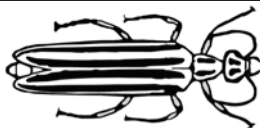

Blister Beetles in Georgia Alfalfa Hay



G. David Buntin, Forage Entomologist, Department of Entomology
University of Georgia Griffin Campus, Griffin, Ga.

Dennis W. Hancock, Forage Agronomist, Department of Crop and Soil Sciences
University of Georgia, Athens, Ga.

Blister beetles sometimes infest forage crops such as alfalfa, where they may become incorporated in hay. Eating alfalfa hay contaminated with dead blister beetles can cause acute illness and death in livestock, especially horses. This publication discusses biology, cause of illness and management of blister beetles.

What is a blister beetle?

Blister beetles are native insects belonging to the family *Meloidae*. The adult beetles range in size from ½ to 1½ inches long. The beetles are elongated, relatively narrow, somewhat cylindrical, and have relatively soft bodies and wing covers. Blister beetles can usually be distinguished from other beetles because the “neck,” or thorax region behind the head, is narrower than the head when viewed from above. (See figures.)

Dozens of species occur in the southeastern United States. Typically, about half a dozen species in the genus *Epicauta* are associated with alfalfa and hay. These species are mainly black, gray or gray with yellow stripes (See Figure 1). **These striped blister beetles are large species and most often associated with hay poisoning.** Other species are the black blister beetle, *E. pennsylvanica*, the margined blister beetle, *E. pestifera*, and the ashgray blister beetle, *E. fabricii*. Only rarely have these other species been implicated in horse poisonings. (See figures 2 and 3.)

Blister beetle adults feed on leaves of various plants including alfalfa, soybean and various wild flowers. Adults are attracted to flowering plants and can be found on goldenrod flowers and similar plants in bloom. Blister beetles have distinct egg, larva, pupa and adult

stages. Larvae of the species contaminating hay will be found in the soil, where they feed on egg pods of grasshoppers. Large blister beetle numbers are sometimes associated with outbreaks of grasshoppers the previous year. In Georgia, blister beetles may occur throughout the season, but usually are most abundant later in the summer from late July through October.

Why are blister beetles a threat to livestock?

Blister beetles contain a chemical toxin in their bodies called *cantharidin*. Cantharidin causes irritation that can blister skin and internal body surfaces. Horses are sensitive to this compound, but ruminant livestock such as cattle and sheep also can be affected. In horses,



Figure 1. Striped blister beetle. [Photo: Marlin E. Rice, Department of Entomology, Iowa State University.]



Figure 2. Black blister beetle. [Photo: Marlin E. Rice, Department of Entomology, Iowa State University]

colic, diarrhea, blood in stool and urine, and the sloughing of intestinal linings have been associated with the ingestion of contaminated hay. Poisoned horses may pass small amounts of blood-tinged urine, place their muzzle in water without drinking, or suffer from elevated temperature, increased pulse rate, dehydration, depression and shock. Death or, in the case of pregnant mares, abortion can result within 24 hours of consumption of contaminated hay. If blister beetle poisoning is suspected, **CONTACT A VETERINARIAN IMMEDIATELY.**

Cantharidin is a naturally occurring toxin produced by the male blister beetle and transferred to the female during mating. Consequently, males tend to contain a higher concentration of the compound than females although this is not always the case. Typical concentrations of cantharidin from studies conducted in Colorado and Kansas for four common species that occur in Georgia are listed in Table 1. It is clear from the average and range of values that cantharidin levels are highly variable among individuals of the same species, between different species, and among locations for the same species.

Table 1. Cantharidin levels in four common blister beetle species.

Blister beetle species	Cantharidin level (mg per beetle)	
	Kansas Study ¹ Average (Range)	Colorado Study ² Average (Range)
Black	0.20 (0.01-0.68)	0.23 (0.01-0.70)
Ashgray	0.04 (0.02-0.05)	0.87 (0.06-3.39)
Margined	0.16 (0.05-0.69)	-
Striped	0.27 (0.04-0.68)	4.87 (1.43-11.13)

¹ from Blodgett, et al. 1991. *Environ. Entomology* 20: 776-780.

² from Capinera, et al. 1985. *Journal of Economic Entomol.* 78: 1052-1055.



