

DETECTION AND CHARACTERIZATION OF LUMPY SKIN DISEASE VIRUS

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Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

ETIOLOGY AND HOST RANGE

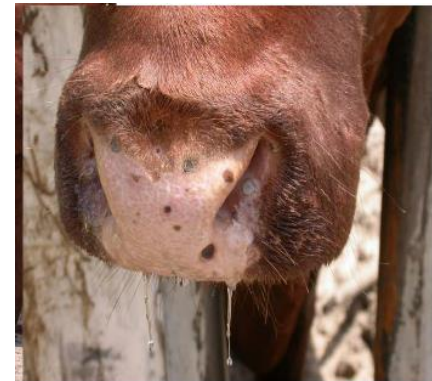
- LSD is an acute to chronic viral disease of cattle characterized by skin nodules accompanied by a persistent fever
 - LSD is caused by a capripoxvirus (CaPV): the Lumpy skin disease virus (LSDV).
 - Others CaPVs, are sheep poxvirus (SPPV) and goat poxvirus (GTPV) affecting sheep and goats.
 - LSD is primarily spread between animals by biting insects (vector), such as mosquitoes and biting flies.
 - The movement of infected animal and animal products can also participate in LSD spread
 - LSDV, SPPV and GTPV cannot be distinguished by virus neutralization or other serological tests.
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- **Domestic animals:** Cattle
 - **Wildlife** (Arabian oryx in Saudi Arabia and Asian water buffalo in Egypt)
 - Experimentally: Giraffe, Impala are susceptible
 - LSDV DNA was characterized in samples from Springbok antelope and Eland

CLINICAL SIGNS



In the field the incubation period is 2 to 5 weeks.
In experimental infection by intradermal inoculation, a lesion develops at the inoculation site within 6 to 20 days

- Fever
- Nodular lesions in the skin followed by necrosis
- Generalized lymphadenitis and oedema of the limbs
- Lacrimation
- Nasal discharge
- Loss of appetite
- Ulcerated lesions may be present in the mouth and nares
- Morbidity in susceptible herds can be as high as 100%
- Mortality is rarely more than 1–2%



LABORATORY DIAGNOSIS

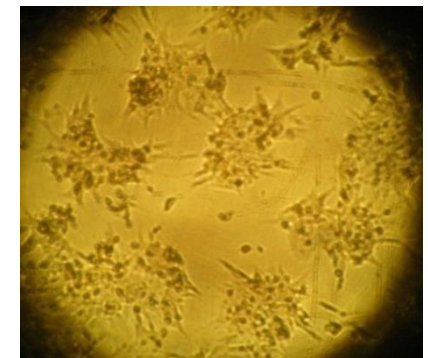
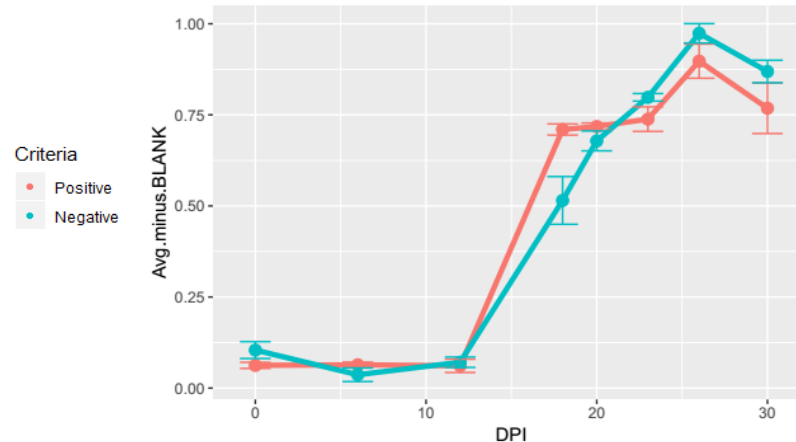
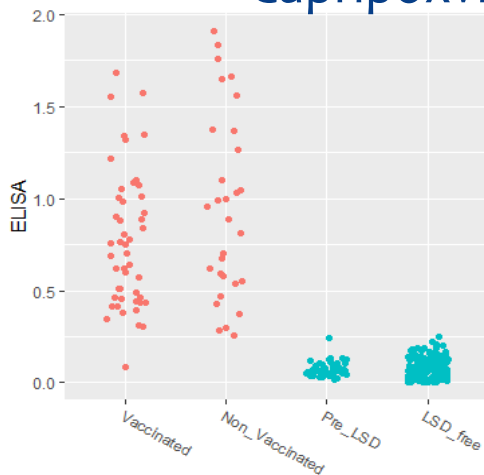
LABORATORY SPECIMEN: Skin biopsies, swabs for virus isolation, molecular detection; Serum samples for serology

