LUMPY SKIN DISEASE

DR EEVA TUPPURAINEN, DVM, MSC, MRCVS

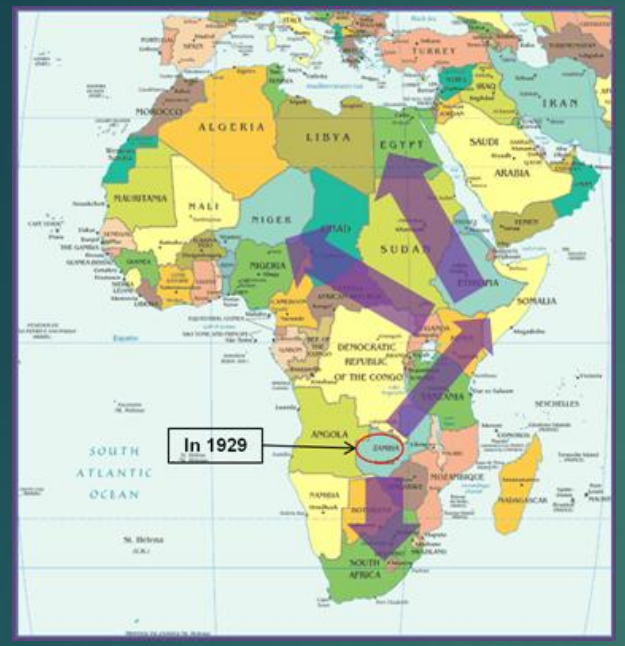
Introduction

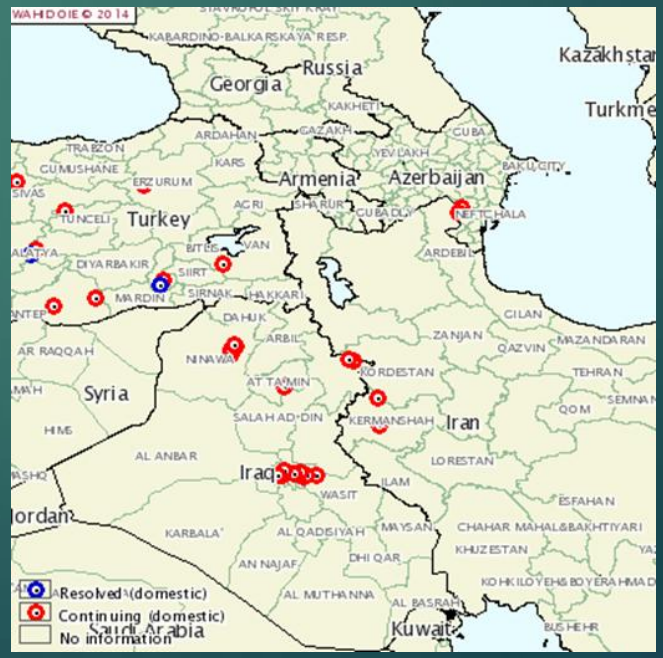
- Lumpy skin disease virus (LSDV) belongs to the genus *Capripoxvirus* within the family *Poxviridae*
- Categorised as a notifiable disease by the OIE
- Serious economic burden for all cattle producers, particularly small-scale farmers in affected countries
- Direct production losses are estimated be 40-60%
- Indirect losses caused by control and eradication measures and restrictions/total ban of international trade of live cattle and their products

Direct and indirect losses due to LSD

- Sharp drop in milk field and mastitis
- Loss of body weight
- Damaged skins and hides
- Abortions
- Infertility problems in cows
- Temporary or permanent sterility in bulls
- Losses due to animal movement restrictions
- Expensive vaccination campaigns
- Limited or banned exportation of live animals and their products