Figure 3. Margined blister beetle. [Photo: Marlin E. Rice, Department of Entomology, Iowa State University]

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

The toxicity of cantharidin to horses has not been definitely determined, but the estimated minimum lethal dose is 0.5 to 1 milligram per kilogram of body weight. The toxicity of cantharidin is comparable to that of cyanide and strychnine. Table 2 estimates the number of beetles needed to be ingested to provide a lethal dose to horses of different body weight, assuming a 1 mg/kg lethal dose. **These values are estimates only.**

Many factors such as a horse's age, size, breed and general health can affect an individual animal's susceptibility. Pregnant mares also are more susceptible to abortion at a lower dosage than the dose needed to cause mortality.

Table 2. Estimated number of blister beetles needed to provide a lethal dose (assuming 1 mg per kg of body weight) of cantharidin to a horse.

Cantharidin content (mg) per beetle	Number of blister beetles per horse weight (lbs)			
	250	500	800	1200
0.5	227	450	719	1090
1	114	225	359	545
3	37	75	119	182
5	23	45	72	109

It is clear from Table 2, however, that it takes more than one or a few blister beetles to kill an adult horse. Reliable reports from Kansas indicate that between 25 and 300 or more beetles may cause horse mortality following a single feeding of contaminated hay. Nevertheless, relatively few blister beetles can cause colic and other symptoms in horses, which may indirectly lead to their death.

Have horses in Georgia been poisoned by eating hay contaminated with blister beetles?

The short answer is *yes*. Occasionally, the University of Georgia's College of Veterinary Medicine has linked horse illness and mortality to ingestion of blister beetles. In most of these cases, the blister beetles have been associated with consumption of contaminated hay from western states. A few cases of poisoned horses from contaminated hay from Georgia have occurred over the past two decades, however.

Blister beetles are a much more severe problem in western states, where conditions are normally dry and large grasshopper populations occur annually. Considerable work has been done in these areas to limit the risk of blister beetle contamination of hay.

Grasshopper populations usually are low in Georgia, except during years of drought. Blister beetles also tend to be more abundant during periods of extended drought conditions.

How do blister beetles get into the hay?

It is not uncommon for blister beetles to be found in fields of alfalfa. It is also possible to find them in fields of clover, although the main threat is with alfalfa. The main species associated with livestock poisoning is the three-striped blister beetle because of its large size and tendency to congregate in large numbers in a very small area of a field. Aggregations of more than 60,000 beetles have been documented in western states, but aggregations in Georgia usually are much smaller. In addition to the three-striped blister beetle, the black and margined blister beetles also are common in alfalfa in Georgia.

When alfalfa is cut and harvested, blister beetles can be crushed and killed as hay is swathed. Because beetles tend to aggregate, many beetles can be deposited in just one or a few bales when hay is baled. If the beetles did not aggregate and were randomly distributed with a field, it is much less likely that a lethal number of beetles would occur in any one bale of hay.

Self-propelled or side-mounted mowers or swathers with conditioning bars can crush beetles in hay during the harvesting process. Wheel traffic over mowed hay also can crush and kill beetles in hay. Indeed, studies show that wheel traffic from a tractor with a side-mounted sicklebar mower can kill a similar number of blister beetles in hay as can a hay conditioner. Unfortunately, cantharidin is a very stable compound and can remain toxic in stored hay for more than a year. Furthermore, raking may dislodge dead beetles from hay before baling, but substantial amounts of cantharidin may remain on hay when body fluids of crushed beetles transfer to the forage.

How easily can blister beetles be seen in hay?

Blister beetle body parts can be very difficult to locate within contaminated hay. All flakes within all bales need to be inspected since most beetles may be in one part of one bale. Also, body fluids containing substantial amounts of cantharidin may remain on contaminated hay even if most of the dead beetles were dislodged during the harvest process. Nevertheless, detailed inspection of small numbers of hay bales for high-valued animals may be useful.

Can anything be done to minimize the risk of hay contamination?

Yes. Several management tactics during the growing and harvesting process of alfalfa can reduce the risk of blister beetle contamination in hay. **While the risk of blister beetle contamination can be minimized, it cannot be completely eliminated.** The following actions will help reduce the risk of blister beetle contamination.