VIRUS ISOLATION AND PROPAGATION:
Primary cells from bovine/ovine
Cell lines (VERO, MDBK, ESH-L, OA₃.Ts)
Chorioallantoic membrane (CAM)

Serology

- Virus neutralization, Indirect fluorescent antibody test
- Immunoperoxidase Monolayer Assay
- ELISA)

Capripoxvirus antibodies detection



infected Vero cell

LABORATORY DIAGNOSIS

MOLECULAR METHODS

GENERAL CAPRIPOXVIRUS DETECTION METHODS

- A gel-based PCR in the OIE manual LSD chapter (Ireland and Binopal 1998, Tuppurainen et al 2005)
- Real time PCR: Bowden et al 2008, validated by Stubbs et al 2010; Haegeman et al 2013.
- LAMP PCR: Murray et al 2013 and Das et al 2013.
- Kits (Techne); Genesig® ;Tetracore; Biosellal

CAPRIPOXVIRUS SPECIES DIFFERENTIATION



Protocol

Real time PCR method for simultaneous detection, quantitation and differentiation of capripoxviruses

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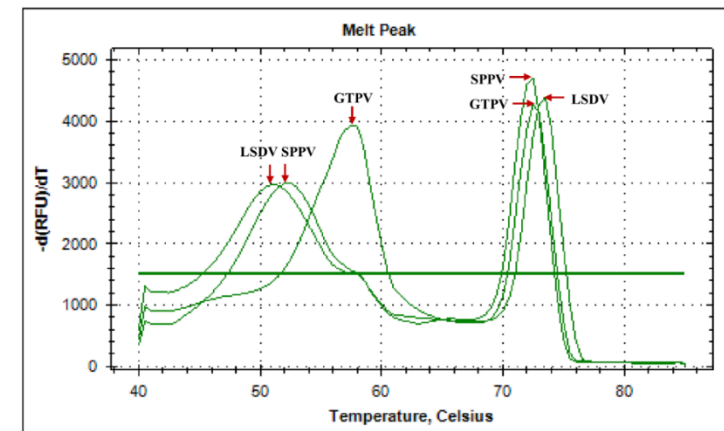
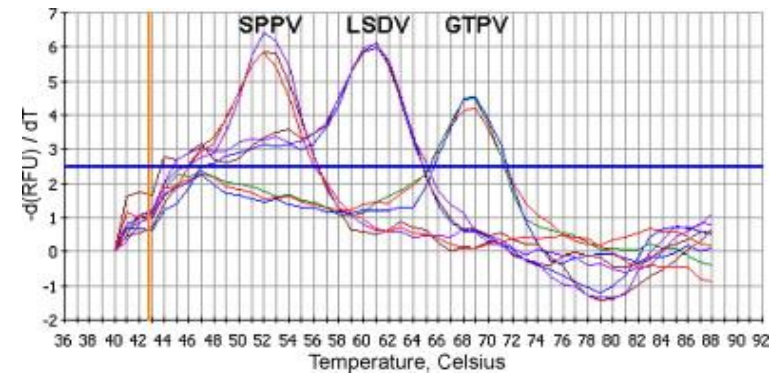
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OPEN ACCESS Freely available online



