EPPO Datasheet: *Diabrotica undecimpunctata undecimpunctata*

Last updated: 2021-04-26

IDENTITY

[more photos...]

Preferred name: *Diabrotica undecimpunctata undecimpunctata*
Authority: Mannerheim
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Chrysomelidae
Other scientific names: *Diabrotica soror* Leconte, *Diabrotica undecimpunctata* Mannerheim
Common names: corn budworm, western spotted cucumber beetle
[view more common names online...]
EPPO Categorization: A1 list
[view more categorizations online...]
EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: DIABUN

Notes on taxonomy and nomenclature

Before the introduction by Michelbacher *et al*. (1941) of the name *undecimpuctata* Mannerheim, the species had been known as *Diabrotica soror* LeConte (Tubbs, 1991). Then Barber (1947) divided *D. undecimpunctata* into four subspecies: the nominal one corresponding to subspecies *soror* LeConte, the subspecies *howardi* Barber (the holotype of *Crioceris sexpunctata* Fabricius is a specimen of this subspecies) and the two other subspecies *tenella* and *duodecimnotata*. *D. undecimpunctata* is closely related to the major pests *Diabrotica barberi* and *Diabrotica virgifera virgifera* (the northern and the western corn rootworms) (EPPO/CABI, 1997).

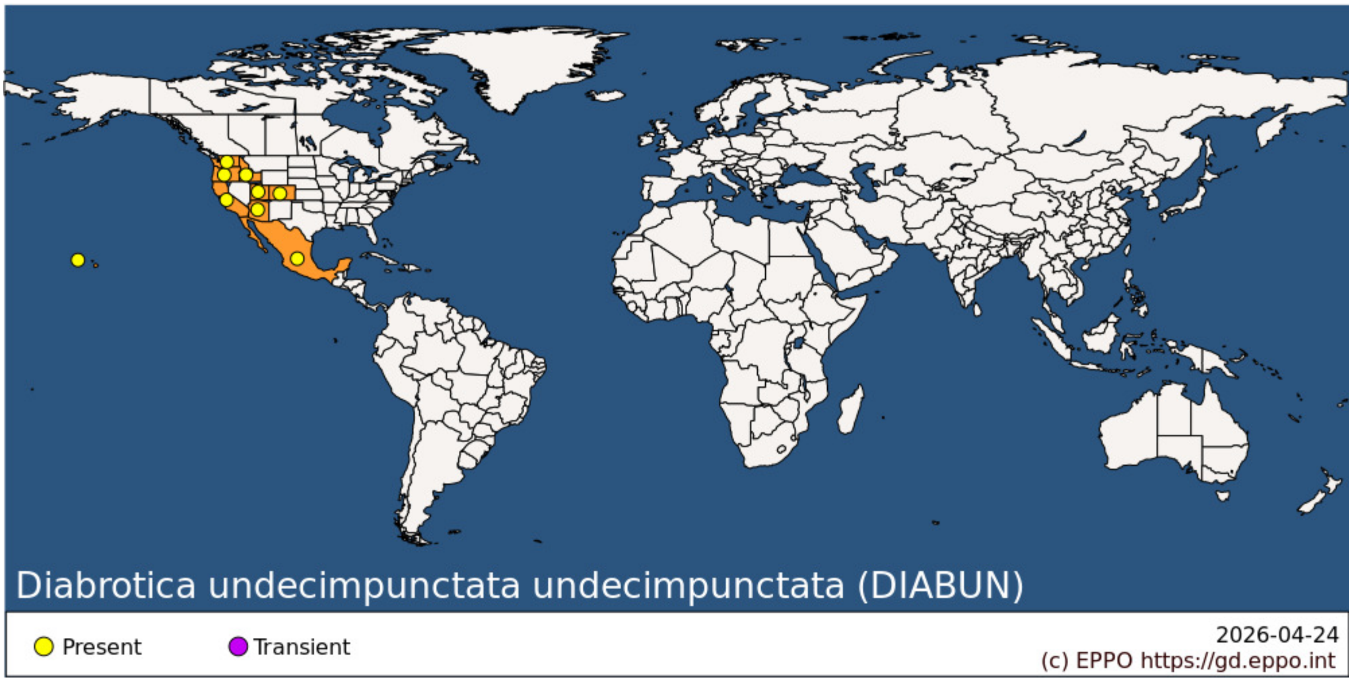
HOSTS

D. undecimpunctata undecimpunctata has a wide host range. A comprehensive list of host plants has been compiled by EFSA PLH (2020) for larvae and adults. True hosts, i.e. those on which this beetle can complete its development and reproduce, include a wide range of wild and cultivated annual plants in the families Chenopodiaceae, Cucurbitaceae, Fabaceae, Poaceae, Polygonaceae and Solanaceae (EFSA PLH, 2020). Adults are able to feed on plants in 28 additional families. However, in the field, larvae exhibit a clear preference for cucurbits (e.g. *Cucumis melo* or *C. sativus*), and adults for cucurbits and maize tassels.

