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Blister Beetles of Montana

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Blister beetles (meloid beetles) are leaf-feeding insects that secrete a liquid that can cause blisters, and can be toxic when accidentally fed to livestock in forage. Of nine species observed in Montana, only one has been reported to have damaged crops. This fact sheet describes the species found in Montana and discusses the risks of crop damage and livestock poisoning.

BLISTER BEETLES, also called meloid beetles, get their name from a toxin called cantharidin found in their body fluids. When the adult beetle is disturbed, "blood" containing this toxin is exuded from the leg joints. The fluid can cause blisters when it comes in contact with the skin.

Beetles killed during alfalfa harvest operations and incorporated into baled alfalfa can be toxic when fed to livestock. However, surveys of blister beetle species and seasonal occurrences conducted over several years in Montana have concluded that they are of minor concern to alfalfa producers or people who feed hay produced in Montana.

Damage and risk posed by blister beetles

Many species of blister beetles occur throughout the United States and Montana. The species group for each region, their seasonal occurrence, abundance during the growing season, and the beetle's toxicity dictate the seriousness of this pest. Blister beetles are documented leaf-feeding pests of potatoes, sugarbeets, soybeans and alfalfa. In Montana, they occur most frequently in alfalfa hay and canola, but have been reported from potatoes and other broadleaf crops.

Blister beetles can be both direct and indirect pests depending on the crop and damage potential. For example, they are not considered a

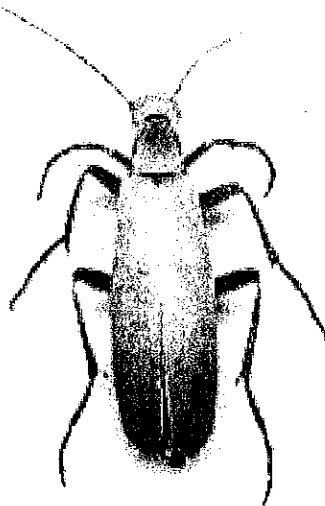


Figure 1. Typical blister beetle with distinct narrow neck, long, soft wing covers and tip of abdomen showing.

direct pest in alfalfa forage, although adult feeding may cause localized defoliation. The primary concern with blister beetles in alfalfa is the potential of contaminating forage with the toxin, cantharidin. This happens when beetles are killed during alfalfa harvest and the dried beetles, which still contain the toxin, are incorporated into baled alfalfa.

In other crops such as canola, potatoes or sugarbeets, feeding by adult blister beetles may cause serious defoliation and may damage or destroy flowers or buds, both of which have impacts on yield and quality of the harvested crop. Blister beetles have been observed



Figure 2. Spotted blister beetle feeding on alfalfa flowers (top). Spotted blister beetle compared to *E. oregona* (larger beetle) (right).



feeding on canola flowers and green seedpods in Montana but the economic impacts are not known.

In contrast to its damage potential, the most well-represented blister beetle genus in Montana, *Epicauta*, can also be considered beneficial because the immature beetles feed on grasshopper eggs.

Description

The blister beetle adult is distinguished by the long cylindrical soft body, with the tip of the abdomen extending beyond the end of the wing covers (elytra), chewing mouthparts, and a thorax (neck) narrower than both the head and the abdomen (Fig 1). Species range in size from 1/4 inch to almost 1-3/4 inches. Indi-

Meloidae species	May	June	July	August	September
<i>E. fabricii</i>					
<i>L. cyanipennis</i>					
<i>E. normalis</i>					
<i>E. maculata</i>					
<i>E. sericans</i>					
<i>E. ferruginea</i>					
<i>E. pensylvanica</i>					
<i>E. murina</i>					
<i>E. nuttalli</i>					

Occurrence from museum
 Occurrence from field survey

Figure 3. Seasonal distribution of nine blister beetle species in Montana data obtained from museum and field collected specimens.

vidual species can be characterized by distinctive coloration and antennal characteristics.

Life cycle

Blister beetles lay eggs in clusters of up to 100 in the soil. The eggs hatch within 14 days into tiny, mobile larvae, called triungulins, which move about, searching for food. The immature beetles feed on grasshopper egg pods or the larval cells of solitary bees, becoming increasingly sedentary as they feed. The larva overwinters in the soil in a specialized form. In the spring, pupation occurs in response to increasing temperature and moisture. Blister beetles have one generation per year.

