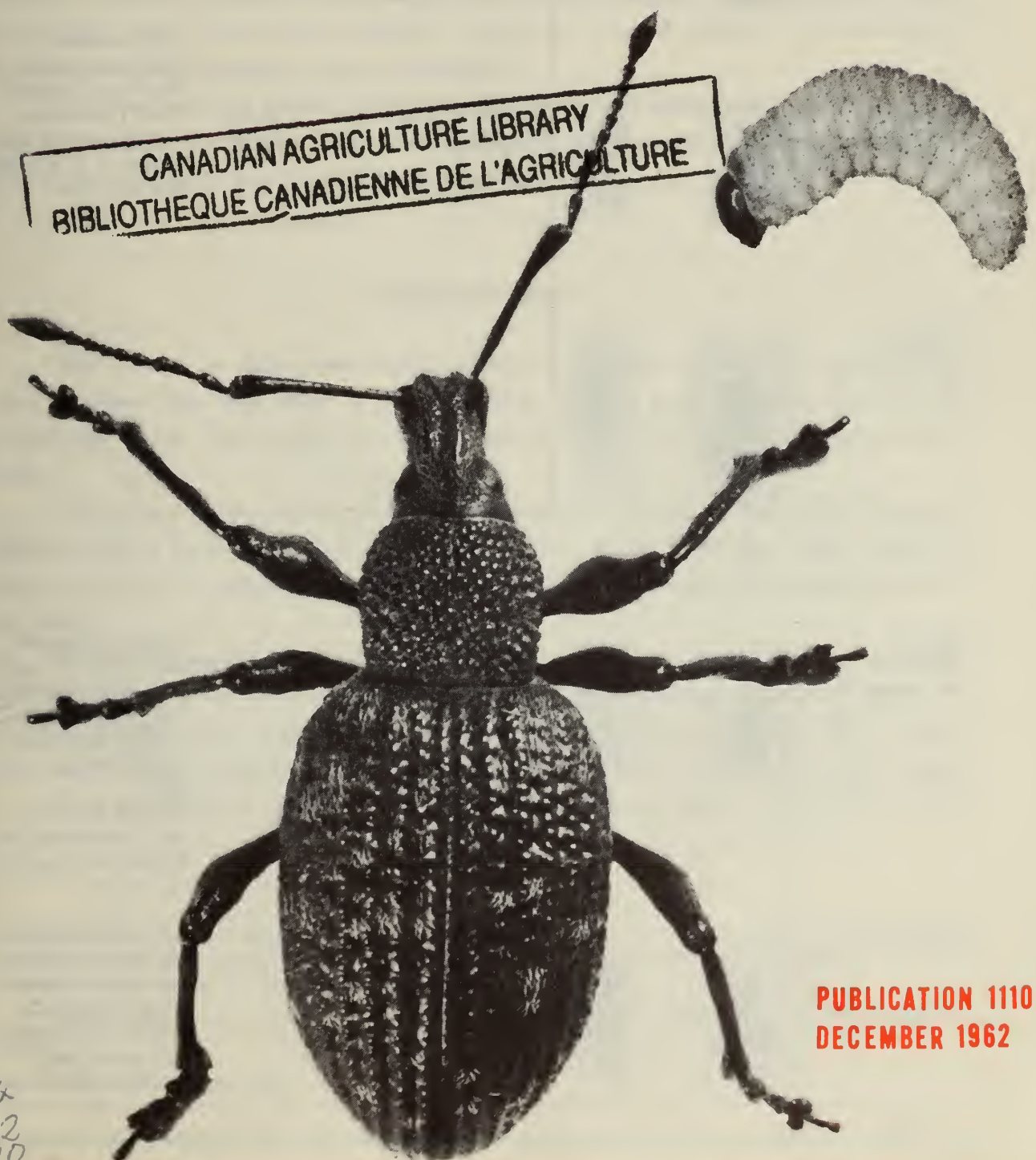


Control of **ROOT WEEVILS** in Strawberries








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Identification and Methods of Control

Weevil	Adult	Mature larva	Distribution	Adults emerge	Control	
					Best applied against	Best method
European Weevils						
Black vine weevil			Most of Canada	June	Young larva	Soil treatment: Aldrin, heptachlor or dieldrin as a spray, dust or granules, before planting and worked in to a depth of six inches
Strawberry root weevil						
Rough strawberry root weevil						
Native Weevils						
Obscure strawberry root weevil			Coastal B.C.	June	Adult	Foliage treatment: Malathion as a spray or dust in early May, immediately after harvest, and again in two weeks; OR: Baiting: In early May, near the end of harvest, and again in two weeks
Bush weevil			Coastal B.C.	September to October March to April Intermittently in summer	Adult	Baiting: In October and April and whenever fresh feeding notches appear in leaves, usually at the edge of the planting near woods

The vertical lines near the photographs of the weevils show the actual lengths of the adults.

