European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

Data sheets on quarantine pests
Fiches informatives sur les organismes de quarantaine

Limonius californicus

Identity

Name: *Limonius californicus* (Mannerheim)
Synonyms: *Cardiophorus californicus* Mannerheim, *Pheletes californicus* (Mannerheim)
Taxonomic position: *Insecta*: *Coleoptera*: *Elateridae*
Common name: sugarbeet wireworm (English)
EPPO code: LIMOCF
Phytosanitary categorization: EPPO A1 action list no. 304

Hosts

This species is polyphagous, its main hosts being potatoes, sugarbeet and cereals, also beans, maize and red clover.

Geographical distribution

L. californicus is found in the Pacific north-west of North America on irrigated land or where annual rainfall exceeds 460 mm.
EPPO region: absent
North America: Canada (Alberta, British Columbia, Manitoba, Saskatchewan), USA (California, Idaho, Oregon, Washington)
EU: absent

Biology

Overwintered adult beetles emerge from the soil in the late spring. When the air temperature exceeds 10°C, the adults become active, feeding on pollen and nectar. They then begin to mate, after which the females look for suitable oviposition sites in the soil. During early summer, individual female beetles lay 200–1400 eggs in loose or cracked soil and under lumps of soil. Depending on the moisture, temperature and firmness of the soil, eggs are oviposited from just below the soil surface to 15 cm depth. Cool weather restricts adult activity and prolongs the oviposition period. Eggs laid in compact soil or near the soil surface can suffer high mortality if rapid fluctuations in moisture and temperature occur.

After 3–7 weeks, depending on temperature, the larvae hatch and begin to feed on roots or germinating host plants. They are unable to ingest solid plant material, but instead chew on underground tissues regurgitating an enzyme-containing liquid which breaks down the plant material. The products are imbibed as a soluble fluid. The larval stage lasts 4–11 years. Older larvae are usually found feeding in the top 15 cm of soil. Larval activity is affected by soil temperature and moisture. Cool wet weather brings the larvae nearer the surface; hot dry weather forces them deeper into the soil. Pupation occurs during summer, at depths of 5–10 cm in the soil. However, adults do not emerge until the following spring.

Detection and identification

Symptoms

Plants that are attacked may not germinate or may germinate poorly and wilt. When fields infested with wireworms suffer damage, crop stands can be thinned. Since thinning can also result from poor germination, wireworm damage may be overlooked, allowing populations to build up over a number of years. Potato tubers are damaged by larval feeding which results in holes that can be up to 15 mm deep, either perpendicular or at an angle to the tuber surface.

Morphology

Eggs
Less than 1 mm, oval and pearly white.

Larvae
The larvar are white when they first hatch, but change to shiny yellow and then to brown as they mature. They are slender, cylindrical, jointed and hard-bodied (hence ‘wireworms’), up to 25 mm long. They have three pairs of legs behind the head. The last abdominal segment is flattened and elongated with short, stout appendages on the end.

Pupa
White, formed in cells in the soil.

Adult

Adult wireworms, commonly called 'click beetles', are slender, black beetles, 8–12 mm long. They have distinctive backward-pointing projections near the middle of their narrow tapering bodies.

Pathways for movement

Transport of soil containing eggs and larvae, or of potato tubers containing larvae, appears to be the most likely pathway for movement of this pest into the EPPO region.

Pest significance

Economic impact

There are over 800 species of wireworms in North America. Most are of no significance. However *L. californicus* is one of six economically important species within the genus *Limonius*. It is an important pest of irrigated crops and a minor pest of sugarbeet (Hill, 1987). In a survey of potato growers from western USA, *L. californicus* was regarded as a pest that was important to control although no individual treatments were usually targeted specifically against it (Radcliffe *et al*., 1991).

Severe infestation can kill all plants within areas of a few square metres up to over a hectare. Such losses results in obvious yield reduction which can be substantial when large field areas are affected. Growers may choose to re-sow badly affected fields and this will incur additional expenditure.

In common with other wireworm species, the larvae of *L. californicus* damage crops as they tunnel in or feed on germinating seeds, roots, hypocotyls of seedlings, and tubers. The literature frequently records them as damaging to cut seed potato pieces. In trials with watermelons, *L. californicus* larvae fed on the developing roots of transplanted watermelons preventing the root system developing sufficiently to absorb the required soil moisture, resulting in plant death. Wireworms do most of their damage in the early spring when they are near the soil surface and when young plants are developing. Tubers of potatoes may be burrowed into, rendering them unmarketable. Potato growers in the Carberry, Portage la Prairie and Winkler areas of Canada have perennial problems with wireworms. In a worldwide survey by Jansson & Seal (1994) on wireworm damage to potatoes, significant losses (7–10%) were reported from California and Idaho. Occasional significant damage was reported from Canada.

Control

To reduce the threat from wireworms, potatoes should not be planted in a rotation following clover, grass, pasture or weedy lucerne crops. However, cultural methods alone cannot be relied upon to reduce wireworm populations sufficiently to prevent damage to potatoes since damage can still occur in fields 3 or 4 years after grass (Anonymous, 1998). To protect potatoes, concentrated insecticide formulations can be broadcast preplanting, during planting, or postemergence (Toba & Turner, 1981). Wheat seed can be treated to protect against *L. californicus* (Toba *et al*., 1988). Alternatively fumigants injected into the soil can control wireworms (though this is no longer regarded as good practice, for environmental reasons). No incidences of resistance to chemical treatments have been reported.

Phytosanitary risk

Wireworms are among the best known soil-inhabiting crop pests. They occur in all kinds of soil and attack many crops (Gratwick, 1992). *L. californicus* has been highlighted from the hundreds of wireworm species around the world as of particular concern, together with *Melanotus communis* (OEPP/EPPO, 2005), since it is an important pest of potatoes, sugar beet and small grains (McCaffrey *et al*., 1995) and because it inhabits regions of North America whose climate is similar to that within the EPPO region. However, North American potato growers do not consider *L. californicus* as a major pest and no measures specifically target it. Given that European growers currently manage indigenous wireworms in the EPPO region by techniques like those used in North America, it is likely that such techniques would be effective against *L. californicus*. However, the presence of an increased diversity of wireworms in Europe would increase the overall risk of wireworm attack under a wider range of conditions, and thus the overall use of soil-applied insecticides.

Phytosanitary measures

L. californicus was added in 2002 to the EPPO A1 action list of pests recommended for regulation as quarantine pests. In general, most EPPO countries prohibit the import of soil, and restrict the import of plants with soil (OEPP/EPPO, 1994), from other continents. This measure should be effective against *L. californicus*. Concerning seed potatoes and ware potatoes, EPPO Standard PM 8/1 (OEPP/EPPO, 2004) recommends, for imports from countries where *L. californicus* occurs, freedom from plant debris and from soil (to a tolerance of 1% for seed potatoes and 2% for ware potatoes).

Acknowledgements

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