Ministry of Forests, Lands and Natural Resource Operations

Operational Biocontrol Agent Lifecycle Schedule

November 2022

Range Branch
Invasive Plant Program

Operational Biocontrol Agent Lifecycle Schedule

		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec-Feb	
		1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Aceria chondrillae	**Life cycle**	overwintering adult		adult		overlap all stages						overwintering adults									
	monitor								Pl-GaEv-Obs												
	collect								Pl-Ga-Cli												
Controls	**release**	Minimum 100 galls/release transported in heavy paper bag(s), avoid dislodging the galls by not overpacking the bags (approx. 30-50 galled stems/bag) . Release the infested stems within the thickest patch of plants at the new site by: "trans-planting" the floral foam blocks; tying the clipped stems to a supporting stake; or, by lodging stems individually into healthy host plants.																			
Rush skeletonweed	**Notes**	Collect stems with mature green galls before they turn brown. Clip long stems and insert into moist floral foam block(s) or tie clipped bundles together. The agent vacates the galls as they become dry or woody.																			
Agapeta zoegana	**Life cycle**	overwintering larva			larva			pupa	adult			larva						overwintering larva			
	monitor				Ro-La-Dis										Ro-La-Dis						
	collect								Pl-Ad-Asp												
Controls	**release**	Minimum 200 adults/release transported as 50/1 litre ventilated containers or proportunate. Release within 24 hrs after collected. Liberate the adults by opening the container and remove the vegetation to allowing adults to fly upward. Encourage remaining adults inside the container to vacate by tipping it slightly downward and either tap the container gently on its sides or "chase" adults out with your fingers or a piece of vegetation. Avoid touching the adults.																			
Diffuse & Spotted knapweeds	**Notes**	Collect adults head first using light suction (heavy suction and aspirating from their rear will damage the adult moths). Larva overwinterings in any instar and resumes feeding and developing the following spring.																			
Agrilus hyperici	**Life cycle**	overwinter larva				pupa			adult / pupa	pupa/adult/egg		adult/egg/larva		overwintering larva							
	monitor							Ro-Pu-Dis		Pl-Ad-Swe											
	collect									Pl-Ad-Swe											
Controls	**release**	Release 200 adults at new sites. Do not scatter over the site.																			
St. John's wort	**Notes**	Adult emergence period may be influenced by seasonal weather and temperature. Adults may also emerge earlier or later depending on the geographic location in B.C. Adults are prone to bright light and take flight quickly from open sweepnet. Overlaps with *Aplocera plagiata* (larva) and *Chrysolina spp* .(adult) and all species can be collected at the same time if desired. *Aphis chloris* is often present at the same time.																			
Aphthona cyparissiae	**Life cycle**	overwintering larva			pupa			adult				adult/larva			larva			overwintering larva			
	monitor								Pl-Ad-Swe												
	collect								Pl-Ad-Swe												
Controls	**release**	Minimum 1000 adults/release transported as 300/1 litre ventilated containers or proportunate. Release all adults at one point, do not widely scatter as they prefer to congregate. When small populations, <1000 adults are released, the site will continue and remain as a small population.																			
Cypress & leafy spurges	**Notes**	*A. cyparissiae* has a longer oviposition period than *A. nigriscutis.* Has only been released on leafy spurge in B.C.																			
Aphthona flava	**Life cycle**	overwintering larva				pupa				adult				adult/egg		egg				larva	
	monitor											Pl-Ad-Swe									
	collect											Pl-Ad-Swe									
Controls	**release**	Minimum 1000 adults/release transported as 300/1 litre containers or proportunate. Release all adults at one point, do not widely scatter as they prefer to congregate. When small populations, <1000 adults are released, the site will continue and remain as a small population.																			
Cypress & leafy spurges	**Notes**	Adults appear to peak by 2nd week of August as the plants become scenecent. Suspend collections by Aug. 31.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling and life stage codes Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