Host list: *Acer sp.*, *Alcea rosea*, *Ambrosia acanthicarpa*, *Ambrosia confertiflora*, *Ambrosia psilostachya*, *Anthemis cotula*, *Arachis hypogaea*, *Arctium sp.*, *Aster sp.*, *Avena sp.*, *Baccharis pilularis*, *Bellis perennis*, *Beta vulgaris*, *Brassica oleracea*, *Brassica rapa*, *Brassica sp.*, *Calystegia sp.*, *Canna sp.*, *Capsicum sp.*, *Carduus pycnocephalus*, *Chrysanthemum indicum*, *Citrullus lanatus*, *Citrus medica*, *Citrus sp.*, *Citrus x limon*, *Citrus x limonia*, *Coreopsis sp.*, *Cosmos sp.*, *Crocus sp.*, *Cucumis melo*, *Cucumis sativus*, *Cucurbita foetidissima*, *Cucurbita pepo*, *Cucurbita sp.*, *Cynara scolymus*, *Dahlia sp.*, *Dianthus sp.*, *Dicentra sp.*, *Eleocharis palustris*, *Elymus sp.*, *Eschscholzia californica*, *Gossypium*, *Helianthus sp.*, *Hesperoyucca whipplei*, *Hordeum marinum subsp. gussoneanum*, *Hordeum sp.*, *Humulus sp.*, *Juglans regia*, *Lactuca serriola*, *Lathyrus hirsutus*, *Lathyrus odoratus*, *Leucanthemum vulgare*, *Leucanthemum x superbum*, *Lilium sp.*, *Lolium sp.*, *Malus sylvestris*, *Marah fabacea*, *Marah oreganus*, *Medicago sativa*, *Morus sp.*, *Nasturtium sp.*, *Nicotiana sp.*, *Orobanche sp.*, *Oryza sativa*, *Paeonia sp.*, *Persea americana*, *Petroselinum crispum*, *Phalaris sp.*, *Phaseolus vulgaris*, *Phleum pratense*, *Pisum sativum*, *Plantago sp.*, *Polygonum sp.*, *Primula sp.*, *Prunus armeniaca*, *Prunus domestica*, *Prunus dulcis*, *Prunus persica*, *Pyrus sp.*, *Ranunculus sp.*, *Raphanus sativus*, *Ribes sp.*, *Rorippa sp.*, *Rosa sp.*, *Rudbeckia hirta*, *Rumex sp.*, *Salsola kali*, *Scirpus sp.*, *Silybum marianum*, *Solanum lycopersicum*, *Solanum melongena*, *Solanum tuberosum*, *Sonchus sp.*, *Spinacia oleracea*, *Taraxacum sp.*, *Trifolium pratense*, *Triticum sp.*, *Tropaeolum sp.*, *Typha latifolia*, *Vicia faba*, *Vicia sp.*, *Viola sp.*, *Wisteria sp.*, *Xanthium spinosum*, *Xanthium strumarium*, *Zea mays*, *Zinnia elegans*

GEOGRAPHICAL DISTRIBUTION

The older literature did not distinguish the two subspecies (*undecimpunctata* Mannerheim and *howardi* Barber). In the distribution given below, the records of subsp. *undecimpunctata* are believed to be reliable and show its presence essentially in the southwest of North America. It is possible that some of the records in western North America given for subsp. *howardi* refer in fact to subsp. *undecimpunctata* (or both).



