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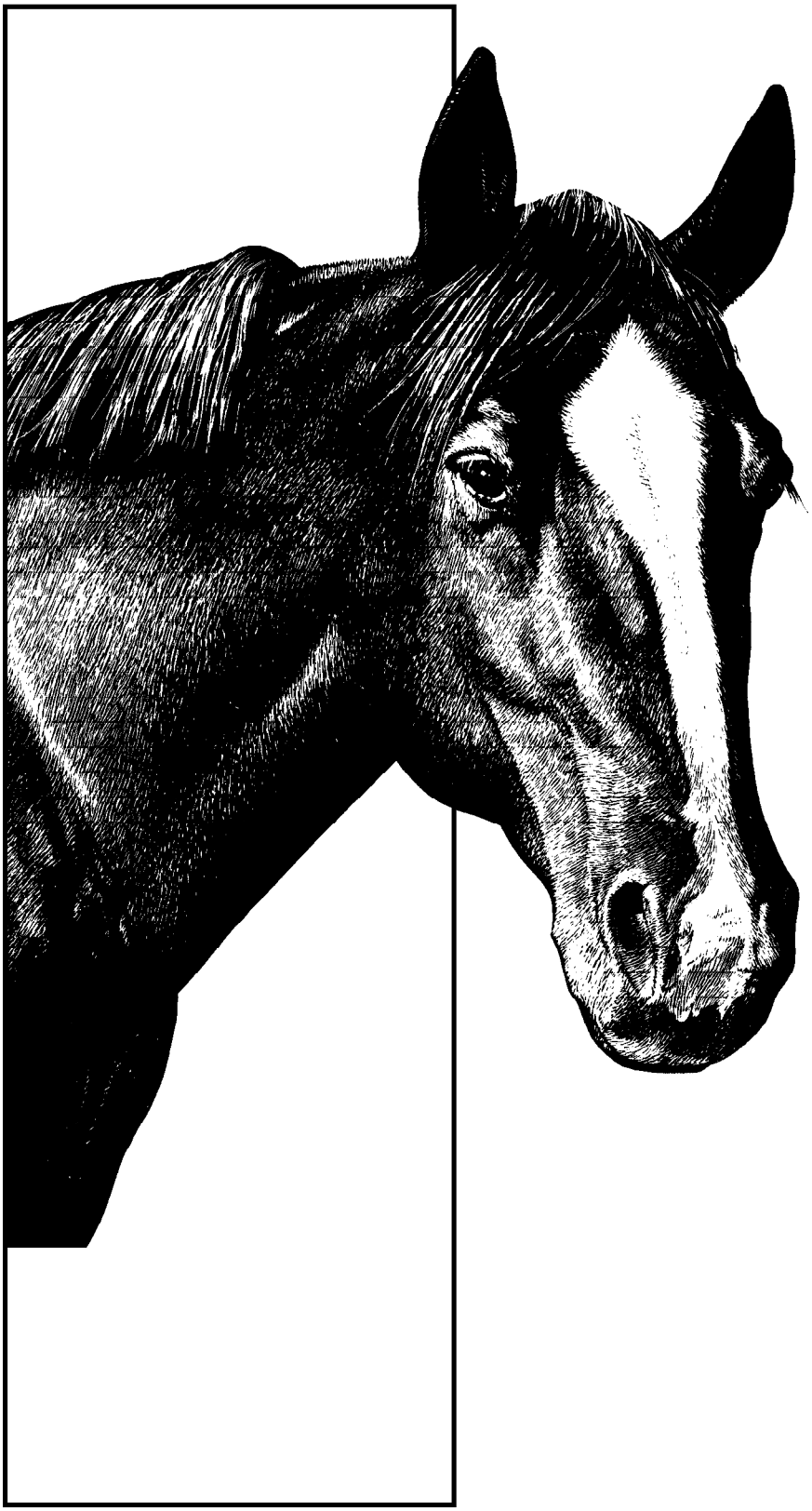

Insect Pests of Horses

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Table Of Contents

A number of insect pests can cause damage and irritation to horses. These insects include biting flies, nuisance flies, lice, and bots. Occasionally other arthropods such as mites and ticks may cause problems. The biology and control of the most commonly encountered insects associated with horses and their premises are discussed here.

Biting Flies

Several types of biting flies bother horses. These include mosquitoes, black flies, deer flies, horse flies and stable flies. Of these pests, the stable fly is probably the most important biting fly pest for several weeks during the sum-mer.

Stable Flies

Adults: Both male and female stable flies feed on blood and are persistent feeders that cause significant irritation to host animals. Adults are 1/4 to 1/3 inch long and resemble house flies (Fig-ure 1). A “checkerboard” appearance on the top of the abdomen and the stiletto-like proboscis separate this species from adult house flies.

Eggs: Stable fly eggs are about 0.04 inch long and are an off-white color. Females deposit clusters of eggs containing up to 50 eggs. Several egg clusters may be deposited during the life of a female fly and a single female can lay up to a thousand eggs during her lifetime.

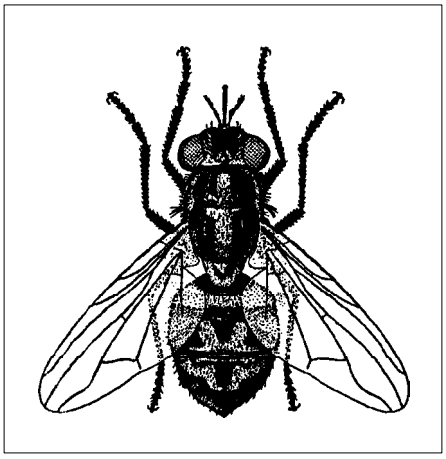

Figure 1. Adult stable fly or dog fly.

Larvae: Stable fly larvae have a typical maggot shape and are similar to the house fly. There are three larval stages. The last stage larva is about 2/5 inch long and is a cream white color.

Pupae: After the third stage larva completes feeding, it shortens, hardens and darkens in color. The chestnut brown pupa is 1/4 inch long. Stable fly pupae are very similar in appearance to house fly pupae and are difficult to distinguish since, in their natural habitat, they are usually mixed with house fly pupae.

Stable Fly Life History and Habits

Stable flies will feed on blood from practically any warm blooded animal including horses, humans, pets and other livestock. During periods of high stable fly activity, humans can be severely annoyed; this insect has been called “the biting house fly.” Individual flies may feed more than once per day (Scholl and Peterson, 1985). Peaks of feeding activity commonly occur during the early morning and again in the late afternoon. Stable flies prefer feeding on lower parts of the hosts such as the legs and belly of horses and cattle. Both male and female flies feed on blood; the female requires blood meals to produce viable eggs. Eggs are deposited into a variety of decaying animal and plant wastes but are rarely found in fresh manure. Fly larvae develop in excrement mixed with straw, soil, silage or grain (Guyer and King, 1956; Meyer and Peterson, 1983) but are also found in wet straw, hay, grass clippings, other post-harvest refuse, and poorly managed compost piles. Large round hay or straw bales, where contacted by moist soil, may also serve as a larval development site. Larval devel-

opment requires 11 to 21 days, depending on environmental conditions. Mature larvae then crawl to drier areas to pupate. The pupal period varies from six to 26 days depending on temperature. The entire life cycle from egg to adult is generally completed in three to six weeks.

