NO. 42 OCTOBER 2013

empres360
animal health

EMPRES
EMERGENCY PREVENTION SYSTEM

ISSN 1564-2615

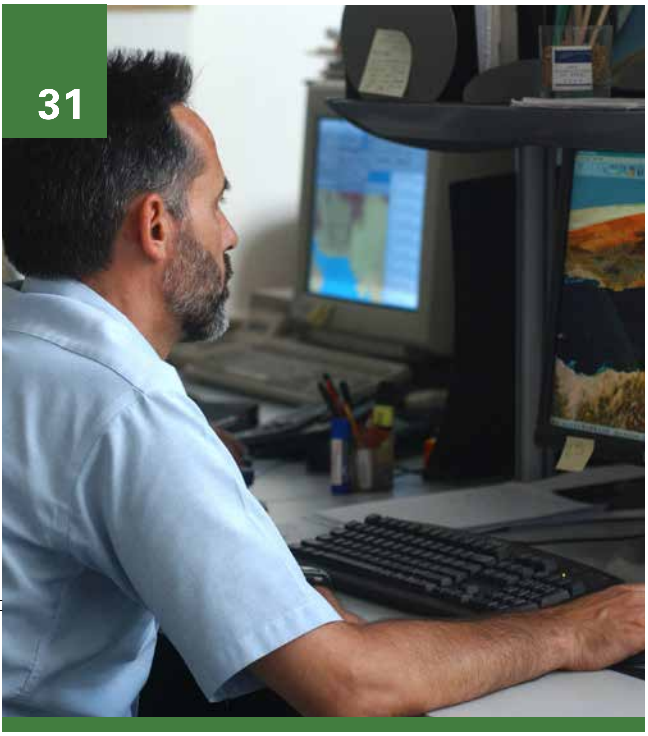
FEATURES

EMPRES-ANIMAL-HEALTH@FAO.ORG
WWW.FAO.ORG/AG/EMPRES.HTML

contents

6

©FAO/Sia Kambou



31

©FAO/Giuseppe Bizzarri

©FAO/Vincent Martin

GUEST EDITORIAL

Protecting health, improving food security and enhancing livelihoods requires integrated animal and public health systems

Vincent Martin **(FAO)**

The livestock sector is growing rapidly to satisfy a vigorously expanding demand for animal food products. The expansion of this sector has the potential to unleash a number of important socio-economic benefits, including improved livelihoods, steady economic development and strengthened food security. However, the expansion of this sector is also threatened continuously by biological hazards and diseases that have the potential to spread along the entire food chain.

Infectious diseases of a transboundary nature have been repeatedly incriminated as one of the major impediments to the sustainable development of livestock production, especially in poor rural areas. Controlling diseases requires coordination at the international, regional and local levels among a wide range of partners. Disease management needs to be part of a larger development context that includes food security and livelihoods, the effects of climate change and investment in building resilience to protracted crises. In addition, more players are also becoming increasingly active in animal health development (e.g., foundations, civil society, farmers' associations, private sector counterparts and regional economic communities). This trend has lead to new, driving forces and dynamics in the global governance of animal health issues.

In the framework of this new global institutional, economic and political environment, international organizations, and animal and public health actors have adapted incrementally their strategies for the provision of technical assistance. They have also developed collaborative agreements and strategic partnerships in recent decades (e.g., the FAO/OIE Global Framework for the Progressive Control of TADs [GF-TADs] established in 2004 or the FAO/OIE/WHO tripartite Global Livestock Early Warning System [GLEWS] launched in 2006).

These institutional changes have also been driven by a paradigm shift in dealing with the complexity of emerging infectious diseases. Efforts focus increasingly on promoting holistic, "One Health" approaches. These approaches are able to build more robust public and animal health systems and better address the concerns of the poor by promoting cross-sectoral and multidisciplinary initiatives.

Furthermore, an observed transition from traditional, vertical disease control strategies towards horizontal programmes that cut across diseases and fit into the broader context of food security is reshaping the way technical assistance for controlling transboundary animal diseases (TADs) is provided. These changes and their impact on TAD control programmes cannot be underestimated. They have required, during the past years, a proactive adaptation of the Emergency Prevention System (EMPRES) – Animal Health (AH) programme to meet the challenge of emerging and transboundary disease threats in a globalized world. The EMPRES-AH progamme, which "contributes to the global effort of reducing transboundary disease threats in a way that improves food security and livelihoods", is also in line with FAO's new Strategic Objectives (SOs). In particular, EMPRES-AH supports SO5, which aims at increasing the resilience of livelihoods to threats and crisis. 360

©FAO/Giulio Napolitano

Cattle grazing outside the village of Goulbi, the Niger

PERSPECTIVES

The avian influenza A(H7N9) events in eastern China, and FAO's response

Contributors: Sophie von Dobschuetz **(FAO)**, Guillaume Belot **(FAO)**, Cortney Price **(FAO)**, Stephanie Sonnberg **(FAO/St. Jude Children's Research Hospital)**, Astrid Tripodi **(FAO)**, Vincent Martin **(FAO)**

On 31 March 2013, the authorities of China reported the first three human cases of infection with a novel avian influenza strain A(H7N9) in eastern China. These cases suffered from severe pneumonia and all three people died. Since then the disease situation in humans has evolved, with new cases reported daily by the Chinese Ministry of Health and Family Planning Commission until 7 May 2013. By 20 May, 131 human cases had been reported from eight provinces (Anhui, Fujian, Henan, Hunan, Jiangsu, Jiangxi, Shandong and Zhejiang), two municipalities (Beijing and Shanghai) and Taiwan Province of China.

This is the first time that an influenza A virus of the H7N9 subtype has been identified in humans. Reports as of 1 August 2013 suggest that many human cases had been in contact with poultry prior to the onset of disease, including at live bird markets and through the transportation, slaughtering and handling of poultry. Surveillance activities in animals in the areas where human cases have been found identified few individual birds infected with the virus. These birds showed no clinical signs. Most positive samples originated from live bird markets, poultry traders' flocks and the premises of one homing pigeon breeder in Jiangsu Province. Further research by the Huzhou Center for Disease Control and Prevention (Zhejiang Province) showed that of 210 samples obtained from live bird markets and two private households in the city of Huzhou, 61 were virologically positive.[1] These results may mean that prevalence of the virus in poultry in affected areas is higher than originally thought.

At this stage, most human cases can be linked to contact with live poultry at live bird markets or through trade, but confirmatory information is needed and investigations are continuing, to identify the origin of human exposure to the virus. Although the virus can infect humans and cause severe disease, there is currently no evidence suggesting sustained human-to-human transmission. However, human-to-human transmission may be possible where there is close contact between human cases and other humans, as in families or in health care settings.

