



Department  
for Environment  
Food & Rural Affairs

## Pest specific plant health response plan:

Outbreaks of *Leptinotarsa decemlineata* (Colorado  
beetle) on potato crops



**Figure 1.** Adult *Leptinotarsa decemlineata* feeding on a potato leaf. Image Courtesy of Fera-Science Limited © Copyright Fera-Science Limited 2016

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<https://planthealthportal.defra.gov.uk/pests-and-diseases/contingency-planning/>

This contingency plan has been undertaken taking into account the environmental principles laid out in the [Environment Act 2021](#). Of particular relevance are:

**The prevention principle**, which means that any policy or action taken, or not taken should aim to prevent environmental harm.

**The precautionary principle**, which assists the decision-making process where there is a lack of scientific certainty.

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# Executive summary

Background	
<b>Regulation</b>	GB Quarantine pest
<b>Key Hosts</b>	Potatoes
<b>Distribution</b>	Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, China, Croatia, Cuba, Czech Republic, Estonia, France, Georgia, Germany, Greece, Guatemala, Hungary, Iran, Iraq, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Mexico, Moldova, Netherlands, North Macedonia, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Tajikistan, Türkiye, Turkmenistan, Ukraine, USA, Uzbekistan.
<b>Key pathways</b>	Seed and ware potatoes
<b>Industries at risk</b>	Potato growers
<b>Symptoms (2.2)*</b>	Defoliation of hosts
Surveillance	
<b>Demarcated zones (5.33)</b>	Infested zone = Infested field/site Buffer zone = 1 - 5 km
<b>Surveillance activities (5.34-5.37)</b>	<ul style="list-style-type: none"> <li>• Visual surveys will be carried out of the buffer zone</li> <li>• Visual surveys of other sites where there is potential spread via infested equipment etc.</li> </ul>
Response measures	
<b>Interceptions (5.1-5.9)</b>	<ul style="list-style-type: none"> <li>• Infested consignments should be destroyed or re-exported</li> <li>• Processing or control measures solely on beetles may be permitted under specific scenarios</li> <li>• Tracing exercises carried out where required</li> <li>• UKPHINS notification made</li> </ul>
<b>Outbreaks and Incursions (5.42-5.85)</b>	<ul style="list-style-type: none"> <li>• Action will be dependent on the scenario but could include: <ul style="list-style-type: none"> <li>• Decontamination of equipment and machinery and destruction of waste</li> <li>• Treatment of crop with insecticides or herbicides</li> <li>• Destruction of tubers</li> <li>• Effective control of volunteers</li> <li>• Visual inspections of fields, areas, equipment and waste</li> <li>• Safe disposal of waste</li> <li>• Crop breaks or trap plants</li> <li>• Prevention of planting seed crops</li> </ul> </li> </ul>
Key control measures	
<b>Biological</b>	N/A
<b>Chemical</b>	Insecticides and herbicides
<b>Cultural</b>	Effective control of volunteers, trap plants
Declaration of eradication	
<p>Eradication can be declared if no pest is detected during annual surveys for three years (for an outbreak) or two years (for small scale outbreaks or incursions). For an outbreak, this must include two consecutive years with effective control of volunteer plants and a year with either a ware potato crop or trap potato plants. For an incursion or small scale outbreak, this must include one year with effective control of volunteers and a year with either a ware potato crop or trap potato plants.</p>	

\* Numbers refer to relevant points in the plan.

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# 1. Introduction and scope

- 1.1. This pest specific response plan has been prepared by the Defra Risk and Horizon Scanning team. It describes how the Plant Health Service for England will respond if an infestation of *Leptinotarsa decemlineata* is discovered on potato (*Solanum tuberosum*).
- 1.2. The plant health authorities in Northern Ireland, Scotland, Wales and the Crown Dependencies have been consulted on this plan and will use it as the basis for the action they will take in the event of *L. decemlineata* being detected in their territories.
- 1.3. This document will be used in conjunction with the *Defra Generic Contingency Plan for Plant Health in England* (<https://planthealthportal.defra.gov.uk/pests-and-diseases/contingency-planning/>), which gives details of the teams and organisations involved in pest response in England, and their responsibilities and governance. It also describes how these teams and organisations work together in the event of an outbreak of a plant health pest.
- 1.4. The aim of this response plan is to facilitate the containment and eradication of *L. decemlineata*.

# 2. Summary of threat

- 2.1. *Leptinotarsa decemlineata* was first recorded in 1811 in the USA by Thomas Nuthall but was not formally described until 1824, by Thomas Say. The first report of this species damaging potato plants was in 1859, 100 miles west of Omaha, Nebraska (Pope and Madge, 1984). The beetle has since spread across the USA, and moved into Canada, Central America, Europe and Asia (EPPO, 2016). It first established in Europe in Bordeaux, France, in 1921, and is now present in most European countries (Fig. 6; EPPO, 2016). However, it has yet to establish in the UK (EPPO, 2016).
- 2.2. Larvae and adults of *L. decemlineata* feed on the foliage of potato plants and can completely strip plants of their leaves if they are left uncontrolled. In some EPPO countries, the resulting yield losses have been as high as 50% (EPPO, 1997). Large economic losses (millions of dollars per year) have also been recorded in the USA and China (Grafius, 1997; Liu *et al.*, 2012).
- 2.3. Since 1952, there have been three outbreaks of *L. decemlineata* in the UK. There were two outbreaks detected in 1976 and 1977, respectively, and both outbreaks were eradicated shortly after detection. A more recent outbreak of *L. decemlineata* was detected in a single location in Kent, England in July 2023. A finding of larvae within a ware potato crop led to a pest management response from the UK Plant

Health Service, with the aim of eradicating the pest. Live *L. decemlineata* are regularly intercepted, 'hitch-hiking' on leafy vegetables, salad leaves, fresh herbs and grains, as well as on potatoes, from continental Europe, and dead adults are regularly found in processed frozen vegetables, again from continental Europe (Fera interception records 1996-2024).

- 2.4. Eggs, larvae and adults of *L. decemlineata* are mainly associated with potato plants. However, solanaceous plants are prohibited from entering the UK from most third countries, and potato plants entering from the EU are tested for harmful organisms. The entry of *L. decemlineata* on potato plants is therefore unlikely. Larvae, pupae and adults are also associated with seed and ware potatoes and associated soil. Due to the rigorous selection and testing process prior to import on seed potatoes, ware potatoes and any associated soil are considered to be more of a risk. This pathway is mitigated in part by the national measures used against *Epitrix* potato flea beetles, which ensures that ware potatoes coming from *Epitrix* demarcated areas in Portugal and Spain must be brushed and/or washed, and that ware potatoes coming from non-demarcated areas of Spain must be washed. The pest is most likely to be detected whilst "hitch-hiking" on unregulated plants and produce (that may be from nearby to infested potato fields, where beetles may overwinter or use for harbourage), and this has been the case over the last few years.

### 3. Risk Assessments

- 3.1. The beetle currently has an unmitigated and mitigated UK Plant Health Risk Register score of 60 and 20 respectively. Overall scores range from 1 (very low risk) to 125 (very high risk). These scores are reviewed as and when new information becomes available (<https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?csref=4840>).
- 3.2. An EFSA Pest Categorisation of *L. decemlineata* concluded that climate analyses based on a minimum temperature of 10°C have shown that one generation per year of the pest is possible in parts of Ireland and Sweden (EFSA, 2020). As England has regions with similar climates to that of Ireland and Sweden, and as the pest is present in climatically similar countries such as France and Germany, it is likely that the pest could establish and cause impacts in England.

### 4. Actions to prevent outbreaks

- 4.1. *Leptinotarsa decemlineata* is a GB Quarantine Pest ([Annex 2](#) of [the GB Phytosanitary Conditions Regulation 2019/2072](#)) and is therefore prohibited from

being introduced into, or spread within, GB. Further pest and host specific requirements are listed in [Annex 7](#). *Leptinotarsa decemlineata* is also a GB Priority Pest listed in the [Annex](#) of [the GB Regulation 2019/1702](#), meaning it is a GB quarantine pest which has been assessed to have the most severe potential economic, environmental and social impacts to GB.