Development of a Cost-Effective Method for Capripoxvirus Genotyping Using Snapback Primer and dsDNA Intercalating Dye

Esayas Gelaye^{1,5,6}, Charles Euloge Lamien^{1*}, Roland Silber², Eeva S. M. Tuppurainen³, Reingard Grabherr⁴, Adama Diallo¹



LABORATORY DIAGNOSIS

MOLECULAR METHODS

DIFFERENTIAL DIAGNOSIS

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SCIENTIFIC REPORTS

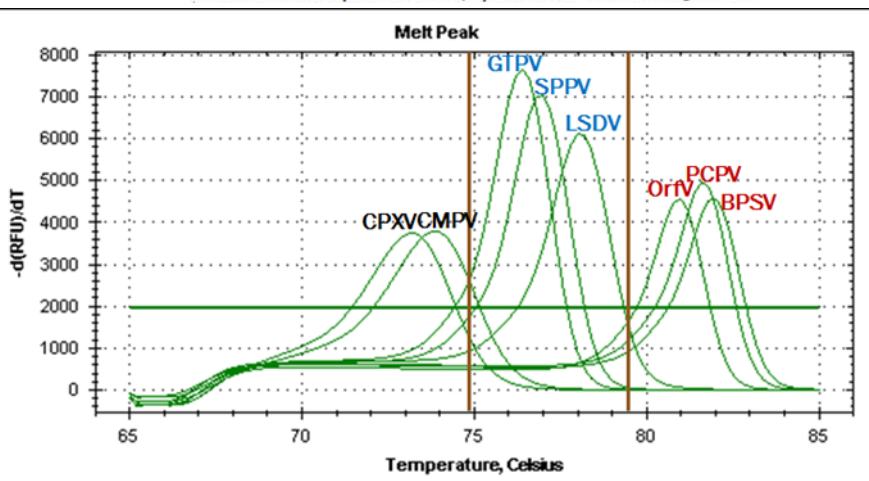
OPEN A novel HRM assay for the simultaneous detection and differentiation of eight poxviruses of medical and veterinary importance

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Esayas Gelaye^{1,2,3}, Lukas Mach², Jolanta Kolodziejek⁴, Reingard Grabherr⁵, Angelika Loitsch⁶, Jenna E. Achenbach¹, Norbert Nowotny^{6,7}, Adama Diallo⁸ & Charles Euloge Lamien¹



- Pseudo lumpy skin disease
- Bovine papular stomatitis
- Pseudocowpox
- Vaccinia and Cowpox
- Dermatophilosis
- Insect or tick bites
- Hypoderma bovis infection
- Photosensitisation
- Cutaneous tuberculosis



ISSUES WITH LIVE ATTENUATED CAPRIPPOX VACCINES

To investigate lesions in cattle following vaccination using a live attenuated capripox vaccine we need:

- User-friendly tools to distinguish vaccine virus from field virus
- Accurate tools for quality control before vaccination

Ruling out vaccine involvement in LSD outbreak

Antiviral Research 119 (2015) 28–35



Capripox disease in Ethiopia: Genetic differences between field isolates and vaccine strain, and implications for vaccination failure



Esayas Gelaye^{a,b,c}, Alebachew Belay^c, Gelagay Ayelet^c, Shiferaw Jenberie^c, Martha Yami^c, Angelika Loitsch^d, Eva Tuppurainen^e, Reingard Grabherr^f, Adama Diallo^g, Charles Euloge Lamien^{a,*}

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^f Institute of Animal Microbiology, University of Natural Resources and Life Sciences, Muthgasse 11, 1190 Vienna, Austria