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		1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Aphthona nigriscutis	**Life cycle**	**overwintering larva**				**pupa**			**adult**				**adult/larva**				**larva**			**overwinting larva**			
	monitor								**Pl-Ad-Swe**												
	collect								**Pl-Ad-Swe**												
Controls	**release**	Minimum 1000 adults/release transported as 300/1 litre ventilated containers or proportunate. Release all adults at one point, do not widely scatter as they prefer to congregate. When small populations, <1000 adults are released, the site will continue and remain as a small population.																			
Cypress & leafy spurges	**Notes**	*A. nigriscutis* has a 1-week shorter oviposition period than *A. cyparissiae.*																			
Aplocera platigata	**Life cycle**	**overwintering 2nd gen. larva**				**pupa**		**adult**	**adult/larva**		**pupa**		**adult 2nd gen. larva**				**overwintering 2nd gen. larva**				
	monitor					Pl-Ad-Obs				**Pl-La-Swe**/Asp/Obs			**Pl-La-Swe**/Asp/Obs								
	collect									**Pl-La-Swe**/Asp/Hpk			**Pl-La-Swe**/Asp/HaP								
Controls	**release**	Minimum 500 larvae/release transported 100-150/1 litre ventilated containers or proportunate. Maintain sufficient fresh food during the tranporting times, replenish daily when held overnight.																			
St. John's wort	**Notes**	Wear gloves when handling larva. Larva tend to mimic "sticks" when plants are disturbed and easily blend with the plants features.																			
Botanophila seneciella	**Life cycle**	**overwintering pupa**						**adult**	**adult/egg/larva**			**larva**	**larva/pupa**			**overwintering pupa**					
	monitor								Pl-Ad-Swe/Asp/Obs	**Sh-La-Dis/Exc**											
	collect								Pl-Ad-Asp	**Sh-La-Cli**											
Controls	**release**	Minimum **1000-1500 larva infested seed heads**/release transported as 300-500/1 litre containers or proportunate. *B. seneciella* adults can be kept up to one week in a cool environment, although releasing them asap is always recommended. A potential candidate for the dark to light, seed-head releasing appartus to avoid seed spread if a sand layer can be successfully layered in the apparatus. Potential to rear larva/pupa to adults, but is very labour intensive: using a sand tray or seed-head capsule to avoid seed spread by collecting larva infested heads and pressing them slightly into the surface of a sand filled tray; loosely cover the tray and allow the larva to exit the heads to pupate in the sand; store the tray outdoors or in a growth chamber to allow it to sync with the natural environment, misting it lightly with water to maintain some moisture, but avoiding saturation or wet conditions; the following spring/summer, place the sand tray at the site. immediately after the first adults begin to emerge. Adults must be released within 24 hours after being collected.																			
Tansy ragwort	**Notes**	Formerly known as *Hylemyia seneciella*. At high elevations, larva may exit plants in July to pupate in the soil. Adults are easily observed on bolted plants, soon after floral buds begin to form. Symptoms of ovipositing and agent presence is observed on seedh-heads, making viable collections easier.																			
Brachypterolus pulicarius	**Life cycle**	**overwintering pupa**			**pupa**		**adult**		**adult/egg/larva**			**larva**				**overwintering pupa**					
	monitor							**Pl-Ad-Obs/**Swe & Pl-AdEv/LaEv-Obs/Hpk													
	collect							**Pl-Ad-Asp**/Swe/Hpk													
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate.																			
Dalmatian & Yellow Toadflaxes	**Notes**	Adults may overwinter in climates with long growing seasons. A good candidate for dark to light seed-head release apparatus.																			

Handling Description	Plant part-Agent life cycle stage-Handling method
Handling Codes	Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);
	Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)
	Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).

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Calophasia lunula	**Life cycle**	**overwintering pupa**				**adult**		**adult/egg/larva**								**overwintering pupa**					
	monitor						Pl-Ad/La/LaEv-Obs						**Pl-La/LaEv/Pu-Obs**								
	collect							**Pl-La-Hpk**													
Controls	**release**	Minimum 200 larvae/release transported as 40/1 litre containers or proportunate. Release asap - daily cleaning & supplying new food is required. Excessive handling causes stress and mortality. Any larva that have advanced to pupa should placed individually in protected locations on the soil surface and loosely covered, but not buried, with plant litter and bits of tree bark, to protect it from direct precipitation and dehydration.																			
Dalmatian & Yellow Toadflaxes	**Notes**	Wear gloves when handling larva. Larva are easily agitated when handled; minimize handling as much as possible during collecting. It is not unusal for mature larva (5th instar) may begin to pupate during the collection session.																			
Chaetorellia acrolophi	**Life cycle**	**overwintering larva/pupa**						**adult/larva**		**larva/pupa/F1 adult**				**overwintering larva**							
	monitor			**SH-La/Pu-Cli/Dis**			**Pl-Ad-Swe**							**SH-Pu-Cli/Dis**							
	collect			**SH-La/Pu-Cli**						Pl-Ad-Swe											
Controls	**release**	Early spring collections and releases of larva and pupa infested seedheads have been successful. Minimum 1000 infested seed heads/release transported as 100/1 litre containers or proportunate. Many larvae/pupae do not occupy a single seed head nor do all heads contain larvae/pupae therefore many seed heads are needed for a release. A good candidate for the seed-head releasing apartus to avoid seed spread. Adults must be released within 24 hours after being collected.																			
Diffuse & Spotted Knapweeds	**Notes**	Larva, pupa, and adult lifecycles tend to overlap. 2-3 generations in BC. Prefers spotted knapweed; occasionally found on diffuse; also now found on short-fringed and meadow knapweeds; not found on other knapweed species in BC at this time. Collection timing will require adjustments for various geographic locations and seasonal climate flucutations. When releasing infested seed-heads, there is potential of other seed-head feeders also being present such as *Urophora species, Larinus species* and *Metzneria paucipunctella.* Sweeping for adult collections is less preferred. Adults are very delicate, therefore, when collecting adults by sweeping, & aspirating the resulting adults from the sweepnet must be carried out for every 4-6 sweeps taken to avoid excessive damage.																			
Chrysolina hyperici	**Life cycle**	**overwinteing egg**			**larva**		**pupa**	**pupa/adult**		**adult**		**inactive adult**			**adult**		**overwintering egg**				
	monitor				Pl-Ad-Swe/Asp/Obs & Pl-La-Obs			**Pl-Ad-Swe**/Asp/Hpk							Pl-Ad-Swe/Asp/Obs & Pl-La-Obs							
	collect							**Pl-Ad-Swe**/Asp/Hpk													
Controls	**release**	Minimum 200 adults/release transported as 75-100/1 litre containers or proportunate.																			
St. John's wort	**Notes**	*C. hyperici nor* mally overwinterings in the egg stage, however, it may overwintering in adult and larva stages. Difficult to differentiate the *Chrysolina* species. When releasing field collected adults from sites that have mixed species present and if the species are not separately identified and recorded, record the entire collection and subsequent release as Chrysolina spp. When choosing to sort the species, refer to St. John's wort / Chrysolina samples collected for identification (2015) to differentiate the species.																			
Chrysolina quadrigemena	**Life cycle**	**overwinteing egg**			**larva**		**pupa**	**pupa/adult**		**adult**		**inactive adult**			**adult**		**overwintering egg**				
	monitor				Pl-Ad-Swe/Asp/Obs & Pl-La-Obs			**Pl-Ad-Swe**/Asp/Hpk							Pl-Ad-Swe/Asp/Obs & Pl-La-Obs							
	collect							**Pl-Ad-Swe**/Asp/Hpk													
Controls	**release**	Minimum 200 adults/release transported as 75-100/1 litre containers or proportunate.																			
St. John's wort	**Notes**	*C. quadrigemena* normally overwinters in adult and larva stages. Difficult to differentiate the *Chrysolina* species. When releasing field collected adults from sites that have mixed species present and if the species are not separately identified and recorded, record the entire collection and subsequent release as *Chrysolina spp.* When choosing to sort the species, refer to St. John's wort / Chrysolina samples collected for identification (2015) document to differentiate the species.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

