Insect Pests of Horses in Missouri

Robert D. Hall and Flernoy G. Jones
Extension Livestock Entomologists

Kathleen E. Doisy
Research Technician

Department of Entomology University of Missouri-Columbia

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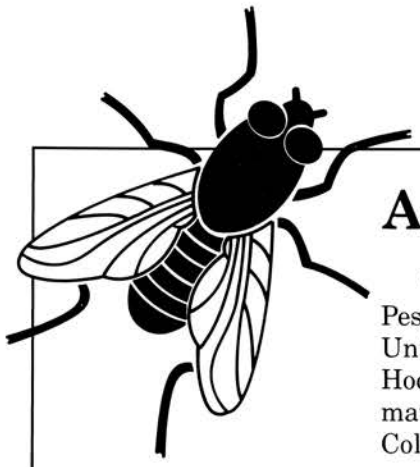

Acknowledgments

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Cover: Top: Abdul, an eight-year-old Arabian stallion, lives at the University of Missouri-Columbia's College of Veterinary Medicine. He receives a high level of health care, including ectoparasite control. **Bottom:** The eviscerated stomach of a horse is severely infested with bot flies.

Insect Pests of Horses in Missouri

Robert D. Hall **Flernoy G. Jones** **Kathleen E. Doisy**

Introduction

The role of horses in our society has changed dramatically in recent years. In the past, horses were used for transportation and agricultural production, but now they are enjoyed as pets and recreational animals.

Missouri is home for almost 250,000 horses. Most horse owners are eager to provide the best health care possible for their animals and realize a sound external parasite control program is necessary. When combined with good feed, shelter, regular exercise, foot care, vaccinations and protection from accidents or contagious diseases, equine parasite control can maximize the pleasure derived from horse ownership.

Parasites damage horses directly and indirectly. They suck blood and mucous discharges from horses and spread disease. They cause digestive upsets, poor growth and even death from stomach rupture. Some adult flies frighten horses so badly the horses injure themselves or their handlers. Other flies make the inside of horses' ears so raw it is difficult to halter the horses.

Many horse owners attempt to reduce expenses by eliminating parasite control. This is unfortunate but understandable. It is easy to comprehend the value of feeding and housing horses, but more difficult to see the detrimental effects caused by parasites.

Most horse owners depend on their veterinarians for advice and assistance in managing diseases and parasites. A sound knowledge of the biology, life history and habits of parasite species is helpful when establishing control programs. Because parasite populations are dynamic, and thus continually changing, it is important for veterinary personnel to stay informed about new developments in control techniques and methods. Organizations that sponsor horse shows and fairs can also encourage and underwrite effective parasite control programs.

Flies affecting horses

Many species of flies are severe pests of horses. They affect horses during each of the four basic stages of the fly life cycle: the egg, larval (maggot), pupal and adult male and female (Figure 1). Most adult flies have only one pair of wings; the second pair evolved into a pair of knobbed balancing organs.

Adult flies feed in one of two ways. The house fly and face fly,

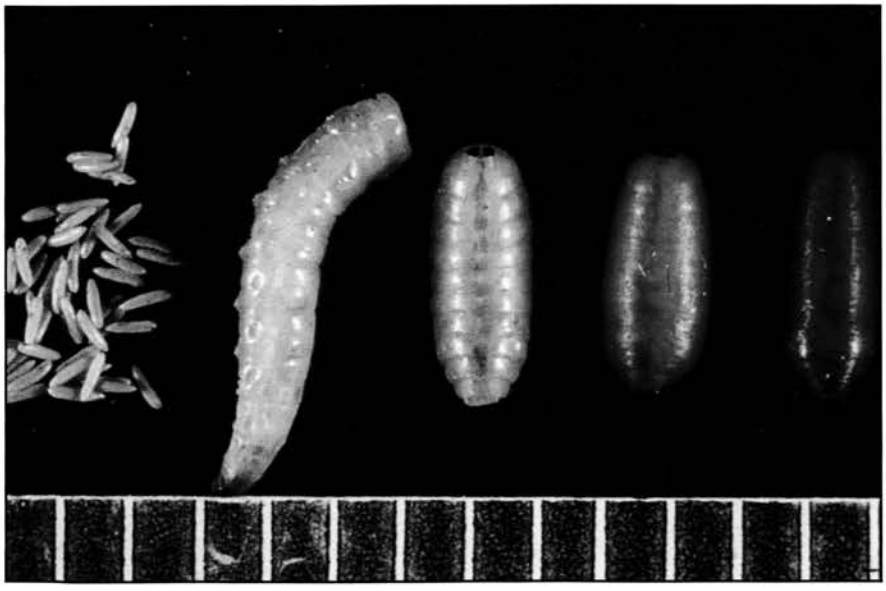

Figure 1. Immature stages of the house fly's life cycle (eggs, third stage maggot and pupae). Note how the pupae darken as they get older. An adult house fly eventually emerges from each pupal case.

for example, use their mouthparts as sponging devices capable of soaking up liquids. Most sponging feeders exude a droplet of saliva (a "vomit drop"), which dissolves food material that the fly subsequently reingests. Other flies, such as adult mosquitoes and stable flies, use needle-like mouthparts for sucking blood. Female mosquitoes and both sexes of stable flies use blood as a rich source of protein and other nutrients. Still other flies have small mouthparts that cannot be used for feeding. For example, horse bots and cattle grubs do not feed at all in the adult stage.

House flies

Common house flies, *Musca domestica* Linnaeus, are directly associated with livestock and human activity. They are not obligate ectoparasites; that is, they can live away from host animals. Still, they may annoy horses, humans and other animals.