Stable flies are active during the summertime in the north central plains and are one of the most important pests of horses and livestock. Stable flies prefer to feed outdoors and rarely are found feeding or resting indoors. These flies are strong fliers and dispersion from one livestock facility to the next is common. They remain active into October. However, larval development slows as autumn temperatures decrease. At temperatures near freezing, larvae can survive but continue to develop slowly in habitats such as piled silage or manure where fermentation generates heat (Scholl et al., 1981).

Stable Fly Management

A sound sanitation program is of paramount importance to fly control; all other types of control are doomed to failure without this important first step. Control of stable flies in barnyards, stables or corral areas usually involves several methods. These methods also apply for the house fly. Chemical control directed at larval and adult stages of both insects is usually required periodically during the fly season.

Sanitation around stable or corral. The basic aim of a sanitation program is to reduce or eliminate larval development sites on the farmstead. A number of areas require attention because of the varied habitats suitable for larval development of these flies. Manure management is essential in limiting fly production. Timely spreading of manure promotes drying and prevents larvae from developing. Even small areas, where manure mixes with straw, are ideal breeding sites for large numbers of both stable and house flies. Wet areas where manure, mud and plant debris accumulate also form ideal breeding habitats for these fly species. Modifications of the drainage around corrals to reduce excess moisture can eliminate these fly production sites and make chemical control efforts much more successful.

Chemical control. A variety of chemical control techniques are available to the horse owner. Generally, control of adult flies using residual insecticides as surface treatments and knock-down sprays to kill existing adult flies are the most effective techniques. In most barnyard situations, a combination of residual and space sprays is used, often on an alternating schedule. Treatments applied directly to horses are not as effective for control of stable or house flies as residual surface treatments. In practice, both techniques usually are needed. These and other methods of more limited usefulness are discussed below. ALWAYS FOLLOW THE LABEL RECOMMENDATIONS FOR RATE AND FREQUENCY OF ANY PESTICIDE TREATMENT.

Applications of residual insecticides to premises are frequently used to control both house and stable flies. Longer residual insecticides provide control for an extended period when sprayed onto sites where the adult flies congregate. Sides of buildings, inside and outside surfaces of stalls and fences may be potential day or night resting sites for these flies. Observation of your own barnyard situation will quickly tell you the favored resting sites for flies. Flies contact the insecticide when they land on the treated surfaces.

Knock-down sprays are effective in killing adult flies present at the time of application. The chemicals used for these applications are usually short residual insecticides having a quick knock-down and high contact toxicity. Several types of spray or fogging apparatus may be used for these applications. Wind velocities should be low at the time of application and the droplet or particle size should be small (50-75 microns) to ensure drift through the corral area. This method requires less time for application but has the disadvantage that it will only kill flies present at application and thus provides short-term relief.

Direct animal applications of sprays and dusts may be used in some situations to protect animals. Materials used for direct animal application usually have short residual activity and this type of application is labor intensive.

Other methods of fly control such as baits, electric grids and traps may have some limited use for house fly control but are ineffective for the blood feeding stable fly. Baits may be used effectively for house fly control in enclosed areas. Fly papers, cords and strips may also help alleviate fly problems in these areas. Such methods are usually ineffective in open areas.

Control of immature flies (larvae) is sometimes possible. Usually, the best approach is to remove the potential source of fly production with sanitation practices. When this is not possible, a larvicide can kill the developing flies. A larvicidal insecticide may be applied directly to places where eggs are laid and larvae develop.

Biological control has potential for controlling barnyard fly problems (Morgan, 1980; Peterson and Meyer, 1983; Peterson et al., 1983). A number of parasites and predators of both house and stable flies exist that help to reduce fly numbers. Some of these natural parasites are available commercially but to date research has not demonstrated cost-effective fly control.

Horse and Deer Flies

Horse and deer flies are large biting flies (Figure 2) which can inflict painful bites on horses and humans. Several species may become abundant enough to constitute a problem for grazing horses, particularly animals pastured near streams or low, wet areas. Both horse and deer flies have been incriminated in the transmission of equine infectious anemia. Further, because the bite is painful, horses may become restless and unmanageable when they attempt to ward off attacks by these flies. Immature larval horse flies are aquatic or semi-aquatic and the last stage larva overwinters. Life cycles are long; most species have only one generation per year and some species may have a two year life cycle. Only female flies feed on blood. Control is difficult; individual animal treatment using repellents or insecticidal sprays may reduce fly bites.

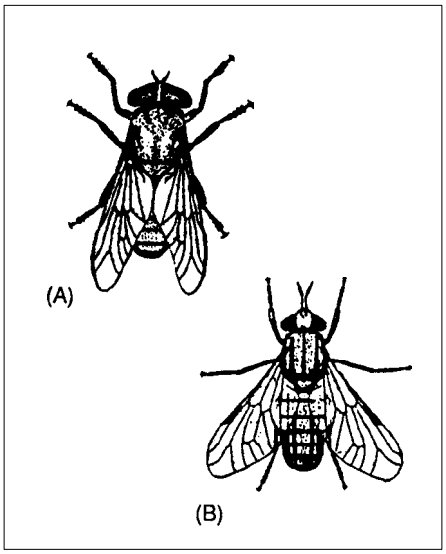

Figure 2. Adult horse fly (A) and deer fly (B).

Black Flies

Black flies or buffalo gnats (Figure 3) are small, 1/12 to 1/15 inch long, hump backed, biting flies which may have high populations in the spring and early summer, particularly in pasture areas along streams. The immature stages are found in flowing water. Pupation occurs underwater and the adults float to the surface, ready for flight, feeding and mating. Adult feeding on horses and other animals can pose serious animal health problems, and the irritation caused by black fly bites can make horses unmanageable. Anemia as a consequence of black fly feeding on the blood of the vertebrate host is a possibility when the black fly population is high. Bites may cause severe reactions such as toxemia and anaphylactic shock; these reactions can result in death. Control is difficult; species which feed in the ears of horses can be controlled using insecticidal applications or by using petroleum jelly in the interior of the horses' ears. When possible, horses can be stabled during the day and pastured at night. Black flies only feed during daylight hours and usually do not enter stable areas. Area sprays or general topical applications of insecticides are not very effective.

