitefly ( <i>Trialeurodes vaporariorum</i> )			∅	∅	+	✓
	Silverleaf whitefly ( <i>Bemisia tabaci</i> )	✓	+	∅	∅	+	✓
	Greenhouse whitefly ( <i>Trialeurodes vaporariorum</i> )			✓		+	✓
	Silverleaf whitefly ( <i>Bemisia tabaci</i> )	✓	+	✓	+	✓	✓
<b>Developmental stages</b> targeted by predation (Pr) or parasitism (Pa) (All = all stages)		Pr: L2 Pa: L3, L4	Pr: L1, L2 Pa: L2, L3	Pr: L1, L2, L3, L4	Pr: E, L1, L2	Pr: All	Pr: mostly E, L1, L2, L3, L4, P
CHARACTERISTICS							
<b>Action mechanism</b> (Pr = Predation, Pa = Parasitism)		Pa-Pr	Pa-Pr	Pr	Pr	Pr	Pr
<b>Development cycle</b> (⌚ slow : ex. > 3 weeks at 25°C)				—	—		
<b>Mobility/Dispersion</b> ( - : low, ± : moderate, + : good, ++ : very good, (A) = Adult)		±	±	±	±	+	+
<b>Application method</b> (Fo = Foliar, G = Ground)		Fo	Fo	Fo	Fo	Fo	Fo
<b>Preferred temperature</b> (see legend)		warm	hot	cool	hot	hot	hot
<b>Minimal temperature tolerated</b>		>16°C	>18°C	>13°C	>15°C	>15°C	>13°C
<b>Possible winter use</b> (❄️; with lighting 💡)		❄️	❄️ >18°C	❄️	❄️	❄️💡	❄️ >18°C
<b>Requirements</b> (🌼 pollen, 🐛 preys, 💧 humidity, (P) = preventive)		—	—	🌼 (P)	🌼 (P) 💧	mullein <sup>1</sup>	🐛
<b>Introduction period</b> (P = Preventive in bulk, before or immediately after the first pest detection, P <sup>1</sup> = Preventive in sachet, C = Curative, A = Area affected)		P - C - A	P - C - A	P - C - A	P - C	P - C	C - A
<b>Introduction rates</b> (quantity/m <sup>2</sup> ). Suggested rates; consult your supplier for more information.		0,25 - 9	1,5 - 9	50 - 250	20 - 100	0,25 - 0,5	0,5 - 4
<b>Introduction frequency</b> (d)		7	7	7	7 - 21	7	7 - 14
<b>Number of introductions</b> (or as needed)		min 5*	min 3*	1-5	as needed	3	3 - 4
<b>Introduction cost</b> according to rates above (1: ≤ 0,2 \$/m <sup>2</sup> , 2: 0,2-0,5 \$/m <sup>2</sup> , 3: 0,5-1 \$/m <sup>2</sup> , 4: >1 \$/m <sup>2</sup> )		1	1 - 2	2	1 - 2	2	1 - 4
<b>Compatible biocontrol agents</b> (bold = best combination)		Al, As, <b>Dca</b> , Dh, <b>Ee</b>	<b>Dca</b> , Dh, <b>Ef</b>	<b>As</b>	<b>Ee, Ef, Nc<sup>2</sup>, Oi, Pp<sup>2</sup></b>	Ee, Ef	Ee, Ef
<b>Incompatible biocontrol agents</b>		—	—	—	<b>Aa, Nc<sup>3</sup>, Pp<sup>3</sup></b>	—	—
<b>Other information</b>		Selective leaf thinning as to not remove parasitized white flies. Leave leaves on ground.		Alternative food sources ( <i>Carpoglyphus</i> or pollen)	Cannibalism and predation of other possible mites <sup>3</sup>	Potential plant damages if not enough prey. Leave leaves on ground.	—
<b>Quebec suppliers</b> (A = Anatis, K = Koppert, P = Plant Products; other province, please check)		A K P	A P K	K	A K P	A P	A K P

## Legend

- ◊ Biocontrol agent still on trial
- ⊗ Biocontrol agent rarely used
- ∅ Glandular hairs slow down mobility

