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8TH ANNUAL MEETING OF THE PPR GLOBAL RESEARCH AND EXPERTISE NETWORK (PPR-GREN)

25 – 27 NOVEMBER 2025 QINGDAO, CHINA



中华人民共和国农业农村部

Ministry of Agriculture and Rural Affairs of the People's Republic of China



中国动物卫生与流行病学中心
China Animal Health and Epidemiology Center

Produced under the
GF-TADS framework



GF-TADS
GLOBAL FRAMEWORK FOR THE
PROGRESSIVE CONTROL OF
TRANSBOUNDARY ANIMAL DISEASES



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Current Knowledge on the Role of Wildlife and Atypical Hosts in PPR Epi-Systems Around the World

Nussieba Osman – Atypical Domestic Hosts

Amanda Fine – Wildlife Hosts

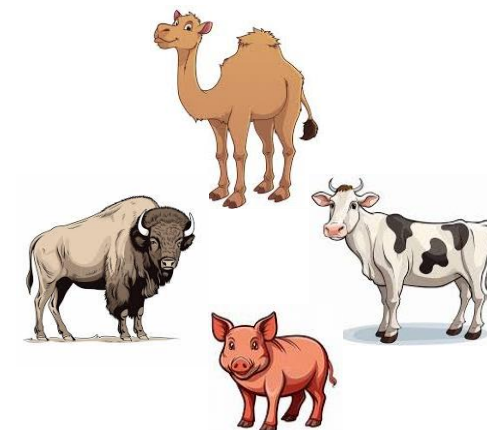
Pests des petits ruminants: a multi-host disease

- Small ruminants; sheep and goats, are the recognized maintenance hosts for PPR.
- The involvement of other species; atypical hosts and wildlife, has been a critical area of research due to their presence in endemic areas and their close association with small ruminants in pastoral systems.



How do we assess and address the role of atypical hosts in PPR epi-systems?

- ✓ Camels (*Camelidae*);
- ✓ Pigs (*Suidae*);
- ✓ Cattle, and other bovids such as African buffalo, Asian water buffalo (*Bovidae*);
- ✓ Dogs (*Canidae*);
- ✓ Lions (*Panthera*).



Natural infection

Ethiopia - East Africa

Roger et al., 2000

Clinical disease

- An epizootic disease affected camel populations in Ethiopia between 1995-1996.
- An acute febrile infection (41-42°C).
- Sudden onset of disease.
- Sero-muco-purulent nasal discharge and submandibular area swelling.
- Lacrimation.
- Highly contagious respiratory syndrome: coughing, dyspnea and abdominal breathing.
- Diarrhea in some cases.
- Animals became depressed and incapable to move.
- Morbidity (90%) + Mortality (5-70%). All age groups were infected.

Diagnosis

- RT-PCR, sequencing: PPRV lineage III.

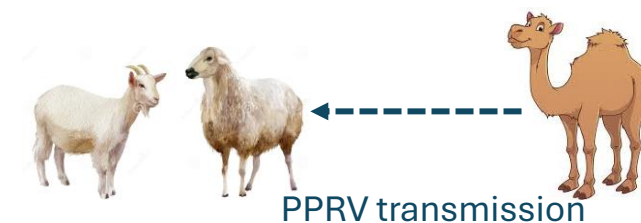
Journal of Camel Practice and Research

December 2000/

Vol 7 No 2, p 163-165

INVESTIGATIONS ON A NEW PATHOLOGICAL CONDITION OF CAMELS IN ETHIOPIA

F.Roger, L.M.Vigezu, C.Hurard, G.Libeu, G.Y.Mebratu, A.Diallo and B.Faye
CIRAD-EMVT, Campus International de Baillarguet, BP 5035, 34032 Montpellier Cedex 1, FRANCE



Atypical Hosts: Clinical PPR in camels

Natural infection

Sudan - East Africa

Khalafalla et al., 2010

Clinical disease

- The disease reported in Kassala, Eastern Sudan (200
- Sudden death of apparently healthy animals;
- Yellowish and later bloody diarrhea;
- Abortion;
- Mild signs of subcutaneous edema and submandibular swelling;
- Chest pain and infrequent coughing;
- Decreased milk production, loss of weight and increased water consumption
- Signs persisted for 10–14 days.
- Morbidity (90%) + Mortality (0%-50%). All age groups were infected.

Diagnosis

- RT-PCR, IC-ELISA, virus isolation.
- N-gene sequencing: PPRV lineage IV (Kwiatek et al., 2011).

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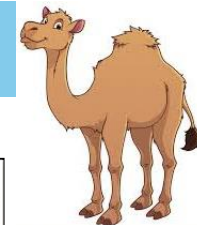


Acta Tropica 116 (2010) 161–165

Contents lists available at ScienceDirect

Acta Tropica

journal homepage: www.elsevier.com/locate/actatropica



An outbreak of peste des petits ruminants (PPR) in camels in the Sudan

Abdelmelik I. Khalafalla^{a,*}, Intisar K. Saeed^b, Yahia H. Ali^b, Magdi B. Abdurrahman^b, Olivier Kwiatek^c, Geneviève Libeau^c, Ali Abu Obeida^a, Zakia Abbas^b



Atypical Hosts: Clinical PPR in camels

Natural infection

Iran - West Asia

Zakian et al., 2016

***Herd of camels imported from Kuwait**

Clinical disease

- PPR outbreak observed Khuzestan province, south-west Iran in 2013.
- Clinically there is sudden death;
- Fever; conjunctivitis;
- Oral erosion, and ecthyma like lesions;
- Yellowish diarrhea;
- Pneumonia and respiratory distress;
- Enlargement of lymph node;
- Severe dehydration, dermatitis, ulcerative keratitis;
- Mortality (40%). All age groups were infected.

Diagnosis

- IC-ELISA, RT-PCR, N-gene sequencing: PPRV lineage IV.

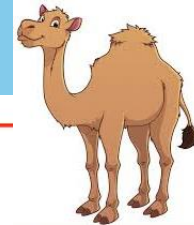
Trop Anim Health Prod (2016) 48:1215–1219
DOI 10.1007/s11250-016-1078-6

REGULAR ARTICLES

The first report of peste des petits ruminants (PPR) in camels (*Camelus dromedarius*) in Iran

Amir Zakian¹ • Mohammad Nouri¹ • Houman Kahroba² • Babak Mohammadian³ •
Mohammad-Reza Mokhber-Dezfouli⁴





Natural infection

Kenya - East Africa

Omani et al., 2019

Hindawi
Advances in Virology
Volume 2019, Article ID 4028720, 6 pages
<https://doi.org/10.1155/2019/4028720>

Peste Des Petits Ruminants (PPR) in Dromedary Camels and Small Ruminants in Mandera and Wajir Counties of Kenya

R. N. Omani¹, G. C. Gitao,¹ J. Gachohi,² P. K. Gathumbi,¹ B. A. Bwihangane,³ K. Abbey,⁴ and V. J. Chemweno¹

Clinical disease

- PPRV involved in the epidemics of Camel Sudden Death syndrome in 2016.
- These clinical signs are similar to those observed in small ruminants;
- Inappetence, loss of body condition;
- General weakness terminally leading to diarrhea;
- Ocular nasal discharges preceding death;
- Conjunctivitis/keratoconjunctivitis;
- Edema of the ventral surface of the abdomen;
- Morbidity (93%).

Diagnosis:

- RT-PCR, N-gene sequencing: PPRV lineage III.



Atypical Hosts: Camels are dead-end hosts for PPRV



Experimental infection



viruses

Viruses 2019, 11, 1133; doi:10.3390/v11121133

Article

Camelids and Cattle Are Dead-End Hosts for Peste-des-Petits-Ruminants Virus

Claudia Schulz ^{1,*}, Christine Fast ², Ulrich Wernery ³, Jörg Kinne ³, Sunitha Joseph ³, Kore Schlottau ¹, Maria Jenckel ¹, Dirk Höper ¹, Nissy Annie Georgy Patteril ³, Ginu Syriac ³, Bernd Hoffmann ¹ and Martin Beer ¹



ELSEVIER

Veterinary Microbiology 235 (2019) 195–198

Contents lists available at ScienceDirect

Veterinary Microbiology

journal homepage: www.elsevier.com/locate/vetmic



Short communication

Experimental infection of dromedary camels with virulent virus of Peste des Petits Ruminants

Fatima-Zohra Fakri^{a,b,*}, Zahra Bamouh^a, Mohammed Jazouli^a, Khalid Omari Tadlaoui^a, Mehdi Elharra^a

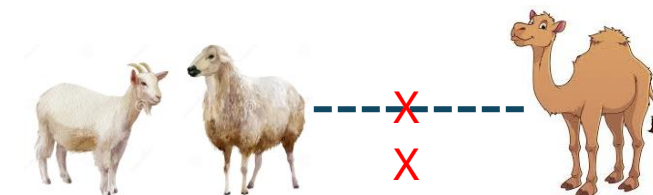


Schulz et al., 2019: Germany – Europe

Fakri et al., 2019: Morocco - North Africa

Camels infected with PPRV developed:

- No clinical signs.
- No viremia.
- No viral shedding and no PPRV transmission to the contact animals.
- Low PPRV-RNA loads in swab samples.
- A different pathogenesis were suggested for camelids as **dead-end hosts for PPRV**.



