Species and Abundance of Diptera at the Texas A&M Beef Cattle Center

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Abstract: A total of 54 Diptera were caught via insect net over the course of four weeks at the Texas A&M Beef Cattle Center. Both weather and time of day affected whether the collectors were able to collect specimens. Once the Diptera were collected, they were identified as *Musca species*, Calliphoridae or *Stomoxys calcitrans* (L.). Attached to the *Musca species* and *Stomoxys calcitrans* were migratory mites. By determining what species of Diptera are present at the Beef Center, scientists can further analyze types of diseases associated, thus preventing such diseases from affecting the cattle.

Keywords: Survey, cattle, Calliphoridae, *Musca*, mechanical control

When raising cattle, it is important to identify insects that come in contact with the cattle so that the insects that vector dangerous diseases can be controlled. Calliphorid flies can cause myasis in livestock (Castro, 2011), these adult flies have been linked to vectoring dysentery in humans and animals (Negre, 2013). These flies can carry a bacterium known to cause paratuberculosis (Fischer, 2004). If left untreated, this intestinal infection caused by *Mycobacterium avium* can lead to death, economically affecting beef production (Fosgate, 2009). *Stomoxys calcitrans* also vectors its own disease that negatively affects cattle health. According to a scientific journal in Brazil, "The stable fly has been of great significance to livestock production […]; it has a painful bite, sucks blood, and carries many diseases" (Bittencourt, 2006). Overexposure to these flies have led to cattle becoming anemic as well as lowering milk production (Catangui, 1997). *Stomoxys calcitrans* is also a mechanical vector of *Besnoitia besnoiti*, a parasite known to cause microcysts on livestock skin, which also negatively impacts the leather industry (Cortes, 2005). Finally, the *Musca* genus can also vector several diseases such as typhoid fever, dysentery, anthrax, and African sleeping sickness (Abbas 2014).

Mites use flies as a mode of transportation from one host to another and can cause many problems for cattle, along with the Diptera transporting them. For example, *Demodex bovis* (Stiles), the cattle follicle

mite, can cause lesions and sores on the cow's neck, shoulders and sometimes udder (Anonymous, Livestock Veterinary Entomology). Over time sores can form which damages the skin of the cattle, which leads to an economic loss in the tanning industry. Cattle can inhale and ingest mites through infested feed, which can lead to problems if the mites are part of one of the 15 families of mites that are problematic after repeated exposure. Therefore the mite population, as well as the Diptera population, must be monitored and controlled (Anonymous, Livestock Veterinary Entomology).

This experiment was meant to determine and identify the most abundant fly species at the Texas A&M Beef Cattle Center over a four-week period. A minimum of 50 Diptera samples were collected via an insect net, and stored until later identified. The purpose of collecting Diptera was to further analyze the species in order to understand the diseases and hazards associated with the Diptera on beef cattle.

Materials and Methods

A location was based on the abundance of beef cattle and the expectation of collecting numerous Diptera. For four weeks, ten to twelve Diptera were collected per week at the Texas A&M Beef Cattle Center. The collection method used consisted of a net (BioQuip, Inc., Compton CA) and a water bottle (Nestle Waters North America Inc., Stamford CT) full of rubbing alcohol (Walgreen Co., Deerfield IL). An area in the pasture was selected, and the net was used to capture the specimens. The specimens were then transported from the net into the rubbing alcohol solution contained in the water bottle.

Once collected, the Diptera were then identified via microscope in the lab using the key provided from ENTO 208 (Veterinary Entomology). After identification, the specimens were transferred to separate glass vials (SKS Bottle & Packaging Inc., Watervliet NY) based on their genera and species. The results were recorded for further analysis.

Results

On 23 March 2014, the TAMU Beef Center was surveyed for Diptera, however no flies were present. On the 24th, the area was surveyed again in the late afternoon in which more flies were present. Seventeen flies were caught via a fly net and placed in alcohol for preservation. These flies were later identified and fifteen flies were determined to be *Musca species*. Two of these flies collected on this day were *Stomoxys calcitrans*.

The week of the 30th, twelve Diptera were caught on a cattle fecal pile. Four *Stomoxys calcitrans*, seven *Musca species* and one Calliphorid species were captured that week.

The week of April 5th the TAMU Beef and Cattle center was visited three times. Throughout the duration of these visits, 15 Diptera were caught. Of the 15 species caught during this time, 11 were *Stomoxys calcitrans*, three were Calliphorid species, and the remaining one was a *Musca species*.

The week of the 13th the TAMU Beef and Cattle center was visited three times. No specimens were captured during the first two

visits. On the third visit, ten flies were captured, which were later identified as *Stomoxys calcitrans*.

At least 20 mites were found on the Diptera collected from the TAMU Beef Center. Majority of the mites were found attached to *Stomoxys calcitrans* and *Musca species*. This was most likely due to the fact that these two species made up 92.5% of the Diptera collected. These mites were determined to be migratory mites because of the way they were attached to the Diptera.

Table 1. Number and types of Diptera species present at TAMU Beef Center.

