BEST MANAGEMENT PRACTICES FOR

European Chafer Beetle

in the Metro Vancouver Region

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

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INVASIVE SPECIES COUNCIL OF METRO VANCOUVER

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Introduction

The impacts of invasive species on ecological, human and economic health are of concern in the Metro Vancouver region. Successful control of invasive species requires concerted and targeted efforts by many players. This document – "**Best Management Practices for European Chafer Beetle in the Metro Vancouver Region**" – is one of a series of species-specific guides developed for use by practitioners (e.g., local government staff, crews, project managers, contractors, consultants, developers, stewardship groups and others who have a role in invasive species management) in the region. Together, these best practices provide a compendium of guidance that has been tested locally by researchers and operational experts.

The European chafer beetle was first recorded in British Columbia in 2001 in lawns and turf along boulevards (City of New Westminster 2018). It has since spread to many communities in the Metro Vancouver region and best practices for identifying and managing the European chafer beetle have advanced rapidly. Academic institutions, government, and non-government organizations continue to study this species in British Columbia. As researchers and practitioners learn more about the biology and control of European chafer beetle in British Columbia, it is anticipated that the recommended best management practices may change over time and this document will be updated. Please check metrovancouver.org regularly to obtain the most recent version of these best management practices.

REGULATORY STATUS

Section 2 (1) (b) (iii) of the *Community Charter*, Spheres of Concurrent Jurisdiction – Environment and Wildlife Regulation, states that "municipalities may regulate, prohibit and impose requirements in relation to control and eradication of alien invasive species", which includes European chafer beetle.

IMPACTS

The European chafer beetle has been found in turf, horticulture, and field crops in Eastern North America. These beetles have damaged turfgrass lawns and sports fields throughout the Metro Vancouver region (BC AGRI 2020). The larvae eat fibrous grass roots, which damages the grass plant. This damage is mostly caused by the third and final instar grubs in the fall and early spring, but damage can be masked by the abundant moisture at these times (BC AGRI 2020). The grass often feels spongy if there is a heavy infestation (CNLA and WCTA n.d.). Drier weather can make damage more apparent, creating brown, dying patches in the lawn. The grubs have a strong scent, which attracts birds and medium-sized mammals (e.g., crows, skunks, racoons, etc.). These predators tear up lawns to consume grubs. Photos of chafer beetle damage versus damage by predators are shown below.

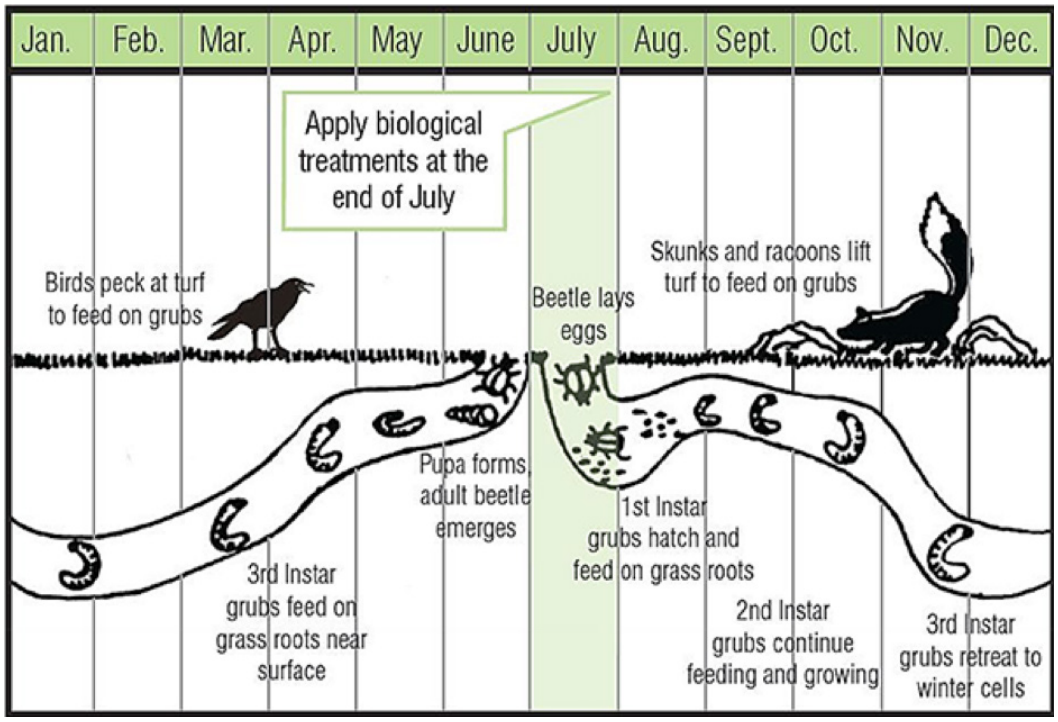
The difference between grass damaged by chafer beetle grubs (top) and by vertebrates consuming the grubs (bottom).
CREDIT: BC AGRI 2020

The primary food source for grubs is turfgrass, however if grubs are numerous and food is scarce, they may move on to the fibrous roots of planted crops, including corn, potatoes, blueberries, strawberries, conifers, and other crop roots (BC AGRI 2020). They can also cause damage to ornamental and nursery plants by reducing their root system; relatively small infestations can cause extensive root loss when plants are containerized (Purdue University 2013).

