DISCONTOOLS

# Parapox viruses
## Summary

### Introduction

1. This note provides a brief summary of an analysis undertaken by a DISCONTOOLS group of experts on parapox viruses (PPV). They reviewed the current knowledge on the disease, considered the existing disease control tools, identified current gaps in the availability and quality of the control tools and finally determined the research necessary to develop new or improved tools. Full details of the analysis can be downloaded from the web site at http://www.discontools.eu/ by selecting Disease Database, then the specific disease and highlighting the variables of interest. This is completed by selecting "create a report" which can then be downloaded as either a PDF or Excel spread sheet

### Disease profile

2. The genus *Parapoxvirus* (PPV) includes three members for which zoonotic transmission has been reported: bovine papular stomatitis virus (BPSV), which infects cattle/camels, pseudocowpox virus (PCPV) affecting cattle/reindeer/dromedarius/humans and orf virus (OV) which can infect sheep/goats/reindeer/muskox/humans. All cause contagious skin infection. PPV associated infectious diseases are found throughout the world. PPV diseases are normally self-limiting with low impact on individual animals, although lack of thrift is common leading to delayed finishing times. Occasional severe outbreaks can occur leading to fatalities. Scabs contain millions of virus particles which, when they dry up and drop off the animal, will contaminate the environment for years. The PPVs are very stable in dry environments but can also persist in clinically healthy animals.

3. PPVs are highly transmissible (almost 100% morbidity on affected farms). The majority of PPVs are transmissible to man with disease considered an occupational hazard to farmers, shepherds, veterinarians, animal handlers, meat and wool processors and also associated with religious slaughter of animals

### Risk

4. PPV infections and in particular orf have a great economic impact to those rural communities that are reliant on livestock farming for their livelihood. OV is in the top twenty most important viral diseases of sheep and goats globally in terms of impact on the poor. No country has eradicated the diseases. Prevention and control is normally a combination of vaccination and sanitary / bio-security measures. Recent gains in diagnostic and treatment capacity for orthopoxvirus infections engendered through bio-terror preparedness activities could be leveraged to combat the negative health and welfare impacts of PPV infections

5. In general, however, there is likely to be underreporting of the occurrence of zoonotic poxvirus infections worldwide as appropriate diagnostic assays are not readily available, and the stigma attached to producers and hunters due to contact with these agents is considerable. These are classic neglected zoonoses with considerable potential to cause significant, even life-threatening, disease in humans and animals as well as profound negative impacts on agricultural productivity.

### Diagnostics

6. ELISAs and PCRs are available but are performed at academic institutions or in public health reference laboratories. Recently, possibly due to the increase in severe outbreaks of disease, laboratories across Europe, the US, Japan, India and South Africa have shown an interest in the PPV. In most instances this has been to confirm diagnosis of disease outbreaks, thereby reducing the incidence of misdiagnosis.

7. There are no routine diagnostic tests in use for poxviruses which can lead to misdiagnosis with other pathogens causing vesicular disease in ruminants. Practical problems emerged during the 2001 pan Asiatic type O FMD outbreak in the UK because of the difficulty of diagnosing FMD in sheep in the face of orf infection. The development of rapid and reliable diagnostic tests capable of distinguishing between the PPVs and other agents causing vesicular disease in ruminants especially the notifiable diseases would be beneficial. The development of rapid validated pen side devices to rapidly distinguish PPV from other agents would also be of value.
8. A standard diagnostic test needs to be established to assess PPV associated disease across Europe. The specificity and sensitivity of diagnostic tests also needs to be maximised against the library of virus strains from across Europe. Equally important would be an assessment of worldwide PPV strain variability to develop accurate diagnostics test that can differentiate between endemic and imported isolates. This may also allow for regional differentiation and could enhance epidemiological efforts.

**Vaccines**

9. Limited licenced vaccines are available only for OVs but efficient and safe vaccines providing long lasting immunity are not available. All current vaccines are fully virulent live viruses that can themselves cause outbreaks of disease. No vaccines are under development for specific use in animals.
10. There are few commercial vaccines against OV, with none having authorisation for use across the whole of Europe, . There is a need to improve vaccines against OV since current vaccines are fully virulent live viruses. It is most likely that protective immunity to OV requires the stimulation of a cellular response. It cannot be predicted if this will be achieved most efficiently by a non-infectious subunit vaccine, an engineered attenuated OV, or some other means such as a vector containing the appropriate OV genes. For this reason it is important to pursue each of these lines of investigation. Viral antigens must be delivered in such a way as to stimulate a cell mediated response. The most promising candidate is DNA vaccination.

**Pharmaceuticals**

11. There are no approved veterinary treatments for poxvirus related Infections with none available commercially. Antivirals have been tested successfully in vitro, ex vivo and in vivo experiments.

**Knowledge**

12. There are significant areas of uncertainty in the understanding and knowledge about the disease caused by PPVs especially in relation to pathogenesis, immunology, epidemiology and control. These include a lack of information on the prevalence of severe PPV disease and nothing is known about the risk factors associated with severe disease. Information is missing about the clinical and subclinical prevalence of PPV infections in cattle, red deer and small ruminants in EU member states and the implications of this for public health and livestock production. The possibility of subclinical infections in animals needs to be investigated. The stability of live virus under ambient conditions in nature is largely unknown. Several aspects of virus genotype associated pathology remain undefined and are currently under study.
13. Further research is needed to fill these knowledge gaps as many are linked to the research requirements to develop more effective tools for the control of the disease. Full details of the gaps are shown in the Disease and Product analysis for PPV on the DISCONTOOLS web site.

**Conclusions**

14. No vaccines capable of providing sterile immunity for PPVs are available. Obstacles for prevention and control of zoonotic poxviruses include, an absence of readily available diagnostic assays, lack of familiarity with human and animal clinical disease (among veterinarians and physicians), lack of vaccines and therapeutics to prevent virus acquisition/transmission and current incomplete understanding of the burden and distribution of zoonotic poxviruses globally.
15. Research in this field may lead to a reduction in the incidence, and therefore in the impact, of parapoxvirus associated disease. This will not only have benefits for the health and welfare of affected animals, but should also reduce the zoonotic impact on human health.