Adult house flies are about one-quarter-inch long and are dull gray with dark stripes lengthwise down the tops of their backs. They consume a broad spectrum of food, using their sponging mouthparts to dissolve sugary materials as well as feces and other filth. When house flies alight, they usually deposit a vomit droplet and often a fecal drop. Therefore, large populations quickly foul their environment (Figure 2).

Figure 2. A mass of tiny fly specks on a barn rafter. These specks result when a house fly feeds or alights. House flies are attracted to vertical lines. This many specks can occur in a single summer.

House flies develop as larvae in almost any decomposing organic matter, including feces, garbage, decomposing straw and hay, silage and greenchop. Horse dung is an excellent breeding medium. A complete life cycle of the house fly is relatively short, requiring between one and two weeks during the summer. If not controlled, house flies can establish very large populations quickly.

In addition to annoying people and animals and soiling the environment, adult house flies can act as an intermediate host for the *Habronema* species of horse-stomach worms. They can also carry many harmful microorganisms on their bodies.

Stable flies

Stable flies, *Stomoxys calcitrans* (Linnaeus) (Figure 3), are among the most severe fly pests of horses. They resemble the common house fly, but have a rigid beak (proboscis) projecting forward from underneath their heads. They use their beaks for blood feeding, and both male and female stable flies feed only on blood.

Adult stable flies prefer to feed on horses' legs, with the lower legs and flanks supporting the largest populations. Their bite is painful to horses, and horses stamp and kick to try to dislodge feeding stable flies. Large numbers of adult stable flies can cause severe dermatitis, possible infection and secondary effects from blood loss.

Stable flies are more restricted in breeding habitat than are house flies. Rotting hay or straw mixed with horse or cattle feces or urine is a good medium. Horse dung accumulated in stalls or stables and subsequently wet with urine or water is also a good breeding site. Decomposing straw, silage, grass clippings and similar materials are suitable for stable fly breeding even without feces or urine. In recent years, large, round hay bales have been found to support large populations of stable fly larvae. Stable flies probably

survive the winter as larvae in manure piles, dung piles or trench silos where the heat of decomposition prevents the material from freezing. In the suburban environment, compost piles and grass clippings often provide good breeding conditions for stable flies.

The life cycle of stable flies is longer than that of house flies. Stable flies need three to four weeks to progress from the egg to adult stage. Adult females need a separate blood meal before laying each batch of eggs and can produce as many as 20 batches of about 50 eggs each. Such reproductive potential means stable fly populations can build quickly during the summer months. These flies often annoy people and dogs.

Figure 3. Adult stable fly feeding. It uses a rigid proboscis like a hypodermic syringe (photo: Elton Hansens, Rutgers University).

Control of house flies and stable flies

In some cases, you can control stable fly adults with insecticidal applications directly to the horse (Table 1). Apply these insecticides to the horses' legs, and reapply when effectiveness decreases. Tall, wet grass and severe rainfall tend to wash insecticides off horses.

House flies and stable flies are often termed synanthropic, meaning they have certain essential links with human activities. These species also need suitable developmental material for eggs and larvae, adequate moisture and sufficient warmth to complete development. Eliminating any of these three factors stops fly development. During the warm summer season, an effective fly control program involves: 1) eliminating breeding sites, 2) controlling moisture, 3) using mechanical control and 4) using insecticides when necessary.

Eliminating breeding media

Because fly populations cannot develop in the absence of suitable developmental material for the larvae, sanitation is the best way to achieve long-lasting fly control.

You should design horse quarters so removal of dung, manure, feedstuff and soiled bedding materials is easy. Construct feed bins to minimize accumulation of feed below. Remove the flies' breeding materials weekly to disrupt the life cycles of both house and stable flies. It is important to search for and eliminate **all** potential breeding sites because many adult flies can develop in media missed during superficial cleaning (Figure 4). Carefully clean corners in barns and stables. Be sure to clean out places that are difficult to reach,

Figure 4. This horse barn needs to be cleaned thoroughly. The rotting straw and hay have mixed with horse urine and feces to produce fly breeding media. House flies and stable flies will flourish in this environment.

such as spaces under metal grates and spaces under fences. Don't forget areas near fenceposts and other posts, near silos, near feed racks and near water tanks. The best way to dispose of the waste material is to spread it thinly on cropland with a mechanical spreader.

You can also store manure temporarily if you cannot spread it on fields immediately. Pits or lagoons filled with liquid manure reduce fly breeding if you add enough water to the slurry and if agitation prevents floating debris from accumulating. You can also use non-liquid storage methods, or you can easily manage manure concentrated in a small area, bearing in mind that breeding may still occur in the outer layers. Composting and digestion of manure for methane production show promise in recovering some of the energy lost in manure while reducing fly numbers.

Control of moisture

The larval development of flies cannot occur in the absence of adequate water. Therefore, drying breeding media is an effective preventative measure. Design stables, pens and corrals to promote effective drainage. Pay special attention to areas where manure is piled, and routinely inspect automatic waterers and water tanks to ensure that water does not leak from them.

Mechanical control

Do not overlook traditional methods of fly control when planning your program. Screens on windows are one of the most effective ways to exclude pest flies. They are effective in feed rooms, tack rooms and stalls. High-velocity fans above doors often prevent flies from entering. If only a few flies are present, consider hanging sticky fly tapes as a remedial measure.

Another type of mechanical control is labor intensive. In some areas of the country where high-priced horses are kept and bred, it is not unusual to see hired attendants following horses as the animals meander leisurely through the paddocks. The attendants carry rakes, wait until the horses defecate and then break the pile of feces into small bits that dry quickly. In this manner, flies are stopped from breeding, and the life cycle of *Habronema* worms is interrupted. Of course, not all horse owners have the time or financial resources for this non-chemical approach.