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Cochylis atricapitana	**Life cycle**	**larva**		**pupa**		**adult**		**larva**		**larva/pupa**		**adult**	**adult/larva**	**larva**						**larva**	
	monitor	Ro-La-Exc						**Ro-La-Exc**						**Ro-La-Exc**							
	collect	Pl-La-Tra						**Pl-La-Tra**						**Pl-La-Tra**							
Controls	**release**	Larvae in 25 – 50 infested plants from a well-established site & transplanted into a new site. Transplant entire whole plants at release site and water with a min. 500 ml water/transplant. Increase the amount of water for large plants or current weather conditions.																			
Tansy ragwort	**Notes**	Multiple larva/plant in stems or in root crown area. Early spring larva may move upward on plant (internally or externally) to feed in stems and on developing vegetative and floral buds. Second gen. larva mine basal leaves and downward into root crown. Well developed 2nd gen. final (5th instar) larva will vacate the root and pupate in the soil. Monitor by excavating suspected infested plants prior to mature larva vacating to pupate in the soil. Avoid excessive disturbance to the root ball and the soil adjacent to the plant when excavating in order to preserve any pupa that may be present. Carefully transplant at new site with root ball/soil intact.																			
Cyphocleonus achates	**Life cycle**	**overwintering larva**		**larva**				**pupa**		**pupa/adult**		**adult**		**overwintering larva**							
	monitor			**Ro-La/LaEV-Exc**				**Ro-La/**LaEV/Pu-**Exc**				**Pl-Ad-Obs**		Ro-La/LaEV-Exc							
	collect											**Pl-Ad-Hpk**									
Controls	**release**	Minimum 200 adults/release transported as 50/1 litre containers or proportunate. When shipping adults longer distances or when the will be released more than 24 hours after being collected, it is advised to reduce the container quantities in half and to also consider sexing the weevils and shipping the males and females in separate containers. When releasing the adults, gently scatter the weevils, over a small area among healthy and abundant plants and where there is minimal ground litter. Ideal release points and sites will have exposed soil between slightly spaced apart plants. Adults may feign death when disturbed and released, ensure to release all agents, including those that may appear to have died.																			
Diffuse & Spotted knapweeds	**Notes**	Early emerging adults yield more males, the ratio evens during peak, and near the end of the season there are more females present. It has a preference for spotted over diffuse, and has not been found on other Centaurea species at this time.																			
Galerucella calmariensis	**Life cycle**	**overwintering adult**					**adult**		**all stages**		**adult**	**overwintering adult**									
	monitor						**Pl-Ad-Ob**	**Pl-Ad/**AdEv-**Obs**		Pl-Eg/La/LaEV-Obs		Pl-Ad/AdEv /LaEV-Obs									
	collect							**Pl-Ad-Asp**				Pl-Ad-Asp									
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. When plants are in standing water, release above the water level to allow adults to disperse themselves onto desirable plants.																			
Purple loosestrife	**Notes**	Spring adults and F1 adults overlap one month oviposition in summer, therefore, early collections help ensure viable adults are collected. Spring adults emerge one week earlier than *G. pusilla.* When collections occur where mixed species exist, it is not necessary to separate the species, however, the release data should recognize it may be mixed by recording *Galerucella* species.																			
Galerucella pusilla	**Life cycle**	**overwintering adult**					**adult**		**all stages**		**adult**	**overwintering adult**									
	monitor						**Pl-Ad-Ob**	**Pl-Ad/AdEv-Obs**		Pl-Eg/La/LaEV-Obs		Pl-Ad/ AdEv /LaEV-Obs									
	collect							**Pl-Ad-Asp**				Pl-Ad-Asp									
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. When plants are in standing water, release above the water level to allow adults to disperse themselves onto desirable plants.																			
Purple loosestrife	**Notes**	Spring adults and F1 adults overlap one month oviposition in summer, therefore, early collections help ensure viable adults are collected. Spring adults emerge one week later than *G. calmariensis.* When collections occur where mixed species exist, it is not necessary to separate the species, however, the release data should recognize it may be mixed by recording *Galerucella* species.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

