Unraveling the caterpillar and Mare Reproductive Loss (MRLS) mystery: What every horse owner should know

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What is Mare Reproductive Loss Syndrome (MRLS)

- MRLS appeared in 2001/2002 in Kentucky
  - Rapid appearance - within 3 wks
  - 1/3 of Kentucky's foal crop was lost in 2001
    - In total, 3,600 Thoroughbread and 1,000 Paint and Quarter horse foals lost
  - 60 cases of pericarditis, ~ 55 cases of eye loss and 3 encephalitis cases
  - ~ $500 million in losses
  - Mares showed few signs of illness
  - Non-specific bacterial infections of fetuses

The 2001 Mystery

- Following numerous "spontaneous" abortions, researchers of all types were enlisted
  - Epidemic of the Eastern tent caterpillar noted
    - Numerous toxins, including cyanide, ruled out
    - A return of caterpillars in 2002 resulted in losses
  - Bacterial infections
    - Fetus/Fetal membrane infections noted
  - Barbed setal fragments – a link???
    - Hairs (setae) from caterpillars proposed as a factor

Theory: How It Worked

- Caterpillars consumed by horse
  - In gut, hairs break off & lodge in stomach lining
    - Hairs carry small amounts of gut bacteria
      - Hairs are barbed, so they worked their way through the tissue, some are picked up by the bloodstream
        - These hairs are transported throughout the body
          - Hairs deposited in immuno-sensitive areas are most problematic, given uncontrolled bacterial growth

Afflicted Areas

- Several areas of the body have limited or no immune system. These include:
  - Eye
  - Pericardium (sac surrounding heart)
  - Brain/spinal column
  - Placenta/fetal membranes

Afflicted Areas

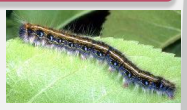
- Clues included:
  - Non-specific bacteria, very similar to that found in the horse gut
  - Sudden onset of bacterial sepsis
  - Eye and heart infections in males and non-pregnant females and fetal abortions
  - Mares not presenting as healthy

Follow-up: Non-Horse Studies

- Mathematical modeling for the following year matched what occurred the following year
- Using ETC-dosed pigs, researchers showed intestinal microgranuloma's (small sites of infection). All had a ETC setae
- Lack of adult horse blood infections – showed this was not an infection of the mare passed to fetus
- Eye infections allowed for calculation of circulating setae levels of 10 setae/day

Follow-up: Horse Studies

- Four Studies
  - Study 1: Mares exposed to pasture grass with ETC:
    - 18 of 29 mares aborted with MRLS symptoms
  - Study 2: Is it the caterpillar or the feces?
    - 3 of 7 mares fed whole ETC aborted
    - No losses in control or ETC feces fed groups



Follow-up: Horse Studies

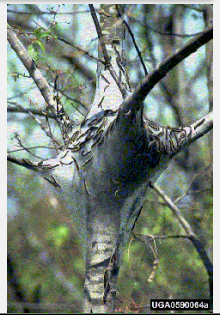
- Four Studies
  - Study 3: Are they carrying anything?
    - 3 of 5 mares fed frozen ETC aborted
    - No mares fed sterilized ETC or frozen gypsy moth caterpillars aborted
  - Study 4: What is the responsible component of ETC?
    - Abortions occurred in whole and exoskeleton-containing treatments
    - No abortions with caterpillar gut or filtered components

Eastern Tent Caterpillar

- ETC is a cyclic insect
- The outbreak experienced by KY was of exceedingly large size.
- Black cherry trees were quite abundant
- These trees are one of several hosts for the caterpillar

Photograph courtesy of H.Q. Murphy

Eastern Tent Caterpillar



Black Cherry – *Prunus serotina*

So, What Happens

- Why would my horse eat these caterpillars?
  - The caterpillars themselves are not toxic
  - As observed in KY, the outbreak was very large
    - Essentially, the caterpillars were so numerous, when they were crawling from trees to find places to pupate or turn into a cocoon, they were eaten by the horses
  - This phenomenon had never been associated with spontaneous abortions and horse owners were caught unaware.

Is Florida at Risk?