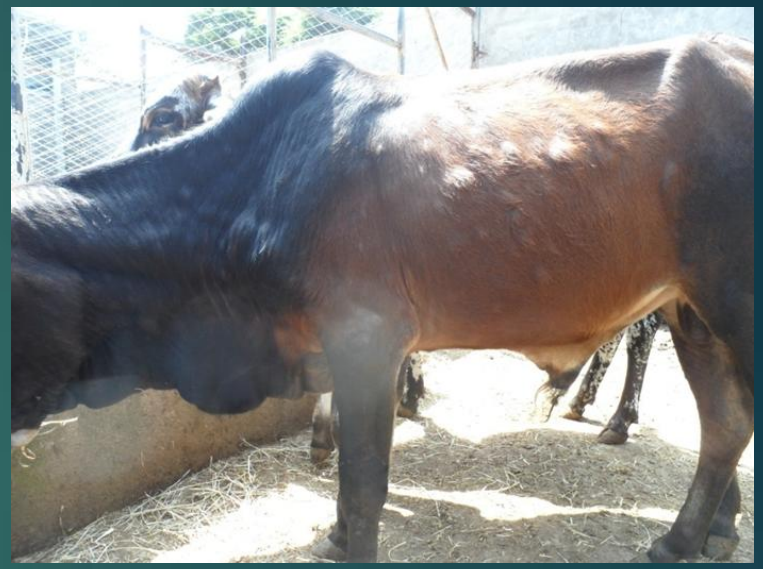
Geographic distribution of LSDV



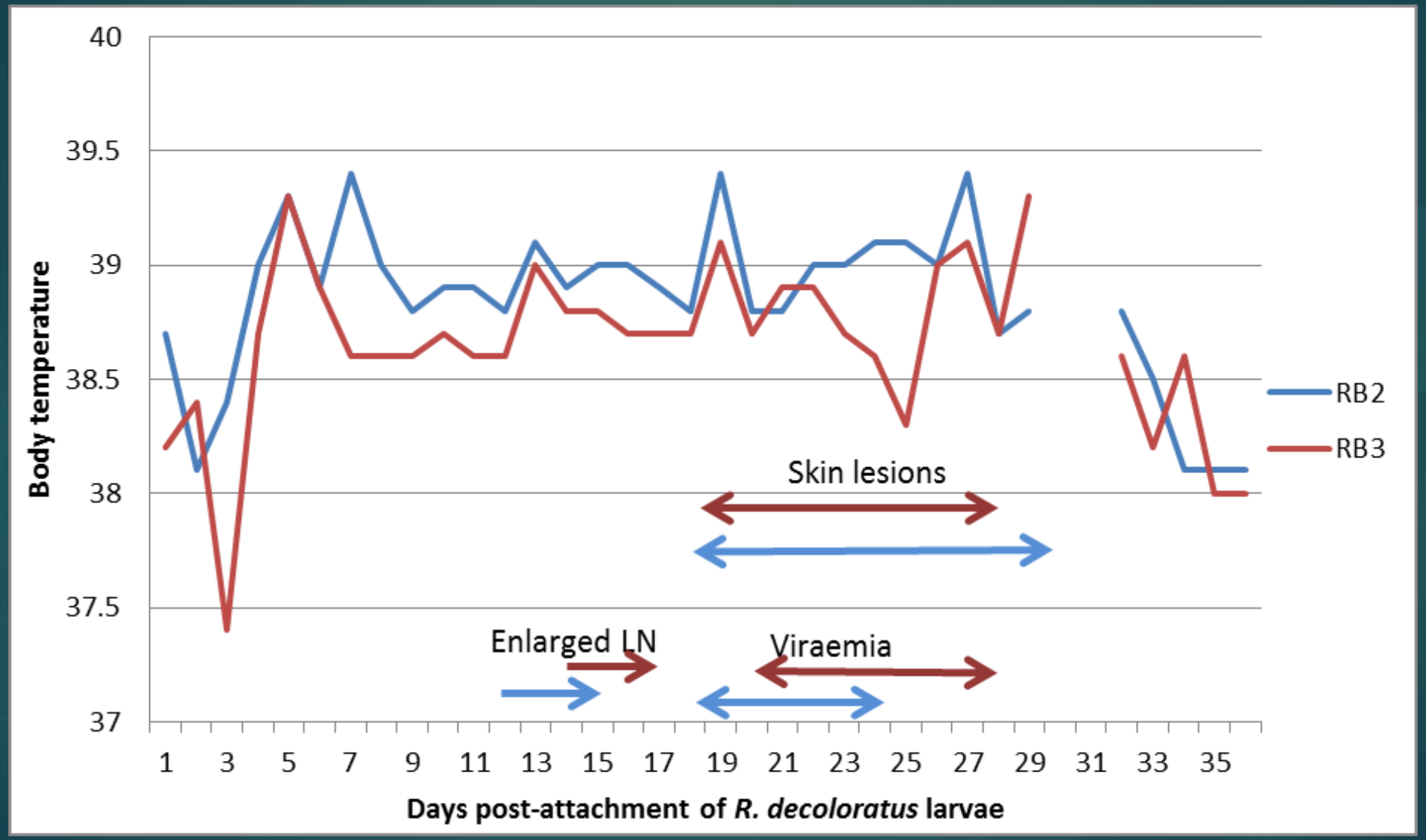


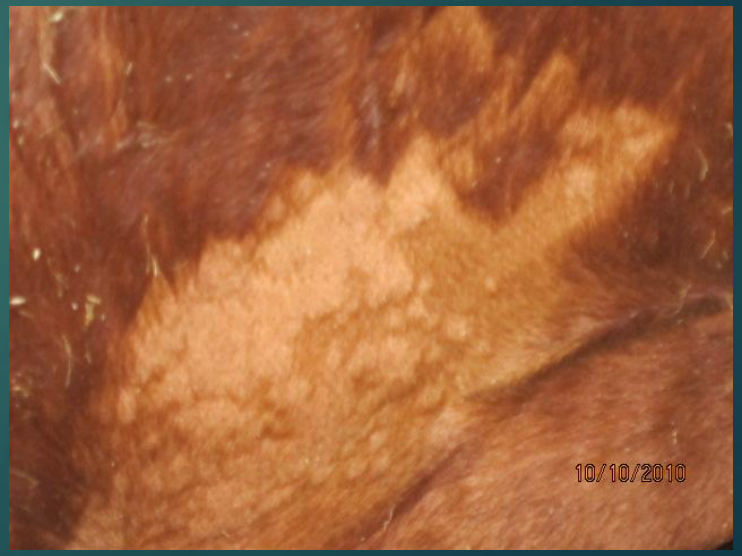
Characteristic clinical signs of LSD

- High fever
- Enlarged lymph nodes (particularly prescapular and precrural)
- Circular skin lesions of 1 to 5 cm in diameter
- Within 1 to 2 weeks the top of the lesion forms a scab which then sloughs off, leaving a raw ulcer (sitfasts)
- Eye and nasal discharge
- Lesions in the oral, nasal and ocular mucous membranes
- Swellings in the leg and lameness
- Oedema in the dewlap

