



# VMC 605: Systematic Animal Virology

## Equine Infectious Anaemia Virus

Dr Manoj Kumar  
Assistant Professor  
Department of Veterinary Microbiology  
Bihar Animal Sciences University

# Introduction

---



Equine infectious anemia (EIA) occurs in horse populations worldwide



characterized by antigenic variability and persistent infection.

Affected animals  
remain viremic  
often suffer irregularly recurring episodes of disease.  
become lifelong carriers of the virus.




EIA is sometimes referred to as “swamp fever”

as most outbreaks occur in warm wet areas  
where hematophagous insects are prevalent &  
transmit the virus

# Equine infectious anemia virus (EIAV)

## TAXONOMY

- **Family:** *Retroviridae*
- **Subfamily:** *Lentivirus*
- **Genus:** *Alpharetrovirus*
- **Species:** Equine infectious anemia virus (EIAV)



Equine  
infectious  
anemia virus  
(EIAV) is closely  
related to

Maedi visna virus (MVV)

Caprine arthritis-encephalitis virus (CAEV)

Bovine immunodeficiency virus (BIV)

Feline immunodeficiency virus (FIV)

Simian immunodeficiency virus (SIV)

Human immunodeficiency virus (HIV)



# Genome



Equine infectious anemia virus has a simple RNA genome

- 8 kb in length.
- includes three principal genes (*gag*, *pol*, *env*)

three regulatory genes important for viral replication and pathogenesis.

***gag*** gene encodes the structural proteins needed for virus assembly and encapsidation of the genome.

- include the nucleocapsid (p11), capsid (p26), and matrix (p15).

Gag proteins are the predominant protein components of the EIAV particle.

***pol*** gene encodes enzymes required for viral replication (reverse transcriptase) and integration into the host cell genome (integrase).

***env*** gene encodes the virus envelope surface unit (gp90) and transmembrane (gp45) glycoproteins.

# Equine infectious anemia virus (EIAV)



A lentivirus



Included in subfamily with other members - such as maedi visna virus and caprine arthritis virus



Associated with persistent and debilitating infections.



Persistent replication of the virus within the host leads to the periodic emergence of novel antigenic strains of EIA.



Virus is stable in refrigerated serum



Inactivated by heat (56°C), detergents and organic solvents such as ether.





# Equine infectious anaemia

Equine Infectious Anemia (EIA) or swamp fever is a chronic infectious disease of equids caused by a lentivirus of the *Retroviridae* family





Epidemiology



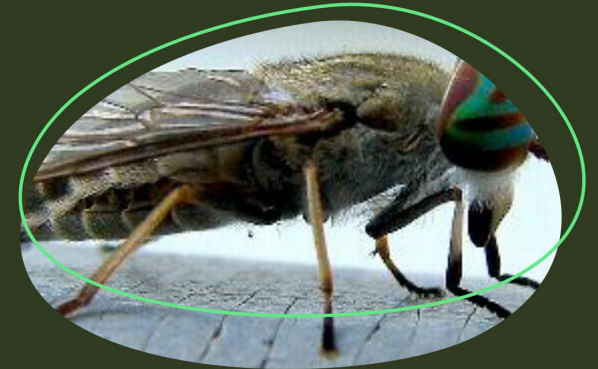


## Susceptible host

It can infect Equidae, including horses, ponies, donkeys, mules, and zebras.

# EIAV – transmission through arthropods

- Transmitted primarily through hematophagous biting insects,
- Particularly horseflies (*tabanus* spp.), Deer flies (*chrysomyia* spp.), Stable flies (*stomoxys* spp.) and mosquitoes.
- Horseflies are the most effective natural vectors of EIA because of their large mouthparts,



## EIAV - Transmission from mare to foal

- Transmission of EIA can occur transplacentally.
- Foals may become infected after birth by ingesting virus contaminated colostrum or milk.



