Biting midges are flies that belong in the family Ceratopogonidae. Within this family, midges in the genus Culicoides are very small and are often called “no-see-ums”. They are tiny enough to fly through window screens, and their aggressive, persistent biting behavior has led to the development of specialized tent screens with very fine mesh netting to prevent them from entering. In our biting midge studies in Montana, we have collected 12 species of Culicoides. Of these, some feed preferentially on large animals and others on birds. We seldom receive reports of midges attacking humans. The primary species of importance in Montana is Culicoides sonorensis, which readily feed on livestock and wildlife and is the principal vector of the viruses causing bluetongue disease and epizootic hemorrhagic disease.

Description and Life Cycle

Adult Culicoides midges are usually 1 to 2.5 mm long, with distinctive wing patterns that are important for species determination (Figure 1). They are more abundant near productive breeding sites, but will travel an average of 1.5 miles in search of a suitable host. When host-seeking, female Culicoides are most active during dusk and dawn. Once a host is found, female midges feed by lacerating the skin and siphoning the blood up as it accumulates in the wound, a process called pool feeding. After they have fed, females develop and lay up to 400 eggs, depending on the size of the blood meal. Ideal habitats for egg laying include the edges of a lake, stock pond, marsh, swamp or overflowing water tank where the soil is moist and has a high organic content (Figure 2, page 2). After the larvae hatch, they grow and molt four times within two to three weeks in the summer, feeding on microorganisms and detritus. Larvae are typically 2 to 5 mm long, slender and white with brown head capsules. They can be recognized by their serpentine-like movements as they swim through the water. Pupation occurs near the margins of the semi-aquatic habitat and lasts two to three days. Males emerge first and tend to hover in a swarm above the emergence sites waiting to mate with the females.

Biting midges are typically problematic for livestock in Montana from mid-summer until the first killing frost in the fall. They overwinter as larvae by burrowing into the moist substrate to avoid freezing temperatures, and pupate in the spring or early summer, producing the season’s first generation of adults. In the northern plains of the US, most biting midges are multivoltine, typically producing two or three generations per year.

Impact of Biting Midges

In Montana, biting midges are seldom a public health concern. However, in other regions of the US they are extremely annoying due to their persistent and painful biting behavior, which may cause localized reactions such as stinging or burning sensations and well-defined red areas on the skin. Because of their small size, biting midges are difficult to see, and their bites are often
mistaken as mosquito bites. In North America, biting midges are not responsible for human disease transmission; however, they are considered important vectors of various human diseases in other parts of the world.

Two livestock/wildlife diseases transmitted by *C. sonorensis* in Montana are bluetongue disease (BT) and epizootic hemorrhagic disease (EHD). Bluetongue and EHD are very similar in many respects; the viruses are closely related and their clinical symptoms are difficult to tell apart. Neither disease is spread through contact; transmission between animals can only occur through the vector, *C. sonorensis*. After the midge takes a blood meal from an infected host, the virus multiplies in the gut of the insect and then invades the insect’s salivary glands; this is known as the extrinsic incubation period. In the salivary glands, the virus continues to multiply and is transmitted to new hosts during subsequent blood feedings. The length of the incubation period depends on the type of virus and temperature. The average amount of time for BT is about 13 days and 6 days for EHD. Following infection, the midge remains infective throughout its life. Most BT and EHD transmission occurs in late summer and early fall, and stops after a hard frost kills the adult midges. In Montana, the largest densities of *C. sonorensis* are found primarily east of the Continental Divide.

Bluetongue primarily affects domestic sheep, but domestic goats, cattle, buffalo, white-tailed deer, antelope and mule deer can also be infected. Most sheep and cattle that do become infected with BT do not develop clinical signs of an infection and may instead serve as reservoirs of the disease, whereas deer and antelope experience high mortality rates when infected with BT. Typically, Montana livestock and wildlife are considered at low risk for BT infection because disease transmission is rare. Serological surveys on Montana cattle conducted between 2000 and 2003 showed less than one percent of the cattle in Montana tested positive for BT. Previous outbreaks in Montana occurred in range sheep in the 1960s and more recently, in 2007, when higher than average summer temperatures contributed to the increased prevalence of BT and high midge populations. The epidemic in 2007 resulted in a 30-day quarantine of 16 counties in eastern Montana preventing transfer and sale of market animals and rams, costing producers an estimated $750,000.