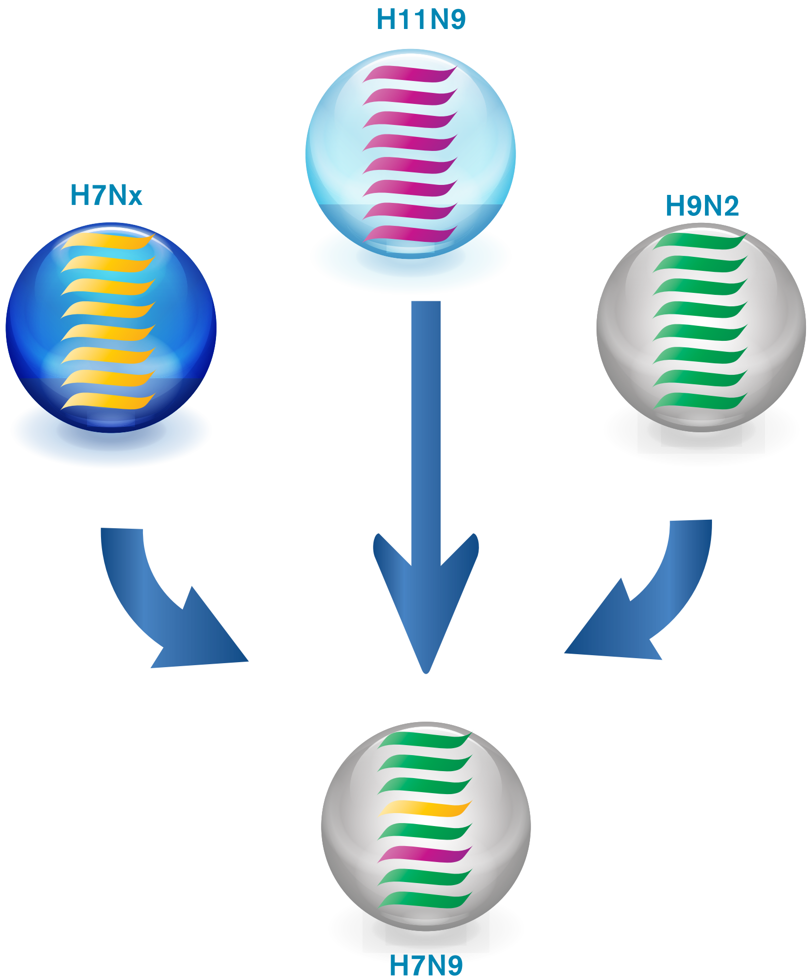


Figure 1: Reassortment of three avian influenza viruses that generated H7N9.
Influenza virus genomes have eight separate gene segments. To generate the avian influenza A(H7N9) virus, three avian influenza ancestor viruses mixed, likely in birds and most probably in two separate events. However, the intermediate viruses have not yet been found and the bird species in which these events occurred is not known. Additional investigations in the field and research in laboratories are addressing these knowledge gaps. The neuraminidase (NA) type of the H7 virus donating the HA segment is not known (indicated with "x").

China responded swiftly to the situation by implementing vigorous control measures in the poultry chain, including the culling of poultry, transport bans, the closure of live bird markets, and market disinfection. These measures had severe impacts on poultry producers and traders. According to the China Animal Husbandry Association, poultry industry losses caused by the event already exceed US$6.5 billion as of mid-May 2013.

The Food and Agriculture Organization of the United Nations (FAO) set up an emergency incident team at its China office and a remote expert team at Headquarters and the Regional Office for Asia and the Pacific. Since the first days of the event, FAO experts liaised with the Chinese authorities, the international scientific community and

[1] Reported in *Eurosurveillance*, 18(20): http://www.eurosurveillance.org/viewarticle.aspx?articleid=20481

One Health partners such as the World Organisation for Animal Health (OIE) and the World Health Organization (WHO). Efforts focused on improving understanding of the virology and epidemiology of H7N9, including virological traits, virus detection in animals, animal sources and reservoirs, and the level of risk that H7N9 may pose to animal populations.

Analysis of the viral genome by FAO Reference Centres and partners revealed that the strain is a triple reassortant H7N9 influenza virus generated from three low pathogenic avian influenza viruses:[2]

1. A low pathogenic H7 virus found in wild and domestic birds, particularly waterfowl, donated the haemagglutinin (HA) gene segment.
2. The N9 gene was donated by a low pathogenic virus found in wild birds.
3. A low pathogenic H9N2 virus that is commonly found in chickens donated the six internal genes.

At present, the avian influenza A(H7N9) virus is considered to be a low pathogenic virus, which decreases the chances of finding infection in birds and necessitates adaptation of surveillance strategies originally designed for highly pathogenic avian influenza (HPAI).

To help guide countries in taking appropriate prevention and control measures in response to this event, FAO is promoting several early reaction and coordination actions:

- updating laboratory protocols to help veterinary services improve their detection of the new virus;
- advising countries on enhanced and targeted surveillance methods in light of the current low pathogenicity of the new virus;
- reviewing countries' emergency and contingency planning efforts, and providing advice;
- raising global awareness of the need for enhanced biosecurity to protect animals and people;
- collecting, assessing and analysing information on the virus and the animal health situation, and disseminating digests of findings to partners and the general public;
- bringing together experts from multiple disciplines to discuss prevention and control strategies and assess risks.

An emergency expert meeting was organized at FAO Headquarters in Rome, Italy on 17–18 April 2013, where leading international specialists from many disciplines – including epidemiology, public health, virology, disease modelling, risk management, biosecurity, food safety and communications – worked with teams of FAO experts. In this response, FAO can build on experience amassed over more than eight years of helping prevent the global spread of H5N1 HPAI. FAO used the science-based advice from the expert meeting to produce draft guidelines on risk assessment, surveillance along the production chain, risk management and risk mitigation.

> "At present, the avian influenza A(H7N9) virus is considered to be a low-pathogenic virus, which decreases the chances of finding infection in birds"

H5N1 HPAI and, more recently, pandemic influenza H1N1 (2009) have shown the world that multidisciplinary and transparent coordination is fundamental to effective pandemic preparedness. With the aim of delivering multidisciplinary practical guidance to member countries, FAO and partners are applying the One Health approach to put their knowledge to work for member countries. As the H7N9 situation evolves, FAO is committed to continuing its key role in coordination and knowledge dissemination in support of pandemic preparedness and in defence of vulnerable livelihoods placed at risk by H7N9 and other animal and human health threats. 360

Live fowl for sale at a street market

[2] Reported in the *New England Journal of Medicine*: http://www.nejm.org/doi/full/10.1056/nejmoa1304459?query=featured_home#t=articleresults

©Visiontime/J. Scerri

PERSPECTIVES

FAO's approach for supporting livelihoods and building resilience through the progressive control of peste des petits ruminants and other small ruminant diseases

Contributors: Felix Njeumi **(FAO),** Vincent Martin **(FAO)**

BACKGROUND

Peste des petits ruminants (PPR) is a widespread, virulent and devastating disease of domestic and wild small ruminants. Also referred to as goat plague, it is caused by a morbillivirus closely related to rinderpest virus. It can have significant economic, food security and livelihood impacts. The disease was first described in 1942 in Côte d'Ivoire (West Africa) and subsequently confirmed in other regions. To date, the presence of the virus has been confirmed in large areas of Asia, the Near East and Africa, and is spreading to new countries, affecting and threatening directly or indirectly an increasing number of small ruminants and livestock keepers. Since the late 1970s, sub-Saharan Africa, then the Near East and Asia (west, central and south) have experienced severe epidemics. Expansion into new, uninfected territories has continued, particularly from 2004 to 2012, when the virus extended its range southwards in Africa as far as southern parts of the United Republic of Tanzania in 2008 and the Democratic Republic of the Congo and Angola (Cabinda Province) in 2012. It also advanced into North Africa, to Tunisia in 2006, Morocco in 2008 and Algeria in 2011. Outbreaks occurred in China (Tibet Autonomous Region) in 2007, the Maldives in 2009, and Bhutan and the Comoros in 2010. It is unclear what factors favour the spread of the disease, but many millions of small ruminants in southern Africa, central Asia, southeast Asia, China, Turkey and southern Europe must now be considered at high risk of PPR virus incursion.