No PPRV transmission to in-contact animals



Experimental infection

J Infect Dev Ctries 2022; 16(2):374-382. doi:10.3855/jidc.14947

JIDC | THE JOURNAL OF INFECTION
IN DEVELOPING COUNTRIES

Original Article

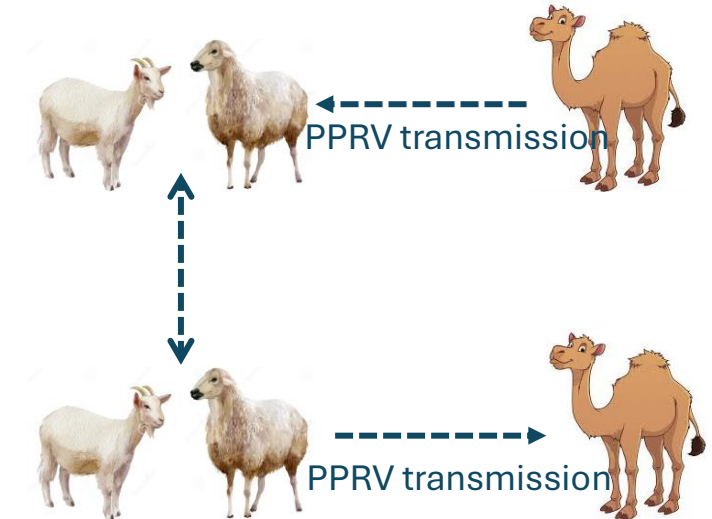
A study on transmission of Peste des petits ruminants virus between dromedary camels and small ruminants

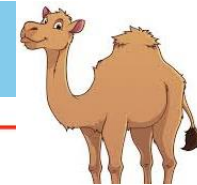
Intisar Kamil Saeed^{1,2}, Moez Abdulrahman Haj¹, Sahar Mohamed Alhassan¹, Shaza Mohamed Mutwakil¹, Baraa Ahmed Mohammed¹, Khalid Mohammed Taha³, Genevieve Libeau⁴, Adama Diallo⁵, Yahia Hassan Ali^{1,2}, Abdelmalik Ibrahim Khalafalla^{6,7}

Saeed et al., 2022: Sudan - East Africa

Camels, sheep and goats infected with PPRV developed:

- Marked clinical signs in infected sheep and goats.
- Severe clinical signs in SR kept in-contact with infected camels.
- Camels showed mild infection but can transmit the disease to small ruminants.
- Post-mortem revealed PPR-specific lesions in all animals including camels.





Trop Anim Health Prod (2015) 47:995–998
DOI 10.1007/s11250-015-0798-3

SHORT COMMUNICATIONS

Mixed infection of peste des petits ruminants virus (PPRV) and other respiratory viruses in dromedary camels in Sudan, an abattoir study

Intisar Kamil Saeed¹ • Yahia Hassan Ali¹ • Magdi Badawi AbdulRahman¹ • Zakia Abas Mohammed¹ • Halima Mohammed Osman¹ • Khalid Mohammed Taha² • Mohammed Zain Musa³ • AbdelMelik Ibrahim Khalafalla⁴

DOI: 10.1002/vms3.457

ORIGINAL ARTICLE

Detection of peste des petits ruminants virus in pneumonic lungs from clinically apparently healthy camels slaughtered at Tambul slaughterhouse, Central Sudan

Nahid A. S. Abdalla¹ | Alaa E. M. Alhussain¹ | Sana I. Mohammed² | Mihad Hakeem³ | Ihsan H. Ahmed⁴ | Galal E. Mohammed⁵ | Nussieba A. Osman¹ 

1166 | wileyonlinelibrary.com/journal/vms3

Vet Med Sci. 2021;7:1166–1171.

Sudan - East Africa

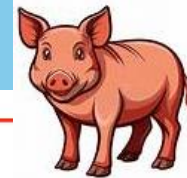
Saeed et al., 2015; Abdalla et al., 2021

- PPRV was detected in lung tissues of slaughtered dromedary camels in Sudan.
- Presence of PPR viral antigens was found in camels associated with pneumonia.
- This indicates exposure of camels to PPRV and suggests potential subclinical infection in camels.

Atypical Hosts: Surveillance in camels



Prevalence (Ag)	Seroprevalence (Ab)	Country	Region	Reference
-	7.8	Ethiopia	East Africa	Roger et al., 2001
-	14%	Sudan	East Africa	Haroun et al., 2002
-	3%	Ethiopia	East Africa	Abraham et al., 2005
-	0%	Morocco	North Africa	Touil et al., 2012
-	0%	Ethiopia	East Africa	Ayelet et al., 2013
-	22.8%	Libya	North Africa	El-Dakhly et al., 2013
-	27.8%	Nigeria	West Africa	El-Yuguda et al., 2013
-	3.36%	Nigeria	West Africa	Woma et al., 2015
45.1%	-	Sudan	East Africa	Saeed et al., 2015
-	2.1	Sudan	East Africa	Saeed et al., 2017
-	2.92%	Saudi Arabia	Middle East	Hemida et al., 2019
8.3%	8.5%	Pakistan	South Asia	Rahman et al., 2020
-	0%	Mauritania	Northwest Africa	Cosseddu et al., 2021
0.8%	-	Sudan	East Africa	Abdalla et al., 2021



***Historically, pigs were not considered significant as hosts for PPR**

Experimental infection

Nawathw et al., 1979: **Nigeria - West Africa**

Schulz et al., 2019: **Germany - Europe**

Trop. Anim. Hlth Prod. (1979) 11, 120-122

EXPERIMENTAL INFECTION OF DOMESTIC PIGS WITH THE VIRUS OF PESTE DES PETITS RUMINANTS

D. R. NAWATHE¹ and W. P. TAYLOR²

¹ *The National Veterinary Research Institute, Vom, Plateau State, Nigeria;* ² *The Animal Virus Research Institute, Pirbright, Surrey, England*

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 24, No. 12, December 2018

Neglected Hosts of Small Ruminant Morbillivirus

Claudia Schulz,¹ Christine Fast, Kore Schlottau,
Bernd Hoffmann, Martin Beer

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Serosurveillance

Adedeji et al., 2025: West Africa: **Nigeria - West Africa**

Adedeji et al. *Veterinary Research* (2025) 56:49
<https://doi.org/10.1186/s13567-025-01482-3>

Veterinary Research

RESEARCH ARTICLE

Open Access

Can pigs add another “P” to the PPR?
Serological evidence of frequent Peste des
petits ruminants infections in pigs in Nigeria



中国动物卫生与流行病学中心
Chinese Animal Health and Epidemiology Center

中华人民共和国农业农村部

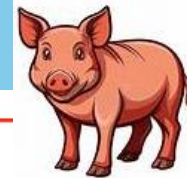
Ministry of Agriculture and Rural Affairs of the People's Republic of China



GF-TADs
GLOBAL FRAMEWORK FOR THE
PROGRESSIVE CONTROL OF
TRANSBOUNDARY ANIMAL DISEASES

Food and Agriculture
Organization of the
United Nations

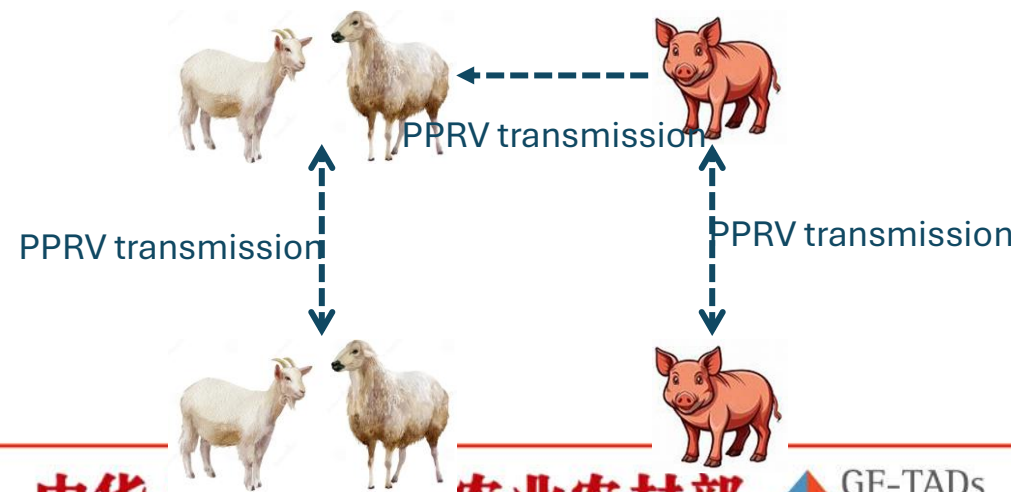
World Organization
for Animal Health



Experimental infection

Nawathw et al., 1979; Schulz et al., 2019:

- Swine susceptibility to PPRV was confirmed in pigs experimentally infected with a virulent strain or close contact with infected goats.
- Infected pigs displayed clinical symptoms.
- Experimental evidence suggests that inter-species transmission from pigs to small ruminants is feasible through direct contact and aerosol inhalation.
- The absence of evident clinical signs in many cases raises concerns, as asymptomatic pigs could silently carry and spread the virus.
- Pigs may act as reservoir or spillover/maintenance hosts.