While adult beetles may be active and visible (at dusk) both on the lawn and in nearby trees in the month of June, this life stage does not eat and the adults do not actually cause damage to the lawns (BC AGRI 2020).

REPRODUCTION AND SPREAD

European chafer beetles go through several life stages over the course of a year. As illustrated on page 6, adult beetles emerge in June. The grubs moult twice over eight weeks and the mature grubs continue to feed throughout the fall. In the winter, they generally remain within 5 cm of the soil surface, except during periods of freezing conditions when they will dig deeper (BC AGRI 2020). During freezing conditions, they have been known to dig up to 1 m below the surface (Denbow 2017), but rarely go deeper than 10 cm in Metro Vancouver (LeDoux 2017). Lawns are most susceptible to damage in fall and winter as birds and mammals search for and consume the grubs. The remaining grubs begin to feed again in the spring until April, when they transform into pupae. The adults emerge in late May and June and fly to nearby tall trees (BC AGRI 2020), telephone poles, peaks of houses and other vertical structures to mate (LeDoux 2017). They mate in swarms at dusk, then the females return to nearby exposed soil and typically deposit between 20 to 50 eggs (CNLA and WCTA n.d.) (BC AGRI 2020). Adults don't eat, and die shortly after first leaving the soil (Purdue University 2013). Males die shortly after mating, while females die shortly after laying their eggs (LeDoux 2017).



The Lifecycle of the European Chafer Beetle
CREDIT: CITY OF RICHMOND (ADAPTED FROM LANDSCAPE ONTARIO HORTICULTURAL TRADES ASSOCIATION)

The European chafer beetles' short life cycle can lead to a rapidly increasing population if not managed (City of Vancouver 2017).

The spread of European chafer beetle can be accelerated by the use of infested soil and turf, plants, and landscaping equipment, as well as through composting infested turfgrass and soil (City of Port Coquitlam 2017). It is likely that most of the current spread in the region has been due to the use of infested soil, turf and plants in landscaping.

HABITAT AND DISTRIBUTION

To date the European chafer beetle has been confined to turfgrass habitat in urban areas in Metro Vancouver. They have yet to be discovered in agricultural or natural areas, but have been known to live off crop roots in other parts of the world (BC AGRI 2020).

The European chafer beetle was first found in British Columbia in New Westminster in 2001, in lawns and turf along boulevards (City of New Westminster 2018). Their 1-year life cycle has allowed them to spread relatively quickly throughout the region. The European chafer beetle is currently found throughout Vancouver, Burnaby, Coquitlam, Port Coquitlam, Richmond, Delta, Port Moody, District and City of North Vancouver, West Vancouver, Surrey and Maple Ridge (Lascelle 2016).

CLIMATE ADAPTATION

Climate modellers predict that the Metro Vancouver region will experience warmer temperatures; a decrease in snowpack; longer dry spells in summer months; more precipitation in autumn, winter and spring; more intense extreme events; and an extended growing season. In the past, our region had an average of 252 days in the growing season. In lower elevations 45 days will be added to the growing season by the 2050s, and 56 days by the 2080s, resulting in nearly a year-round growing season of 357 days on average. In higher elevation ecosystems the growing

season length will increase by 50% to 325 days by the 2080s (Metro Vancouver 2016). These changes will stress many sensitive ecosystems, increasing their vulnerability to invasive species.

No specific information on how European chafer beetle will adapt to climate change was found in the literature, but research on other white grub species suggests a range expansion will occur. It is speculated that the European chafer beetle may benefit from our future climate in similar ways:

- **Longer summer drought periods:** Drought occurrences favor grub development. Additionally, drought can increase the effects of grub damage by delaying the regeneration of the impacted turfgrass (Hann et al 2008).
- **Warmer temperatures:** Increased soil temperatures have the same effect as drought periods (Hann et al 2008).

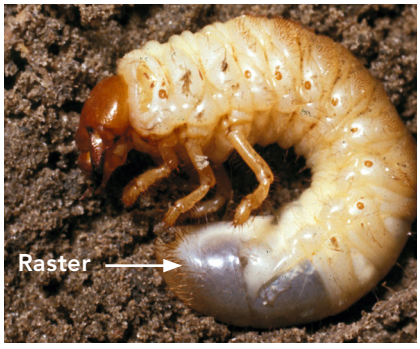
With these kinds of competitive advantages, this species is more adaptable than native insects and suggest that it will be able to withstand, and possibly thrive, with changing climate conditions.

Identification

The European chafer beetle belongs to the family *Scarabaeidae*.

Adults: Tan to brown coloured and 12-15 mm in length (BC AGRI 2016) (CNLA and WCTA n.d.).