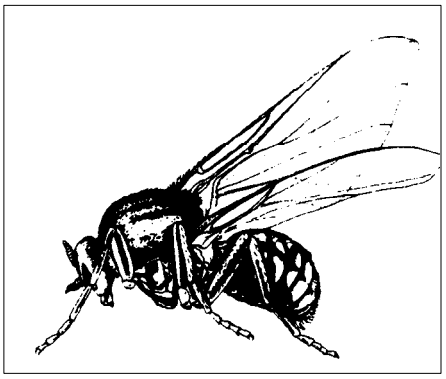

Figure 3. Adult black fly or buffalo gnat.

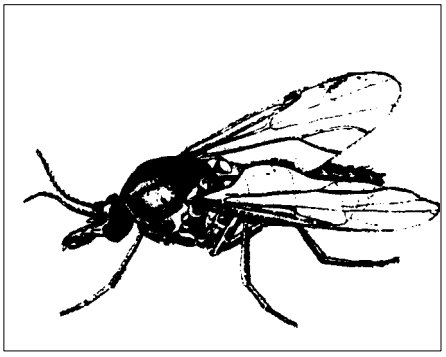

Figure 4. Adult biting midge.

Biting Gnats

"No-see-ums," "punkies" or biting midges (Figure 4) can be a serious pest of horses. Blood loss and irritation associated with the feeding of these very small (usually less than 0.04 inch), blood feeding flies can be significant. The immature stages of these flies complete development in water in a variety of locations from tree holes or man-made containers to lakes and streams. Adults of these flies often are unnoticed because of their small size and because they are active at night, late evening or early morning. Direct treatment of horses with wipes or sprays containing insecticides or repellents can provide relief for the horses.

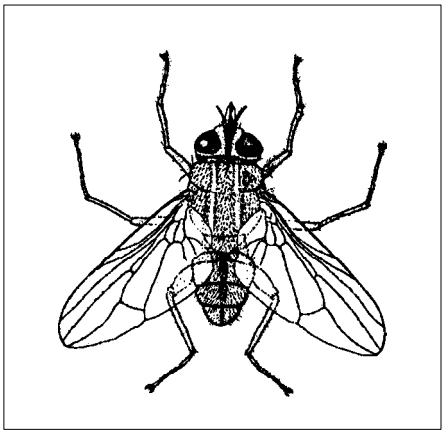

Figure 5. Adult horn fly.

Horn Flies

The horn fly is normally a pest of grazing cattle; however, when cattle and horses are pastured together, this fly will feed on horses. Horn flies are about one-half the size of stable flies and like stable flies are biting flies (Figure 5). The horn fly usually remains on the host animal almost continually, both day and night. Females lay eggs on fresh cattle droppings. Control of horn flies on cattle using established treatment methods such as self-treating de-vices provides the best approach to this problem if horses are pastured with the cattle. Sprays or wipes can be used successfully on horses. For more information about the horn fly see Extension Bulletin 40, **The Horn Fly, *Haematobia irritans* (L.) in North Dakota.**

Nuisance Flies

Several types of nuisance flies may be associated with horses or their premises. These include the house fly, bottle flies, false stable flies and other species of barnyard flies. Face flies, usually a pest of cattle, may also affect horses, particularly when cattle are nearby.

Two major pest species which bother horses are the stable fly and the house fly, a non-biting species. A distinguishing feature, visible to the naked eye, that separates the two species is the distinct stiletto-like proboscis of the stable fly which extends forward beyond the head (Figure 1). This sharply pointed beak is used to pierce the skin and draw blood. The house fly cannot bite since it has sponging mouthparts.

House Fly

Adults: Both male and female house flies are grayish-brown with a black and grey striped thorax (Figure 6). The house fly is a medium sized fly ranging from about 1/4 to 1/3 inch long with sponging mouthparts. House flies do not bite but feed on a variety of plant and animal wastes and garbage, as well as other sources of carbohydrates and proteins.

Eggs: House fly eggs are about 0.04 inch long, whitish and slightly curved. The females generally deposit eggs in batches of about 100 eggs at a time. Each female may deposit four to six batches of eggs during an average lifetime of two to four weeks during the summer.

Larvae: The three larval stages are similar in appearance to stable fly larvae. The third stage reaches approximately 1/2 to 2/3 inch in length. Differentiation of the two species is based on the size and shape of the posterior spiracles (or respiratory tract openings).

Pupae: Pupae are barrel shaped and are of the same approximate size and coloration as stable fly pupae.

House Fly Life History and Habits

House fly females lay their eggs (Figure 7) in clusters, preferably in moist decaying organic material (Meyer and Peterson, 1983). Eggs hatch within eight to 40 hours, depending on temperature. Larvae feed on yeast, bacteria and decomposition products which occur in their development site. Larval development through three stages takes from three to eight days. Larvae crawl to drier areas to pupate when feeding is completed. The pupal stage lasts from three to 10 days, depending primarily on temperature. Adults emerge from the puparia and begin feeding within 24 hours. Males are ready to mate shortly after emergence and females begin mating by the second or third day. Most females mate once and deposit eggs in batches every two to four days (Moon and Meyer, 1985; West, 1951).

The flies feed on carbohydrates and proteins. Females require protein to produce viable eggs. Solid foods are first liquified with saliva and are then ingested using the sponging mouthparts.

The entire life cycle from egg to adult can be completed in as little as 10 to 14 days during warm weather. Like the stable fly, house flies overwinter in sites where microbial fermentation heats the larval habitat, such as silage or manure piles. House flies may develop throughout the year in heated livestock facilities. They are active near sources of food during daylight hours and generally rest at night on stationary objects both indoors and outdoors. The flies prefer shaded areas during much of the day and commonly move inside structures where livestock are held.

House Fly Management

House fly management, like stable fly management, is based on a strong farm sanitation program. The methods for reducing house flies are the same as those discussed for the stable fly.

Face Fly

The face fly (Figure 8) is usually a pest of grazing cattle. However, when horses are pastured with or close to cattle or when face flies are numerous these flies will feed on secretions around the eyes of horses. Adult face flies look much like house flies. The face fly does not bite, but the persistent

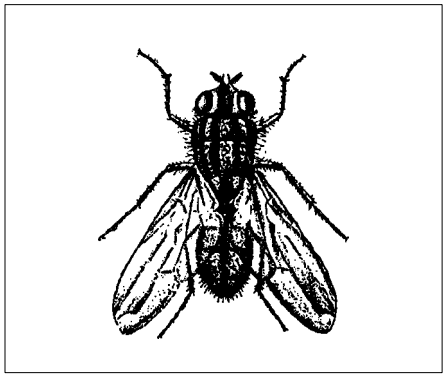

Figure 6. Adult house fly.