North America: Mexico, United States of America (Arizona, California, Colorado, Hawaii, Idaho, Oregon, Utah, Washington)

BIOLOGY

The two main subspecies of *D. undecimpunctata,* subspecies *undecimpunctata* and *howardi* have very similar biology (Metcalf and Metcalf, 1993).

Unlike *D. virgifera*, the adult is the overwintering stage. Adults hide under leaves and litter in woodland and are only active during this period when the temperature is around 15-20°C. Beetles generally overwinter only in areas with mild winters, principally the southern states of the USA and Mexico. From these areas beetles disperse northwards annually where they form transient (non-overwintering) populations. After overwintering, the adults become active in the spring and feed on wide array of flowering weeds and crop plants. They move and ?y readily from one host plant to another, including wild hosts and host crop species grown in close proximity. For example, migrations between snap beans (*Phaseolus vulgaris* L.) that provide a high protein diet for egg development in adult females, and sweet corn, the preferred larval host are mentioned by Miller (2007) in Oregon. Females lay 200 to 1200 eggs singly in the soil, close to the bases of larval host plants (see Host list). The number of eggs produced by female is quite variable in the literature, decreasing as the beetles progress from generation 1, to 2 and to 3 (Capinera, 2008). For oviposition, females prefer coarse soil or soil with cracks to fine and smooth soil; they also prefer wet over dry soil. The young larvae bore into the roots of their hosts where they feed, passing through three instars. During the latter part of the third instar, the larvae leave the host plants, burrow into the soil and enter the inactive or prepupal stage. Pupation takes place in an earthen shell. At 27°C in laboratory conditions, the average rate of development is 6.4 days for eggs, 13.2 days for larvae, 3.6 days for prepupae and 6.5 days for pupae. From egg to adult the average time for development is about 29.6 days (Rimando *et al.*, 1966). Aggregation behavior of adult is reported in overwintering sites such as in fields adjacent to corn fields (Luna and Xue, 2009).

DETECTION AND IDENTIFICATION

Symptoms

Adults feed on many plants (see host list) but symptoms are generally described on cucurbits in the literature. In spring on cucurbits, they chew holes in cotelydons and leaves and then disperse to non-cucurbit hosts to lay eggs. In summer, adults migrate back to cucurbits to feed on leaves and sometimes on soft fruits (Alston and Worwood, 2012). Symptoms are easily visible as small feeding holes and scars on runners and young fruits, but these symptoms are not specific to this species. High densities of adults may induce severe defoliation.

The larvae feed on the roots and also dig into the base of the stems of maize plants (*Zea mays*), beans, small grains (e.g. *Hordeum* sp., *Triticum* sp.) but not cucurbits. Infested maize plants usually show the effect of larval infestation of the roots when they are 20-50 cm tall. Plants grow poorly, becoming stunted and yellow, but may survive and still produce grain. If the stem is attacked, internal drilling causes the bud to wither and may cause the plant to die. Grain seedlings, particularly corn, are often damaged by larval feeding. Older plants are less susceptible to death following larval feeding (Capinera, 2008).