The adults emerge, usually from late May until mid-July, and begin to feed and lay eggs. Adults of each blister beetle species emerge successively during the growing season. Various blister beetle species may be found in Montana from May until mid-September (Fig. 3).

Crop damage and economic impact

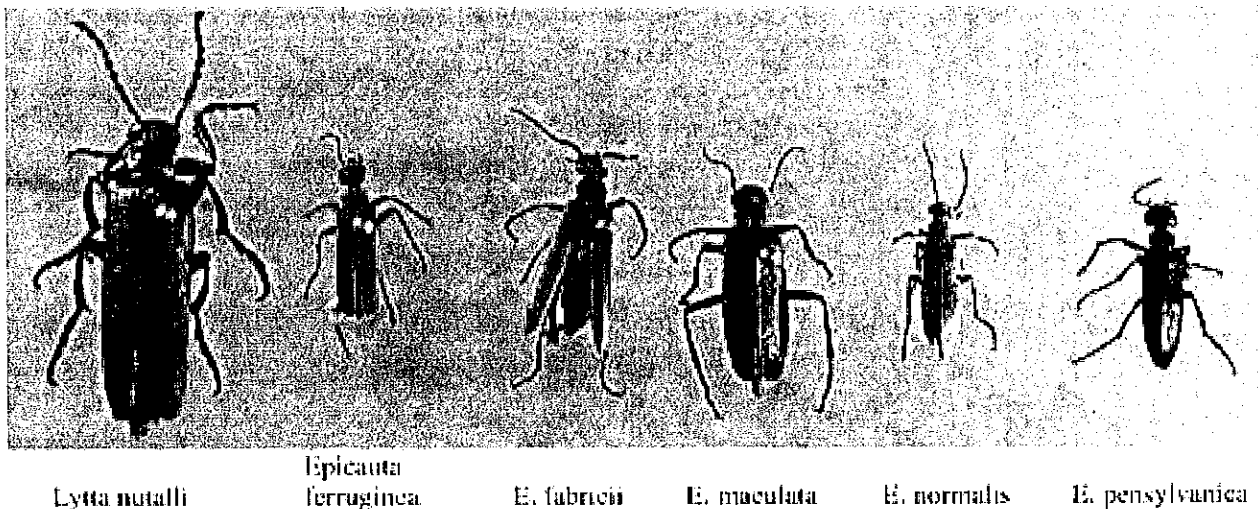
Sugarbeets: Several species of blister beetles feed on sugarbeet foliage and may cause isolated patches of defoliation in the crop. Black, ash-gray and spotted beetle species have been documented on sugarbeets in Montana. However, economic infestations are rare.

Canola: A large (1 - 1-1/4 inch), purple and green iridescent beetle (*Lytta nuttalli* or Nuttall's blister beetle) can be found in Montana feeding on the leaves, stems and flowering heads of canola plants. This species can be found in dense groups on the edges of canola fields and have been observed moving from windbreaks of caragana hedges into flowering canola fields. From observations made on this species in Canada, they seemed to prefer low- (canola) rather than high-glucosinolate strains of rapeseed, and low- rather than high-coumarin strains of sweet clover. This species of blister beetle stands out because of its large size and metallic coloration. The defoliation damage that they cause does not have significant economic impact except when populations are extremely high or are concentrated on the buds and flowers. Treatment is not recommended under normal conditions.

Potatoes: Blister beetles can occur in mid-summer on potatoes and may cause extensive foliar damage. Typically, blister beetles may cause localized areas of foliage damage, but widespread economic damage is rarely encountered.

Risk posed by blister beetles in alfalfa hay

Although adult beetles feed on alfalfa foliage, their primary impact is not due to defoliation damage. Instead, blister beetles are of concern because they contain a toxin in their body fluids called cantharidin, a very



2 Figure 4. Major species that occur in Montana

stable compound. Blister beetles can be killed during hay harvest and incorporated into baled forage.

When hay containing blister beetles is ingested by sensitive livestock, blistering of the esophagus and stomach

can occur, kidney and heart function can be impaired, and in severe cases, death can result. Horses are especially prone to blister beetle poisoning, which occurs when they feed on dried, baled forage containing the dried beetles.