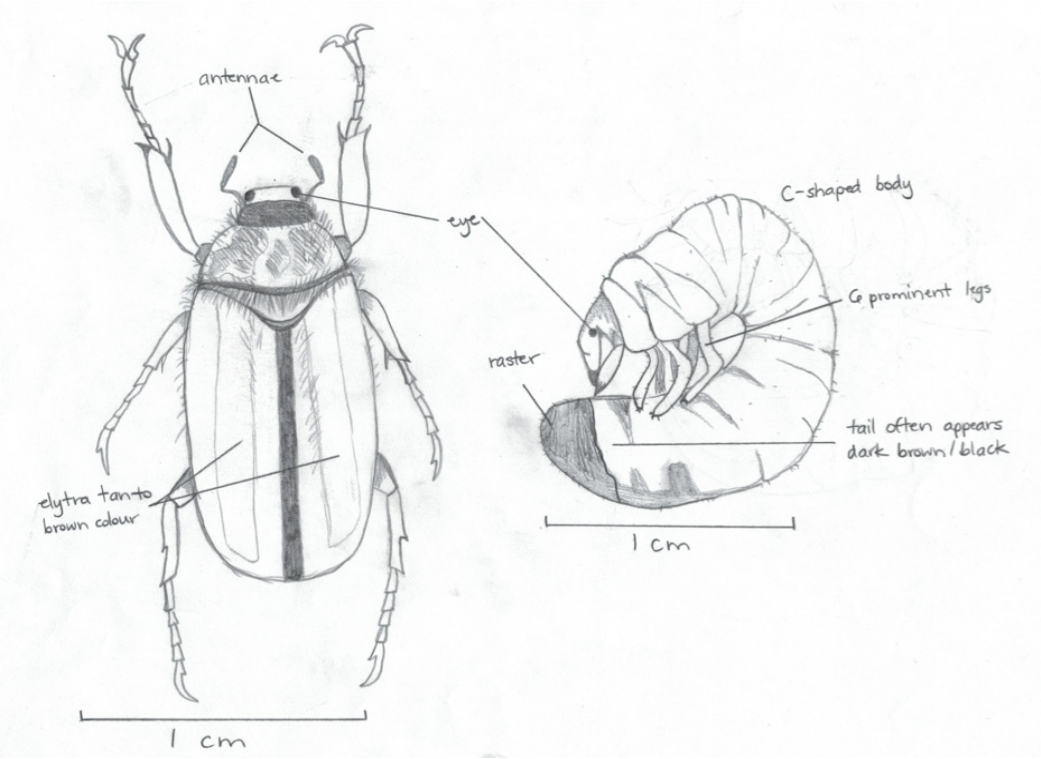
Adult European chafer beetle
CREDIT: BC AGRI 2020



European chafer grub
CREDIT: CLEMSON UNIVERSITY USDA COOPERATIVE EXTENSION SLIDE SERIES, BUGWOOD.ORG

Grubs: Mature grubs, also called larvae, have a C-shaped body and brown head with six prominent legs (BC AGRI 2020). They often appear to have a dark brown/black tail end from the soil they have ingested (Nutri-lawn n.d.). Mature chafer beetle grubs are up to 25 mm long, roughly the size of a quarter (LeDoux 2017).

Several look-a-like beetle grubs can be found in the Metro Vancouver area. A microscope may be used to confirm the species (BC AGRI 2020). European chafer beetle grubs can be distinguished by the pattern created by fine hairs on their tail end, also known as their 'raster pattern' (Nutri-lawn n.d.). The hairs on the tail end of the European chafer grub are arranged in a diverging rows of spines, similar to an open zipper.



Adult

Mature Larva

Adult European chafer beetle

CREDIT: M. REDING AND B. ANDERSON, USDA AGRICULTURAL RESEARCH SERVICE, BUGWOOD.ORG

Raster patterns of European chafer beetle (left) and Japanese beetle (right) grubs

CREDIT: OHIO STATE UNIVERSITY

SIMILAR SPECIES

In British Columbia, some similar beetle species could be confused with the European chafer beetle larvae or adults:

NATIVE BEETLES

- **Ten-lined June beetle** (*Polyphylla decemlineata*) can often be found in sandy soils in British Columbia. Adults are 20 to 35 mm long, substantially larger than the European chafer beetle, and they feed on foliage but do not cause economic damage to fruit trees (WSU-TFREC 2018).

Adult ten-lined June beetle

CREDIT: L. ELLIOT

NON-NATIVE BEETLES

- **Japanese beetle** (*Popillia japonica*), another locally-invasive beetle, was discovered in the City of Vancouver in the summer of 2017. The adult Japanese beetle looks quite different than the European chafer, but the larvae are very similar. The larvae can be differentiated by looking at the arrangement of the hairs on their tail ends (raster pattern) under a microscope.

Adult Japanese beetle

CREDIT: J. BERGER, BUGWOOD.ORG

Tracking

Presence of an infestation is best confirmed between January and March by digging up sections of turf in an area showing evidence of turf damage. Follow these steps to confirm whether a lawn has an infestation of European chafer beetles (BC AGRI 2020):

1. Cut 3 sides of a 30 cm x 30 cm (1 square foot) piece of sod to a depth of 5 cm.
2. Fold it back to count the grubs; it should fold back relatively easily if there is an infestation, as the grubs have consumed the roots.
3. Check under dead or dying patches of turf, or where there has been damage by vertebrates such as birds, skunks, or raccoons.

This process should be repeated in five locations to get an average grub concentration for the site (City of Port Coquitlam 2017).

BC Ministry of Agriculture (2020) suggests that the management threshold for a European chafer beetle 'infestation' is 20 grubs/ft2 (900 cm2) area; however, other sources suggest control is justified at lower concentrations. The Canadian Nursery Landscape Association in collaboration with Western Canada Turfgrass Association and Nutri-Lawn, suggest greater than 5-10 grubs per section could warrant control measures. Many municipalities in British Columbia suggest if five or more grubs are found in each sample, an infestation is likely present and control measures are warranted. Concentrations less than 5 grubs/ft2 are generally not considered high enough to require treatment.