- 4.2. *Leptinotarsa decemlineata* is an EU Protected Zone Quarantine Pest. Countries with protected zone status include **Cyprus**, **Finland** (the districts of Åland, Häme, Kymi, Pirkanmaa, Satakunta, Turku and Uusimaa), **Ireland**, **Malta**, **Portugal** (Azores and Madeira), **Spain** (Ibiza and Menorca) and **Sweden** (Blekinge, Gotland, Halland, Kalmar and Skåne). The pest is also absent from the Canary Islands (Spain).
- 4.3. *Leptinotarsa decemlineata* is an A2 listed pest in the EPPO region and is therefore recommended for regulation by EPPO member countries.
- 4.4. The Plant Health Service for England (including the Animal and Plant Health Agency (APHA), Defra and Fera Science Ltd.) should be aware of the measures described in this plan and be trained in responding to an outbreak of *L. decemlineata*. It is important that capabilities in detection, diagnosis, and risk management are available.

## 5. Response

### Official action to be taken following the suspicion or confirmation of *Leptinotarsa decemlineata* on imported plants, including tubers and seeds

#### Holding consignments at ports of entry, including packhouses

- 5.1. If *L. decemlineata* is suspected by the Plant Health and Seeds Inspectorate (PHSI) to be present in a consignment moving in trade, the PHSI must hold the consignment until a diagnosis is made. Ideally, the consignment should be placed in a sealed cold store and any opened containers should be resealed. Samples should be sent to Fera Science Ltd., Plant Clinic, York Biotech Campus, Sand Hutton, York, YO41 1LZ (0300 100 0323) in a sealed bag or container, within at least two other layers of containment, which are not liable to be crushed during transit (no food should be included, but a drop of water can be provided).
- 5.2. When an infestation of *L. decemlineata* is confirmed, the PHSI should advise the client of the action that needs to be taken by way of an official plant health notice. The consignment should be destroyed by either incineration or deep burial (as in 5.64), or

exported back to the country of origin in a sealed container. For some consignments, processing may be permitted in certain circumstances with the agreement of the PHSI (for example, infested salad could be processed on a production line if the pest could be removed by hand and there was no risk of spread of the pest). If it is not possible to organise destruction by deep burial or incineration, suitable alternatives should be discussed with the Defra Risk and Horizon Scanning team.

- 5.3. Where there is a high risk of escape before destruction or export back to the country of origin, fumigation may be used under guidance from the Defra Risk and Horizon Scanning team. Fumigation is also preferred over destruction or export back to the country of origin for timber.
- 5.4. For consignments where beetles are restricted to the outside e.g. on wood packaging, action only needs to be taken to destroy the beetles themselves.
- 5.5. When only dead beetles are found, sorting of the consignment may be permitted. It should be noted that live beetles can enter a state of torpor at low temperatures, becoming immobile, and therefore giving the appearance of being dead. Thus, beetles should be kept at room temperature for several hours to confirm their status.
- 5.6. As appropriate, any host plants (as listed in Table 1 and including any potato tubers) should be surveyed for signs of pest presence in the immediate vicinity of the interception if this occurs during the growing season. The immediate vicinity can be defined as 100 m if the interception is made at a residential property, or 2 km if the interception is made in an area near commercial potato production. If the origin of the interception cannot be traced and there is a concern that the pest could be present in the vicinity, the survey should be repeated during the following growing season e.g., in mid-summer (see 5.21-5.23). If the site is in a potato growing area, the two potato fields closest to the site and a field on the prevailing wind side should also be visually surveyed during the growing season. Waste disposal processes and areas should also be inspected.
- 5.7. A UKPHINS (UK Plant Health Interception Notification System) notification should be made upon confirmation of an infestation of live *L. decemlineata*. UKPHINS is the IT system for recording findings and non-compliance in order to maintain records and notify other National Plant Protection Organisations (NPPO) of plant health issues.
- 5.8. If all or part of the consignment has been distributed to other premises prior to a confirmed diagnosis, trace forward and back inspections should take place on suspicion of the presence of *L. decemlineata*. Details of future and previous consignments from the same grower/supplier should also be obtained from the supplying country NPPO.

- 5.9. A pest alert to raise awareness of *L. decemlineata* and its symptoms should be distributed to packers/processors and importers where *L. decemlineata* has been found, and to those in the local area and those associated with the infested premises. A pest alert is available on the Plant Health Portal - <https://planthealthportal.defra.gov.uk/pests-and-diseases/pest-and-disease-alerts/notifiable-pests/pests/>.

## Official action to be taken following the suspicion of a *Leptinotarsa decemlineata* outbreak

- 5.10. Suspected outbreaks will be assessed on a case-by-case basis. An Outbreak Triage Group (OTG), chaired by the Chief Plant Health Officer (CPHO) or their deputy and including specialists from APHA, Defra and other relevant organisations, should be set up to assess the risk and decide on a suitable response. Where appropriate, the OTG will also decide who will be the control authority (the lead organisation responsible for the eradication or containment of the pest), who will then nominate an Incident Controller. An Incident Management Team (IMT) meeting, chaired by the Incident Controller, will subsequently convene to produce an Incident Action Plan (IAP). See the [Defra Generic Contingency Plan for Plant Health in England](#) for full details.
- 5.11. The OTG will set an alert status, which will consider the specific nature of the outbreak. The alert levels in order of increasing severity, are white; black; amber and red (more detail on the levels can be found in Table 2 of the [Defra Generic Contingency Plan for Plant Health in England](#)). Under most scenarios, an infestation of *L. decemlineata* suspected in a potato field is likely to be given an amber alert status. An amber alert status refers to a serious plant pest/disease with potential for relatively slow, but extensive geographical spread leading to host death and/or major economic, food security or environmental impacts.

## Restrictions on movement of material, equipment and machinery to and from the place of production

- 5.12. Larvae, pupae and adults can be transferred in soil associated with non-host material, equipment and machinery, and adults can hitch hike on these. Therefore, it is advisable that movement of material, equipment and machinery between infested and non-infested areas should therefore be restricted. However, if movement is necessary, the material, equipment and machinery should be thoroughly cleaned at the designated outbreak site to remove any soil and life stage of *L. decemlineata*. If cleaning at the outbreak site is not feasible, growers must inspect the material, equipment and machinery, prior to movement and if large amounts of soil is present

this should be removed at a site agreed with the PHSI before the machinery goes into any other agricultural fields.

- 5.13. Movement of people into the infested zone should be restricted, especially during the early investigation phase. Personnel should be briefed on the importance of good hygiene practice to reduce the risk of carrying life stages of *L. decemlineata* to other areas of the site or to other sites.

### **Preliminary trace forward/trace backward**

- 5.14. If an infested consignment is considered as being the source of the suspect outbreak, investigations regarding the origins of infested consignments will be undertaken to locate other related and therefore potentially infested consignments moving to and from the site. If applicable the relevant NPPO should be contacted. This process is particularly important for propagation or seed potato stocks.
- 5.15. In addition to trace forward investigations relating to seed or ware linked to the outbreak crop we should also carry out trace forward / back investigations linked to machinery used on the infested field. Farms often share equipment e.g. potato harvesters/planters.

## **Confirming a new outbreak**

### **How to survey to determine whether there is an outbreak**

- 5.16. Information to be gathered by the PHSI on the suspicion of an infestation of *L. decemlineata*, in accordance with ISPM 6; guidelines for surveillance (<https://www.ippc.int/en/publications/615/>):
- The origin of the potatoes and seed lot numbers etc.
  - Details of other premises or destinations where the potatoes have been grown or sent, where the beetle may be present.
  - The layout of the premises and surrounding area (in relation to potential buffer zones), including a map of the fields/cropping/ buildings, at risk growers, and details of neighbouring crops, especially any commercial or non-commercial solanaceous crops in fields, allotments, gardens or glasshouses.
  - Details of where relevant crops were grown in the previous season.
  - Details of the crop variety, growth stage and any other relevant information.
  - Description of the surrounding habitat.
  - Area and level of infestation, including life stages and a description of symptoms (could take photos). Symptoms would include defoliation and black, sticky excrement.
  - The location of any known populations, including grid references.