Genotype the viral strain in the vaccine

Antiviral Research 109 (2014) 1–6

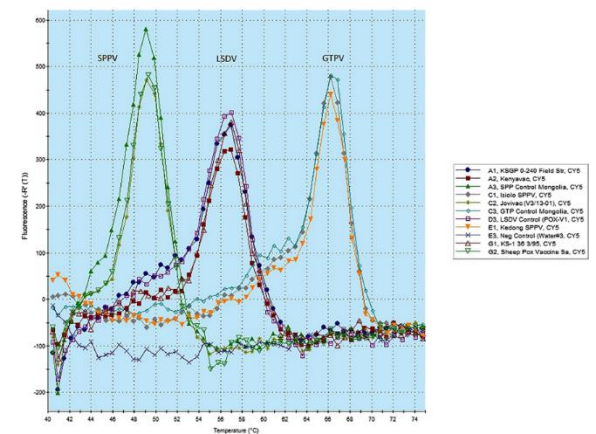


Characterization of sheep pox virus vaccine for cattle against lumpy skin disease virus



Eva S.M. Tuppurainen^{a,*}, Caroline R. Pearson^a, Katarzyna Bachanek-Bankowska^a, Nick J. Knowles^a, Shadi Amareen^b, Lorraine Frost^c, Mark R. Henstock^c, Charles E. Lamien^d, Adama Diallo^e, Peter P.C. Mertens^f