Reporting

Most municipalities in the Metro Vancouver area have not established a process for reporting European chafer beetle infestations on private land.

Prevention and Control Strategies

Effective management may include a variety of control techniques ranging from prevention, chemical, cultural, manual, biological, and/or mechanical methods. Several strategies can be used to address European chafer beetle infestations, but the best way is through prevention. Once an infestation has established, it is difficult to control while retaining a turfgrass lawn. The following sections discuss management options and timelines in order of effectiveness.

Coordinated management efforts across jurisdictional boundaries are critical. If infestations are shared, it is ideal for the entire infestation to be treated with the same method at the same time. Management efforts will be less successful if only a portion of the infestation is targeted.

STRATEGY COLOUR LEGEND

GREEN: RECOMMENDED

ORANGE: CAUTION

RED: NOT RECOMMENDED OR NOT AVAILABLE

PREVENTION: IMPERATIVE

Prevention is the most economical and effective way to reduce the spread of European chafer beetle over the long term. Maintaining a healthy lawn with thick roots and long grass stems, or altering the composition of the lawn from turfgrass to an alternate species, will reduce the impact or likelihood of an infestation. A healthy lawn with dense roots is much less hospitable to European chafer beetle (City of Surrey n.d.). To maintain a healthy lawn, water it one hour per week, or less if it rains (District of West Vancouver n.d.). Aerating twice a year in the spring and fall can also improve the health of lawns (City of Port Coquitlam 2017), as well as adding compost and over-seeding (City of Surrey n.d.). Clippings should be left on the lawn to act as mulch (City of Port Coquitlam 2017). Applying lime to the lawn may also be required to maintain optimal soil pH for plant growth if the soils are overly acidic (City of Coquitlam n.d.). Soils are often acidic in rainy areas where rhododendrons and other acidophilic plants thrive. Before liming, it is best to take a soil test to ensure soil pH is below 6.5.

Since the female European chafer beetles prefer to lay eggs in short turfgrass, maintaining grass height at least 6 cm tall is a useful preventative measure (BC AGRI 2020), and some municipalities suggest a minimum of 8 cm (City of Richmond n.d.). The taller blades will also help to protect the soil surface from water loss, and encourage deeper root growth (District of West Vancouver n.d.).

Care should be taken not to move infested plants or soils into an un-infested property (BC AGRI 2020). When purchasing topsoil, the vendor should be asked where the soil originated, and how they ensure it is not infested (City of Port Coquitlam 2017). Any tools used in an infested area should be properly cleaned (City of Port Coquitlam 2017) by hosing off with water.

Note that nematode application will **not** work as a preventative measure; nematodes should only be applied to a lawn with an existing European chafer beetle infestation (City of Burnaby 2017, Metro Vancouver 2018). If prevention is unsuccessful, the population of European chafer beetles should be controlled before repairing the lawn so as not to waste time and resources (City of New Westminster 2018).

BIOLOGICAL: RECOMMENDED

ALLOW WILDLIFE FEEDING

While birds and mammals feeding on larvae often results in damaged turf, they also help decrease the pest population. In early spring after they have fed on the grubs, the lawn can be raked to remove any pulled-up sections of turfgrass (City of Surrey n.d.). After feeding is completed and the grubs have pupated, the turf can then be reseeded, and a layer of compost added (BC AGRI 2020).

Many biological diseases and parasites occur naturally in the soil; if the grubs appear to be sick or dying, action may not be required (NYSIPM 2013).

NEMATODES

One of the more effective ways to manage chafer beetle infestations in Metro Vancouver is to apply parasitic nematodes (Metro Vancouver 2018). Nematodes are small, parasitic roundworms that can be used as a biological agent and applied to an infested site. Nematodes actively seek out white grubs, such as the European chafer beetle, and quickly destroy them from the inside-out (BC AGRI 2020). While many agencies say they are quite effective (BC AGRI 2020), others question their long-term effectiveness as a strategy (Hesketh 2017). Evidence suggests that nematodes have a success rate around 75% for control of European chafer beetle (Teasdale *et al.*, 2007). In the absence of other control strategies nematodes remain the most commonly recommended approach to address populations of European chafer beetle in Metro Vancouver.

Some municipalities in Metro Vancouver are currently conducting trials with *Steinernema scarabaei* nematodes and having some success (Hesketh 2017); however *Heterorhabditis bacteriophora*, sometimes sold under the name 'Nemasys G', is currently considered to be the best nematode choice (BC AGRI 2020). Several strains of *H. bacteriophora* nematode are available - strain 1 (produced by Becker Underwood) is generally most effective, followed by strain 2 (Koppert Canada) or strain 3 (Biobest Canada) (Teasdale *et al.*, 2007). Most municipalities recommend contacting your local garden centre to secure a population of nematodes up to two months before using them (City of North Vancouver 2016). Some municipalities have subsidy programs that cover up to half the cost of nematodes (e.g., City of New Westminster, City of Burnaby, City of Port Moody). These subsidies are often first come-first serve, and must be ordered in April or May, well in advance of the nematode application (City of Burnaby 2017). As of 2017, the average cost of nematodes was $80/packet (City of Burnaby, ECB Program n.d.).