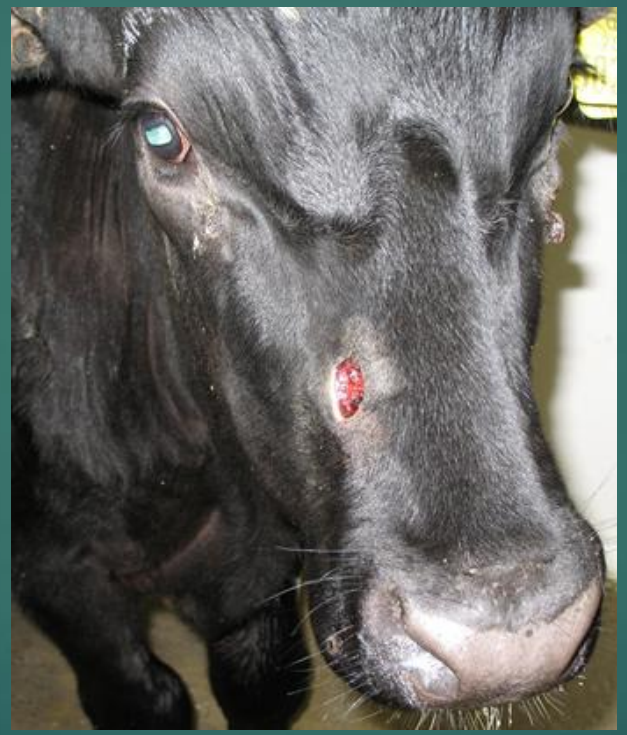


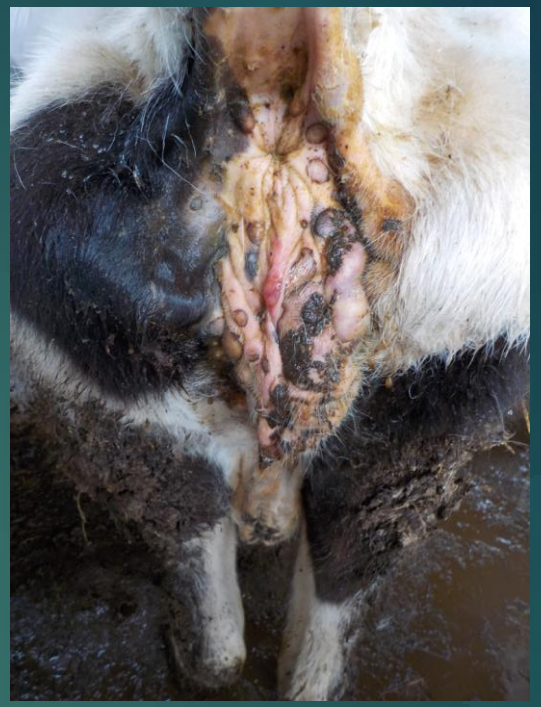
Fever, viraemia and skin lesions




10/10/2010

Deep skin lesions and scar formation

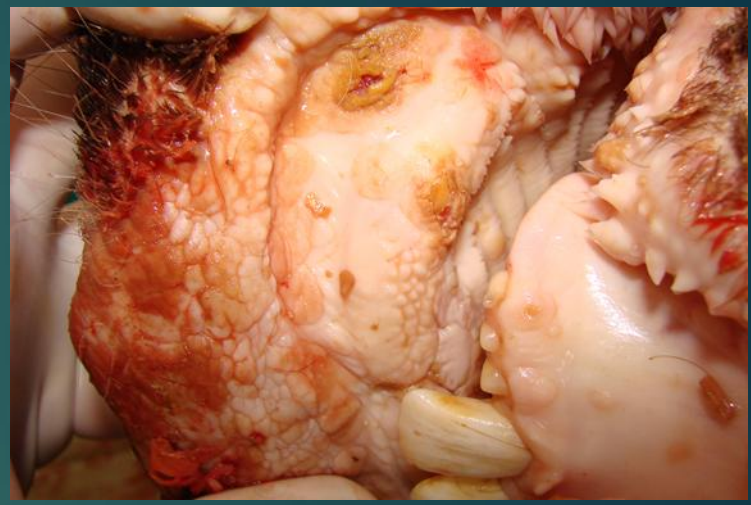





18/09/2012

Older skin lesions, in non-viraemic animal scabs are good sample material

Lesions in the mouth, tongue and oral mucous membranes



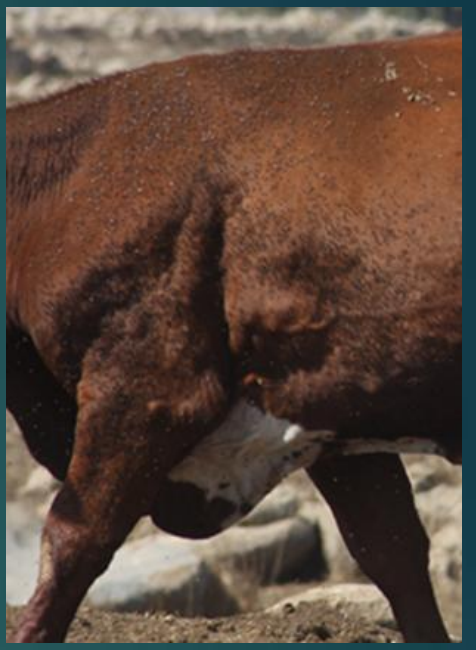
Lesions in the cornea and the mucous membranes of the eye