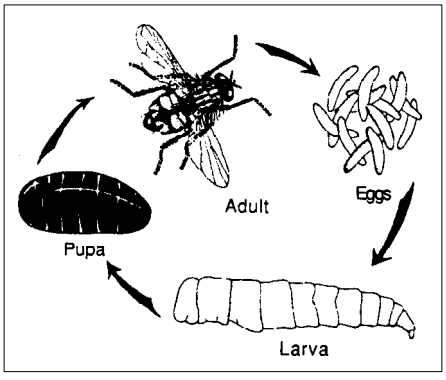

Figure 7. Life cycle of the house fly.

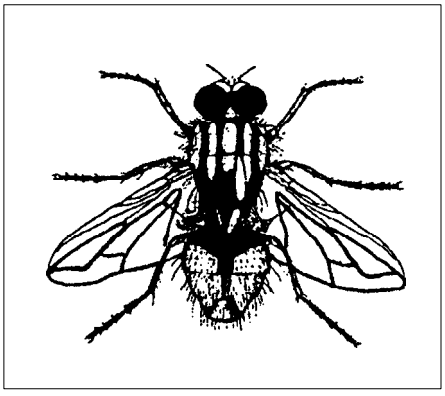

Figure 8. Adult face fly.

feeding behavior of the fly makes it a nuisance pest. In addition, the face fly can mechanically transmit parasites or pathogens to the horse. Control of face flies is difficult. Relief can be obtained by stabling horses during the daytime when the face fly feeds. In addition, since the face fly feeds predominantly on cattle, pasturing horses separately from cattle will lessen the incidence of these flies on the horses. Topical insecticide applications are usually not effective because face flies spend little time on the vertebrate host. For additional information about the face fly see Extension Bulletin 36, **The Face Fly, *Musca autumnalis* DeGeer in North Dakota.**

Mosquitos

There are at least 43 species of mosquitoes known to occur in North Dakota. Fortunately, only a few species cause annoyance. Nevertheless, their presence affects people engaged in outdoor activities during the warm months of the year. Mosquitoes also annoy livestock causing weight loss, reduced milk production, and poor reproduction.

Besides the nuisance biting activities of various mosquito species, there are several species in the genera *Culex* and *Aedes* that can transmit diseases such as St. Louis and Western equine encephalitis to humans and horses, and heartworm to dogs. While Western equine encephalitis does occur occasionally in North Dakota, the disease is not common in the state. However, during the 1941 outbreak when encephalitis reached an all time high in the United States and Canada, 1,101 people and 2,552 horses contracted the disease in North Dakota with a mortality rate of 12.6 percent (139 deaths) and 21 percent (549 deaths), respectively. Practically all cases were the Western type encephalitis.

The danger of disease outbreaks such as encephalitis (sleeping sickness) in people and horses is always possible.

Life Cycle and Breeding Habits

The most abundant mosquitoes in North Dakota are the *Aedes* (Figure 9) temporary pool water breeders (also sometimes known as flood-water mosquitoes). They lay their eggs singly on damp soil near water. Like all mosquitoes, they pass through four life stages: egg, larva (four stages or instars), pupa and adult (Figure 10). In North Dakota, they overwinter in the egg stage. All mosquitoes live in water continuously from the time the eggs hatch through the larval (wiggler) and pupal (tumbler) stage until the adults emerge. Multiple generations are possible. They are found in shallow water with abundant vegetation above and/or on the water surface and where there is a fluctuation of water level and they are protected from wave action. Roadside ditches are common breeding sites. They do not live in running water or deep, open waters of lakes and ponds. Mosquito eggs, if not exposed to water, can survive for several years until they are flooded.

Other types of mosquitoes occurring in North Dakota are permanent water breeders. These permanent water types (*Culex*, *Culiseta* and *Anopheles*) lay their eggs on the water surface (Figure 9). Several generations are produced each summer. The adults overwinter in protected areas.

The adults emerge from pupal cases, their wings expand, and after a few hours the exoskeleton becomes hardened enough for flight. Because blood is necessary for egg development, the female then seeks a blood meal from human or animal. Adults often rest in weeds, tall grass or other vegetation but never reproduce there. After a few days the females return to suitable pools to deposit eggs and the cycle begins again. Depending on the amount of light and temperature, the cycle from egg to adult may take one to four weeks.

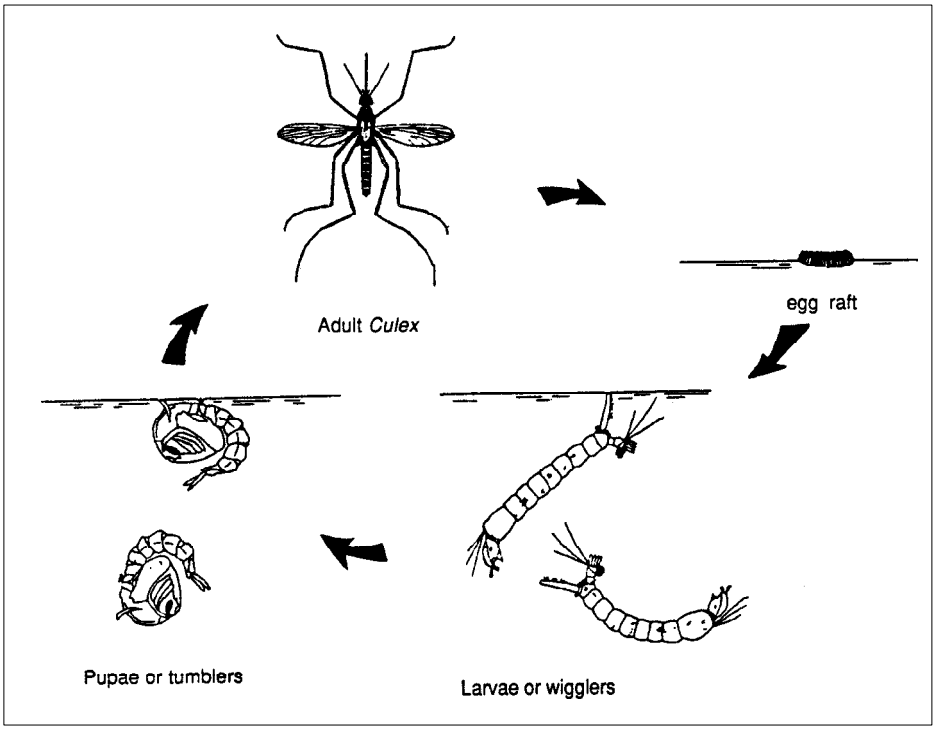

Figure 9. Life cycle of permanent water breeders (*Culex*).