CONTROL OF PPR AND OTHER SMALL RUMINANT DISEASES

The relentless spread of the disease in affected countries and the subsequent threat in PPR-free African, Asian and southern Europe countries have resulted in increased recognition of the urgent need to embark on regional and global programmes for controlling this disease.

There are several compelling reasons for the international community to join forces against PPR: i) to stop the rapid spread of the disease within already affected countries and into regions at risk, with particular focus on countries facing an immediate

©FAO/Giulio Napolitano

A woman of the Batwa community tending goats, Burundi threat, in the Southern African Development Community (SADC), the Caucasus and Europe; ii) to mitigate the damage the disease causes to livelihoods in the least economically developed nations, because of the key role that sheep and goats play in national food and nutrition security, income security and livelihood resilience in countries across the world; and iii) to sustain the momentum created by eradication of rinderpest, which increased the international community's interest in addressing PPR at the regional and global levels.

During the global declaration by Heads of State, Heads of Government, ministers, chief veterinary officers (CVOs) and other participants attending the Thirty-Seventh Conference of the Food and Agriculture Organization of the United Nations (FAO) in June 2011, FAO was requested: "to initiate, in collaboration with global, regional and national partners, appropriate programmes for the control and eradication of peste des petits ruminants within the framework of improved ruminant health".

In line with this request, FAO has released a position paper on PPR and small ruminant disease control, which outlines the preliminary steps for initiating regional approaches and – later – global initiatives, and identifies appropriate partnerships for driving and implementing the required activities. A strategic framework has been formulated, defining a common vision for PPR prevention and control (see link at the end of article). This common vision will facilitate a consistent, cohesive and coordinated response focused on eliminating the threat that small ruminant diseases (particularly PPR) pose to the livelihoods, food security and health of people at the national, regional and global levels.

FAO, the World Organisation for Animal Health (OIE) and the International Atomic Energy Agency (IAEA) have established a PPR Working Group tasked with formulating a global strategy. The overall goal of this strategy will be the progressive control and eradication of PPR from the small ruminant sector in Asia and Africa, and the prevention of further introductions of the disease in non-infected countries, thereby: i) promoting viable small ruminant production; and ii) improving the livelihoods of small ruminant stakeholders, especially the poor.

The FAO framework proposes two guiding principles for the strategy:

1. The approaches used for controlling PPR should be based on the best available epidemiological knowledge and an optimal preparedness to prevent the further spread of the disease.
2. The approaches will be livelihood-centred and tailored to address country- and sector-specific epidemiological scenarios.

The purpose of the strategic framework is to contribute to the overall objective by:

1. providing robust country- and sector-specific technical options for the prevention and control of PPR and other diseases in small ruminants;
2. building the capacity to implement and maintain these technical options;
3. supplying analytical and logistics support to ensure that the technical options can be implemented in ways that are sustainable, technically sound and socially equitable.

The relative priorities placed on the different components[1] of the framework in individual countries will vary depending on the epidemiological scenarios in each country, the progress made with national strategies, and the capacity to implement the options and approaches for PPR prevention and control. Countries that are currently not infected will give higher priority to components 1 and 2, while countries where the disease is already endemic will prioritize components 2 and 3. Countries with limited research capacity may give lower priority to component 4. Components 5 to 9 will be important in all countries.

It is suggested that the global strategy incorporating all of these components be implemented in three consecutive phases:

1. improvement of epidemiological understanding and establishment of progressive control;
2. progressive control;
3. final eradication and verification.

The programme will be linked to FAO and OIE Reference Laboratories and regional and subregional (disease-specific) networks and will include research components on the epidemiology of PPR in camels and wildlife, the efficiency of vaccine delivery systems and the socio-economic impact of the disease.

Key research areas for ensuring success include:

- development and transfer of an effective thermo-stable vaccine against PPR (and sheep and goat pox) in the short term;
- development of improved diagnostics tools such as pen-side tests, robust antigen/ribonucleic acid (RNA) detection tests and robust serological tests (Differentiating Infected from Vaccinated Animals [DIVA]) in the long term;
- epidemiological research, including antibody/virus dynamics in populations, estimation of the basic reproductive rate, determinants of virus virulence, and wildlife/livestock interactions;
- cost-effectiveness of progressive control options, along with incentives for economic contributions and participation, including the development of guidelines and a methodology for understanding the socio-economics of PPR and other small ruminant diseases.

CONCLUSION

FAO is committed to reducing the impact of transboundary animal diseases on livelihoods by tackling PPR through support to countries' development of PPR eradication strategies that are sustainable, realistic and implementable. FAO recognizes the important role that healthy small ruminants play in reducing the vulnerability of smallholders, and perceives smallholders as important actors in disease management and control. It proposes a livelihood-centred response with a twin vision focusing on both immediate and medium-term goals to protect the assets of small ruminant keepers.

The immediate response will be based on clear, epidemiologically defined, targeted surveillance and vaccination, and enhanced capacities for early warning and response. It will be complemented by a medium- to long-term strategy to enhance the technical capacities of communities and small ruminant owners to protect their assets through improved integrated activities targeting small ruminant health and productivity.

Although country-level progressive control of PPR and other small ruminant diseases is possible, coordinated interventions through subregional strategies that take into account country-specific realities and requirements will provide synergies and benefits that are not available to stand-alone and uncoordinated approaches. The global framework provides a guideline for formulating subregional or regional strategies for the progressive control and eradication of PPR, to support livelihoods and build the resilience of poor rural people who are dependent on small ruminants.[360]

[1] More information on the components are available in the full position paper at: http://www.fao.org/docrep/017/aq236e/aq236e.pdf

PERSPECTIVES

FLURISK global review and characterization of influenza surveillance systems

Contributors: Sophie von Dobschuetz **(RVC and FAO)**, Olga Muñoz **(IZSVe)**, Marco De Nardi **(IZSVe)**, Sylvie van der Werf **(IP)**, Katharina Stärk **(RVC)**[1] and the **FLURISK consortium**

The FLURISK project is funded by the European Food Safety Authority (EFSA) to develop and validate an influenza risk assessment framework (IRAF) that will allow the ranking of animal influenza A strains according to their potential to cross the species barrier and cause human infection (see project description on page 24). Project activities include reviewing and describing the animal and human influenza virus surveillance strategies and control programmes that are currently in place in the veterinary and public health sectors. Results are to be used in the mapping of influenza surveillance coverage by geographic area and of the variation in coverage worldwide. Two questionnaires have been developed: one on surveillance in animal populations and one on surveillance in humans.

CHARACTERIZATION OF INFLUENZA SURVEILLANCE SYSTEMS IN ANIMALS

The review and characterization of influenza surveillance systems in animals is led by the Royal Veterinary College (RVC, United Kingdom of Great Britain and Northern Ireland) in collaboration with the Food and Agriculture Organization of the United Nations (FAO) Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES). The aim is to assess the global capacity for early detection of potentially zoonotic influenza viruses circulating in animal populations. The assessment will ultimately allow the identification of geographic areas and/or the targeting of species that would benefit from strengthened influenza surveillance activities.

The specific objectives are to:

1. review the systems, tools and approaches for animal influenza surveillance and control strategies that are currently being implemented around the world;
2. describe and evaluate the current monitoring of animal influenza viruses;
3. measure the coverage of animal influenza surveillance by country and species;
4. assess the variation in this coverage around the world;
5. identify gaps or weaknesses in animal influenza surveillance.

