Summer 2013
Hannah Burrack
Assistant Professor
Department of Entomology
NC State University

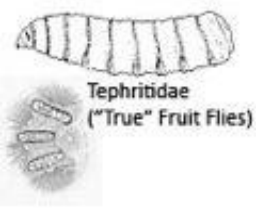
Post harvest insect sampling in North Carolina blueberries

Why is it necessary to sample blueberries for insects post harvest?

While several insects pests may potentially be present in blueberries at harvest (including cranberry fruitworm, cherry fruitworm, and plum curculio), most are easily removed by pickers or sorting equipment. However, this is not the case for two important fly pests in blueberries, blueberry maggot (*Rhagloetis mendax*) and spotted wing drosophila (*Drosophila suzukii*). Fruit marketers generally have zero tolerance for infestation by internally feeding insect pests. Some countries where fruit may be exported (most notably Canada) have quarantine restrictions for BBM. Fruit infested by either blueberry maggot (BBM) or spotted wing drosophila (SWD) may appear undamaged and risk being harvested. It is therefore important to sample fruit after they have been packed in clamshells in order to determine if either BBM or SWD are present.

How can I identify blueberry maggot (BBM) and spotted wing drosophila (SWD)?

Adults of both insects are black (BBM) or brown (SWD) flies, but only BBM and SWD larvae are potentially present in fruit. Fly larvae (or "maggots") are typically white , legless, and worm-like. BBM are members of the fly family Tephritidae, and larvae are about 1 cm long when nearly mature and "carrot-shaped" meaning they are tapered in the front and broad in the rear. BBM larvae have up to six breathing holes (call "spiracles" by entomologists) at their broad end.



SWD larvae are smaller than BBM when fully mature, about 5 mm long. They are also white and legless, but unlike BBM, they are tapered at *both* ends. SWD have two breathing "stalks" at their rear end. These stalks remain in pupae, which may also be present in fruit.

It is important to note that SWD larvae and pupae cannot be distinguished from other, non pest, *Drosophila* species. SWD are most commonly found in sound ripening and ripe fruit, while other *Drosophila* species are found in rotting fruit. Sampling only apparently sound, otherwise marketable fruit minimized the likelihood that non SWD larvae will be detected.

SWD pupa (left, middle) and nearly mature larva (right). Middle and right samples are placed on a penny as a backdrop for scale. Note star shaped "breathing tubes" on pupa. These are distinctive to *Drosophila* pupae in fruit.

Post harvest insect sampling in North Carolina blueberries

How do I sample for insects in blueberries?

Blueberry maggot monitoring methods are specified by quarantine protocols (http://bit.ly/yO3h0U). This protocol requires between 2 to 6% of product to be sampled.

Number of primary containers (e.g. pints, quarts, etc)	Sample size/No. of containers (e.g. pints, quarts, etc)
0-100	4
100-300	6
300-500	8
500 or more	10

Because SWD is a relatively new pest, we know less about how many samples should taken is less clear, but it is reasonable to take a similar number of samples as for BBM.

Two sampling methods are approved for BBM cooking and a sugar test (see http://bit.ly/yO3h0U). The sugar test can also be used for SWD, and samples cooked for BBM are likely to detect larger SWD larvae as well. However, one additional sampling method has been developed for SWD:

Salt extraction: Place fruit in a flat container in a thin layer. A dark container or a clear container against a dark surface works best. Pour salt water (1/4 c salt per gal of water) over fruit. After 10-15 minutes, larvae will exit fruit. If no larvae are visible, gently crush fruit to ensure salt water has diffused inside. Large, dense fruit, like strawberries may need to be cut into smaller pieces. Larvae are more visible when moving and immersion in salt water will eventually kill them.

Other ways in which BBM and SWD have been observed include freezing or refrigeration (larger larvae will exit fruit left at cold temperatures overnight) and through direct observation of infested fruit.

Where can I learn more?

Read us @ www.ncsmallfruitsipm.blogspot.com
Follow us @NCSmallFruitIPM on Twitter
Like us @ http://www.facebook.com/NCSmallFruitIPM

Spotted wing drosophila research and extension efforts are supported by the Southern IPM Center, the NC Department of Agriculture & Consumer Services Specialty Crop Block Grants Program, and the North Carolina Blueberry Council, Inc.