E = Egg, L = Larva (1 to 4 stages), P = Pupa, A = Adult


\* up to 80% of parasitism  
— N/A

Aa: *Aphidoletes aphidimyza*; Oi: *Orius insidiosus*; Pp: *Phytoseiulus persimilis*; Nc: *Neoseiulus cucumeris*

<sup>1</sup> Banker plants. Use with *Ephestia* eggs and/or *Artemia* cysts

<sup>2</sup> with prey

<sup>3</sup> without prey

Best efficiency	
Good efficiency	+
Efficient	✓
Optimal efficiency (or tolerance) in cool temperatures (>10-15°C)	cool
Optimal efficiency (or tolerance) in hot temperatures (>25°C and <30°C)	hot
Optimal efficiency in warm temperatures (around 16-25°C)	warm

**Detection:** Yellow sticky traps (strips at 1/50-100m<sup>2</sup>).

**Alternative strategies:** Insect screen. Mass trapping with sticky traps. Selective deleafing and leaves on ground.

This information sheet has been created by J.E. Maisonhaute, G. Labrie (CRAM) and L. Lambert (MAPAQ), in collaboration with biological control agent suppliers (Anatis Bioprotection, Koppert et Plant Products).

Québec

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N.B. : Recommended introduction rates and costs can vary according to suppliers. Consult your biological control agent supplier for more information.