Morphology

Egg

Eggs are generally oval, 0.7 x 0.5 mm, light yellow when first oviposited, but become darker yellow as they age. It has been noted by Atyeo *et al*. (1964) that the surface of the egg of rootworms pests is covered with primary polygons and sometimes secondary ridges useful for specific identification using the scanning electron microscope (SEM). The subspecies of *Diabrotica undecimpunctata* are indistinguishable but are readily distinguished from *D. virgifera virgifera* and *D. virgifera zeae* because they have pits within the polygons, and from *D. barberi* because they have 14 to 20 pits per polygon (vs. 6 to 12 per polygon for *D. barberi*).

Larva

Larvae have a yellowish white, wrinkled body, 12-19 mm long, with six very small legs, and a greyish-brown head. Mendoza and Peters (1964) have provided morphological criteria to differentiate *Diabrotica undecimpunctata*, *D. virgifera* and *D. barberi* larvae. But *D. undecimpunctata undecimpunctata* and *D. undecimpunctata howardi* are not distinguishable at the larval stage.

Pupa

Length about 6.3 mm, width about 3 mm. White becoming yellow with age. The tip of the abdomen bears a pair of stout spines, and smaller spines are found dorsally on the remaining abdominal segments. There is a sexual dimorphism at the pupae stage, female pupae bearing a pair of distinctive papillae on the venter near the apex of the abdomen, whereas such papillae are lacking for males (Krysan and Miller, 1986).

Adult

Length 4.8-6.9 mm long. Elytra green, yellow or reddish-brown, maculate with 12 round black maculae, black head with filiform antennae, pronotum yellow, subquadrate, bifoveate, scutellum black. *D. undecimpunctata undecimpunctata* can be separated from other subspecies by the following features: legs and abdomen entirely black, partly pale in other subspecies. A full description of the adult is available in Derunkov *et al*. (2013).

Detection and inspection methods

Visual examination of imported commodities and soil or washing the roots and sifting soil to recover hidden stages (i.e. larvae or pupae) is possible, but the effectiveness of these methods is quite uncertain, especially in cases of very low levels of infestation. A method to distinguish between the larvae of the three species of corn rootworms using morphological characters is reported by Mendoza and Peters (1964).

Yellow sticky traps baited with chemical kairomone attractant (Hongtrakul 1997) and cucurbitacin-baited traps can be used for the monitoring of production sites (Alston and Worwood, 2012; Luna, 2006). However, the effectiveness of this trapping for the detection of very low populations has yet to be proven. Adults of *D. undecimpuncta undecimpuncta* can be identified using the diagnostic protocol for *Diabrotica virgifera virgifera* which includes a key to the adults of 13 *Diabrotica* species which occur in US agriculture (EPPO, 2017).

PATHWAYS FOR MOVEMENT

The EFSA Panel on Plant Health performed a pest categorization of *D. undecimpunctata undecimpunctata* including a full investigation of potential pathways (EFSA PLH, 2020). EFSA PLH (2020) noted that immature stages (eggs, larvae or pupae) in soil and growing media (with or without host plants) or adults on foliage or fruits are the only potential pathways involved. However, adults only feed on young fruits not ready for harvest and in addition, fly away quickly when disturbed. The probability of remaining on the foliage or fruit during handling is thus considered very low.

The adults are strong fliers, travelling readily from field to field during the summer. But their flight potential is not sufficient to spread from North America to the EPPO region. Hitchhiking behaviour cannot be excluded, as has been observed with *Diabrotica virgifera* in Europe.

Survival of immature stages on roots of true host plants, or in soil (either as a commodity on its own, or when accompanying plants for planting in international trade), is not known. But considering that the rearing of *Diabrotica* species in laboratory facilities requires experience and attentiveness of the operator and also a good knowledge of the ecological needs of the insect to promote the growth and development of the insect (Jackson, 1986), the survival rate is probably very low.

It is worth noting that *D. undecimpunctata undecimpunctata* does not seem to show any propensity to travel via international trade: Europhyt records of pest interceptions from 1995 to 2020 do not report any interceptions of this species in the EU (EFSA PLH, 2020).