- The date and time the sample was taken, how it was identified and by whom. If taken by non PHSI, an official sample would be required.
- Current treatments/controls in place e.g. chemical treatments.
- Details of the movement of people, equipment, machinery etc. to and from the infested area.
- Cultural and working practices.
- The name, address, email and telephone number of the person who found the beetle.

5.17. This information should be included on the plant pest investigation template.

5.18. An initial survey should be carried out to determine if it is an isolated finding or an established outbreak, and further samples of suspected *L. decemlineata* should be taken if found in surrounding lots or fields.

5.19. If an interception takes place at a processor, any host plants (including any potato tubers) should be surveyed for signs of pest presence in the immediate vicinity of any interception if this occurs during the growing season and again during the following growing season (see 5.21-5.23). If the site is in a potato growing area, the two potato fields closest to the site and a field on the prevailing wind side should also be surveyed. The waste disposal areas should also be inspected.

5.20. Finance for the surveys will depend on the individual circumstances of the outbreak, and will be subject to discussion, usually between Defra policy and the PHSI.

## Sampling

5.21. Although adult *L. decemlineata* are distinctive, both the eggs and larvae of ladybird beetles and other leaf beetles are often mistaken for those of *L. decemlineata* (see Appendix A Morphology section). Foliage can be visually inspected for signs of defoliation, characteristic black, sticky excrement and all life stages of the pest. Because the larvae and adults can be hidden among the foliage, they are best detected by shaking the host plant over a white sheet or tray. However, eggs tend to adhere to the host and may not be detached by shaking host material.

5.22. When walking through a potato crop, two rows can be taken at a time, and any findings marked with flagged canes (ideally around the perimeter of any colonies).

5.23. Following the identification/capture of an egg, larva, pupa and/or adult, the samples should be sent for diagnosis as in 5.1.

## Diagnostic procedures

- 5.24. There are descriptions of the egg and larval stage of *L. decemlineata* (e.g. Australian Government Department of Agriculture, 2013), but these cannot be identified to species based on their morphological characteristics as no keys are available. Confirmatory identification of these life stages needs to be made by DNA sequencing.
- 5.25. For adults, there is a North American key to the genera in the tribe Doryphorini, including the genera most closely related to *Leptinotarsa*, as well as 31 of the 41 species in the genus *Leptinotarsa*, including *L. decemlineata* (Jacques, 1988).

## Criteria for determining an outbreak

- 5.26. If a breeding population of *L. decemlineata* is detected at a location, and following initial surveillance is deemed not to be confined to a recently introduced consignment(s) then an outbreak should be declared. For example, if multiple life stages of the pest, are found in several areas of a potato field then this is likely to be classed as an outbreak.
- 5.27. If the pest is detected at a location, and following initial surveillance is deemed not to be confined to a recently introduced consignment, but there is no evidence of a breeding population being present or there is no evidence of the pest having spread from the initial site of infestation, the finding will be classed as an incursion. For example, an incursion is likely to be declared if a single adult male was detected in a potato field.
- 5.28. If *L. decemlineata* is detected on recently imported potatoes within a cold store or on other produce, this would be classified as an interception and an outbreak or incursion should not be declared.
- 5.29. There are likely to be several scenarios in which the pest could be found, and the OTG will make the final decision on whether a finding is classed as an outbreak, an incursion or an interception.

## Official action to be taken following the confirmation of an outbreak or incursion

- 5.30. The scale of the outbreak or incursion will determine the size and nature of the management team and action.

## Communication

- 5.31. The IMT will assess the risks and communicate details to the IPPC, EU and EPPO, in accordance with ISPM 17: pest reporting (<https://www.ippc.int/en/publications/606/>), as well as within Government to Ministers, senior officials and other government departments, devolved governments and agencies (e.g., the Environment Agency) on a regular basis as appropriate; and to stakeholders.
- 5.32. A generic communications plan is available for use across all plant health outbreaks. This will be owned by APHA and FC communications teams and is intended to provide consistency across outbreaks. This plan aligns with the Plant Biosecurity Strategy and can be tailored to the outbreak, using pest and outbreak specific information. It includes a list of key stakeholders and templates for:
- Core Narratives
  - Press releases
  - Reactive lines
  - Frequently Asked Questions

## Surveillance and demarcated zones

- 5.33. After an outbreak or incursion has been detected, a regulated area should be established that includes:
- An **infested zone** (i.e. the infested field or crops). This may also include field margins or uncropped areas if infestation is found on solanaceous weed species.
  - A **buffer zone** should extend out at least 1 km from the infested zone and may extend out to 5 km depending on the characteristics of the outbreak.
- 5.34. Initial maps of infested sites should be produced by officials.
- 5.35. If it is considered possible that the pest has been spread to distant fields on machinery, these fields should also be surveyed. If resources are limited, priority should be given first to areas where there has been movement of large quantities of soil from the infested zone and secondary areas looked at as resources dictate. The IMT will decide on the survey method to be used, however, a visual scanning inspection of the crop using the step over method and sweep netting of the headland is advised.
- 5.36. Host plants in the buffer zone should be visually inspected and any suspect samples should be sent for diagnosis (5.21-5.23). This should include fields containing

volunteer potato plants or solanaceous weeds. However, if resources are limited, priority should be given to commercial potato crops over inspections of potato crops at residential properties. If there is resource available, inspections of volunteer plants and solanaceous weeds could take place before the end of the season.

- 5.37. The regulated area should be adjusted in response to further findings. If *L. decemlineata* is found within a field outside the infested zone, this should subsequently be designated as infested. If beetles are found within uncropped areas outside the infested zone, then any field directly adjacent to these areas should normally be designated as infested.

## **Decontamination procedures**

- 5.38. Within the infested zone, all non-disposable material, equipment and machinery, should be thoroughly cleaned (or inspected as in 5.12) to remove the pest and any soil before movement to un-infested areas.
- 5.39. Any waste (plant or other potentially infested material) should be removed and destroyed (via deep burial, incineration or other appropriate methods, see 5.64-5.66).

## **Tracing forwards/backwards**

- 5.40. Once other sites that are potentially infested by *L. decemlineata* have been identified, these should be inspected as per 5.16-5.23.
- 5.41. A pest alert to raise awareness of *L. decemlineata* and its symptoms should be published and distributed to potato growers, packers/processors and importers, and displayed at public locations, nearby to the infested site and other areas at risk. The pest alert should be distributed to residential addresses nearby to the outbreak site, if it is deemed likely that hosts of *L. decemlineata* could be growing in residential gardens. Confidential information about the location of the infestation will not be released.

## **Pest management procedures**

- 5.42. The movement of machinery and equipment where the risk of moving life stages of *L. decemlineata* to non-infested sites should be restricted as in 5.12.
- 5.43. The movement of people into the infested zone should be restricted as in 5.13.

## Scenario 1: Outbreak in a potato crop – infested zone

- 5.44. The whole crop should be treated as soon as possible with a foliar insecticide. PHSI will advise on an appropriate treatment regime in consultation with the Defra Risk and Horizon Scanning team. Foliar insecticides will kill life stages above ground, but will have no effect on the larvae, pupae or adults within the soil. Recommendations of insecticides will take into account the need to use different modes of action as part of a planned treatment programme, whilst taking into account the financial implications for growers.
- Any applications should be made following the advice on the product label or where relevant, on the Extension of Authorisation for Minor Use (EAMU) and be in accordance with HSE guidance. In some cases, there may be a requirement to carry out a Local Environment Risk Assessment for Pesticides (LERAP) depending on the product used and the situation of the finding.
  - Growers will be placed under notice to apply the recommended plant protection products and make the applications using their own or contractor's equipment. Records of applications will be kept, including details of the amount of product and water used.
  - If the crop is organic, plant protection products will still have to be used if the situation demands it as the statutory requirement to eradicate *L. decemlineata* overrides any restrictions on the use of pesticides on organic farms.
  - Bee advisors and local beekeepers should be contacted to inform them of any insecticide applications and their timing. Bee inspectors should be able to provide contact details.
  - Visual inspection should be used to assess the efficacy of insecticide treatments. This should not be carried out while the crop is still wet with insecticide.
- 5.45. When the level of adults is low, the potato haulm should be destroyed in areas of the field known to be infested (using methods in 5.63) to eliminate the food supply of *L. decemlineata* and thereby reduce their ability to survive and multiply.
- 5.46. If the level of adults is high, the potato haulm should **not** be destroyed due to the high risk of adults dispersing to hosts in other fields/sites.
- 5.47. Even if the number of adults is low when the haulm is destroyed, there is still a risk of some adults (including newly emerging adults) spreading further afield. Several rows of crop should therefore be left at the edge of the field to act as a trap. These should be treated regularly (e.g. fortnightly) with insecticide and destroyed later in the season.