Dissociation Curve



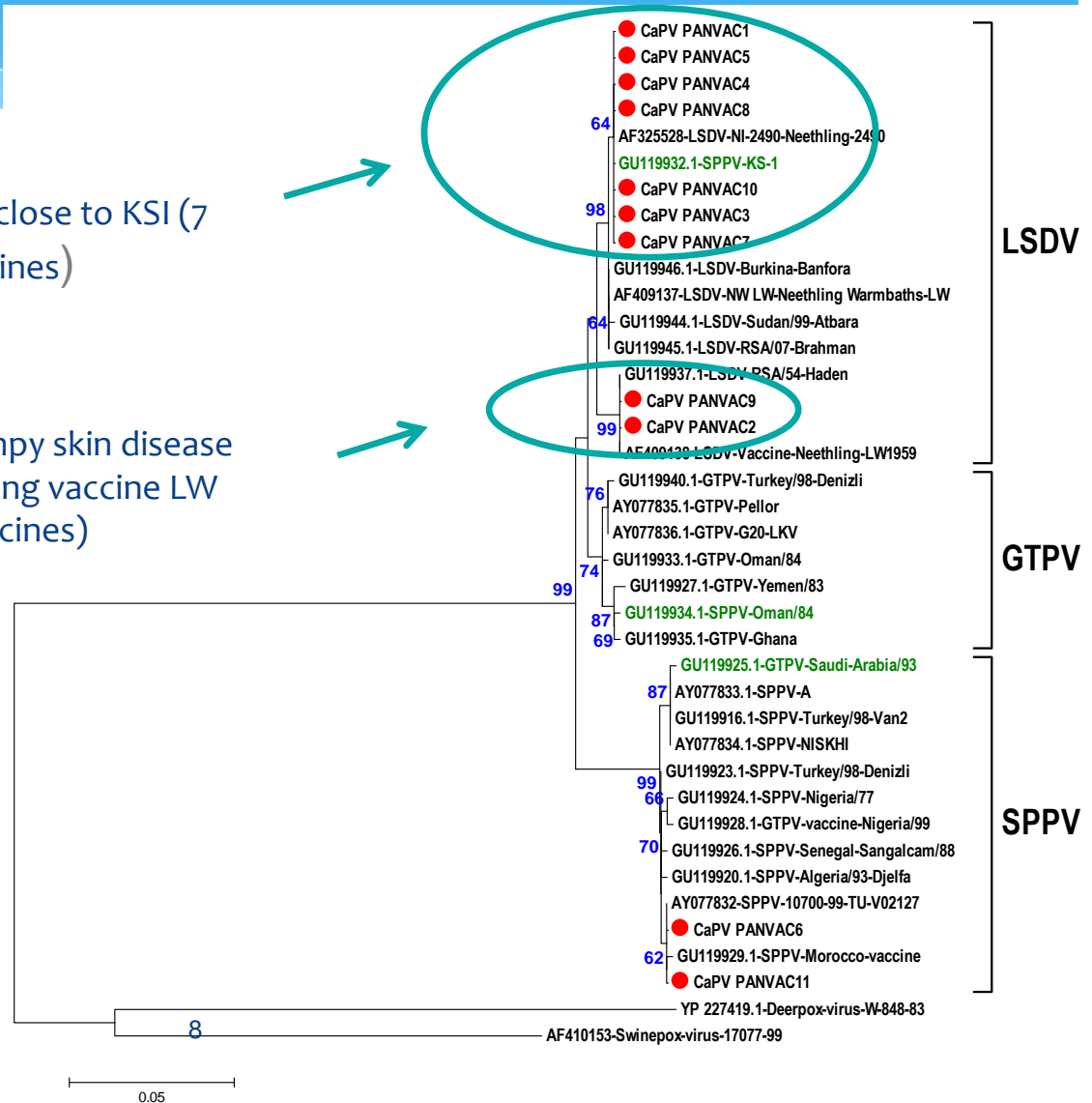
QUALITY CONTROL OF CAPRIOX VACCINES

Characterisation of Vaccine seed

Group 1 very close to KSI (7 vaccines)

Group 2 close to Lumpy skin disease virus isolate Neethling vaccine LW 1959 (2 vaccines)

