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Strawberry Sap Beetle Management in Maryland Strawberry Production

Maryland strawberry growers who produce diverse fruit crops or run pick-your-own operations may face issues with strawberry sap beetle, an elusive pest that directly damages strawberry fruit. Strawberry sap beetles are difficult to spot in the field because they are small and quickly scatter when disturbed. Although they are small, they can cause severe feeding damage in strawberry plantings. Preventing this damage is challenging, but understanding strawberry sap beetle damage, identification, and life cycle can help growers successfully implement control measures.

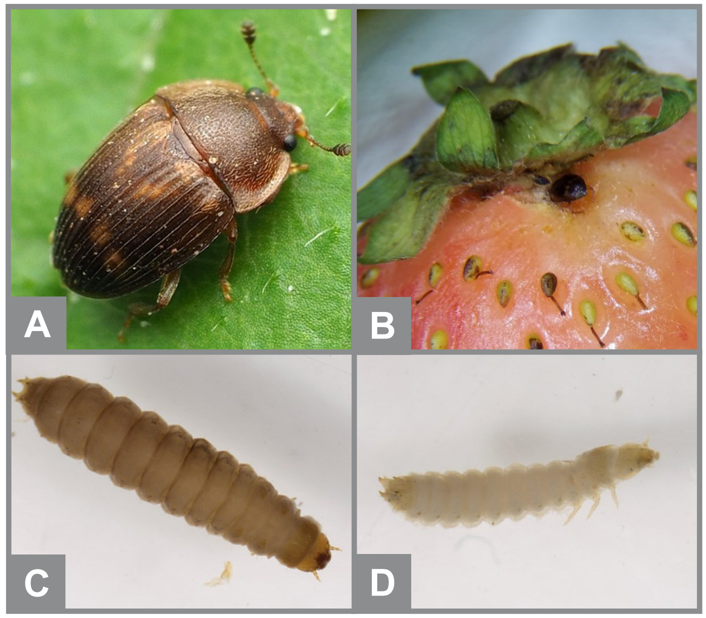

Figure 1. (a) *Adult strawberry sap beetle with light brown "X" marking on back (Katja Schulz, iNaturalist (CC BY).* **(b)** *Adult sap beetle feeding on strawberry (Kelly Hamby).* **(c & d)** *Example sap beetle larvae, similar to strawberry sap beetle larvae (Shea III).*

Damage

Strawberry sap beetles cause yield losses by directly damaging fruit. Adult beetles are attracted to nearly ripe, ripe, and overripe strawberries (Demchak, 2013), especially those with other pest or mechanical damage (Connell, 1980). Fruit rot disease, specifically anthracnose fruit rot, can also make strawberries more attractive and susceptible to infestation (Swett et al., 2020). Strawberry sap beetles bore small holes into strawberries that are near or touching the soil (Demchak, 2013) and feed on them. Because of this, beetles can also easily access matted row strawberries. While feeding, adults lay eggs that hatch into larvae, which also feed directly on strawberries (Loughner et al., 2007). Larvae can sometimes be found inside strawberries, which customers find unappealing (Loughner et al., 2008). Although the beetles' damage primarily results from feeding, they can also cause damage by spreading pathogens that cause fruit rot diseases (Loughner et al., 2007; Rondon et al., 2017).

Identification

Strawberry sap beetle adults are brown and oval shaped (Demchak, 2013), with a lighter brown X-shaped marking across their outer wings (elytra) (Figure 1a). Like all sap beetles, they have clubbed antennae (Rondon et al., 2017), but with a length of 1/8 to 1/10 of an inch (Ewing, 2004), they are smaller than many other sap beetle species (Figure 1b). Larvae are off white, less than 1/4 of an inch in length, and have two large smoky gray spots near their head (Peng et al., 1990) (Figure 1c and Figure 1d).