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Hadroplontus litura	**Life cycle**	**adult**		**adult/egg/larva**				**egg/larva**	**larva**	**larva/pupa**		**pupa**		**adult**		**overwintering adult**					
	monitor					**Pl-La-Cli**				Pl-LaEv-Cli											
	collect					**Pl-La-Cli**															
Controls	**release**	Release a 500 infested stems with mature or late instar larva present. Transplant clipped stems in floral foam directly into the soil and water it in or scatter infested stems among plants. When transplanting the foam block, tilt it at a 45 degree angle to allow those larva that prefer, to exit to pupate in the soil as opposed to remaining inside the stem.																			
Canada thistle	**Notes**	When collecting, determine larva instar and average quantity by slicing open up to 10 stems and couting the number of larvae present. Identify stems with larva present by reddish tinged interior as you clip down from the terminal and up from the rosette, stopping short before reaching the mined areas at both ends. Insert larvae infested stems into a prepared wet floral foam.																			
Hyles euphorbiae	**Life cycle**	**overwintering pupa**					**adult**	**adult/egg/larva**		**larva**	**larva/pupa**	**adult/egg/larva**		**larva/pupa**		**overwintering pupa**					
	monitor								**Pl-La/Ad-Obs**												
	collect								**Pl-La-Hpk**												
Controls	**release**	Minimum 300 larva/release transported as 50/1 gallon containers. Maintain sufficient fresh food for the larva during the collection and shipping process. Delayed shipping may require additional daily or twice daily cleaning to remove defoliated spurge and resulting feces. Mature larva collected in their final instar may begin pupation during the collection and transporting process. Any larva that have advanced to pupa should placed in indidiual protected locations on the soil surface and loosely covered, but not buried, with plant litter and bits of tree bark, to protect it from direct precipitation and dehydration. Do not pool the pupa together at one location and avoid placing them near predators such as ant colonies or among rodent burrows. Has not been released on cypress spurge in B.C.																			
Cypress & leafy spurges	**Notes**	The moth is widely dispersed in B.C. and it is unlikely larvae can be found in sufficient quantities for release. Numerous small collections over a prolonged period of time, possibly from multiple sites, could be done in order to collect sufficient quantities for release.																			
Larinus carlinae	**Life cycle**	**overwintering adult**							**adult**	**larva/pupa**		**adult**		**overwintering adult**							
	monitor								**Pl-Ad-Asp/Obs**	**SH-La/Pu/**LaEv/Pu /PuEv-Dis		Pl-Ad-Asp/Obs									
	collect								**Pl-Ad-Asp**	Sh-La-Cli											
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. Release infested thistle seedheads, 300-400 seed-heads regardless of thistle species. Consider using a seed-head releasing apparatus to avoid seed spread. When releasing seedheads, a baseline count of the potential quantity of adults is strongly recommended.																			
Canada, Bull, Nodding, Plumeless Thistles	**Notes**	Originally approved for Canada thistle. Mating and ovipositing occurs when temperatures reach 22^{o}C Canada thistle flower buds need to be 5-7 mm for oviposition. When collecting larva/pupa, select buds with oviposition marks on flower bracts. One bud will yield one bioagent. *L. carlinae* and *Rhinocyllus conicus* co-exist at many sites. It is **NOT** acceptable to collect both and pool the quantities; the two agents must be counted individually and recorded as separate releases. When collecting and releasing unopened seedheads, there may be other bioagents also released such as *R. conicus.*																			
Larinus minutus	**Life cycle**	**overwintering adult**						**adult**		**adult/larva**		**larva/pupa**		**adult**		**overwintering adult**					
	monitor								**Pl-Ad-Swe**/Asp	Sh-La/LaEv/Pu/PuEv-Dis											
	collect								**Pl-Ad-Swe**/Asp												
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate.																			
Diffuse & Spotted Knapweeds	**Notes**	Females are more numerous than males, however, males live longer. Some adults hibernate a second year. When collections occur where mixed species may exist, it is not necessary to separate the species, however, the data should record *Larinus species* released.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