The risk of blister beetle poisoning depends on how much cantharidin is ingested. Several factors may effect the cantharidin concentration in the baled forage including the species of blister beetle, the beetle population










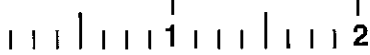
Species (common name)	Adult length	Coloring	Season of emergence	Plants observed feeding on	Damage reported
 Lytta cyanipennis	3/4 to 1 ¹ / ₄ inch	Head, thorax and wing covers deep metallic blue varying to green	March to August. In Montana primarily observed mid-June through mid-July	Lupine, vetch, peas, alfalfa and beans	
 L. nuttalli (Nuttall)	3/4 to 1 ¹ / ₄ inch	Head and thorax usually metallic green with wing covers metallic purple	June and July	Sweet clover, alfalfa, milkvetch, caragana, locoweed and vetch canola, barley, oats, beets and sainfoin	Reports of damage to canola, barley, oats, beets and sainfoin
 Epicauta fabricii (ash gray)	3/8 to 5/8 inch	Uniformly ash gray with black antennae	June through August	Alfalfa, sweet clover, wild indigo, soybeans and locoweed	
 Epicauta ferruginea	1/4 to 1/2 inch	Uniformly golden in color	May through August.	Canola, alfalfa, sunflower, thistle, gumweed and lentils	
 Epicauta maculata (spotted)	1/2 to 1 inch	Characteristic black spots caused by the absence of pubescence	June through July		
 Epicauta murina	1/4 to 3/8 inch	Dark gray	mid-June to mid-August	alfalfa	
 Epicauta normalis (dark)	1/2 to 1 inch	Gray with black spots (similar to E. maculata)	July	unknown	
 Epicauta pensylvanica (black)	1/4 to 5/8 inch	Uniformly black	June and July	A wide range of plant hosts including crops such as alfalfa, sunflower, sugarbeets and weeds such as amaranthus, aster, nightshade, sage and yarrow	
 Epicauta sericans	1/4 to 3/8 inch	Gray	July	Weeds, such as goldenrod, bindweed, nightshade	
					

Table 1. Summary of research observations

and its distribution or density within the field. Some species occur in very dense aggregations similar to that of a honeybee swarm and these species have been most frequently implicated in horse poisoning cases. Aggregations of blister beetles occur in localized areas of 100–200 sq. ft. In this case, only a few flakes from a bale of hay may contain blister beetles. However, the species that are known to cluster in swarms have not been found in Montana. The danger of blister beetles to forage production is low in Montana.

How many blister beetles can kill a horse

Several factors contribute to the severity of blister beetle poisoning, including concentration of the toxin cantharidin, size and health of the horse, and the dosage (or number of beetles) consumed. John Capinera (formerly at Colorado State University) did some work investigating the dosage of the toxin, cantharidin (contained in blister beetles), needed to kill horses of different sizes. The following table is taken from work that he published.

Although all blister beetle species contain some level of the toxin, cantharidin, only those species belonging to the 'Striped' or Vittata Group, that form dense aggrega-

tions have been documented to kill horses. These species have not been found to occur in Montana.

Major species that occur in Montana

A survey of blister beetles in alfalfa was conducted during a 4-year study at Montana State University, 1994-1997 by the authors. Eight species were found to occur in Montana alfalfa (Fig. 3). Blister beetle collection information was also gathered from the museum collection, Montana Entomology Collection and used where host plant data are indicated. *E. normalis* was not found in field collections, but specimens are present in the Montana Entomology Collection.

Management

Monitoring to detect the presence and type of blister beetle present is important. If blister beetles are present at harvest, it is important to use harvest equipment that allows the beetles to escape from mowed and swathed forage. Type of equipment and its operation has an impact on blister beetle mortality during hay harvest. Research at Kansas State University has shown that self-propelled swathers without conditioning rollers but with windrowing attachments are safer than mower conditioners and sicklebar mowers.

Sicklebar mowers, long recommended for reducing the potential for blister beetle incorporation into baled forage, were found to cause significant mortality if recently cut hay was driven over. Wheel traffic on recently mowed alfalfa hay caused mortality of those beetles remaining in the cut forage. Allowing beetles to disperse after mowing and before baling reduced the number of beetles incorporated into baled hay.

Insecticides can be used to reduce populations. However, since blister beetles are mobile and may move into the crop at any time, the residual activity of registered insecticides may not be sufficient to control blister beetles up to harvest.

Another strategy would be to treat immediately before harvest, but insecticides with zero-day pre-harvest intervals are not labeled for blister beetle control. Also, Kansas State University discourages the use of insecticides because it causes beetle mortality, resulting in beetles remaining in the forage.

