VMP 930
Veterinary Parasitology

Arthropods

Flies
Filth Flies (Muscidae)

- Family Muscidae - disease vectors & fly-bother.
  - *Musca domestica* - house fly
  - *Musca autumnalis* - face fly
  - *Stomoxys calcitrans* - stable fly
  - *Haematobia irritans* - horn fly
FILTH FLIES

Musca domestica

Musca autumnalis

Stomoxys calcitrans

Haematobia irritans

Fly Life Cycle

From Novartis
Musca domestica - house fly

- Morphology - have fleshy, sponging and sucking mouth parts. Not biting.
Musca domestica - house fly

Life cycle

- **Eggs** deposited on any decaying organic matter.
- Larva is a common *maggot*.
- Pupal stage in soil or drier areas for 4 to 5 days.
- Both Male & Female flies contribute to annoyance.
- Loiter indoors or outdoors
**Musca domestica** - house fly

- **Pathology**
  - **Excellent vector**, it vomits to digest food and defecates at random.
  - **Mechanical vector for a variety of pathogens** (Viral, bacterial, protozoan, etc.)
Musca domestica - house fly

- Control
Musca autumnalis - face fly

- **Morphology**
  - Sponging mouthparts
  - Little larger than the house fly.
  - Abdomen of female is black on the sides in contrast to yellowish color of the house fly.
Musca autumnalis - face fly

- Life cycle
  - Eggs laid in fresh cow manure.
  - Only female feeds on animals
  - Adult swarms overwinter inside
  - In summer, will not follow animals into buildings.
    Loiter outside on plants, posts, fences, etc.

http://entomology.ces.ncsu.edu/face-fly-pest-management/
Musca autumnalis - face fly

- Pathology
  - Fly-bother
  - Mechanical vector - pinkeye = keratoconjunctivitis (Morexella bovis)
  - Biological vector - eyeworm (Thelazia)
**Musca autumnalis - face fly**

- **Control**
  - In-feed insecticides
  - Topical insecticides on animals (sprays, dusts, ear tags, rubs)
  - Fly strips & traps
  - Fly masks
  - Biological control: parasitoid wasps
**Stomoxys calcitrans** - stable fly

- **Morphology**
  - Resembles house fly
  - But **piercing mouth parts**: pointed, shiny black proboscis, bayonet-like in front of head.
  - **Aristae** (bristles) on antennae have setae (hairs) on upper sides only.
**Stomoxys calcitrans - stable fly**

- **Life cycle**
  - Breed in decaying hay/straw/silage, rotting vegetable matter.
  - Adult males and females feed on blood.
**Stomoxys calcitrans** - stable fly

- **Loitering habit**
  - Prefer outdoors: **light-colored surfaces, found on outside walls of buildings.**
  - **Cooler or rainy weather may come indoors.**
Pathology

- Bites are extremely painful. Feed on cattle, horses, man. (issue for beach tourists)
- Fly-bother results in weight loss, low productivity, and low feed-conversion.
- Suspect mechanical vector - many pathogens (viral, bacterial, protozoan, etc.)
- Biological vector - horse stomachworm (*Habronema microstoma*)

*Stomoxys calcitrans* - stable fly
**Stomoxys calcitrans** - stable fly

- **Control**
  - Eliminate / reduce breeding habitat ??
  - Topical insecticides on walls & animals (sprays, dusts, ear tags, rub
  - Fly strips & traps
  - Biological control: parasitoid wasps
Haematobia irritans - horn fly

- Morphology
  - Resembles the stable fly but smaller & more slender
  - Biting-fly with short piercing mouth-parts.
**Haematobia irritans** - horn fly

**Life cycle**
- Eggs deposited on freshly passed cow manure.
- Larvae burrow in manure.
- Both males & females are blood feeders
- Prefer cattle, but occasionally on horses
**Haematobia irritans - horn fly**

- **Habits**
  - Adults will always be on host’s back
  - Or on abdomen when raining or very hot.
  - Leave host only
    - to lay eggs
    - or when host goes inside.
Haematobia irritans - horn fly

Pathology

- Prefer cattle.
- Fly-bother is the main “pathology”
  - Loss of weight, decreased weight gain, decreased milk production, thriftiness.
- Biological vector - cattle filarial worm
  *(Stephanofilaria stilesi)*

Heavily infested cattle may lose 0.5 pounds of flesh per day and milk production reduced by 10 to 20%.
Haematobia irritans - horn fly

- **Control**
  - In-feed insecticides
  - Topical insecticides on animals (sprays, dusts, ear tags, rubs)
  - Fly traps
    - (Bruce fly trap)
  - Fly vacuum

