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Workshop of the EU-RL for equine diseases for EIA
November 9th, 2022
Anses laboratory for Animal Health in Normandy- PhEED unit



EQUINE INFECTIOUS ANEMIA

RELEVANT PUBLICATIONS

2018-2021

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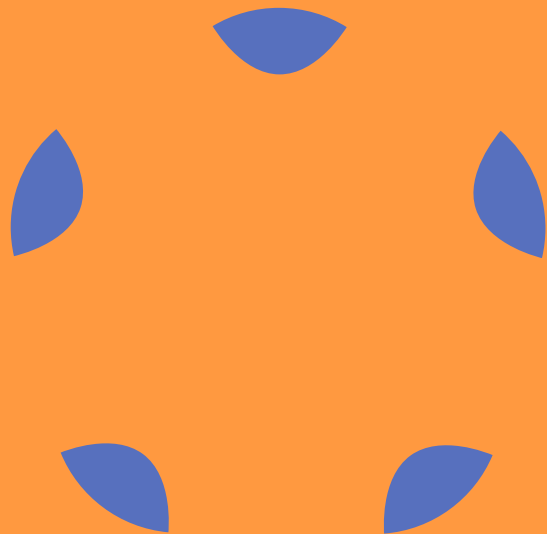
1. Introduction

2. Relevant Publications 2018-2021

- a. Virus
- b. Cell-Host interactions
- c. Diagnostics

3. Conclusion

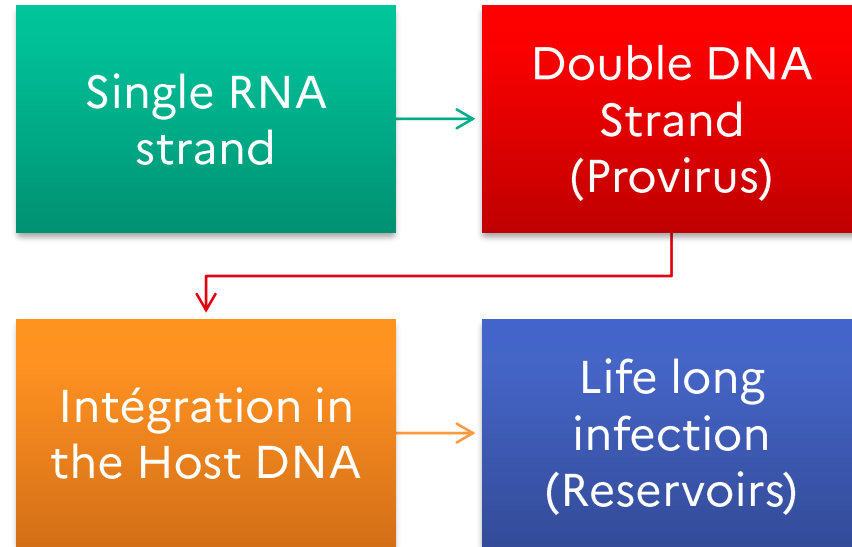
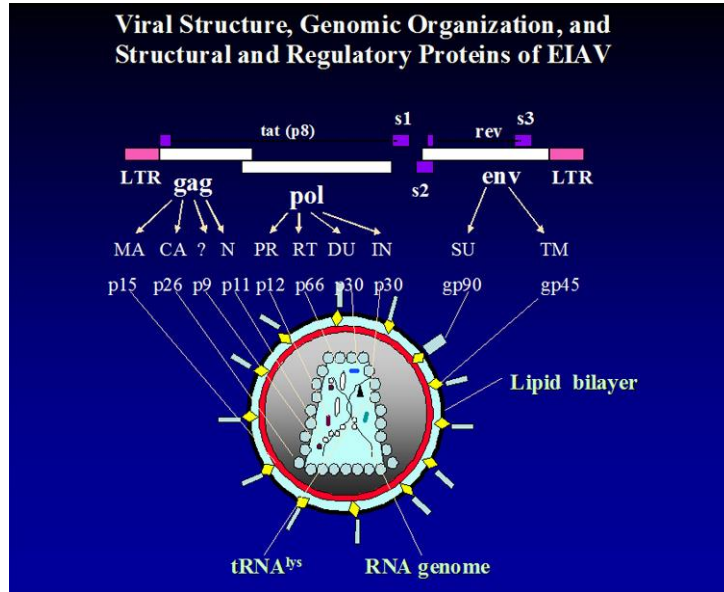
1. Introduction



