Culicoides Biting Midges and Hemorrhagic Disease of White-tailed Deer


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White-tailed Deer: Not Always Abundant

- Many populations nearly extirpated
  - 3-500,000 left at turn of Century
- Reintroductions 1930s-50s

SCDDS - Southeastern Cooperative Deer Disease Study
Established in 1957
What is HD?

- One of the most significant infectious diseases of WTD in North America
- Caused by two closely related orbiviruses
  - Epizootic hemorrhagic disease viruses (EHDV)
  - Bluetongue viruses (BTV)
- Outbreaks since late-1800s
  - Annually since 1970s
Insect killing deer

By Mike McKee
Outdoors

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A tiny midge insect appears to be knocking off a considerable number of deer in north central La Porte County.

"I've heard of a couple dozen," said Linda Byer, Indiana's District 2 wildlife biologist.

"The deer are victims of EHD (Epizootic Hemorrhagic Disease), not (the more serious) CWD (Chronic Wasting Disease) or Bluetongue."

EHD is set in motion by a Culicoides biting fly, which is smaller than the average mosquito. Within a week of infection, deer develop fever-like symptoms and hemorrhaging that is often fatal.

Some sportsmen believe the problem may be worse than the DNR believes.

"My estimation, by the number of people that come through here and have seen them (dead deer), is about 150," Dale Elkins of Elkins Taxidermy in New Carlisle, said.

- 812 counties
- 31 states
- >100 mortalities per county reported from 11 states
- >65,000 deer mortalities
How Do The Viruses Cause Disease?

Virus replicates in endothelialial cells lining blood vessels

→ Damage to blood vessels

↓ Hemorrhage  ↓ Edema

→ Coagulation system attempts repair
→ Clotting factors get used up
→ Worsening hemorrhage and edema
What is the Outcome of Infection?

• Highly variable
  – Subclinical -> peracute death -> chronic form
  – Depends on host immunity, virus strain, and vector competence and abundance

• Three forms of HD
  – Peracute
  – Acute
  – Chronic
Peracute HD

- Clinical signs
  - Fever, depression, weakness, decreased activity, death
Acute HD

- Clinical signs
  - Depressed, decreased activity, lameness, death
Chronic HD

• Clinical signs
  – Weight loss, lameness, emaciation, death
When Does HD Occur?

• Predictable seasonality – August to November
Where Does HD Occur?

Distribution of hemorrhagic disease
1980-2003

↓ outbreak frequency but ↑ disease severity
Field Signs

- White-tailed deer mortality
- Late summer and early fall
Visibility of Outbreaks

• Outbreaks can be highly visible or go completely unrecognized
Tenacity of *Culicoides*
Culicoides

- Order Diptera, Family Ceratopogonidae
  - >1,200 spp worldwide
  - <1% proven vectors
  - 1-3 mm...”no-see-ums”
- Proven competent vectors
  - EHDV: *C. sonorensis*
  - BTV: *C. sonorensis, C. insignis*
Life History

- Life cycle duration variable
  - Weeks to > 1 year
- Aquatic or semi-aquatic habitats
  - Larval development requires moist substrate
    - Margins of waterways, tree holes, manure, enriched moist soils, etc
Life History (cont.)

- Adults emerge from pupal stage in late spring
- Females seek blood meal for egg development
- Duration of larval development variable
  - Overwinter as 4\textsuperscript{th} instars
- Adults not strong fliers
  - Often remain near breeding sites
  - Passively disperse on winds
Virus Transmission

- Optimal conditions create perfect storm

Climatic conditions
- Temperature, moisture, winds

Extrinsic Incubation (4-20d)

Survivorship Activity Find host

Viremic host

Naïve host
**C. sonorensis / EHDV / Temperature**

- **Midge life cycle**
  - ↓ duration of life cycle parameters
  - Ideal temp. → ↑ generations and ↑ adult pop.
    - Excessive temperatures can ↓ daily survivorship

- **Viral replication**
  - ↑ temp → greater replication rate → ↓ EIP
Questions?

Kansas Flint Hills