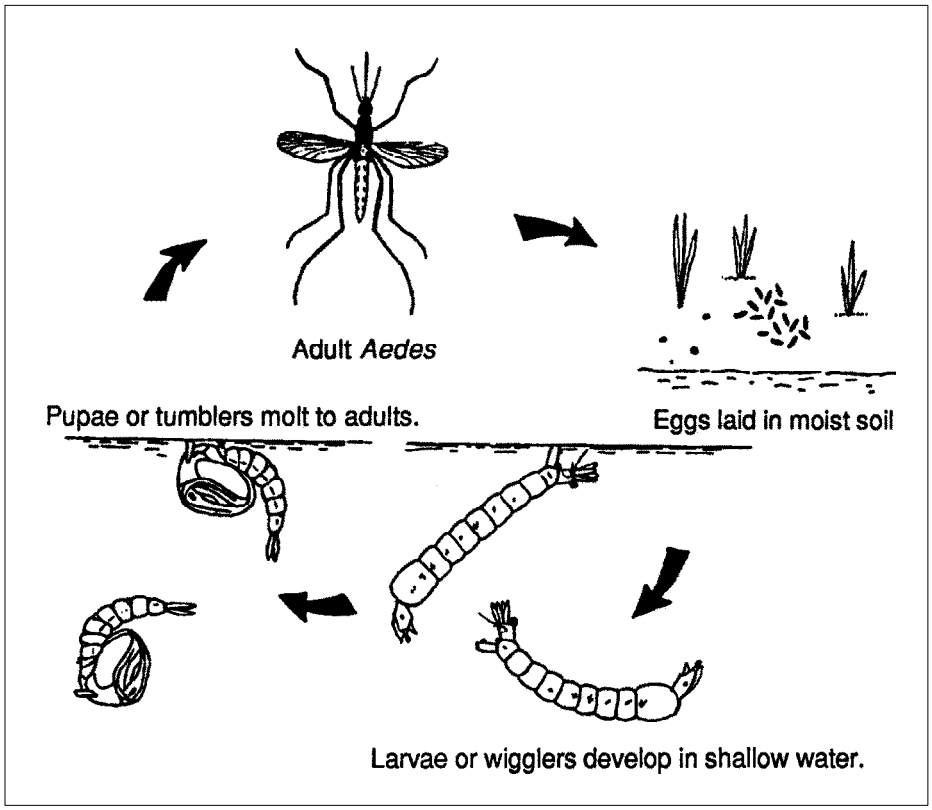

Figure 10. Life cycle of temporary water breeders (*Aedes*).

Adult mosquitoes are strong fliers. They can fly (or be blown) long distances from their breeding sites, although they usually go only far enough to find a blood meal.

Mosquito Management

Mosquito reduction on an area-wide basis is a complex problem which should be based on established principles of good mosquito management. A number of techniques are available, depending on the target species involved and the priorities which have been established. For example, the control of species implicated as disease vectors can be quite a different problem from that of species which are strictly nuisance biters.

An effective mosquito management program cannot be planned or implemented until a survey is made to locate the major breeding places of problem mosquitoes. Mosquito surveys take a great deal of time and work but are well worth the effort. Though mosquitoes usually require standing water for breeding, it is not true that mosquitoes will be produced in every body of standing water. A survey will identify breeding sites which must be eliminated or treated. This will avoid unnecessary intrusion upon areas which need not be treated, thereby preserving the environment. Since the most efficient management programs concentrate on control of mosquito larvae rather than adults, the survey is an essential prerequisite.

The following practices may be used to reduce mosquito breeding sites:

1. Ditch and clean stagnant streams to ensure a continuous flow of water to eliminate border vegetation which provides habitat for mosquito development.
2. Drain or fill back-water pools and swamps where stagnant water accumulates. Sanitary landfills, which can often be used in such locations, will eliminate mosquito breeding sites and improve the value of the land. Before considering establishing such landfills contact the North Dakota State Health Department.
3. Since all mosquitoes breed in shallow, quiet water, remove vegetation and debris from along the shores of lakes and ponds to discourage mosquito breeding. Such bodies of water should have a steep, clean shoreline with as little vegetation as possible. Approved weed killers may be used in some cases to eliminate or prevent emergent plant growth.

Chemical control is, at best, a temporary expedient which should be limited to situations which offer no other alternatives. In general, chemical control can be divided into two major operations. The first, control of larvae, is the most efficient and effective and should be the backbone of any good chemical program. The second, control of adults, is less efficient and should be used strictly for supplemental or emergency purposes. The detection of active transmission of a mosquito-borne disease is an example of such an emergency.

A number of insecticides are registered for mosquito control. The relative value of chemical control varies with the mosquito species and environmental conditions at the location where control is to be applied. Because each situation differs, care must be taken to select the proper insecticide for your particular situation. Some factors to consider include: effectiveness against target species (resistance problems); relative toxicity to humans and domestic animals (impact on non-target organisms); contamination of garden or fruit; cost; availability in quantities needed; need for residual action in some situations; chemical stability; flammability; ease of preparation; corrosiveness; and offensive odor, staining, etc..

Resistance can be a problem in mosquito control, especially when using some of the carbamate and organophosphate compounds. However, before assuming that resistance is the cause of poor control, it must be established that poor control is not caused by other factors such as improper identification of mosquitoes, spray techniques, lack of knowledge about insect habits, or faulty source reduction procedures. Any decrease in susceptibility should be substantiated in carefully controlled tests

before changing either the toxicant or the application procedure.

You can reduce numbers of mosquitoes on horses by treating individual animals using sprays or wipe-on insecticides. In stables, sprays, fogs and insecticide impregnated strips provide useful methods of control.

Lice

Biting and Sucking Lice

Both biting (Figure 11) and sucking lice (Figure 12) parasitize horses. Both types are host specific to horses, mules and donkeys.

Horses infested with lice usually look poorly groomed. The hair coat looks poor and the animals rub and scratch to alleviate the itching caused by feeding activity of the lice. The initial locations of infestation are generally on the head, neck, mane or tail; however, as numbers of lice increase, other areas of the body become infested. Heavy louse populations may predispose the horse to other disease conditions and reduce the vigor of the animal.

Both types of lice found on horses have similar biologies. Eggs are glued to the hair on the horse, usually close to the skin. The eggs hatch in about seven days to three weeks depending on species. Immature lice remain on the horse throughout three nymphal stages which last about a month before molting into adult lice. Adult lice remain on the horse during their entire life. Lice which are removed from the animals die within a short time. Lice are transferred from one horse to another by direct contact with other animals.

