EPPO Datasheet: *Epitrix cucumeris*

Last updated: 2020-10-16

IDENTITY

Preferred name: *Epitrix cucumeris*
Authority: (Harris)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Chrysomelidae
Common names: potato flea beetle
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EU Categorization: Emergency measures
EPPO Code: EPIXCU



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Notes on taxonomy and nomenclature

Flea beetles are classified by some authors in a separate subfamily (Alticinae) of the family Chrysomelidae, but others place the group in a tribe (Alticini) of the subfamily Galerucinae. The genus *Epitrix* Foudras comprises to date 162 described flea beetle species worldwide (Bienkowski & Orlova-Bienkowskaja, 2017), and many undescribed species (Deczynski, 2016). The majority of the described *Epitrix* species are of American origin (Döberl, 2000) and most are native to the neotropics (Deczynski, 2016). A few *Epitrix* species are associated with potato, such as the North American species *Epitrix tuberis* (tuber flea beetle), *E. cucumeris* (potato flea beetle), *E. similaris* (no common name), *E. subcrinita* (western potato flea beetle) (Gentner, 1944), the South American species *E. yanazara*, *E. ubaquensis* and *E. hilariana rubia* (collectively named 'pulguilla saltona') (Alcázar, 1997), and *E. papa*, with unknown origin and introduced in Europe.

E. cucumeris was initially considered to be a widespread species in the USA, present from the west to the east coast in potato production zones, until Gentner (1944) discovered that three different *Epitrix* species were being misidentified as a single species. The two other species identified by Gentner are *E. tuberis* and *E. similaris*. *E. tuberis* was found to be distributed in the west and mostly associated with tuber damage, whereas *E. cucumeris* was found to be distributed in the east and associated with foliar damage. Consequently, some of the earlier observations on economic importance, hosts, distribution and biology reported for *E. cucumeris* may be doubtful (Gentner, 1944; Morrison *et al.*, 1967; Clark *et al.*, 2004). The species was detected in Azores around 1979 and misidentified as a new species, *E. azorica* (Gruev 1981; Döberl, 2000). In mainland Portugal, where *E. cucumeris* is often found together with *E. papa*, field observations may be reported collectively as *Epitrix* spp. given the impossibility of distinguishing the species in the field.

HOSTS

E. cucumeris is associated with solanaceous hosts, as is the case for all other *Epitrix* species, the adults feeding on the foliage and the larvae on the roots (Doguet, 1994). The adults of *E. cucumeris* may feed temporarily on plants from other botanical families, which are not suitable for their multiplication, when their solanaceous hosts are not available (Clark *et al.*, 2004).

The most economically important hosts for *E. cucumeris* are potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum*), aubergine (*Solanum melongena*), sweet pepper (*Capsicum annuum*), and tobacco (*Nicotiana tabacum*) (Clark *et al*., 2004). The species has a wide host-range of solanaceous hosts, in particular in the genus *Solanum* and *Physalis*, but also develops on jimsonweed (*Datura stramonium*), and on ornamental *Petunia* hybrids (Clark *et al*., 2004). In laboratory experiments, *E. cucumeris* multiplied on potato, tomato, aubergine, jimsonweed (*D. stramonium*), and black nightshade (*Solanum nigrum*) but surprisingly not on sweet pepper plants (*Capsicum annuum*), and it produced considerably more offspring on black nightshade than on the remaining host plant species (Boavida *et al*.,

