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**Short Review Paper**

# Chemical and ecological control methods for *Epitrix* spp.

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**ABSTRACT:** Very little information exists in regards to the control options available for potato flea beetles, *Epitrix* spp. This short review covers both chemical and ecological options currently available for control of *Epitrix* spp. Synthetic pyrethroids are the weapon of choice for the beetles. However, the impetus in integrated pest management is to do timely (early-season) applications with something harsh which will give long-term protection at a time when there are not a lot of beneficials in the field. Finding the balance for control of *Epitrix* spp. is proving difficult.

**Key words:** *Chemical control; Epitrix spp.; Potato crops; Pesticide sprays*

## INTRODUCTION

The genus *Epitrix* (Coleoptera: Chrysomelidae: Alticinae) comprises nearly 180 species worldwide. Most of the species occur in the neotropics (130) and only 12 and 17 species are known from North America and Europe, respectively (Doeberl, 2000). *Epitrix* species feed mainly on plants from the family Solanaceae, though they may feed on other plant families when their preferential host is not available (e.g. Chenopodiaceae, Cucurbitaceae, Fabaceae (European and Mediterranean Plant Protection Organization (OEPP/EPPO), 2005). The adults feed above-ground on the leaves of their host-plants. The females lay eggs at the base of the stem, and the larvae develop underground, on the root system. In the American continent, several *Epitrix* species which are very similar in appearance have been associated with potato damage. In the USA and Canada, the most damaging to potato tubers is the tuber flea beetle *E. tuberis* Gentner (Gentner, 1944; Morrison *et al*., 1967; Seeno and Andrews, 1972; Vernon and Mackenzie, 1991a, 1991b; Kabaluk and Vernon, 2000; Antonelli and Davidson, 2001; Ambrosino, 2008), which is a well studied species. Three other species were also reported in the USA on potato, namely *Epitrix cucumeris* (Harris), *Epitrix similaris* Gentner and *Epitrix subcrinita* (LeConte), but their impact on tubers is lesser/poorly known.

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In North America, where they are native pests, *Epitrix* spp. can be well controlled with insecticides although the timing of spray applications is critical. Monitoring programmes and thresholds for sprays have therefore been developed. Sprays may be justified when there is more than 1 adult feeding hole on a leaf per 10 plants, or more than 1 beetle per 10 net sweeps (Agriculture and Agri-Food Canada, 2005). In the USA, chemical treatments are initiated following the first finding of adults and can continue through the cropping season. Such regular insecticide spray programmes applied to potato in North America limit populations of adult *Epitrix* spp. and prevent serious damage due to adult feeding. Soil treatments with granular formulations can be applied against the larvae, but these are relatively costly (Smith *et al*., 1997). Many of the products used in the USA are, however, not available in the UK and other parts of Europe.

In the early 1930's products such as sodium aluminium fluoride, barium fluosilicate, Paris green, Red A soap with Black Leaf 40, Penetrol with Black Leaf 40 and pyrethrum soap were used on potatoes on the eastern shore of Virgina (Anderson and Walker, 1937). Specific chemical control against *E. cucumeris* is uncommon. Adults are generally controlled by insecticides applied against other pests, in particular *Leptinotarsa decemlineata.* Therefore, *E. cucumeris* is easily controlled. Occasionally, specific spray treatments are applied against adults when a threshold is reached.

It was noted that resistance to previously used insecticides appeared rapidly in the USA after 5-6 generations (Kring, 1958), so similar problems may arise with the use of more modern insecticides. Cultural methods may favour control, such as keeping the fields free from weeds which can host the pest, and destroying plant residues to hamper survival during overwintering. McLeod *et al*., (2002) found that spinosad was very effective against *E. fuscula*, the eggplant flea beetle, offering a viable alternative to carbamate and pyrethroid insecticides. They also found that thiamethoxam and chlorfenapyr offer high levels of toxicity towards *E. fuscula*. Vernon and Mackenzie (1991a) demonstrated that foliar sprays of bifenthrin, cyfluthrin, cypermethrin and deltamethrin were key components of *E. tuberis* management programmes. They showed that pyrethroids generally resulted in beetle mortality for longer periods of time than did the nonpyrethroids carbaryl, endosulfan, chlorpyrifos and methamidophos. Several pyrethroids provided residual beetle control for up to 7 days after applications.

