

## 4 GUIDE TO THE BIOLOGICAL CONTROL OF WEEDS

### 4.1 Screening Biological Control Agents

Organisms considered for use as biological control agents are carefully studied and screened before they are introduced into North America. Initial screening is conducted in Europe, which is within the native range of all the introduced weeds in British Columbia. Potential agents are collected in areas that have similar habitats to the potential release sites in British Columbia. During the screening process, they are tested on a wide variety of North American vegetation to ensure host specificity (that is, to ensure that agents will feed on – and damage – only weeds). By international agreement, an organism will be released in North America only if the screening process confirms that there will be no detrimental impact on non-target organisms. The second step in introducing a new biological control agent is a quarantine period in North America to ensure that no unwanted organisms are introduced with the agent. In a few situations, further host specificity tests may be conducted at quarantine sites in North America. Once the screening has been completed and reviewed, the suitable biological control agents are approved for release at field sites for propagation and distribution.

### 4.2 Propagating Biological Control Agents

To monitor new importations and ensure their successful establishment, agents are often confined to propagation units for their initial release. Tented plots containing the target weed provide a protected environment for the biological control agents to increase in population in preparation for operational releases (Figure 36). Propagation units also allow research staff to gather more information on the life cycles, habitat preferences, and collection, shipping, handling, and release procedures.

### 4.3 Collecting Biological Control Agents

Successful biological control depends on the effective distribution of the control agents. Not only can agents take many years to distribute themselves naturally, but weed populations are also often geographically isolated by the mountainous terrain in British



**Figure 36** Biological control propagation plots

Columbia. Collection and redistribution, therefore, are key elements to a successful biological control program.

Biological control agents can be collected by a variety of techniques including hand picking, the collection of plant material containing the agents, aspirating, sweep netting, and the use of collection trays and funnels. Traditional collection techniques that damage or kill insects, such as sticky traps or pit traps, are obviously inappropriate.

For most agents, collection can be completed once the population has been located. The description of the specific biological control agent should be checked to determine if the agent is more active during certain times of the day than others. Some nocturnal moths can be attracted to a site with blacklight traps during the night to increase the likelihood of collection or detection.

#### **4.3.1 Hand picking**

Hand picking can be used for larger adult weevils and beetles and free-living moth larvae (caterpillars) that position themselves in visible locations on the plants and will not be damaged by handling.

- Pick these agents gently with your forefingers and store in aerated containers. If collecting for extended periods of time or during

hot days, store the collected material in shipping containers with cool packs (see Section 4.4, "Shipping and Handling Biological Control Agents").

- Do not forcefully dislodge insects that are holding onto plant material. It may damage them. As well, never handle adult moths with your hands. It will damage their wings.
- Very small insects (<2 mm long) can be collected with a damp artist's brush: dab the insect on the back and transfer to a collection container. Weevils can sometimes be coaxed from plants by rubbing a short piece of straw under their abdomen.

#### 4.3.2 Collection of plant material

Collecting biological control agents in or on plant material is mostly self-explanatory.

- When gathering material for seedhead, stem, or root galls, open up some plant material to determine or confirm the presence of the biological control agent.
- Plant material infected with rusts should be collected when visible fruiting bodies are present to ensure infected material is collected.
- When excavating plants for agents contained in or on the roots, first loosen the soil with a spade or fork to prevent breaking the root open underground.
- Collect plant material when it is relatively dry; this will prevent unwanted moulding or deterioration in transport and storage. Wear heavy gloves to protect your hands from spines or prickles when necessary.

#### 4.3.3 Aspirators

Vacuum suction aspirators can be used for collecting adult moths and other small adult insects.

- To construct an aspirator, attach a collection container with an intake tube to a screened tube connected to a low-powered vacuum source (Figure 37). A backpack type aspirator can be constructed with a leaf-blower/vacuum unit for the suction source. High-powered suction should not be used for most insects, which can be damaged by being pulled into the collection chamber at too great a speed.