CONTROL OF ROOT WEEVILS IN STRAWBERRIES

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Root weevils¹ of European origin attack strawberries in most provinces. Since they are poorly adapted to most Canadian climates, however, they are usually abundant only in coastal British Columbia and the Maritime Provinces. In coastal British Columbia they often destroy strawberry plantings kept for two or more years. They also damage raspberry, loganberry, blackberry, blueberry, cranberry, grape, primula, rhododendron, begonia, cyclamen, azalea, yew, grasses and clover. Some other root weevils² native in coastal British Columbia have recently become important pests of strawberry.

The root weevils should not be confused with the strawberry weevil,³ which damages strawberry plants in Eastern Canada by cutting the blossom stems. This pest is not known to occur in British Columbia.

DESCRIPTION

The larvae, or grubs, are white, cream, or pinkish with brown heads. They have no legs. They are found in a C-shaped or slightly curled position in the soil around the roots. When fully grown they are $\frac{1}{4}$ to $\frac{1}{2}$ inch long, depending on the kind.

The grubs change into pupae, which are also found in the soil. Those of different kinds look very much alike but differ in size. They are white and soft, and have the adult antennae, legs, and wing covers showing but pressed against the body.

The adult beetles have short snouts, elbowed antennae or feelers, and hard-shelled bodies. They have no wings and cannot fly. Those of European origin are shiny black or brown. The native ones are dull brown or gray with lighter areas that form definite patterns. All the adults are females; each lays fertile eggs.

The photographs on the cover show the larva and adult of the black vine weevil.

¹ Strawberry root weevil, *Brachyrhinus ovatus* (L.); black vine weevil, *B. sulcatus* (F.); rough strawberry root weevil, *B. rugosostriatus* (Goeze).

² Obscure strawberry root weevil, *Sciopithes obscurus* Horn; bush weevil, *Nemocestes incomptus* (Horn).

³ *Anthonomus signatus* Say.

LIFE HISTORY AND BEHAVIOR

Except for the bush weevil, the root weevils have similar life histories. The partly grown grubs overwinter deep in the soil, to avoid frost. They start to feed again on the roots early in spring, become fully grown by May and change to pupae.

By early June the adults emerge from the soil and begin to feed on the foliage at night. They start laying eggs three to four weeks after they emerge and continue to mid-September. During this time they crawl into new areas and lay eggs as they go. The eggs hatch in 10 to 15 days and the young grubs move into the soil to feed on fibrous roots before overwintering.

Most of the adults die before winter but a few survive in protected places such as sheds or houses near the planting or even at the bases of the plants in mild winters. The survivors start feeding on foliage again in April and laying eggs in May.

The life history of the bush weevil is irregular. Large numbers of both grubs and adults overwinter. The grubs change to adults in the soil from March to October, the largest numbers emerging from March to April and from September to October. As a result, grubs of all sizes can be found in the soil at any time. Adults that emerge in the fall lay some eggs before winter, especially if the fall is mild, but most of the eggs are laid during the spring and early summer. During mild winters the adults feed on foliage even in December and February.



Figure 1. — Strawberry leaves notched by feeding of adult root weevils. Damaged leaves in a planting show that root weevils are present.

DAMAGE

Grubs of European root weevils eat all the roots and tunnel in the crowns, but those of native root weevils strip off the laterals from the main roots and move on to adjacent plants. Damaged plants wilt as the fruit forms, especially if the weather is dry. The plants are flattened, and have reddish leaves that curl over so that the undersides show. These plants can be pulled from the soil easily. Since the adults cannot fly, usually only border areas, near older plantings or pasture, show damage the first season, but damage spreads each year the planting is kept.

Adults usually do only slight damage by feeding on the leaves, but those of the strawberry root weevil often feed on the ripening fruit. Leaf-feeding is an important sign that weevils are present (Figure 1). The obscure strawberry root weevil makes deep, narrow, feeding notches in the leaves.

CONTROL

Avoid planting strawberries in succession on the same land. Set out new plantings as far from old ones or other susceptible crops as possible.

For proper control it is important to know what kinds of root weevils are present and when the adults occur. Look for notches in the leaves (Figure 1) and capture some adults on these leaves after dark with the aid of a flashlight. Compare them with the photographs on the inside of the front cover. The following control measures are recommended.

European Root Weevils

Soil treatment before planting. — As a rule, treat the soil before planting if you expect to crop the plants for more than two years, especially in British Columbia.