# Aphids

## Biological control agents

		Parasitoids				Ladybugs		Midge	Hoverfly	Lacewings	Predatory mites	
		<i>Aphidius colemani</i> (Ac)	<i>Aphidius matricariae</i> (Am)	<i>Aphidius ervi</i> (Ae)	<i>Aphelinus abdominalis</i> (Aab)	<i>Hippodamia convergens</i> (Hc)	⊗ <i>Adalia bipunctata</i> (Ab)	<i>Aphidoletes aphidimyza</i> (Aa)	⊕ <i>Eupeodes americanus</i> (Ea)	<i>Chrysoperla carnea / rufilabris</i> (Cc)	⊗ <i>Micromus variegatus</i> (Mv)	⊕ <i>Anysis baccarum</i> (Aba)
	Green peach aphid ( <i>Myzus persicae</i> )	👑	👑	✓	–	∅	∅	+	–	∅	∅	–
	Potato aphid ( <i>Macrosiphum euphorbiae</i> )	–	–	👑	+	∅	∅	+	–	∅	∅	–
	Foxglove aphid ( <i>Aulacorthum solani</i> )	–	✓	+	✓	∅	∅	+	–	∅	∅	–
	Green peach aphid ( <i>Myzus persicae</i> )	👑	👑	✓	✓	+	✓	+	+	✓	✓	+
	Potato aphid ( <i>Macrosiphum euphorbiae</i> )	–	–	👑	+	+	✓	+	+	✓	✓	+
	Foxglove aphid ( <i>Aulacorthum solani</i> )	–	✓	+	✓	+	✓	+	+	✓	✓	+
	Green peach aphid ( <i>Myzus persicae</i> )	+	+	✓	–	+	✓	+	+	✓	✓	–
	Potato aphid ( <i>Macrosiphum euphorbiae</i> )	–	–	+	+	+	✓	+	+	✓	✓	–
	Melon aphid ( <i>Aphis gossypii</i> )*	👑	+	–	–	+	✓	👑	+	✓	✓	–
<b>Development stages targeted</b>		All developmental stages (L1, L2, L3, L4, A)										
CHARACTERISTICS												
<b>Action mechanism</b> (Pr = Predation, Pa = Parasitism)	Pa	Pa	Pa	Pa - Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr
<b>Development cycle</b> (⌚ slow : ex. > 3 weeks at 25°C)	–	–	–	⌚	⌚	⌚	⌚	⌚	⌚	⌚	variable	⌚
<b>Mobility/Dispersion</b> ( - : low, ± : moderate, + : good, ++ : very good, (A) = Adult)	++	++	++	-	++	+	+	+	+	++	++ (A)	++
<b>Application method</b> (Fo = Foliar, Gr = Ground)	Fo	Fo	Fo	Fo	Fo	Fo	Fo	Gr	Fo	Fo	Fo	Fo
<b>Preferred temperature</b> (see legend)	warm	warm	cool	hot	warm	warm	warm	warm	warm	warm	cool	warm
<b>Minimal temperature tolerated</b>	>10°C	>10°C	>10°C	>15°C	>12°C	>12°C	>12°C	>12°C	>10°C	>15°C	>4°C	>10°C
<b>Possible winter use</b> (❄️; with lighting 💡)	❄️	❄️	❄️	❄️	–	❄️	💡 >16h	❄️	❄️	💡	❄️	❄️
<b>Requirements</b> (🌸 pollen, 🐜 preys, 💧 humidity, (P) = preventive)	–	–	–	–	🐜	🐜	💧 + substrate <sup>1</sup>	🌸	–	–	–	🐜 🌸 💧
<b>Introduction period</b> (P = Preventive in bulk, before or immediately after the first pest detection, P <sup>1</sup> = Preventive in sachet, C = Curative, A = Area affected)	P - C	P - C	C	P - C	C - A	C - A	C	P - C	C - A	C - A	C - A	P - C
<b>Introduction rates</b> (quantity/m <sup>2</sup> ). Suggested rates; consult your supplier for more information.	0,25 - 2	0,25 - 2	0,25 - 2	0,25 - 2	1 - 20	10 - 50	0,1 - 10	0,25 - 0,5	10 - 50 larvae	0,1 - 1	5 - 60	
<b>Introduction frequency</b> (d)	7	7	7	7	as needed	as needed	7	7 - 14	7 - 14	as needed	as needed	
<b>Number of introductions</b> (or as needed)	**	**	**	**	as needed	as needed	***	2-3	as needed	as needed	as needed	
<b>Introduction cost</b> according to rates above (1: ≤ 0,2 \$/m <sup>2</sup> , 2: 0,2-0,5 \$/m <sup>2</sup> , 3: 0,5-1 \$/m <sup>2</sup> , 4: >1 \$/m <sup>2</sup> )	1	1	1 - 3	1 - 3	1 - 2	3 - 4	1 - 3	3-2	2 - 4	1 - 3	1 - 4	
<b>Compatible biocontrol agents</b> (bold = best combination)	<b>Aa, Hc</b>	<b>Aa, Cc</b>	Aa, Aab, Ac	<b>Ae, Aa, Hc</b>	Ac, Aa, Aab	Aa	<b>Aab, Ac, Ae, Am, Hc</b>	<b>Aa, Ac, Mv</b>	Am	–	–	<b>Ae, Aa, Nc, As, Ss, Oi, Dca, Mv, Pp, Nf, Gg, Ef</b>
<b>Incompatible biocontrol agents</b>	–	–	–	–	–	–	–	–	–	–	–	Nc <sup>2</sup>
<b>Other information</b>	Banker plants of cereals		–	–	–	–	Prefers lower leaves. Do not disperse on leaves.	Banker plants; keep ants away.	Possible cannibalism	–	–	To be eliminated before selling fruits
<b>Quebec suppliers</b> (A = Anatis, K = Koppert, P = Plant Products; other province, please check)	A K P	A K P	A K P	A K P	A P	A K P	A K P	A <sup>3</sup>	A K P	A	A	

### Legend

- 👑 Biocontrol agent still on trial
- ⊕ Biocontrol agent rarely used
- ∅ Glandular hairs slow down mobility
- L = Larva (stades 1 à 4), A = Adult
- N/A

\* Population of Melon aphid grows very fast on cucumber.

\*\* up to 80% of parasitism

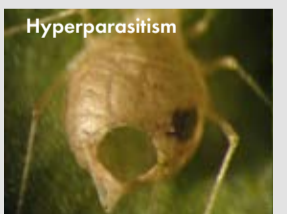
\*\*\* until biocontrol agent is established

As: *Amblyseius swirskii*; Dca: *Delphastus catalinae*; Ef: *Encarsia formosa*; Gg: *Gaeolaelaps gillespiei*; Nc: *Neoseiulus cucumeris*; Nf: *Neoseiulus fallacis*; Oi: *Orius insidiosus*; Pp: *Phytoseiulus persimilis*; Ss: *Stratiolaelaps scimitus*

<sup>1</sup> Substrate for pupation (ex. soil, vermiculite...) <sup>2</sup> without prey <sup>3</sup> Poor product availability in Jan-Feb

**Detection:** Visual observation. Exuviae or fumagine on leaves. Winged shapes on sticky traps. Leaf deformation.

**Alternative strategies:** Preventive introduction of *Aphidius*. Introduction of *Aphidoletes* and/or *Aphelinus* if hyperparasitism present. Other predators on area affected.