A preliminary study of publically available data – such as the World Organisation for Animal Health (OIE) World Animal Health Information Database (WAHID), ministry of agriculture web sites, and surveillance project descriptions on the web sites of non-governmental organizations and institutions – revealed that information on national or regional surveillance activities regarding influenza viruses in animals is scarce and scattered throughout the public domain. The information also often lacks the details needed for assessing the preparedness and response activities of countries or regions.

So far, the only study in this field was conducted by the OIE/FAO Network of Expertise on Animal Influenza (OFFLU) in 2009 (Swayne *et al*., 2011;[1] Pavade *et al*., 2011)[2] and describes surveillance strategies for highly pathogenic avian influenza in a subset of countries in Africa, Asia and Europe. Results of the OFFLU study have been integrated into this review.

METHODOLOGY

A database and questionnaire were designed to collect information on influenza surveillance in animals, the control actions taken when positives are detected, and the communication of results. In January 2013, through FAO's Chief Veterinary Officer (CVO) Juan Lubroth, 183 CVOs were asked to review and – if necessary – add to and update the information collected by the FLURISK team before it was released for publication.

The data has to be analysed according to the following parameters:

- surveillance type: active, passive, sentinel, participatory disease surveillance; objectives and purpose;
- surveillance frequency: continuing, by rounds; specific times of year;
- targeted disease, population and production sector;
- sustainability: funding sources;
- surveillance results: case definition; positives found; sequencing performed: yes/no, and extent;
- control actions when positives are detected: epidemiological investigation, vaccination, culling, movement control;
- communication and reporting of results: whom to, means, frequency, sequences uploaded in public databases, whether public health sector is alerted.

Analysis of these parameters allowed categorization and weighting of the reliability and geographical coverage of animal influenza surveillance strategies. These findings will be used as a parameter in the FLURISK IRAF and will inform the assessment of the global-level capacity for early detection of potentially zoonotic influenza viruses in animals.

CHARACTERIZATION OF INFLUENZA SURVEILLANCE SYSTEMS IN THE HUMAN POPULATION

The second review, characterizing influenza surveillance systems in humans, was led by the *Institut Pasteur* (IP, Paris, France). The aim of this task was to examine whether and how animal influenza viruses are detected during surveillance in humans. The consortium used a multidisciplinary approach to generate the questionnaire, reflecting its medical and veterinary expertise. Questions focused on surveillance systems for human influenza and for influenza at the human–animal interface. The latter part of the questionnaire investigated the reporting of results, to estimate the region's capacity for the timely detection of introduction of animal influenza viruses into the human population. Questions pertaining to other areas of the surveillance system were also included.

METHODOLOGY

National influenza centres and influenza reference laboratories were identified in August 2012 through publically available databases, such as the World Health

[1] http://web.oie.int/boutique/extrait/18swayne839870.pdf

[2] http://web.oie.int/boutique/extrait/02pavade661671.pdf

Organization (WHO) web site. Between August and September 2012, 123 countries were contacted by electronic or postal mail and a total of 147 questionnaires were sent to heads of laboratories (some countries have more than one reference laboratories).

The questionnaire included several sections providing information on:

- **A.** surveillance component: human influenza;
- **B.** influenza surveillance at the human–animal interface;
- **C.** virus characterization: for influenza surveillance in humans and at the human–animal interface;
- **D.** laboratory biosafety;
- **E.** quality assurance;
- **F.** shipment of samples: imports and exports;
- **G.** surveillance of other respiratory diseases;
- **H.** reporting of results: for influenza surveillance in humans and at the human–animal interface.

Section A gathered data on surveillance of human influenza, such as the kind of network (sentinel or non-sentinel) on which active surveillance was based, the type of specimens collected and the case definitions used. Section B aimed to find out whether active or passive surveillance at the human–animal interface was carried out in a country and how these systems were designed, such as target populations, the screening methods used, whether and how the systems interact with the veterinary sector, and whether research is conducted regarding influenza at the human–animal interface. Sections C and H apply to both human and animal influenza virus surveillance in humans, and aimed to generate information on the handling of samples, virus characterization through sequencing, and the availability of sequences in public databases. Sections D, E, F and G collected general information about the organization and activities of the laboratory.

Analysis of this information allowed measurement of the sensitivity of current surveillance systems in detecting zoonotic influenzas in humans, and assessment of interdisciplinary interaction and data sharing. The final results will be inputs to the FLURISK IRAF.

REFERENCES

Swayne, D.E., Pavade, G., Hamilton, K., Vallat, B. & Miyagishima, K. 2011. Assessment of national strategies for control of high-pathogenicity avian influenza and low-pathogenicity notifiable avian influenza in poultry, with emphasis on vaccines and vaccination. *Rev. sci. tech. Off. Int. Epiz.*, 30(3): 839–870. http://web.oie.int/boutique/extrait/18swayne839870.pdf

Pavade, G., Awada, L., Hamilton, K. & Swayne, D.E. 2011. The influence of economic indicators, poultry density and the performance of Veterinary Services on the control of high-pathogenicity avian influenza in poultry. *Rev. sci. tech. Off. Int. Epiz.*, 30(3): 661–671. http://web.oie.int/boutique/extrait/02pavade661671.pdf

CONCLUSION

By sharing information on their existing influenza surveillance systems, countries are not only contributing directly to the FLURISK project and development of the IRAF but also facilitating assessment of the extent to which the One Health concept is applied, the sensitivity of surveillance systems in detecting novel influenza viruses, and the quality of the data produced by these systems. Results of the reviews will feed into the mapping of influenza surveillance coverage by geographic area and of the variation in coverage worldwide, a parameter used in the FLURISK IRAF. Another important output will be the identification of surveillance gaps. The reviews will provide indications for improving the capacity to detect novel, potentially pandemic influenza strains, and the timeliness of surveillance information flow.

Countries are therefore invited to share their data and knowledge with FLURISK if they have not already done so, thus participating in the development of a common good in pandemic influenza preparedness. 360

©FAO/ Munir Uz Zaman

A woman farmer feeding her ducks in Gopalgonj, Bangladesh

©FAO/Franco Mattioli

Arabian mare and foal at the Arabian Horse Center, Saudi Arabia

©FAO/Noel Celis

Assisted Natural Regeneration (ANR) Approach to Forest Restoration, the Philippines

©FAO/Pius Ekpei

Special Programme for Food Security, Nigeria

©FAO/Klaas Dietze

ADVANCES

Update on implementation of the Global Foot-and-Mouth Disease Control Strategy

Contributors: Klaas Dietze **(FAO-EMPRES)**, Jan Hinrichs **(FAO-RAP)**, Julio Pinto **(FAO-EMPRES)**, Samia Metwally **(FAO-EMPRES)**, Keith Sumption **(EuFMD)**

In June 2012, at the second Global Conference on Foot-and-Mouth Disease (FMD) Control – held by the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE) in Bangkok, Thailand – participants endorsed the Global FMD Control Strategy (the "Global Strategy") jointly prepared and presented by FAO and OIE as the guiding framework for global FMD control efforts. With support from international organizations and development partners, regional bodies and countries are expected to use this framework to consolidate and strengthen FMD control and to facilitate the regional coordination of control efforts. The following overview gives the FAO perspective on recent developments in implementation of the Global Strategy.