PEST SIGNIFICANCE

Economic impact

Adults damage various vegetable and flower crops, especially cucurbits. In this respect, they are more significant pests than the adults of *D. virgifera* or *D. barberi*. *D. undecimpunctata undecimpunctata* is cited as the predominant *Diabrotica* species found throughout California and is one of the most common insects on a variety of weedy and cultivated plants (Goodell and Phillips, 2019). It is also the major insect pest of the Willamette Valley vegetable industry in Oregon, attacking snap beans, sweet corn, and cucurbits (Luna, 2004) or vegetable, ornamental, forage, and fruit crops west of the Rocky Mountains (Luna, 2009). Pod feeding by the spotted beetle can cause severe economic loss, and insecticides are widely used for its control. Adult feeding on lettuce and spinach is a particular problem to organic growers (Alderman, 2010). *D. undecimpunctata undecimpunctata* is more often cited as a pest of cucumber than of maize (hence its common name). In Utah, overwintering adults chew holes in cotelydons and leaves of cucurbits before dispersing to non-cucurbit hosts to lay eggs and the second generations of adults migrate back to cucurbits to feed on leaves and, sometimes, on soft fruits (Alston and Worwood, 2012).

For practical purposes, *D. undecimpunctata undecimpunctata* is often considered together with another chrysomelid *Acalymma vittata* (the striped cucumber beetle), which causes very similar damage. An economic injury level was estimate by Weinzierl (1984) and Weinzierl *et al*. (1987) on *Phaseolus vulgaris*. It was estimated at a daily average of 4.1 beetles per 10 sweeps during the 14 days preceding harvest and growers suffer considerable economic loss if pod damage exceeds 1.5 feeding scars per 100 pods. In recent years, cucumber beetle infestations in Northern California melon crops have been especially severe and foliar insecticide use to control the adults has increased (Pedersen and Godfrey, 2011). The beetle is also important as a vector of cucumber mosaic virus and muskmelon necrotic spot virus, and bacterial wilt of cucurbits (*Erwinia tracheiphila*) and of corn (*Pantoea stewartii*) (Capinera, 2008), squash mosaic virus, bean mosaic virus and maize chlorotic mottle virus (Alston and Worwood, 2012). It seems likely that the western spotted cucumber beetle can also vector pathogenic *Fusarium* species (Miller, 2007).

D. undecimpunctata undecimpunctata is also a root pest of maize: larvae can reduce root volume, cause corn lodging, or increase root rot. Greenhouse studies suggest that maize is the most suitable larval host (Pedersen and

Godfrey, 2011). For example, this species is the predominate *Diabrotica* species to attack sweet corn in the Willamette Valley of Oregon (Miller, 2007). In general, this species is, though, of lesser importance on corn than the related *D. virgifera* and *D. barberi*. The larvae are also pests of many other crops, including nursery crops.

Control

On vegetable, fruit, and nursery crops pesticides are commonly used to control adults (Alderman, 2010), mainly to protect plants at the cotyledon stage and allow a good stand to establish, but also as foliar applications to prevent transmission of bacteria and viruses. Because of the relative simplicity of adding an insecticide to the 'tank mix' of fungicide being applied for white mould control, bean growers in Oregon achieved relatively effective control of *D. undecimpunctata undecimpunctata*. It has been noted in the USA that beetles aggregate along the edge of the snap bean fields next to the sweet corn (Luna & Xue, 2009). Spraying the edges of bean fields shows potential for significant pesticide reduction, as well as reducing risk of economic loss from crops harvested from the highly aggregated areas.

If heavy infestation by larvae is foreseen, planting time application of granular insecticides, applied in a band over the row, is often recommended for protection of plant roots. Control techniques used in North America include such treatment with e.g. terbufos or isofenphos (Sutter *et al.*, 1990).

There is currently interest among many vegetable growers for IPM strategies to limit pesticide inputs.

The incidence of corn rootworms is limited by rotation of maize with other crops (in North America, typically soybean) and late planting into land that has been ploughed earlier in the spring and applying granular baits containing cucurbitacin arrestants, which control adults when broadcast just before egg laying.