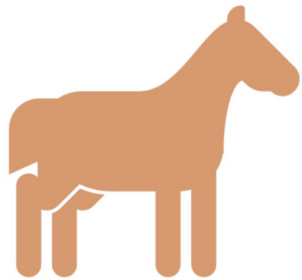


A photograph of two brown horses with blonde manes and tails standing in a green and yellow grassy field. In the background, there are dark, rugged mountains with patches of snow under a cloudy sky. The word "TRANSMISSION" is written in large, white, bold, sans-serif capital letters across the middle of the image.

# TRANSMISSION

- Infection is spread primarily through
  - mechanically by hematophagous biting insects *Tabanidae* family
  - contaminated needles and other instruments
  - passed on from mare to foal in utero.
  - transmission in the milk to nursing foals
  - iatrogenic transmission

# Pathogenesis



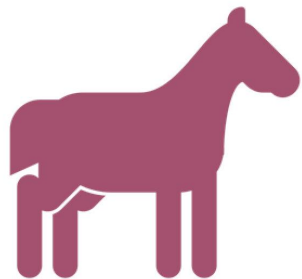
After the infection most horses become asymptomatic carriers of the virus

remains latent until the horse has a stress (other diseases, severe stress, intense exercise) resulting in recurring episodes of fever, anemia, weight loss and depression.

EIA virus persists in blood leukocytes for life, and also occurs in plasma during febrile episodes.



# Pathogenesis



EIA appears to be due to

- antigenic change of the surface glycoprotein of the virus
- the periodic release of new strains that evade the host's immune system.
- When a new variant is released there is some delay before the horse adapts and produces antibodies that neutralize the virus.

Virus have a predilection for macrophages and monocytes

- provide a vehicle for dissemination to a variety of organs including the liver, kidney, adrenal, brain and heart.

Anaemia occurs - Virus adhere to erythrocytes results from hemolysis of erythrocytes & impairment of bone marrow function.

Glomerulitis occurs - due to the deposition of circulating virus-antibody complexes in the kidney

# Incubation period



Normally 1-3 weeks



Highly variable and may be as long as 3 months.



Antibodies usually develop in infected horse blood 7-14 days after infection and lifelong.



# Three clinical forms of EIA

Acute  
chronic  
inapparent

# ACUTE FORM



- Characterised by non-specific signs such as fever, icterus, ventral edema, blood-stained feces and petechiae on the mucus membranes.
- Severe signs of the disease
- Display rapidly, and horses can die within 2-3 weeks.
- occurs so quickly - often an elevated body temperature is the only sign seen.
- Survived horses become chronically infected or inapparent carriers.

# CHRONIC FORM



- Recurrent episodes of a sudden rise in temperature to 105° or more followed by recovery.
- In mild cases, a fever can last less than a day.
- Decreased appetite and chronic weight loss.
- Swelling of the lower chest, abdomen and legs (edema).
- Decreased number of red blood cells (anemia) and an irregular heartbeat.
- Thin or watery blood, blood-stained feces.
- Pinpoint-sized hemorrhages on mucous membranes.
- Depression, with general listlessness and a head hanged low.



# INAPPARENT FORM

- Majority of infected horses become inapparent carriers, without signs of disease unless exposed to a severe stress.
- Continue to represent a risk to other horses.



---

# DIAGNOSIS





## **I. Clinical signs and symptoms**

## 2. Laboratory confirmation







# Serological techniques:

- Enzyme-linked immunoassay (ELISA)
- Agar Gel Immunodifusion Test (AGID or Coggins test).



# COGGINS TEST

---

01

Coggins test is an immunoprecipitation test.

02

Coggins test is the official, gold standard test for the diagnosis of EIA (OIE).