- 5.48. No tubers should be harvested from areas of the field known to be infested, or from the whole field if there are multiple areas of infestation, due to the risk of pest dispersal with the tubers and any associated soil. Destruction of tubers in a way that does not risk further spread (e.g., spraying the crop with a plant growth regulator to prevent the risk of sprouting of unharvested tubers in subsequent seasons and a herbicide treatment could be used to destroy the haulm) should be considered. The method of destruction will be decided by the IMT. Tubers can be permitted to be harvested if the risk of pest presence with the tubers and any associated soil is deemed to be low by the IMT. Harvesting procedures must be agreed by the IMT. All potato tubers that are harvested should be brushed and/or washed to remove soil and the pest prior to movement outside of the 1 km buffer zone around the site of the incursion. The potatoes should also only be marketed as ware potatoes and must not be used as farm saved seed.
- 5.49. Host plants, such as solanaceous weeds, and host debris in the infested zone, and uncropped areas, field boundaries and hedgerows in the immediate vicinity of the infested zone should be destroyed by herbicide or mechanical means.

**Scenario 2: Incursion in a potato crop where the pest is present in a restricted area of the crop and there is no evidence of a breeding population – infested zone**

- 5.50. The pest, and infested plants if applicable, should be removed by hand if feasible and destroyed as per 5.64.
- 5.51. The crop should be treated as soon as possible with a foliar insecticide. PHSI will advise on an appropriate treatment regime in consultation with the Defra Risk and Horizon Scanning team. All points listed in 5.44 are relevant in this situation.
- 5.52. Tubers can be permitted to be harvested if the risk of pest presence in the tubers and any associated soil is deemed to be low by the IMT. Harvesting procedures must be agreed by the IMT. All potato tubers that are harvested should be brushed and/or washed to remove soil and the pest prior to movement outside of the 1 km buffer zone around the site of the incursion. The potatoes should also only be marketed as ware potatoes and must not be used as farm saved seed.
- 5.53. Several rows of crop should be left at the edge of the field to act as a trap after the crop is harvested. These should be treated regularly with insecticide and destroyed or harvested later in the season (the restrictions on harvested tubers in 5.52 are relevant for these remaining trap plants).

**Scenario 3: Measures to be taken in the case of detection of infestation in tubers after harvest (e.g. in a grower's potato store or during processing/packaging when the tubers can be traced back to a known crop or farm)**

5.54. The following should be designated as infested:

- The lot from which the sample was taken.
- The waste from the infested lot, such as soil and processed waste.
- The equipment and other articles (e.g. machinery and packing material) which have been in contact with the lot.
- The field where the lot was grown.

5.55. As in 5.33, a buffer zone should be created that extends out to at least 1 km from the infested field(s) and store.

5.56. Fields or areas where potentially infested equipment, waste, and other articles, have been used should be surveyed, and any tubers harvested from these fields should be inspected.

5.57. There is the risk that other potato stocks may have become infested after harvest. This could have been through the transfer of soil in grading lines or storage boxes. Any tubers and associated containers in storage, and tubers linked to infested machinery and equipment, should therefore be classed as possibly infested and inspected for the presence of *L. decemlineata*.

5.58. Points 5.2-5.6 and 5.8-5.9 should be followed, but only destruction rather than export back to the country of origin should be considered.

**Crops growing within the buffer zone (1 km around the infested zone) in the year of the outbreak / incursion**

5.59. If no infestation is found in the potato crops growing in the buffer zone following surveillance, then they should be treated with a programme of foliar insecticides under notice until harvest and monitored for any sign of *L. decemlineata*.

5.60. Growers of non-potato crops, but which contain host volunteers or weeds may be restricted under notice from undertaking any husbandry or harvesting of the crops until they have been inspected and found free of the beetle.

5.61. Potato tubers should also be inspected during and/or immediately after harvesting. This will also apply to non-potato crops in fields or other areas containing volunteer potato plants or solanaceous weeds.

- 5.62. All potato tubers that are harvested should be brushed and/or washed to remove soil and the pest prior to movement outside of the buffer zone. The potatoes should also only be marketed as ware potatoes and must not be used as farm saved seed.

## **Disposal plan**

### **Infested growing host crops**

- 5.63. The primary means of destruction of potato plants in a field is through herbicide application. The Defra Risk and Horizon Scanning team should be consulted for appropriate treatments.

### **Infested harvested tubers/soil/plant debris**

- 5.64. Adults, pupae and possibly larvae may be present with the harvested tubers, associated soil and plant debris. It is important that all of this material is disposed of safely so as to eliminate the pest. When deciding on the most appropriate method(s) of disposal, factors such as the likelihood of adults being present, the level of handling and transportation required, all need to be taken into account. For all methods, measures need to be taken to ensure that there is no risk of spread during transport and treatment or disposal. Material that can be moved safely should be destroyed by incineration at a licensed facility (if in small quantities) or deep burial. Disposal and/or destruction should be under the approval and supervision of the PHSI. If material must be moved off the premises, it should be contained within at least one sealed layer, and two layers if possible. Deep burial may be done at an approved landfill site, or on the site or nearby farm, but only in agreement with the local Environment Agency. Incineration must comply with appropriate waste management regulations, Environment Agency in England, Scottish Environment Protection Agency and Natural Resources Wales.
- 5.65. Other possible methods of destruction for potato tubers should be considered on a case-by-case basis and include heat sterilization, industrial processing (under official supervision), fermentation and composting, steaming and feeding to animals, and anaerobic digestion (minimum temperature of 55°C for 24 h without interruption with a hydraulic dwell time in the reactor of at least 1 day).
- 5.66. All objects designated as 'infested', such as equipment, machinery, storage facilities that may be contaminated with infested soil or potato material should be thoroughly cleansed (or inspected as in 5.12) to remove the pest and all soil. This should be carried out at the outbreak site or a site nearby in agreement with a Plant Health and Seeds Inspector. Any waste material generated should be bagged and sent for deep burial or incineration (as in 5.64).

## Measures in subsequent seasons

### Infested zone – when an outbreak has been declared

- 5.67. No host or root crop should be planted for at least two years and with effective control of volunteer plants for two consecutive years (under notice). Trap plants planted in subsequent years following the outbreak are exempt from this rule.
- 5.68. If trap plants are used, these should be planted early in the season to ensure they are present before the emergence of adult beetles in spring, and they should ideally be planted at the perimeter of the field (e.g. 6-24 m, but width will be dependent on the size of the field and situation) where beetles are more likely to overwinter. If possible, trap plants could be used in combination with a chemical attractant. These plants should be inspected regularly during spring and summer (e.g. fortnightly) and sprayed regularly (e.g. fortnightly) with an appropriate insecticide program as discussed with the Risk and Horizon Scanning team. The size of the area planted with trap plants will be decided by the IMT.
- 5.69. If practical, steam treatment could be used prior to the emergence of adult *L. decemlineata*. The treated soil should subsequently be covered for three months to improve the efficacy of the soil treatment. For large fields, only areas of known infestation should be treated and covered.
- 5.70. Effective control of volunteer plants should be carried out early in the season following the outbreak **and will be kept under review by the PHSI**. If the population of volunteer plants is low, they can be removed by hand, but if the population of volunteer plants is high, they are best controlled by an application of an effective herbicide (see 5.63). Solanaceous weeds should also be controlled in a similar way.
- 5.71. 'Infested' fields may be maintained in permanent pasture with frequent close cutting or intensive grazing. This option has the advantage of providing effective control of potato volunteers and solanaceous weeds.
- 5.72. The frequency of inspections will be determined by the Incident Management Team.
- 5.73. Following two years with effective control of volunteer plants, only ware potatoes or trap plants should be produced in the following season, with the crop and any harvested tubers inspected for *L. decemlineata*. If there are no finds of the pest following this, then either seed or ware potatoes can be produced on the field the following year.