If strawberry sap beetle adults or larvae cannot be found, examine the strawberry damage carefully because slug damage can easily be mistaken for sap beetle feeding. The key difference is that strawberry sap beetles leave behind circular holes that are soft and sunken (Figure 2a) while slug damage holes have cleaner edges and are irregularly shaped (Figure 2b). Additionally, slugs may feed on leaves, may leave behind slime trails as they feed (Figure 2b), and are more likely to feed on unripe fruit

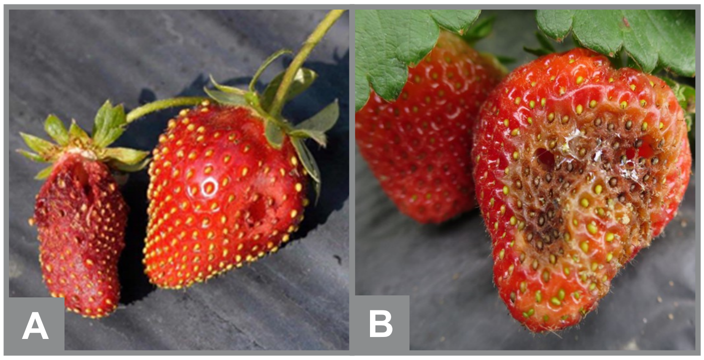

***Figure 2. (a)** Characteristic strawberry sap beetle feeding damage with sunken edges (Natalie Hummel, LSU). (**b**) Characteristic slug feeding damage. Damage looks similar to strawberry sap beetle damage, but the holes are cleaner and slugs often leave behind slime trails (Maria Cramer).*

than other strawberry pests. Slug damage can also be confirmed by scouting for the slugs themselves at night with a headlamp or flashlight, or in the morning on cool, wet days (Burrack & Toennisson, 2014; Demchak, 2013). It is critical to correctly identify which pest is responsible for damage, because control measures for sap beetles are not effective against slugs. Damage from both pests can occur on the same berries as well.

Life Cycle

Adult beetles are attracted to strawberries as they begin to ripen in May and June, and populations can increase over the summer as other host fruits ripen and rotting fruit accumulates (Demchak, 2013; Loughner et al., 2007) (Figure 3). Adults lay eggs inside fruit, eggs hatch into larvae, and larvae develop before pupating in the soil and emerging as a new generation of adults (Demchak, 2013). Strawberry sap beetle takes about 20 days at an average temperature of 68.9°F to develop from an egg to an adult (Weber & Connell, 1975). Various crops including blueberries, raspberries, cherries, melons, and peaches serve as additional hosts on which beetles can feed and develop, so farms that produce diverse fruit crops may be more prone to sap beetle pressure (Demchak, 2013; Loughner et al., 2007). Blueberries and raspberries in particular may also serve as overwintering sites (Loughner et al., 2007). Pick-your-own operations are also at higher risk of infestation because customers often leave behind ripe and overripe fruit (Demchak, 2013) that attract strawberry sap beetles from overwintering sites. Traps baited with food odor (fermenting fruit or bread dough) may be used to monitor migrating adults by placing them along wooded edges near fields (Loughner et al., 2008).