Once the nematodes are obtained, they must be handled carefully. Most require storage in the refrigerator and must be used as quickly as possible. They generally survive for up to two weeks in a refrigerator set at between 3 to 6°C or 37 to 42°F (City of Port Coquitlam 2017). It is best to check that the nematodes are alive at the time of purchase. Using a hand lens or magnifying glass, dead nematodes are straight, while live nematodes appear curled (Isaacson 2017).

Nematodes should be applied to a lawn from mid-July to the end of August, when grubs are small (BC AGRI 2020), and are most effective when applied in the last two weeks of July (City of Coquitlam n.d.). The nematodes often come in packets that are mixed with water, and they should then be applied using a watering can or hose end sprayer (City of Burnaby 2017) at a concentration of 750,000 per m^2 or 70,000 per ft^2 of lawn (CNLA and WCTA, n.d.). As they are sensitive to light and heat, nematode application should take place early in the morning.

Once deposited, most nematodes require the environment to remain quite wet. The site should be watered thoroughly within one hour after application (Art Knapp 2018). Most nematodes require watering every day, for 2 to 3 weeks (District of West Vancouver n.d.); however, regional lawn watering regulations must be followed. From May 1 to October 15, daily lawn watering in the Metro Vancouver area requires a water exemption permit from the municipality. All municipalities will provide permits during Stage 1 and 2 lawn watering restrictions, but no permits will be issued or renewed during Stage 3 (Metro Vancouver 2018).

Nematodes only survive for one season; therefore, they typically need to be re-applied on an annual basis (LeDoux 2017 for 4–5 years). However, no examples of complete eradication through biological control were noted in any of the references used to develop these best management practices.

The table on page 13 summarizes the life stages and associated damage through the 1-year life cycle of the European chafer beetle, and the recommended timing for nematode application and proactive lawn management. It is a collation of information on the municipal and private landscaping websites referenced in this document.

TIME OF YEAR	LIFE STAGES AND DAMAGES	BEST MANAGEMENT PRACTICES FOR METRO VANCOUVER
January-March	- Grubs will continue to grow as they feed on turf roots - They remain within 5 cm of the surface - Predators cause the most turf damage at this time and in the fall, as they dig up the grubs for food	- Look for damaged turf - Monitor for grubs in cut sections of lawn - If 5-10+ grubs per 900 $cm^2$are found, plan for control measures
April-May	- Grubs enter a resting stage (pupa) in May, then emerge as adult beetles in June - Minimal turf damage at this time	- Aerate soil - If biological control is planned, pre-order nematodes - Rake up or till damaged turf - Apply top dressing of compost/topsoil - Re-seed with deep rooted grass (new turf should be watered daily*) - Water established lawns once weekly* - Keep grass at least 6 cm high, and leave mowed clippings on the lawn
June	- The adult beetles emerge and fly in swarms at dusk into the trees to mate - Female beetles deposit eggs (20- 50, per female) into the soil	- Water lawns once a week* - Keep grass at least 6 cm high, and leave mowed clippings on the lawn
July	- Eggs hatch - New grubs begin to feed on grass roots - Infected turf may feel spongy when stepped on - Damage to turf may start to be visible as brown, dying patches of grass	- **Apply nematodes in late July** - Water lawn daily for 2-3 weeks after application of nematodes*; - Keep grass at least 6 cm high, and leave mowed clippings on the lawn
August	- Grubs continue to feed on turf - Infected turf may feel spongy, and damage to turf may be visible as brown, dying patches of grass if feeding becomes excessive	- Water lawns once weekly* - Keep grass at least 6 cm high, and leave mowed clippings on the lawn - Nematode application can be done in early August if not done in late July
September		- Apply slow-release fertilizer - Keep grass at least 6 cm high, and leave mowed clippings on the lawn
October-November	- Grubs will continue to grow as they feed - They remain within 5 cm of the surface - Predators cause turf damage as they dig up the grubs for food	- Aerate soils - Monitor for grubs - Cover exposed soil to deter further damage from animals
December		- No maintenance needed at this time

* A water exemption permit will likely be required from your municipality. The Resources section provides municipality-specific requirements.

BACTERIA

Since 2019, a microbial product that can be used to manage European chafer beetle was approved and it is now available in Canada. The active ingredient is Bacillus t*huringiensis galleriae* (also called Btg), which kills larvae or beetles after they have ingested it (BC AGRI 2020). Commercial products BeetleGONE!® and GrubGONE!® must be applied by a commercial applicator (for more information, consult the Chemical Control section). A domestic product, Grub B Gone® (sold by Scott's), is available at home and garden supply stores for homeowners to purchase.

Unlike nematodes, Btg products can be applied more frequently and generally have a higher success rate (Western Turf Farms Ltd. 2017). Btg products are effective on all larval stages and adults. Local governments in the Metro Vancouver have started using Btg products in sports fields and at other infested sites. Note that some local government pesticide use bylaws may not permit the use of *Bacillus* products. Check all local regulations before use.

CULTURAL: RECOMMENDED

Cultural controls include a broad range of practices that render the environment less favorable for the pest. The following cultural controls are recommended for European chafer beetle.