Seroprevalence: Adedeji et al., 2025

- Recent research in Nigeria indicates frequent exposure of pigs to PPRV, with a sero-prevalence of 4.24%.
- Pigs may serve as **reservoir or maintenance hosts** for PPRV, contributing to new infections in susceptible hosts.
- Infections in pigs are typically **subclinical or mild**, complicating **detection through passive surveillance**.
- The significance of pig involvement is most pronounced in areas with **high inter-species contact**, especially where **extensive husbandry practices are common**.
- Therefore, pigs has critical implications for the control and eradication efforts.

Atypical Hosts: Cattle are dead-end hosts for PPRV



Experimental infection



viruses

Viruses 2019, 11, 1133; doi:10.3390/v11121133



Article

Camelids and Cattle Are Dead-End Hosts for Peste-des-Petits-Ruminants Virus

Claudia Schulz ^{1,*}, Christine Fast ², Ulrich Wernery ³, Jörg Kinne ³, Sunitha Joseph ³, Kore Schlottau ¹, Maria Jenckel ¹, Dirk Höper ¹, Nissy Annie Georgy Patteril ³, Ginu Syriac ³, Bernd Hoffmann ¹ and Martin Beer ¹

Schulz et al., 2019: Germany – Europe

In cattle infected with the 4 lineages of PPRV:

- No clinical signs.
- No viremia.
- No viral shedding,
- No persistence of the virus,
- **Seroconversion.**
- Cattle do not play an epidemiological role in the maintenance and spread of PPRV = **dead-end hosts**

Research in Veterinary Science 124 (2019) 118–122

Contents lists available at ScienceDirect

Research in Veterinary Science

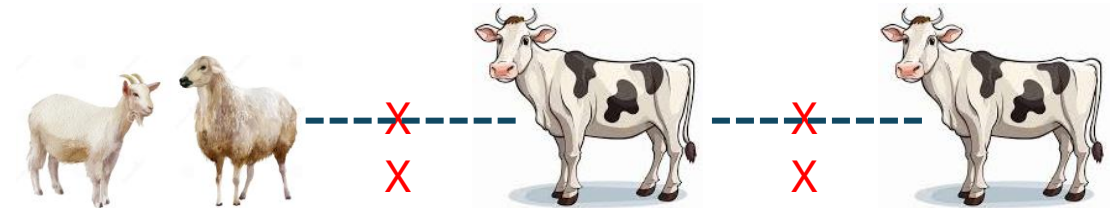
journal homepage: www.elsevier.com/locate/rvsc



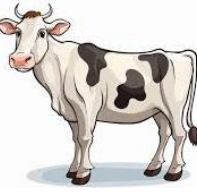
Experimental infection of cattle with wild type peste-des-petits-ruminants virus – Their role in its maintenance and spread

Emmanuel Couacy-Hymann*, Mathurin Y. Koffi, Valère K. Kouadio, Arsène Mossoum, Léonce Kouadio, Antonette Kouassi, Krou Assemian, Privat H. Godji, Pauline Nana

Couacy-Hymann et al., 2019: Ivory Coast - West Africa



No PPRV transmission to in-contact animals



Epidemiological Survey of Peste des Petits Ruminants in Ethiopia: Cattle as Potential Sentinel for Surveillance

Getahun E. Agga¹, Didier Raboisson², Ludovic Walch², Fitsum Alemayehu³, Dawit T. Semu³, Getahun Bahiru³, Yilkal A. Woube⁴, Kelay Belihu⁵, Berhe G. Tekola⁶, Merga Bekana³, François L. Roger⁷ and Agnès Waret-Szkuta^{2*}

Agga et al., 2019: Ethiopia – East Africa

- Non-vaccinated cattle and SR in mixed herds had a significantly higher PPR seroprevalence.
- Seroprevalence is indicating exposure to PPRV and subclinical infection.
- Mixed herds of different animal species likely transmit PPR virus to contact animals.
- The turn-over rate of cattle is lower than that of small ruminants.
- Cattle can be sentinel animals for PPR surveillance.

Atypical Hosts: Surveillance in cattle



Prevalence (Ag)	Seroprevalence (Ab)	Country	Region	Reference
-	11.4%	Sudan	East Africa	Haroun et al., 2002
-	9%	Ethiopia	East Africa	Abraham et al., 2005
-	41.86%	Pakistan	South Asia	Khan et al., 2008
-	8%	Pakistan	South Asia	Rashid et al., 2008
-	18%	Turkey	West Asia	Albayrak and Gür, 2010
-	5.9 - 26.7%	Tanzania	East Africa	Lembo et al., 2013
-	16.7%	Nigeria	West Africa	El-Yuguda et al., 2013
-	10.0 - 17.5%	Pakistan	South Asia	Abubakar et al., 2015
-	25.8%	Sudan	East Africa	Saeed et al., 2017
-	42%	Sudan	East Africa	Ali et al., 2019
-	49.431%	Egypt/Sudan	East Africa	Hekal et al., 2019
-	5.88%	Nepal	South Asia	Prajapati et al., 2020
-	11.6%	Tanzania	East Africa	Herzog et al., 2020
-	12%	Mauritania	Northwest Africa	Cosseddu et al., 2021



Isolation of pestes des petits ruminants virus from an outbreak in Indian buffalo (*Bubalus bubalis*)

R. Govindarajan, A. Koteeswaran, A. T. Venugopalan,
G. Shyam, S. Shaquna, M. S. Shaila, S. Ramachandran

Veterinary Record (1997) **141**, 573-574

- One report of PPRV infection in Indian buffalo (*Syncerus caffer*) in 1997.
- Clinical signs included depression, profuse salivation, and conjunctival congestion. However, a typical symptom in sheep and goats, high fever was not observed.
- PPRV infection in buffalo is typically asymptomatic or subclinical.
- Buffaloes can be infected but do not excrete the virus, hence they do not transmit it to other animals.



Trop Anim Health Prod (2008) 40:521–527
DOI 10.1007/s11250-008-9129-2

ORIGINAL PAPER

The detection of antibody against peste des petits ruminants virus in Sheep, Goats, Cattle and Buffaloes

Haider Ali Khan • Muhammad Siddique •
Sajjad-ur-Rahman • Muhammad Abubakar •
Muhammad Ashraf

Trop Anim Health Prod (2012) 44:301–306
DOI 10.1007/s11250-011-0020-1

ORIGINAL RESEARCH

Seroprevalence of *Peste des petits ruminants* in cattle and buffaloes from Southern Peninsular India

OPEN ACCESS Freely available online



Toll-Like Receptor Responses to *Peste des petits ruminants* Virus in Goats and Water Buffalo

Sakthivel Dhanasekaran¹, Moanaro Biswas², Ambothi R. Vignesh¹, R. Ramya¹, Gopal Dhinakar Raj¹, Krishnaswamy G. Tirumurugan¹, Angamuthu Raja¹, Ranjit S. Kataria³, Satya Parida^{4*}, Elankumaran Subbiah^{2*}

8TH ANNUAL MEETING OF THE PPR GLOBAL EXPERTISE NETWORK (PPR-GREN)

November 2014 | Volume 9 | Issue 11 | e111609

25-27 NOVEMBER 2015 QINGDAO, CHINA

• Transboundary and Emerging Diseases. **64** (2017) 513–519

Serological Detection of Antibodies to Peste des Petits Ruminants Virus in Large Ruminants

M. Abubakar^{1,*}, M. Mahapatra^{2,*}, M. Muniraju², M. J. Arshed^{1,3}, E. H. Khan³, A. C. Banyard⁴, Q. Ali¹ and S. Parida²

J Infect Dev Ctries 2022; 16(2):369-373.

JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

Original Article

Peste des petits ruminants virus antibodies in domestic large ruminants in Bangladesh

Emdadul Haque Chowdhury¹, Preyangkar Kundu¹, Jahan Ara Begum¹, Tusar Chowdhury¹, Mushfiqur Rahman¹, Afia Khatun², Shib Shankar Saha³, Mohammed Nooruzzaman¹, Rokshana Parvin¹, Mohammad Rafiqul Islam¹

Veterinary World, EISSN: 2231-0916
Available at www.veterinaryworld.org/Vol.17/March-2024/4.pdf

RESEARCH ARTICLE
Open Access

Seroprevalence of peste des petits ruminants disease in Indonesian buffaloes may be an emerging threat to small ruminants

Indrawati Sendow¹ , Heri Hoerudin¹ , Risza Hartawan¹ , Nuha Fairusya¹ , Atik Ratnawati¹ , April Hari Wardhana¹ , Dyah Haryuningtyas Sawitri¹ , Harimurti Nuradji¹ , Ni Luh Putu Indi Dharmayanti¹ , Muharam Saepulloh¹ , and Emdadul Haque Chowdhury²