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Larinus obtusus	**Life cycle**	**overwintering adult**						**adult**		**adult/larva**		**larva/pupa**		**adult**		**overwintering adult**					
	monitor								**Pl-Ad-Swe**/Asp		Sh-La/LaEv/Pu/PuEv-Dis										
	collect								**Pl-Ad-Swe**/Asp												
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate.																			
Diffuse & Spotted Knapweeds	**Notes**	Females are more numerous than males, however, males live longer. Some adults hibernate a second year. When collections occur where mixed species may exist, it is not necessary to separate the species, however, the data should record Larinus species released.																			
Lobesia euphorbiana	**Life cycle**	**overwintering pupa**						**pupa / adult / larva**		**adult/larva**		**larva**				**overwintering pupa**					
	monitor								**Pl-La/Pu-Obs**		Pl-LaEv/PuEv-Obs										
	collect								**Pl-La/Pu-Cli**												
Controls	**release**	Release a 100-200 leaf ties with mature or late instar larva present. When releasing, thin the amount of plants per foam block by removing up to half the ties and lodging them into plants at the new site. Transplant the remaining ties in the floral foam and water it in. When transplanting the foam block, tilt it at a 45 degree angle to allow those larva that prefer, to exit the tie and pupate in the soil as opposed to remaining inside the stem.																			
Cypress & leafy spurges	**Notes**	When collecting, determine larva instar and development by opening a few (up to 10) ties. Larva are highly agitated when disturbed, therefore, only open enough ties to determine the larva instar and occupancy (not vacant). Clip plant parts (stems) with larva/pupa present and insert the stems into a prepared wet floral foam.																			
Longitarsus jacobaeae (Italian strain)	**Life cycle**	**egg/larva**		**pupa**		**adult**				**inactive adult**				**adult**				**adult/egg/larva**			
	monitor	Ro-La-Exc				Pl-Ad/AdEv-Ob/Asp								Pl-AdEv-Obs		**Pl-Ad/AdEv-Obs/Asp**				Ro-La-Ex	
	collect															**Pl-Ad-Asp**					
Controls	**release**	Minimum 500 adults/release transported as 250/1 litre containers or proportunate.																			
Tansy ragwort	**Notes**	Applicable to *L. jacobaeae* (Italian) strain only. Although adults are largely inactive through most the summer, they do emerge and feed briefly, but they do not begin to congregate until late summer and fall. Fall emerging adults feed intensely on plants. Larvae evidence may be confused with other root feeding agents such as Cochylis atricapitana or the Swiss strain of *L. jacobaeae*.																			
Longitarsus jacobaeae (Swiss strain)	**Life cycle**	**overwintering egg**				**larva**		**larvae/pupa**		**adult**		**adult/egg/larva**				**overwintering egg**					
	monitor					Ro-La/LaEv-Exc		Pl-AdEv-Obs & Ro-LaEv-Exc						**Pl-Ad/AdEv-Obs/Asp**							
	collect													**Pl-Ad-Asp**							
Controls	**release**	Minimum 500 adults/release transported as 250/1 litre containers or proportunate.																			
Tansy ragwort	**Notes**	The Swiss strain is best suited for high elevation sites west of the Cascades, more northern sites, or sites that may incur cooler early fall weather or later warming in spring. Adult emergence at high elevation sites are delayed by 1 week for every 200 m above the lower elevation sites(600 m). High elevation sites appear to have a longer emergence period. Although adults are largely inactive through most the spring & summer, they do emerge and feed briefly, leaving behing signature feeding holes that persist through the summer. Feeding becomes heavy when the adults emerge and congregate late summer. Larvae evidence may be confused with other root feeding agents such as *Cochylis atricapitana* or the Italian strain of *L. jacobaeae*.																			
Mecinus janthiniformis	**life cycle**	**overwintering larva/pupa/adult**				**adult**		**all stages**				**larva**		**larva/pupa**		**pupa**		**overwintering larva/pupa/adult**			
	monitor			**St-La/LaEv/Pu-Dis**		**Pl-Ad-Asp/Hpk**								St-La/LaEv/Pu-Dis		St-Pu-Dis					
	collect	**St-La/Pu/Ad-Cli**				**Pl-Ad-Asp/Hpk**												St-La/Pu/La-Cli			
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. Can store fall infested stems overwinter in cold, dry location like in an unheated shed; prevent predation and mould. Moisture (typically in the form of snow melt or rain) may be required following spring for weevil to emerge. When releasing infested stems, a baseline count of the potential quantity of adults is strongly recommended.																			
Dalmatian toadflax	**Notes**	Formerly misidentified as *M. janthinus*. May be present in adult form on yellow toadflax, usually in a mixed stand with or near Dalmatian toadflax. Cold climates or lack of snow insulation may cause mortality. In Canada, adults overwinter in cells inside stems. To date has not been found in larva or pupa form inside yellow toadflax stems in B.C.																			

Handling Description	Plant part-Agent life cycle stage-Handling method
Handling Codes	Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);
	Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)
	Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).

Operational Biocontrol Agent Lifecycle Schedule

		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec-Feb	
		1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Metzneria paucipunctella	**Life cycle**	**overwintering larva**				**pupa**	**adult**	**all stages**								**overwintering larva**					
	monitor			**Sh-La/LaEV/Pu-Dis**		Sh-Pu-Dis		Pl-Ad/AdEv/La/LaEv/Pu/PuEv-Obs													
	collect			**Sh-La/Pu-Cli**																	
Controls	**release**	Minimum 1000-1500 larva infested seed heads/release transported as 100/1 litre containers or proportunate. Potentially only one to three Metzneria paucipunctella larvae/pupae will occupy a seed head, therefore, a large quantity of infested seed heads is required to ensure good establishment. Probably not a good candidate for the dark to light seed-head releasing apparatus because moths tend to be nocturnal and will not be drawn to light.																			
Spotted & Diffuse Knapweeds	**Notes**	Evidence = discarded pupal casings can be observed as evidence inside seedheads long after the adult has exited. Shows a preference for spotted over diffuse. Occasionally found on meadow knapweed.																			
Mogulones crucifer	**Life cycle**	**overwintering - mixed stages**		**adult**		**all stages**						**adult**				**overwintering - mixed stages**					
	monitor			**Pl-Ad-Obs/Asp**				**Pl-Ad-Obs/Asp & Ro-La/**LaEv-**Exc**				**Pl-Ad-Obs/Asp**									
	collect			**Pl-Ad-Asp**								**Pl-Ad-Asp**									
Controls	**release**	Minimum 100 adults/release transported as 100/1 litre containers or proportunate. *M. crucifer* adults can store in their containers inside a refrigerator for up to one week, although releasing them asap is always recommended.																			
Hounds tongue	**Notes**	Summer emerging adults remain in their cocoon for 10 days to allow their bodies to harden. *M. crucifer* is suitable for the "dark to light" self-sorting system. When excavating and dissecting roots for larva/pupa, care must be given to avoid confusing *L. quadriguttatus* with *M. crucifer*. Formerly known as *M. cruciger*.																			
Ompalapion hookeri	**Life cycle**	**overwintering adult (female only)**						**adult**	**adult/egg/larva**	**all stages**		**adult**		**overwintering adult (female only)**							
	monitor									**Sh-La/Pu/Ad-Cli/Dis & Pl-Ad-Obs/Asp**											
	collect										**Sh-La/Pu/Ad-Cli & Pl-Ad-Asp**										
Controls	**release**	Minimum 200 adults in infested seed heads/release transported as 50-100 seed heads/1 litre containers or proportunate. Consider using a seed-head releasing apparatus to avoid seed spread.																			
Scentless chamomile	**Notes**	Formerly known as *Apion hookeri.*																			
Pterolonche inspersa	**Life cycle**	**overwintering larva**					**larva/pupa**	**larva/pupa/adult**			**adult**		**overwintering larva**								
	monitor							Ro-La/LaEv-Exc	**Ro-La/LaEv/Pu/PuEV-Exc**		Pl-Ad/AdEv-Obs	**Pl-LaEv/AdEv-Obs**									
	collect							Pl-La-Tra	**Pl-La/Pu-Tra**		Pl-Ad-Asp										
Controls	**release**	Minimum 100 infested plants/release, transported and dug into the new site. The plants must be watered in when transplanted, and if possible more watered more than once over several days, to keep alive as the larvae continue to develop in the roots.																			
Diffuse & Spotted knapweeds	**Notes**	Prefers diffuse knapweed. Adults difficult to collect. Evidence - chimney formation. Self dispersal quite widespread in areas where released and diffuse knapweed is present. Collect plants with larvae present and as close to pupatoin as possible, but before adults have exited.																			