LAWN ALTERNATIVES

Turf can be removed from chafer-prone areas, and replace with a substitute landscape feature (BC AGRI 2020), such as xeriscaping, pollinator gardens, raised beds, or farming the space (West Coast Seeds n.d.). Lawns can also be converted from turfgrass to something the European chafer beetles do not consume, such as beetle resistant grass blends, moss, woody plants, creeping thyme, micro clover, little star creeper and others. Several private companies provide alternative turf replacement mixes that are available for sale in the Metro Vancouver area. Changing the composition of the lawn will make it difficult for European chafer beetles to forage, and will increase biodiversity, thereby increasing forage and shelter for other organisms (MacDonald 2017). Metro Vancouver's Grow Green website provides lawn alternatives as well as drought-tolerant, non-invasive plant and design suggestions for various conditions. Such turfgrass alternatives can also have the added benefits of not requiring mowing, or at least less frequent mowing, and being drought resistant (City of Surrey n.d.). Note that conversion of grass to other vegetation must be done by permission of the landowner; residents who wish to convert or maintain boulevards need to consult with their municipality.

BARRIERS

Some residents have had success with using barriers such as Remay cloth (non-woven polypropylene or polyester clothlike material), plastic sheeting, or landscape fabric to cover lawns for the duration of the mating and egg laying cycle thereby preventing the beetles from laying eggs in their turf (City of North Vancouver 2016). While some covers may require removal each morning, barrier cloths, also known as crop blankets, will prevent beetles from accessing the soil, but still allow sun and moisture to reach the lawn during the day (Art Knapp 2018). Crop blankets should be applied the first week of June, and remain on the lawn for 3 weeks (Art Knapp 2018).

Using the landscape fabrics during other parts of the year can increase the concentration of European chafer beetle by limiting crows and raccoons from consuming the grubs (Whysall 2015).

CHEMICAL: CAUTION

Many municipalities have restrictions on pesticide use for cosmetic purposes, which includes treating lawns and turfgrass. Some municipal websites explicitly mention that chemical control methods are not permitted for European chafer beetle infestations. Prior to treatment, all municipal bylaws and provincial and federal regulations must be reviewed to determine if chemical control is allowed for cosmetic purposes.

In municipalities where pesticide use is permitted, a few chemical treatment options can effectively control European chafer beetle in Metro Vancouver.

With the exception of substances listed on Schedule 2 of the Integrated Pest Management Regulation, the use of pesticides is highly regulated in British Columbia. Site characteristics must be considered with pesticide prescribed, based on site goals and objectives and in accordance with legal requirements. This summary of *BC's Integrated Pest Management Act* provides an overview of the provincial legislation.

Pesticides (e.g., insecticides, herbicides, fungicides) are regulated by the federal and provincial government, and municipal governments often have pesticide bylaws.

- Health Canada evaluates and approves chemical pest control products as per the *Pest Control Products Act*.
- The *BC Integrated Pest Management Act* sets out the requirements for the use and sale of pesticides in British Columbia. This Act is administered by the Ministry of Environment and Climate Change Strategy.
- Several municipalities have adopted bylaws which prohibit the use of certain pesticides.

Everyone who uses pesticides must be familiar with all relevant laws.

ONLY companies or practitioners with a valid Pesticide Licence and staff who are certified applicators (or trained assistant applicators working under a certified applicator) may apply pesticide on invasive species located on public lands in British Columbia. Applicators must be either the land manager/owner or have permission from the land manager/owner prior to pesticide application.

On private property the owner may obtain a Residential Applicators Certificate (for Domestic class products only) or use a qualified company. Refer to the 'Pesticides & Pest Management' and 'Home Pesticide Use' webpages listed in the Additional Resources Section for more information.

Questions? Contact the BC Integrated Pest Management Program:

Telephone: (250) 387-9537

Email: bc.ipm@gov.bc.ca

PESTICIDE LICENCE AND CERTIFICATION

A valid pesticide licence is required to:

- offer a service to apply most pesticides;
- apply most pesticides on public land including local government lands[1]; and
- apply pesticides to landscaped areas on private land, including outside office buildings and other facilities.

A pesticide applicator certificate in the appropriate category is required to apply pesticides under a licence holder in BC. Refer to the 'Pesticides & Pest Management' webpage listed in the Additional Resources Section or contact IPM program staff to determine which certificate category is required for the intended pesticide uses. Assistant applicator training is also available and the online course and exam are free.

It is best practice for personnel supervising or monitoring pesticide contracts to also maintain a pesticide applicator licence so they are familiar with certification requirements. For more information on how to obtain a licence and the requirements when working under the provincial *Integrated Pest Management Act* and Regulation, please visit www.gov.bc.ca/PestManagement .

INSECTICIDE LABELS

Individual insecticide labels must always be reviewed thoroughly prior to use to ensure precautions, application rates, and all use directions, specific site and application directions are strictly followed. Under the federal *Pest Control Products Act* and the BC Integrated Pest Management Regulation, **persons are legally required to use pesticides (including insecticides or larvicides) only for the use described on the label and in accordance with the instructions on that label**. Failure to follow label directions could cause damage to the environment, poor control results, or danger to health. Contravention of laws and regulations may lead to cancellation or suspension of a licence or certification, requirement to obtain a qualified monitor to assess work, additional reporting requirements, a stop work order, or prohibition from acquiring authorization in the future. A conviction of an offence under legislation may also carry a fine or imprisonment.