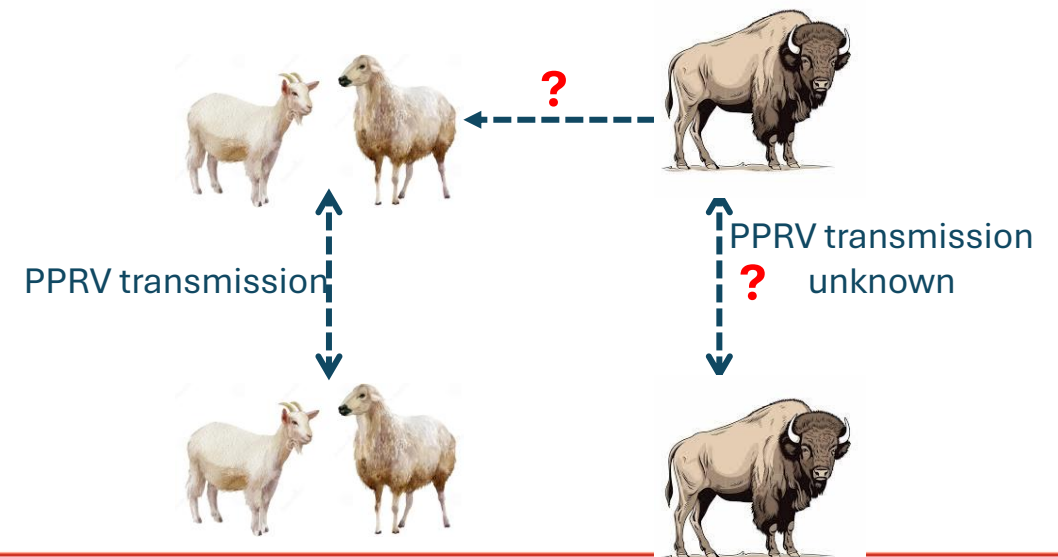
中华人民共和国农业农村部
Ministry of Agriculture and Rural Affairs of the People's Republic of China



Atypical Hosts: Surveillance of PPR in buffaloes



- Domestic water buffalo “*Bubalus bubalis*” is susceptible to PPRV infection.
- Seroprevalence studies demonstrated varying levels of seroprevalence in buffalo across regions highlighting their sentinel role.
- Buffalo might influence PPR epidemiology, potentially acting as subclinical hosts.
- No evidence to support buffalo as major reservoirs or sources of re-infection for sheep and goats?
- Further investigation is required to clarify buffalo's role in PPRV transmission.





Asia - India

Ratta et al., 2016

Curr Microbiol (2016) 73:99–103
DOI 10.1007/s00284-016-1030-z



Detection of Peste Des Petits Ruminants Virus (PPRV) Genome from Nasal Swabs of Dogs

Barkha Ratta¹ · Mayank Pokhriyal¹ · Shanker K. Singh² · Ajay Kumar¹ ·
Meeta Saxena¹ · Bhaskar Sharma¹

- PPRV detected in nasal swabs of dogs (3/12).
- RT-PCR and sequencing confirmed a PPRV strain different from the vaccination strain used in India, but similar to ones in the Indian subcontinent.
- This suggests a potential crossing of species barrier, necessitating further serological investigation.
- In developing disease-endemic settings, dogs usually live close to or at livestock farms in companionship, increasing the likelihood of spillover events and transmission from infected animals.
- Viral nucleic acids in dogs may result from feeding on PPRV-infected animals.

Asia - India

Balamurugan et al., 2012

pISSN 1229-845X, eISSN 1976-555X
J. Vet. Sci. (2012), 13(2), 203-206
<http://dx.doi.org/10.4142/jvs.2012.13.2.203>
Received: 20 Jun. 2011, Revised: 2 Sep. 2011, Accepted: 17 Mar. 2012

Short Communication

Peste des petits ruminants virus detected in tissues from an Asiatic lion (Panthera leo persica) belongs to Asian lineage IV

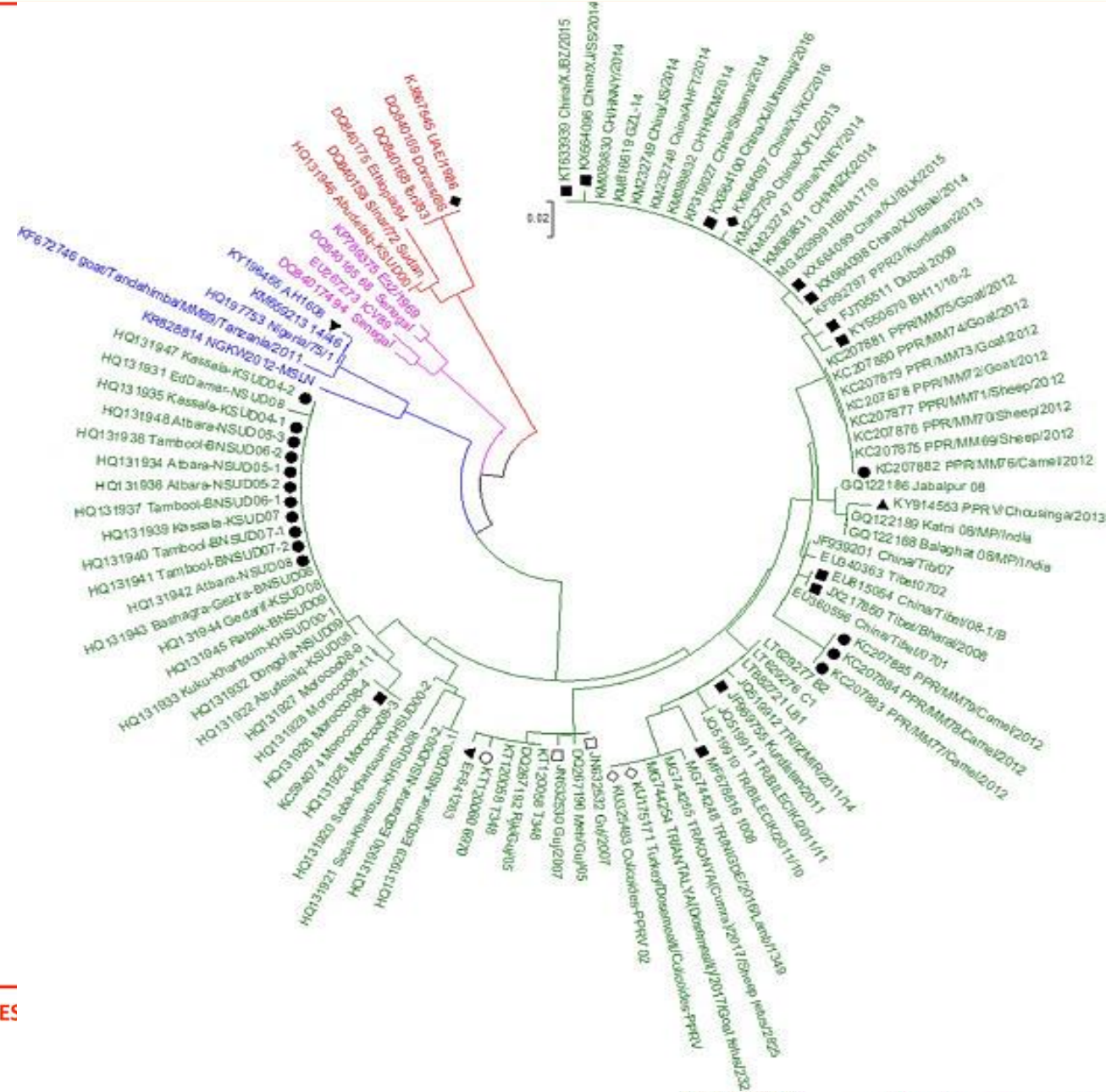
Vinayagamurthy Balamurugan^{1,2}, Arnab Sen¹, Gnanavel Venkatesan¹, Vandana Bhanot¹, Vineeta Yadav¹, Veerakyathappa Bhanuprakash^{1,3}, Raj Kumar Singh^{1,4,*}

JOURNAL OF
Veterinary
Science



- PPRV was identified in tissues from a deceased Asiatic lion (*Panthera leo persica*).
- Pooled tissue samples were negative for canine distemper virus (CDV) but tested positive for PPRV NA through one-step RT-PCR.
- Sequencing of partial N, M, and F genes confirmed the presence of PPRV.
- Phylogenetic analyses revealed that an Asian lineage IV and closely related to PPRV strains circulating in India.

Atypical Hosts: Evolutionary and Phylogenetic Relationship of PPRV Strains



Ul-Rahman et al., 2022
PPRV strains from different hosts were indicated with signs as follows:

- Goats
- Camels
- ◆ Antelope
- ▼ Cattle
- Dog
- Lion

▲ Wildlife

Summary: PPR in Atypical Hosts

	Atypical Hosts				Typical Hosts
Host	Camels	Pigs	Cattle	Buffalo	Sheep and Goats
Disease outcome	Clinical infection	Subclinical infection	Subclinical infection	Clinical/Subclinical infection	Clinical infection
Seroprevalence	Yes	Yes	Yes	Yes	Yes
Transmission and Persistence in atypical hosts	Yes	Yes	?	?	Yes
Spill-back to sheep and goats	Yes	Yes	?	?	Yes
Impact on PPR-GEP	Yes	Yes	?	?	Primary target



Wildlife & PPR

What have we learned
about PPR in wildlife and
the role of wildlife in PPR
epi-systems?