Insecticidal control

Despite effective sanitation and control of moisture, fly populations occasionally become large enough to constitute a problem. In these cases, chemical control is a necessary supplement. You should never use chemicals as the sole means of fly control, or eventually resistance or allied troubles will occur.

Many ways to use insecticides for fly control exist.

Residual insecticides are applied to fly resting sites such as the walls and ceilings of stables. They generate a residue of material with sufficient contact toxicity and longevity so flies resting on treated surfaces pick up lethal doses and die. Other areas suitable for residual treatment include fences, sheds and vegetation, such as hedges and windbreaks. Effective insecticides often provide up to six weeks of control. You should apply them early in the spring when flies first appear and reapply when their effectiveness seems to diminish. In general, wettable powder formulations provide longer lasting control than do emulsifiable concentrates, especially when applied to bare wood or concrete walls.

Space sprays, fogs and mists can be valuable in suppressing large populations of adult flies, particularly in enclosed spaces such as barns. In general, these chemicals have a short life and must be reapplied frequently.

Insecticidal plastic strips are made of a resin that contains dichlorvos (Vapona^{R}), an insecticide that vaporizes easily. They are most effective in small, confined spaces and are essentially useless where ventilation is good, such as in barns or stables.

Insecticidal baits can effectively control flies. They are available in wet or dry forms and are attractive feedstuffs for flies (sugar is a main ingredient), but insecticide

is added. When flies eat such baits, they die. When spread daily in areas where adult flies congregate, baits can markedly reduce populations of house flies. They are ineffective against stable flies, which feed only on blood. You must keep insecticidal baits away from horses, other livestock, pets and children.

Larvicides are insecticides designed to kill fly larvae. They are most often applied where maggots develop, such as in manure piles. A special category, **oral larvicides**, includes insecticides designed to be incorporated into horse feed. When eaten, they pass harmlessly through horses' digestive systems and appear in the feces, where they kill developing fly maggots.

You should always read and follow label directions when using any insecticide, especially on or near horses. Horses have sensitive skin and cannot tolerate chemicals not specifically designed for dermal application. Observe proper safety precautions when using or handling insecticides, and do not contaminate feed, water or equipment.

The integrated house fly and stable fly control program described here, if followed, will result in satisfactory suppression of these flies and will delay the onset of insecticide-resistant fly strains. Most resistance problems start in locations with poor sanitation and management. If resistance develops, it is a good idea to rely more on non-chemical controls and to use short-lived chemicals where possible.

Summary of fly control recommendations

- Remove and properly dispose of fly breeding materials (manure, feces, spilled feed) weekly.
- Modify stables and associated facilities to make cleaning easier and to facilitate proper drainage.
- Survey and clean up all potential fly breeding areas.
- Use insecticidal control only in conjunction with good sanitation, moisture control and mechanical control practices.
- Start using residual insecticide treatments, space sprays, fogs, mists and fly baits early in the spring before fly populations become large.
- In general, use larvicides only on areas of intense maggot activity.

Face flies

Face flies, *Musca autumnalis* De Geer, can be severe pests of pastured horses, especially horses kept near cattle. Face flies, particularly females, use their rasping-sponging mouthparts to feed on the mucous secretions from horses' eyes and nostrils. Principally pests of pastured cattle, face flies feed readily on blood flowing from accidental wounds or from wounds made by bloodsucking insects such as horse flies. Face fly feeding around horses' eyes seems to annoy horses (Figure 5).

Face flies are an introduced species first discovered in North America during the early 1950s. Females deposit eggs in fresh cow pats and lay between 30 and 250 eggs during their lifetimes. The face flies' entire life cycle requires from 15 to 25 days, depending on temperature. Face flies closely resemble house flies except the puparia (the cocoon-like stage from which the adult fly emerges) are calcified grayish white, instead of the typical mahogany brown of related species.

It is hard to obtain satisfactory control of face flies because they tend to land only on the horses' heads, where insecticides are difficult to apply, and land only for a short time. Additionally, only a small proportion of the face fly population lands on host animals at any one time.

Spray or wipe-on insecticides applied to horses' heads daily may afford satisfactory control. Some insecticide-impregnated strips and collars are labeled for face fly control on horses, and fly shakes attached to halters may provide protection for horses' eyes. Protect wounds with dressings and fly repellents. Dustbags, face rubbers and ear tags applied to nearby cattle herds help reduce the overall face fly population near horses. Remember, face flies inhabit pastures; the flies you see crawling on corraled horses' faces are generally house flies.

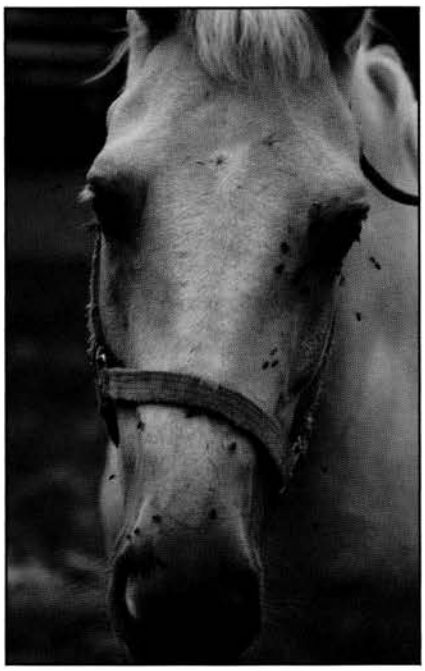

Figure 5. Face flies congregating around a horse's eyes. This is very annoying to the horse, and may cause it to rub its eyes against posts or fences and possibly injury itself.