Equine Infectious Anemia Virus - EIAV

Family : Retroviridae

Genus: Lentivirus



<http://www.uky.edu/Ag/VetScience/EIA/eiavirus.html>

Transmission

Iatrogenic mode :

- Blood/Plasma transfer
- Contaminated material use : Utilisation de matériel contaminé :
syringes, needles, dental equipment

Mechanical Vectors:

- Biting Flies: Tabanidae and Stomoxys
- No viral replication in the insect: purely mechanical transmission of the disease

Transplacental and sexual pathways (rare)

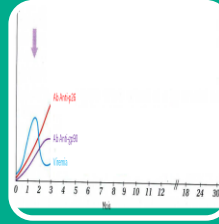


Clinical signs

1 to 3 weeks (up to a few months):

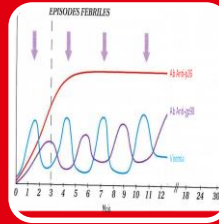
Anemia,
Edema,
Fever,
Thrombocytopenia,
Hyperthermia,
Edema,
Loss of weight,
Asthenia,

Recurrent febrile episodes



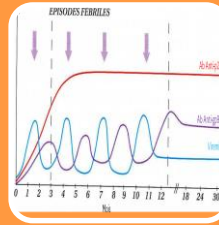
Acute Phase (primo-infection) :

- Severe anemia and fever
- Horses may die



Chronic Phase :

- Recurrent febrile episodes
- If the viral load is low at the time of primary infection, the horse may enter the chronic phase directly



Asymptomatic Phase :

- Horses become healthy carriers without apparent clinical signs

Diagnostic methods

Method	Purpose					
	Population freedom from infection	Individual animal freedom from infection prior to movement	Contribute to eradication policies	Confirmation of clinical cases	Prevalence of infection – surveillance	Immune status in individual animals or populations post-vaccination
Identification of the agent¹						
PCR	–	+/-	–	+/-	–	–
Virus isolation	–	–	–	+	–	–
Detection of immune response						
AGID	++	++	++	++	++	–
ELISA	++	++	++	+	+	–
Immunoblot	–	++	++	++	–	–

Key: +++ = recommended for this purpose; ++ recommended but has limitations;

+ = suitable in very limited circumstances; – = not appropriate for this purpose.

PCR = polymerase chain reaction; AGID = agar gel immunodiffusion; ELISA = enzyme-linked immunosorbent assay.

Virological diagnosis:

Not recommended

Serological diagnosis:

Agar gel immunodiffusion, OIE recommended test

Introduction



equine infectious anemia



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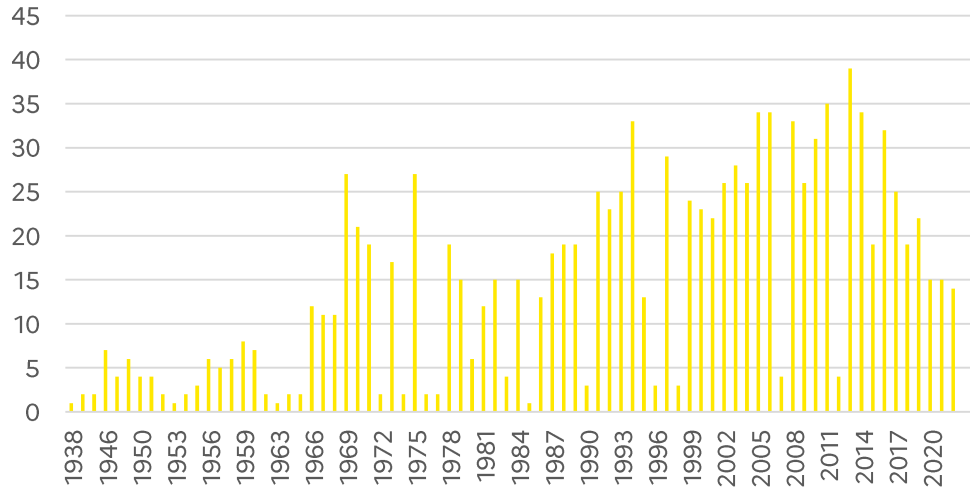
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Introduction

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equine infectious anemia diagnosis



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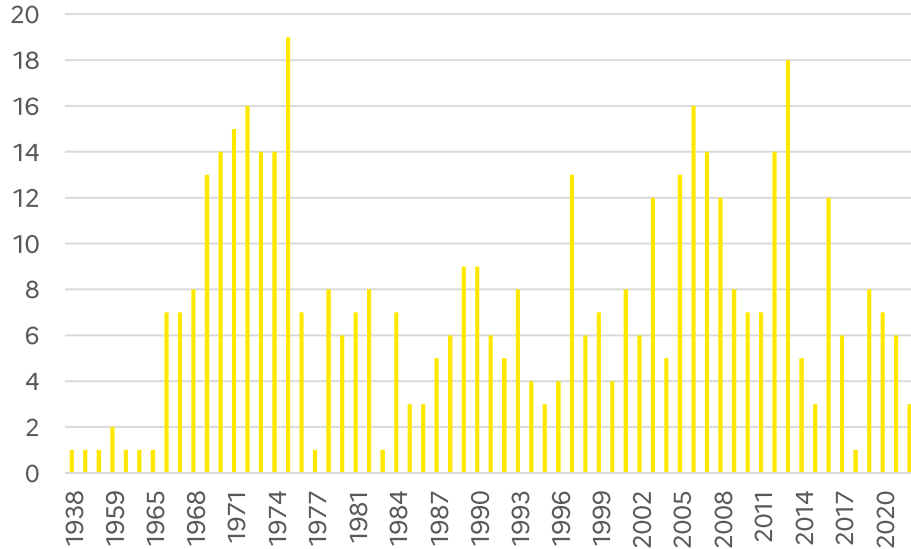
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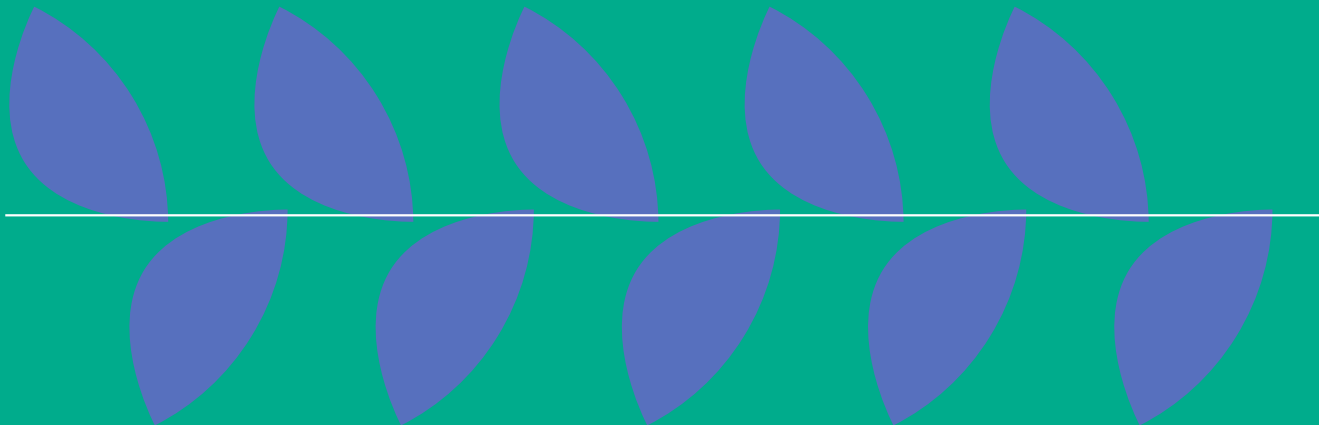
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AIE Publications 2018-2021