Integrated pest measures for cucumber beetles fall into several categories: visual survey and sticky traps are used to detect western spotted cucumber beetle populations and take pest management decisions. Economic thresholds depend on the type of cucurbit, age of plants and susceptibility to bacterial wilt. For example, Cornell University recommends crop scouting twice a week, with emphasis on the inspection of young cucurbit plants with fewer than five leaves. These population counts are used to calculate the average number of beetles per plant. One beetle per plant is the threshold for treating cucurbits in the Midwest, especially with melons and cucumbers, to prevent excessive loss from bacterial wilt (Lam and Forster, 2005 cited by Diver and Hinman, 2008). Trap and kill technologies are under development (Alderman, 2010). A three-component trap has been developed, consisting of a kairomone lure, a physical trap, and a cucurbitacin food source baited with a toxin located inside the trap. More research is needed to avoid a too rapid degradation of kairomone and cucurbitacin in field conditions and to improve the trap design, placement and density (Luna, 2006). Varietal resistance is sought in cucurbits and groundnut in particular. Early ploughing removes vegetation and discourages egg laying. Transparent screens can be used to exclude the beetles from cucurbit crops. Early trap plantings of cucurbits can be used to attract adults, which are then destroyed with insecticides.

Parasites and predators seem to be of little importance in California (Smith and Michelbacher, 1949). The tachinid parasitoid *Celatoria diabroticae* (Shimer), one or more mermithid nematodes or the fungus *Beauveria* are involved in the natural control of the western spotted cucumber beetles (Weinzierl, 1984; Capinera, 2008). Several strains of *Bacillus thuringiensis* have an insecticidal activity against *D. undecimpunctata undecimpunctata* (Lambert *et al.*, 1994).

Phytosanitary risk

The predicted distribution of *D. undecimpunctata undecimpunctata* was estimated by Marchioro and Krechemer (2018) using a machine-learning algorithm (MaxEnt) with ten predictors (Environmental variables). The predicted optimal climatic areas with hosts present include a large part of Western Europe, but also a portion of North Africa, as well as a large part of the eastern Mediterranean region. Existing experience of the spread of *D. virgifera* strongly suggests that *D. undecimpunctata undecimpunctata* would rapidly spread in the EPPO region if it entered and suggests that it could be damaging in large parts of this region. *D. undecimpunctata undecimpunctata* feeds on ?eld crops and moves between crops and wild vegetation; it regularly migrates between lowlands and foothills. Adults of this species are, more than in the case of *D. virgifera* and *D. barberi*, associated with damage to cucurbit and other vegetable or flower crops, and can vector bacterial and viral diseases. *D. undecimpunctata undecimpunctata* is not expected to establish in greenhouses if it were to enter the EU (EFSA PLH, 2020). The spread of *Diabrotica* to the areas identified as suitable may represent a significant threat to farmers because the damage caused by larvae and adults on roots and aerial parts of plants may result in severe economic losses (Marchioro and Krechemer, 2018).

PHYTOSANITARY MEASURES

Considering that adults actively ?y and are unlikely to remain on the plants during harvesting or transatlantic trade, phytosanitary measures at import should focus on true host plants with roots and soil where immature stages could be present.

Requirements for the production of host plants with roots and soil could be based on the production in pest free areas or in a pest free place/site of production (e.g. under complete physical isolation) (EFSA PLH, 2020). In particular, a number of EPPO countries already require that plants for planting should be accompanied by a phytosanitary certificate to enter their territory, indicating that these plants have been inspected and are free from quarantine pests prior to entry (EU, 2019). In case of entry on such plants, the following additional measures could be ordered: chemical treatments of consignments, processing under specified conditions or storage in a modified atmosphere.

Relevant management measures could also include the prohibition of the introduction of soils and growing media as such into the EPPO region. Such import from North America is already prohibited by a number of EPPO countries (EU, 2019).