- Learn to identify blister beetles. They are fairly distinct and easily distinguish from other beetles. The three-striped blister beetle is easily recognized.
- If possible, grow your own alfalfa. If you cannot grow your own hay, know your suppliers and their management practices. The risk of blister beetle infestation in hay is greatly reduced when hay producers implement best management practices for blister beetle scouting and control.
- Studies in Georgia and other areas have found that the first cutting has the least risk of infestation. Blister beetles normally emerge after the first cutting and do not reach peak numbers until late July through October. Later cuttings are more likely to be infested than the first one or two cuttings.
- When harvesting alfalfa, blister beetles may "swarm" in front of the harvester. The driver should be able to identify the beetles and be on the lookout for them. If observed, stop harvesting and allow the beetles to disperse.
- Blister beetles are attracted to flowering plants. Harvest alfalfa before or soon after bloom begins. Cutting in the bud stage (before first bloom) or 10 percent bloom stage not only minimizes blister beetle incidence but also harvests the forage at a high level of feed quality. Repeatedly harvesting alfalfa in the bud stage, however, may result in poor stand persistence.
- Control broadleaf weeds in alfalfa. Since blister beetles are attracted to flowering plants, they also are attracted to flowering weeds.

- Scout alfalfa for aggregations of blister beetles immediately before harvest. Focus on the field margin where beetles may move in from surrounding vegetation. Avoid harvesting infested spots.
- Because of the humid conditions, crimping and conditioning hay is almost always done in Georgia. Crimping and conditioning can crush beetles in the forage as it is being harvested. However, refraining from the use of a conditioner drastically prolongs hay curing (1 or more days). Weigh the risk of rain damage against the risk of blister beetle infestation.
- Avoid wheel traffic over freshly cut hay. Use the mower so the alfalfa is conditioned but subsequent wheel traffic straddles and does not drive over drying hay. If a mower/conditioner is used, set the machine to lay the forage in a swath that is narrow enough to accommodate wheel traffic. To optimize drying time, follow the cutting operation with a hay tedder to fluff and scatter the forage.
- Use of a rotary disk mower without a conditioner or sicklebar cutter is often recommended to cut the forage, allowing beetles to disperse. Wheel traffic from tractors over previously cut forage, however, can crush and kill beetles before they disperse. So the previous comment about not driving over freshly cut hay also applies to tractors with a disk mower or with a sicklebar cutter.
- Do not use hay for horses from the end of the field or the edge because beetles tend to occur along the field margins. Also, turning of harvest equipment at the field edge often crosses over windrows, which increases the chance of crushing beetles in cut forage.
- Insecticides: Several insecticides are effective in killing blister beetles. Studies vary on the benefits of using insecticide. Research indicates that following an insecticide application, many but not all beetles will fall out of the alfalfa foliage and burrow below the leaf litter on the soil surface. This behavior may reduce the risk that beetles killed by an insecticide application will remain in treated forage. Not all beetles drop from the foliage, however, and dead beetles can be incorporated back into hay during swathing and raking. Also,

insecticides such as Sevin or lambda cyhalothrin have a pre-harvest interval of 7 or 14 days, which allows time for beetles to re-infest treated fields. Malathion is the only labeled insecticide that can be applied the day of harvest. Do not apply insecticide during bloom to avoid killing bees.

- Inspecting hay bales for dead blister beetles is difficult and may not identify contaminated hay. Nevertheless, detailed inspection of a small number of hay bales for high-valued animals may be useful.

Further References

- Blodgett, S. L., R. A. Higgins, and G. A. Milliken. 1995. Blister beetles (Coleoptera: Meloidae) mortality evaluated during alfalfa harvest. *J. Economic Entomol.* 88: 398-406.
- Blodgett, S. L., J. E. Carrel, and R. A. Higgins. 1991. Cantharidin content of blister beetle (Coleoptera: Meloidae) collected from alfalfa in Kansas and implications for inducing cantharidiasis. *Environ. Entomol.* 20: 776-780.
- Blodgett, S. L., J. E. Carrel, and R. A. Higgins. 1992. Cantharidin contamination of alfalfa hay. *J. Medical Entomol.* 29: 776-780.
- Buntin, G. D. 1989. Occurrence of blister beetles (Coleoptera: Meloidae) in Georgia alfalfa. *J. Entomol. Science* 24: 519-525.
- Capinera, J. L., D. R. Gardner, and F. R. Stermitz. 1985. Cantharidin levels in blister beetles (Coleoptera: Meloidae) associated with alfalfa in Colorado. *J. Economic Entomol.* 78:1052-1055.
- Hutchison, W. D., M. J. Murphy, and G. N. Tufe. 1990. Blister beetles in alfalfa, management options to minimize poisoning of horses. Minnesota Extension Service, AG-FO-5510-D, 4 p.
- Higgins, R. A., and F. Oehme. Blister beetles. Kansas State University Agric. Exp. Stn. and Coop. Extension Serv. Forage facts sheet. (http://www.oznet.ksu.edu/pr_forage/pubs/97notebook/fora32.pdf) Iowa State University).