Handling Description	Plant part-Agent life cycle stage-Handling method
Handling Codes	Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);
	Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)
	Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).

Operational Biocontrol Agent Lifecycle Schedule

		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec-Feb	
		1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Rhinusa antirrhini	**Life cycle**	**overwintering adult**				**adult**		**adult/larva**			**all stages**		**adult**			**overwintering adult**					
	monitor						Sh-La/LaEv/Pu/PuEv-Dis & **Pl-Ad-Obs/Asp**						Sh-La/PuEv/Ad-Dis & Pl-**Ad-Obs/Asp**								
	collect						**Pl-Ad-Asp**						**Pl-Ad-Asp**								
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. Do not widely scatter at new release sites.																			
Dalmatian & Yellow Toadflaxes	**Notes**	Two strains, one on Dalmatian toadflax and the other on yellow toadflax. The life cycle for both strains are the same, but have distinct host plants																			
Rhinusa linariae	**Life cycle**	**overwintering adult**				**adult**		**adult/egg/larva**		**larva**		**larva/pupa**		**pupa/adult**		**adult**		**overwintering adult**			
	monitor					Pl-Ad-Obs				**Ro-Ga-Exc/Dis**											
	collect					Pl-Ad-Asp								**Ro-La/Pu-Ga-Exc/Dis**							
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. Or preferably, transplant 1000 galled roots. Adult releases are not preferred due to R. linariae and R. antirrhini lifecycles overlap. When collecting adults, each adult must be visually inspected to be *R. linariae* as opposed to *R. antirrhini*. The two are difficult to differentiate without magnification. They CANNOT be released as mixed populations.																			
Yellow toadflax	**Notes**	Females will continue to oviposit for up to 2 months only when suitable plants are available. Evidence= galls. Not all galls may contain agents, however, some will contain multiple agents. When monitoring for presence, carefully cut open a representative number of galls to expose lifecycle stage and quantities. Gall dissections must be done in a manner to sustain and not jeopardize the existing population. Has been released on Dalmatian toadflax in rearing tents and released at sites with both yellow and Dalmatian toadflaxes present, however, it appears to prefer only yellow toadflax because no galls have ever been recovered on Dalmatian toadflax at any field sites.																			
Rhinocyllus conicus	**Life cycle**	**overwintering adult**				**adult**			**larva**		**pupa**	**adult**				**overwintering adult**					
	monitor						**Pl-Ad**/AdEv-**Obs** & **Pl-Ad-Asp**		**SH-Eg**/EgEv-**Obs** & **SH-La**/LaEv-**Dis**		**SH-Pu**/PuEv-**Dis**	Pl-Ad/AdEv-Obs & Pl-Ad-Asp									
	collect							**Pl-Ad-Asp**		**SH-La/Pu-Cli**		Pl-Ad-Asp									
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. Release infested thistle seedheads, 50-100 heads for nodding or bull thistles, or 200 for Canada or plumeless thistles. Transport dry seedheads in suitable size paper bags. Consider using a seed-head releasing apparatus to avoid seed spread when releasing seedheads. When releasing seedheads, a baseline count of the potential quantity of adults is strongly recommended.																			
Bull, Canada, Nodding, & Plumeless Thistles	**Notes**	Approved for release on nodding and plumeless thistles (Carduus sp.), but has crossed over to other invasive thistles in B.C., including marsh plume thistle. Summer adults remain in seedheads until their bodies harden. When collecting and releasing unopened seedheads, there may be other bioagents also released such as *L. carlinae*. *R. conicus* and *L. carlinae* co-exist at many sites. It is **NOT** acceptable to collect both and pool the quantities; the two agents must be counted individually and recorded as separate releases. Although adults can be extracted from seedheads for release, it is advised to allow them to emerge on their own to ensure they have sufficiently developed and to help prevent mortalities.																			
Sphenoptera jugoslavica	**Life cycle**	**overwintering larva**						**pupa/adult**		**adult**		**larva**		**overwintering larva**							
	monitor					**Ro-La/Pu Dis**		**Ro-Pu-Dis**		Pl-Ad		Ro-La-Dis									
	collect									**Pl-Ad**											
Controls	**release**	Minimum 200 adults/release transported as 200/1 litre containers or proportunate. Do not widely scatter at new release sites.																			
Diffuse & Spotted Knapweeds	**Notes**	Males emerge 1 wk earlier than females. Immature larva going into winter will resume feeding in the spring before they pupate. Prefers diffuse over spotted. Appears to attack spotted knapweed after diffuse knapweed is significantly reduced or absent.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