Aldrin, heptachlor or dieldrin gives excellent control for at least four crops on mineral soils if properly applied and worked into the soil. The insecticide kills the newly hatched grubs as they move through the treated soil. Apply the material to the soil surface at the following rate and work it in at once by rotary tilling or plowing to a depth of six inches:

<i>Insecticide</i>	<i>Amount per Acre</i>
Aldrin or heptachlor	
20% emulsible concentrate as a spray	2½ gallons
2.5% dust or granules	200 pounds
Dieldrin	
20% emulsible concentrate as a spray	1¼ gallons
2.5% dust or granules	100 pounds

Spraying is the cheapest method for large areas. Arrange the spray boom to cover the soil evenly. Make a trial run at a set speed and determine the amount of water that will be used to cover one acre as follows:

$$\text{Gallons per acre} = \frac{43560 \times \text{gallons applied in trial}}{\text{trial swath width (ft.)} \times \text{trial distance traveled (ft.)}}$$

To reduce the amount of water required, and hence the number of times you have to fill the tank per acre, use smaller nozzles or drive the tractor faster. Regardless of the amount of water used, you must apply the recommended amount of emulsible concentrate per acre.

For small areas, dusts or granules are best. Preferably spread them with a small fertilizer cart. For the 200 pounds per acre, apply $\frac{1}{2}$ pound in an 18-inch swath 25 feet long; for the 100 pounds per acre, $\frac{1}{4}$ pound in a similar swath. Cover the whole area to be planted and work the insecticide well into the soil.

Treating the soil with these insecticides does not control the native root weevils in British Columbia but gives excellent control of white grubs and wireworms.

Foliage treatment after planting. — Treat the foliage only if you do not treat the soil. Treat it in early May to kill overwintered adults, again just *after* harvest in early July to kill the new adults before many eggs are laid, and again in late July.

Aldrin, heptachlor and dieldrin as sprays or dusts also kill adults of the European root weevils, but use them only when native ones are not present. For large areas, apply a spray: 1 quart of a 20 percent emulsible concentrate of aldrin or heptachlor in 100 gallons per acre at 100 pounds' pressure; or 1 pint of a 20 percent emulsible concentrate of dieldrin in 100 gallons per acre at the same pressure. For smaller plantings, apply about 30 pounds of 2.5 percent dust per acre using a puff-type knapsack duster.

The treatment for the obscure strawberry root weevil (next section) is effective also against the European root weevils.

Obscure Strawberry Root Weevil (coastal British Columbia, usually on new land or near wooded areas)

If this weevil is present, apply a spray or dust of malathion to the foliage, or malathion plus DDT. Malathion remains effective for less than five days, but it kills this root weevil and also the European ones, aphids, some leaf rollers, and some mites.

Use an 80 percent emulsible concentrate of malathion at 1 pint in 100 gallons per acre at the same times given for the foliage treatment against the European root weevils. To make a longer-lasting spray, add DDT using 3 pints of 25 percent emulsible concentrate in 100 gallons.

A 5 percent dust of malathion is also effective, at 30 pounds per acre.

NOTE: This root weevil damages plants even where the soil has been treated with aldrin, heptachlor or dieldrin.

Bush Weevil (coastal British Columbia, usually on new land or near wooded areas)

For best control, apply commercial root-weevil bait when you notice notches in the leaves of plants, especially in early October and April. Malathion spray or dust is only moderately effective.

Apply a tablespoon of the bait to the crown of each plant in the evening after a dry day, at 80 to 100 pounds per acre. Avoid dropping the bait on the tender stems or growing leaves. Rain spoils the bait, so apply more after rain. You can reduce costs by spot treating only the infested areas, usually near the edge of the planting. Repeat the application when fresh notches appear.

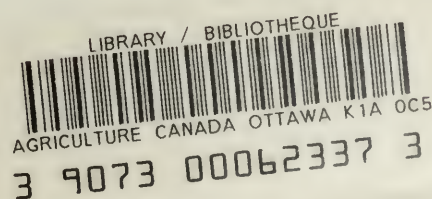
NOTE: This root weevil damages plants even where the soil has been treated with aldrin, heptachlor or dieldrin.

CAUTIONS

Follow closely all the cautions listed on the insecticide label. The interval required between the last application and harvest for the foliage treatments varies with the material used, the number of applications, and the amount applied. Keep to the interval given to avoid residues that would render the strawberries unfit for sale.

INQUIRIES

For more information, consult your agricultural representative or provincial entomologist, or write to the Research Station, Vancouver, or the nearest insect laboratory of the Canada Department of Agriculture.



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