56 articles Equine infectious Anemia	EIAV – Structure / Cell-Host Interaction	EIAV Diagnostics Techniques	EIAV World distribution (New strains / Outbreaks)
2021 - 14	8 / 1	2 / 1	4 / 2
2020 - 12	8 / 0	2 / 0	2 / 0
2019 - 17	6 / 0	5 / 2	6 / 3
2018 - 13	7 / 2	3 / 1	3 / 1
	29 / 3	12 / 4	15 / 6

Total / EU Publications

2. EIA Relevant Publications 2018-2021

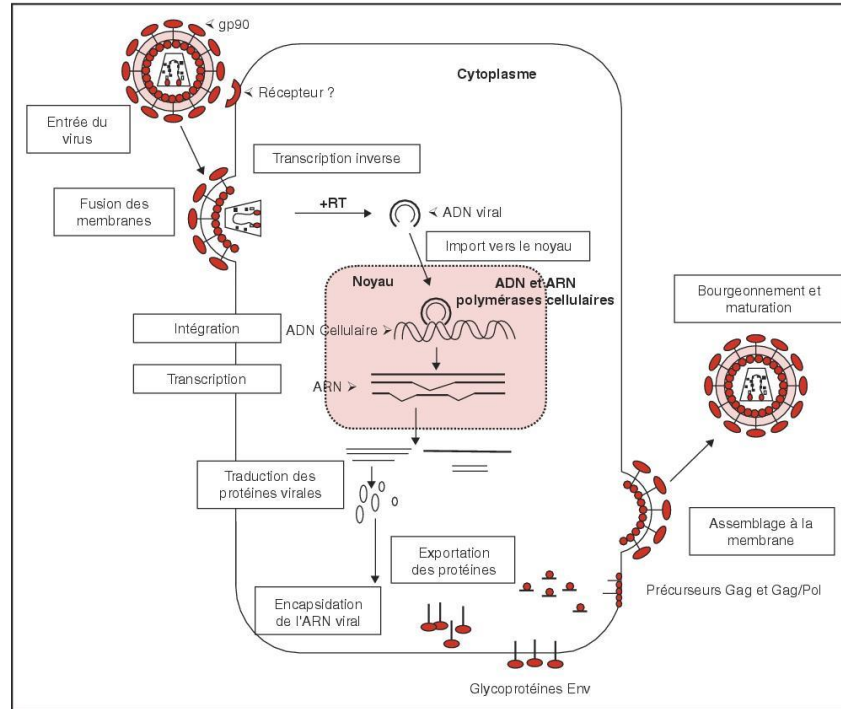


EIA Relevant Publications 2018-2021

Viral cell cycle & Cell Host - Interactions

Viral Restriction
Factors viral co-
factors - Cell host
interactions

Viral Quasispecies



Development of
new treatments

Gene therapy

Understanding
viral evolution

Vaccines
development

EIA Relevant Publications 2018-2021

Viral cell cycle & Cell Host - Interactions

Viral cell cycle & Cell Host - Interactions

34960718	Modelling Mutation in Equine Infectious Anemia Virus Infection Suggests a Path to Viral Clearance with Repeated Vaccination
34495693	Truncation of the Cytoplasmic Tail of Equine Infectious Anemia Virus Increases Virion Production by Improving Env Cleavage and Plasma Membrane Localization
33283463	Identification of large genetic variations in the equine infectious anemia virus tat-gag genomic region
33172327	Equine lentivirus counteracts SAMHD1 restriction by Rev-mediated degradation of SAMHD1 via the BECN1-dependent lysosomal pathway
34131946	The reproductive syndrome in equine leptospirosis
34209034	Influence of Different Glycoproteins and of the Virion Core on SERINC5 Antiviral Activity
33627514	Correction for Yin et al., "Equine Tetherin Blocks Retrovirus Release and Its Activity Is Antagonized by Equine Infectious Anemia Virus Envelope Protein"
33477490	Effect of Small Polyanions on In Vitro Assembly of Selected Members of Alpha-, Beta- and Gammaretroviruses
32525460	Env diversity-dependent protection of the attenuated equine infectious anaemia virus vaccine
33077079	Variation of Hematochemical Profile and Vitamin E Status in Feral Giara Horses From Free Grazing in the Wild to Hay Feeding During Captivity
32934084	A Potent Postentry Restriction to Primate Lentiviruses in a Yinpterochiropteran Bat
