

Cabbage Family — Specifically, Flea Beetles

In the initial discussion, the farmers indicated that flea beetles were their key pests. They controlled caterpillars with Bt if needed. Everyone in the room introduced themselves and mentioned what they had tried or thought about using against flea beetles.

- Elizabeth Henderson uses Reemay® row cover on a clean field early in the spring. She has also used a backpack vacuum (adapted from a leaf blower). She noted that rotenone sprays have not worked well for her.
- Cass Peterson has tried yellow and white sticky traps.
- Bryan O'Hara uses a cotton row cover. He prefers cotton to the synthetic row covers because the cotton is heavier and does not blow off. Thus, he doesn't have to use anything (weights or stakes or earth staples) to hold it down. He lays it loosely right on top of the greens, picks it up when he needs to work underneath, then puts it back. The cotton row cover is more expensive than synthetic materials (\$30 for a piece 100 feet by 7 feet, 3 inches), so he handles it carefully to maximize its useful life. He notes that although the weave is loose and the flea beetles could go through it, in his experience, they don't.

Bryan also mentioned later in the discussion that he has not had flea beetle problems in his fall plantings of brassicas when he has planted into fields from which he has just harvested alliums (garlic and onions). The fall plantings were also well separated from spring plantings by hedgerows. Elizabeth Henderson has had the same experience in fall plantings after alliums.

- Emily Brown Rosen has used Typar® row cover.
- Walter Greist has tried sprays of a mixture of garlic and hot pepper, rotenone sprays, and row covers. None of these methods has worked very well for him.

- Bill Duesing does not consider flea beetles a major problem.
- Steve Gilman grows greens only in the fall from transplants. He has used row covers from Johnny's Selected Seeds with ribs for reinforcement but found that the ribs added to damage from abrasion.
- Eero Ruuttila tried Reemay® row covers with some success, but he finds that it makes tractor cultivation a hassle. He grows greens in the fall from direct seeding and irrigates before seeding to stimulate rapid germination.
- Bambi Jones uses Reemay® row covers.
- Bill Lamp noted that some species of flea beetles feed heavily on weeds and thus they may have some beneficial effects.

What Do We Know about Flea Beetles?

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I picked the title for this talk carefully, because I do not want to imply that I have a suitable straightforward alternative to insecticides ready to present at this conference. Instead, I will present information about the biology of the flea beetles attacking brassica crops and possibilities for alternatives that have been suggested by what we know about the biology of flea beetles, but not yet backed up by field experiments.

Biology of flea beetles on brassicas: The number one misconception about flea beetles is that there is only one kind of flea beetle and that it feeds on many different host plants. This is not true at all. Specifically, the flea beetles that feed on eggplant or tomatoes or potatoes are completely different species from the flea beetles that feed on plants in the cabbage family. Thus, keeping your cabbage family plants far away from your nightshade family plants is not going to improve the management of flea beetles.

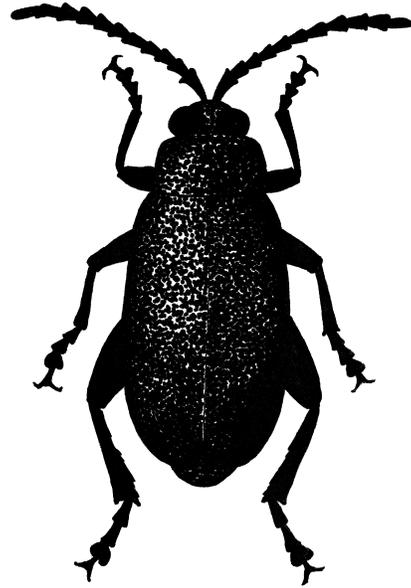
There are several different species of flea beetles that feed on plants in the cabbage family, but the most abundant is *Phyllotreta cruciferae*. This species does not have an official common name, but I will call it the crucifer flea beetle. This beetle is not native to North America. It apparently arrived accidentally on this continent from Europe or Asia in the early 1900s in British Columbia and arrived in the Northeast in the 1950s.

The crucifer flea beetle (like most other flea beetles) overwinters as an adult beetle. It spends most of the winter in leaf litter or other plant materials under hedgerows or weeds outside cultivated fields, but some beetles can be found in the soil near cabbage family plants, particularly if the plants are available late into the fall. The beetles become active early in the spring and feed on cabbage family weeds (common winter cress or yellow rocket; *Barbarea vulgaris*, for example) before cultivated host plants are available (Root and Tahvanainen 1969).