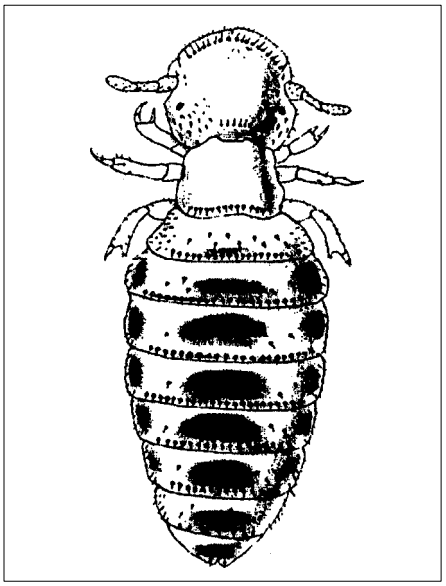

Figure 11. Horse biting louse (*Bovicola equi*).

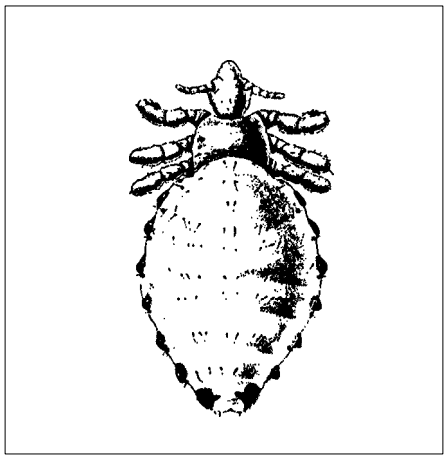

Figure 12. Horse sucking louse (*Haematopinus asini*).

The horse sucking louse (Figure 12) feeds on blood and the biting louse (Figure 11) feeds on shed skin or scurf and on secretions from the skin. Both types of lice reproduce throughout the year. However, these pests are most common during the winter months. Good grooming and adequate nutrition are important to maintain the health of the horse. Grooming provides an excellent opportunity to inspect the horse for lice. Insecticidal sprays prepared from wettable powders can be used to control both types of lice. Emulsifiable concentrates should be used with caution since some horses are likely to develop a der-matitis from the concentrate. Avoid unnecessary use of louse control pro-ducts by treating only when you have verified that lice are present.

Ticks and Mites

Ticks

Ticks and mites are arthropods related to insects that may become numerous and damage horses in some years. Several species of ticks may occasionally become pests on horses in North Dakota. *Dermacenter variabilis*, the American dog tick, and *Dermacenter albipictus*, the winter tick (Figure 13), cause the most frequent problems. Both species are similar in appearance. Unfed stages are very flat and hard. Before ticks feed they are about 1/4 inch long. Ticks attach to the vertebrate host to obtain a blood meal; heavy populations may cause the death of animals from excessive blood loss. Engorged ticks are about 1/2 inch long and look inflated. The adults have eight legs. The engorged female tick drops from the host and lays large numbers of eggs (up to 6000) on the ground.

The winter tick is a one host tick; this means that all stages in the devel-

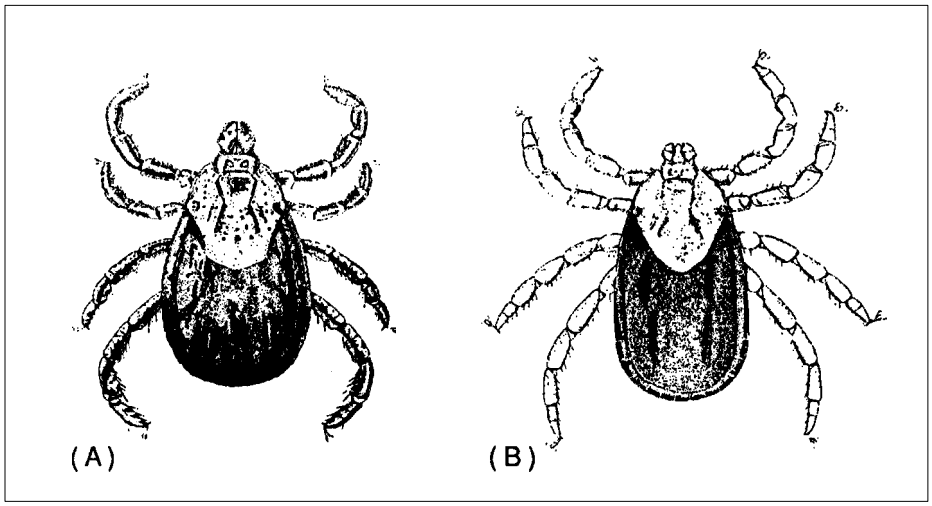

Figure 13. The American dog tick (A) and winter tick (B).

opmental cycle can parasitize the same type of host animal. The preferred host for the winter tick is the moose; however, horses are frequently fed upon. Occasionally cattle, sheep, bison and other large animals are attacked. The winter tick is most abundant during the fall through the winter months. Heavy infestations cause loss of appetite, depression and debilitation of horses.

The American dog tick is a three host tick. Larvae and nymphs feed on rodents and small mammals. Adult dog ticks feed on a variety of larger mammals including horses, cattle and humans. Grooming of horses should reveal ticks which are present. These ticks can be removed by hand, or topical applications of acaricides can be used to prevent infestations.

Mites

Several types of tiny mites cause skin conditions, collectively called mange, in horses. Generally the symptoms of mange include areas of cracked, dry skin and formation of scabs. Mite activity is extremely irritating and results in scratching, rubbing and licking at infested areas. Secondary infections of the infested areas are possible. Sarcoptic, chorioptic and psoroptic manges of horses are caused by separate species of small mites which invade the skin of the horse. All of these mites are very difficult to see without magnification. A sarcoptic mange mite, *Sarcoptes scabiei equi*, is shown in Figure 14. Confirmation of a mite infes-tation is usually by examination of skin scrapings or excised mites under a microscope. Early detection is important in limiting the spread of the mites to other horses and is equally important to prevent severe mange on an animal. These mites spread from horse to horse by direct contact, or by the use of com-mon grooming tools and tack. Frequent grooming is important for early detec-tion; when symptoms appear, consult a veterinarian for confirmation and treatment.

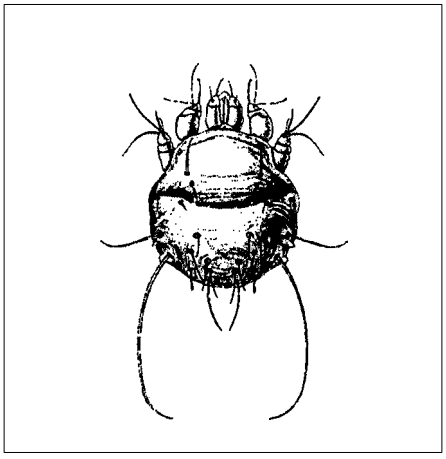

Figure 14. Sarcoptic mange mite (*Sarcoptes scabiei equi*).