## **Infested zone – when an incursion has been declared**

- 5.74. No host or root crop should be planted for at least one year and with effective control of volunteer plants for one year (under notice). Trap plants planted in subsequent years following the incursion are exempt from this rule.
- 5.75. If trap plants are used, these should be planted early in the season to ensure they are present before the emergence of adult beetles in spring, and they should ideally be planted at the perimeter of the field (e.g. 6-24 m, but width dependent on the size of the field and situation) where beetles are more likely to overwinter. If possible, trap plants could be used in combination with a chemical attractant. These plants should be inspected regularly during spring and summer (e.g. fortnightly) and sprayed regularly (e.g. fortnightly) with an appropriate insecticide program as discussed with the Risk and Horizon Scanning team. The size of the area planted with trap plants will be decided by the IMT.
- 5.76. Effective control of volunteer plants should be carried out early in the season following the incursion **and will be kept under review by the PHSI**. If the population of volunteer plants is low, they can be removed by hand, but if the population of volunteer plants is high, they are best controlled by an application of an effective herbicide (see 5.63). Solanaceous weeds should also be controlled in a similar way.
- 5.77. 'Infested' fields may be maintained in permanent pasture with frequent close cutting or intensive grazing. This option has the advantage of providing effective control of potato volunteers and solanaceous weeds.
- 5.78. The frequency of inspections will be determined by the Incident Management Team.
- 5.79. Following one year with effective control of volunteer plants, only ware potatoes or trap plants should be produced in the following season, with the crop and any harvested tubers inspected for *L. decemlineata*. If there are no finds of the pest following this, then either seed or ware potatoes can be produced on the field the following year.

## **Buffer zone (at least 1km around the infested zone) – when an outbreak has been declared**

- 5.80. Host crops should not be planted outdoors for at least two years (under notice). Volunteer plants and weeds should be under effective control **and will be kept under review by the PHSI**. Following this period, only ware potatoes should be produced

with the growing crop and harvested tubers inspected for *L. decemlineata*. If there are no finds of the pest, then either seed or ware potatoes can be produced on the field.

- 5.81. The frequency of inspections will be determined by the Incident Management Team.
- 5.82. Host crops planted indoors should be monitored, and if *L. decemlineata* found, the site (which may include outdoor fields) should be designated as infested and an appropriate programme of insecticides applied.

### **Buffer zone (at least 1km around the infested zone) – when an incursion has been declared**

- 5.83. Host crops should not be planted outdoors for at least one year (under notice). Volunteer plants and weeds should be under effective control and will be kept under review by the PHSI. Following this period, only ware potatoes should be produced with the growing crop and harvested tubers inspected for *L. decemlineata*. If there are no finds of the pest, then either seed or ware potatoes can be produced on the field.
- 5.84. The frequency of inspections will be determined by the Incident Management Team.
- 5.85. Host crops planted indoors should be monitored, and if *L. decemlineata* found, the site (which may include outdoor fields) should be designated as infested and an appropriate programme of insecticides applied.

## **6. Criteria for declaring eradication / change of policy**

- 6.1. With the exception of small outbreaks as described in 6.2, a *L. decemlineata* outbreak can be declared eradicated (by the CPHO) only after three calendar years since the last finding of a viable *L. decemlineata* life stage. These three years should include two consecutive years with effective control of volunteer plants and either a ware potato crop or trap potato plants should be grown in the third year following the finding.
- 6.2 In cases where it can be demonstrated that an outbreak is of a small size and is considered to be relatively easy to eradicate, eradication can be declared after two calendar years since the last finding of a viable *L. decemlineata* life stage. This is in line with the policy for declaring eradication in the event of an incursion of *L. decemlineata* (see 6.3). There should be effective control of volunteer plants in the

year following the finding, but trap potato plants should be grown in that same year. Either a ware potato crop or trap potato plants should be grown in the second year following the finding.

- 6.3 A *L. decemlineata* incursion can be declared eradicated (by the CPHO) after two calendar years since the last finding of a viable *L. decemlineata* life stage. There should be **effective control of volunteer plants** in the year following the finding, but trap potato plants should be grown in that same year. Either a ware potato crop or trap potato plants should be grown in the second year following the finding.

## 7. Evaluation and review of the contingency plan

- 7.1. This pest specific contingency plan should be reviewed regularly to consider changes in legislation, control procedures, pesticides, sampling and diagnosis methods, and any other relevant amendments.
- 7.2. Lessons should be identified during and after any *L. decemlineata* or other pest outbreak, including what went well and what did not. These should be included in any review of the contingency plan leading to continuous improvement of the plan and response to outbreaks.

## 8. Appendix A

### Data sheet for *Leptinotarsa decemlineata*

#### Identity

PREFERRED SCIENTIFIC NAME	AUTHOR (taxonomic authority)
<i>Leptinotarsa decemlineata</i>	(Say, 1824)

CLASS: Insecta

ORDER: Coleoptera

SUBORDER: Polyphaga

SUPERFAMILY: Chrysomeloidea

FAMILY: Chrysomelidae

SUBFAMILY: Chrysomelinae

TRIBE: Chrysomelini

SUBTRIBE: Doryphorina

OTHER SCIENTIFIC NAMES (Jacques, R.J. Jr. (1988))

*Doryphora decemlineata* Say, 1824

*Chrysomela decemlineata* (Say, 1824)

*Myocoryna multilineata* Stål, 1859

*Leptinotarsa multilineata* (Stal, 1859)

*Myocoryna multitaeniata* Stål, 1859

*Leptinotarsa multitaeniata* (Stal, 1859)

*Leptinotarsa intermedia* Tower 1906

*Leptinotarsa oblongata* Tower

*Leptinotarsa rubicunda* Tower 1906

## INTERNATIONALLY USED COMMON NAME/S & INTERNATIONAL LANGUAGE

Coloradobille (Danish)

Kartoffelbille (Danish)

Kartoffelkäfer (German)

Kolorado-Käfer (German)

Colorado beetle (English GB)

Colorado potato beetle (English US)

Ten-lined potato beetle (English GB)

Ten-striped spearmen (English GB)

Catarinita de la papa (Spanish)

Dorifora (Spanish)

Escarabajo de la patata (Spanish)

Escarabajo de las hojas de patata (Spanish)

Mayata de la papa (Spanish)

Tortuguilla (Spanish)

Susske sibsamini (Persian)

Koloradokuoriainen (Finish)

Chrysomèle de la pomme de terre (French)

Doryphore (French)

Doryphore de la pomme de terre (French)

Burgonyabogar (Hungarian)

Crisomela della patata (Italian)

Dorifora delle patate (Italian)

Scarabeo del Colorado (Italian)

Coloradokever (Dutch)

Koloradobille (Norwegian)

Stonka ziemniaczana (Polish)

Doriforo (Portuguese)

Escaravelho-da-batateira (Portuguese)

колорадский жук (Russian)

колорадский картофельный жук (Russian)

Koloradoskalbagge (Swedish)

Patetes bocegi (Turkish)

## Notes on taxonomy and nomenclature

*Leptinotarsa decemlineata* is one of over 35 currently recognised species in the genus *Leptinotarsa* (Open Tree Taxonomy). Specimens can be identified to genus using the keys provided in Arnett et al. (2002), and to species using Jaques (1988).

## Biology and ecology

### Life history

The adult beetles overwinter in the soil, usually in areas adjacent to potato fields, but also within the potato fields themselves. The depth at which the beetles overwinter in the soil varies depending on the climate, with beetles burrowing deeper (between 25 and 40 cm) in the cooler, northern European countries (CABI, 2021). Adults emerge over several weeks in spring and/or summer and walk or fly to their host plants. They locate their host plants largely at random, though the odour of potato plants has been found to be attractive to the beetles; potato plants damaged by feeding were more attractive under laboratory conditions than undamaged plants (Bolter *et al.*, 1997; Landolt *et al.*, 1999). The adults are able to fly many kilometres in search of a host, including over large water bodies (Wikteliuss, 1981). Once they reach the potato plants, the adults feed and mating usually takes place within 5-10 days of emergence.

