Blueberry Gall Midge Damage to Floral and Vegetative Buds in Blueberry

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There are two species of blueberry gall midges (BGM) infesting blueberry plantings in Florida. *Dasineura oxycoccana* (Johnson) is an important pest of *Vaccinium* species, including southern highbush blueberry, and feeds on developing floral and leaf buds. *Prodiplosis vaccinii* (Felt) is a BGM species that typically feeds almost entirely on leaf buds during summer months. The feeding injury caused by the larvae of these pests is observed as, dieback from leaf tips, crumpled and withered buds (Figure 1), leading to reduced plant vigor, increased susceptibility to secondary infections, and reduced yields by up to 80% in the case of damaged floral buds. In Florida, populations of BGM have been recorded on blueberry farms throughout the north-central and central regions of the state.

Figure 1. Injury to flower buds and developing leaves.
Credit: M. Lopez, UF/IFAS

Preventive control measures include maintaining blueberry beds by regularly adding fresh mulch or using plastic or fabric mulch; selecting cultivars that exhibit greater resistance to BGM; and ensuring proper timing of reduced-risk insecticide applications prior to floral bud break, followed by another application ten days later. Chemical control measures can also be employed when two or more adult BGM are seen in a trap. While damage from *Prodiplosis vaccinii* can occur on vegetative buds during warmer months, the remainder of this article will focus on BGM damage to floral buds and leaf buds.

Life Cycle

Adult BGM live for two to three days, and once mated females lay eggs in the base of floral and leaf buds, typically choosing buds that are in their second to third developmental stage (between swelled bud and bud break). The larvae take around 10 days to develop, after

which they emerge from the buds and drop to the soil to undergo pupation (Figure 1). Most larvae exit the buds and pupate in the soil from early to mid-morning (6 a.m.–9 a.m.), when morning dew protects the larvae from drying out on their way down from flower and leaf buds. Under ideal temperatures, BGM can complete one generation within two to three weeks.

Figure 1. Larvae emerging from a leaf whorl and moving down a stem.
Credit: M. Lopez, UF/IFAS

BGM damage on blueberry flower buds has been mistakenly attributed to freeze damage or insufficient chilling. In recent years, growers faced “false winters” beginning in November. During false winters, there is a cold period when high temperatures fall between 68°F–77°F for one to two days, then quickly rise again. After one of these sudden chilling events, BGM break out of a summer and fall period where development has been suspended. Because males emerge before females, finding mostly males in a planting is a sign that the midges have just begun to become active; more females will likely be seen after two weeks. If there are subsequent warm temperatures, the first generation of eggs will hatch, and larvae will begin feeding inside the buds, which damages flowers and leaves.

Monitoring

Monitoring for BGM and implementing chemical controls should begin as early as (1) mid to late November, (2) following a cold spell, or (3) as soon as the first BGM generation is observed. Effective monitoring techniques such as destructive sampling and the utilization of traps can be employed to detect the presence of BGM.

Destructive sampling involves collecting floral buds in the second to third stages and placing them in a zip lock bag at room temperature. If present, larvae will begin to emerge in two to four days. Ziplock bags should be kept at room temperature for 10 -14 days before being discarded.

Trapping adult BGM can be accomplished by using either clear (transparent) sticky traps (to detect the presence of adult females before they lay eggs in buds) or bucket traps (to determine whether a new generation of larvae or adults have emerged). There is evidence that pheromone baited traps can increase the captures of BGM adults and the overall monitoring efficiency. These BGM pheromones should be used in the traps when available. When placing traps in the field, growers should consider "hot spots" where midges can develop, indicated by depressions in the ground. Growers should consider using two to four clear sticky traps and one to three bucket emergence traps per acre, checking them once every few days or once a week. Chemical control is recommended when two or more BGM are caught on these traps. Identification of BGM vs. other midge species can be difficult. Details of how to use these trapping methods and identifying BGM can be found in UF EDIS Publication ENY2105, "Management of the Blueberry Gall Midge on Southern Highbush Blueberries in Florida" (https://edis.ifas.ufl.edu/publication/IN1414).

Management Practices

Management practices for BGM include the use of mulches, potentially resistant cultivars, and natural enemies. Use of reduced-risk and conventional insecticides should be used only when all other strategies have proven ineffective.