Horse Bots

Three species of bots parasitize horses, mules and donkeys. These are the common bot, *Gasterophilus intestinalis* (DeGeer), the throat bot, *G. nasalis* (Linnaeus), and the nose bot, *G. haemorrhoidalis* (Linnaeus). Adults of these three species are nearly the same size as bees and are hairy bodied; however, they do not bite and do not feed at all. Mouthparts are greatly reduced and non-functional. Bot flies are active in the warm weather months in the north central plains until the first frost.

Description of Stages

Eggs. Eggs are attached to hair (Figure 15) on the host's body; the site of egg laying varies depending on the species of bot. Superficially the eggs resemble louse eggs, but the location and time of deposition are characteristic for bot species.

Common bot. Eggs of the horse bot are stalkless and are generally glued near the end of the hairs. The eggs are greyish yellow to yellow in color and about 0.05 inch long. Two flanges along the lower half of the egg encircle the hair and serve to attach the egg to the hair. The non-flanged half extends from the hair at about a 30 degree angle.

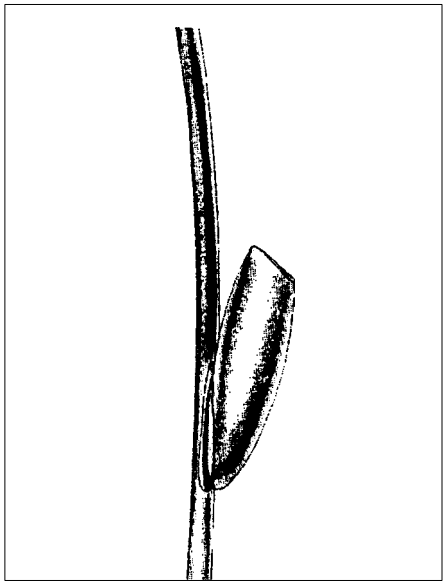

Figure 15. Egg of horse bot fly attached to host's hair.

Throat bot. Eggs of the throat bot are also stalkless and are usually laid near the skin. For this reason, they are often obscured by overlying hair. The flanges which attach the egg to the hair extend almost the entire length of the egg. The color is whitish-yellow and the egg is approximately 0.05 inch long. The long axis of the egg extends parallel to the hair.

Nose bot. Nose bot eggs are stalked and the general shape is barnacle-like. The connecting flange extends from the stalk upward toward the top of the egg. The general color is brownish-black and the egg is about 0.06 inch long.

Larvae. Horse bot larvae are well adapted to life in the digestive tract of the horse. Larvae are equipped with mouth hooks, setae and spines to damage and irritate submucosal tissues in the mouth of the horse and to attach to the lining in the stomach and intestines of the horse. The last stage larva (Figure 16) is robust and yellowish in color. The feeding larva is the overwintering stage. Larvae of all three species are similar in appearance.

Pupae. The pupae of horse bots are all similar. Pupation takes place on the ground, after the last stage larvae have left the horse. The pupal period lasts approximately one month before the emergence of the adult fly.

Adults. The adults of all three species are similar in appearance and superficially resemble honey bees (Figure 17); they are hairy-bodied and about the same size as honey bees. Adult flies have non-functional mouthparts and do not bite.

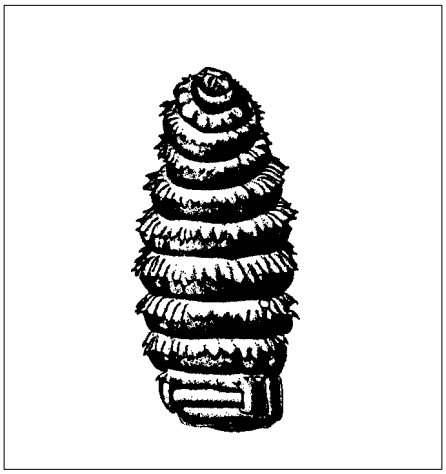

Figure 16. Last stage larvae of horse bot fly.

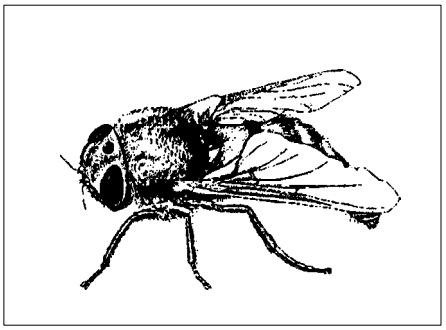

Figure 17. Adult horse bot fly.

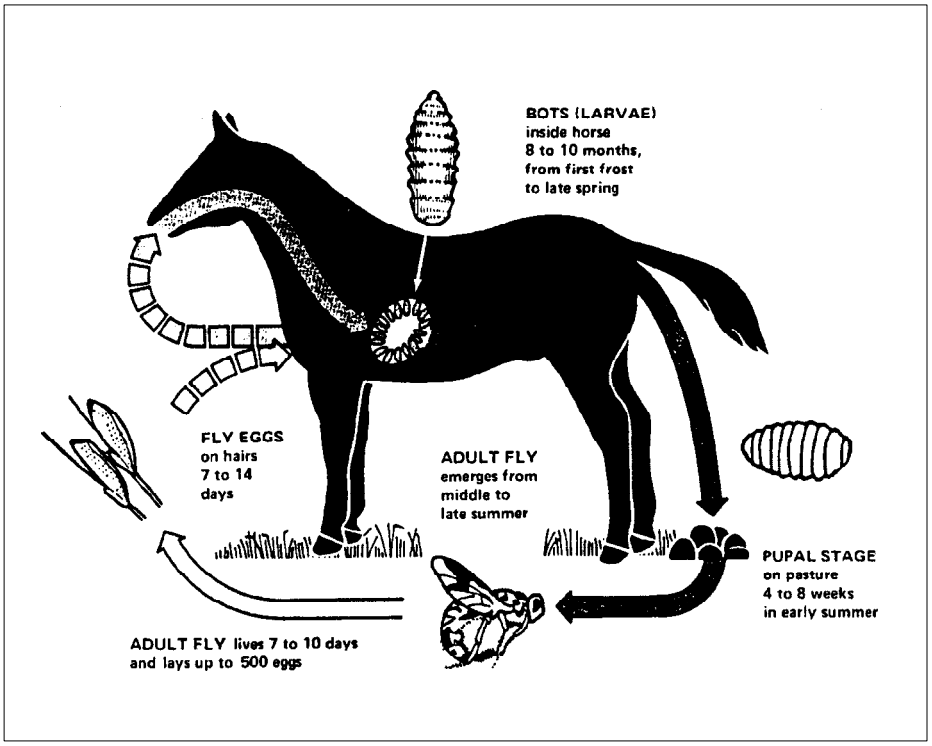

Figure 18. Horse bot fly life cycle.

