

VACCINIUM SCALE IN MA CRANBERRY

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Vaccinium scale injury on a cranberry bed.

INTRODUCTION

Armored scale insects are important pests worldwide. They are in the insect order Hemiptera and the family Diaspididae. The armored scale insect constructs a waxy protective cap over their body, which is a soft, legless blob.

Vaccinium scale is an armored scale. The cover is firmly appressed to the plant substrate upon which the scale feeds. The base of the scale's cover is cemented to the plant surface and this protects the immobile yellow insect underneath.



Close-up of a Vaccinium scale cover in August, showing the snug connection to the upright surface. The cover protects against water loss, rain, and chemical applications.



A cranberry upright encrusted by Vaccinium scale.

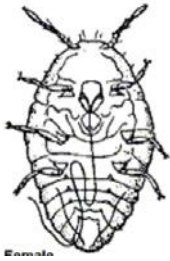
Vaccinium scale biology: As of this writing, Vaccinium scale (*Diaspidiotus* sp.) is very common on MA cranberry and is found at outbreak levels on beds throughout the industry. A sampling survey of cranberry and upland plants in the cranberry growing region in MA, showed that Vaccinium scale was solely found on cranberry and blueberry. The outbreak scale populations in MA were originally presumed to be Putnam scale (*Diaspidiotus ancyclus*), but molecular analysis indicated that the outbreaks were genetically distinct, and thus, we coined the new common name, Vaccinium scale.

The adult female lays eggs under her scale covering. Here, the eggs remain until nymphs (crawlers) hatch out and emerge from under the cover. In Illinois populations of Putnam scale (a close relative to Vaccinium scale), each female laid about 50 eggs at a rate of 2-3 eggs per day; the eggs hatched in an average of 16 hours. We observed that spring population Vaccinium scale crawlers appear starting in June. The summer population crawlers appear starting in August and may overwinter as second instars. This latter point requires verification.



Image shows a flipped scale cover to reveal the saclike yellow female with eggs, white eggshells, and crawlers underneath.

Some scale species are known to produce a thin flap or cover extension just before crawlers are ready to emerge from under the female cover, and this appears to be the case for *Vaccinium* scale. Crawlers escape via the exit flaps.

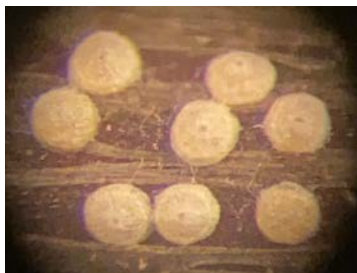


Enlarged scale diagram. Eggs hatch into an active crawler stage, which unlike older stages, is able to walk about and search for a spot to settle. Image: Z. Avidov

Crawlers settle and lose their legs and antennae. They build up a white waxy cover called a 'white cap.' The insect is now completely immobile on the host plants and will continue to molt in place.



Bright yellow crawlers emerge from eggs and are the only mobile stage of *Vaccinium* scale. They have antennae and legs. Crawlers are the agents of dispersal and search for a site to settle.

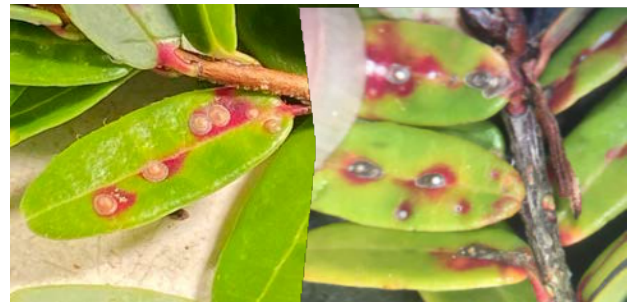


'White caps:' crawlers settle on the host plant and cover their body with a white waxy cover.

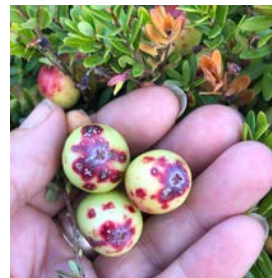
Feeding. Scales have threadlike mouthparts (stylets) that insert into the plant to allow extraction of plant cell contents (they are not phloem feeders and do not produce honeydew). The scales can develop on all above-ground parts of the cranberry upright: the upright stem, flower buds, berries, and leaves.



Bark of the cranberry upright has grown over the scale cover. Appearance of the scale cover may vary.



Variation in *Vaccinium* scale on cranberry leaves. Round female covers on left and elongated cover of males on right. Red areas occur around the feeding sites.