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# Spider mites

 		Biological control agents						
		Predatory mites					Ladybug	Midge
		<i>Phytoseiulus persimilis</i> (Pp)	<i>Neoseiulus californicus</i> (Nca)	<i>Amblyseius andersoni</i> (Aan)	<i>Neoseiulus fallacis</i> (Nf)	<i>Anystis baccarum</i> (Aba)	<i>Stethorus punctillum</i> (Sp)	<i>Feltiella acarisuga</i> (Fa)
	<b>Spider mites</b> Two-spotted spider mites ( <i>Tetranychus urticae</i> )		∅	✓	+	-	∅	✓
				+	+		+	✓
				+	+		+	✓
<b>Developmental stages targeted</b>		All developmental stages (O, L, N1, N2, A)						
<b>CHARACTERISTICS</b>								
<b>Action mechanism</b> (Pr = Predation, Pa = Parasitism)		Pr	Pr	Pr	Pr	Pr	Pr	Pr
<b>Development cycle</b> ( ⏳ slow : ex. > 3 weeks at 25°C )		-	-	-	-	⏳	⏳	-
<b>Mobility/Dispersion</b> (- : low, ± : moderate, + : good, ++ : very good, (A) = Adult)		+	±	+	++	++	++ (A)	+(A)
<b>Application method</b> (Fo = Foliar, G = Ground)		Fo	Fo	Fo	Fo	Fo	Fo	Fo
<b>Preferred temperature</b> (see legend)		warm	wide	wide	wide	warm	wide	warm
<b>Minimal temperature tolerated</b>		>15°C	>10°C	>6°C	>9°C <sup>1</sup>	>10°C	>12°C	>13°C
<b>Possible winter use</b> ( ❄️ ; with lighting 💡 )		❄️	❄️	-	❄️ >18°C	❄️	❄️ >12°C 💡 >16h	❄️
<b>Requirements</b> ( 🌼 pollen, 🕷️ preys, 💧 humidity, (P) = preventive)		💧 🕷️	-	-	-	🕷️ (P) 🌼 💧	🕷️	💧
<b>Introduction period</b> (P = Preventive in bulk, before or immediately after the first pest detection, P <sup>1</sup> = Preventive in sachet, C = Curative, A = Area affected)		A - C	P - P <sup>1</sup> - C	P	P - C	P - C	C	A
<b>Introduction rates</b> (quantity/m <sup>2</sup> ). Suggested rates; consult your supplier for more information.		5 - 100	25 - 100	3 - 6	1 - 2	3 - 22	0,5 - 5	0,25 - 10
<b>Introduction frequency</b> (d)		7	14 - 21	3 - 30	7 - 14	as needed	7	7
<b>Number of introductions</b> (or as needed)		1 - 2	as needed	≥ 3	as needed	as needed	3	3
<b>Introduction cost</b> according to rates above (1: ≤ 0,2 \$/m <sup>2</sup> , 2: 0,2-0,5 \$/m <sup>2</sup> , 3: 0,5-1 \$/m <sup>2</sup> , 4: >1 \$/m <sup>2</sup> )		2-4	1-4	1	1	2-3	2-4	2-4
<b>Compatible biocontrol agents</b> (bold = best combination)		<b>Nf, Nca, Fa, Sp</b>	<i>Pp</i> <sup>2</sup> , <i>Sp</i> , <i>Fa</i> , <i>Ef</i>	<b>Pp</b>	<b>Pp</b> <sup>2</sup> , <b>Sp</b> <sup>3</sup>	<b>Ae, Nc</b> <sup>2</sup> , <i>As</i> <sup>2</sup> , <i>Ss</i> , <i>Oi</i> , <i>Dca</i> , <i>Aa</i> , <i>Mv</i> , <i>Pp</i> , <i>Nf</i> , <i>Gg</i> , <i>Ef</i>	<i>Nf</i> , <i>Nca</i> , <i>Pp</i>	<b>Pp</b> , <i>Nca</i>
<b>Incompatible biocontrol agents</b>		<i>Id</i> , <i>Nc</i> <sup>3</sup>	<i>Pp</i> <sup>3</sup> and other predatory mites <sup>3</sup>	-	<i>Pp</i> <sup>3</sup> and other predatory mites <sup>3</sup>	<i>Nc</i> <sup>3</sup> and other predatory mites <sup>3</sup>	-	-
<b>Other information</b>		-	Survival on pollen	Survival on pollen	Survival on pollen	To be eliminated before selling fruits	-	Careful deleafing
<b>Quebec suppliers</b> (A = Anatis, K = Koppert, P = Plant Products; other province, please check)		A K P	A K P	A P	A P	A	A P	K P