In Portugal, the worst economic damage occurred in 2008 when whole consignments of potatoes sent for processing in France, Spain and other countries were rejected. In 2009, growers applied additional early sprays of insecticides (mainly the neonicotinoid insecticide, acetamiprid and the synthetic pyrethroid, bifenthrin) and there were fewer reports of economic tuber damage (Boavida *et al*., 2013). Field observations suggest that if 2-3 early insecticide sprays are applied in addition to early applications for the normal Colorado beetle spray programme, the tuber damage is usually kept below 2-3%. However when no insecticide sprays are applied, 80% tuber damage can commonly occur. In the UK, ware crops receive on average only one insecticide spray and if *Epitrix* potato flea beetles were to become established, insecticide inputs would undoubtedly have to increase, especially for crops where market requirements dictate that even low levels of tuber damage are deemed unacceptable (Malumphy et al., 2010; Eyre and Giltrap, 2012; Cuthbertson, 2014). Other important elements of control include the maintenance of an adequate rotation between potato crops (3 years) and the control of volunteers and host weeds during the intervening period.

At present, the use of botanical insecticides in the regulation of several pests in crops is gaining interest (Isman, 2006). The plant extracts obtained from the Neem tree (*Azadirachta indica*) have been the most studied in the last few years. Their effectiveness is widely proved in the control of insects, acari, and nematodes (Hernández *et al*., 1999). There are also a few studies on the cowpea crop, proving the use of natural extracts in the regulation of leafhopper and chrysomelid populations. Yabar (1980) showed that deltamethrin (Decis) gave excellent initial and long-lasting control of *Epitrix* spp. and was not harmful to predacious carabids that exercised a degree of biological control. In the study it was shown that organophosphorus compounds gave good control of *Epitrix* but had an adverse affect on populations of carabids. Malathion was shown to be non-harmful to carabids but did not afford good control of *Epitrix*. Thiacloprid was used successfully for controlling the tobacco flee beetle *Epitrix hirtipennis* (Sannino *et al*., 2005). Here, thiacloprid was shown to give much better control than imidacloprid.

Dominick (1965, 1967) tested the effectiveness of various soil applications of organophosphorus and carbamate insecticides in controlling the tobacco flea beetle. Phorate gave excellent control in reducing the emergence of second-brood tobacco flea beetles in the soil. Zinophos and diazinon were ineffective. Hofmaster (1956) showed that soil treatments with aldrin and heptachlor alone effectively reduced flea beetle activity to a point where foliage damage was negligible. Semtner et al. (1980) reported that nitrogen had significant effects on tobacco flea beetle abundance.

Synthetic pyrethroids are the weapon of choice for the beetles. Outside edge or localized sprays are generally effective for control of flea beetles. Flooding of fields can kill many of the overwintering beetles, however some may survive on high ground, pastures, or headlands. When rouging of volunteers with beetles occurs the beetles may move into new crops. The impetus in integrated pest management is to do timely (early-season) applications with something harsh which will give long-term protection at a time when there are not a lot of beneficials in the field (Cymbush and other synthetic pyrethroids are toxic to fish but less so to humans and other mammalian species). Monitor, Sevin, Thiodan and other OP and Carbamates offer less residual activity than the synthetic pyrethroids. According to the University of California Agricultural and Natural resources website (UCANR 2013), Permethrin (Pounce) 25WP, Esfenvalerate (Asana XL) and Spinosad (Entrust) are used to control *Epitrix* on eggplant.

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## CONFLICT OF INTEREST

The author declares no conflict of interest.

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