Eggs are laid in masses (of 10-30), usually on the underside of leaves, with each female laying up to 2000 eggs during their lifetime. Larvae use egg bursters (or oviruptors) on their meso and metathorax, and abdominal segments to hatch from the egg (within 4-14 days). They subsequently feed on the chorion (outer shell), before moving onto foliage within 24

hours. Larvae tend to hatch synchronously within egg masses and stay together until their first moult. Larvae have four instars, with the level of feeding increasing between instars; 3, 5, 15 and 77% of consumption during larval development occurs in the first, second, third and fourth instars respectively (Ferro *et al.*, 1985). Feeding generally takes place on the leaves, but larvae will feed on the petioles and stems if leaves are unavailable. Similarly, larvae and adults will feed on eggs of their own species under certain conditions (e.g. Shrod *et al.*, 1996). Larval development takes between 8 and 28 days depending on the temperature, and is largely not impacted by unfavourable weather conditions, though heavy rain and strong winds have been shown to cause mortality (CABI, 2021). Faithi *et al.* (2013), Kahrizeh *et al.* (2014) and Yaşar and Güngör (2005) have also found mortality, as well as fecundity and development time, to vary depending on the potato variety.

When fourth instar larvae mature, they burrow into the soil nearby to the plant they were just on and pupate. The pupal stage lasts from 8 to 20 days. Adults then emerge and feed on nearby plants. The number of generations varies between 1 and 4 depending on the climate; the number of day degrees required from the egg to the adult is approximately 543, with a development threshold of 10.90°C (Zhou *et al.*, 2010). Diapause is principally triggered by a short photoperiod, though it is also affected by temperature and host plant chemistry (Hsiao, 1988; Izzo *et al.*, 2014). The removal of host plants entirely can also trigger diapause, as is the case in North Carolina, where the beetle enters diapause following potato harvest in June despite the day lengths being at their longest (CABI, 2021). In mild climates, the beetles may undergo an additional aestival diapause during the summer. This is triggered by the deterioration of their host plants, and the beetles will come out of this diapause once the host plant condition has improved (CABI, 2021).

## Hosts/crops affected

The most significant host of *L. decemlineata* is potato (*Solanum tuberosum*), though the beetle will feed on other cultivated crops, including tomato (*Solanum lycopersicum*) and aubergine (*Solanum melongena*), as well as some wild solanaceous plants. Previously, incidental associations of the beetle on plants led to erroneous records of certain hosts. However, in 2021, EPPO and CABI adopted the true host list shown in Table 1, which includes only those plant taxa that *L. decemlineata* is known breed on.

**Table 1.** Hosts of *Leptinotarsa decemlineata*.

Hosts	Type	Reference
<i>Hyoscyamus niger</i> (henbane)	Wild/Weed	EPPO (2021)
<i>Solanum dulcamara</i> (woody nightshade)	Wild/Weed	EPPO (2021)
<i>Solanum elaeagnifolium</i> (white horse nettle)	Wild/Weed	EPPO (2021)
<i>Solanum lycopersicum</i> (tomato)	Minor	EPPO (2021)

<i>Solanum melongena</i> (aubergine)	Minor	EPPO (2021)
<i>Solanum rostratum</i> (Buffalo bur)	Wild/Weed	EPPO (2021)
<i>Solanum sarrachoides</i> (green nightshade)	Wild/Weed	EPPO (2021)
<i>Solanum tuberosum</i> (potato)	Major	EPPO (2021)
Solanaceous weeds	Wild/Weed	CABI (2021)

### Plant stage affected

*Leptinotarsa decemlineata* affects plants during growth and post-harvest.

### Plant parts affected

Leaves, stems, vegetative organs, and tubers (occasional).

### Symptoms/signs - description




Both the larvae and adults of *L. decemlineata* feed on foliage and strip the leaves from the edge inwards. Tubers, which are exposed at the soil surface, may also be eaten.

Additionally, larvae and adults produce black and sticky excrement, which is visible on the foliage.

### Morphology

**Egg:** Orange/yellow in colour, elongate ovoid and approximately 1.2 mm in length. The female lays the eggs in upright clusters generally on the under surfaces of leaves where they are held in place by a special secretion produced by the female beetle. Image © Jyrki Tomminen (<https://creativecommons.org/licenses/by/2.0/legalcode>).



<p><b>Larvae:</b> First instar larvae are dark red and 1.5 mm in length. Each subsequent instar of which there are four in total is slightly paler than the last until by the 4<sup>th</sup> instar the mature larva is a paler orange red and up to 8mm long. The head and legs are consistently black in colour and there are two rows of black spots running along each side of the larvae. Typical chrysomelid larvae have a rather bloated, sack like and shiny body. Image © Stephan Czuratis (<a href="https://creativecommons.org/licenses/by-sa/2.5/legalcode">https://creativecommons.org/licenses/by-sa/2.5/legalcode</a>).</p>	
<p><b>Pupa:</b> Yellowish in colour, naked (no pupal case is formed) and up to 1 cm in length. Pupation takes place in the soil, and so pupae are unlikely to be encountered. Image © Jyrki Tomminen (<a href="https://creativecommons.org/licenses/by/2.0/legalcode">https://creativecommons.org/licenses/by/2.0/legalcode</a>)</p>	
<p><b>Adults:</b> Body oval, convex, 8.5 to 11.5 mm in length, males generally smaller. The elytra (wing cases) are smooth, shiny and yellow-orange in colour with each bearing 5 distinctive longitudinal black stripes. The head and pronotum (thorax) are orange in colour and are marked with a variable array of black spots. Legs are orange in colour. Image © Crown copyright</p>	

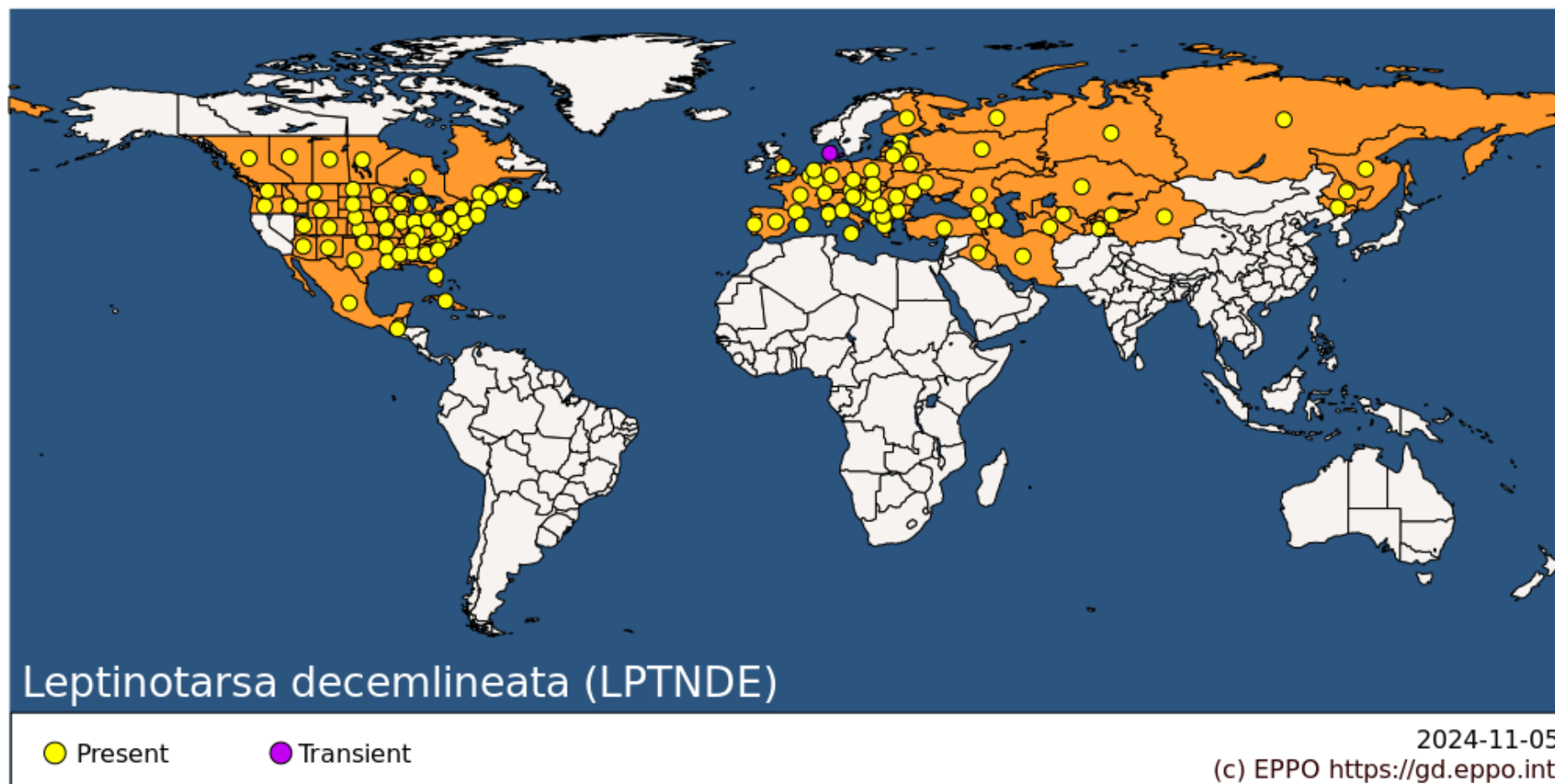
## Similarities to other species/diseases/plant damages