*100-200 horn flies per head is the economical threshold for treatment.*
Myiasis
Invasion of tissue by dipterous larvae

- Sarcophagidae - Flesh flies
- Calliphoridae - bottle flies or blow flies, and screwworm flies.
- Oestrids (bots)
  - Gasterophilidae - horse bot
  - Hypodermatidae - cattle grub, warble or heel fly
  - Oestridae - nose bot
  - Cuterebridae - emasculating fly, human skin bot
Family Sarcophagidae

- Flesh Flies
- Adult morphology - larger than *Musca* & grey color.
- Maggots are “saprophytic” scavengers
- Accidental / facultative myiasis due to soiled fur or wool.
- Ovoviviparous (larviposit)
Family Calliphoridae

- Blow flies or Bottle flies
- Adult Morphology - slightly larger than *Musca*, bright metallic color.
- Maggots are mostly saprophytic
- Occasionally accidental myiasis
- Few true parasitic myiasis
Some Blow flies

Blue Bottle Fly
(*Calliphora vomitoria*)

Green Bottle Fly
(*Phaenicia (Lucilia) sericata*)
(copper variation)

Black Blow Fly
(*Phormia regina*)
Family Calliphoridae

- **Life cycle**
  - Eggs laid in carrion, decaying vegetable matter, diseased / necrotic tissue or in wounds
  - hatch in 24 hours.
  - After a week of feeding, larvae drop to ground or crawl to a dry area and form puparium.
  - See adults in a month.
Family - Calliphoridae

Pathology

- Maggots may infect wounds or soiled wool or hair coat.
- If the area is not treated, healthy tissue may become invaded. (facultative myiasis = accidental myiasis)
Family - Calliphoridae
*Cochliomyia hominivorax* - primary screwworm

- Morphology
Family - Calliphoridae
*Cochliomyia hominivorax* - primary screwworm

- **Life cycle**
  - Females deposit batches of 10 to 400 eggs in shingled masses on edge of wound.
  - Larvae feed on living tissue for 3 to 5 days.
  - Female fly copulates only once.
    - Release of irradiated pupae permitted eradication from southern U.S.
Pathology

- The primary screwworm is a true parasite and lives only in the living flesh of warm-blooded animals. (Obligate myiasis)
- Only a small break in integument will permit infestation. (barbed wire scratch, tick bite, dehorning, castration, etc.)
- Cochliomyia macellaria (secondary Screwworm - facultative myiasis)
Myiasis
Invasion of tissue by dipterous larvae

- Oestrids (bots)
  - Gasterophilidae - horse stomach bot
  - Hypodermae - cattle grub, warble or heel fly.
  - Oestridae - nose bot.
  - Cuterebridae - emasculating fly, Human skin bot.

- Obligate Myiasis
Bot Flies & Bots

Morphology

- Adult Fly - large, heavy bodied like honey bees or bumble bees, but lack mouth parts.
- Larvae = Bots
  - Large heavy stout bodied, somewhat rounded on both ends, may have tegumental spines, bumps or ridges.
  - Respiratory spiracles identify genera.
Gasterophilus spp.
Horse stomach bots
Gasterophilus sp. -- Life cycle
**Gasterophilus sp.**

**Life cycle**

- Adult fly cements eggs (nits) to horse’s hair
- Eggs hatch and larvae enter mouth
- Larvae penetrate the mucosa of the cheek, gums and tongue for about a month and then pass to the stomach.
- 3rd stage larvae (bots) remain in the horse for 8 to 10 months and then pass out in the feces.
- Pupation takes place in loose dirt
- After 3 to 5 weeks the adults emerge during the latter half of the summer and live for about 3 weeks.
**Gasterophilus sp.**

**Biology**

*G. intestinalis*
- Common bot fly
- Eggs on the fetlock and forelegs
- Eggs require licking to hatch
- L3 attach near cardiac region of stomach
- Throughout US

*G. nasalis*
- Throat bot fly
- Eggs on the inter-mandibular area.
- Eggs hatch spontaneously in about 5-10 days.
- L3 attach near pylorus in the duodenum
- Throughout US

*G. haemorrhoidalis*
- Nose bot fly
- Eggs on the nose and cheek.
- Eggs hatch spontaneously in about 5-10 days.
- L3 attach in the duodenum & rectum
- North-central US
Adult flies annoy horses.

Heavy infestation may damage mucosa of mouth during L1 & L2 migrations.