Horse Bot Life Histories and Habits

The life histories of the three species of bots share a number of similarities (Figire 18). All species have one generation per year in the north central plains. All three species attach their eggs directly to the hair on horses. Larvae of all species are internal parasites of the gasterointestinal tract. Species differ in egg laying sites on the host and there are some differences in the sites of infestation within the horse.

Common bot females lay their eggs along the forelegs and flanks where they can be reached by the horse as it rubs its muzzle and tongue over the area. The heat of friction supplied by the rough tongue of the horse causes the larvae to emerge from the eggs. The larvae are picked up on the tongue where they invade the mucous membrane. Larvae remain there for several weeks before they migrate to the cardiac portion of the stomach. Here the larvae attach to the lining until spring or summer. Mature larvae pass out with the feces to pupate in dry soil or the dried feces. Adults emerge in approximately one month. Mating takes place soon after emergance and the female lays about 500 eggs over a period of about a week.

Throat bot females deposit their eggs under the jaw or throat area by hovering in midair, then darting in to attach eggs. The fly makes repeated attacks until it has laid many eggs. One female can lay about 500 eggs. Larvae hatch within three to five days and crawl along the jaw, enter the mouth and penetrate the gumline. Formation of pus pockets is common and irritates the horse. Larvae remain in these locations for a month or more. Development continues in the distil part of the stomach during the winter and spring. Grown larvae pass out with the feces and pupate on the ground.

Nose bot females oviposit on the very fine hairs around the lips, particularly the upper lip, close to the mouth. This species and the throat bot cause distress to the horse as they dart in to deposit a single egg at a time. The ovipositing fly makes repeated attacks in this manner to lay its full complement of eggs. Each female can deposit about 160 eggs. The eggs hatch in as little as two days and penetrate the lip and tongue membranes where they develop for five to six weeks. They migrate to the stomach where they remain for the duration of the winter. In the spring they detach and migrate to the rectum; here they reattach near the anus before dropping to the ground to pupate. Adults emerge about a month later.

Effects on the Horse

Egg laying activity causes indirect damage to horses by making them unruly and difficult to manage. Irritated and frightened horses may damage themselves, equipment or fences.

Direct damage results from larval infestations in the horse. Newly hatched larvae produce irritation as they tunnel into the gum line, tongue or lips. Horses may show signs of this irritation by rub-bing their lips and noses on the ground or against fences, stock tanks or other equipment.

Bot infestations in the digestive tract of the horse impair digestion and occasionally larvae are numerous enough to obstruct passage of material from the stomach and cause colic. In extreme cases rupture of the stomach wall could cause death.

Management of Horse Bots

To control horse bots you must break the insect's life cycle and stop its devel-opment. Bot eggs, particularly of the common bot, can remain viable long after flies have disappeared. Sponging the horse with warm water frequently will induce eggs to hatch and the expos-ed first stage larvae will die quickly. (This treatment is most effective if it is used on cool days). Treatment of egg laying sites with insecticidal washes will also reduce the numbers of larvae which can be injested by the horse. These treatments should be applied weekly for common bot control and more frequently for both the throat and nose bots. Treatment of the horse's face is best applied using a wipe; a spray may irritate the eyes, nose and mouth of the horse and could startle and frighten the animal.

A variety of direct animal treatments are available to rid horses of bot infestations in the stomach and intestines. These medications are available as pastes, gels, pellets, liquids, powders and boluses. All of these product dosages are based on animal weight, so you should be able to estimate your animal's weight with some accuracy. Many of these products are best applied by a veterinarian familiar with horses. Several of these products are also effective treatments for other internal parasites. These types of chemical control are most effective when the bots are all in the stomach or intestines, generally from November through January.

Blister Beetles

Blister beetles (Figure 19) in the insect family Meloidae have a toxic secretion, cantharidin, in their blood. Cantharidin is a defensive chemical produced by blister beetles that causes severe dermal irritation to the skin and mucous membrane of warm blooded animals. This defensive chemical serves blister beetles well, since once a warm blooded animal crushes a blister beetle on its skin, it will take conscious steps to avoid future contact with blister beetles. If whole or crushed parts of blister beetles are ingested by a grazing animal, the cantharidin can cause irritation and hemorrhages in the stomach. The amount of cantharidin produced varies from male to female and among species of blister beetles (Capinera *et al*., 1985). Sufficient cantharidin is produced by any of the common North Dakota species to be of veterinary concern.

Among domestic grazing animals, horses are most susceptible to this toxin. Only a few beetles, eaten with hay, can cause severe illness or even death to a horse. Affected horses exhibit signs of colic, frequently void small amounts of blood tinged urine, and at times have muscle tremors. If blister beetle poisoning is suspected, immediately consult your local veterinarian so treatments can be started.

Blister beetles commonly feed on alfalfa and the flowers of a number of plants that frequently grow in hay

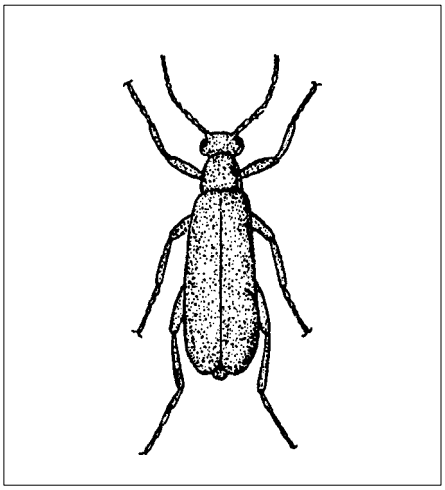

Figure 19. Ash gray blister beetle.

fields. The problem occurs when the hay harvesting process crushes or grinds up blister beetles and toxic parts remain in hay that is fed to horses.

North Dakota has over 20 species of blister beetles, and the three most abundant species feed on alfalfa and other flowering plants in hay fields and meadows. Thus, the potential for a problem always exists, if the beetles are accidently incorporated into hay.

Some steps can be taken to reduce the possibility of incorporating blister beetles in hay. First cutting hay seldom has blister beetles present, since if it is cut in early to mid-June, that is before the adult blister beetles are present in alfalfa. Blister beetle poisonings have increased since the advent of swather-conditioning equipment which runs hay between rollers or crimpers. Separate cutting followed by windrowing allows the beetles to find their way out of windrows while the hay is drying and prior to baling. Hay conditioning equipment will kill many beetles as they pass through the rollers, contaminating several feet of windrow with crushed beetle parts. For additional information about blister beetles see Extension Service circular E-1002, **Blister Beetles**.

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Chemical Controls for Insect Pests of Horses

Always follow the label recommendations for proper rate and method for application of insecticides. Use only formulations approved for use on horses. For information on specific products or recommendations for a particular pest control problem consult your county extension agent, an extension entomologist or your veterinarian. Control recommendations for the current year are contained in the North Dakota Insect Control Guide. Mention of any proprietary product does not imply endorsement of a particular brand.

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