Operational Biocontrol Agent Lifecycle Schedule

		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec-Feb	
		1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Trichosirocalus horridus	**Life cycle**	**overwintering**		**adult**		**adult/egg/larva/pupa**						**larva/pupa**		**adult/egg/larva**		**overwintering all stages**					
	monitor								**Pl-Ad-Asp & Ro-La/**LaEv/**Pu/**PuEv-**Exc**			**Pl-LaRo-La/**LaEv/**Pu/**PuEv-**Exc**								
	collect								**Pl-Ad-Asp**												
Controls	**release**	Minimum 75 adults/release. Transport no more than 100/1 litre containers or proportunate. Appears to easily adapt and become established when collected from one host species and released on the other. Establishes well with relatively small quantities of adults initially relesed.																			
Plumeless & Nodding thistles	**Notes**	Adults can easily be hidden in flower bud bracts and in axils. Larva and larva feeding evidence may be confused with native artichoke moth. Foliar feeding can also be confused with the similar feeding patterns of *Rhinocyllus conicus* and *Larinus carlinae. T. horridus* can occupy the same plants with other seed and foliar feeders. Test releases made in B.C. on bull, marsh plume and Scotch thistles did not establish and therefore is considered to be a non-desirable combinations.																			
Tyria jacobaeae	**Life cycle**	**pupa**				**adult**		**adult/larva**		**larva**		**pupa**									
	monitor					Pl-Ad-Obs				**Pl-La/**LaEv**-Obs**		La-Ev-Obs									
	collect									**Pl-La-Hpk**											
Controls	**release**	Minimum 1000 early instar larvae/release transported as 100/1 gallon containers or proportunate. Do not keep *T. jacobaeae* larvae for prolonged periods of time because daily cleaning and supplying new food is required and excessive handling causes stress and mortality.																			
Tansy ragwort	**Notes**	Wear gloves when handling larvae. Monitor **OTHER** indicates the opportunity to monitor for presence only, extensive foliar feeding is typical of *T. jacobaeae.* Larva appears to persist well into September and October, but collections this late may not provide sufficient time to develop and overwinter.																			
Urophora affinis	**Life cycle**	**overwintering larva**				**pupa**		**adult**		**adult/larva**		**larva/pupa**		**adult/larva**		**overwintering larva**					
	monitor	**Sh-La/Pu/Ga/GaEv-Dis**						Pl-Ad-Obs/Swe		Sh-La-Dis		**Sh-La/Pu/Ga/GaEv-Dis**		**Sh-La-Dis**							
	collect	**Sh-La/Pu-Cli**												Sh-La/Pu-Cli							
Controls	**release**	Minimum 400 larvae in 200 infested seed heads/release transported as 100 seed heads/1 litre containers or proportunate. Found less frequently on diffuse knapweed and thus requires typically double the quantity of diffuse seedheads to be collected for a release. Collections off other knapweed species would require a baseline be obtained to determine the quantity of seedheads to clip for release. A good candidate for the seed-head releasing apparatus to avoid seed spread.																			
Diffuse & Spotted Knapweeds	**Notes**	Only the earliest emerging larva will pupate in summer which go on to produce the second generation overwintering larva. Do not collect adults for release by sweeping. Samplers must be able to fluently differentiate ALL seed feeders, although U. affinis is the easiest due to the woody gall they produce. Limited dispersal occurring on meadow knapweed in Coastal habitat, but not yet seen on same plant beyond Vancouver Island.																			
Urophora cardui	**Life cycle**	**larva**				**pupa**		**adult**		**egg/larva**				**larva**							
	monitor			**St-Ga/La-Cli/Dis**		**St-Ga/La/Pu-Cli/Dis**		Pl-Ad-Obs							**St-Ga/La-Cli/Dis**						
	collect	**St-Ga-Cli**				St-Ga-Cli										**St-Ga-Cli**					
Controls	**release**	Minimum 500 galls/release transported as 50 galls/paper bag. Fall collected galls can be stored overwinter in a cold, dry location such as in an unheated shed or in the fridge; prevent condensation and mould. Galls must be introduced into the new site with sufficient time to allow spring moisture (typically in the form of snow melt or rain) to break down the woody galls and allow for the fly to emerge. Use a protective release box or cage when releasing. May also be a good candidate for the seed-head release apparatus.																			
Canada thistle	**Notes**	Larva overwintering in woody galls. Galls are collected and released intact to allow the pupa to develop.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Plant parts = Plant (Pl); Stem (St); Roots (Ro); Seed Heads (Sh); Seed Pods (Sp); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