- In 2006 a small occurrence was observed in Florida
- Florida horses may be at risk, however, a KY-like outbreak is not likely. In fact, ETC levels have not occurred in KY to the level seen in 2001.
- Reasons **in favor** of a FL outbreak
  - We have the same caterpillar, appropriate host trees and a large horse population
- Reasons **against** a FL outbreak
  - Our ETC season is much earlier, perhaps lowering the risk to fetuses. Many *Prunus* trees have been removed and we are aware of the situation and owners can address these proactively

ETC Management

- Remove all *Prunus* species trees from your pastures and adjacent areas under your control
  - Although black cherry trees are the most common, this is a very large group of tree species that includes apple, plum, pear, plum and crabapple
  - If infestations are found, there are chemical treatments, however, the size of most trees usually requires a professional applicator
  - Work with neighbors to remove or treat their trees, if of concern

ETC Management

- Put reminders on calendars. ETC emergence is tied very closely to tree dormancy breaking
  - In FL, ETC eggs hatch around Feb. 01(latitude dependent) and develop for 4-6 weeks
  - When fully developed, many larvae will leave the tree to find a pupation site. **This is when they are a risk to horses**
  - So, watch for large caterpillars moving down tree trunks or on grass during early- to mid-March
  - Remove animals from pastures with active infestations

Recommendations

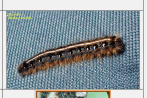
- ETC produces one generation per year
  - Natural enemies keep them in control most years
  - Remove egg masses in winter (esp. ornamentals)
- Insecticide applications
  - Microbial: *Bacillus thuringiensis* var *kurstaki* for young caterpillars
  - Other insecticides: See UF/IFAS EDIS http://edis.ifas.ufl.edu/in628
  - Larvae in tents are protected beneath webbing & are difficult to kill

Equine Amnionitis and Fetal Loss

- Australia – 2004
- Mid- & late-term abortions - similar presentation to MRLS
- Noted presence of processionary caterpillar
  - Walk away from tree in a single-file line
  - Known skin irritator
  - Similar hairs as ETC
- Clinical studies showed losses as with EAFL

Other Hairy Caterpillars?

- Although the evidence pointed to ETC, does this mean that other hairy caterpillars are a risk to my horse?
  - Other "hairy," tree-inhabiting caterpillars occur on common pasture trees & they may pose a risk.
    - Many shade trees: oak, hickory, pecan, walnut, gum
    - Cannot cut them all down, so monitor them
  - However, no data exists and more likely than not, these will not pose the same risk as ETC.
  - Many of these caterpillars occur much later in the year than the Feb/March ETC season, so watch for them.

Insect	Life cycle and time of year	Hosts	Description	
Eastern tent caterpillar, *Malacosoma americanum*	Hatch Feb. 1 Larvae 4-6 wks Pupae 2 wks Adult moths, late March, early April	Cherry, Plum, Apple, Crabapple Rarely others	Full-grown larvae 2-2.5 inches long Black heads, long light brown body hairs. Back has solid light stripe, bordered with yellow-brown and black wavy lines Tents around branch do not contain foliage. Image: woodypests.cas.psu.edu/Insects/EasTentCat/EasternTentCaterpillarLarva.jpg	
Forest tent caterpillar, *Malacosoma disstria*	Hatch late February Larvae 4-6 wks Pupae 2 wks Adult moths, April	Oak, Tupelo gum	Larvae 2 inches, with pale bluish lines on sides of brownish body. Row of keyhole shaped white spots down middle of back. Produces silk, no tent formed. Image: www3.gov.ab.ca/srd/forests/_larvae.html	
Walnut caterpillar, *Datana integerrima*	2-3 generations/yr Late summer (2nd) generation, generally most abundant.	Walnut, Pecan, Hickory	Larvae 1-2 inches long. Mature larvae nearly black with white hairs. 4 dorsal tussocks. Image: ent3541.ifas.ufl.edu/	
Tussock moth, *Orgyia detrita* *(2 other FL species)*	Hatch: March 1 Larvae 4-6 wks Pupae 2 wks Adult moths, May	Oak Incidental on may other plants	Dark, red head, 2 black "hair pencils" look like antennae Image: ent3541.ifas.ufl.edu/	
Fall webworm, *Hyphantria cunea*	Multiple generations from early spring to late summer. Most numerous August - September	Pecan, Hickory, Persimmon, Sweet gum, Many others	Larvae 1-1.25 inches long, covered with silky hairs. Color varies pale yellow to green, black stripe on back, yellow stripe on each side. Construct tents that enclose foliage. Image: www.fs.fed.us/r8/foresthealth/idotts/insects/	

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Sources of Information

- UF - EDIS system (http://edis.ifas.ufl.edu)
  - http://edis.ifas.ufl.edu/in628
  - http://edis.ifas.ufl.edu/IG139 (Pest Mgmt. Horses)
  - http://entnemdept.ifas.ufl.edu/publicat.html
- County Extension Offices
  - Fantastic resource for many needs - 1st stop
- Univ. Kentucky
  - ETC Factsheet: http://www.ca.uky.edu/entomology/entfacts/entfactpdf/ef423.pdf
  - MRLS Website: http://www.ca.uky.edu/gluck/mrlsindex.asp