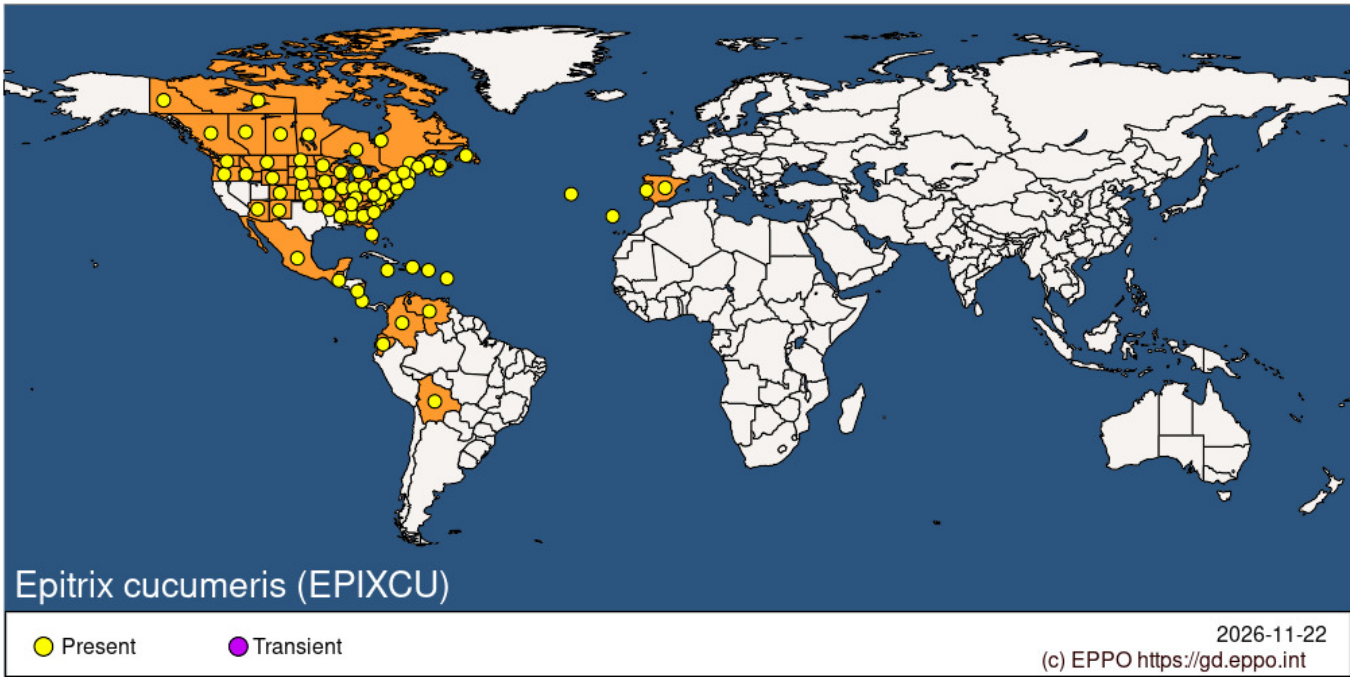
2013).

In addition, Clark *et al.* (2004) compiled a list of numerous non-solanaceous plants reported by different authors, but believed that some of these associations are occasional in time, and that some others are doubtful, either because they are based on misidentifications of *E. cucumeris*, or because the presence of the pest on a non-host-plant was incidental.

Host list: *Alkekengi officinarum*, *Atropa belladonna*, *Capsicum annuum*, *Datura stramonium*, *Nicotiana tabacum*, *Petunia axillaris*, *Petunia hybrids*, *Petunia*, *Physalis angulata*, *Physalis longifolia*, *Physalis peruviana*, *Physalis pubescens*, *Solanum americanum*, *Solanum carolinense*, *Solanum dulcamara*, *Solanum lycopersicum*, *Solanum melongena*, *Solanum montanum*, *Solanum nigrum*, *Solanum physalifolium*, *Solanum pseudocapsicum*, *Solanum retroflexum*, *Solanum rostratum*, *Solanum torvum*, *Solanum tuberosum*

GEOGRAPHICAL DISTRIBUTION

E. cucumeris is native from North America, and is widely distributed in the American continent, from Bolivia to Canada. The first record of this species in the EPPO region was in 1979 in the North Atlantic island of Faial (archipelago of Azores, Portugal) (Gruev, 1981; Döberl, 2000). Later, in 2008, the species was detected for the first time in mainland Europe, in Portugal, north of Porto, from where it spread southwards to other locations in Portugal (Boavida & Germain, 2009; Doguet, 2009). *E. cucumeris* was also accidentally introduced into the Island of Madeira (Portugal) around 2001 (Gruev & Döberl. 2005). In 2017, the species was detected in Spain for the first time, in Jerez de la Frontera (Cadiz, Andalucia) (MAPAMA, 2019).



