Lumpy skin disease: a direct threat to Europe

Lumpy skin disease continues to spread further into Europe

Lumpy skin disease is a transboundary, systemic, viral disease of cattle that has traditionally been found in southern Africa. It has steadily been expanded its geographic boundaries and in the past 5 years moved very efficiently through the Middle East and into eastern Europe and Russia. Current control measures have been unable to restrict the spread of the disease and it now represents a direct threat to the rest of Europe.

Lumpy skin disease is caused by infection with *Lumpy skin disease virus* (LSDV), a poxvirus classified in the *Capripoxvirus* genus. It is a highly species-specific virus infecting only cattle, buffalo and closely related wildlife. It causes a very characteristic and easily recognisable clinical disease. After an initial period of fever and lymphadenopathy the animal develops large, firm cutaneous nodules up to 5cm diameter (**Figure 1**). These can be found all over the body but particularly sparsly-haired areas such as the head, udder, scrotum and perineum. The nodules may become necrotic and ulcerate, leading to increased risk of myiasis. In severely affected animals necrotic lesions can also develop in the respiratory and gastrointestinal tract. The disease severity varies widely from subclinical to fatal. Morbidity and mortality in LSDV outbreaks in the European countries so far affected has been low; for example in the 2015 outbreak in Greece morbidity was 8.7% and mortality 0.4% (Tasioudi, Antoniou et al. 2016). In Turkey, where rapid culling of affected herds was not practiced, morbidity was 12.3% and mortality 6.4% (Sevik and Dogan 2016). The number of subclinically infected animals in affected herds is unknown.

The spread of LSD through the Middle East and into neighbouring areas in the past 5 years has been rapid, possibly aided by civil unrest and the breakdown of veterinary services in countries such as Iraq and Syria. LSD was first identified in 2012 in Lebanon, Jordan, Saudi Arabia, Iran and Turkey. The virus then spread north into Russia (Dagestan) in 2015 and Armenia in 2016, and east into Greece in 2015 and Bulgaria and the Former Yugoslav republic of Macedonia in 2016 (**Figure 2**). It is widely expected to continue to spread. An important route of virus transmission is believed to involve insect and arthropod vectors including *Aedes aegypti* mosquitoes (Chihota, Rennie et al. 2001) and possibly stable flies (*Stomoxys calcitrans*) (Kitching and Mellor 1986) and ticks (Tuppurainen, Lubinga et al. 2013). Direct spread of the virus between infected and naïve animals may also occur but the relative importance of this route compared to vector spread is unknown.

Diagnosis of LSD is most often performed by detection of viral DNA in blood or tissues of acutely ill animals using the polymerase chain reaction. This is a straightforward test with high sensitivity and specificity. Detection of antibodies to LSDV (serological diagnosis) is more challenging. The only validated test available is a virus neutralisation test which is slow, expensive, requires the use of live virus and has excellent specificity but low sensitivity.

How best to control LSD is a subject of much current debate. Israel experienced a widespread outbreak of the disease in 2012-2013 but successfully eradicated it using a mass vaccination campaign with no reports of clinical cases of LSD in the country since 2013 (Ben-Gera, Klement et al. 2015). In contrast Turkey first identified the disease in 2012 and, despite a country-wide vaccination programme, was unable to limit virus spread and declared the disease endemic in 2014 (Sevik and Dogan 2016). Most control campaigns include a combination of movement restrictions, culling of affected animals and / or herds, and vaccination using live attenuated virus strains as vaccines. In addition to these measures, preparedness will be a key additional aspect of future control

programmes in Europe. This will ideally include education of veterinarians, farmers and livestock workers so they are able to recognise clinical cases of LSD in a timely fashion, capacity-building in regional and national laboratories to enable the rapid diagnosis of the disease once suspected, and stockpiling of vaccine.