1 on up to 50 ha/year by a single organization. Organizations looking to treat over 50 hectares of land per year are also required to submit a Pest Management Plan and obtain a Pesticide Use Notice confirmation.

Insecticide labels include information on both the front and back. The front typically includes trade or product name, formulation, class, purpose, registration number, and precautionary symbols. Instructions on how to use the pesticide and what to do in order to protect the health and safety of both the applicator and public are provided on the back (BC Ministry of Environment 2011).

Labels are also available from the Pest Management Regulatory Agency's online pesticide label search or mobile application as a separate document. These label documents may include booklets or material safety data sheets (MSDS) that provide additional information about a pesticide product. Restrictions on site conditions, soil types, and proximity to water may be listed. If the insecticide label is more restrictive than provincial legislation, the label must be followed.

INSECTICIDE OPTIONS

Chlorantraniliprole (e.g., brand name Acelepryn™) is registered by Health Canada's Pest Management Regulatory Agency for application on turfgrass to control European chafer beetle larvae and other pests. It paralyses the larvae, but has very low toxicity to mammals and has been used to manage Japanese beetle larvae in the City of Vancouver since 2018.

Research suggests that one of the most effective chemical control agents is imidacloprid (e.g., brand name Merit®) (Teasdale *et al.*, 2007). It is taken up by plant roots, which in turn are consumed by European chafer beetle grubs (Teasdale *et al.*, 2007). It is a selective insecticide which disrupts insect behavior by signaling them not to feed or reproduce, leading to death. Merit can be applied in June, prior to egg hatch and at the peak time of adult flights at the beginning of or during the egg-laying period (Art Knapp 2018); however Merit is also currently banned in many Metro Vancouver municipalities due to its suspected toxicity to bees. Note that the Canadian Pest Management Regulatory Agency is undertaking a re-evaluation of all agricultural, turf and ornamental uses for imidacloprid and its associated end-use products, specifically to assess the risk to pollinators with a final decision anticipated in December 2018.

Carbaryl (e.g., brand name Sevin®) has been used in the past but is no longer permitted for turf applications in commercial and residential areas, including lawns (Pest Management Regulatory Agency 2016).

Insecticides work best if applied when grubs are small; from mid-July to September (BC AGRI 2020). However, they can also be applied to non-frozen turf in the fall and early spring.

MANUAL/MECHANICAL: NOT RECOMMENDED

Manual (e.g., hand digging) or mechanical (e.g., tilling with machinery) control would be time consuming and would result in further destruction of the lawn. The likelihood of eradication would be low since every grub present in the soil would have to be removed.

CONTROL SUMMARY

The following table provides a summary and comparison of control methods for European chafer beetle.

CONTROL STRATEGY	TECHNIQUES	APPLICABLE SITE TYPE	PROS	CONS
Biological	**Allow wildlife feeding during the spring**	Any site	Animals will reduce the number of grubs, non-chemical, non-chemical, natural form of control that doesn't require any intervention	Wildlife and damage to turf may be unwanted
	Nematode application	Any site, application in late July	Non-chemical, some municipalities have subsidy programs	Will reduce the beetles but not eradicate them, must special order from garden centres, nematodes are sensitive and must be handled carefully, may need to obtain a watering regulation exemption permit, must be re-applied annually
	Bacteria application	Any site	Non-chemical	Some products can only be applied by a qualified applicator
Cultural	**Lawn alternatives**	Any site	Non-chemical, many options for lawn replacements, some alternatives may be better adapted to local climate conditions than turf	Labour intensive, some alternatives not appropriate for every site, depending on alternative, may require maintenance
	Barriers	Unobstructed sites where barriers can be installed	Non-chemical, prevents beetles from accessing the soil while still allowing the lawn to survive	Depending on the material used, it may need to be removed each morning so the grass receives sunlight and water
Chemical	**Application of insecticide**	Any site, works best when applied from mid-July to September		Unintended environmental/health impacts, high public concern, requires trained staff
Manual/ mechanical	**Digging, tilling**		Non-chemical, doesn't require trained staff	Time consuming, results in further destruction of lawn, low efficacy

CONTROL SUMMARY COLOUR LEGEND

GREEN: RECOMMENDED

ORANGE: CAUTION

RED: NOT RECOMMENDED OR NOT AVAILABLE

Disposal

ON SITE DISPOSAL

Most references reviewed recommend that soil from infested areas should not be removed, due to the high risk of spreading European chafer beetles throughout Metro Vancouver (BC AGRI 2020). Instead of disposing infested soils, the ground should be tilled using a rototiller, and a new layer of sod, seeds, and fertilizer laid on top in order to improve growing conditions for the lawn. Soils that have experienced long-term European chafer beetle infestations have fewer, smaller grubs (Isaacson 2017) as natural population controls such as bacteria and fungus begin to build up in the soils (NYSIPM 2013).

OFF SITE DISPOSAL

If the site is highly infested and off site dispose of contaminated turf is necessary, DO NOT put it in the green bin (City of Port Coquitlam 2017) or composter.

In the Lower Mainland, the following facilities accept European chafer beetle-infested turf and soil for disposal, provided they have sufficient capacity:

- Vancouver Landfill, 5400 72nd St, Delta, BC. Accepts soil for deep burial only (additional charge). A Waste Assessment Form must be completed.
- Mission Landfill, 32000 Dewdney Trunk Road, Mission, BC. Accepts soil for deep burial only (additional charge). A Waste Assessment Form must be completed.