Horn flies

Horn flies, *Haematobia irritans* (Linnaeus), were introduced into the United States during the late 1800s and have been a pest of cattle since then (Figure 6). They attack horses pastured or ridden near infested cattle.

Adult horn flies are gray and about half the size of stable flies. Like stable flies, horn flies have rigid beaks projecting forward from under their heads. Both sexes commonly hang upside down as they feed on host blood. In contrast to face flies, horn flies tend to remain on their host animals both day and night, leaving only to feed on other animals or to lay eggs. The females lay eggs only in fresh cattle dung. Their eggs hatch in less than a day and the flies' entire life cycle requires between 10 and 30 days. Horn flies overwinter in pupal diapause, a quiet state that occurs in or below cattle dung pats. In Missouri, adult horn flies emerge in the spring during the last half of May.

Figure 6. Horn flies feeding on a steer's back. These blood-sucking flies often attack horses pastured near herds of infested cattle.

Horn flies on horses are best controlled by treating nearby cattle herds. Backrubbers, dust bags, sprays and insecticidal ear tags are effective in most locations. Sprays and wipes provide control on horses as well.

Mosquitoes and biting midges

Mosquitoes (Figure 7) feed on pastured horses and can cause extreme annoyance. Often, mosquitoes go unnoticed because their feeding activity chiefly occurs at night.

Mosquitoes are slender-bodied, long-legged insects with scaly wings. Many species grow to one-half inch in length. Mosquitoes develop as larvae in standing or slow-moving water such as swamps, streams, ditches and flood waters. Sites also include tree holes, cisterns, gutters, watering tanks, watering troughs, cans, bird baths and old tires that hold water. The life cycle of mosquitoes can be completed in 10 to 14 days under good conditions. Only the female mosquito feeds on blood, and most species require blood before they can lay eggs. Male mosquitoes feed on plant juices such as sap and nectar.

Large populations of mosquitoes can adversely affect horses. Their bite is irritating, and horses under consistent attack can suffer significant blood loss. In addition, mosquitoes may carry several important encephalitides that affect both horses and humans. These diseases are essentially inflammations of the brain and include such well-known conditions as eastern equine encephalitis, western equine encephalitis and Venezuelan equine encephalitis. These diseases are often fatal to horses and are frequently severe in humans. Mosquito species vary in their ability to transmit encephalitis viruses.

Control of pest mosquitoes is most effectively accomplished as a community-wide effort. Eliminating suitable breeding sites is most permanent, but requires a lot of time and money. You can control mosquitoes on horses by regularly using sprays or wipe-on insecticides (Table 1). The space sprays, fogs and insecticidal strips useful in fly control in stables provide good mosquito control inside buildings (Table 2).

Biting midges in the genus *Culicoides* are often called punkies, sandflies or no-see-ums because they are small. These tiny flies develop in standing water, in water in tree holes or in moist humus. The females are avid blood feeders, but generally go unnoticed because they are either active at night, in the early morning or in the late evening. Recent surveys indicate these insects often attack pastured horses. In addition to blood loss, damage to horses may include dermatitis, secondary infection and possible transfer of pathogens. To effectively protect horses, you should apply insecticidal sprays, wipes or repellents directly to the animals.

Figure 7. An adult female *Anopheles* mosquito feeding. The abdomen swells as it fills with host blood (photograph courtesy of Elton Hansens, Rutgers University).

Black flies

Often called buffalo gnats because of their humpbacked appearance, black flies are attracted to warm-blooded animals. The females of most species require a blood meal before they can produce eggs. Adult black flies are small, dark, gnatlike insects that often swarm about the faces of humans and livestock. Pastured horses are vulnerable to these day-feeding pests. Most species of black flies develop in swift-moving, clean streams where they feed by filtering microorganisms from the water. However, *Simulium vittatum*, the species in Missouri that most frequently annoys horses, may occur in slow-moving, polluted waterways.

Adults of various species emerge from spring through fall, and most adults of a particular species appear in synchrony; that is, all adults of a species tend to appear at about the same time. Upon emergence, the females are strongly attracted to carbon dioxide, so they flock to animals. Occasionally, black flies become so numerous that they suffocate cattle and other animals by plugging air passages and lungs. Some individual animals may be hypersensitive to the feeding secretions of black flies, and death from shock has been recorded.

The general damage black flies cause to horses occurs when *Simulium vittatum* and related species feed inside the pinna of the ears. This feeding activity makes ears bloody and sore (Figure 8), predisposes horses to secondary infections and invasions and frequently causes riding horses to become headshy. Occasionally, black flies feed on horses' bellies.

Like mosquitoes, black flies are best controlled on a community basis. Some new insecticides, such as *Bacillus thuringiensis israelensis* (B.t.i.), show promise for use against larval black flies. Ultra-low-volume (ULV) applications of various materials can be effective against adult black flies. You can prevent black fly damage by wiping the inner portion of the horses' ears with petroleum jelly (Vaseline^{R}) every other day or so. Petroleum jelly prevents female flies from feeding and promotes healing of damaged tissue.

Figure 8. Damage caused by black flies feeding in a horse's ear. The scabbing and irritation can make horses headshy.

Cattle grubs

Larvae of two species of large, beelike flies are known as cattle grubs, and cattle are the normal and typical host. *Hypoderma bovis* (Linnaeus) are often called bomb flies because they buzz host animals as they attempt to lay eggs on them. The southern, or common, cattle grubs are *Hypoderma lineatum* (de Villers). They approach hosts quietly and do not cause as much alarm.