03

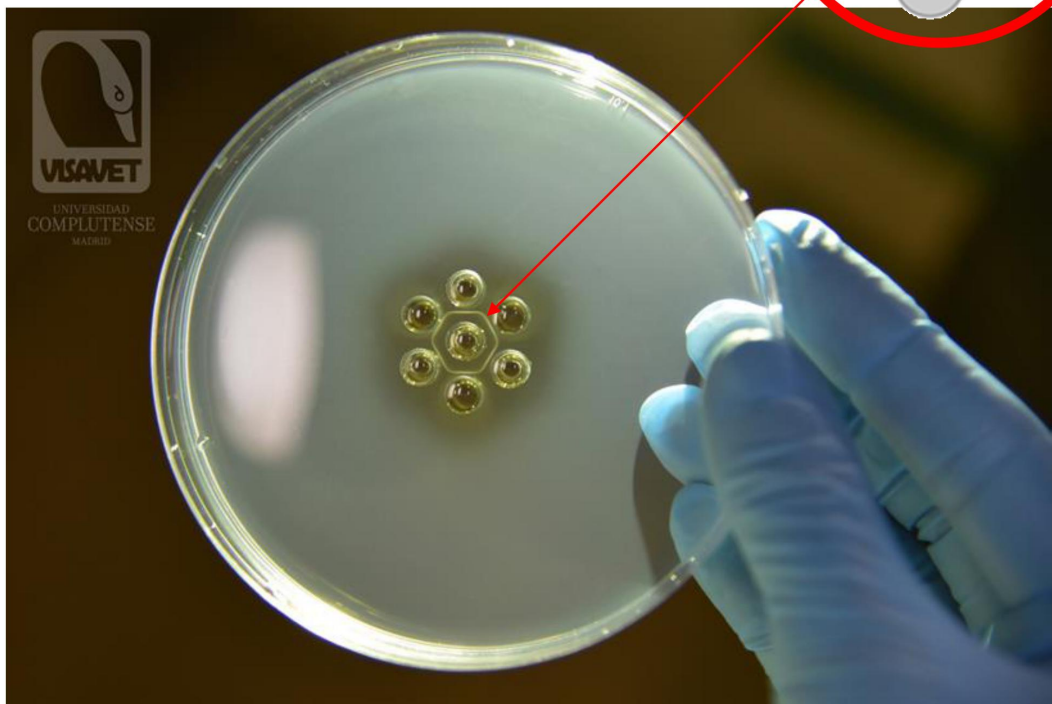
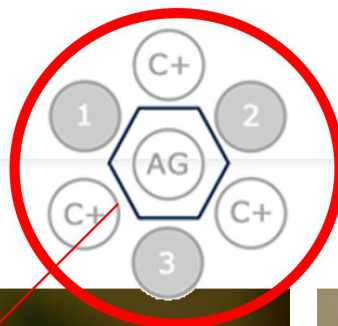
Can detect antibodies 2-3 weeks after the infection