Even if current national regulations in the EPPO region are not always comprehensive of the true host range of *D. undecimpunctata undecimpuncatata*, phytosanitary measures are widely applied to plants for planting and soil and the entry pathways can be considered as partially closed.

REFERENCES

Alderman K (2010) Developing trap and kill technologies to improve management of the western spotted cucumber beetle (*Diabrotica undecimpunctata undecimpunctata*) and the western Striped cucumber beetle (*Acalymma trivittatum*). Undergraduate Thesis - Oregon State University. 25pp.

Alston D & Worwood D (2012) Western striped and western spotted cucumber beetles. *All Current Publications*. Paper 987. Available at https://digitalcommons.usu.edu/extension_curall/987 [accessed on 2021-03-31]

Atyeo WT, Weekman GT & Lawson DE (1964) The identification of *Diabrotica* species by chorion sculpturing. *Journal of the Kansas Entomological Society* **37**(1), 9-11.

Barber HS (1947) *Diabrotica* and two new genera. *Proceedings of the Entomological Society of Washington* **49**, 151-161.

Becker SC & Meinke LJ (2008) A technique to morphologically differentiate larvae of *Diabrotica virgifera virgifera* and *D. barberi* (Coleoptera: Chrysomelidae). *Journal of the Kansas Entomological Society* **81**, 77-79.

CABI/EPPO (1998) *Diabrotica undecimpunctata*. *Distribution Maps of Plant Pests* **580**. CAB International, Wallingford (GB).

Capinera JL (2008) Encyclopedia of entomology, 2nd ed., Vol. 1-4, Springer Science and Business Media, New York: 4346 pp.

Derunkov A, Konstantinov A, Tishechkin A, Hartje L & Redford AJ (2013) Diabrotica ID: Identification of *Diabrotica* species (Coleoptera: Chrysomelidae) from North and Central America. USDA APHIS PPQ Center for Plant Health Science and Technology, USDA Agricultural Research Service, University of Maryland, and Louisiana State University. Available at http://idtools.org/id/beetles/diabrotica/ [accessed on 2021-03-31]

Diver S & Hinman T (2008) Cucumber beetles: organic and biorational integrated pest management. ATTRA – National Sustainable Agriculture Information Service. 20pp.

EFSA PLH (Panel on Plant Health) (2020) Bragard C, Dehnen Schmutz K, Di Serio F, Gonthier P, Jacques M?A, Jaques Miret JA, Justesen AF, Magnusson CS, Milonas P, Navas Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H?H, Van der Werf W, Civera AV, Yuen J, Zappalà L, Kertész V, Streissl F and MacLeod A. Scientific Opinion on the pest categorisation of *Diabrotica undecimpunctata undecimpunctata*. *EFSA Journal* **18**(10), 6291, 26 pp. https://doi.org/10.2903/j.efsa.2020.6291

EPPO/CABI (1997) *Diabrotica barberi* and *Diabrotica virgifera*. In *Quarantine Pests for Europe* (2nd ed), pp. 233-237. CAB International, Wallingford (GB).

EPPO (2017) EPPO Standard PM 7/36 (2) Diagnostics. *Diabrotica virgifera virgifera*. *EPPO Bulletin* **47**, 164-173.

EU (2019) Commission implementing Regulation (EU) 2019/2072 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/201. Official Journal of the European Union L319 (2019).

Goodell PB & Phillips PA (2019) A field key to the cucumber beetle species found in California. University of California. Agriculture & Natural Resources. 4pp.

Hongtrakul T (1997) Attractivity of plant volatiles and a semichemical-based bait to the western spotted cucumber beetle, Diabrotica undecimpunctata Mannerheim (Coleoptera: Chrysomelidae). Thesis of the Oregon State University. 54pp.

Jackson JJ (1986) Rearing and handling of *Diabrotica virgifera* and *Diabrotica undecimpunctata howardi*. In Methods for the study of pest *Diabrotica* (pp. 25-47). Springer, New York, NY.

