Kansas State University Agricultural Experiment Station and Cooperative Extension Service

KANSAS CROP PESTS

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Blister Beetles in Kansas

Blister beetles, commonly referred to as blister or oil beetles, belong to the family Meloidae. Species vary in size and color but are easily recognized by their elongated, narrow, and cylindrical body shape. The neck is accentuated by a constriction between the back of the head and the narrow anterior end of the thorax (Figure 1). Although adult blister beetles feed on vegetation, the larvae of common species (genus *Epicauta)* feed on grasshopper eggs. This fact sheet describes the life cycle and habits of the blister beetle, highlighting its importance to agriculture. It addresses common questions about damage associated with blister beetles, most notably adverse effects on horses and other livestock from consuming contaminated hay.

Life Cycle and Habits

Blister beetles have a complex life cycle that begins when the adults emerge from the soil in early to midsummer. Adult blister beetles forage for a few weeks, mate, and then deposit eggs in the soil. Depending on the species, beetles produce egg clusters of up to 100 eggs per capsule that usually hatch in a couple of weeks. The tiny larvae called triungulins, actively search for food in the soil, mainly grasshopper egg pods. They are predacious for the first 2-4 weeks of life, then become relatively inactive, losing their legs and growing a thick skin as they turn into pseudopupae for overwintering. With the return of favorable conditions in the late spring, they pupate. Depending on temperatures, adults emerge in June or July to start the process all over again. Blister beetles are univoltine, which means they have only one generation per year.

Agricultural Significance

Blister beetles can defoliate localized areas of soybean and alfalfa fields, but do not cause economic damage. Plants compensate for foliage losses, and there is little to no effect on yields. Damage may be limited because of the gregarious nature of blister beetle species found in Kansas.

Harm to livestock can be significant. Blister beetles produce cantharidin, a chemical irritant that blisters internal or external body tissues exposed to it. Livestock usually come into contact with blister beetles by consuming alfalfa hay containing dead beetles. Horses are especially susceptible to blister beetle poisoning (cantharidiasis). Blister beetles can be crushed and killed as alfalfa is swathed. When hay is baled, bodies of dead beetles, which still contain cantharidin, may be incorporated into bales. Contamination may not be visible if beetles are crushed during haymaking. Once contaminated, hay does not lose toxicity. Cantharidin does not break down when heated or dried.

Figure 1. Ashgray blister beetle.

The following information addresses common questions about blister beetle poisoning in horses.

Q: How many blister beetles does it take to kill a horse?

A: There is no precise answer. Cantharidiasis severity depends on several factors. Different species contain different amounts of cantharidin. Adult males seem to produce most of the cantharidin, which they transfer to females during mating. The size and overall health of the horse and the amount of cantharidin ingested influence onset of symptoms. It may take as few as 25 or as many as 300 or more beetles to kill a horse in a single feeding, depending on its health status. One study found that 5 grams of blister beetles could kill some horses (roughly equivalent to 30 striped blister beetles). Cattle are much less susceptible, but a laboratory study shows that cantharidin can reduce the digestibility of certain forages.

Figure 2. Black blister beetles on the weedy margin of a field. Blister beetles are strongly attracted to pollinating weeds.

Q: What are the signs of blister beetle poisoning?

A: Blisters and ulcerations may appear on body tissues that have come in contact with the chemical. Colic and diarrhea, accompanied by blood and intestinal tract mucosal linings discarded in the stool may be noted. Urinary system disorders include frequent attempts to urinate, voiding only small amounts of urine, blood in the urine, and pain. Low calcium levels (hypocalcemia) may result in body tremors and a peculiar breathing pattern characterized by periodic jerking contractions of the diaphragm synchronized with the heartbeat. This condition, synchronous diaphragmatic flutter, is associated with calcium deficiency. Other signs and complications include a horse placing its muzzle in water without drinking, congested mucus membranes, elevated temperatures, increased pulse and breathing rates, dehydration, depression, and shock.

Q: What are the physiological effects of cantharidin on horses?

A: Significant portions of the horse's digestive tract may be affected. Cantharidin is excreted by the kidneys leading to irritatation of the kidneys, ureters, urinary bladder, and urethra as it leaves the body. Symptoms may include secondary infections and bleeding. For unknown reasons, cantharidin ingestion can drastically reduce calcium levels and destroy heart muscle tissue in horses.