Diptera Species:	**Number of Species Collected:**
Calliphoridae spp.	4
Musca domestica	23
Stomoxys calcitrans	27

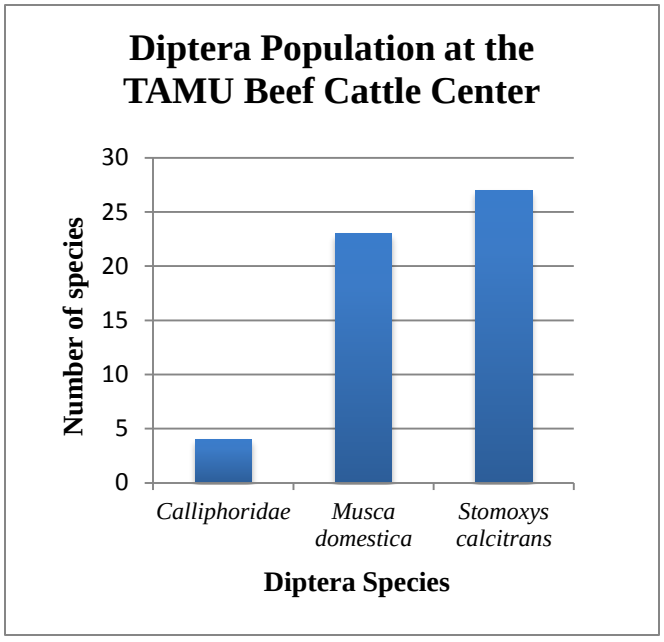

Figure 1. Comparative chart representing each species of Diptera and number present at TAMU Beef Center.

Figure 2. Mites attached to the *Musca species*

Discussion

It was found that *Stomoxys calcitrans* was the most abundant fly collected, followed closely by *Musca* flies. Only some Calliphorid flies were found. It is not uncommon to find both *Stomoxys calcitrans* and *Musca species* occupying the same area (Research Station, Agriculture Canada, Lethbridge, Alberta, 1993). The two fly genera shared several similarities including locations with high rates of decay, both to lay their eggs in and to feed on. This is a key reason as to why these two species were found to be the most dominant species in the TAMU Beef Cattle Center since it has moist materials. Calliphorid species are attracted to areas that contain blood and decomposing flesh, both

to lay their eggs in and to feed on (Sherman, 1995). Their presence at the TAMU Beef Cattle Center is due to wounds being present on the animals inhabiting the barn.

The *Musca species* in the TAMU Beef Cattle Center were feeding on animal manure and secretions around the animals' eyes and nostrils of cattle. Due to this trait, the *Musca species* are seen as less dangerous when compared to other fly species like *Stomoxys calcitrans*, which tend to feed on warm-blooded animals and are considered as one of the more dangerous pests of confined livestock. *Stomoxys calcitrans* create a lot of annoyance to the animals they are attacking since their piercing-sucking mouthparts cause painful bites to the animal (Campbell, 2001). This annoyance can interfere with normal feeding activities that can later result in reduction in weight gain, decrease in milk production, and even blood loss (Campbell, 2001).

Control of these Diptera species around confined livestock can be difficult since it was seen that flies flourish in stable areas. The stable fly and house fly abundance is strongly dependent upon availability of prey and climatic conditions (Junquera, 2013). There are several mechanical control methods that may be used to help rid the area of the pest flies. Some of the mechanical control methods include screening, installing fans that direct air flow downward and outward, fly traps and sticky paper. There are some commercial firms that offer a biological control, which releases a fly parasite to help supplement fly control (Hogsette, 1987).

If mechanical control methods do not work, insecticides are another option that can be used to help reduce fly numbers that work by killing adult flies. There are different kinds of insecticides, depending on which mode-of-action the user prefers. Some include residual insecticides where a chemical is applied to the walls, ceiling and other areas that flies are found resting (Foil, 1994). Space sprays, fogs, and mists are another type of insecticide that may be used to reduce the fly populations. Using this insecticide provides an immediate effect to the flies, causing them to quickly die. Although this type of insecticide is fast-acting, they are short residues so treatments must be replaced or reapplied. Another type of insecticide that may be used is fly bait, which can be placed in a bait station. Although this method is very simple, it should only be used to rid the *Musca* species since it is not effective against blood-feeding stable flies (Townsend, 2007).

Though these methods work, they should be viewed as a temporary solution as they do not address the source of the fly population – moist breeding materials. Both the *Stomoxys calcitrans* and *Musca* species rely on breeding material, moisture, and warmth to develop so stalls should be regularly checked and cleaned to prevent reproduction. Wet manure, spilled feed, and wet hay/straw can be eliminated by maintaining a good drainage system (Foil 1994). If the manure and other breeding sites accumulate organic matter that is dry, the Diptera species will not be attracted to reproduce there (Hogsette, 1987). If there is a breeding site that contains large numbers of maggots but there is not an adequate

amount of time to clean, larvicides may be used. Larvicides are a type of insecticide that can be applied to breeding sites that kills the immature stages of insects (Floate, 2001). If there is a problem with getting rid of excess manure, there is another type of insecticide that makes the manure toxic to developing maggots. Insecticides that are administered at specific levels may be added to the animals' feed, causing the manure that they excrete to be toxic to developing maggots (Floate, 2001). In order for this insecticide to work, the animal must receive the correct amount of feed and insecticide everyday so that the mixture remains in the animal's system.

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