EPPO Region: Portugal (mainland, Azores, Madeira), Spain (mainland)
North America: Canada (Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Northwest Territories, Nova Scotia, Nunavut, Ontario, Prince Edward Island, Québec, Saskatchewan, Yukon Territory), Mexico, United States of America (Alabama, Arizona, Arkansas, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming)
Central America and Caribbean: Costa Rica, Dominican Republic, Guadeloupe, Guatemala, Jamaica, Nicaragua, Puerto Rico
South America: Bolivia, Colombia, Ecuador, Venezuela

BIOLOGY

The general life cycle and the behavior of *E. cucumeris* on potato are similar to those of *E. papa* and *E. tuberis*. There is a certain degree of uncertainty concerning the developmental and reproductive data published for *E. cucumeris*, because most of the related studies were carried out before *E. tuberis* was described and distinguished from *E. cucumeris* (Gentner, 1944). A few of these early studies can be assigned retrospectively to *E. tuberis*, on the basis of geographic distribution and type of damage, such as those carried out in Colorado by Hoerner & Gillette (1928), in Nebraska by Hill & Tate (1942), and by Jones (1944) in Eastern Washington, whereas the study carried out in Virginia by Anderson and Walker (1934) most likely concerns *E. cucumeris*.

The adults of *E. cucumeris* feed on the leaves and the larvae feed on the roots of their host plants. In the Eastern parts of the USA, *E. cucumeris* has one generation per year on potato and possibly a partial second one (Britton, 1918; Anderson & Walker, 1934; Loyola, 1949; Hoffman *et al.*, 1999). In autumn, the adult flea beetles overwinter near fields that were planted with potatoes the previous season, buried in the soil or under leaf litter and other debris (Hoffman *et al.*, 1999). In spring, when the temperature warms up, the adults become active, and start feeding on alternative host plant species available, until the potato plants develop. The females lay the eggs below the soil surface, close to the stems of the host plants. After the eggs hatch, the larvae move to the root parts, where they feed and develop through several instars. The embryonic development is completed on average in 6 days and the larval development takes 13 to 15 days (Anderson & Walker, 1934). When fully-grown, the larvae stop feeding, abandon the roots and tubers, and build a pupation cell with soil particles in which they will metamorphose into an adult. Pupation lasts 11-13 days and the development time from egg to adult requires an average of 32 days (Anderson & Walker, 1934).

DETECTION AND IDENTIFICATION

Symptoms

Both larvae and adults have chewing mouthparts. The adults riddle the leaves of their host plants with small circular holes (1.0-1.5 mm diameter) that produce the characteristic ‘shot-hole’ symptom in the foliage, which is common to all *Epitrix* species.

In Manitoba (Canada) adults are considered to be the most injurious stage for potato, with the larvae feeding mostly on rootlets and rarely damaging tubers (Pernal, 1992; Senanayake *et al.*, 1993), and in Connecticut (USA) Loyola (1949) states that the larvae rarely infested the tubers. But when present, tuber damage consists of shallow scars and fine superficial tunneling (Hoffman *et al.*, 1999; Foster & Obermeyer, 2017), with small pin-holes extending inwards from the surface, sometimes up to 1.2 cm, where the larva had mined (Britton, 1918). These lesions may become rugose and pimply if associated with scab infection. Indeed, potato flea beetle lesions have been claimed to favour the transmission of different pathogens (Hoffman *et al.*, 1999), and Schaal (1934) demonstrated that *E. tuberis* larvae could transmit the common scab fungus (*Streptomyces scabies*) from the soil into the tubers. This could also be the case for *E. cucumeris.*

Morphology

The genus *Epitrix* is a group of small flea beetles with uniform appearance which can be recognized by the presence of elytral punctures arranged into rows, and characteristic rows of erect setae on the intervals (Döberl, 2000; EPPO, 2017a). The morphological identification to species is made by specialists, on the basis of the *habitus* and *genitalia* of the adult insects. The identification keys and illustrations presented in EPPO Standard PM 7/109 (2) (EPPO, 2017a) allow *E. cucumeris* to be distinguished from the related potato species *E. tuberis*, *E. papa* and *E. subcrinita*.

Eggs

The eggs are minute, elliptical and white, when first laid, 0.4 – 0.5 mm long, and approximately 0.2 mm wide (Pernal, 1992)

Larva

The newly hatched larva is white, threadlike, with three pairs of legs, and approximately 1.0 mm long. The full-grown larva is white, with the head and thoracic shield light brown, and approximately 3.5 to 4.5 mm in length (Pernal, 1992).