Small quantities of soil (maximum 0.5 m^3 or two wheelbarrows full) are accepted at Metro Vancouver's Transfer Stations (Langley, Maple Ridge, North Shore, Coquitlam and Surrey). Soil from the Transfer Stations is placed in the garbage stream.

Before disposing of soil, inform facility operators that the soil is infested with European chafer beetle.

PLEASE CONTACT ALL FACILITIES BEFOREHAND TO CONFIRM THEY CAN PROPERLY HANDLE THE MATERIAL.

CLEANING AND DISINFECTION[2]

Before leaving a site, remove all visible grubs, beetles and soil from vehicles, equipment, and gear, and if possible, rinse these items. When back at a works yard or wash station, vehicles should be cleaned and disinfected using the following steps:

- Wash with 180 °F water at 6 gpm, 2000 psi*, with a contact time of ≥ 10 seconds on all surfaces to remove dirt and organic matter such as vegetation parts or seeds. Pay special attention to undercarriages, chassis, wheel-wells, radiators, grills, tracks, buckets, chip-boxes, blades, and flail-mowing chains.
- Use compressed air to remove vegetation from grills and radiators.
- Sweep/vacuum interior of vehicles paying special attention to floor mats, pedals, and seats.
- Steam clean poor access areas (e.g., inside trailer tubes) – 200 psi @ 300 °F.
- Fully rinse detergent residue from equipment prior to leaving facility.

2 Adapted from Metro Vancouver 2018 Water Services Equipment Cleaning Procedures and Inspection Protocols.

* Appropriate self-serve and mobile hot power-wash companies in the Metro Vancouver area include: Zolliker Fleet Cleaning, Omega Power Washing, Eco Klean Truck Wash, RG Truck Wash, Ravens Mobile Pressure Washing, Hydrotech Powerwashing, Platinum Pressure Washing Inc, and Alblaster Pressure Washing. Turfgrass around wash stations should be monitored regularly for European chafer beetle.

Follow-Up Monitoring

Whatever control method is used, follow-up monitoring and maintenance are part of an integrated management plan or approach. Monitoring European chafer beetle treatments will reveal short- and long-term trends that can lead to new knowledge and understanding, and subsequently improve site specific management effectiveness and efficiencies. In the case of turfgrass treated with a biological agent, nematodes must be re-applied each year in order to keep European chafer beetle under control. If turfgrass has been replaced with an alternative lawn species, continue regular inspections and monitoring to ensure that European chafer beetle is not targeting the new species (refer to **Tracking** section). In the case where turfgrass has been converted to alternative non-lawn landscaping, the soil should no longer be hospitable to European chafer beetle and post-control monitoring should not be required.

Restoration

Lawn restoration is most effective in the spring, after the majority of turfgrass damage has occurred, and before the new generation of European chafer beetle eggs have been laid (OMAFRA 2008). Lightly rake over damaged turf areas to remove thatch and debris (City of Port Moody n.d.). Next, lay grass seed on the damaged lawn areas, and add a layer of compost or topdressing soil mix (CNLA and WCTA n.d.). Lightly rake again to ensure the grass seeds reach the soil (City of Port Moody n.d.). Water the seeded area frequently, ensuring that it remains moist until half of the seeds have germinated (City of North Vancouver 2016). Frequent watering may be in conflict with local water restrictions, so be sure to check with the municipality to confirm whether a water exemption permit is needed.

Alternatively, instead of restoring with turfgrass, a non-turfgrass ground cover can be used. For more information on alternative lawn species and landscaping see the Cultural Control section.

While residents can replace lawns with artificial turf, local bylaws should be consulted before installing artificial turf, as some municipalities in Metro Vancouver do not allow it on public properties (City of North Vancouver 2016). Artificial turf can bring a new suite of challenges, including: the expense of installation and maintenance, pollution, lack of cooling, lack of self-sanitation, lack of oxygen production, and a potential increase in run-off and associated decrease in rainwater retention (O'Dell Engineering 2010). Artificial turf can be especially problematic in highly urbanized areas with a high proportion of impermeable surfaces, and in areas with unstable terrain.

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Additional Resources

For more information please refer to the following resources:

- British Columbia Ministry of Agriculture – European Chafer information sheet (January 2020)
- Canadian Nursery Landscape Association and Western Canada Turfgrass Association – The European Chafer: A Management Strategy for the Lower Mainland
- Metro Vancouver's Grow Green website – Lush Lawns (turfgrass alternatives)
- British Columbia Ministry of Forests, Lands, Natural Resources Operations, and Rural Development
- For municipality-specific advice, click on the municipality below:
    - City of Burnaby
    - City of Coquitlam
    - City of Delta
    - City of New Westminster
    - City of North Vancouver
    - City of Port Coquitlam
    - City of Port Moody
    - City of Richmond
    - City of Surrey
    - City of Vancouver
    - District of North Vancouver
    - District of West Vancouver

Some municipalities (e.g., City of Richmond, City of North Vancouver and City of Delta) host workshops for the public to learn about European chafer beetle biology, prevention, and management. Several private organizations also put on seminars and workshops in the Metro Vancouver region.

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