***Vaccinium* scale on berries: on left, white caps (newly established 1st instars) and on right, 2nd instars, showing deformations and bright red areas caused by feeding.**

Dispersal and spread on the infestation

Ample evidence and most armored scale researchers believe that crawlers, with their relatively well-developed legs and antennae are the primary dispersal stage. Dispersal is mainly by wind. In other crops infested with other species of armored scale, sticky traps are placed near the infestation and populations are assessed by observing the number of captured airborne

crawlers. Scales may be passively transported on infested plant material, but it is reported that the plant must be intact and growing. It is unlikely that they are dispersed on cuttings or fruit. There is no evidence or any suggestion in the literature that armored scales move in water. Some studies show that crawlers are able to attach to flying/walking insects, and thereby move to a new site.

MANAGEMENT

To enact the best management using a conventional insecticide such as Diazinon, spring crawlers, and perhaps summer crawlers for intense infestations, should be targeted. Production of crawlers and crawler release is much more synchronous in the spring compared to the summer generation. Onset of crawler production in the summer generation can last for weeks, making it difficult to target with a single spray.

Late water is an excellent management alternative, particularly for beds that must be rescued from heavy populations that are widespread across the bed. Holding the water for four weeks in the spring requires planning, and flooding usually begins mid-April.

Scouting for *Vaccinium* scale

Start by searching for weak, red, or dead circles or swaths of vines in spring, and determine it is not caused by low spots, *Phytophthora* root rot, or drought.

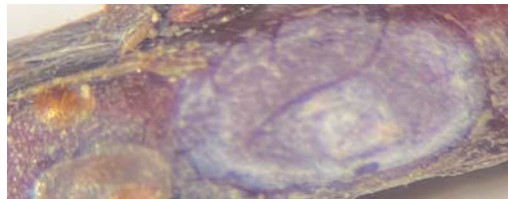


Vaccinium scale injury may occur in discrete circular areas of affected vine.



Typical Vaccinium scale injury seen recently, showing swaths of dead vine.

Do not sample upright where the scales have died on vines that are dried up or dead. Carefully check for live scales on vines with some green leaves that are on the edge of the dying vine area. Look for bumps on the lower portion of the upright's stem. The bumps may feel crunchy when crushed. If the insect is still alive, you will see the yellow female blobs underneath the flipped over cover or yellow goo will ooze if you squish the scale. Flags, or the white spots on the upright where old scale covers have come off are evidence of previous *Vaccinium* scale infestation.



Closeup of a flag on an upright where a scale has dropped off, leaving a circular white residue.



Uprights that show 'flags,' or white spots where the scale covers have fallen off, indicate previous infestation. Check for alive scales when evaluating need for management.

IN SUM:

Use Late Water where possible, especially where outbreaks are very bad.

While we currently recommend Diazinon, keep up to date for newer, better recommendations.

Spraying conventional insecticides to target crawler emergence occurs in June &/or August

The crucial step in scale control with a conventional insecticide like Diazinon is determining when **crawler** (immatures) emergence is well under way. These tiny yellow spots can be seen moving on the stem, perhaps requiring a hand lens. Two crawler periods occur, around mid-June and around mid-August.

Sprays toxic to bees cannot be applied during bloom.

If the spray application is delayed and is too far into crawler emergence, they will have formed protective white caps and spray efficacy is greatly reduced.

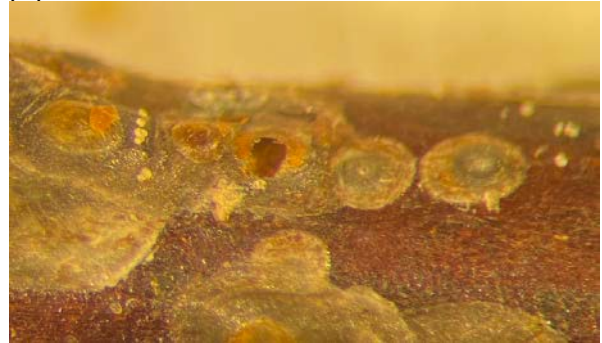
The crawlers do not have a protective cover and thus, crawlers are vulnerable to insecticides. We also find that once crawlers have begun to emerge from under the female's cover, the seal with the plant is broken and the chemigated pesticide can seep under the cover, killing the adult female and any eggs or crawlers underneath.



After effective pesticide treatment, dead crawlers can be seen underneath a removed cover. Just after hatching from the egg, newly hatched crawlers may remain nested beneath the maternal scale and are hit by chemigated insecticide seeping under the cover.

Natural enemies

There are many natural enemies of scales, particularly wasps as well as predators such as ladybird beetles, mites, and entomopathogenic fungi. Sprays of broad-spectrum insecticides, such as Diazinon or bifenthrin (Fanfare), likely will disrupt these natural enemies that often regulate scale populations.



Center scale shows an emergence hole where an adult wasp has chewed through the scale cover and emerged. This is an example of a biological control agent in that the immature of the wasp destroyed the scale as the wasp developed.



A bright yellow alive female scale with her cover removed appears in the upper part of the image, and a parasitized female appears in the middle scale, with a wasp immature feeding inside.



Severe late August Vaccinium scale injury during the 2022 drought.