Animals with BT that develop an illness may exhibit symptoms such as fever, hemorrhaging of oral and nasal tissues, excessive salivation, nasal discharge, respiratory difficulties, tender hooves, and an arched back (Figure 3). Only a few cases develop the characteristic “blue tongue”, in which the tongue swells and becomes discolored due to lack of oxygen. BT virus has been found in the semen of infected bulls and rams and can be transmitted to susceptible cows and ewes. Reproductive problems may include stillbirths, abortions and congenital deformities. Although cattle often have a higher infection rate for BT than sheep, sheep exhibit higher mortality (typically between 2 to 30 percent).

Because of the serious implications of BT outbreaks, the disease is recognized by the World Organization of Animal Health (OIE) as a significant disease that requires monitoring. Participating countries must report a disease status, and nations experiencing outbreaks may be subject to serious economic consequences if international trade is impacted. Montana’s current BT status is considered low risk.
Epizootic hemorrhagic disease is considered the most significant and widespread naturally-occurring disease of white-tailed deer in the US. It can also develop fatal infections in pronghorns and mule deer. The disease is characterized by extensive hemorrhaging, fever and a resultant urge to be near or even immersed in temperature-controlling fresh water. Cattle and sheep are commonly seropositive, but in most cases the animals are asymptomatic.

EHD outbreaks are much more common in Montana than BT outbreaks because the virus requires less time to develop to an infective stage within the midge, resulting in greater transmission potential over the course of the summer. In 2011, white-tailed deer deaths from EHD occurred in counties along the Yellowstone River from Billings to Glendive and east of Roundup on the Musselshell River and along the Tongue River. Similar deer fatalities occurred along northeastern Montana’s Hi-Line from Malta to Fort Peck.

Control of Biting Midges
There are some management practices livestock producers can implement to control C. sonorensis or reduce blood feeding. However, controlling biting midges is difficult because of the diversity and abundance of habitats where they are produced. Some potential management tactics include increasing the slope of stock ponds, thereby making the edges unsuitable for egg-laying by female midges. Repairing and fixing overflowing stock tanks can eliminate sites where midges develop. If possible, livestock can be housed between dusk and dawn to provide some protection from host seeking midges.

On-animal treatments include two pyrethroid insecticides that are approved for use on sheep and cattle and have proven effective against suppressing blood feeding by biting midges on sheep. These products include an insecticide ear tag (trade name PYthon) which contains 10 percent zeta-cypermethrin and 20 percent piperonyl butoxide, a synergist, and a low-volume insecticide spray containing 2.5 percent permethrin and 2.5 percent piperonyl butoxide (trade names Gardstar 40 EC spray and Permectrin CDS). When used individually, the ear tags and spray are effective in preventing C. sonorensis bites for three to four weeks. When the two products are used simultaneously, control may be extended for up to five weeks.

Vaccinations for bluetongue are available, but they are serotype-specific and may not be effective against serotypes found in Montana. It is recommended that livestock owners contact their veterinarian for questions regarding this type of preventive treatment. A vaccination for EHD has recently been created to address the concerns of deer breeders in other parts of the US. However, it is unlikely that this vaccine will be used by the state of Montana to control the disease in wild deer populations.

References

Note: Every attempt was made to include all products commercially available for biting fly control. Omission of any product was unintentional. Due to constantly changing labels, laws and regulations, MSU Extension can assume no liability for the suggested use of chemicals contained herein. Pesticides must be applied legally, complying with all label directions and precautions on the pesticide container and any supplemental labeling and rules of state and federal pesticide regulatory agencies.