Both types of cattle grubs are present in Missouri, with adults active from late May through midsummer. They deposit most of their eggs on the lower leg hairs of cattle, and the eggs hatch within a week. The larvae bore into the skin and begin to wander, arriving at the spinal column (northern cattle grub) or esophagus (southern cattle grub) in November and December. Then, they move to the skin of the back, under which they form pockets or warbles. Growing rapidly, they make a hole in the skin through which to breathe and finally drop out in early spring. Pupation occurs in the soil, and adults emerge a month or so later. The adults do not feed because their mouthparts are nonfunctional.

Cattle grubs are in the wrong host when they enter horses and cannot complete their life cycle in them. Instead, they make erratic migrations just beneath the skin. These migrations may occur near the head, neck and rib cage. They do not generally cause problems unless the larvae appear where the saddle rests. Then, they may form hard nodules, which later become infected. Veterinarians can remove these larvae surgically.

It is easiest to reduce cattle grub populations affecting horses by controlling flies in nearby cattle herds. The use of **systemic insecticides** on cattle is currently the best way to reduce cattle grub numbers, but you must time applications correctly. In Missouri, treatment is best made between mid-August and mid-October.

Horse and deer flies

Well-known to all horse owners, these pests belong to the insect family Tabanidae. Horse flies (most often *Tabanus* species) and deer flies (typically *Chrysops* species) are usually heavy-bodied insects that are yellow, brown or blackish and frequently have iridescent greenish eyes (Figure 9). The females are vicious biters that cause considerable pain as they feed (Figure 10). They are from one-third to one-inch long, and the wings vary from clear, to striped, to smoky black.

Horse and deer fly females feed by piercing the skin with razor-sharp mouthparts and generating a flow of blood, which they lap up as it comes from the wound. Because the pain motivates host animals to dislodge the feeding flies, it is often necessary for horse and deer flies to make many wounds before they obtain a full meal. This in turn promotes blood loss and possible anemia in the host. Females feed only during daylight hours, and each species seems to have preferred feeding sites on the host body. Horse flies have been implicated in transmission of equine infectious anemia (EIA or swamp fever) between horses.

Most horse and deer flies go through only one generation per year, and some species require two or three years to complete their life cycles. The females of most species deposit masses of eggs on vegetation that overhangs water or mud. When they hatch, the larvae drop into the moist environment below and spend the next year or so feeding on aquatic organisms. Pupation occurs in drier areas at the water's edge, and some species evidently develop in dry soil. Most horse and deer flies species emerge in synchrony during the summer. Although the adult flies' longevity is variable, the emergence pattern places pastured horses under fly attack all summer as one species after another emerges.

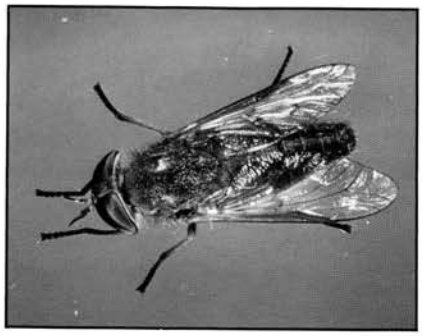

Figure 9. A female horse fly in the genus *Tabanus*. These flies are often called "greenheads" because of the strikingly colored greenish eyes (photo: Elton Hansens, Rutgers University).

Figure 10. Horse flies feeding on a Missouri mule. These blood-feeding insects can cause anemia in horses and in other animals. The insects may also carry pathogens that produce disease (photo: Lee Jenkins, University of Missouri-Columbia).

Control of horse and deer flies is extremely difficult. The flies develop in water or mud, so insecticidal control is often impossible. Draining ponds or wetlands may offer some relief. Sprays of synergized pyrethrins, certain organophosphates or pyrethroids may give limited control (Table 1). Constructing box or canopy horse fly traps (Figure 11) and placing them properly may reduce the horse fly population in local areas and provide protection if you have few horses.

For detailed plans for these traps, write Extension Livestock Entomologist, 1-87 Agriculture Building, University of Missouri, Columbia, Missouri 65211.

Figure 11. A canopy-type horse fly trap set up near a suburban pasture. Such traps can remove many female horse flies from a small area, such as a pasture of several acres.

Horse bot flies

Severe infestations of stomach bots in horses can cause gastrointestinal problems. Occasionally, bots become so numerous they block the stomach outlet and cause colic (Figure 12). In severe cases, the stomach wall may rupture and affected horses may die.

Bots are the larvae of horse bot flies (gad flies) and are the most damaging stage in the bot fly life cycle. Mature larvae are fat, tough maggots that are blunt at the rear end and taper in front to a pair of strong mouth hooks. Each segment of the maggot's body bears a circlet of strong spines. The larvae vary in color from golden brown to yellowish or pink.

Figure 12. Bots or grubs (*Gasterophilus* fly larvae) in the stomach of a horse. If such bots become numerous, they may obstruct the stomach and cause death (photo: Entomological Society of America).

The adult flies resemble honey bees but cannot sting. In addition, their mouthparts are undeveloped, so they cannot feed. Their activities, therefore, include mating and depositing eggs. Adult horse bot flies are active from midsummer until the first frost. Females lay between 150 and 500 eggs during their lifetime, which lasts between seven and 10 days. They glue the eggs onto horses' hair, and each of the three species seems to prefer a different place to lay the eggs.

The female common bot fly, *Gasterophilus intestinalis* (De Geer), deposits yellow-white eggs on hairs of horses' forelegs, chests, necks, bellies and sometimes on the hindlegs and flanks. The eggs incubate for one or two days and then are stimulated to hatch as the horses lick them. The warmth and moisture from the horse tongue causes the eggs to hatch immediately, and the larvae then bore into the front of the tongue. It takes the larvae about a month to traverse the tongue. They then emerge from its rear surface and migrate to the stomach, where they attach to the wall.