Q: How soon should I look for signs and symptoms of poisoning?

A: There is no set time for a response to blister beetle poisoning. The number of blister beetles ingested and the size of the horse influence the onset of poisoning symptoms. Death may occur suddenly without warning. In some cases, symptoms of blister beetle poisoning have appeared within 4 to 6 hours of ingestion. Horses may be ill for hours to days before death occurs, or they may recover.

Q: What should I do if I suspect my horse has been poisoned?

A: Provide fresh water and allow the horse to move about freely to minimize colic injury. Consult a veterinarian. With good care and a long period of convalescence, animals may make a partial or complete recovery.

Q: Can I confirm blister beetle poisoning as the cause of illness?

A: If you suspect poisoning, inspect the hay and feeder for dead beetles. It is difficult to tell whether hay contains cantharidin just by looking at it. Beetle fragments are difficult to see and do not have to be present for hay to be contaminated. Beetles may have been crushed during harvesting. Old hay should be removed and replaced with feed less likely to be contaminated with blister beetles.

Q: What is known about blister beetle occurrence in Kansas alfalfa fields?

A: During a five-year study, seven species of blister beetles were recovered from Kansas alfalfa fields, but only five deemed to be hazardous. Two of these species, *E. vittata* and *E. occidentalis*, both striped, present the greatest risk of poisoning. Striped species, which tend to form dense swarms or aggregations (Figure 3), have been associated with a greater incidence of cantharidiasis. With these species, there is a greater chance of enough cantharidin being present in hay bales to cause health concerns in horses.

Striped blister beetles may be present in Kansas alfalfa fields from mid-June through mid-September with peak populations typically occurring from the end of June through the end of July. Overall, second through fourth cuttings present a greater risk than other cuttings. The first, peak, and last appearance of blister beetle species known to occur in Kansas alfalfa are shown in Figure 4. Nationwide, blister beetles occur throughout all alfalfa growing regions. Species composition, seasonal occurrence, and abundance vary widely among geographic production regions.

Figure 3. Aggregation of striped blister beetles on soybeans.

Q: Can field sampling accurately detect blister beetles?

A: Because blister beetles congregate and are quite mobile, it is not easy to detect potentially harmful concentrations. For instance, an aggregation estimated to contain at least 60,000 beetles was encountered harvesting a field that had been intensively scouted a few hours earlier by trained individuals. The swarm was dense enough for the weight of the beetles to bend standing hay. Apparently, the aggregation flew into the field after scouting was finished but before harvesting. Blister beetles tend to be encountered more frequently within 100 feet of the edge rather than further into the field. Yet in several instances, significant populations were located deep within the field. Thus, it is risky to guarantee that hay will be free of blister beetles even with intensive sampling.

Q: Can hay cuttings be guaranteed to be free of blister beetles?

A: No. The second through fourth cuttings are at greatest risk of blister beetle contamination as shown in Figure 4. Ashgray blister beetles have been collected from alfalfa as early as the beginning of May. Although populations did not peak until June, and this species was not seen aggregating in large numbers, beetles could occur in sufficient numbers to cause horse poisonings. Margined and black blister beetles have not been observed swarming, but may occur in large numbers at certain times on pollinating plants, especially weeds. Thus, these species are not as likely to be responsible for horse poisonings.

Q: Does the type of haying equipment make a difference?

A: Several types of equipment, including modifications, have been evaluated to determine potential for incorporating blister beetles into hay bales, including sicklebar mowers, pull-type swathers with conditioning rollers, and various types of self-propelled mowers. The least blister beetle mortality was detected with the use of a self-propelled mower/windrower (without conditioning rollers). This device produced windrows that were straddled by the wide-set wheels. Nearly all of the blister beetles passed through the machine unscathed, leaving the windrow and field before loose hay was baled. The mower could still produce problem bales if the blister beetle swarm was located in alfalfa at the end of the field. Beetles could be crushed by the swather wheels as they passed over fallen hay when the machine was turned around. Hay bales from turn areas are more likely to contain blister beetles than bales of hay gathered from the rest of the field.