Main Pathology due to L3

- Third stage larvae are “mature” bots, 1 - 2 cm long, 0.5 - 1 cm in diameter
- Damage mucosa of stomach / duodenum
  - (stomach ulcers, colic, etc.)
- May block the pyloris.
**Gasterophilus sp.**

**Control**

- Nit Combs
- Wash nits
  - Warm water with insecticide
  - *G. intestinalis*
- Late summer & Fall “deworming” with an avermectin
Gasterophilus sp.
Hypoderma spp.
Heel Fly, Gadfly
Cattle Grub, Ox Warble
Hypoderma sp. -- Life cycle

1. Adult
2. Eggs attached to hairs in rows
3. Larvae
4. Migration on cattle
5. Warble
6. Pupa

Life cycle diagram
Hypoderma sp.
Life cycle

- Adult flies lay as many as 800 eggs on hairs of cattle’s legs.
- Eggs hatch in about 4 days and larvae crawl down hair and penetrate skin.
- Larvae migrate for a while in deeper tissues.
- Larvae eventually migrate to the subcutaneous tissue of the cattle’s the thoracolumbar region and cut holes in the skin for respiration.
- After 5 to 10 weeks in subcutaneous cysts on the back, larva enlarges hole, works its way out and falls to the ground to pupate.
Hypoderma sp.

Biology

**Hypoderma lineatum**
- Common Cattle Grub
- Eggs laid in rows
- Larvae migrate to the *esophageal submucosa* where it remains until midwinter; then to the diaphragm up through loin muscle to a subcutaneous location on the back.
- Widespread throughout much of US
- Adult flies active in spring for about 2 months

**Hypoderma bovis**
- Northern Cattle Grub
- Eggs laid singly
- Larvae migrate through the *spinal canal* and muscles of the back to subcutaneous location on the back.
- Widespread throughout much of US but extends farther north.
- Adult flies active after *H. lineatum*
**Hypoderma sp.**

**Pathology**

- Cattle have instinctive fear of adult flies and are stampeded by them.

- Migration of larvae through loin muscles results in necrotic tracts and condemnation.

- Hides punctured by larvae are downgraded.

- Post-treatment Pathology:
  - Killing bots in the spinal canal or esophagus leads to paralysis or bloat.
  - Migratory larvae killed by systemic drugs will cause immune reaction, inflammation, abscess, etc.
  - *H. lineatum* -- paralysis of esophagus & fatal bloat
  - *H. bovis* -- spinal cord affected; posterior limb paralysis.

- Treat soon after fly season. Do not delay.
In areas where *Hypoderma* spp. are prevalent, cattle, especially calves, should be treated as soon as possible after the end of the heel fly season. They should not be treated later than 8-12 wks before the anticipated first appearance of grubs in the backs, because adverse reactions may occur when migrating larvae are killed.
Oestrus ovis
Sheep Nasal Bot
Oestrus ovis -- Life cycle
Oestrus ovis

Life cycle

- Larvae deposited in the nostrils of sheep and goats during summer or early autumn. (Note: no egg stage)
- Larvae crawl up nostrils into sinuses where they attach to mucosa and feed.
- By spring, the larvae are developed and crawl down nostrils to be sneezed out.
Oestrus ovis

Pathology

- **Mild to moderate infections** -- no pathology
- **Heavy infestation**
  - Animals show great distress by sneezing and shaking of head
  - purulent discharge
  - loss of appetite
  - fatal if there is penetration into the cranium.
*Cuterebra spp.*
Rodent Bot or Emasculating fly
Cuterebra emasculator -- Life cycle
**Cuterebra spp. Life Cycle**

- Fly lays eggs at rodent run, nest, borrow entrance.
- Mechanical stimulation of an entering rodent (or snooping cat) causes larva to instantaneously hatch on to host’s fur.
- Larvae migrate to and enter a natural orifice (nose, mouth, orbit of eye, anus).
- After some migration, larva reaches subcutaneous location, cut breathing hole and develop further.
- Larvae exit “warble” (= subcutaneous pocket), fall to the ground & pupate.
Cuterebra sp.

Pathology

- Subcutaneous cyst containing bot
- Rodents & Squirrels
  - Various parts of the body, including the scrotum.
- Dogs & Cats
  - Usually on the head or neck
  - Potential migration through the brain
**Cuterebra sp.**

**Treatment**

- Do not rupture bot.
- Attempt to remove by applying Vaseline to cover spiracles
- Or blunt dissection to enlarge opening
Dermatobia hominis
Human Bot

- Morphology - same as for other bots.
- Life cycle - Eggs laid on a mosquito or stable fly ("slave fly")
- Larvae hatch and enter the host upon which the slave fly is feeding.
- Pathology - subcutaneous cyst containing bot in man, cattle, sheep and other mammals.
- Central and South America.