## Legend

- ◊ Biocontrol agent still on trial
- ⊗ Biocontrol agent rarely used
- ∅ Glandular hairs slow down mobility

Best efficiency	
Good efficiency	+
Efficient	✓
Optimal efficiency in warm temperatures (around 16-25°C)	warm
Tolerance for a wide range of temperatures (15°C to >30°C)	wide

E = Egg, L = Larva, N1 = Protonymph, N2 = Deuteronymph, A = Adult

Aa: *Aphidoletes aphidimyza*; Ae: *Aphidius ervi*; As: *Amblyseius swirskii*;  
Dca: *Delphastus catalinae*; Ef: *Encarsia formosa*; Gg: *Gaeolaelaps gillespiei*;  
Id: *Iphiseius degenerans*; Mv: *Micromus variegatus*; Nc: *Neoseiulus cucumeris*; Nca: *Neoseiulus californicus*; Oi: *Orius insidiosus*; Ss: *Stratiolaelaps scimitus*

- N/A

<sup>1</sup> Slow-release sachet    <sup>2</sup> with prey    <sup>3</sup> without prey

**Detection:** Visual inspection of plants (look for individuals or nutritional waste and nutrition damage [white dots]).

**Alternative strategies:** *P. persimilis* on 1st area affected with local misting

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Québec

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CRAAQ  
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# Thrips