PPR Virus in Wildlife

- Paramyxoviridae –
Morbillivirus caprinae
 - Negative strand RNA virus
 - Highly contagious
 - Acute disease
 - Inter-species
transmission
 - Indirect transmission
- Phylogenetic tree image

Recent Report

- Sixty-five **free ranging** Bharals (*Pseudois nayaur*) and Argali (*Ovis ammon*) with clinical signs consistent with PPR reported in Feb 2024
- Southern Rutog County, Tibet Autonomous Region
- Sequenced PPRV (N & F gene) (ChinaTibet2024): Lineage IV closely related to PPRVs isolated in China 2013 – 2014



Brief Report

Wildlife Infection of Peste des Petits Ruminants Detected in China, 2024

Jiao Xu ¹, Zebin Qu ², Yingli Wang ¹, Weijie Ren ¹, Shan Liu ¹, Yanli Zou ¹, Na Su ², Jingyue Bao ¹ and Zhiliang Wang ^{1,2,*}



Clinical Signs & Pathology in Wildlife

Respiratory & Gastrointestinal Systems

- **Clinical:** fever, anorexia, weakness, ocular & nasal discharge, salivation, difficulty breathing, diarrhea, and death
- **Gross:** conjunctivitis, lung consolidation, oral mucosal congestion with ulcerative lesions; intestinal mucosal hemorrhage
- **Histologic:** bronchoalveolitis, diffuse hemorrhagic enteritis, viral inclusion bodies and viral syncytia



Mongolian Saiga Antelope (*Saiga tatarica mongolica*) with PPR, January 2017

Recent Report

PPR in a **captive** Red-fronted gazelle (*Eudorcas rufifrons*) at the University of Ibadan Zoo, Nigeria, in 2023

Animal Research International (2025) 22(2): 6210 – 6216

6210

ACUTE PESTE DES PETITS RUMINANTS IN A CAPTIVE RED FRONTED GAZELLE: A CASE REPORT AND POST-MORTEM FINDINGS

¹BAKRE, Adetolase Azizat, ²JARIKRE, Theophilus Aghogh, ²OLAIFA, Olanrewaju Samuel, ²EZEUGWU Chukwudi Christian, ²ALAKA, Olugbenga Olayinka, ²OHORE, Obokparo Godspower, ²TIJANI, Monsuru Oladunjoye, ²OLA, Olawale Olawumi, ²TAIWO, Victor Olusegun, ³ADEBIYI, Taiwo Kemi and ⁴OJO, Philip Olusoji

¹Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Ibadan, Ibadan, Oyo State, Nigeria.

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Received April 17, 2025; Revised May 12, 2025; Accepted May 16, 2025

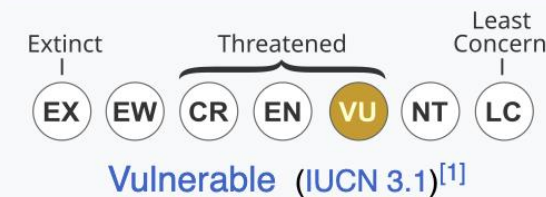


Burkina Faso, Cameroon, Central African Republic, Chad, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal, South Sudan and Sudan.

Red-fronted gazelle



Conservation status



Epidemiological Studies of PPR in Wildlife

Peste des Petits Ruminants Virus Infection at the Wildlife–Livestock Interface in the Greater Serengeti Ecosystem, 2015–2019

[Bryony A. Jones](#)^{1*}, [Mana Mahapatra](#)², [Daniel Mdetele](#)³, [Julius Keyyu](#)⁴, [Francis Gakuya](#)⁵, [Ernest Eblate](#)⁴,
[Isaac Lekoloo](#)⁵, [Campaign Limo](#)⁵, [Josephine N. Ndiwa](#)⁶ and [Peter Hongo](#)⁵

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[Show more](#) ▾

Viruses **2021**, *13*(5), 838; <https://doi.org/10.3390/v13050838>

This article belongs to the Special Issue *Peste des Petits Ruminants (PPR) Eradication: Improved Understanding of Epidemiology, Diagnostics and Vaccine Efficacy*

- Investigated PPRV infection in wild artiodactyls in the Greater Serengeti and Amboseli Ecosystems
- Found serological evidence of PPRV infection.
- No expression of PPR disease or positive swabs.
- Low seroprevalence suggests sustained transmission unlikely

Diagnostic Testing for PPR in Wildlife

► [Sci Rep. 2023 Sep 8;13\(1\):14787. doi: 10.1038/s41598-023-41630-3.](#)

The evaluation of five serological assays in determining seroconversion to peste des petits ruminants virus in typical and atypical hosts

Matthew Tully¹, Carrie Batten², Martin Ashby², Mana Mahapatra², Krupali Parekh², Satya Parida^{2 3}, Felix Njeumi³, Brian Willett⁴, Arnaud Bataille⁵, Genevieve Libeau⁵, Olivier Kwiatak⁵, Alexandre Caron⁵, Francisco J Berguido⁶, Charles E Lamien⁶, Giovanni Cattoli⁶, Gerald Misinzo⁷, Julius Keyyu⁸, Daniel Mdetele⁹, Francis Gakuya¹⁰, Sanne Charles Bodjo¹¹, Fatima Abdelazeem Taha¹², Husna Mohamed Elbashier¹³, Abdelmalik Ibrahim Khalafalla^{14 15}, Abdinasir Y Osman^{16 17}, Richard Kock¹⁷

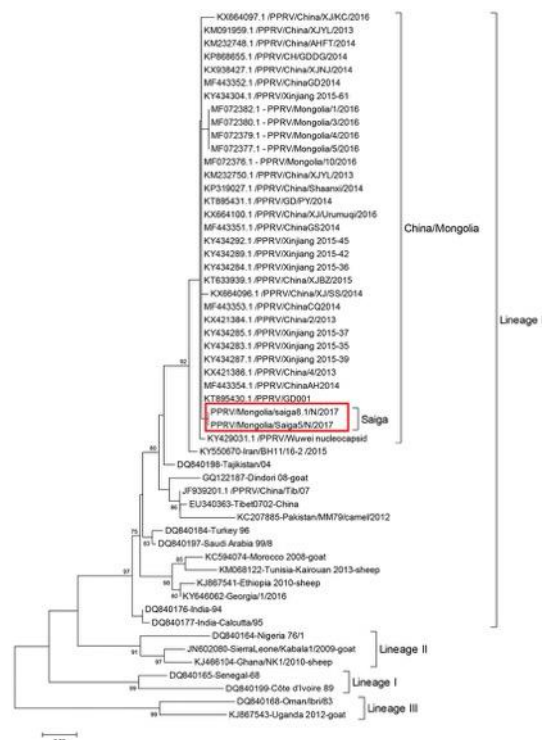
- Evaluated
 - VNT, ID VET N-ELISA and AU-PANVAC H-ELISA (LIPS and Pseudotyped VNA
- Results
 - Typical species 75% - 88% agreement
 - Atypical species 44% - 62% agreement
 - Interspecies variation

PPR Impact on Wildlife Populations



December 2016, PPR deaths among Mongolian saiga antelope confirmed. In the following months 1,000s of critically endangered Mongolian saiga died.

Lineage IV virus clusters with sequences from livestock in Mongolia and outbreaks in China 2013-2016



Additional Wild Ungulate Cases Confirmed



Goitered Gazelle
(*Gazella subgutturosa*)

