

Biological control agent screening process

Screening is the process of experimentally assessing the host range of the potential biocontrol agents, to ensure they are specific to the target plant and will not inflict major damage to other Canadian plants of economic or environmental importance. As initial field collections of the biocontrol agents are small, rearing methods may first have to be developed for the insects, pathogens that attack the target invasive plant.

British Columbia Ministry of Forests (FOR) Range Branch, Invasive Plant Program (IPP), on behalf of the province, work closely with entomologists from Agriculture and Agri-Food Canada (AAFC) to enable the research required to implement biological control as a means of managing invasive alien plants in British Columbia. BC's funding contributes to larger funding consortia which pool contributions from other Canadian provinces, US states and countries such as New Zealand and Australia, depending on the invasive plant targeted. The research is performed by scientists around the world, depending on the plant and the step required in the screening process, including but not limited to: AAFC (<https://profiles.science.gc.ca/en/research-centre/lethbridge-research-and-development-centre>); Commonwealth Agricultural Bureaux International (CABI) (<https://www.cabi.org/what-we-do/invasive-species/biocontrol/>); and the United States Department of Agriculture, Agricultural Research Service (USDA ARS) (<https://www.ars.usda.gov/midwest-area/columbia-mo/biological-control-of-insects-research/>); and Animal and Plant Health Inspection Service (USDA APHIS) (<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/biological-control-program>).

The invasive plant species targeted in FOR's Biocontrol Program have been introduced to BC from other continents, primarily Europe and Asia and as such have no natural enemies to attack them and keep them under control. IPP seeks to reunite these invasive plants with their natural enemies via importation of insects that feed on the plants from the native habitat.

Potential biological control agents are investigated and collected in the country of origin of the target plant species in locations with the latitude and habitat types as similar as possible with BC. Agents are usually scarce in their native regions because the plants often exist at low population levels. Additionally, often little is known about their biology and habitat requirements. For these reasons, multiple potential agents will be involved in the initial stages of the screening process for a single plant because it is not known at the outset which agents will successfully pass the host-specificity tests.

Host-specificity tests consist of providing the potential agent with the target invasive plant and a variety of closely related plants of concern to the country where the insect may be released (i.e. plants from BC/Canada). Different life stages

of the agent are investigated such as adult starvation and larvae feeding tests. The biocontrol agents must be very host specific in order to be released. The agent must not develop on the other related species, particularly on any rare and/or economically or ecologically desirable plants. If they do attack and develop on these plants, they are either removed from the screening process or further testing is conducted to determine if these species are less preferred than the target invasive plant, or whether they would be avoided in the field if the agent were released (i.e., testing of the species ecological host range). Screening also is used to determine which biological control agents will be effective in controlling the target plant.

If a successful specific biocontrol agent is identified, screening results are used to submit a petition to request importation of the new biocontrol agent to the Canadian Food Inspection Agency (CFIA). The petition is reviewed by a panel of experts from the federal government, universities and often provincial specialists from the province where the release is proposed. In addition, input is provided from the US Technical Advisory Group (TAG) for Biological Control of Weeds USDA-APHIS because importation of a biocontrol agent can have North American implications. In most cases, petitions are submitted jointly to CFIA and the USDA TAG. In Canada, the release of biological control agents is governed by the federal [Plant Protection Act](https://laws-lois.justice.gc.ca/eng/acts/p-14.8/) (<https://laws-lois.justice.gc.ca/eng/acts/p-14.8/>). If the petition is approved, overseas collaborators use lab populations or collect the biocontrol agents from the same location as the screened populations. This ensures genetic consistency of the released populations. The insects are shipped to a CFIA approved quarantine facility in Ottawa or the Insect Microbial Containment Facility at AAFC Lethbridge to ensure there is no contamination of the biocontrol agents with undesirable organisms. However, the review panels may reject the agent or they may request additional testing to address concerns regarding impact on non-target species. A program to find, screen, propagate and release a biocontrol agent takes between 8-10 years on average. Over this time frame the test-plant list for a potential biocontrol agent may change as more is learned about plant taxonomy. For detailed information on the Canadian federal requirements for importing biocontrol agents please see the document [Guide for the Importation and Release of Arthropod Biological Control Agents](https://agriculture.canada.ca/en/agriculture-and-environment/agricultural-pest-management/agricultural-pest-management-resources/guide-importation-and-release-arthropod-biological-control-agents) (<https://agriculture.canada.ca/en/agriculture-and-environment/agricultural-pest-management/agricultural-pest-management-resources/guide-importation-and-release-arthropod-biological-control-agents>).

Multiple agents may successfully pass the host-specificity tests. In some circumstances, invasive plant populations can be controlled with a single biocontrol agent. Often several different agents are needed to achieve the desired suppression of invasive plants throughout the variety of ecological and climatic conditions that exist in British Columbia.

Once a successful invasive plant biocontrol agent is introduced, the benefits to costs range from 3:1 to >100:1 depending on the pest targeted. Resulting invasive plant control is persistent, host-specific, self-sustaining (biocontrol agents spread with the invasive plant), cost effective in terms of requiring additional treatments, avoids development of herbicide resistance and has a relatively low environmental impact.