Thus, the adult beetles are often present when seedlings first emerge from the soil. Newly emerged seedlings are very attractive to the beetles, and this is when they are most likely to do severe damage. This damage can be avoided by starting seeds in a protected location (a greenhouse, a cold frame, under row covers) and then transplanting the plants when they are large enough to withstand some feeding damage. Row covers can be used throughout the season to keep out flea beetles as well as other pests, such as imported cabbageworm and cabbage maggot, depending on the specific needs of the operation and the crop.

The beetles lay their eggs in soil at the base of their host plants, and the larvae hatch and feed on the roots. The overwintered adults then gradually die off. New adults emerge later in the summer. There can be one or two generations per year, depending on temperature and climate.

There is very little known about natural enemies of the crucifer flea beetle. There is a parasitic wasp (*Microctonus vittatae*) that attacks the adults, but only a small percentage. In reviewing the scientific literature, I came across a reference to one report that the overwintering adults of crucifer flea beetle in Europe have sometimes been found to be 90% parasitized by several species of insect-attacking



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Phyllotreta cruciferae, sometimes called the crucifer flea beetle

nematodes. These nematodes are not commercially available species, and it is not clear if the same species occur in the United States. The adult beetles are good at avoiding predators by rapidly jumping away. Probably there are predators, parasites, and diseases of the larvae, but because these larvae are small, in the soil, and not easily raised in the laboratory, there is very little known about the larvae beyond their structure and rate of development.

Possibilities for Control Methods

Manipulating behavior of flea beetle adults:

1. Trapping. I have experimented with sticky traps baited with mustard oil. Plants in the cabbage family release tiny amounts of mustard oil as they grow or are injured, and the beetles use this smell to find their hosts. The mustard oil is very attractive to the flea beetles, but there are several problems. The traps are not very efficient. I suspect that they attract many more beetles than they trap. Mustard oil, while a natural product, is also a very nasty chemical to handle. I began experimenting with using mustard powder mixed with water this past summer but do not yet have sufficient results to present.

2. Interfering with beetle movement. It is well-known that the crucifer flea beetle prefers monocultures of its cabbage family hosts. Interplanting nonhost plants (clover, weeds, tomato, and potato are examples that have been tried) seems to interfere with their ability to find their host plants once they have jumped off. This interference causes them to gradually decrease in interplanted fields and increase in monocultural fields nearby. These experiments have been done on small plots, so it is unclear over how large an area the beetles will move.
3. Differences in preference among cabbage family host plants: There are differences in preference that are evident to most farmers and gardeners. One plant characteristic affecting preference that has been studied is wax on the surface of the leaves. Plants with a thick wax, which looks like a bluish haze to the eye, are less susceptible to flea beetles because the wax interferes with the ability of the beetle to walk on the plants. In general, cabbage, broccoli, cauliflower, Brussels sprout, collards, and kale have this thick wax. There are probably other chemical and physical differences among the whole range of cabbage family plants and among varieties within a species or crop type that contribute to differences in beetle preference.

Taken together, these three items suggest that there may be opportunities to creatively move flea beetle populations from more susceptible or more highly valued crops to other crops or areas where they could be trapped.

Discussion: Cabbage Family Crops and Flea Beetles

During and after Kim Stoner's presentation, possible trapping methods for crucifer flea beetles were discussed. Some of the points made were:

- An alternative to sticky traps could be water pan traps (white or yellow) with mustard powder either added to the water or in a container suspended over the water. Flea beetles drown very readily in water with a small quantity of soap.
- Kim Stoner is not yet certain of the efficiency of her sticky traps. The traps may attract more flea beetles than they catch, thus increasing the abundance locally.
- There is a scientific paper identifying an aggregation pheromone for the crucifer flea beetle. That would be another possible lure for a trap.
- Traps could be used in and around cruciferous weeds early in the spring. The crucifer flea beetle feeds on some of these weeds during early spring. A model of what photoperiod, temperature, or accumulation of degree-days is required for the overwintering adults to become active would be useful in this strategy.

Although several studies have shown that interplanting brassicas with clover or solanaceous crops reduces the density of crucifer flea beetles, Eero Ruuttila has interplanted brassicas with herbs, and it has not helped him manage flea beetles.

There was also a discussion about the possibility of studying the crucifer flea beetle in Europe and finding out whether it is a pest there. From those studies we might learn management techniques used by European growers or we might learn about natural enemies of the flea beetles that could be imported and introduced in the United States.