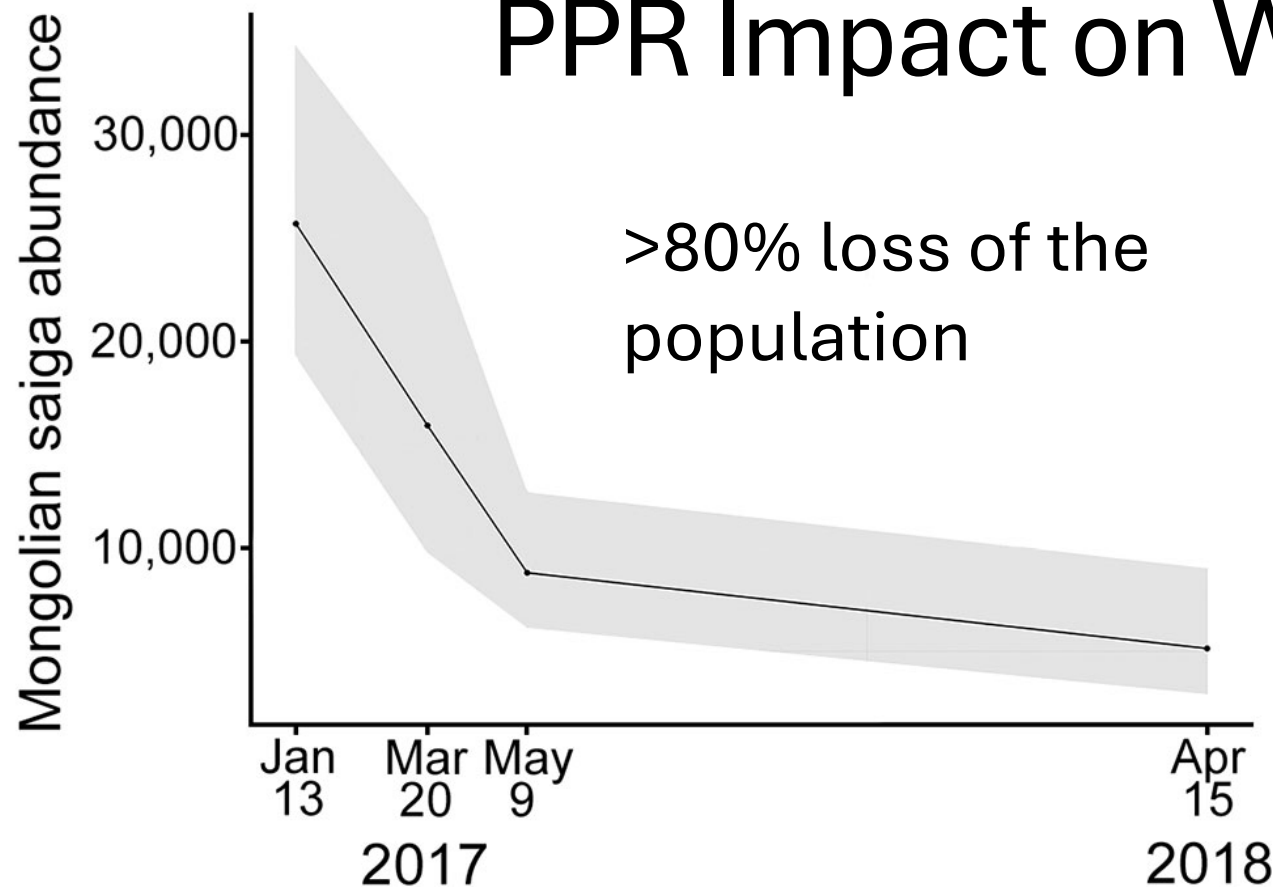


Siberian Ibex
(*Capra sibirica*)



Argali Sheep
(*Ovis ammon*)

PPR Impact on Wildlife Populations

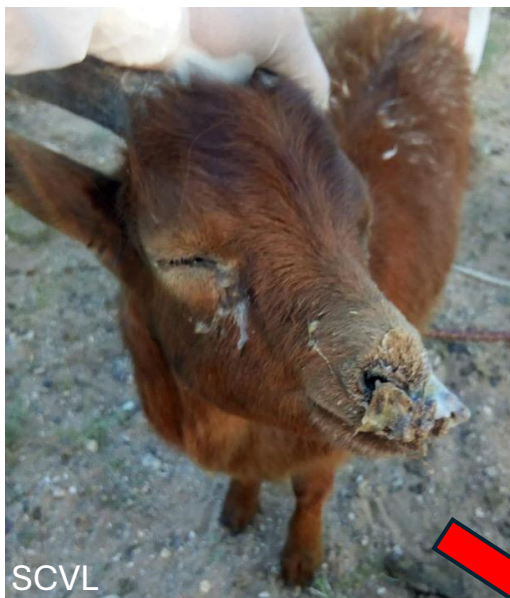


Publication: Pruvot M, Fine AE, Hollinger C, Strindberg S, Damdinjav B, Buuveibaatar B, et al. Outbreak of Peste des Petits Ruminants among Critically Endangered Mongolian Saiga and Other Wild Ungulates, Mongolia, 2016–2017. *Emerg Infect Dis.* 2020;26(1):51-62.
<https://doi.org/10.3201/eid2601.181998>

Figure 5. Saiga population in Mongolia during the outbreak of peste des petits ruminants in 2017 and the next year. Shaded area represent 95% CIs around abundance estimates.

PPR in livestock and wildlife 2016-2017 in Mongolia

1



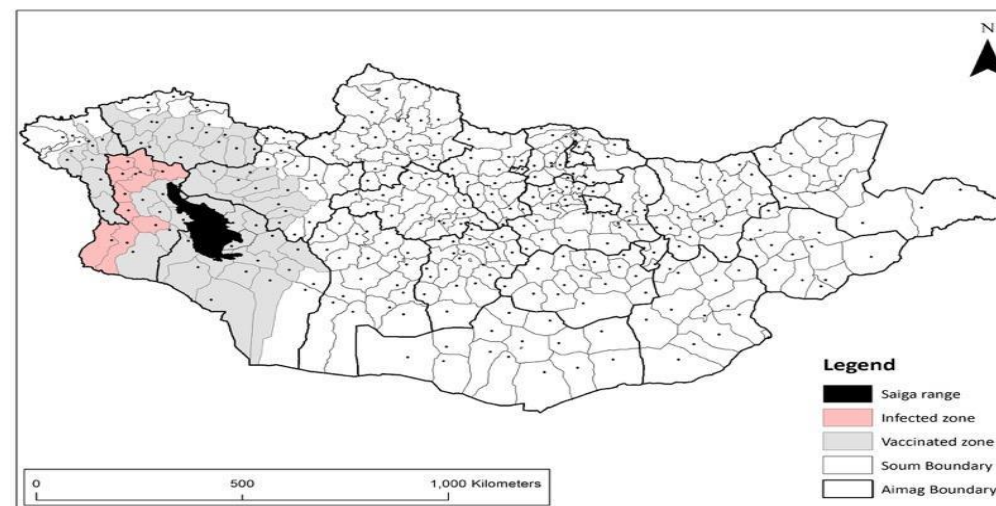
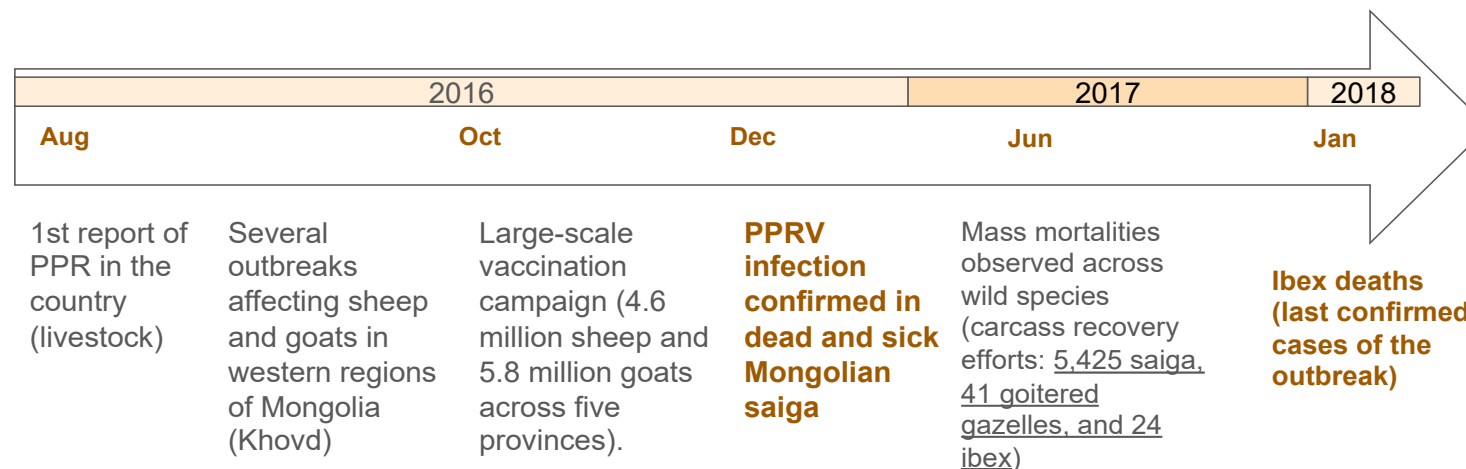
SCVL

2

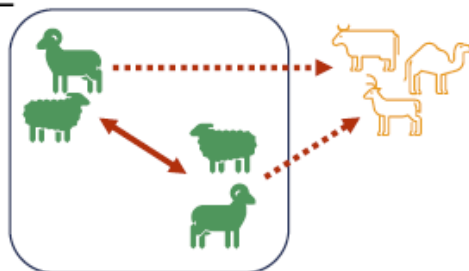


SCVL

1: domestic goat with PPR
2: saiga antelope with PPR

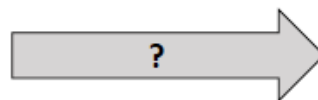


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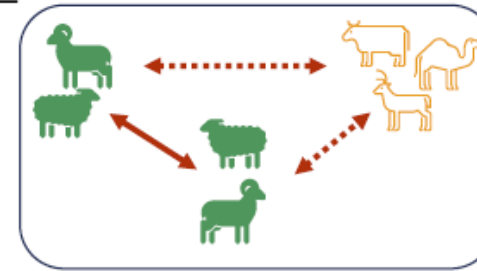


PPRV circulation only occurs
between small ruminants

Can only consider target
populations in elimination
campaigns



B



Occasional backwards
transmission of PPRV

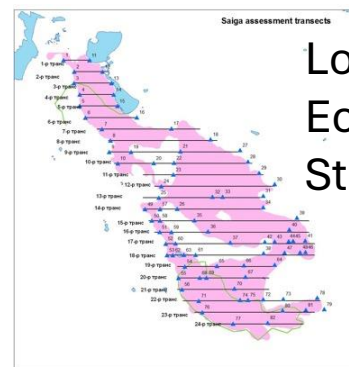
Must consider blocking or
other interventions beyond
target populations