The FMD Working Group of the FAO/OIE Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) has switched its main focus from strategy formulation and conference preparation to implementation of FMD control. Recently, at its regular meetings, the working group decided the initial steps for implementing the recommendations of the second FAO/OIE Global Conference on FMD Control. FAO and OIE will coordinate FMD control at the global level, with GF-TADs providing the mechanism for coherent support to countries and regions on their path towards control. In addition to coordination, resource mobilization and strategic alignment of major stakeholders, the working group will focus on providing technical guidance, including on the design and validation of assessment tools for the Progressive Control Pathway (PCP) for FMD and the development of guidelines for post-FMD vaccination monitoring.

The Government of Italy has agreed to support the establishment of a joint FAO/OIE FMD Secretariat based at FAO Headquarters in Rome, as envisaged in the Global Strategy. Under the same agreement, funds need to be secured to support the development of regional roadmaps for FMD control, preparatory work on socio-economic impact assessments of FMD, and technical capacity building in laboratory diagnostics and epidemiology. The roadmaps will guide regional approaches and facilitate regular communication of relevant information among countries within the same virus pool. With the exception of West Africa, each of the country clusters of an FMD virus pool – and some sub-clusters – have established either a regional roadmap or a regular information communication mechanism, and these will require further support and development. In West Africa, FMD control is less of a priority

©FAO/ Klaas Dietze

Buffaloes and their role in FMD epidemiology – one of the questions addressed through an FAO project in Pakistan

©FAO/ EUFMD

FMD lesions

©FAO/ EUFMD

FMD lesions

for many veterinary authorities, and solutions will build on Global Strategy components 2 (strengthening of veterinary services) and 3 (prevention and control of other major diseases of livestock) to incorporate FMD control into a comprehensive package of animal health interventions.

The World Reference Laboratory (WRL) for FMD – the Pirbright Institute in the United Kingdom of Great Britain and Northern Ireland – and FAO are collaborating on the transfer of laboratory results to the Global Animal Disease Information System (EMPRES-i) through a web-based mechanism. Laboratory reports on serotyping, vaccine matching and genetic sequencing will be linked to epidemiological information available in the EMPRES-i database. Once the link between the two databases is established, the WRL will also have access to FAO data layers for further analysis, early warning activities and the formulation or support of FMD disease control strategies.

In December 2012, the FMD Unit at FAO Headquarters, which combines diverse work streams related to FMD, convened an FAO-wide meeting with officers from all relevant countries and regional offices to take stock of the current portfolio of FMD activities and to discuss the regions' gaps and needs for rolling out the Global Strategy.

A wide range of FAO projects and activities covering aspects of FMD control at the regional and country levels are already feeding into the Global Strategy, mainly through the development of FMD epidemiology and laboratory diagnostic capacity and/or the adoption of a PCP approach. For example, the regional project on "FMD Control in Southeast Asia through Application of the PCP within the Framework of Improving National Preparedness for TADs in Developing Countries in Southeast Asia", funded by the Republic of Korea, seeks to improve FMD control and management through application of the PCP-FMD in participating countries – Cambodia, Lao People's Democratic Republic and Viet Nam. By the end of the project in June 2015, participating countries are expected to have reached PCP-FMD stage 2 [1]. Socio-economic impact assessments, value chain studies and social network analyses are among the main tools used in this project to improve understanding of the production and market chains of FMD-susceptible species, animal movement patterns and the socio-economic impacts of FMD.

In line with the underlying technical principle of the Global Strategy – that national and regional circumstances must be considered when control plans are being developed – FAO's Regional Office in Cairo is formulating a regional FMD control strategy for countries of the Near East and North Africa. A first draft of the strategy was presented to the delegates of involved countries and other stakeholders at a workshop in December 2012, and follow-up activities will finalize the strategy and initiate its implementation in the near future.

The European Commission for the Control of FMD (EUFMD), a regional body based at FAO Headquarters and linked to the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) through participation in the FAO FMD Unit, has included a pillar of its 2013–2017 work portfolio to promoting the Global Strategy. This will entail providing expertise to support training in application of the PCP, development of FAO/OIE regional roadmaps and other PCP-related tools and guidelines, and assisting in monitoring of the Global Strategy roll-out by the Global FMD Working Group. Another pillar of EUFMD's plan for 2013–2017 will fund risk reduction activities in the European region, in coordination with GF-TADs. This pillar is to support the continuation of processes under the West Eurasian regional FMD roadmap, including the provision of training and technical support to national PCP action plans, with a focus on national strategy development and the monitoring and evaluation of programmes.

An example of FAO's activities at the country level is the "Development of a Technical Framework for the Progressive Control of FMD in Pakistan" project, funded by the United States Department of Agriculture, which will enable one of the crucial countries for FMD control within the West Eurasian virus pool to move from PCP stage 1 to stage 2.

The participants of the FAO-wide FMD meeting in December concluded that attention must be directed to regional coordination mechanisms combined with country-based activities that apply the PCP concept. Capacity building across regions to ensure appropriate PCP implementation is a prerequisite for functional roadmaps. Emphasis must also be given to increasing the sense of ownership of both regional bodies and individual countries, starting from the formulation of proposals on how to address identified gaps and advocate for major investment in FMD control and animal health services. 360

[1] More information on the Progressive Control Pathway (PCP) is available at: http://www.fao.org/ag/againfo/commissions/eufmd/commissions/eufmd-home/progressive-control-pathway-pcp/en/

©FAO/Olivier Asselin

ADVANCES

EMPRES/GLEWS activities to enhance disease surveillance capacity building in East Africa

Among the activities of the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) and the Global Early Warning System for Major Animal Diseases, including Zoonoses (GLEWS), One Health Project OSRO/GLO/104/IRE is funded by the Government of Ireland and started in May 2012. The project's overall goal is to contribute to the Food and Agriculture Organization of the United Nations' (FAO's) One Health initiative to improve the management of emerging and re-emerging animal health and animal-related human health risks in East Africa. Several African countries are planning to introduce One Health-related joint disease surveillance, prevention and control systems, but few existing systems can be considered functional applications of One Health principles. The project aims to assist participating countries in sub-Saharan Africa in developing tools to improve disease surveillance and risk management at the human–animal–ecosystem interface. These aims will be realized through locally adapted approaches and joint strategies for preventing and controlling animal diseases that have impacts on livestock production, food safety, public health, poverty and livelihoods. The project is being implemented through three main activities as described in the following.

1. SUPPORT TO CAPACITY BUILDING FOR ANIMAL HEALTH–FOOD SAFETY SURVEILLANCE IN EAST AFRICA THROUGH THE ONE HEALTH APPROACH

Contributors: Julio Pinto **(FAO)**, Andrijana Rajic **(FAO)**, Fairouz Larfaoui **(FAO)**, Bouna Diop **(FAO)**, Sam Okuthe **(FAO)**

Strengthening of food security and food safety, livestock health and public health is a current and future priority in East Africa. Sustainable and safe agrifood production systems are essential for improving food security and public health, and fostering social and economic development through better market access for agrifood products.

The impacts of threats arising at the interfaces among humans, animals, plants, the food chain and the environment can be devastating for low-income countries, and frequently result in food and trade crises, human illness and economic disasters of national or regional proportions. Effective surveillance capacity is necessary for the rapid forecast, identification and prevention of such threats and for sustainable responses to them. The One Health approach provides a framework for holistic, multidisciplinary and intersectoral collaboration, and is gaining significant international recognition as a promising way of managing cross-cutting health threats.