Several capripox vaccines are mis-labelled

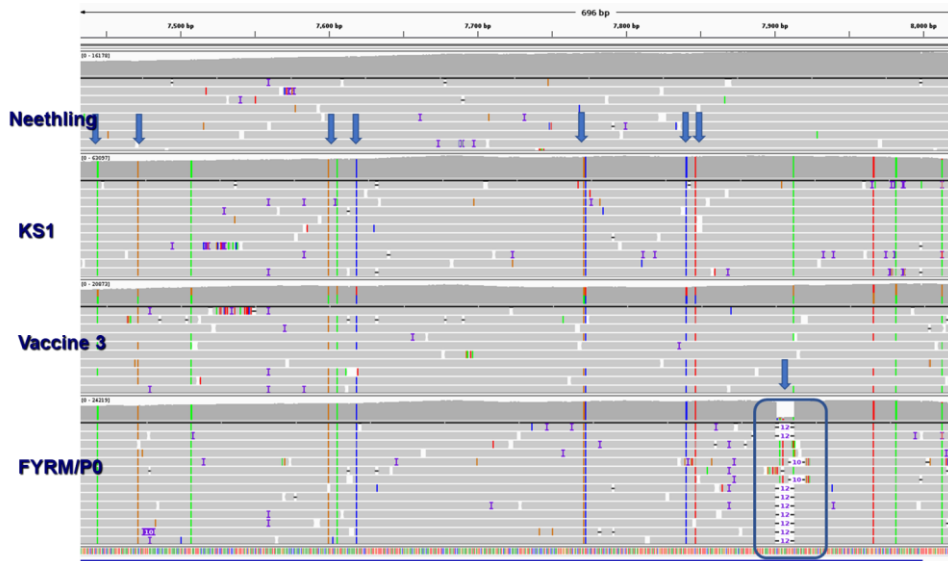


QUALITY CONTROL OF CAPRIPOX VACCINES

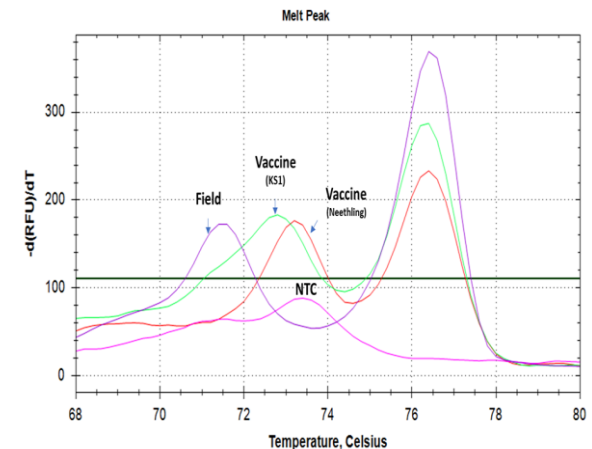
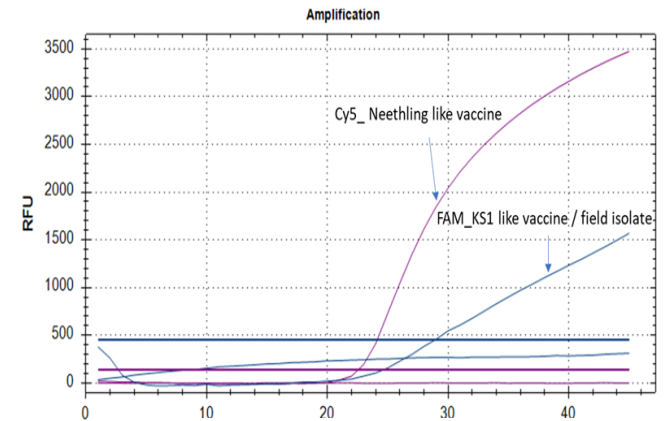
Cross contamination (KS1/Neethling vaccine)

- * When both Neethling (for cattle) and KS1 (for small ruminants) are produced by the same manufacturer, there is a high risk for cross contamination

Viral population analysis



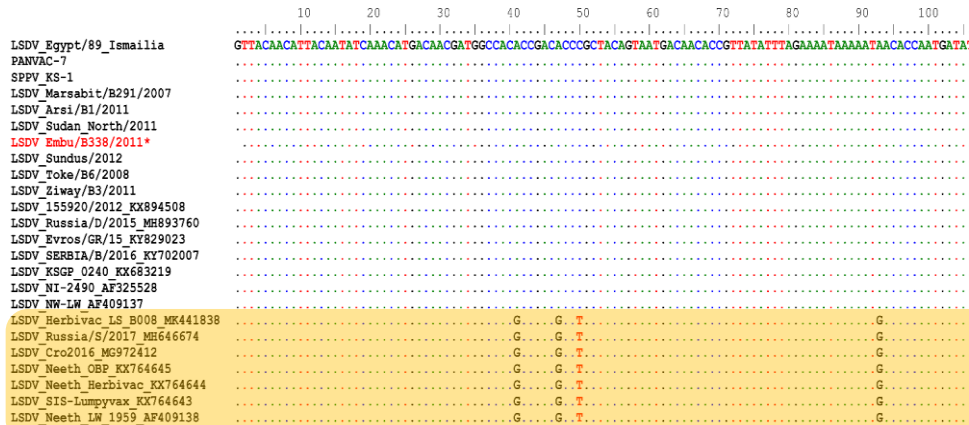
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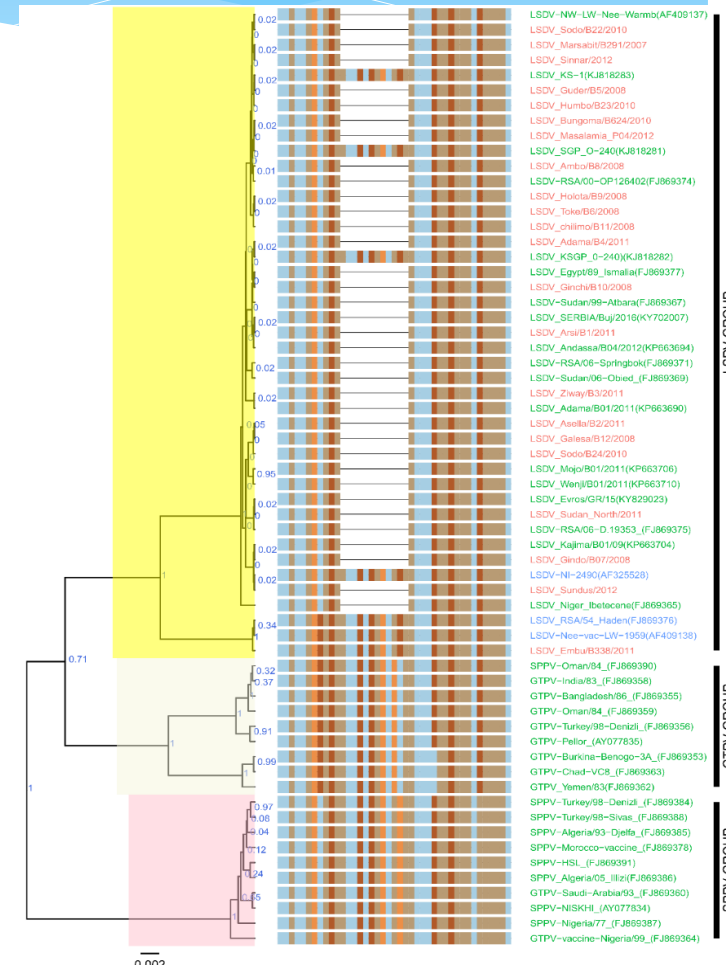
MOLECULAR EPIDEMIOLOGY