		Biological control agents									
		Predatory mites						Pirate bug	Rove beetle	Nematod	
		<i>Amblyseius swirskii</i> (As)	<i>Neoseiulus cucumeris</i> (Nc)	<i>Iphiseius degenerans</i> (Id)	<i>Amblydromalus limonicus</i> (Al)	<i>Anystis baccarum</i> (Aba)	<i>Gaeolaelaps gillesspiei</i> (Gg)	<i>Stratiolaelaps scimitus</i> (Ss)	<i>Orius insidiosus</i> (Oi)	<i>Dalotia coriaria</i> (Dc)	<i>Steinernema felifiae</i> (Sf)
	Western flower thrips ( <i>Frankliniella occidentalis</i> ), Onion/tobacco thrips ( <i>Thrips tabaci</i> )	∅	+	∅	∅	-	+	+	∅	✓	+
				✓	+	+	+	+		✓	+
			+	✓	+	-	+	+	+	✓	+
<b>Developmental stages</b> targeted (All = all stages)		L1, L2	L1	L1	L1, L2	L1 à A	P, N	P, N	L1, L2, A	L1, L2, Pp, P	All except E
CHARACTERISTICS											
<b>Action mechanism</b> (Pr = Predation, Pa = Parasitism)		Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr
<b>Development cycle</b> ( ⏳ slow : ex. > 3 weeks at 25°C )		-	-	-	-		-	-		-	-
<b>Mobility/Dispersion</b> (- : low, ± : moderate, + : good, ++ : very good, (A) = Adult)		±	+	++	±	++	+	±	++	+	±
<b>Application method</b> (Fo = Foliar, Gr = Ground)		Fo	Fo	Fo	Fo	Fo	Gr	Gr	Fo	Gr	Fo-Gr
<b>Preferred temperature</b> (see legend)		hot	wide	warm	cool	warm	warm	warm	warm	wide	wide
<b>Minimal temperature tolerated</b>		>15°C	>8°C	-	>13°C	>10°C	>14°C	>16°C	>15°C	>13°C	>8°C
<b>Possible winter use</b> ( ❄️ ; with lighting 💡 )		❄️	❄️	❄️	❄️	❄️	❄️	❄️	❄️ >15°C 💡 >14h	❄️	❄️
<b>Requirements</b> ( 🌸 pollen, 🐛 preys, 💧 humidity, (P) = preventive)		🌸 (P) 💧	🌸 💧	🌸	🌸 (P)	🐛 🌸 💧	-	💧	🌸 💧	💧	💧
<b>Introduction period</b> (P = Preventive in bulk, before or immediately after the first pest detection, P <sup>1</sup> = Preventive in sachet, C = Curative, A = Area affected)		P <sup>1</sup> - P - C	P <sup>1</sup> - P	P - C	P - C - A	P - C	P	P	P - C	P - C	C
<b>Introduction rates</b> (quantity/m <sup>2</sup> ). Suggested rates; consult your supplier for more information.		20 - 100	50 - 100	5	50 - 250	0,25-10	100	100	0,5 - 10	0,1 - 1	0,25M - 1 M*
<b>Introduction frequency</b> (d)		7 - 21	7 - 21	as needed	7	as needed	14 - 21	14 - 21	7 - +14	7 - 14	7 - 14
<b>Number of introductions</b> (or as needed)		as needed	**	**	1 - 5	as needed	1 - 2	1 - 2	1 - 2	1 - 2	1 - 3
<b>Introduction cost</b> according to rates above (1: ≤ 0,2 \$/m <sup>2</sup> , 2: 0,2-0,5 \$/m <sup>2</sup> , 3: 0,5-1 \$/m <sup>2</sup> , 4: >1 \$/m <sup>2</sup> )		1 - 2	1	3	3 - 4	1-4	2	1 - 2	1 - 3	1 - 2	1 - 3
<b>Compatible biocontrol agents</b> (bold = best combination)		<b>Oi</b>	<i>Pp</i> <sup>2</sup> , <i>Ss</i> , <i>Oi</i>	<i>Oi</i>	<b>As</b>	<i>Ae</i> , <i>Aa</i> , <b>Nc</b> , <i>As</i> , <i>Ss</i> , <i>Oi</i> , <i>Dca</i> , <i>Mv</i> , <i>Pp</i> , <i>Nf</i> , <i>Gg</i> , <i>Ef</i>	<b>Dc</b> , <b>Sf</b>	<b>Dc</b> , <b>Sf</b>	<b>As</b> , <b>Nc</b> , <i>Id</i>	<b>Gg</b> , <b>Ss</b> , <i>Sf</i>	<i>Dc</i>
<b>Incompatible biocontrol agents</b>		<i>Aa</i> , <i>Pp</i> <sup>3</sup> , <i>Nc</i> <sup>3</sup>	<i>Id</i> <sup>3</sup> , <i>Pp</i> <sup>3</sup>	<i>Aa</i> , <i>Pp</i> , <i>Nc</i> <sup>3</sup>	-	<i>Nc</i> <sup>3</sup>	-	-	-	-	-
<b>Other information</b>		Possible cannibalism and predation of other mites <sup>3</sup>	-	Castor bean banker plants	-	To be eliminated before selling fruits	Acts on ground surface	Acts in depth	-	Needs organic substrate.	Use a wetting agent for foliare applications; protect from UV.
<b>Quebec suppliers</b> (A = Anatis, K = Koppert, P = Plant Products; other province, please check)		A K P	A K P	P	K	A	A	A K P	A K P	A K P	A K P

## Légende

- ◊ Biocontrol agent still on trial    ∅ Glandular hairs slow down mobility
- ⊗ Biocontrol agent rarely used    - N/A

Best efficiency	
Good efficiency	+
Efficient	✓
Optimal efficiency (or tolerance) in cool temperatures (>10-15°C)	cool
Optimal efficiency (or tolerance) in hot temperatures (>25°C and <30°C)	hot
Optimal efficiency in warm temperatures (around 16-25°C)	warm
Tolerance for a wide range of temperatures (15°C to >30°C)	wide

*Aa*: *Aphidoletes aphidimyza*; *Pp*: *Phytoseiulus persimilis*

E = Egg, L = Larva (stages 1 and 2), Pp = Prepupa, P = Pupa, A = Adult

\*M = Million

\*\* until biocontrol agent is established

<sup>1</sup> Slow-release sachet

<sup>2</sup> with prey

<sup>3</sup> without prey

**Detection:**  
Sticky traps.

**Alternative strategies:** Keep humidity levels high. Hydrated lime or introduction of control agents on the ground (Gg, Ss). Massive trapping with sticky yellow traps. Blue traps if *Orius* is introduced. Attractive pheromones on sticky traps.