32715980	Seroprevalence of Leptospira spp. in Colorado equids and association with clinical disease
32665269	SERINC5 Potently Restricts Retrovirus Infection In Vivo
32239368	Comparative analysis of CpG islands in equine infectious anemia virus strains
31941773	A Conserved Acidic-Cluster Motif in SERINC5 Confers Partial Resistance to Antagonism by HIV-1 Nef
31986188	Structures of immature EIAV Gag lattices reveal a conserved role for IP6 in lentivirus assembly
31376080	High-Efficiency Rescue of Equine Infectious Anemia Virus from a CMV-Driven Infectious Clone
31391270	Attenuation of Equine Lentivirus Alters Mitochondrial Protein Expression Profile from Inflammation to Apoptosis
31487820	The Conserved Tyr176/Leu177 Motif in the α -Helix 9 of the Feline Immunodeficiency Virus Capsid Protein Is Critical for Gag Particle Assembly
31357166	A PLPPV sequence in the p8 region of Gag provides late domain function for mouse mammary tumor virus
30862674	The retroviral accessory proteins S2, Nef, and glycoMA use similar mechanisms for antagonizing the host restriction factor SERINC5
30737028	Thermostable properties of the equine infectious anemia virus nucleocapsid protein NCp11
30181218	Interplay of ancestral non-primate lentiviruses with the virus-restricting SAMHD1 proteins of their hosts
30081309	Equine MX2 is a restriction factor of equine infectious anemia virus (EIAV)
29743377	Equine Myxovirus Resistance Protein 2 Restricts Lentiviral Replication by Blocking Nuclear Uptake of Capsid Protein
30126090	Prospects in Innate Immune Responses as Potential Control Strategies against Non-Primate Lentiviruses
29386282	Characterization of Equine Infectious Anemia Virus Long Terminal Repeat Quasispecies In Vitro and In Vivo
29445361	A Quasi-Steady-State Approximation to the Basic Target-Cell-Limited Viral Dynamics Model with a Non-Cytopathic Effect
29055819	Dynamics of lentiviral infection in vivo in the absence of adaptive immune responses

EIA Relevant Publications 2018-2021

EIAV Diagnostics Techniques

Serology Diagnostics tests

Indirect ELISA Test (x2)