Pupa

The pupa is pearly white when newly formed and approximately 2.5 mm long and 1.5 mm wide.

Adult

The adults are small black beetles, 1.6-2.0 mm long, with rows of punctures along the elytra arranged into striae and one row of white setae between elytral striae (Deczinsky, 2016; EPPO, 2017a).The hind femurs are enlarged, adapted to jumping.

Detection and inspection methods

Detection is made by visual inspection of the foliage of potato or other host plants, looking for shot-hole symptoms and adult flea beetles. On potato, the tubers are inspected visually for symptoms of larval injury (EFSA, 2019), namely those described in the symptoms section (shallow trails, fine superficial tunneling in the form of pin-holes, rugose or pimply surface (Britton, 1918; Anderson & Walker, 1934). Detection of larvae is practically impossible in the field, however Anderson & Walker (1934) observed larvae feeding with their heads inside the tuber and the abdomen protruding outside.

These symptoms are not specific for *E. cucumeris* and the identification of the species requires the collection of insect specimens for analysis. Adult specimens may be collected with a sweep-net or with a mouth aspirator. The larvae are very difficult to detect and collect because of their small size and translucent colour, and also because of their feeding behaviour.

The identification of all *E. cucumeris* life stages can be made reliably by non-specialists, using molecular methods (DNA barcoding on cytochrome c oxidase subunit I (COI) gene) (EPPO, 2016a; Germain *et al*., 2013; Mouttet *et al.*, 2019). Reference sequences for this species are available in EPPO-Q-bank and BOLD databases.

PATHWAYS FOR MOVEMENT

Short distance dispersal of *E. cucumeris* is by flight, jumping and walking. The main pathway for long distance spread is through the commercial transport of potato tubers (seed or ware potatoes), when associated with soil and plant debris (EPPO, 2016b; 2017a). When potatoes are harvested from an infested field, adults and pupae of *E. cucumeris* may be present in the stubble and soil, and larvae in the tubers. Adult beetles may be carried passively on the surface of potatoes, or with the soil adhering to potato tubers. This possibility would be higher in exports of seed potatoes, because potatoes are not washed. However, there are no reports to date of *E. cucumeris* larvae being detected inside potatoes exported from infested zones, and it is possible that the larvae leave the tubers after these are dug up, as reported by Fulton & Banham (1962) for the similar species *E. tuberis*.

PEST SIGNIFICANCE

Economic impact

Early season foliar damage by adult flea beetles may be potentially destructive to newly emerged plants of solanaceous crops, such as potato, tomato, sweet pepper, aubergine, and others, because leaf feeding by the adults may cause the leaves to whither and the plantlets to die (Foster & Obermeyer, 2017; Bessin, 2019). These early season infestations are controlled by insecticides (Hoffman *et al.*, 1999). Later, with the crops established, the vigorous plant growth normally outpaces the reduction of foliar surface by the adults and, in potato, the yield is not

affected, unless extremely high population levels occur, such as that which would cause 30-40 holes per leaflet, which can result in plant death under hot and dry weather conditions, and may require specific treatments (Hoffman *et al.*, 1999).

There is no consensus on the importance of potato tuber damage caused by *E. cucumeris* larvae. Some authors suggest that *E. cucumeris* larvae feed primarily on the potato roots and rarely infest the tubers (e.g. Loyola, 1949; Pernal, 1992; Foster & Obermeyer, 2017; Bessin, 2019), and this possibility might support the evidence reported by Boavida & Germain (2009) that in the Island of Faial (Azores, Portugal) thirty years after *E. cucumeris* was detected, no tuber damage had been recorded. In contrast, other authors report that the larvae feeding on potato tubers may cause roughness, pits, and trails on the surface of the tuber, as referred to by Foster & Obermeyer (2017). In laboratory experiments, larvae of *E. cucumeris* were observed feeding on both the roots and the small immature tubers of the potted plants (Boavida *et al.*, 2013).