Female throat bot flies, *Gasterophilus nasalis* (Linnaeus), lay eggs on the hairs under horses' jaws and throats. These eggs hatch on their own after incubating five or six days, and the larvae infest the gum margins around the cheek teeth for about a month before migrating to the stomach, pylorus and duodenum. Severe infestations may cause abcesses and mouth irritation.

Nose bot flies, *Gasterophilus haemorrhoidalis* (Linnaeus), deposit black eggs on the hairs of horses' lips. These eggs hatch in several days, and the larvae penetrate the lip membranes in front of the incisors. After five to six weeks, they migrate and attach to the stomach wall.

When the bot fly larvae are fully grown, they detach and pass out of the digestive tract with the feces. Burrowing into the soil, they pupate for one or two months, and adult flies emerge during the late summer. The entire life cycle from egg to adult requires a year.

To control horse bot flies, you must treat the host or interrupt the flies' life cycle by other means. The eggs of the common horse bot fly can accumulate until frost and may remain viable until midwinter. Sponging horses with warm water (104 to 118 degrees F) frequently causes the eggs to hatch, and if you sponge horses on a cool day, the larvae quickly die of exposure. Additionally, insecticidal treatment of the body areas where the female bot flies glue their eggs reduces the number of larvae finally arriving in the stomach. You should apply this treatment once per week for the common horse bot fly and two to three times per week for the nose and throat bot flies.

Internal medication of horses for bot infestations is best handled by a veterinarian trained in equine practice. Traditionally, the most dependable way to rid horses of bots is to apply insecticides through a stomach tube. It is important that you or the veterinarian place the tube into the stomach and not into the lungs! You can also get medications in the form of pellets, liquids, pastes, gels, boluses and powders to mix in feed or apply orally (Table 3). Dosages are based on horse weight, so you need a close estimate for safe and effective treatment.

Occasionally, people get horse bot fly larvae in their own mouths. Larvae cannot progress beyond the first stage in humans but may cause gum irritation or abcesses. Consult a dentist or physician if you suspect problems. Larvae will not infest human stomachs.

Lice on horses

Two different types of lice can bother horses. Typical signs of louse infestations include scurfy, unkempt hair coat and excessive rubbing and scratching. Lice infest all body areas, but generally are noted first on the head, neck, mane or tail where the horse has difficulty grooming itself effectively. Lice reproduce all year, but are more troublesome in winter when they find an ideal environment under thick horse hair. They complete their entire life cycle without leaving the horse.

Horse biting lice, *Bovicola equi* (Denny), are about one-tenth inch long. They are chestnut brown, except for their abdomens, which are yellow with dark crossbands. They use their chewing mouthparts to feed on sloughed skin, hair and skin secretions. Females glue eggs to horse hair close to the skin, particularly near the jaw and flanks. The eggs hatch in about a week, and the nymphs mature in about a month.

Horse sucking lice, *Haematopinus asini* (Linnaeus), are about one-eighth inch long and are slate gray. They have broad abdomens and long, narrow heads. Sucking lice are generally more common and more irritating to horses than are biting lice. Their constant blood-feeding activity can cause horses to become anemic and to rub off patches of hair in frantic attempts to relieve the itching. Horse sucking lice attach eggs to horse hair, and the eggs hatch in two to three weeks. The nymphs immediately begin to feed on blood, completing their development in two to four weeks. The lice transfer easily between individual horses during close contact. Horses that are susceptible are known as carriers. You should inspect them routinely and treat them when required.

Effective grooming and proper diet are important aspects of louse control. Grooming does not kill or remove lice, but it provides a good opportunity to inspect horses thoroughly. Adequate nutrition enables horses to withstand moderate louse populations with few ill effects. You can use insecticidal sprays to kill lice (Table 1). Wettable powder formulations are preferred over emulsifiable concentrates because some horses suffer dermatitis from the concentrates. Be sure the insecticide you use is labeled for direct application to horses, and do not use insecticide unless you find lice.

Figure 13. Human body lice, *Pediculus humanus humanus*, feeding. All blood-sucking lice are superficially similar in appearance (photograph courtesy of Elton Hansens, Rutgers University).

Occasionally, horses will be found infested with a few human lice. The human body or head louse, *Pediculus humanus* (Linnaeus) (Figure 13), and the human crab louse, *Pthirus pubis* (Linnaeus), have been collected from horses' bodies and tack. These primary human parasites will not reproduce on horses. In these cases, horses become infested from their riders or handlers!

Ticks affecting horses

Ticks are not a consistent problem on Missouri horses, but American dog ticks, *Dermacentor variabilis* (Say), and lone star ticks, *Amblyomma americanum* (Linnaeus), might infest horses in the spring, especially in southern Missouri.

Ticks are blood-feeding arthropods that are related to insects but are more closely related to mites. They can withdraw large quantities of blood, and severe infestations can cause horses to die from exsanguination. You can control ticks on horses by using insecticides labeled for louse control (Table 1).

Blister beetles on alfalfa

Blister beetles produce an irritating secretion that may cause painful, fluid-filled eruptions on human skin. The dangerous chemical in the secretion is *cantharadin*, which is poisonous when eaten. Blister beetles may infest alfalfa, and if horses eat the beetles, the horses may become sick and possibly die.

Several species of blister beetles (insect family Meloidae) dwell on alfalfa during the growing season. The adults feed on alfalfa foliage and flowering parts and tend to congregate in small areas of the field. All species in Missouri are similar in shape and range from about one-half to one-inch long. They vary from black, to gray, to brown. The striped blister beetle (Figure 14) is most often associated with this type of sickness in horses.