Immunoblot assay employing
an objective reading system

Virological Diagnostics tests

Insulated isothermal RT-PCR
assay to aid diagnosis under
field conditions

EIAV targeted sequence
enrichment and next
generation sequencing

EIA Relevant Publications 2018-2021

EIAV Diagnostics Techniques

EIAV Diagnostics Techniques

33609629	Comparison of serological techniques for the diagnosis of equine infectious Anemia in an endemic area of Argentina
33663722	Evaluation of Equine Infectious Anemia Virus by the Indirect Enzyme-linked Immunosorbent Assay EIA-LAB as Screening Tools in Mexico
33059644	Comprehensive pathogen detection in sera of Kawasaki disease patients by high-throughput sequencing: a retrospective exploratory study
32266552	Molecular detection, histopathological analysis, and immunohistochemical characterization of equine infectious anemia virus in naturally infected equids
31493650	Molecular characterization of Equine Infectious Anemia Viruses using targeted sequence enrichment and next generation sequencing
31267701	Molecular characterization of equine infectious anaemia virus strains detected in England in 2010 and 2012
30353944	Rapid detection of equine infectious anaemia virus nucleic acid by insulated isothermal RT-PCR assay to aid diagnosis under field conditions
30684508	Validation of an immunoblot assay employing an objective reading system and used as a confirmatory test in equine infectious anaemia surveillance programs
30576724	Serological diagnosis of equine infectious anemia in horses, donkeys and mules using an ELISA with a gp45 synthetic peptide as antigen
29982961	Enzyme-linked immunosorbent assay and agar gel immunodiffusion assay for diagnosis of equine infectious anemia employing p26 protein fused to the maltose-binding protein
29899176	Comparison of two agar gel immunodiffusion protocols for diagnosing equine infectious anemia
28986292	Validation of an indirect ELISA employing a chimeric recombinant gag and env peptide for the serological diagnosis of equine infectious anemia

EIA Relevant Publications 2018-2021

EIAV world outbreaks – New isolated EIAV Strains

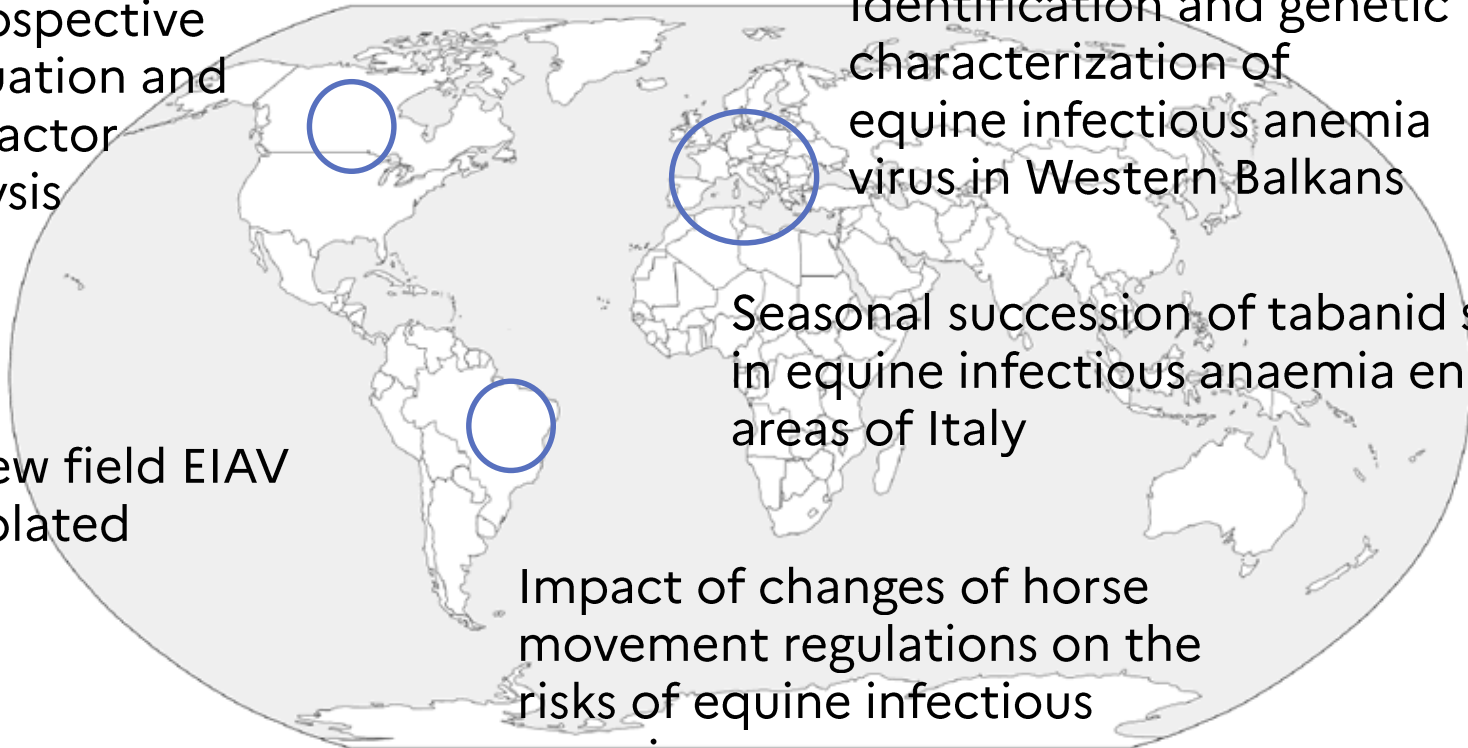
Retrospective
evaluation and
risk factor
analysis