Control

Where *E. cucumeris* is considered a threat, control relies on preventive cultural methods and insecticide treatments. Early season infestations in potato are controlled in the USA by insecticides used against *L. decemlineata* , but where severe mid- to late-season infestations occur, specific treatments may be required (Anderson & Walker, 1934; Hoffman *et al.*, 1999). An indicative threshold of >50 flea beetles/25 sweeps is used to recommend the treatment of young potato plants (Hoffman *et al*., 1999). For emerging pepper and aubergine crops (< 7 cm tall plants) a spray is recommended when the threshold of two potato flea beetles per plant is reached (Hoffman *et al.*, 1999). However, as for the flea beetle species *E. papa* and *E. tuberis*, cultural methods, namely crop rotation with non-solanaceous crops, and control of volunteer host crop plants and weeds is essential for keeping the populations at manageable levels (Hoffman *et al.*, 1999). In Portugal, the populations of *E. cucumeris* and *E. papa* were drastically reduced after these control measures were implemented in potato production. Based on experience, a national regulatory control system for *Epitrix* species damaging potato tubers was developed (EPPO, 2016b). No damage thresholds exist yet for *E. cucumeris* and *E. papa* in Portugal and Spain and the mandatory treatments in the demarcated areas stipulated by the Commission Implementing Decision 2012/270/EU of 16 May 2012 (EU, 2018) against these *Epitrix* species are recommended to start very early in spring, as soon as the overwintered beetles start colonizing the early potato crops (DGAV, 2018; 2019; MAPAMA, 2019). The negative impact of these early season treatments on beneficial insects can be mitigated if the treatments are directed to specific spots or rows infested by the beetles, avoiding spraying the entire field. Indeed, in well rotated fields the overwintered colonizing beetles tend to settle and feed initially on the border rows of the crop (Cusson *et al.*, 1990).

Phytosanitary risk

The very wide distribution of *E. cucumeris* in North and Central America and in South Europe indicates that it could find suitable climatic conditions in Europe and the Mediterranean part of the EPPO region. One could expect it to establish in all of the potato-growing areas of Central and Northern Europe (EPPO, 2011).

Since *E. cucumeris* can be controlled chemically, its presence could lead to a generalized use of insecticides on potato, rather than the occasionally targeted use against *L. decemlineata*, as at present in most EPPO countries. The problem would arise even more acutely in countries where *L. decemlineata* has not been introduced (EPPO, 2011). Furthermore, the control of *E. cucumeris* could be critical in several EPPO countries, namely in a majority of the EU countries, where insecticides used in North America are no longer authorized.

PHYTOSANITARY MEASURES

The import of seed potatoes from third countries is prohibited in several EPPO Countries, namely in the EU (EU, 2016), but sometimes authorized under derogation procedures, e.g. from Canada into the EU (EU, 2003).

Following the risks identified in a Pest Risk Analysis carried out by EPPO on *Epitrix* species damaging to potato tubers (EPPO 2011), specific requirements related to *E. cucumeris, E. papa, E. subcrinita* and *E. tuberis* are recommended in the EPPO potato Standard PM 8/1 (2) (EPPO, 2017b) for the international trade of seed potatoes (except micropropagative material and minitubers) and ware potatoes. This Standard recommends that seed and ware

potatoes should be washed or brushed so that they are free from plant debris and have no more than 0.1% w/w of soil remaining, and where appropriate subject to transitional arrangements (pest-free area for *E. cucumeris* and origin from a pest-free potato production and distribution system for the pest, according to EPPO Standard PM 3/61 (2) (EPPO, 2019). For ware potatoes this Standard recommends that potatoes should either (a) originate from a pest-free area for *E. cucumeris* according to EPPO Standard PM 3/61 (EPPO, 2019) or that (b) measures as described in EPPO Standard PM 9/22 (EPPO, 2016) for *E. cucumeris* have been implemented to ensure that there is no risk of spreading this pest, or (c) there should be absence of plant debris and no more than 0.1% w/w of soil present.

Additional requirements are recommended for soil or growing medium attached to rooted host plants from countries where *E. cucumeris* occurs (removal of soil and growing media, or production in a pest free area, or in a pest-free place under protected conditions, or production under screened greenhouse conditions with appropriate monitoring in the framework of a bilateral agreement) (EPPO, 2011).

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Datasheet history

This datasheet was first published in the EPPO Bulletin in 2005 and revised in 2020. It 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.

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