This information sheet has been created by J.E. Maisonhaute, G. Labrie (CRAM) and L. Lambert (MAPAQ), in collaboration with biological control agent suppliers (Anatis Bioprotection, Koppert et Plant Products).

Québec


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# Gnats / Flies

		Biological control agents			
		Predatory mites	Rove beetle	Nematod	
   		Gaeolaelaps gillesspiei (Gg)	Stratiolaelaps scimitus (Ss)	Dalotia coriaria (Dc)	Steinernema feltiae (Sf)
 <p><b>Gnat / flies</b> Ex. Dark-winged fungus gnat/Shore fly/Sewer gnat</p>				+	
<b>Developmental stages</b> targeted		O, L, P	O, L, P	O, L, P	L, P
Characteristics					
<b>Action mechanism</b> (Pr = Predation, Pa = Parasitism)		Pr	Pr	Pr	Pa
<b>Development cycle</b> ( ⏳ slow : ex. > 3 weeks at 25°C )		–	–	–	–
<b>Mobility/Dispersion</b> ( - : low, ± : moderate, + : good, ++ : very good, (A) = Adult)		+	±	+	±
<b>Application method</b> (Fo = Foliar, Gr = Ground)		Gr	Gr	Gr	Gr
<b>Preferred temperature</b> (see legend)		cool	cool	wide	wide
<b>Minimal temperature tolerated</b>		>14°C	>16°C	>13°C	>8°C
<b>Possible winter use</b> ( ❄️ ; with lighting 💡 )		❄️	❄️	❄️	❄️
<b>Requirements</b> ( 🍷 pollen, 🐛 preys, 💧 humidity, (P) = preventive)		–	💧	💧	💧
<b>Introduction period</b> (P = Preventive in bulk, before or immediately after the first pest detection, P <sup>1</sup> = Preventive in sachet, C = Curative, A = Area affected)		P	P	P-C	C
<b>Introduction rates</b> (quantity/m <sup>2</sup> ). Suggested rates; consult your supplier for more information.		100	100	0,1 - 1	0,25 M - 1 M*
<b>Introduction frequency</b> (d)		14 - 21	14 - 21	7 - 14	7 - 14
<b>Number of introductions</b> (or as needed)		1 - 2	1 à 2	as needed	1 - 3
<b>Introduction cost</b> according to rates above (1: ≤ 0,2 \$/m <sup>2</sup> , 2: 0,2-0,5 \$/m <sup>2</sup> , 3: 0,5-1 \$/m <sup>2</sup> , 4: >1 \$/m <sup>2</sup> )		2	1 - 2	1 - 2	1 - 3
<b>Compatible biocontrol agents</b> (bold = best combination)		<b>Sf</b>	<b>Sf</b>	<b>Gg, Ss, Sf</b>	Dc, Ss, Sf
<b>Incompatible biocontrol agents</b>		–	–	–	–
<b>Other information</b>		Acts in depth	Acts on ground surface	Needs organic substrate	Needs humid substrate
<b>Quebec suppliers</b> (A = Anatis, K = Koppert, P = Plant Products; other province, please check)		A	A K	A K	A K P

## Légende

Best efficiency	
Good efficiency	+
Optimal efficiency (or tolerance) in cool temperatures (>10-15°C)	cool
Tolerance for a wide range of temperatures (15°C to >30°C)	wide

E = Egg, L = Larva, P = Pupa, A = Adult  
\* M = Million  
– N/A



**Alternative strategies** : Hydrated lime on the ground. Mass trapping with yellow sticky ribbons or yellow sticky traps.

**Detection** : Yellow sticky traps

Note that the predatory fly *Coenosia attenuata* is often found naturally on site and attacks sciarid adults.

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CRAAQ  
Centre de référence en agriculture et agroalimentaire du Québec

K  
Koppert

PLANT PRODUCTS  
Membre du groupe Biobest

ANATIS  
BIOPROTECTION

CRAM  
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