# Peste Des Petits Ruminants
## Summary

### Introduction

1. This note provides a brief summary of an analysis undertaken by a DISCONTOOLS group of experts on Peste des Petits Ruminants (PPR). 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. PPR virus (PPRV) is a member of the family Paramyxoviridae, genus *Morbillivirus* and is antigenically closely related to rinderpest virus. Four genetic lineages of PPR virus have been identified, but only one serotype. Since its first description in the Ivory Coast in 1942 PPR has expanded to cover large regions of Africa, the Middle East and Asia. Southern Africa is still free of the disease, but it appears to be spreading in that direction. PPRV is circulating endemically in Turkey, in close vicinity to the Europe Union. There have been outbreaks in Georgia and Mongolia in 2016/2017, areas where the disease had never been reported before.

3. PPR affects sheep, goats, and a large number of species within the order Artiodactyla, both wild and captive, with a mortality rate of 50-80% in a susceptible population. The recent outbreak in Mongolia resulted in thousands of deaths in endangered Saïga antelopes, highlighting the threat of PPR to endangered wild species. The disease spreads mainly by direct contact with discharges from infected animals. Extensive systems with communal resources and seasonal migration facilitate disease transmission. No carrier or reservoir has yet been identified.

### Risk

4. The increase of animal movement for commercial and trade purposes (e.g. the massive imports of small ruminants to the Middle East), transhumance and nomadic customs along with extensive farming practices have all contributed to the maintenance and global spread of PPR. The current spread of PPRV Asian lineage IV across Africa is one result of this transboundary dynamic. The fact that both PPRV Asian lineage IV, and East African lineage III have been found in the Middle East indicates that sources of infection in this region are probably infected sheep and goats imported from both Asia and East Africa. Emergence in the EU may occur via the illegal importation of animals, notably from North Africa or Turkey. Movement of wildlife (e.g. wild deer) throughout Europe may also play a role in disease emergence and spread.

5. PPR virus infection has for many years been one of the most important constraints to the increase in production of small ruminants in sub-Saharan Africa and parts of Asia. The presence of disease can limit trade, export, import of new breeds and the development of intensive livestock production. PPR is a major constraint on the availability of protein for human consumption as well, and represents a significant threat to food security. It has an important impact on livelihood and economic stability for low-income farmers. There are difficulties in the control of movements of affected and more importantly incubating animals into disease free areas. PPR can be controlled through mass vaccination campaigns, but better farmer and veterinary awareness, appropriation of the process and involvement of stakeholders, vaccine delivery, and early detection of (re)occurrence are a necessary condition for rapid response and the effective management of possible outbreaks of PPR.

### Diagnostics

6. Syndromic diagnosis can be difficult in areas where multiple diseases circulate. Immunocapture enzyme-linked immunosorbent assay (ICE-ELISA), and nucleic acid amplification are the most currently used diagnostic tests for PPRV identification. Serological tests including the competitive ELISA and virus neutralisation are also routinely used to assess herd exposure where mild disease may circulate and/or vaccination status. Commercial

serological and virological diagnostic kits are available, but for the routine use in developing countries where PPR is endemic (Asia, Middle East and Africa) these kits are too expensive.

7. Currently it is not possible to differentiate infected from vaccinated animals (DIVA) using existing vaccines and companion diagnostic tests. DIVA tests will be important to provide meaningful assessment of vaccine coverage and epidemiological surveillance where the virus is circulating. This will be especially important for the last stages of the eradication programme and for countries to get disease-free status faster. Lateral flow devices for antigen detection are available and in development, but penside tests for genome detection and non-invasive tests adapted to wildlife are also needed. Validation of new tests must be undertaken both in the laboratory situation but also under field conditions in countries where the disease exists.

**Vaccines**

8. Current live attenuated vaccines for PPR provide a good immunity which may last for at least 3 years but vaccinated animals cannot be distinguished serologically from naturally infected animals. A cold chain is required for transport and storage of PPR vaccine. Stability of vaccines in lyophilized form and when resuspended vary among producers. Vaccines highly stable in lyophilized form are being tested in the field. Most vaccines are effective for only 2-3 hours after resuspension, but some can be used for up to 24hrs. Not all vaccines produced go through strict quality control procedures, so effectiveness of vaccines may vary.

9. Commercially available live attenuated PPRV vaccines are available from more than 20 vaccine production companies and government laboratories in Africa, the Middle East, Asia and Turkey. There are no commercial vaccines authorised for use in Europe.

10. New generations of vaccines are under development or in field trial: recombinant Capripox-based PPR vaccine able to protect against both Capripox and PPR, DIVA vaccines, conventional live attenuated vaccine with high stability in lyophilized form.

**Pharmaceuticals**

11. There is no therapy for PPR. Potential for pharmaceuticals is extremely limited as EU regulations do not allow treatment of PPR-infected animals.

**Knowledge**

12. Significant areas of uncertainty in the understanding and knowledge about PPR exist especially in relation to pathogenesis, immunology, vaccinology, and epidemiology. Information is needed in areas such as the identification of factors involved in the variation of host susceptibility, determinants of PPRV pathogenicity, the importance of animal species other than sheep and goats in the epidemiology of PPR, the potential importance of indirect transmission of virus, and the transboundary transmission dynamics of PPRV, notably in complex multispecies systems. Research is needed to fill these gaps in knowledge. Full details of the gaps are shown in the Disease and Product Analysis for PPR available on the DISCONTOOLS website.

**Conclusions**

13. The PPR situation in countries bordering the EU emphasises the importance of implementing and maintaining appropriate control measures with regard to illegal imports and animal movements to mitigate risks. Equally the tools necessary to control and eradicate any incursion into the EU must be available.

14. PPR is one of the most economically important diseases in developing countries. There is now a global effort to eradicate PPR. Filling the gaps in our knowledge of the disease and development of new diagnostic tools and new vaccines will increase our chances to reach this goal. Importantly, regional coordination and involvement of all stakeholders will be paramount to success. Cooperation of EU member states and European commission should be encouraged.