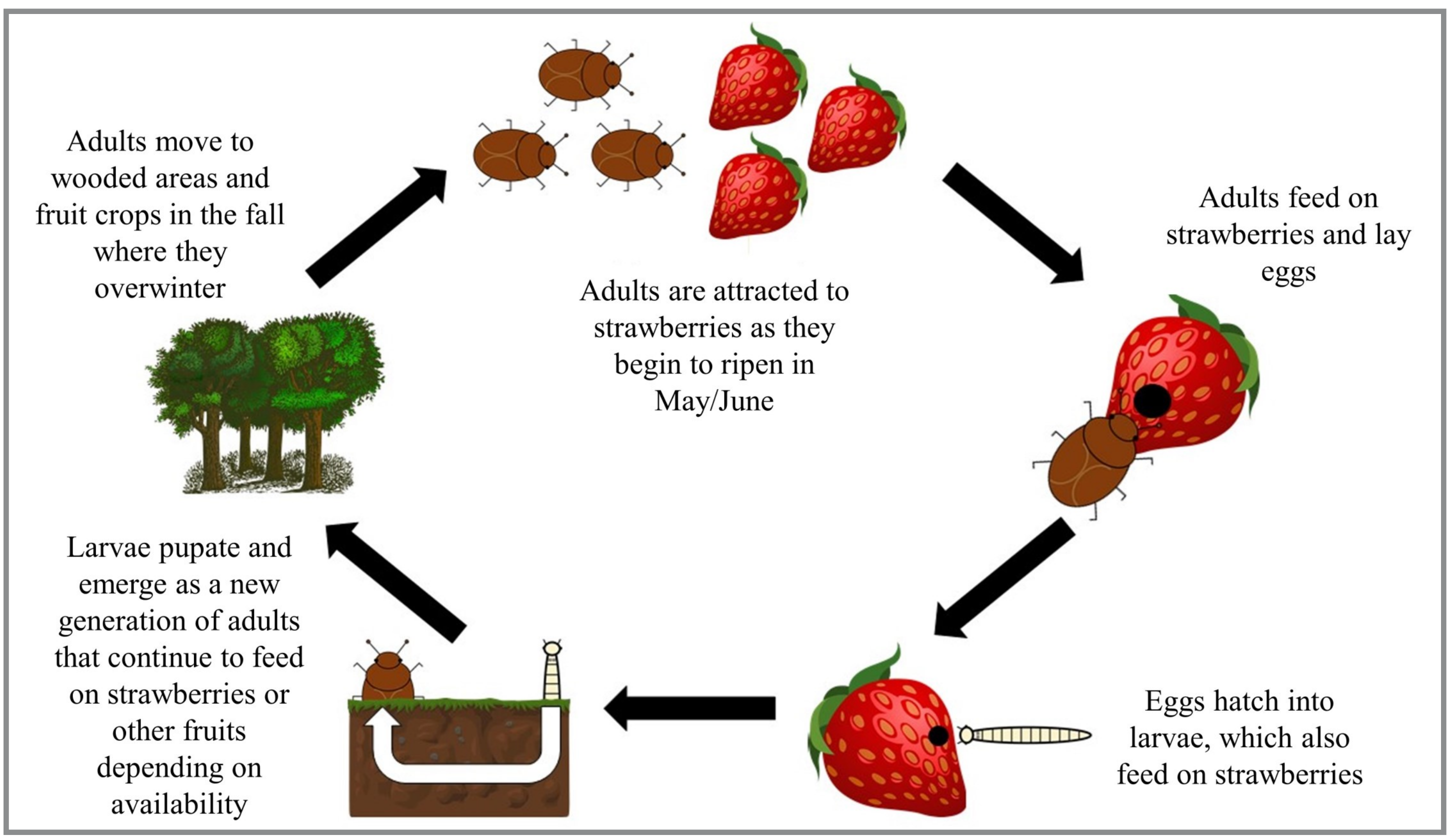

***Figure 3.** Strawberry sap beetle life cycle. Image by S. Ganesh.*

Cultural Control

Cultural approaches are the most effective methods for preventing strawberry sap beetle infestations. Thorough sanitation is critical for interrupting the sap beetle life cycle and preventing populations from building up (Demchak, 2013). At pick-your-own farms, consider providing customers with separate containers for collecting damaged and overripe fruit (Sial et al., 2018). It may also help to hire farm labor to remove any remaining unmarketable fruit (Sial et al., 2018); however, labor costs may make this uneconomical. These strategies have been implemented by pick-your-own operations to control spotted wing drosophila, another pest that is attracted to and reproduces in ripe and overripe fruit (Sial et al., 2018). Once collected, unmarketable fruit should be destroyed (Demchak, 2013; Sial et al., 2018). Sealing fruit in plastic bags and leaving in the sun to solarize destroys spotted wing drosophila in raspberries (Leach et al., 2017) and may be effective for other pests like sap beetles, but has not been tested for them. Although the length of time necessary to kill sap beetles is unknown, freezing the fruit should also work. At grower-harvested farms, harvest as much as possible as frequently as possible, making sure to remove and destroy all damaged fruit, overripe fruit, and debris (Demchak, 2013). On farms that produce diverse fruit crops, sanitation is important in later-ripening fruits as well since they also attract strawberry sap beetles. In matted row production, renovate fields immediately after harvest to destroy any remaining fruit and to disturb strawberry sap beetles pupating in the soil, interrupting their life cycle (Dively & Embrey, unpublished).

Growers can also take preventative measures when planting strawberries. Planting a manageable amount of strawberry acreage can help prevent overripe fruit from accumulating during harvest (Demchak, 2013). It may also help to avoid planting strawberries directly adjacent to wooded areas and other fruit crops that could serve as overwintering sites for strawberry sap beetles (Loughner et al., 2007). Additionally, plasticulture may help suppress strawberry sap beetle populations and prevent feeding damage (Dively & Embrey, unpublished). The exact mechanism explaining this is unknown, but it is possible that plasticulture prevents fruit from contacting soil, making it less accessible. Additionally, plasticulture warms the fruit, which may make it less favorable for feeding. However, moving to plasticulture will impact frost and freeze management.