The regional workshop, held on 23 and 24 January 2013, was a joint collaboration involving the One Health Central and Eastern Africa (OHCEA) network and three FAO teams: EMPRES-Animal Health; the Emergency Centre for Transboundary Animal Disease Operations (ECTAD) Eastern Africa office; and EMPRES-Food Safety. More than 40 veterinary public health professionals from 11 East African countries attended. Through structured focus groups and forum debates, participants discussed how to use One Health principles and practices to enhance: i) regional surveillance networks, through better links between health issues (including animal diseases and veterinary public health) and food safety and security; ii) early warning and rapid alert capacities for animal health and food safety at the regional and country levels; and iii) management of risks related to the interfaces among humans, animals, the environment and the food chain. Participants made the following recommendations for establishing effective One Health surveillance capacity in the region:

- Conduct an assessment of surveillance capacities for animal health and food safety at the regional and national levels.
- Prioritize the needs identified during the workshop, through participatory processes involving related disciplines and a broad range of stakeholders.
- Establish and/or improve national and regional networks for animal health surveillance and food safety.
- Harmonize and consolidate animal health and food safety information systems and tools across East Africa. 360

©FAO

FAO/OHCEA Regional One Health Surveillance Workshop, 23 to 24 January, Entebbe, Uganda

2. PILOTING OF AN FAO TOOL FOR EARLY DISEASE REPORTING: EMPRES-I EMA

Contributors: Fairouz Larfaoui **(FAO)**, Julio Pinto **(FAO)**

Following the regional workshop, a national workshop in Entebbe, Uganda on 25 January 2013 facilitated information exchange on the information systems and tools for disease surveillance and reporting used by Uganda's National Veterinary Services, and identified opportunities for collaboration among national professionals covering the livestock–wildlife interface. The workshop had two sessions: animal health information systems at the national level, and using mobile devices to improve the quality and timeliness of disease reporting and information gathering. Participants identified a strong need for innovation in and harmonization of animal health information systems in Uganda, and agreed to implement a pilot activity with FAO in Uganda on use of the Global Animal Disease Information System (EMPRES-i) Event Mobile Application (EMA). This innovation will be tested to assess its capacity in facilitating timely disease reporting to the National Animal Disease Diagnostics and Epidemiology Center (NADDEC).

The EMA pilot project will be implemented during the second half of 2013 in ten districts selected by NADDEC. These districts will already carry out regular disease reporting to NADDEC's Epidemiology Unit. District veterinary officers (DVOs) and NADDEC staff will receive training on the use of EMPRES-i EMA and the EMPRES-i platform, to ensure proper functioning of the system. A specific agreement covers the relationship between FAO and NADDEC for data storage on the EMPRES-i server. Using Smartphones, DVOs in the selected districts will regularly collect epidemiological data on an agreed list of diseases. They will transmit these data, which are geo-referenced, to an EMPRES-i platform that is customized for NADDEC to facilitate NADDEC's access to all the reports from the districts.

While reports and data are being transmitted to EMPRES-i, an automatic e-mail notification will be sent to NADDEC's Epidemiology Unit, where data managers will access the EMPRES-i platform and verify the new data. After the Head of the Epidemiology Unit has validated the verified data, an automatic e-mail notification of the validated report will be sent to the national Chief Veterinary Officer. An important advantage of this approach is that EMPRES-i can provide a stable platform for data storage and management, which is often unobtainable for less developed countries with limited financial and infrastructure resources. This pilot is

> “Using Smartphones, DVOs in the selected districts will regularly collect epidemiological data on an agreed list of diseases. They will transmit these data, which are geo-referenced, to an EMPRES-i platform that is customized for NADDEC to facilitate NADDEC's access to all the reports from the districts”

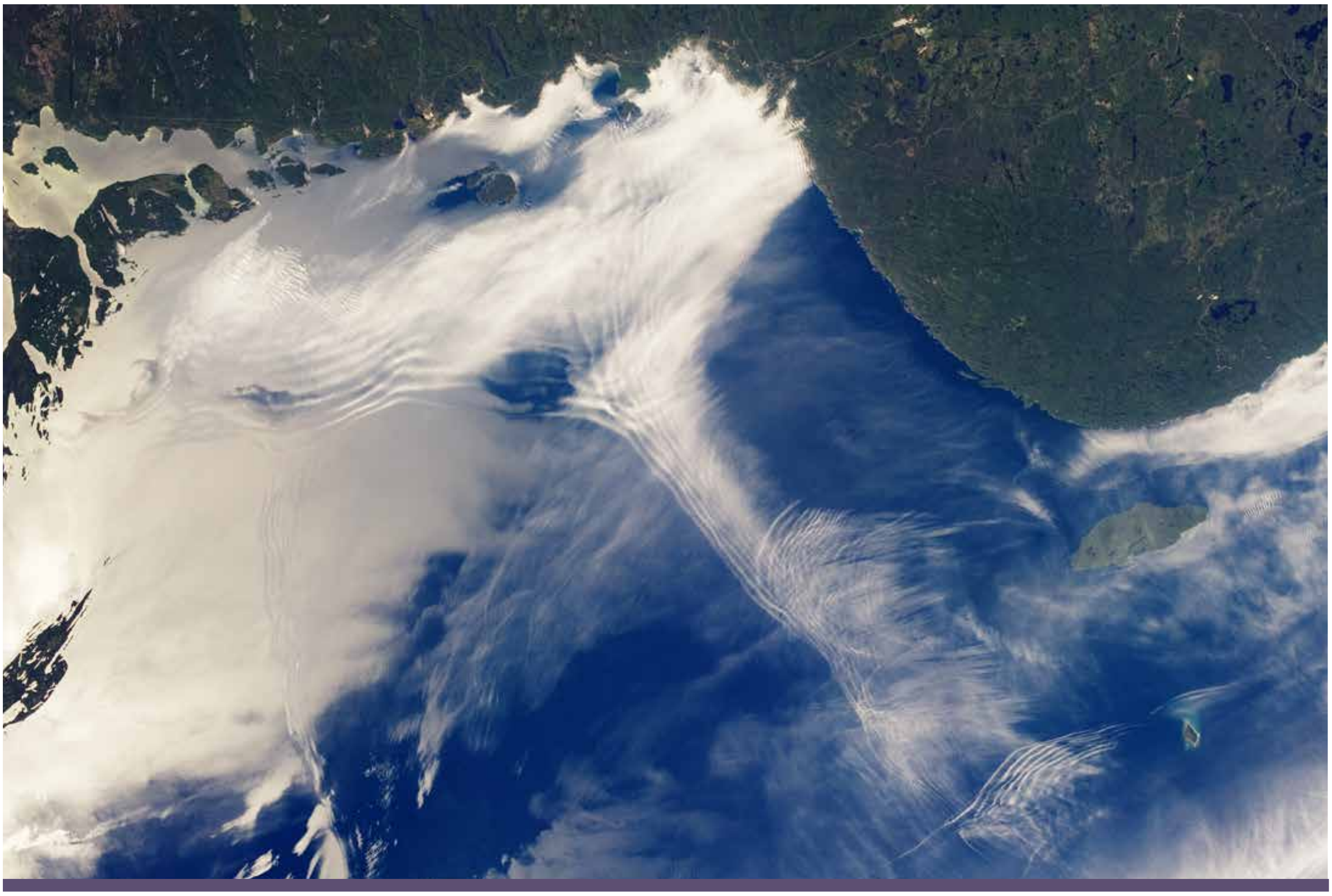
the first initiative for validating the use of EMPRES-i EMA in improving surveillance of animal diseases; FAO plans to extend the project to other countries and regions. 360