Krysan JL & Miller TA (1986) *Methods for the study of pest Diabrotica*. Springer-Verlag, New York, USA.

Lambert BJ, Jansens SK & Peferoen M (1994) U.S. Patent No. 5,369,027. Washington, DC: U.S. Patent and Trademark Office.

Luna JM (2004) Trap cropping and removal trapping to enhance control of western spotted cucumber beetle in vegetable crops. College of Agricultural Sciences - Oregon State University. 14pp.

Luna JM (2006) Development of an IPM program for western spotted cucumber beetle in vegetable cropping systems. A report to the Oregon processed vegetable growers and the agricultural research foundation. 7pp.

Luna JM & Xue L (2009) Aggregation behavior of western spotted cucumber beetle (Coleoptera: Chrysomelidae) in vegetable cropping systems. *Environmental entomology* **38**(3), 809-814.

Marchioro CA & Krechemer FS (2018). Potential global distribution of *Diabrotica* species and the risks for agricultural production. *Pest management science* **74**(9), 2100-2109.

Mendoza CE & Peters DC (1964) Species differentiation among mature larvae of *Diabrotica undecimpunctata howardi, D. virgifera*, and *D. longicornis*. *Journal of the Kansas Entomological Society* **37**(2), 123-125.

Metcalf RL & Metcalf RA (1993) *Destructive and Useful Insects: their Habits and Control* (5th ed). McGraw-Hill, New York (US).

Michelbacher AE, MacLeod GF & Smith RF (1941) A preliminary report on control of the western twelve-spotted cucumber beetle in orchards. *Journal of Economic Entomology* **34**(5), 709-716.

Miller NL (2007) Responses and relationships among *Fusarium* species, sweet corn, and western spotted cucumber beetles. Thesis of the Oregon State University. 135pp.

Pedersen AB & Godfrey LD (2011) Field and vegetable crops as hosts of larval western spotted cucumber beetle (Coleoptera: Chrysomelidae). *Environmental entomology* **40**(3), 633-638.

Rimando LC, Corey RA, & Sun YP (1966) Mass rearing of the western spotted cucumber beetle. *Journal of Economic Entomology* **59**(1), 230-231.

Smith RF & Michelbacher AE (1949) The development and behavior of populations of *Diabrotica 11-punctata* in foothill areas of California. *Annals of the Entomological Society of America* **42**(4), 497-510.

Sutter GR, Fisher JR, Elliott NC & Branson TF (1990) Effect of insecticide treatments on root lodging and yields of maize in controlled infestations of western corn rootworms. *Journal of Economic Entomology* **83**, 2414-2420.

Tubbs PK (1991) *Diabrotica undecimpunctata* Mannerheim, 1843 (Insects, Coleoptera): proposed conservation of the specific name, and of the subspecific name howardi Barber, 1947. *Bulletin of Zoological Nomenclature* **48**(3), 219-221.

Weinzierl RA (1984) Sampling methods and injury thresholds for western spotted cucumber beetle in snap beans. Thesis of the Oregon State University. 125pp.

Weinzierl RA, Berry RE & Fisher GC (1987) Sweep-net sampling for western spotted cucumber beetle (Coleoptera: Chrysomelidae) in snap beans: spatial distribution, economic injury level, and sequential sampling plans. *Journal of economic entomology* **80**(6), 1278-1283.

ACKNOWLEDGEMENTS

This datasheet was extensively revised in 2021 by Philippe Reynaud. His valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2026) *Diabrotica undecimpunctata undecimpunctata*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int

Datasheet history

This datasheet was first published in the EPPO Bulletin in 1999 and is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', 'Hosts', and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

EPPO (1999) EPPO Data sheets on quarantine pests - *Diabrotica undecimpunctata*. *EPPO Bulletin* **29**(4), 477-482. https://doi.org/10.1111/j.1365-2338.1999.tb01422.x

Co-funded by the European Union