Chemical Control

Always read and follow the safety information and application instructions on the label. The label is the law.

On their own, insecticides are not highly effective against strawberry sap beetles because beetles and larvae are usually protected inside and under fruit (Demchak, 2013); however, various insecticides provide some degree of control (Table 1). If multiple insecticide applications are necessary, rotate between products with different activity groups to help delay resistance.

Biological Control

Certain parasitic wasps and nematodes that target sap beetles have been identified, but fail to provide sufficient control of sap beetles at naturally-occurring population levels (Rondon et al., 2017). There are some commercially available biological control agents that may be effective against strawberry sap beetle, but they have not been tested (Rondon et al., 2017).

Conclusion

Strawberry sap beetles can cause significant yield loss and are difficult to manage. Cultural approaches that reduce the accumulation of overripe fruit on farm most effectively reduce populations and damage. Although they are less effective, well-chosen insecticide applications targeting the adult beetles also contribute to successful management of this pest.

Additional Resources

1. **Strawberry Sap Beetle:** Loughner, R., Loeb, G.M. 2009. Strawberry Sap Beetle. New York State IPM Program, https://ecommons.cornell.edu/bitstream/handle/1813/43132/strawberry-sap-beetle-FS-NYSIPM.pdf?sequence=1
2. **Sap Beetle Complex:** Rondon, S.I., Price, J.F., Cantliffe, D.J., Renkema, J.M. 2017. Sap beetle (Coleoptera: Nitidulidae) Management in Strawberries, https://edis.ifas.ufl.edu/publication/HS234

Table 1. *Pesticides approved for strawberry sap beetle control in Maryland. Effectiveness ratings are from the 2013-2014 Mid-Atlantic Berry Guide.*

Trade Name[A]	Activity Group	Active Ingredient	REI	PHI	Efficacy	Application Restrictions	Maximum Usage (ai/acre/year)
Assail 70 WP	4A	Acetamiprid	12 hrs	1 day	Slight[B]	2 applications per year 7 days between applications	0.26 lb
Brigade	3	Bifenthrin	12 hrs	0 days	Very	N/A	0.5 lb
Cormoran	4A, 15	Acetamiprid, Novaluron	12 hrs	1 day	No rating	35 fl oz per acre per season 7 days between applications	0.26 lb acetamiprid, 0.23 lb novaluron
Danitol 2.4 EC	3	Fenpropathrin	24 hrs	2 days	Moderate	2 applications per year	0.8 lb
Diazinon 50W	1B	Diazinon	3 days	5 days	Moderate	1 lb ai/acre per application 30 days between applications	2.0 lbs
Dibrom 8 Emulsive	1B	Naled	48 hrs	1 day	Moderate	5 applications per season 7 days between applications Do not apply above 90 °F	4.7 lbs
Malathion 8	1B	Malathion	12 hrs	3 days	Slight	4 applications per year 7 days between applications	2.0 lbs
Rimon 0.83 EC[C]	15	Novaluron	12 hrs	1 day	Slight[D]	7 days between applications	0.23 lb
Sevin 4F	1A	Carbaryl	12 hrs	7 days	Moderate	5 applications per year 7 days between applications	10 quarts

[A] Other formulations or products with the same active ingredient may also be effective. Use of a product name does not imply endorsement of the product to the exclusion of others that may be suitable.

[B] The southern region IPM guide (Hale et al., 2022) ranks Assail 30SG as "good," but they also face a broader complex of sap beetle species and primarily grow plasticulture strawberries. This product likely has not been tested against strawberry sap beetle.

[C] Rimon targets larvae and should be applied as soon as adults are spotted.

[D] Efficacy tests in southern regions indicate that including Rimon in spray rotations can improve control due to the control of the larvae, but it has not been tested against strawberry sap beetle. The southern region IPM guide (Hale et al., 2022) ranks Rimon 0.83EC as "excellent."

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SANKARA GANESH

MARIA CRAMER
mec@umd.edu

KELLY HAMBY
kahamby@umd.edu

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