Differential diagnosis

- Pseudo lumpy skin disease; BHV-2 (Bovine herpes virus); more superficial lesions and shorter course of the disease
- Insect bites and allergic reactions (urticaria)
- Besnoitiosis (widely distributed in Africa, recently also in central and western Europe)
- Demodicosis
- Onchocerciosis

Transmission of LSDV

- Mechanical transmission by a wide variety of blood-feeding vectors (insects and ticks)
- Iatrogenic transmission: by contaminated needles during veterinary treatments or vaccination campaigns
- By contaminated feed or water (common drinking troughs)
- Seminal transmission via mating or artificial insemination
- Transplacental transmission
- Direct contact ineffective??? Requires further investigations



Transmission by blood-feeding insects

- Mechanical mode of transmission *Aedes aegypti* mosquito (Chihota et al., 2001)
- Stable fly *(Stomoxys calcitrans)* transmission of SPPV (Kitching et al., 1986)
- What other species involved?
- Horn flies, horse flies, midges?
- Does the virus multiply in insect cells?

Transmission of LSDV by ixodid ticks

- Transmission has been demonstrated in common sub-Saharan ticks: *Rhipicephalus (Boophilus) decoloratus* (transovarial), *Rhipicephalus appendiculatus* and *Amblyomma hebraeum* (mechanical/intrastadial)
- Some evidence on biological transmission have been obtained but further studies on actual replication of the virus in ticks are needed
- Surveillance of the virus in ticks contaminates the environment
- Closely related species in the Middle East region: *R. (Boophilus) annulatus*, *R. sanguineus*, *A. variegatum* and *Hyalomma extravatum*

Epidemiology

- Morbidity 5-45%, mortality usually <10%
- LSDV infects domestic cattle and water buffaloes but the disease has been confirmed in some wild ruminants such as springbok, impala and giraffe
- Outbreaks may occur anytime but are more common during warm and wet season, with high levels of insect activity
- Any situation when high densities of cattle come to close contact (communal grazing and watering points, cattle markets, quarantine stations)
- No known carrier stage
- Wildlife or insect/tick reservoir?

Epidemiological observations

- In experimentally infected cattle only 50% are likely to show clinical disease although all animals become viraemic
- Viraemic cattle without skin lesions have been shown to mechanically transmit the disease via tick vectors
- In infected herds the number of animals capable for transmitting the disease via arthropod vectors is likely to be much more than those animals showing skin lesions
- Culling of only those animals showing clinical signs of LSD is not likely to control the spread of LSDV effectively

Immunity against LSDV

- Poxviruses have a large genome and they stimulate host immune system effectively
- Lifelong immunity follows a natural infection
- Immunity is predominantly cell-mediated but also humoral response
- Antibodies can be detected approximately 3 months after infection
- Neutralization tests are not sensitive enough to detect low antibody levels in vaccinated animals or in those showing mild or silent disease
- LSDV has been used as vaccine vector for Rift Valley fever, PPR, rabies - however, none of these vaccines are commercially available
- No ELISAs are commercially available

Sample collection

- Specimens should be collected in early acute phase of infection from febrile animals
- Length of viraemic stage varies but approximately 1 to 2 weeks
- Tissue samples for the isolation of a live virus should be collected before the appearance of neutralizing antibodies
- Live LSDV in skin lesions live virus up to 39 days post infection
- Dried scabs: live virus is well protected inside the scabs and viral DNA can be detected for several months
- Antibodies against CaPV start to rise about 2 weeks post detection of the first clinical signs