04

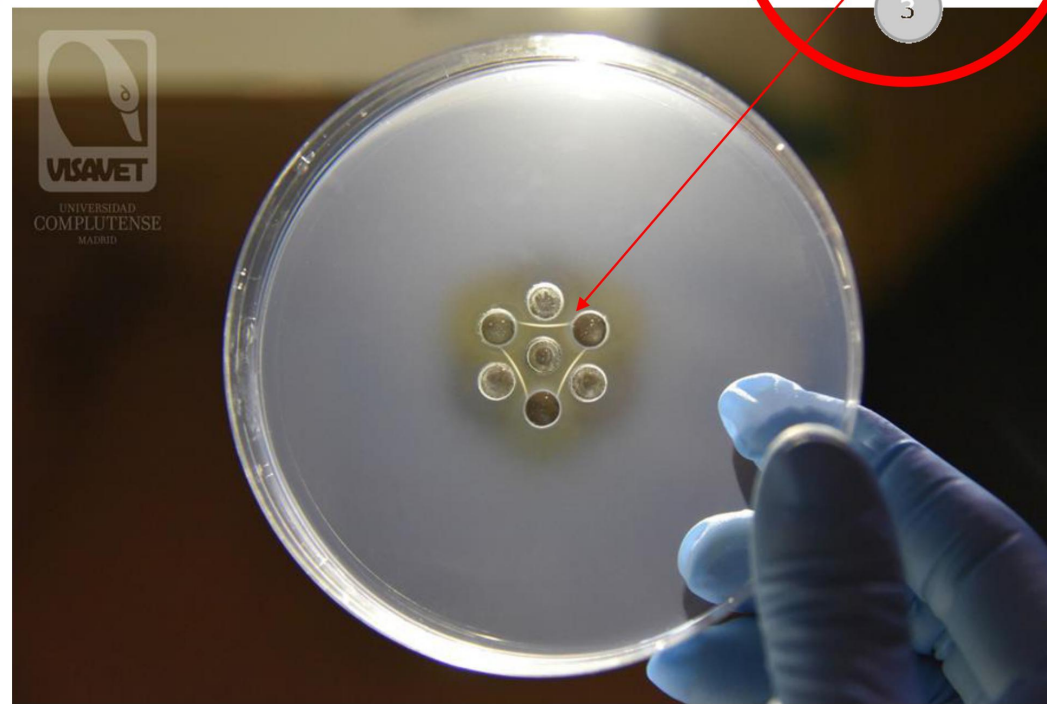
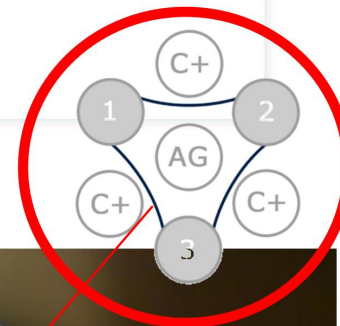
Results are available after 48 hours and the interpretation of results require experience.

# Coggins test

**Positive**



**Negative**







# ELISA TEST

---

01

ELISA test requires less time and with a higher sensibility and objectivity than Coggins test.

02

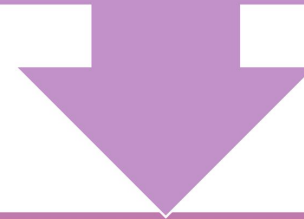
ELISA is more sensitive than Coggins, false positives may likely to occur.

03

For this reason, positive results on ELISA are confirmed with the AGID test.

## Reverse-transcriptase polymerase chain reaction (RT-PCR)

RT-PCR assays used for screening of EIAV in the blood of suspicious horses.



Used for determination of infectious status in the following cases:

To supplement or confirm serological tests

For confirmation of conflicting results or when an infection is suspected but serology is negative or equivocal.

To determine the infection status of foals born to infected mares.

## Prevention and control



No vaccine of proven efficacy is currently available

detection of infected horses by the Coggins test and their isolation.

Control of vectors by

drainage of swampy areas

strategic use of insecticides

# Websites

---

- <https://vcahospitals.com/know-your-pet/equine-infectious-anemia-eia>
- <http://www.merckvetmanual.com/generalizedconditions/equine-infectious-anemia/overviewof-equine-infectious-anemia>
- <http://www.aaep.org/info/horsehealth?publication=757>
- [https://www.aphis.usda.gov/publications/animal\\_health/content/printable\\_version/fs\\_equine\\_infectious\\_anemia.pdf](https://www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_equine_infectious_anemia.pdf)
- <https://www.lsuagcenter.com/profiles/kkramer/articles/page1492705790303>
- <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/equine-infectious-anemia>
- <https://doi.org/10.1016/B978-012374410-4.00395-2>
- <https://doi.org/10.1016/B978-1-4557-0891-8.00023-3>



# Further readings

Mealey, R. H. (2014). Equine Infectious Anemia. *Equine Infectious Diseases*, 232–238.

Retroviridae: In *Fenner's Veterinary Virology* (Fifth Edition), 2017