Identification and genetic
characterization of
equine infectious anemia
virus in Western Balkans

New field EIAV
Isolated

Seasonal succession of tabanid species
in equine infectious anaemia endemic
areas of Italy

Impact of changes of horse
movement regulations on the
risks of equine infectious
anemia



EIA Relevant Publications 2018-2021

EIAV world outbreaks - Strains

EIAV world outbreaks – New isolated EIAV Strains

33797316	Molecular detection of equine infectious anemia virus in clinically normal, seronegative horses in an endemic area of Mexico
33713963	Impact of changes of horse movement regulations on the risks of equine infectious anemia: A risk assessment approach
33858420	Identification and genetic characterization of equine infectious anemia virus in Western Balkans
34024382	Serological evidence of equine infectious anaemia, West Nile fever, surra and equine piroplasmosis in a herd of horses in northern Argentina
32059508	High Genomic Variability in Equine Infectious Anemia Virus Obtained from Naturally Infected Horses in Pantanal, Brazil: An Endemic Region Case
31952638	Molecular Characterization of the Major Open Reading Frames (ORFs) and Enhancer Elements From Four Geographically Distinct North American Equine Infectious Anemia Virus (EIAV) Isolates
31791528	Piroplasmosis in Italian Standardbred Horses: 15 Years of Surveillance Data
31692681	Disease investigations for equine infectious anemia in Canada (2009-2012) - Retrospective evaluation and risk factor analysis
31685446	[Equine Infectious Anaemia - a review from an official veterinary perspective]
30775793	Seasonal succession of tabanid species in equine infectious anaemia endemic areas of Italy
31327910	Surveillance of the equine infectious anemia virus in Eastern and Central Saudi Arabia during 2014-2016
31022927	Characterization of EIAV env Quasispecies during Long-Term Passage In Vitro: Gradual Loss of Pathogenicity
30964455	Spatial distribution and risk factors for equine infectious anaemia in the state of Mato Grosso, Brazil
29752558	Equine infectious anemia virus in naturally infected horses from the Brazilian Pantanal
28503813	Molecular characterization of equine infectious anaemia virus from a major outbreak in southeastern France

3. Conclusions



EIA in press !!

- 56 EIA articles were published between 2018-2021
- Most of the articles are focused on the understanding of the viral cycle and the viral – cell host interactions
- The EU labs have an important implication in the EIA publications related with the EIA diagnostics methods.
- New technologies as NGS are helping to identify new EIA strains and to increase the number of EIAV complete sequences accesibles in genebank
- An interesting study about the vector of the EIA has been published, and we will be focus on that regarding the clima changes that we are living those days..



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Anthony



Cécile



Fanny



Gabrielle



José-Carlos

Thank you for your attention