3. RISK MODELLING FOR PRIORITY DISEASES TO SUPPORT PREVENTION AND EARLY WARNING ACTIVITIES IN EAST AFRICAN COUNTRIES

Contributors: Carlene Trevennec **(FAO)**, Julio Pinto **(FAO)**,

Early warning systems for animal disease emergencies can include the use of mathematical modelling and risk mapping approaches to forecast outbreaks. Decision-makers may use the outputs of these models to improve preparedness, based on possible outbreak scenarios, and to design risk-based surveillance and intervention strategies. As part of its early warning activities, FAO's EMPRES/GLEWS is developing a risk modelling approach for priority diseases in East African countries. This work is starting with prevention and early warning activities for Rift Valley fever (RVF) and peste des petits ruminants (PPR), and is implemented in collaboration with the International Cooperation Centre of Agricultural Research for Development (CIRAD). Geo-spatial models for RVF and PPR will be developed from existing data on the drivers of these diseases. A multiple criteria decision analysis (MCDA) tool – a knowledge-driven, risk mapping tool based on existing knowledge and expert opinion – is being developed to identify areas of eastern Africa that are particularly susceptible to PPR and RVF. A list of risk factors potentially linked to the transmission and/or local spread of PPR and RVF has been built from a literature review and made available in geo-coded format. The factors listed include host densities (sheep, goats, cattle, camels), road networks, number of veterinarians from veterinary services per administrative unit, locations of the main ruminant markets, elevations, and (for RVF only) permanent and temporary bodies of surface water. An important feature is that wildlife is represented in the model, as well as the presence/absence of ruminant species. All these data are already directly available or can be estimated from satellite images and existing knowledge. The building of and use of such models does not require local disease data, except for model validation, so events can be forecasted in areas with no previous disease reports. The approach also allows regular updating of risk maps at low cost. The maps will help improve targeted surveillance, leading to earlier detection of PPR and RVF in infected and uninfected countries, and will assist authorities in adapting prevention, preparedness and control strategies. A joint FAO/CIRAD mission was conducted in Uganda in March 2013 to introduce the method to the animal health authorities and to discuss the implementation of two pilot geo-spatial models to support disease surveillance activities in the country. 360

> "A multiple criteria decision analysis (MCDA) tool – a knowledge-driven, risk mapping tool based on existing knowledge and expert opinion – is being developed to identify areas of eastern Africa that are particularly susceptible to PPR and RVF"


©NASA

Satellite imagery can support prevention and early warning activities

ADVANCES

Options for non-invasive collection of saliva from wild ungulates for disease surveillance

Contributors: Sergei Khomenko **(FAO)**, Tsviatko Alexandrov **(Bulgarian Food Safety Agency)**, Keith Sumption **(EUFMD)**

INTRODUCTION

In many parts of the world, the risk of wildlife being involved in the transmission of livestock diseases such as foot-and-mouth disease (FMD) is growing, together with wildlife populations (Kittelberger *et al*., 2011; Putman, Apollonio and Andersen, 2011; EFSA, 2012). Experience shows that surveillance in wildlife for early detection of the FMD virus (FMDV) is a crucial part of risk management (EFSA, 2012). The traditional collection of samples from hunter-harvested animals is time-consuming and logistically challenging. Hunting is limited in both time and space, and wildlife authorities and the general public do not always favour the killing of wild animals for sample collection purposes. In addition, the samples collected by hunters are often of poor quality. For these reasons, an early warning system for diseases such as FMD based on serological surveillance in wildlife is almost impossible to implement (EFSA, 2012). Development of a non-invasive (NI) methodology that would allow timely detection of pathogens through the collection of saliva is a viable option for overcoming some of these complications.

Several infectious agents are shed in oral fluid, including viruses such as FMDV, classical swine fever virus (CSFV) and porcine reproductive and respiratory syndrome virus (PRRSV) (Prickett and Zimmerman, 2010). The feasibility of using NI saliva collection from domestic swine on commercial farms (Hoffman *et al*., 2008) and from wild boar (Chichkin *et al*., 2012) for the diagnostics of various diseases has already been demonstrated. Experimental infection of wild boar (Breithaupt *et al*., 2012) showed that FMDV could be found in saliva several days before the detection of antibodies, and was still detectable until at least 27 days post-infection (DPI). FMDV was detectable in the oral fluids of some deer species until 28 to 63 DPI (Forman *et al*., 1974; Gibbs *et al*., 1975). In theory therefore, the testing of saliva enables both earlier detection and more effective monitoring than do traditional serological surveys for FMD and other pathogens in wildlife species.

One of the challenges confronting this approach is how to develop methods for the cost-effective and logistically simple collection

CONTINUED

Figure 1: Bait designs used in the study: 1) maize cobs with six swabs incorporated in each; 2) CSF vaccine bait used as attractant: 2a) vaccine in a blister replaced with a swab and incorporated into the bait; 2b) vaccine bait wrapped in cotton gauze and string; 2c) vaccine bait placed in plastic tubing wrapped in cotton string; 3a) and 3b) blocks of salt with holes to incorporate saliva-trapping swabs

of saliva from wild ungulates. In February 2013, the European Commission for the Control of Foot-and-Mouth Disease (EUFMD) and the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) of the Food and Agriculture Organization of the United Nations (FAO) conducted a small pilot field experiment in the framework of a study commissioned by the EUFMD Standing Technical Committee and funded by the European Commission to investigate the options for collecting saliva from three wild ruminant species – wild boar (*Sus scrofa ferus*), red deer (*Cervus elaphus*) and roe deer (*Capreolus capreolus*) – using an NI approach.

EXPERIMENT DESCRIPTION

The study location Bobla Gora in Bulgaria is a 25-km^2 forest near the town of Tutrakan in Silistra Oblast (Alexandrov *et al*., 2011). In spring 2013, there were an estimated 220 red deer, 80 roe deer and 70 wild boar (at 8.8, 3.2 and 2.8 animals per square kilometre respectively). Animals were provided with regular supplementary feed as part of their normal management in this area. Additional experiments at salt licks were conducted at a separate location in Teteven (Lovec Oblast). Three main types of bait were developed incorporating swabs to trap saliva (see figure 1). The baits were distributed to seven feeding sites (four for wild boar and three for red deer) and bait uptake (including bait taken by non-target species), consumption by target species and swab recovery rates were recorded for four nights (19 to 23 February 2013).

Feeding sites were 2 to 3 km apart. At each of the four wild boar feeding sites, five baits of type 1, three of type 2a, and two of type 2b were distributed every night (ten baits per site); four baits of type 2c were distributed once. At two of the red deer feeding locations baits of types 1 and 3 were used every night (five maize cobs and one block of salt with three swabs). The third red deer site was baited with ten maize cobs for one night. Three salt licks for roe deer were also established in Teteven, with blocks of salt wrapped in cotton gauze. Four camera traps on infrared photo (at 15-second intervals) or video mode were set up to monitor site attendance 24 hours a day in Bobla Gora. Animal tracks were recorded at the sites without camera observation. All baits and data from camera traps were checked daily. Baits that were consumed or disappeared were replaced. All the recovered baits or parts of baits were recorded. Recovered swabs and cotton material visibly contaminated with saliva were collected into individually labelled sealable plastic bags for further testing for the presence of species-specific desoxyribonucleic acid (DNA). The statistical significance of differences in bait performance was assessed with the Fisher


©FAO/ Sergei Khomenko

Collection of saliva samples from the baits taken by wild boar for DNA testing

Exact Test (FET) using the GraphPad Software (2013). All P values are two-tailed.