**Guidance in
Support of PPR
Eradication**

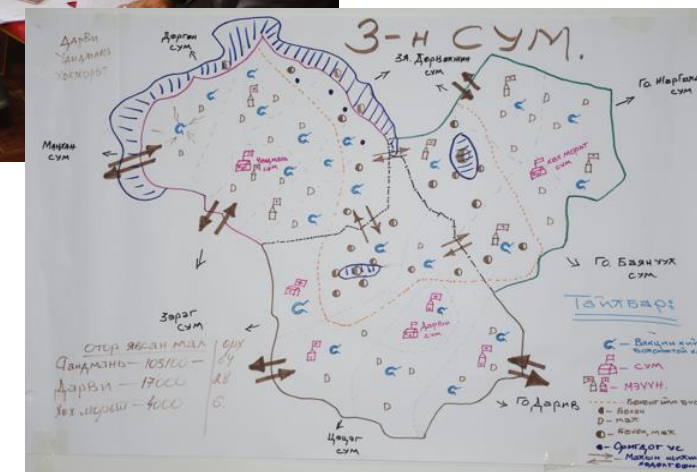
Presentation by Dr. Cadhla Firth @ PPR GREN VI Meeting 2023

Identify High-Risk Sites for PPRV Transmission

- Livestock distribution and density
- Wildlife species range (habitat)
- Seasonal movements of wildlife and livestock
- Congregation points: water, minerals
- Grazing overlap: resource availability
- Wildlife population structure and dynamics – breeding, calving, etc.
- Interspecies-intraspecies interactions

Participatory
Epidemiology
Methods

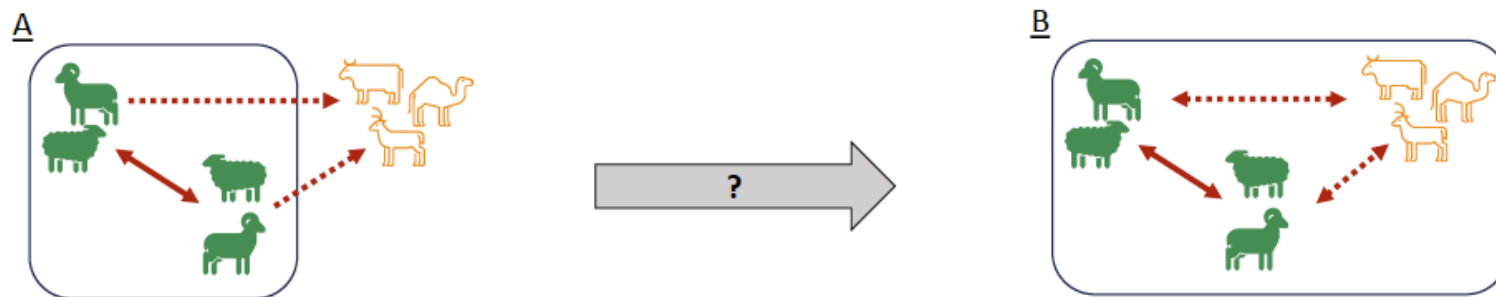
Long-term Ecological Studies



Activate PPR Surveillance in Wildlife Populations

PPR outbreaks in wildlife = key source of information

- Field Epidemiology + Molecular Epidemiology
 - Surveillance event data (geo-referenced)
 - Individual animal data (common and scientific name)
 - Specimen data (diagnostic and sequencing)



Summary

- PPR infection detected in wildlife species in Africa and Asia
 - Free ranging wildlife & captive wildlife
 - Apparent variation in species susceptibility
- Recurrent PPR outbreaks reported in Ibex (wild goat species) in Iran (*Capra aegagrus*) and Pakistan (*Capra aegagrus blythi*)
- Regional PPR outbreaks in Europe have raised concerns about spillover to wild ungulates (no evidence to date)
- PPR molecular diagnostic approaches can be used in wildlife species; use caution when interpreting results from serological testing



Managing PPR, High impact and Zoonotic diseases at Wildlife-Livestock Interface meeting

Topic: Current status and understanding at the wildlife-livestock
interface in Mongolia



Ariunbaatar Barkhasbaatar, Fellow, Wildlife Conservation Society

Munkhduuren Shatar, Chief veterinarian of State Central Veterinary Laboratory of Mongolia

Justine Shanti Alexander, Country Director, Wildlife Conservation Society Mongolia Program

Buuveibaatar Bayarbaatar, Senior Scientist, Wildlife Conservation Society Mongolia Program

Stephane Ostrowski, Senior Advisor of Temperate Asia Region & Associate Director of Wildlife Health Program, Wildlife Conservation Society

María José López Jara, Veterinarian, PhD candidate, The University of Glasgow

Amanda E. Fine, PPR GREN Wildlife Working Group

Ariunbaatar Barkhasbaatar

Mongolia

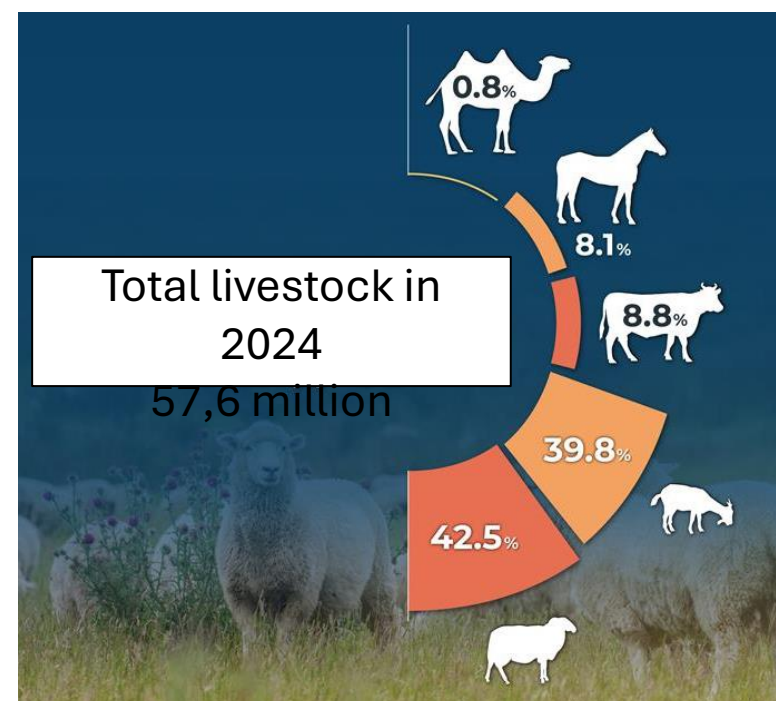
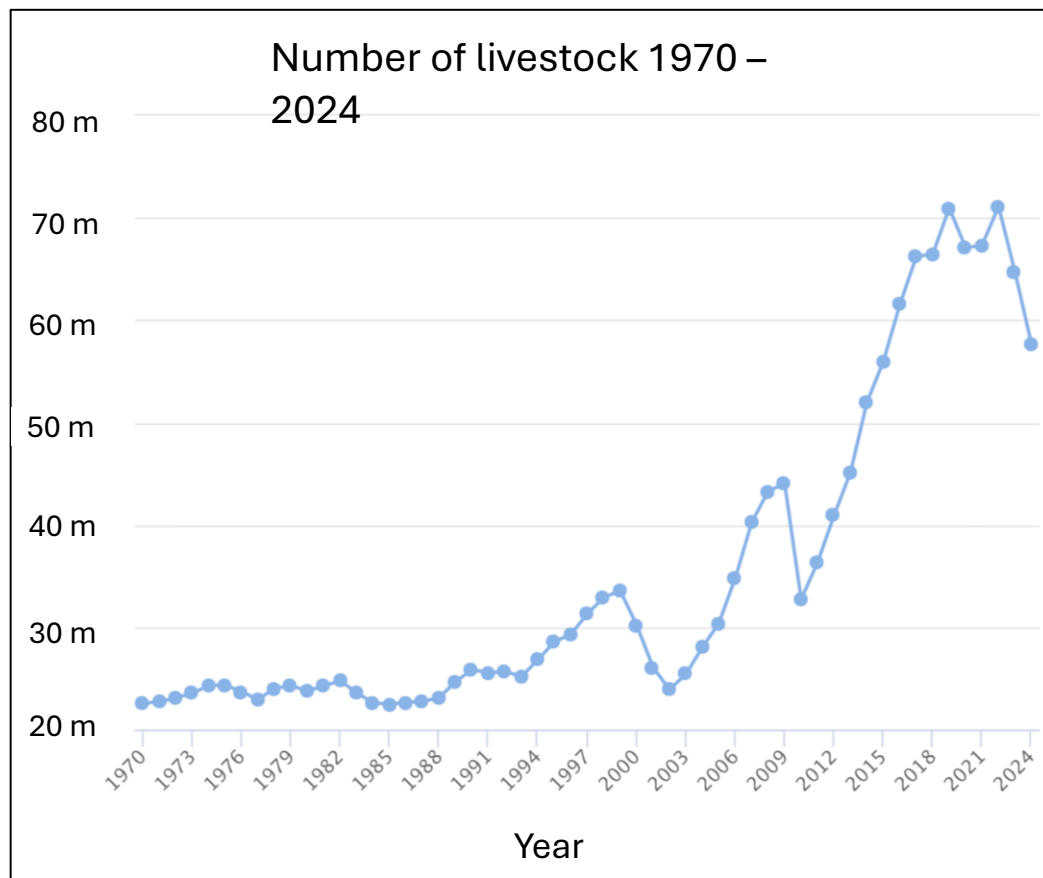