There is no doubt that the current LSD epidemic poses a significant threat to Europe. Our ability to devise effective, safe, and economically sound LSD control programmes is greatly hampered by key gaps in our understanding of the disease. Three of the most important gaps are highlighted here: 1. The means by which the virus is transmitted from animal to animal and herd to herd, and how this varies under different ecological and climatic conditions, is incompletely understood. In particular the role of vector transmission and the vectors involved is unclear. Therefore the effectiveness of quarantine zones and vector control as part of an eradication campaign cannot be judged. 2. The lack of a simple, rapid and sensitive serological test for LSDV infection means it is very challenging to detect historically or subclinically infected animals. As a result, surveillance studies for LSD are imprecise and it is difficult to track LSD outbreaks or prove disease-free status in a particular region or country. 3. The lack of a suitable vaccine is another key problem. The only currently available LSD vaccines are live-attenuated virus strains which are banned from use in the EU unless specific legislative guidelines are met. The immune response induced by these vaccines cannot be distinguished from that induced in naturally infected animals therefore differentiation of vaccinated and infected animals is not possible, further hampering disease surveillance and proving disease-free status.

The seemingly inexorable spread of LSD into Europe is alarming, particularly for countries in eastern Europe and the Balkans who are under direct threat. With the warmer months likely to increase vector activity, further expansion of LSD into Europe is widely anticipated. There is a clear need for immediate co-ordinated action to limit the spread and impact of this transboundary disease and, in the future, better resourced and targeted research efforts to tackle the key knowledge gaps. It is only by understanding the fundamental biology of LSDV that we will be able to develop safe and effective diagnostic tests and vaccines with which to eradicate LSD.

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Figure captions:

Figure 1. Calf exhibiting multiple cutaneous nodules characteristic of LSD. Image provided by Dr Neil Fourie and Professor Estelle Venter.

Figure 2. Map detailing the spread of LSD through the Middle East and into Europe. Colours represent the year the disease was first reported in the country. FYROM = Former Yugoslav Republic of Macedonia. Data sourced from the OIE WAHID (World Animal Health Information Database).

References:

Ben-Gera, J., E. Klement, E. Khinich, Y. Stram and N. Y. Shpigel (2015). "Comparison of the efficacy of Neethling lumpy skin disease virus and x10RM65 sheep-pox live attenuated vaccines for the prevention of lumpy skin disease - The results of a randomized controlled field study." Vaccine **33**(38): 4837-4842.

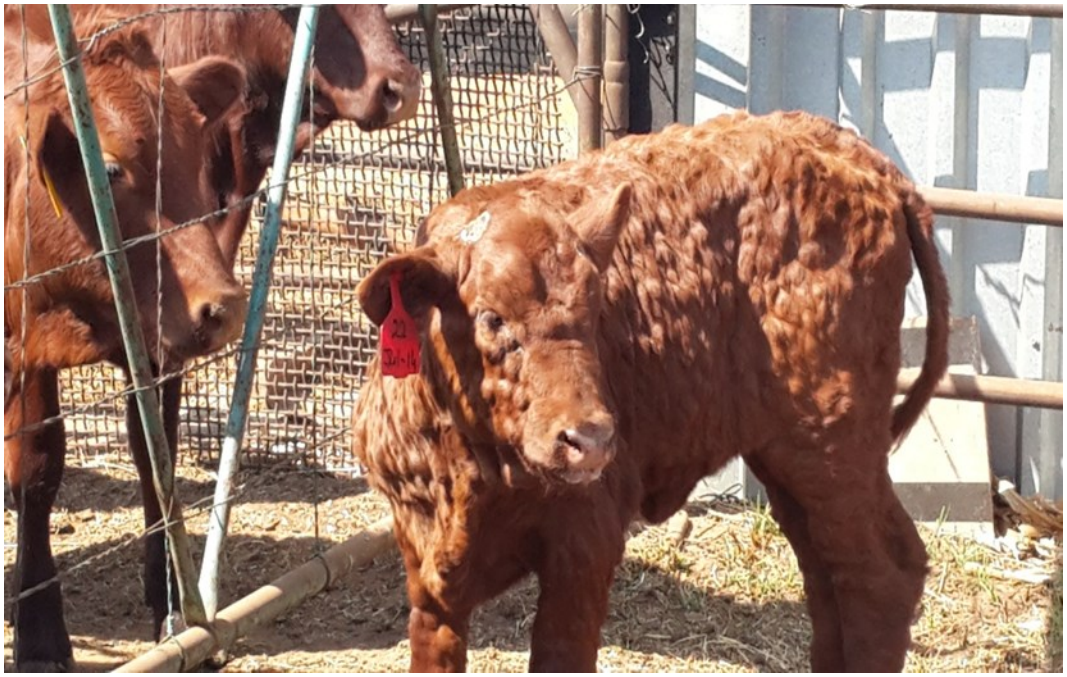
Chihota, C. M., L. F. Rennie, R. P. Kitching and P. S. Mellor (2001). "Mechanical transmission of lumpy skin disease virus by Aedes aegypti (Diptera: Culicidae)." Epidemiol Infect **126**(2): 317-321.

