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Flea Beetle Damage being Misdiagnosed as Cavity Spot in Carrots

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For the past few years carrot growers in the lower San Joaquin and Antelope Valleys have been reporting an unknown injury to the taproot of carrots. Superficially the damage looks like cavity spot (*Pythium* sp.), a fungal disease that causes depressed lesions oriented across the taproot. However, upon closer inspection it became evident that damage was being caused by some type of feeding by an insect, coupled with secondary infections that enhanced the injury's appearance as cavity spot. This damage is now attributed to feeding by flea beetle larvae.

Insect damage to the taproots of carrots was first noticed in the Antelope Valley where it was thought to be an isolated incidence to just one or two fields. During 2012 the same insect injury was reported from a few fields in Kern County. However, after speaking to people in the carrot industry it has become evident that damage has been much more widespread than originally thought, but that it went unreported due to a misdiagnosis as the fungal disease cavity spot.

During the fall of 2012 researchers at the UC Cooperative Extension office in Kern County conducted field visits to identify possible causes of the damage. Several symptomatic carrots where found with small, white, wormlike insect larvae feeding within cavities on the roots (Fig. 1). These were taken back to the lab and identified as larvae of the potato flea beetle, *Epitrix cucumeris*. Following the identification researchers returned to the location with sweep nets and were able to collect adult potato flea beetle, as well as a second species of flea beetles called palestriped flea beetle, *Systena blanda*. To date, larvae of the palestriped flea beetle have not been found feeding on carrot taproots in Kern County, though future surveying may prove otherwise.

The principal concern with cavity spot and damage by flea beetle larvae is that they are easily confused with each other. This may trigger the use of fungicides for a problem caused by insects, or vice versa. The result is a lack of control, a waste of money, and continued economic damage to the crop. At this point we are still uncertain about the relative prevalence of flea beetle larva injury compared to cavity spot.

The adult potato flea beetle is a small (1.5 to 2.0 mm), oblong to oval-shaped shiny black beetle with reddish legs and antennae. The hind femora (thighs) are enlarged and help the beetle to jump when disturbed. Adults overwinter in leaf litter or soil in protected places such as field margins, tree rows, or less frequently, within cultivated fields. Adults emerge in spring when soil temperatures warm to approximately 15ºC and begin feeding on winter annual weeds. It is anticipated that there are two broods in Kern County's climate, with the first brood feeding on a wide range of weeds and cultivated crops, especially when cotyledons and young leaves are present as the seedlings emerge. The second brood likely begins during the summer around the time that fall carrots are being planted.

Adult flea beetles chew small holes in leaves that can give them a "shot hole" appearance. For most crops, unless this damage occurs during the cotyledon or stand establishment stages of growth, it is not considered to be of economic importance. Adult beetles mate in the spring and summer and lay eggs on the soil surface plant near a plant stem. The emerging larvae burrow down and feed on plant roots. Like the adults, the larvae are generally not considered major pests because they cause minimal superficial damage to roots. However, in the case of carrots, as well as potatoes, superficial and shallow feeding on the roots can result in significant reduction in quality of the harvested product.

Differentiating cavity spot from damage by flea beetle larvae can be challenging, but is possible. Flea beetle injury appears as feeding activity in more or less a straight line down one side of the root (Fig. 2, 3). In addition to the large feeding cavities the larvae create, there are also many small superficial lesions present (Fig. 3). Cavity spot lesions are sunken, elliptical lesions that are randomly scattered on the root surface. They begin as gray, watersoaked lesions (Fig. 4), but rupture and form cavities on the root surface as it expands due to growth (Fig. 5). The lesions are randomly scattered but may be more concentrated on the upper third of the root.

Currently very little is known about the best approach to flea beetle management in carrots in California. In other states management of flea beetles in crops like potato, canola, and sugarbeet is achieved through sampling programs coupled with insecticide treatments as needed. Monitoring for adults can be done with yellow sticky cards clipped to short poles near the plant canopy or with sweep nets for larger plants, and can be done both within the field and near surrounding vegetation. If insecticides are needed, pyrethroids are very effective against adult beetles, and can be applied by ground, air, or through sprinklers. If migrations into the field occur over a long period of time, more than one application might be needed. Foliar, soil, or seed-coat applications of neonicotinoids, such as imidacloprid, are also used to control both larvae and adults in a variety of crops.

Figure.1. Flea beetle larva feeding on a carrot root.

Figure. 2. Lesions on carrots caused by feeding of flea beetle larvae.

Figure 3. Large cavities caused by flea beetle larvae along with several small superficial lesions.

Figure 4.Active cavity spot lesions caused by the fungus *Pythium* sp.

Figure 5. Expansion of the taproot often gives cavity spot a stretched appearance.