Because blister beetles congregate, you will probably find a small number of alfalfa bales that contain many individuals. Research shows that horses that eat two to five blister beetles may get colic, and horses that eat more may die. Even the dried remains of beetles in alfalfa hay are toxic to horses.

Horse owners frequently ask how to protect their horses from blister beetle poisoning. The chances of problems can be reduced by: 1) using alfalfa hay only from early-season first cuttings, which are seldom infested; 2) carefully inspecting alfalfa fields for blister beetles before cutting and baling hay; and 3) not using alfalfa hay obtained from unknown sources.

See UMC Agricultural Guide G4569, "Blister beetles in alfalfa," for more detailed information on this problem.

Figure 14. A striped blister beetle adult. Blister beetles typically occur in clumps in alfalfa fields and may cause poisoning if horses eat them (photo: Wayne Bailey, University of Missouri-Columbia).

Using insecticides

Follow label directions exactly when using any insecticide. If you do not understand the directions, get in touch with someone who does, such as your county extension specialist, extension entomologist or veterinarian. The materials listed in Tables 1 and 2 are labeled for use on horses or in stables. Others may exist.

Trade names are used in this bulletin to simplify presentation and to help you find materials easily. No endorsement is intended, nor is criticism intended of similar products not mentioned.

The instructions for the use of the recommended pesticides are incomplete and are intended as guidelines only. Before using any pesticide, read the label for specific instructions. Many insecticides are sold under brand names not listed in this publication. Check labels for active ingredients, and do not use any product on horses that is not labeled for direct application to horses!

Figure 15. Joy Lazarus and a friend. Programs at Stephens College in Columbia, Missouri, emphasize equine health care.

Table 1. Insecticidal materials used for ectoparasite control directly on horses (Sprays, wipe-ons, dusts, protectants, insecticide-impregnated strips, oral larvicide).

Trade name	Insecticide concentration/ formulation	How applied	Insects controlled
Anchor Horse Spray and Rub on	pyrenone 0.55% methoxychlor 0.5% butoxypolypropylene glycol 10.0%	Spray/rub-on 1 oz/animal	horn flies, stable flies, deer flies, face flies, horse flies, house flies, mosquitoes, gnats
Unico Py-Vona Stock Fly Spray	synergized pyrethrins + DDVP, 0.48% ready to use	Spray 1-2 oz/animal	house flies, horn flies, stable flies, mosquitoes, aids in face fly control
Ortho Dairy and Horse Fly Spray R	pyrenone 0.28% ready to use mist	Mist 1-2 oz/ animal	face flies, horn flies, house flies, stable flies, mosquitoes, gnats
Purina Rub-On Horse Insecticide	pyrenone 0.30% MGK 326 0.70% MGK 264 0.35% ready to use	1-2 oz/animal	stable flies, horse flies, house flies, horn flies, deer flies, mosquitoes, gnats
Rigo Horse and Stable Insecticide	DDVP, pyrenone 0.53% ready to use	1-2 oz/animal	horse flies, stable flies, house flies, horn flies, mosquitoes, aids in face fly control
Unico-Thorobred "H-P" Spray	pyrenone 1.1% ready to use	Mist 1 oz/ animal	horn flies, house flies, stable flies, mosquitoes
Unico Livestock and Barn Fogging Spray	pyrenone 1.1% ready to use	Mist 2-5 t/animal	horn flies, house flies, stable flies, mosquitoes, lice
CoRal 25% WP	coumaphos 25% WP	2-8 lb/100 gal water; wet thoroughly	horn flies, lice, ticks, screwworms
Co-Ral Emulsifiable Livestock Insecticide	coumaphos 11.6% EC	2-8 qt/100 gal water; wet thoroughly	horn flies, lice, ticks, screwworms
Co-Ral Livestock Duster	coumaphos 5% dust	hand treat	ear ticks, screwworms
Co-Ral Spray Foam	coumaphos 3% foam	wound treat	screwworms, fly maggots
5% Malathion Dust	malathion 5% dust	dust 3 t/ animal	horn flies
Farnam Overkill 60 EC	permethrin 11% EC	1 pt/25-50 gal water; spray 1-2 qt/ animal	horn flies, face flies, stable flies, house flies, horse flies, lice

Table 1. Continued

Trade name	Insecticide concentration/ formulation	How applied	Insects controlled
Farnam Repel-Xp	pyrenone 1.4% EC	1 pt/4-7 pts water; spray 8 oz/animal	house flies, horn flies, gnats, mosquitoes, horse flies, deer flies, stable flies, ticks
Cythion	malathion 57% EC	1-2 gal/100 gal water; spray thoroughly	lice, horn flies, ticks
Anchor Screwworm and Ear Tick Spray	ronnel 2.5% aerosol	spray lightly	screwworms, other maggots, ear ticks
Rigo Screwworm Bomb	ronnel 2.5%	spray lightly	screwworms and other maggots
Ectiban Wipe-On	permethrin 1% ready-to-use	sponge on 2-4 oz	stable flies, horn flies, face flies, house flies
Purina Horse Spray Concentrate	stabilene 50% methoxychlor 5% EC	1 pt to 7 pts water; sponge on or spray	horse flies, mosquitoes, gnats, lice, horn flies, stable flies, deer flies
Farnam Roll-On	pyrenone 1.4%	roll-on	house flies, stable flies, horn flies
Farnam Flys-Away	pyrenone 1.4%	stick rub-on	house flies, gnats, mosquitoes
Anchor Permectrin Strips	permethrin 10% plastic strip	attach to halter	aids in control of lice, stable flies, house flies
Farnam Fly Guard Collar	fenvalerate 8% plastic strip	buckle around throat	face flies, horn flies
Unico Pressurized Spray	ronnel 2.5% aerosol	wound spray	screwworms, other maggots
Fermenta Rabon Oral Larvicide	tetrachlorvinphos 7.76% premix or 97.3% granular	feed, salt, mineral blocks	face flies, horn flies, stable flies, house flies
Farnam Equitrol	tetrachlorvinphos 2.468%	feed additive larvicide	house flies, stable flies
Farnam Drive	tetrachlorvinphos 0.475%	feed supplement	house flies, stable flies
Farnam Vita-Plus	tetrachlorvinphos 1.234%	feed supplement	house flies, stable flies