Current insecticide recommendations can be found in the High Plains Integrated Pest Management Guide, located on the web at <http://highplainsipm.org/>

Summary

The species that have been detected in Montana are not regarded as a significant problem because numbers are relatively low and occur infrequently. The species that is most frequently cited as the cause of horse deaths have not been found to occur in Montana.

Cantharidin content in beetle (mg)	beetles required to kill 550 lb horse	beetles required to kill 825 lb horse
1 mg	250 beetles	350 beetles
3 mg	83 beetles	124 beetles
5 mg	50 beetles	75 beetles

Table 2. Cantharidin toxicity in horses (study by Capinera, CSU)

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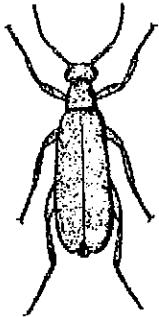
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Blister Beetles

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Ash-gray blister beetle, *Epicauta fabrici*.
(Courtesy of U.S. Public Health Service.)

Blister beetles are infrequent pests of several crops including alfalfa, sweet clover, potatoes, beans, and sugarbeets. They are also injurious to a wide variety of vegetables and many flowers and other ornamentals. They normally cause limited plant damage. However, when they are ingested by horses or other livestock, serious illness or even death may result.

Description

Blister beetles are common throughout the United States. Several species can be found in the Great Plains during the summer months.

Adults range from 1/2 to 1 inch long and have a characteristic narrow, elongate, soft body with a head wider than the pronotum (see figure). The flexible wing covers are rounded over the abdomen and the color varies from black to gray to brown. Some species have a metallic sheen or they may have conspicuous orange stripes.

The larvae of the largest genus *Epicauta* are considered beneficial, for they feed on grasshopper eggs in the soil. Many species are found in bees' nests where they feed on bee eggs and food stored in the nest.

Problems associated with blister beetles have traditionally been in those areas where environmental conditions favor frequent outbreaks of grasshoppers. This is especially true in the relatively arid states of the west, central and northern Great Plains.

Effects on Livestock

All species of blister beetles produce a toxic substance called cantharidin. This toxin is a well-known vesicant (blister-causing substance) that is quickly absorbed upon contact and causes inflammation and blistering of internal and external body tissues. The amount of toxin produced varies considerably between species. The ash-gray, black, striped, and margined blister beetles are a few of the more common species which produce levels of cantharidin capable of poisoning livestock. Livestock come in contact with blister beetles when they consume infested alfalfa hay. Horses are most susceptible to the toxin, while sheep and cattle are more tolerant. The reaction to the toxin depends upon the relative dose; enough ingested beetles can be lethal to any animal.

Researchers have determined the lethal dose of cantharidin to be approximately 1 milligram per kilogram of horse body weight. This means that about 200 blister beetles could have levels of toxin sufficient to kill an adult horse. In addition, an average of 5.0 mg of cantharidin has been found in striped blister beetles, which indicates that 30 to 50 adults could be potentially lethal. However, even a few beetles may cause colic in horses. Cantharidin can also be lethal to cattle and sheep. Although less susceptible than horses, they may experience symptoms if enough beetles are consumed. A laboratory study has shown that cantharidin can reduce the digestibility of certain forages. Little information or research exists addressing the effects of cantharidin on lactating dairy cows. Symptoms of sublethal poisoning include depression, diarrhea, elevated temperatures, increased pulse and breathing rates, and dehydration. There is also frequent urination, especially after the first 24 hours. If cantharid poisoning is suspected, a veterinarian should be contacted immediately.

The toxin is extremely stable. Crushing or chemically killing the beetles will not diminish the toxin's activity. Even the remains or dried juices from crushed beetles on the hay may cause severe digestive and urinary tract ailments in domestic animals.

Management Strategies

Several management options are available which can reduce the number of blister beetles found in forage crops but none will eliminate the problem.

Adjust harvest dates and maintain weed free alfalfa. Since blister beetles are readily attracted to flowering plants, controlling the number of flowering weeds in the field and cutting alfalfa prior to bloom stage will reduce the potential for infestation.

Check hay for blister beetles prior to cutting. Blister beetles are gregarious and are often found in high numbers in localized areas of the field. Prior to harvest, growers should be aware of potential infestations, and if blister beetles are present in the field, the harvest should be delayed for several days. In many instances, the beetles will move. However, they may move to another part of the field, so a careful inspection is necessary.