A factsheet confirming the diagnostic characteristic of *L. decemlineata* and comparing this species with other insects frequently mistaken for it the UK is available (<https://planthealthportal.defra.gov.uk/pests-and-diseases/pest-and-disease-factsheets/notifiable-pests/>).

## **Detection and inspection methods**

Leaves can be visually inspected for eggs, larvae and adult beetles. Also, signs of defoliation and characteristic black, sticky excrement can be looked out for. Because the larvae and adults can be hidden among the foliage, plants can be shaken over a white sheet or tray to dislodge any hidden specimens.

## Distribution



**Figure 2.** *Leptinotarsa decemlineata* global distribution as of November 2024. (Source: EPPO Global database).

<https://gd.eppo.int/taxon/LPTNDE/distribution>

## History of introduction/spread

*Leptinotarsa decemlineata* was first discovered in 1811 by Thomas Nuthall in the USA, and was later described by Thomas Say in 1824 from specimens collected in the Rocky Mountains on buffalo bur (*Solanum rostratum*) (Casagrande, 1985; Jacques, 1988). In 1859, likely as a result of host range expansion, *L. decemlineata* was recorded damaging potato crops 100 miles west of Omaha, Nebraska, in the USA (Pope and Madge, 1984). The beetle gradually moved eastwards, crossing the Mississippi river in 1865, reaching Ohio in 1869 and Maine in 1872, before arriving at the Atlantic coast in 1874 (Casagrande, 1987; Jacques, 1988). It now occurs throughout most of the USA, except for Alaska, California, Hawaii and Nevada. The beetle is also present in Canada, which it reached in 1901 (Ivanschik and Izhevsky, 1981), and Central America.

*Leptinotarsa decemlineata* was first recorded in Europe in 1875 in the UK, and soon after in Germany and Poland. Although these outbreaks were eradicated (Feytaud, 1950; Wegorek, 1955; Jacques, 1988), the beetle eventually became established in Europe in 1922, within Bordeaux, France, and subsequently spread across the rest of Europe. It is now found in Belarus, Belgium, Romania, Russia, Slovakia, Spain (1935 – year first reported), Estonia, the Czech Republic, Germany, Italy, Latvia, Libya, Lithuania, Luxembourg (1936), Moldova, the Netherlands, Switzerland (1937), Austria (1941), Portugal (1943), Poland (1946), Hungary (1947), Turkey (1949), Bulgaria (1958), Greece (1963) and several other European countries. The beetle has also moved further east, into Asia.

Since 1952, the UK has only experienced three outbreaks of *L. decemlineata*; one outbreak was in 1976 and the other in 1977, whilst a more recent outbreak was detected in 2023. In September 1976, four egg batches and 135 adult beetles were found in a field of potatoes (184 m<sup>2</sup>) in Thanet, Kent. After the implementation of control measures, no further beetles were found after March of the following year. The second outbreak in July 1977 was also small and consisted of just 61 larvae in a 12 m<sup>2</sup> allotment in Hastings, Kent. Inspections carried out after treatment of the allotment found no further beetles. A third outbreak of *L. decemlineata* was detected in a single location in Kent, England in July 2023. A finding of larvae within a ware potato crop led to a pest management response from the UK Plant Health Service.

Live *L. decemlineata* are regularly intercepted, “hitch-hiking” on leafy vegetables, salad leaves, fresh herbs and grains, as well as on potatoes from continental Europe and dead adults are regularly found in processed frozen vegetables, again from continental Europe. Between January 1996 and September 2024 there have been 471 interceptions i.e. approximately 16 interceptions annually (Fera interception records)

## Phytosanitary status

*Leptinotarsa decemlineata* is listed as a Protected Zone Pest (Annex III) in the EU. Countries with protected zone status include Spain (Ibiza and Menorca), Ireland, Cyprus, Malta, Portugal (Azores and Madeira), UK, Sweden (Blekinge, Gotland, Halland, Kalmar, Skåne), and Finland (the districts of Åland, Häme, Kymi, Pirkanmaa, Satakunta, Turku, Uusimaa).

*Leptinotarsa decemlineata* is also on the EPPO A2 list and on many other quarantine organism lists (see Table 2).

**Table 2.** Lists on which *Leptinotarsa decemlineata* has been included as a quarantine organism (EPPO, 2016).

Country/Organisation	List	Year of addition
<b>AFRICA</b>		
<b>Egypt</b>	A1 list	2018
<b>Morocco</b>	Quarantine pest	2018
<b>Tunisia</b>	Quarantine pest	2012
<b>AMERICA</b>		
<b>Argentina</b>	A1 list	2019
<b>Brazil</b>	A1 list	2018
<b>Canada</b>	Quarantine pest	2019
<b>Chile</b>	A1 list	2019
<b>Mexico</b>	Quarantine pest	2018
<b>Paraguay</b>	A1 list	1992
<b>Uruguay</b>	A1 list	1992
<b>ASIA</b>		
<b>Bahrain</b>	A1 list	2003
<b>China</b>	Quarantine pest	2021

Country/Organisation	List	Year of addition
Iran	A2 list	2018
Israel	Quarantine pest	2009
Jordan	A1 list	2013
Korea, Republic	Quarantine pest	2018
Uzbekistan	A2 list	2008
Azerbaijan	A2 list	2007
<b>EUROPE</b>		
Belarus	Quarantine pest	1994
Norway	Quarantine pest	2012
<b>OCEANIA</b>		
New Zealand	Quarantine pest	2000
<b>RPPO</b>		
APPPC	A1 list	1988
CAN	A1 list	1992
COSAVE	A1 list	2018
EPPO	A2 list	1975
EU	PZ Quarantine pest (Annex III)	2019
IAPSC	A2 list	1989
OIRSA	A2 list	1992
PPPO	A2 list	1993

## Means of movement and dispersal

Adults of *L. decemlineata* are not strong fliers and tend to remain in the area where they developed as larvae (Grafius, 1995; Hurst, 1975). However, they can travel considerable distances in search of new habitat when aided by the wind, sometimes by as much as 100 km or more (van Poeteren, 1939; Wikteliuss, 1981). Adults are also capable of surviving for long periods on sea water (Feytaud, 1936; Vassiere, 1939); on more than one occasion, they have been found coming ashore onto Jersey, having dropped into the sea after flying from the Contentin peninsula in France, which is 14 miles away (Brokenshire *et al.*, 2012).

Because of their presence on leaves and stems, eggs, larvae and adults can be found in association with host plants for planting in trade (CABI, 2021). Larvae and adults, as well as pupae, can also be found with any associated soil, and adults can sometimes be found on potato tubers (CABI, 2021). Additionally, adults can be found “hitch-hiking” on non-host plants, transport and packaging, as well as with travellers and their baggage (CABI, 2021). All interceptions in the UK have been as a result of this “hitch-hiking” on leafy vegetables, salad leaves, grain, potatoes and in frozen vegetables, all from continental Europe (Fera interception records to November 2024).