Samples

- Skin lesions
- Scabs can be transported in a container without any medium
- Lung or other tissue with pox lesions (10% glycerole in PBS*)
- EDTA blood for PCR and heparin blood for virus isolation
- Blood in FTA paper suitable for PCR analysis
- Nasal, saliva and ocular swabs (transport medium such as DMEM**+ antibiotics***)
- Whole blood for serology

*Phosphate buffered saline

** Dulbecco's Modified Eagles Medium

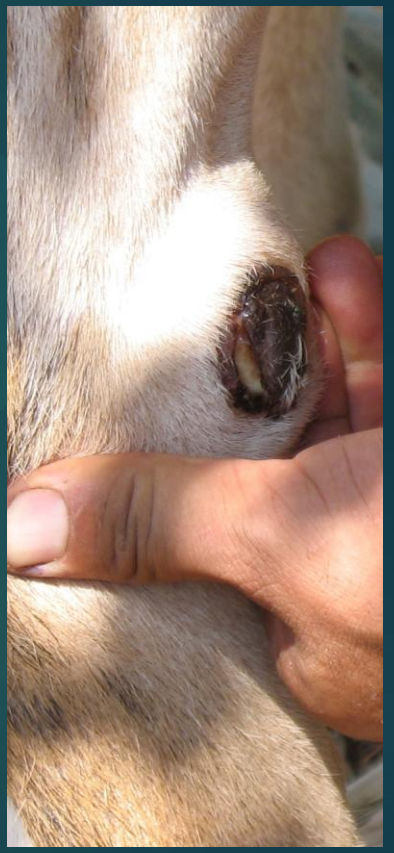
***Ampicillin 0.05mg/ml, Gentamycin 0.1mg/ml and AmphotericinB 5µg/ml

Control and eradication (1/2)

- Vaccination with homologous vaccine
- Total stamping-out of all infected and in-contact animals (if feasible)
- Culling only those animals, showing clinical disease is not effective as a sole control measure
- Quarantine
- Strict animal movement restrictions and border control
- Awareness campaigns for farmers, animal carers and veterinarians
- Early detection/reporting - Enforcement of local diagnostic capacity
- Strict bio security measures on farm level on entry and exit (people, animals and vehicles)

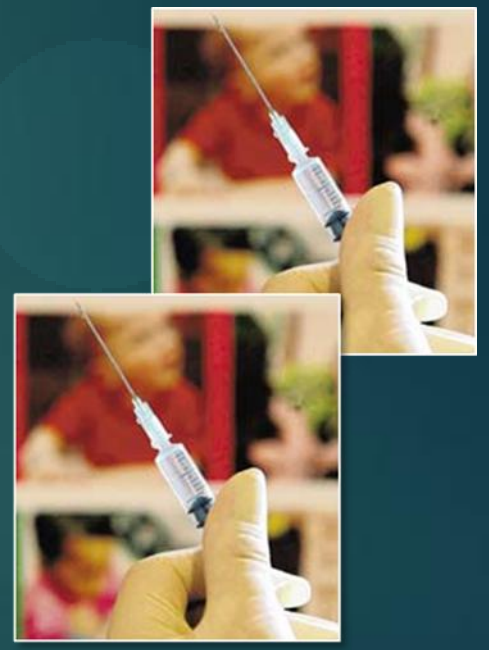
Control and eradication (2/2)

- Active surveillance (clinical signs and sample collection from infected and suspected animals)
- Farmers practising nomadic pastoralism – vaccination of the cattle should be a priority
- Vector control in animals and facilities – may decrease the infection rate but no studies available
- Zoning (at the radius of 25-50 km)
- When restocking an affected farm - Sentinel animals first
- Major problem - political unrest, armed conflicts and movement of refugees in the region