Mulches

Populations of BGM tend to thrive in older, more decomposed mulch, since larvae need to reach the soil as quickly as possible to prevent their bodies from drying out. Mulches should not exceed a 75% decomposition level. Some growers use black polyethylene plastic mulch or weed mat. Because BGM need to burrow into the soil, plastic mulches over the raised beds can be an effective barrier to larvae reaching the soil directly under the bushes. However, when bushes grow past the plastic mulched area larvae can reach soil in the row middles and continue their life cycle.

Potentially Resistant Cultivars

Some research has been conducted on the resistance of certain southern highbush blueberry (SHB) cultivars to BGM injury. In a recent study six SHB cultivars were screened for resistance in north-central Florida, including 'Farthing', 'Patrecia', 'Magnus', 'Sentinel', 'Optimus', and 'Colossus'. This field screening found that 'Sentinel' and 'Optimus' may have high levels of resistance, while 'Magnus' and 'Colossus' have moderate levels. 'Farthing' and 'Patrecia' appear to have the lowest levels of resistance in this group. The poor resistance of these two latter cultivars to BGM must be further studied.

Regarding other cultivars, ‘Emerald’ and ‘Jewel’ suffered major crop losses on a central Florida farm due to severe BGM infestations, while infestation levels were low to moderate on the same cultivars on other farms in the north-central region. Temperature and relative humidity, the length of planting establishment time, the cultivar planted, and cultural control strategies all play a role in how severe a BGM infestation will be. Plantings established for more than five years with little mulch turnover may host greater numbers of BGM. With warmer winters, more generations of this pest can exist in one season and lead to reproductive isolation, where the pest can potentially develop a close relationship with a specific cultivar.

Natural Enemies

Parasitoids (tiny micro-wasps) are the most well-known natural enemies of BGM. The most recognized micro-wasp families that protect blueberries against BGM include Platygastridae and Eulophidae. *Platygaster, Synopeas*, and *Inostemma* are the genera within Platygastridae best known to parasitize this pest. Females inject their eggs into already developing BGM larvae within the buds. The wasps develop inside the midge larvae, and adult wasps emerge instead of larvae. They kill their hosts but do not damage the blueberry buds in the process. In high densities, they can kill as many midges as insecticides can and have been known to parasitize between 25%–40% of midge larvae. Reduced-risk pesticides should be selectively used to preserve parasitoid populations.

In organic plantings, spiders have been observed constructing webs around the vulnerable blueberry buds and early floral development stages. Spiders may play a significant role in minimizing BGM numbers, but further research is needed.

Reduced-Risk Insecticides

Reduced-risk insecticides should be considered due to their ability to synchronize with naturally occurring micro-wasps (parasitoids), providing effective control even before pests establish themselves in the system. By utilizing reduced-risk insecticides, the risks of negative impacts to the parasitoids can be minimized, and resistance development in the BGM reduced.

In a recent field study, several reduced-risk insecticides were evaluated for their efficacy on BGM and their key parasitoid. The results found that Movento® (spirotetramat) with Induce® (nonionic low foam wetter/spreader adjuvant) was able to control 59% of BGM adults in the system and 56% of BGM larvae hidden within the blueberry buds. Movento®’s systemic mode of action is especially effective to target larvae hidden within floral and leaf buds, which are impossible to reach using contact insecticides. Apta™ (tolfenpyrad) was the second best insecticide against BGM, reducing adults by 53% and larvae by 51%. Both Apta™ and Movento® with Induce® also performed significantly better than Delegate®. Apta™

was one of the three most lethal to the micro-wasp parasitoids— the first being Exirel® (cyantraniliprole) followed by Admire® Pro (imidacloprid).

To learn more about the identification, life history, damage, monitoring, and management of BGM, refer to the EDIS Publications "Management of the Blueberry Gall Midge on Southern Highbush Blueberries in Florida" (Lopez, Munoz, and Liburd), "Blueberry Gall Midge on Southern Highbush Blueberry in Florida" (Liburd and Phillips 2019) and "Blueberry Gall Midge, *Dasineura oxycoccana* (Johnson) (Insecta: Diptera: Cecidomyiidae)" (Steck et al. 2020).

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