## Control

### Biological control

There are many natural enemies that attack *L. decemlineata*, including insect predators and parasitoids, nematodes, fungi, bacteria and viruses (a full list is provided by CABI, 2021). However, these are generally ineffective, particularly when compared with chemical alternatives. Abdukerim *et al.*, (2025) and Sevim *et al.*, (2025) have discussed the need for locally adapted biological control agents, and have demonstrated that entomopathogenic fungi isolated from specific locations are promising candidates for controlling *L. decemlineata* collected from the same regions, although further tests in the field are still required.

Transgenic plants, which express the gene for *Bacillus thuringiensis* subsp. *tenebrionis* Cry3A delta-endotoxin is highly toxic to *L. decemlineata*. It was approved for commercial use in the USA in 1995, but due to negative public perception, there is a reticence from growers to use this method (Sanahuja *et al.*, 2011). As resistant beetles will also be selected for by these plants, there is a need for resistance management programmes. These involve the use of refuge areas of plants which do not express the endotoxin, and so will allow non-resistant beetles to persist in the population.

Other biological control methods include antifeedants (e.g. Neem extract, Bezjak *et al.*, 2006; Igrec *et al.*, 2006; Zehnder and Warthen, 1988) and the use of RNA interference (Zhu *et al.*, 2011). The latter has been utilised to develop a new bioinsecticide (Calantha ® a.i.

ledprona) which is commercially available in the USA, specifically for the control of *L. decemlineata* (Bradford *et al.*, 2025).

## Chemical control

Insecticides are the most used method for controlling *L. decemlineata*. Effective insecticides include acetamiprid and esfenvalerate. However, partly because of the dependency on chemical insecticides, *L. decemlineata* has developed resistance to several chemicals. According to the Arthropod Pesticide Resistance Database (2016), there have been 306 cases of resistance in 150 locations against 56 active ingredients. In Long Island, New York State, USA, for example, the beetle exhibited a 155-fold resistance to imidacloprid after just 3 seasons. It is therefore recommended that different insecticide classes are rotated with one another as part of a resistance management programme. The Defra Risk and Horizon Scanning team regularly review the available insecticides for use against *L. decemlineata*, however this information is not published as it can rapidly become out of date.

## Field monitoring/economic threshold levels

The economic injury level (EIL) is the fewest number of insects (or level of defoliation) that will cause yield losses equivalent to the cost of insect management. In the case of *L. decemlineata*, defoliation levels of 20% during plant emergence, 30% during early to late bloom and 60% during late bloom to harvest have been developed by Zehnder *et al.* (1995). However, these thresholds vary depending on the location of the potato plants, current cost of treatment, as well as the statistical approach used (cf. Nault and Kennedy, 1998; Shields and Wyman, 1984). Economic injury levels have also been developed for insect densities; Mailloux *et al.* (1995), for example, report an EIL of 5.8 overwintered adults and 10 summer generation adults per plant, whereas larval densities vary from 0.14 – 0.82 per plant (Senanayake and Holliday, 1990) to 12 per stalk (Mailloux *et al.*, 1991).

Economic thresholds, conversely, are the points at which action should be taken to prevent a pest population reaching the EIL. In many cases where these have been used for *L. decemlineata*, yield losses were not too dissimilar to conventional management programmes. However, fewer insecticide applications were needed (Stewart and Dornan, 1990; Wright *et al.*, 1987; Zehnder *et al.*, 1995). In Virginia, USA, a computerized approach is used called the Potato-Insect Expert System (PIES). This takes into account the insect life stage, the potato growth stage, percentage defoliation and other factors, to decide whether an insecticide application is necessary (Vencill *et al.*, 1995). Likewise, a temperature-driven decision support system (SIMLEP DSS) was designed for Europe. It is composed of two modules; the first (SIMLEP 1) forecasts the first occurrence of the hibernating beetles and the start of egg laying and the second (SIMLEP 3) predicts the occurrence of the development stages. Following validation in a number of countries, this has proven to be very accurate, correctly predicting the periods of maximum egg laying and

young larval presence in 90% of cases. SIMLEP 3 is used by Germany, Austria, and the western part of Poland (Jörg *et al.*, 2007).

Despite these systems to reduce the number of insecticide sprays, the USA tends to adopt a preventative approach, such as the in-furrow applications of imidacloprid (CABI, 2021).

### **Cultural controls and sanitary methods**

The level of infestation by *L. decemlineata* can be reduced by as much as 90% by rotating the potato crop between fields (Lashomb and Ng, 1984; Wright, 1984). Ideally, a minimum distance of 0.5 km from the source of the beetle is required to fully benefit from a crop rotation strategy. This strategy can be maximized by including growers from a large area, allowing longer distance rotations and so reducing the ability of the beetle to locate a host (CABI, 2021).

Populations of the beetle can also be reduced by altering the planting date. Early planting means that the plants will mature before the second generation of beetles is produced, while late planting means that summer generation adults will emerge after the critical photoperiod in autumn and will not be able to produce a second generation (Weber and Ferro, 1993).

Most beetles tend to overwinter at the edges of potato fields (hundreds/m<sup>2</sup>), with only a few beetles per m<sup>2</sup> overwintering in the fields themselves (Hunt and Tan, 2000; Weber and Ferro, 1993). It is also known that beetles tend to disperse initially by walking rather than by flying. Trenches (which act as pitfall traps) and trap plants along the field margins can therefore be effective in preventing and/or slowing the entry of beetles into a field. Plastic lined trenches, for example, caught 95% of the beetles during field experiments (Boiteau and Osborn, 1999; Misener *et al.*, 1993). The efficacy of these traps can be improved further by using semiochemicals; Martel *et al.* (2005) showed that a blend of chemicals emitted by the host plants ((Z)-3 hexenyl acetate,  $\pm$ -linalool and methyl salicylate) increased the efficacy of pitfall traps and, in turn, reduced the level of pesticide needed in the crop.

Potato breeding lines for resistance have also been released (Plaisted *et al.*, 1992; Lorenzen and Balbyshev, 1997). These are largely based on resistance derived from *Solanum berthaultii*, which has glandular trichomes on the foliage and resistance derived from *Solanum chacoense*, which has high concentrations of leptine glycoalkaloids in the foliage (Sinden *et al.*, 1986; Sanford *et al.*, 1997; Yencho *et al.*, 1996, 2000).

Further control measures include mechanical collection, propane flammers, pneumatic thermal machines or bio-collectors and mulching (CABI, 2021). Mulching with grass-clover or triticale-vetch in Germany has been shown to reduce infestation of potatoes with *L. decemlineata* due to a delay or inhibition of egg and larval development (Weiler *et al.*, 2025). This is possibly due to the mulch causing increased periods where the temperature rises above the optimum for egg development and pre-pupation.

## Impacts

### Economic impact

*Leptinotarsa decemlineata* is a destructive defoliator of potato plants worldwide (Hare, 1990), and is also responsible for spreading potato diseases, such as *Ralstonia solanacearum* (potato brown rot) and *Clavibacter sepedonicus* (potato ring rot).

In Michigan, with an area of 250,000 km<sup>2</sup>, the combined cost of treatment and yield loss for potato was \$13.8 million in 1994, equating to 13.7% of the crop value (Grafius, 1997), whereas in China, total losses (not just including potato) of \$3.2 million were estimated in the infested area per year (Liu *et al.*, 2012). Potato yield losses of 50% in some EPPO countries, and tomato yield losses of 67% in a field test in Maryland, USA, have also been reported (EPPO, 1997; Schalk and Stoner, 1976).

### Environmental impact

*Leptinotarsa decemlineata* is largely found on plants in the Solanaceae family, and primarily affects agricultural plants (e.g., potato) within this family; there are no indications that the beetle has any significant negative effects on wild plants in the environment. However, the beetle can have an indirect negative impact on arthropod biodiversity within agricultural fields because of the increased use of insecticides used to control it.

### Social impact

Unlike *Phytophthora infestans* (potato late blight), *L. decemlineata* has not caused enough damage to lead to a significant social impact. However, there are likely to be negative impacts on growers and farmworkers in the event of an outbreak.

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