A multi-targets approach to detect a vaccine-like field isolate of LSDV in Kenya

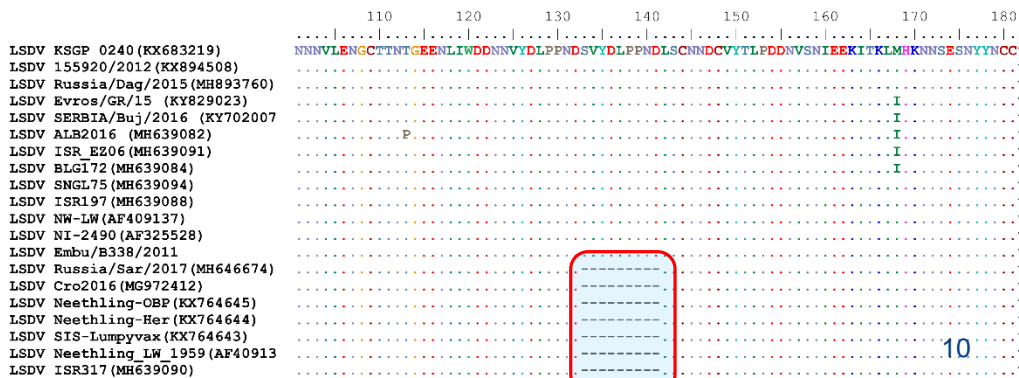
Partial B22R gene



GPCR gene



EEV glycoprotein amino acids sequence



LSDV GROUP
GTPV GROUP
SPPV GROUP

CAPACITY BUILDING AND TECHNOLOGY TRANSFER (VETLAB NETWORK)

Group trainings



Fellowship and long term training



Field support



TEAM AND COLLABORATIONS

JOINT FAO/IAEA DIVISION

- Gerrit VILJOEN
- Giovanni Cattoli
- Bharani Settypalli
- Francisco Berguido
- William Dundon
- Tesfaye Chibssa
- Esayas Gelaye
- Jenna Achenbach
- Adama Diallo

AGES

- Christian Hollub
- Angelika Loitsch
- Prof. Dr. Friedrich Schmoll
- All the team

VETLAB Network partners in R&D

- NAHDIC, Ethiopia
- NVI, Ethiopia
- CVRI, Zambia
- CVL, Namibia
- IRVT, Tunisia
- LNERV, Senegal
- CVL, Mozambique
- BNVL, Botswana
- CVL, Kenya
- CDIL, Bangladesh
- SCVL, Mongolia
- LCV, Mali
- NCVD, Vietnam

Others

- BOKU University
- AU-PANVAC, Ethiopia
- Faculty of Veterinary Medicine, University, Skopje
- NRL of CSF, ASF, Sheep pox and LSD, Sofia, Bulgaria

*FAO/IAEA Agriculture and
Biotechnology Laboratory*

Thank You



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