- **1/3** of national labour force employed in pastoral agriculture
- Traditional pastoral livestock systems account for **83%** of the agriculture sector production.
- Pastoralist activities occupy **72%** of the country's territory



Batsaikhan Nyamsuren

Number of livestock in Mongolia



Source: 1212.mn

Susceptible to PPR and other livestock-borne diseases are present in Mongolia

Goitered gazelle
(*Gazella subgutturosa*)



WCS

Siberian ibex
(*Capra sibirica*)



Batsaikhan Nyamsuren

Mongolian gazelle
(*Procapra gutturosa*)



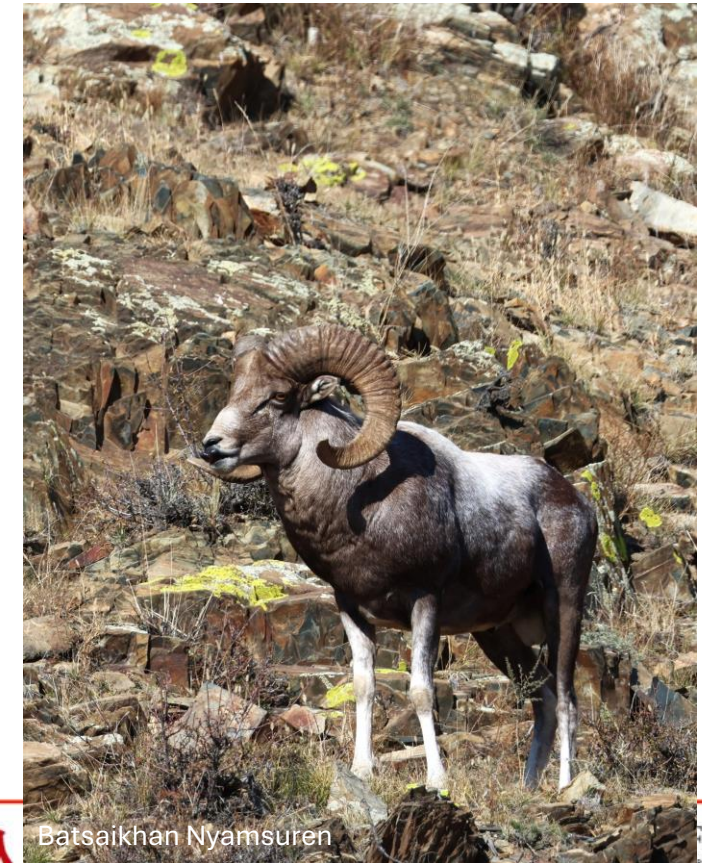
WCS

Mongolian saiga
(*Saiga tatarica mongolica*)



WCS

Argali sheep
(*Ovis ammon*)



Batsaikhan Nyamsuren

Monitoring of PPR in wildlife (2018-2025)



Food and Agriculture
Organization of the
United Nations



Sample collection methods (2018-2025)

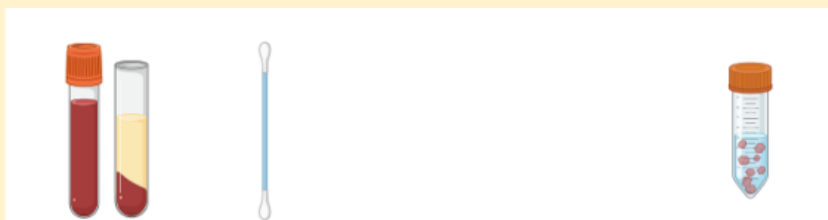
Opportunistic sampling

Live animal sampling while collaring
(drive nets method)

Incident response

Field necropsy

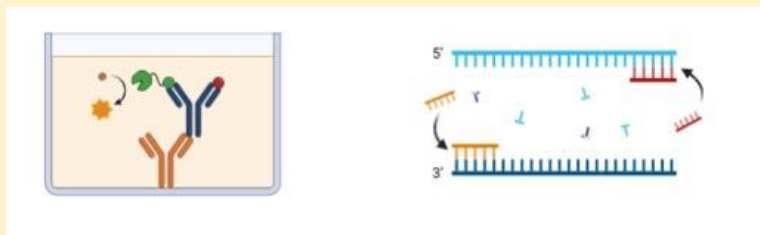
Monitoring approach



serum nasal swabs

tissues

Samples obtained

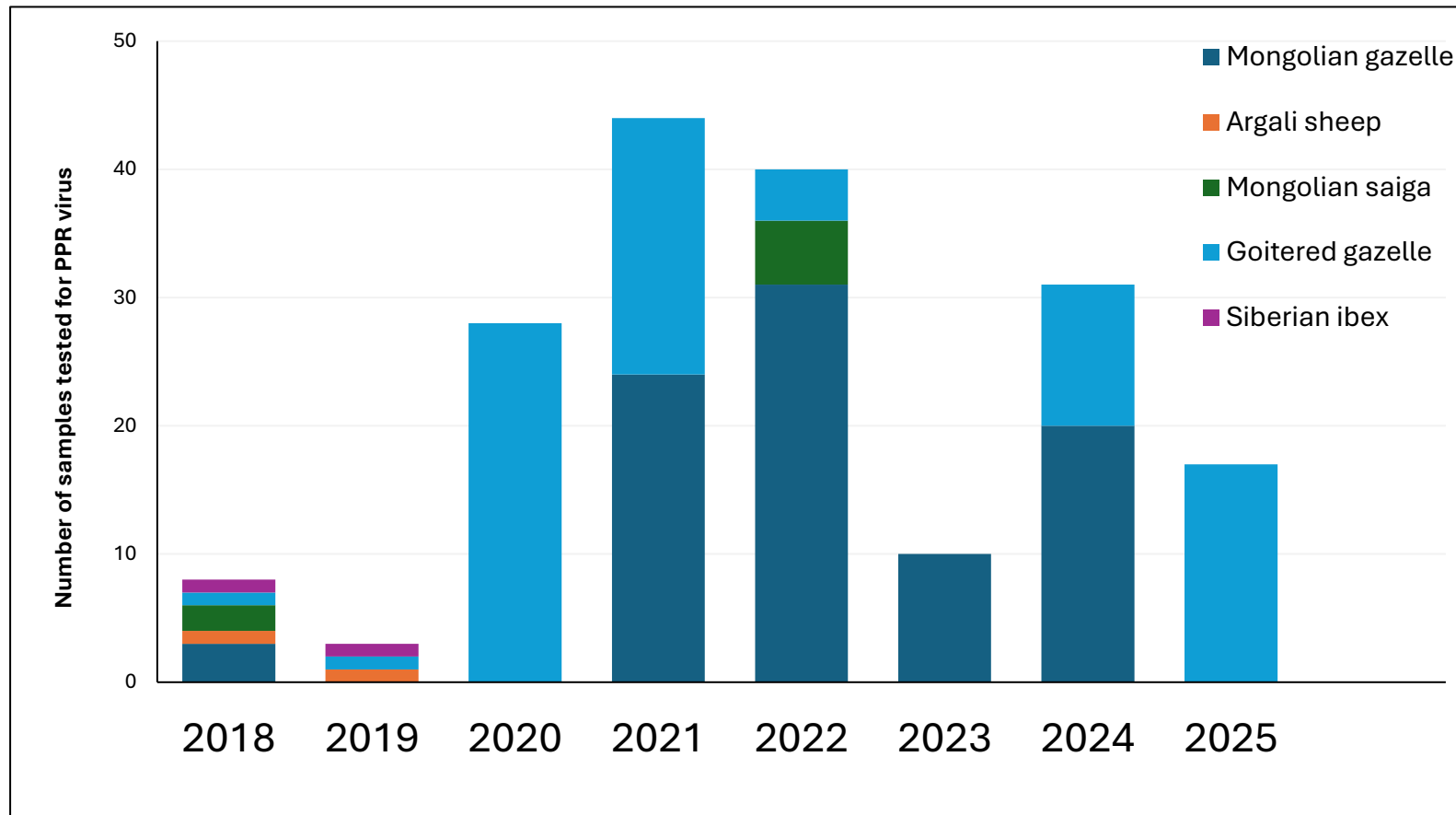


Serology (Competitive ELISA kit)

RT-PCR

Laboratory testing

Results - PPR in livestock and wildlife (2018-2025)



- Total 181 samples tested for PPR
- No evidence of infection with PPR in susceptible ungulates since 2018

Challenges

- Systematic data and sample collection
 - Missing information on animals sampled
 - Missing information on sample collection, storage and analysis
 - Inconsistency in recording animal and sample-associated information (e.g., animal IDs)
- Data management
 - Delays in transferring field data to a digital database
 - Inconsistencies in data entry
 - Database not in a tidy data format

Risk of losing data

Errors in database (duplicated data)

Additional time and effort required

Obstacles for data analysis and interpretation

Conclusion

- Opportunistic approach is useful to get “snapshots” of wild animal health for different wild species
- Samples can be used to help validate diagnostic techniques for wild species
- Findings highlight that escalating PPR monitoring in wild ungulates is needed (naive and susceptible populations).
- There is no evidence to date that wildlife act as a reservoir for PPR in Mongolia. However, as disease dynamics can change over time, continuous health surveillance of wildlife remains essential.

Thank you!