Operational Biocontrol Agent Lifecycle Schedule

		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec-Feb	
		1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
Urophora quadrifasciata	**Life cycle**	**overwintering larva**				**pupa**		**pupa/adult**		**adult/larva**		**larva/adult**		**larva**		**overwintering larva**					
	monitor		**SH-La/LaEv-Dis**			**SH-Pu/PuEv-Dis**			Pl-Ad-Obs /Swe	SH-La/LaEv/Pu/PuEv-Dis & Pl-Ad-Obs				**SH-La-Dis**							
	collect			**SH-La-Cli**		SH-Pu-Dis			adult				adult		**SH-La-Cli**						
Controls	**release**	Minimum 400 larvae in 1000 potentially infested seed heads/release transported as 100 seed heads/1 litre containers or proportunate. *U. quadrifasciata* larva or pupa are not as plentiful as U. affinis in each suitable seed head, therefore, new sites can be established with 500 to 1000 seed heads. Consider using a seed-head releasing apparatus to avoid seed spread.																			
Spotted & Diffuse Knapweeds	**Notes**	Diffuse knapweed offers better floral development for the chance of a second generation. Disperses onto multiple *Centaurea* species. Populations appear to decline when *U. affinis* and *Larinus spp*. is dominent. Do not collect adults for release by sweeping. More common now being found on meadow and short-fringe knapweeds.																			
Urophora stylata	**Life cycle**	**overwintering larva**			**larva**		**pupa**		**pupa/adult**		**adult**				**larva**			**overwintering larva**			
	monitor														**SH-La-Dis**						
	collect															**SH-La-Cli**					
Controls	**release**	Minimum 200 adults in infested seed heads/release transported as 40 seed heads/1 paper bag. Multiple larvae/pupae usually present in each seed head, new releases can be made with 50 seed heads. Release infested thistle seedheads, 50-100 heads for nodding or bull thistles, or 200 for Canada or plumeless thistles. When collecting and releasing unopened seedheads, there may be other bioagents also released such as R. conicus and *L. carlinae*. A good candidate for the seed-head releasing apparatus to avoid seed spread. Galls must be released early enough in spring to allow for the woody gall to break down and allow the adults to emerge.																			
Bull thistle	**Notes**	A strain of *U. stylata* is also found present on Canada thistle. Both strains have the same lifecycle. Overwinters in third larva instar.																			
Handling Description		Plant part-Agent life cycle stage-Handling method																			
Handling Codes		Life cycle stage: Adult (Ad); Larva (La); Pupa (Pu); Egg (Eg);																			
		Agent stages = Adult (Ad); Pupa (Pu); Larva (La); Egg (Eg); Gall (Ga); Oviposition (Ov); Evidence (Ev); All Stages (overlapping stages) (As)																			
		Methods = Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).																			

Operational Biocontrol Agent Lifecycle Schedule

	Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec-Feb	
	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31

The biological control agent lifecycle schedule was developed by using British Columbia field studies and available literature sources.

Seasonal temperatures, climate change and unique habitats may alter the biological control agents' schedule.

Complete details regarding the biological control agents and their host plants can be found at: https://www.for.gov.bc.ca/hra/Plants/Agent-Plant_Matrix.htm

First is the Life Cycle row:

The Life Cycle row contains the predicted life cycle for the agent and is based on literature sources and BC MFLNRORD field studies;

The Monitor and Collection rows:

Some biocontrol agents may be handled in more than one of their life cycle stages and / or during multiple times of the year, the preferred life cycle stage(s) to monitor or collect are indicated in the

appropriate months or part months with bolded text.

“Other” may include an acceptable form of monitoring specific to that bioagent, ie: evidence. Notes will further identify ‘other’;

“All stages” includes recurring or overlapping generations, common with rusts (fungus) or very short-lived insects (midges, aphids); and mites.

(galls, stems, etc.). the quantity of an agent to collect for a single release, tranporting or storage,

Release row:

Contains specfic details such as: acceptable release quantities; transporting/shipping and unique handling techniques; estimates of viable agents collected within plant material (galls, stems, etc.).

Notes row: Contains specific information pertaining to the agent that may be of use to the handler.

Example of use:

To determine when to monitor and collect *Agapeta zoegana:*

Locate the *A. zoegana* bioagent information block;

Follow the **Monitor** row life cycle stage is indicated (there may be more than one life cycle stage during which to monitor at multiple times in a year);

In this case, the life cycle stage "larva" is bolded from Mid-April through the end of May, indicating it is best to monitor A. zoegana larva during this time versus in late September and October.

Follow the **Collection** row until a life cycle is indicated (there may be more than one life cycle stage during which to monitor at multiple times/year);

In this case, it is best to collect A. zoegana from mid June through all of July; and

Refer to the Life cycle row for predictable information and how it may be adjusted for a particular situation.

The **Notes** row will include relevant and current that is important to consider when collecting, or anything else relating to the agent that might help with the handling process. However, the agent webpages are far more indepth with details and this document is not meant to replace the agent pages.

The code legend and function of Table 1 list the codes in the following order:

Plant Part Monitored/Sampled - Agent Life Cycle Stage Sought - Monitor / Sample Method Used

Plant Parts: Seed-heads (SH); Stems (St); Roots (Ro); Leaves (Le); Plants (Pl); Seed-pods (SP)

Bioagent **Life cycle stages**: Adult (Ad); Pupa (Pu); Larva (La); Egg (Eg); Gall (Ga); Oviposition (Ov); Evidence (Ev); All Stages (overlapping stages) (As)

Galls represent evidence of either larvae or pupae. There can be multiples of both larvae or pupae within a single gall, therefore it is important to note whether the agent has been collected and released while in a gall.

For greater accuracy of the number of biocontrol agents released on a site, cut a small number of galls open, count the agents within and extrapolate to obtain a rough estimate of the number of actual biocontrol agents.

Secondary Evidence: Oviposition/Egg evidence (OE); Larva (LE); Pupa (PE); Adult (AE); Galls (GE).

Secondary Evidence: Oviposition/Egg evidence (OE); Larva (LE); Pupa (PE); Adult (AE); Galls (GE).

Evidence of an agent should only be done by those who are knowledgeable with the agent and the type of evidence being sought.

Evidence can represent biocontrol agents that have perished those that have fully developed into adults.

Sampling/collecting/monitoring **Methods**: Dissect (Dis); Sweep (Swe); Aspirate (Asp); Observe (Obs); Hand Pick (Hpk); Clip (Cli); Excavate (Exc); Transplant (Tra).

When multiple stages or handling types are noted, those in bold text identifies the ideal or preferred method. Ideal methods are determined by efficiency, while also considering what impact the method may have on the biocontrol agent such as stress, physical damage, or mortality.

This document is subject to change over time as biocontrol agents adapt to the varying habitats in B.C.