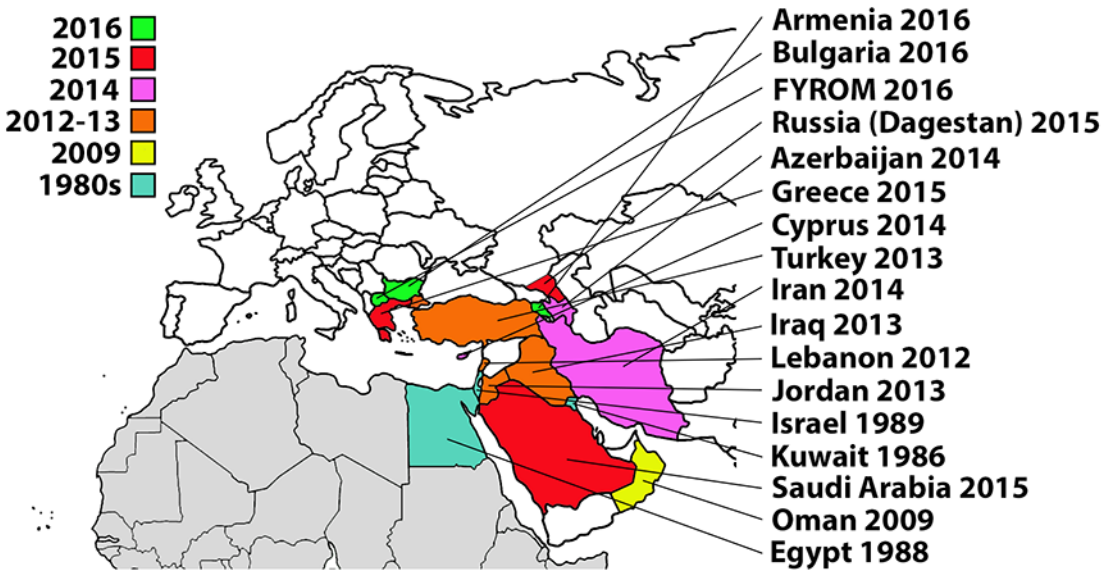
Kitching, R. P. and P. S. Mellor (1986). "Insect transmission of capripoxvirus." Res Vet Sci **40**(2): 255-258.

Sevik, M. and M. Dogan (2016). "Epidemiological and Molecular Studies on Lumpy Skin Disease Outbreaks in Turkey during 2014-2015." Transbound Emerg Dis.

Tasioudi, K. E., S. E. Antoniou, P. Iliadou, A. Sachpatzidis, E. Plevraki, E. I. Agianniotaki, C. Fouki, O. Mangana-Vougiouka, E. Chondrokouki and C. Dile (2016). "Emergence of Lumpy Skin Disease in Greece, 2015." Transbound Emerg Dis **63**(3): 260-265.

Tuppurainen, E. S., J. C. Lubinga, W. H. Stoltsz, M. Troskie, S. T. Carpenter, J. A. Coetzer, E. H. Venter and C. A. Oura (2013). "Mechanical transmission of lumpy skin disease virus by Rhipicephalus appendiculatus male ticks." Epidemiol Infect **141**(2): 425-430.




2016
2015
2014
2012-13
2009
1980s
Armenia 2016
Bulgaria 2016
FYROM 2016
Russia (Dagestan) 2015
Azerbaijan 2014
Greece 2015
Cyprus 2014
Turkey 2013
Iran 2014
Iraq 2013
Lebanon 2012
Jordan 2013
Israel 1989
Kuwait 1986
Saudi Arabia 2015
Oman 2009
Egypt 1988