* Abbreviations: c = cup; conc = concentrated; D = dust; EC = emulsifiable concentrate; fl = fluid; gal = gallon; lb = pound; oz = ounce; pt = pint; qt = quart; t = teaspoon; T = tablespoon; WP = wettable powder.

Table 2. Premise sprays and baits for fly control in horse quarters.

Trade name	Insecticide concentration/ formulation	How applied	Insects controlled
Atroban	permethrin 11% EC	1 pt/10 gal water	house flies, stable flies
Atroban	permethrin 25% WP	6.7 oz/10 gal water	house flies, stable flies
Unico Thorobred "H-P"	pyrenone 1.1% ready-to-use	mist 1 oz/ 1,000 ft^3	house flies, stable flies, horn flies
Unico Livestock & Barn Fogging	pyrenone 1.1% ready-to-use	mist ½ oz/ 1,000 ft^3	house flies, stable flies, horn flies
Unico Py-Vona Stock Fly Spray	synergized pyrethrins + DDVP 0.48% ready-to-use	2 oz/1,000 ft^3	house flies
Ortho Dairy & Horse Fly Spray R	pyrenone 0.28% ready-to-use	2 oz/1,000 ft^3	flies, mosquitoes, gnats
Rigo Premise Spray	pyrenone 3.96% ready-to-use	1 oz/1,000 ft^3	mosquitoes, gnats, moths, house flies, stable flies, horn flies
Ectiban	permethrin 5.7% EC	1 qt/12.5 gal water	house flies, stable flies
Ectiban	permethrin 25% WP	6 oz/11 gal water	house flies, stable flies
Farnam Overkill 60 EC	permethrin 11% EC	1 pt/10 gal water	house flies, stable flies
Unico Fatal Fly Dry Bait	propoxur + muscamone 0.25% bait	scatter	house flies
Starbar Improved Golden Malrin Fly Bait	methomyl + muscamone 1.025%	scatter ¼ lb/500 ft^3	flies
Starbar Super Golden Malrin Fly Bait	DDVP + methylethoxy 0.09% + muscamone 0.12% granules	scatter over feeding area	house flies
Starbar Vapona 20	DDVP 20% EC	1 gal/50 gal water as a residual spray	face flies, house flies
Rigo Sugar Fly Bait	DDVP 0.50%	scatter 1 oz/ 500 ft^3	house flies

Table 2. Continued

Trade name	Insecticide concentration/ formulation	How applied	Insects controlled
Shell Vapona Farm Strip	DDVP 20% strip	1 strip/ 1,000 ft^3	flies, gnats, adult mosquitoes, moths
Shell Ravap Livestock Spray	Rabon 23% DDVP 5.7% EC	1.25-2.5% spray	flies
Cyanamid Cythion	malathion 57% EC	5 T/1 gal water	adult flies
Cythion	malathion 57% EC	mix with sugar or molasses per label directions as bait spray	adult flies, maggots
Cythion	malathion 57% EC	1 part to 28 parts diesel oil, spray on resting sites	adult mosquitoes
Cythion	malathion 57% EC	13 oz/acre for use in standing water	mosquito larvae
Ciba-Geigy Diazinon 50W	diazinon 50% WP	2 lb/25 gal water for residual spray	flies

* Abbreviations: c = cup; conc = concentrated; D = dust, EC = emulsifiable concentrate; fl = fluid; ft^3 = cubic feet; gal = gallon; lb = pound; pt = pint; qt = quart; T = tablespoon, t = teaspoon; WP = wettable powder.

Table 3. Drugs for control of horse bot fly larvae.

Trade name	Active ingredient	Source of supply	Method of administration
Dyrex Captabs	trichlorfon	Ft. Dodge	bolus
Dyrex T.F.	piperazine, phenothiazine, trichlorfon	Ft. Dodge	tube
Equibot-TC	trichlorfon	Farnam	intra-oral
Combot	trichlorfon	Haver-Lockart	tube, intra-oral
Negabot	trichlorfon	Cutter	intra-oral
Anthon	trichlorfon	Cutter	feed
Combotel	febantel & trichlorfon	Haver-Lockart	intra-oral
Negabot Plus Paste	febantel & trichlorfon	Cutter	intra-oral
Equizole B	trichlorfon, thiabendazole	Merck	tube, feed
Telmin B	mebendazole, trichlorfon	Pitman-Moore	intra-oral
Parvex Plus	piperazine-carbon disulfide complex, phenothiazine	Upjohn	tube
Equigard	dichlorvos	Squibb	feed
Equigel	dichlorvos	Squibb	intra-oral
Eqvalan	ivermectin	Merck	intra-oral
None	carbon disulfide	Various	tube

* Tube = drug formulation given by stomach tube; Feed = drug formulation mixed with grain ration; Intra-Oral = paste or gel formulation given by syringe; Bolus = solid formulation given orally. Horses are best wormed for bots after the first frost (generally in October). If you wash the bot eggs off, the horses should be wormed four to six weeks afterwards. They should be rewormed early in the spring to kill the bots possibly missed earlier.

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