Previous CaPV research indicates

- All strains of capripoxvirus of ovine, caprine or bovine origin examined so far share a major neutralising site, so that animals recovered from infection with one strain are resistant to infection with any other strain (Capstick, 1961)
- Life-long immunity after natural infection but not likely after vaccination
- No recent long term studies have been carried out on the duration of the protection after vaccination

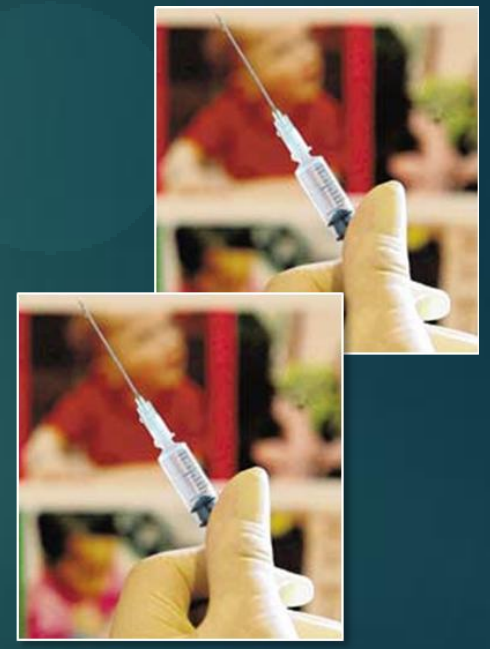


Currently available vaccines against LSDV

- Lumpy Skin Disease Vaccine for Cattle by Onderstepoort Biological Products, SA (Neethling strain)
- Lumpyvax – Merck, Intervet, SA (attenuated field strain)
- Herbivac LS – Deltamune, SA (Neethling strain)
- SPPV RM-65 (JOVAC) (10 x sheep dose)
- KSGP O-240 and O-180 strains (LSDV) by many producers

Successful LSD vaccination campaign

- Large scale annual vaccinations, using homologous vaccine
- Sufficient herd immunity (80% coverage) needs to be created and maintained in large areas around infected zone
- Affordable/subsidized particularly for small-scale farmers and cattle owners, practising transhumance farming
- Vaccinate also pregnant animals
- Calves from vaccinated cows at the age of 4 to 6 months and from non-vaccinated cows as soon as possible
- Imported animals: Vaccination of naïve European breeds before entering farms located within affected regions



Efficacy of the currently available live vaccines

- In general, good protection in case a homologous vaccine and sufficient vaccination coverage (80-90%) is used
- Total protection is not provided for each individual
- Quality of different vaccines varies a lot and the vaccine is not stable in direct sunlight
- The efficacy of SPPV (RM65) vaccine against LSDV has never been evaluated by challenge experiments in controlled environment
- Recent studies by Gari *et. al.* (Vaccine, in print) indicate that Gorgan goatpox vaccine protects cattle against LSDV
- The number of experimental animals in challenge experiments needs to be a minimum of 6 plus controls
- Many vaccine producers rely on field experiments, measuring antibody response of vaccinated animals and skin reaction at the vaccination site

Safety of the live vaccines

- Adverse reactions caused by the live vaccines, particularly LSDV
- Fever and temporary drop in milk yield
- Local reaction at the vaccination site (should be accepted)
- Some animals (<10%) show mild generalized disease
- KSGP O-240 and 180 strains (LSDV) are not recommended for European high-producing dairy breeds
- Other SPPV vaccines rarely cause adverse reaction in cattle but the protection is not that good as homologous vaccines
- Cattle vaccinated with SPPV and then booster with LSDV vaccine show less severe reaction against the LSDV vaccine

Correct handling of the vaccine

- Maintain cold-chain
- Keep the vaccine out of sun
- Opened bottles must be used within 6 hours and then discarded (without exception)
- Proper needle hygiene must be practised (change of the needle between animals)
- Farmers should be informed about adverse reactions and warned that black market vaccines may not be safe nor provide sufficient protection

Thank you for your attention!

Any questions?

Dr Eeva Tuppurainen, DVM, MSc, MRCVS

tuppurainene@gmail.com

Tel +44 79 63828625