**Figure 37** Vacuum aspirator for insect collection

- When collecting adult moths, suck them head first into the collection tube while they are at rest on a plant. This will help prevent damaging their wings.
- Place some plant material or paper towel in the collection container for the insects to cling to.

#### **4.3.4 Sweep nets**

Cotton-bag sweep nets are effective for collecting a variety of insect biological control agents.

- Systematically walk the collection area, sweeping the plant surfaces in a back and forth motion. After an initial pass allow bees and wasps to escape from the bag and transfer the contents to a nylon mesh bag or other ventilated container. After giving the insects adequate time to recover, sweep the same area again to collect those agents that fell to the ground and have climbed back on the plants.
- Sort through the collected material as soon as possible to separate biological control agents from their predators and to clean out other unwanted organisms, plant material, and seeds inadvertently collected.

#### 4.3.5 Beating trays and collection funnels

For scattered weeds, or where sweep nets may damage plants too greatly to support the remaining agents, beating trays and collection funnels can be used.

- Place a tray or funnel with its container below the target weed and shake the plant vigorously to dislodge biological control agents from the plant.
- Sort through the collected material as soon as possible to separate biological control agents from their predators and to clean out unwanted organisms, plant material, and seeds inadvertently collected.

#### 4.4 Shipping and Handling Biological Control Agents

Biological control agents are living organisms and must be treated with care at all times. Measures should be taken to shelter them from environmental extremes, and to isolate them from toxins and other potentially lethal substances (such as pesticides and gasoline). In general, survival improves if handling and storage are minimized; agents should be collected and transported to their new location as quickly as possible.

The following subsections contain general guidelines for shipping biological control agents. Refer to individual agents for specific shipping and handling requirements. Recommendations referring to insects include free-living larvae and adults. Recommendations for plant material include plant material containing insect larvae and pupae, as well as plant or plant galls infested with mites, nematodes, rusts, and other pathogens.

##### 4.4.1 Insects

- Keep insects in aerated containers or paper or cloth bags loosely filled with plant material for the insects to feed on and cling to. Avoid plastic bags because they can produce condensation and static charges that are harmful.
- Ship containers in an insulated carton, cooled with ice packs. Cool temperatures reduce insect activity and prevent damage caused by excessive movement. The coolers also protect them from excessive heat. Insects should not be stored or transported

in cold temperatures (less than 4°C) as they may damage or kill insect agents.

- To protect containers placed in the insulated coolers from moisture condensation and melting ice, wrap the ice packs in paper towel and enclose them in plastic bags. Insect containers placed in the shipping container should not be in direct contact with the ice packs.
- Provide good ventilation in the shipping containers with small enough holes to ensure that no insects escape.
- If shipping lasts for more than 2 days, frequently change the plant material inside the containers (provided for insects to feed on and cling to) to remove excrement and to provide fresh material for feeding.

#### **4.4.2 Plant material**

- Pack plant material containing biological control agents loosely in paper bags; plastic bags may increase humidity and condensation and promote undesirable fungal growth or decay in the plant material.
- Avoid crushing or tightly packing bags for shipment, because this will decrease aeration and promote anaerobic decay.
- Storage at 4°C will slow the decay of plant material. However, do not freeze plant material as it may kill or damage the biological control agents.

### **4.5 Releasing Biological Control Agents**

#### **4.5.1 Site selection**

Because many biological control agents have specific habitat requirements, site selection is very important to their survival and effectiveness.

- Refer to individual agents for specific habitat requirements before site selection. For all releases, sites must have a large enough weed stand to support the agent's population and be free of excessive disturbance. Release sites should not be treated with herbicides, and should receive little or no grazing during the establishment of the agents.