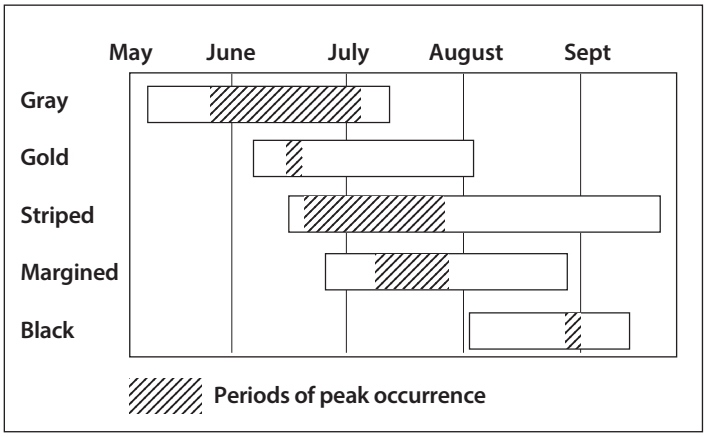

Figure 4. Seasonal and peak occurrence of blister beetles in Kansas alfalfa.

A substantial increase in the number of beetles killed and incorporated into hay bales was noted when alfalfa was cut with a self-propelled mower conditioner. Additional mortality and risk occurred where pull-type mower conditioners were used. Tires running over the fallen hay while mowing increased the risk of contamination.

Sicklebar mowers have often been suggested as the implement of choice to minimize killing blister beetles during the swathing process. It has been shown that the tractor's tires frequently crush a significant percentage of beetles when the mowing equipment passes over the previously cut swath on the next pass around the field. In some instances, this mortality rate approached that of self-propelled mower/conditioners.

Mowing patterns also affected blister beetle contamination risk. Mowing the field in sections may have some unrealized disadvantages. Substantially greater concentrations of blister beetles on the edges of the standing hay were observed the day after some of the field was cut. Presumably, blister beetles surviving the mowing operation moved from the fallen hay to the edge of the standing hay, creating a higher concentration of blister beetles. Raking and baling dislodged beetles from the hay. Dislodging bodies may not eliminate contamination because toxin from smashed beetles can be transferred to the hay.

In the process of baling, the contaminated hay may end up in widely scattered bales. This occurs because swarms often occupy an area greater than the width of a single windrow. As the baler passes up and down the field, it picks up large amounts of uninfested hay between the times the swarm area is encountered. Further scattering of the bales may occur during loading and stacking operations.

Q: Can I condition hay chemically to avoid killing beetles?

A: This approach has limitations. Efforts to dessicate hay with one commercial product succeeded in killing approximately a third of the beetles. Killing beetles chemically or mechanically is undesirable because it increases the likelihood that cantharidin will end up in the hay. Several chemical hay drying products are available, and some may not be as toxic to insects.

Q: Can I control blister beetles with insecticide sprays?

A: Because of the aggregative and restless nature of blister beetles, chemical control of blister beetles in alfalfa may not be desirable. Although it is possible to locate a concentration of blister beetles as a field is scouted, this does not eliminate the possibility of other swarms or new swarms entering the field after spray loses toxicity. Some insecticides are effective for killing blister beetles, but preharvest waiting intervals should be taken into account. No insecticides have enough residual activity to kill blister beetles from the time sprays are applied up until harvest. Additionally, dead beetles that remain in alfalfa foliage may render the hay toxic. Dead beetles on the ground (or their cantharidin) can be transferred back into the hay.

Q: What about inspecting hay before it is used as horse feed?

A: Although inspection of hay bales before feeding them to horses can reduce the liklihood of blister beetle poisoning, this task is difficult and time-consuming. Blister beetles are difficult to spot, and all flakes in all bales should be inspected. Blister beetle swarms are relatively rare, and within any given field, only a small area(s) may be seriously infested. Problems can be concentrated in individual flakes of a single bale. For instance, a particular 5 pound flake of alfalfa hay contained 145 grams of dead blister beetles. Statistically, there were enough blister beetles in that flake to kill 29 horses. In practice, it is more likely that a single horse would have consumed that flake of hay.

Summary

Blister beetles are a major concern for alfalfa producers selling to the horse hay market and for buyers who feed alfalfa hay to horses. Symptoms of poisoning vary, but if cantharidiasis is suspected, consult a veterinarian with experience in the diagnosis. Blister beetles species vary in their seasonal occurrence, cantharidin content, geographic distribution, and propensity to aggregate or swarm. The best way to reduce the risk of poisoning is to avoid killing them. As long as blister beetles are alive and healthy, they can leave the field, minimizing hay contamination.

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