If beetles are present in the field at the time of harvest, avoid using hay conditioners or crimpers. These implements may kill the beetles and prevent them from moving out of the hay as it dries. A self-propelled harvester which has wide-set wheels and no conditioner or crimping equipment can be used to windrow the hay, resulting in fewer dead blister beetles in the hay.

Apply an insecticide for beetle control prior to harvest. Fields suspected of being infested should be thoroughly scouted (concentrating near the field edges) prior to harvest, and if blister beetles are present, an insecticide may be applied for control. Beetles killed by the insecticide will most likely fall to the ground and should not be picked up by the harvesting equipment. Fields should be rechecked 24 hours prior to cutting to ensure that new swarms of blister beetles have not reinfested the fields. Several insecticides registered for use on alfalfa, dry beans, soybeans, potatoes and sugarbeets show good activity on blister beetles. Observe label directions for rates, pre-harvest intervals, restrictions and precautions. Fields should not be treated at peak bloom to avoid bee kill.

In all cases, hay suspected of being infested with blister beetles should be checked for beetles prior to feeding. Contaminated hay should not be fed to horses or other livestock; removal of the beetles from the hay will not make it safe.

It is to the grower's advantage to minimize harvest operations which kill blister beetles, thereby minimizing the possibility of feed contamination. Management practices can only reduce the number of blister beetles present and the potential risk of cantharidin poisoning.

E-1002, January 1992

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Blister Beetles and Alfalfa

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Blister beetles are common in southern and eastern areas of the United States (Figure 1). Of the species that occur in Oklahoma, the most common is the striped blister beetle (*Epicauta occidentalis*). This beetle has several black and orange stripes along the back (Figure 2). All fatalities caused by blister beetle toxicity in horses examined by Oklahoma State University veterinarians have been caused by the striped blister beetle. Several species with spotted, black or gray coloration (Figure 2) are also found in Oklahoma and other areas.

and the larvae immediately begin searching for grasshopper eggs to consume. Grasshopper eggs are laid in clusters of up to 30 or more within 1 to 2 inches of the soil surface during the late summer and fall. Blister beetle larvae devour clusters of eggs, then overwinter in the soil and emerge as adults in late spring or early summer. When infesting alfalfa, beetles prefer to feed on blossoms but will feed on leaves if blossoms are not present. Pigweed, goldenrod, goathead, puncturevine, peanuts, soybeans, and many other plants also serve as hosts for these beetles.

Emergence of adult blister beetles typically occurs after

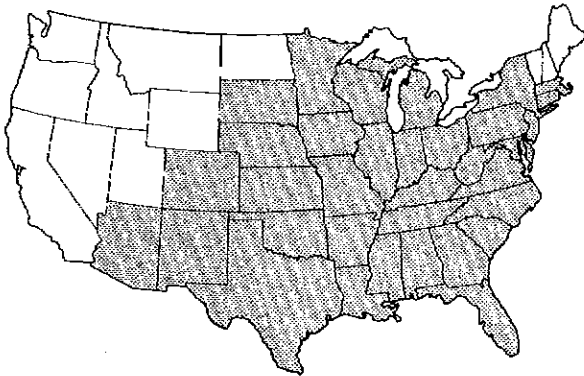


Figure 1. Area of the United States where striped blister beetles have been reported.

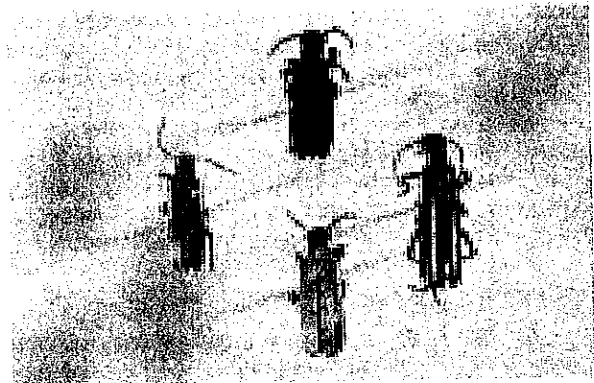


Figure 2. Black, spotted, striped, and gray blister beetles are representative of the many species in the U.S.

All of these beetles contain the blistering agent "cantharidin" in their hemolymph (the blood of insects). Cantharidin is highly toxic when ingested by horses or other livestock and may cause illness and even death in these animals. It is a very stable compound that retains its toxicity to livestock even when dried remains of beetles, that have been killed in the harvesting process, are fed along with forage. Cantharidin is produced only by male blister beetles and is stored until mating. Thus, mating status determines whether females contain the toxin.