- Attempt to match elevations and weed development at the collection and release sites to ensure that the insect's life cycle will synchronize with the plant phenology at the new site.
- Check release records to ensure a reasonable distance is maintained between releases, such that new releases are not redundant as a result of the natural spread of the agents. Wind-spread agents can move 50 km or more in a year, although for others the dispersal rate may be only a few metres per year. A field check to monitor for agent presence is also advisable.

#### 4.5.2 Site identification

- Mark release sites with a stake, and tag them with a release site reference code. The code should be a maximum of 12 characters long and contain the following information:
  1. the biological control agent code. The codes are made up of the first two letters of the genus and species name of the agent;
  2. the Range Unit number in which the release is being made;
  3. the sequential release in that Range Unit for that year; and
  4. the year of the release.

For example, AGZO-3074-02-94 would be the coding for the second release of *Agapeta zoegana* in Range Unit 3074 in 1994.

- Release sites should be mapped at 1:20 000 and should be referenced to an air photograph; additional notes identifying local features can help relocate sites. Photoplots of release sites provide a quick means of recording additional release site information; they also provide a reference for future comparison of the efficacy of the weed control.
- Gather climatic and habitat information, according to the standard release form (Appendix 2) at the time of release and forward it to the provincial weed biological control data base. The current registry for weed biological control release information is:

Weed Technician,  
 B.C. Ministry of Agriculture, Fisheries and Food,  
 162 Oriole Road, Kamloops, B.C. V2C 4N7

The information collected, together with the monitoring data, is important to the biological control program as it adds to the general knowledge of the agents and aids in refining program activities.

#### **4.5.3 Release procedures**

The following guidelines should be used for releasing biological control agents. Refer to individual biological control agents for specific release procedures. Recommendations for insects apply to free-living larvae and adults. Recommendations for plant material apply to plant material containing insect larvae and pupae, as well as plants containing rusts, mites, nematodes, and other pathogens.

#### **Insects**

- At the release site, place the shipping carton gently on the ground and leave it undisturbed for a few minutes before the insects are removed. Do not place new releases near obvious ant colonies or wasp nests to minimize predation losses.
- Carefully shake out the insects in an even distribution in the immediate area of the release location; flying insects should disperse themselves once the container lid is opened.
- Count and record the number of dead insects in the containers to determine the number of live insects released. Some insects feign death when disturbed, therefore, care should be taken to leave the container undisturbed for a few moments before discarding dead insects.

#### **Agents in plant material**

- Plant material containing biological control agents should be transported immediately to field sites when possible.
- Plants should be tied to a stake or confined in a field cage to prevent accidental removal or destruction. Do not place all the material in one pile; spread it into several locations to minimize predation and prevent parasite build-up.
- If the plant material contains mature seedheads and further weed infestation is possible, place the plant material in a container with holes drilled in the top, large enough to allow the biological control agents to disperse but small enough to prevent the seeds in the plants from dispersing.

#### 4.6 Monitoring Biological Control Releases

Monitoring is conducted at various levels of intensity depending on the information desired. Monitoring biological control agents can be conducted to determine one or more of the following:

- presence at a given location;
- density per plant or area;
- amount and type of damage per plant or area; and
- direction, distance, and rate of movement from release point.

For most operational biological control programs, checking for presence will be the only monitoring function. If there is doubt as to whether a release has been made in an area before, or if it is possible that agents have naturally distributed themselves into an area, monitoring of the weed stand should be conducted before a new release is made. Biological control releases can fail at a given site during establishment for various reasons. New releases should therefore be monitored for establishment within 1–2 years to determine if a supplementary release is necessary.

Always record monitoring results and forward to the provincial weed biological control data base. Establishment information is important for planning future biological control activities, including the identification of potential collection sites for future redistributions.

The technique for determining presence will vary for each biological control agent; refer to individual agents for specific instructions. If monitoring for presence of agents requires destruction of plant material, remove and open plants only until the first agent is found. There may only be a few agents at a given site during the establishment phase and destroying too many plants and agents could be a serious setback to the agent's population.