Cantharidin may cause irritation to the lining of the stomach, small intestine, bladder and urethra in horses.

Beetle Life Cycle

Blister beetles complete one generation per year. Adult beetles mate and the females lay eggs during the summer in shallow cavities in the soil. These eggs hatch in the fall



Figure 3. Typical swarm of striped blister beetles found on alfalfa hay.

the first cutting of alfalfa is completed. Striped blister beetles have not been collected by OSU entomologists before May 14 in Oklahoma, and in many years, it is mid-June or later before they become active. Generally, first cutting of Oklahoma alfalfa is in late April or early May. Activity of the adult blister beetle ceases in early fall which should ensure an October cutting free of beetles. Consequently, it is possible for hay producers and buyers to obtain forage harvested at times of the year when there is little chance of beetle infestation.

Avoiding Blister Beetle Contamination

Striped blister beetles are gregarious, and frequently large numbers congregate in small areas of fields (Figure 3). This habit makes them easier to see when harvesting, but it also increases the chances that remains of beetles killed in the harvesting process may be concentrated in a few hay bales or portions of bales unless special precautions are taken.

Blister beetles normally do not migrate long distances. In alfalfa, they are often found within 50 yards of the field margin. Therefore, scouting for blister beetles should be concentrated along field borders. When spraying fields for control of other insect pests, also spray border areas to reduce chances of blister beetle migration.

Blister beetle contaminated hay is almost always the result of beetles being crushed prior to baling. This usually happens when the swather goes through a swarm of beetles. Beetles are killed by the crimper rollers and trapped in the hay. Remains of blister beetles may be concentrated in a small portion of the hay from a field. Beetles are also killed and trapped when forage is driven on before the beetles have had time to escape. If left alone, the vast majority of blister beetles leave alfalfa shortly after cutting. Cutting without using crimpers and avoiding wheel traffic on freshly cut alfalfa are two of the best ways to avoid problems.

Other measures alfalfa producers can take to avoid blister beetles in the hay are:

- Spray entire fields with a short residual insecticide just before harvesting. Spray the fence rows and field borders as well; or,
- Inspect fields shortly before cutting and spray only the infested areas if any are found.

The insecticide Sevin is registered for blister beetle control in alfalfa. It has given good results under Oklahoma conditions. Use Sevin at 0.5 to 1.0 lb active ingredient per acre.

It has a 7-day waiting period before harvest. Methoxychlor is also registered for blister beetle control in alfalfa, and it has a 7-day waiting period before harvest.

In addition to these compounds, other chemicals have been used in controlling blister beetles in alfalfa. Malathion and the Permethrin products (at lower rates) have no waiting period between application and harvest; however, their labels do not list blister beetles as a target pest. Furthermore, the efficacy of these products on blister beetles in Oklahoma has not been thoroughly tested. Parathion has been used effectively for blister beetle control; however, it has a 15-day waiting period before harvest.

Things an Alfalfa Buyer Should Do

- Know your alfalfa supplier.
- Ask producers what precautions were taken to avoid presence of blister beetles in forage.
- Inspect hay before feeding if presence of blister beetles is suspected.
- If feeding small amounts of alfalfa, examine each flake for concentrations of dead blister beetles.
- Purchase hay harvested before May or after September. This will not guarantee a lack of problems with blister beetles but will reduce the risks significantly.
- If symptoms appear, call your veterinarian immediately.

Blister Beetle Poisoning in Horses

Symptoms in horses are dependent on the amount of cantharidin eaten. If a large amount of cantharidin is consumed, a horse may die within 6 hours. If a small amount is consumed, only depression or mild colic (pawing, looking to the side, stretching) may occur. A frequent symptom of cantharidin illness is placing the muzzle in water and playing in the water with the lips and tongue. Severe poisoning may result in low blood calcium and magnesium. These low electrolyte levels may cause stiffness or an exaggerated "goose-stepping" gait. An exaggerated contraction of the diaphragm may also occur. Horses that survive at least 24 hours may strain frequently and void small amounts of darkened urine (blood in urine). Any horse showing these symptoms should be promptly examined by a veterinarian and the forage inspected for presence of blister beetles. Autopsies may be performed on animals that die after consuming legume hay.

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