RESULTS

Site attendance: Over the 20 bait nights at different locations there were a total of seven wild boar and six red deer visits (35 and 30 percent success rates respectively). Newly established salt licks were visited twice by red deer. Wild boar feeding sites were attended three times by a family group of five wild boar; once by a group of six; once by a group of unknown size; and twice by a single male wild boar. The red deer herd sizes were two, 17, three and 12 animals, with two cases when it was not possible to identify the herd size. Based on the observations and bait uptake results, this implies that a minimum of three family groups of wild boar totalling at least 11 animals, and six herds of red deer totalling at least 32 animals were sampled – 15.7 and 15.4 percent of their respective population estimates. Two salt lick locations in Teteven (with 44 bait days from 17 March to 10 April 2013) were attended 28 times by a total of 84 wild boar in groups of one to six animals (a 63.6 percent attendance rate), and 13 times by a total of 22 roe deer in groups of one to three (a 29.5 percent attendance rate). Wild boar visited sites from 21:00 to 24:00, while deer attended mostly in the morning and evening.

Bait performance: Of the 210 exposed baits of all types, 54.8 percent were taken by both target and non-target species, 39.0 percent by target species only, and 30.5 percent were recovered with swabs intact (Table 1) – an average of 3.3 baits were needed to collect one swab sample.

Type 1: Maize cobs were consumed by both wild boar and red deer. Most of the six swabs (5.0 + 1.1) remained inside the cobs and could be recovered. Of the 125 maize cobs exposed, 49.6 percent were taken, 44 percent were consumed by target species (24 percent by wild boar and 20 percent by red deer, difference non-significant). A few cobs were eaten or destroyed by jay (*Garrulus glandarius*) and possibly badger (*Meles meles*). Swabs were recovered from 37.6 percent of the exposed cobs. Sites attended by wild boar only (five bait nights, 25 cobs exposed) and red deer only (four bait nights, 25 cobs exposed) were compared. No significant difference in the swab recovery rate between species was found ($P = 0.1963$).

Types 2: All of these bait subtypes were consumed by wild boar. The survey found no significant differences in the performance of different subtypes, which means that the placement of swabs (inside the blister or simply wrapped around the bait) does not significantly influence their performance. The blisters containing swabs were recovered close to the exposal site (within a 10-m radius) and could be recognized by signs of chewing. Vaccine baits wrapped in cotton (2b) were often swallowed by animals. All four baits with vaccine inside plastic tubes (2c) were recovered on the site. Overall, 67.5 percent of the three bait subtypes were taken, but the target species accounted for only about half of this uptake. The other half was taken by non-target animals, which might include (based on traces, as no camera evidence is available) jays, badgers, jackals (*Canis aureus*), domestic dogs and possibly rodents. In summary, 32.5 percent of all exposed baits were consumed by wild boar and 20.8 percent were recovered with swabs.

Data from the four wild boar sites baited with only vaccine ($n = 77$) or only maize ($n = 75$) made it possible to compare their respective performances in wild boar more


©FAO/ Sergei Khomenko

Red Deer attending feeding location at Bobla Gora as recorded by the camera trap

Table 1: Performances of different baits at Bobla Gora, 19 to 24 February 2013

Bait type	Exposed bait/nights	Total bait uptake n	Total bait uptake % (95% CI)	Bait uptake by target species n	Bait uptake by target species % (95% CI)	Baits recovered with swabs n	Baits recovered with swabs % (95% CI)
1. Maize cobs (all)	**125**	**62**	**49.6 (40–58)**	**56**	**44.8 (36–54)**	**47**	**37.6 (29–47)**
1. Wild boar sites	75	37	49.3 (38–61)	20	26.7 (17–38)	17	22.7 (13–33)
2. Vaccine (all)	**77**	**52**	**67.5 (56–78)**	**25**	**32.5 (22–44)**	**16**	**20.8 (12–32)**
2a. Blisters	45	30	66.7 (51–80)	12	26.7 (15–42)	10	22.2 (11–37)
2b. Cotton	22	18	81.8 (60–95)	10	45.5 (24–68)	3	13.6 (3–35)
2c. Plastic	10	4	40.0 (12–74)	3	30 (7–65)	3	30 (7–65)
3. Salt licks	**8**	**1**	**12.5 (0–53)**	**1**	**12.5 (0–53)**	**1**	**12.5 (0–53)**
Total	**210**	**115**	**54.8 (48–62)**	**82**	**39.0 (32–46)**	**64**	**30.5 (24–37)**

CI = confidence interval. See Figure 1 for a description of bait types. Wild boar sites are wild boar feeding sites baited with both maize and vaccine.

accurately. Wild boar consumed the vaccine baits slightly more frequently than the maize baits (32.5 and 26.7 percent respectively), but this difference was not statistically significant ($P = 0.4799$). Swab recovery rates did not differ significantly (20.8 for vaccine and 22.8 percent for maize baits, $P = 0.8452$).

Type 3: Of the eight bait nights with this type of bait, the two newly established salt licks were attended only once by red deer, and saliva could be collected from all the swabs drilled into the salt block. At the location in Teteven, two salt licks were regularly attended by wild boar and roe deer. Blocks of salt were wrapped in a single layer of cotton gauze to collect saliva. This method seemed to work well, and visibly contaminated samples of cotton were collected.

REFERENCES

Alexandrov, T., Kamenov, P., Stefanov, D. & Depner, K. 2011. Trapping as an alternative method of eradicating classical swine fever in a wild boar population in Bulgaria. *Rev. sci. tech. Off. int. Epiz.,* 30(3): 911–916. http://www.oie.int/doc/ged/D11347.PDF

Breithaupt, A., Depner, K., Haas, B., Alexandrov, T., Polihronova, L., Georgiev, G., Meyer-Gerbaulet, H. & Beer, M. 2012. Experimental infection of wild boar and domestic pigs with a foot and mouth disease virus strain detected in the southeast of Bulgaria in December of 2010. *Veterinary Microbiology*, 159(1–2): 33–39. 10.1016/j.vetmic.2012.03.021

Chichkin, A.Y., Gazaev, I.K., Tsybanov, S.Z. & Kolbasov, D.V. 2012. [Non-invasive method of collecting saliva from wild boar infected with African swine fever.] *Veterinaria*, 6: 26–28 (in Russian)

EFSA. 2012. Scientific opinion on foot-and-mouth disease in Thrace. European Food Safety Authority (EFSA) Panel on Animal Health and Welfare (AHAW). *EFSA Journal*, 10(4): 2635. 91 pp. doi:10.2903/j.efsa.2012.2635. http://www.efsa.europa.eu/en/efsajournal/doc/2635.pdf

Forman, A.J., Gibbs, E.P.J., Baber, D.J., Herniman, K.A.J. & Barnett, I.T. 1974. Studies with foot-and-mouth disease in British deer (red, fallow and roe). II. Recovery of virus and serological response. *J. Comp. Path.*, 84: 221–229.

Gibbs, E.P.J., Herniman, K.A.J., Lawman, M.J.P. & Sellers, R.F. 1975. Foot-and-mouth disease in British deer: transmission of virus to cattle, sheep and deer. *Vet. Rec.*, 96: 558–563.

GraphPad Software. 2013. Quick Calcs. Analyze a 2x2 contingency table. http://www.graphpad.com/quickcalcs/contingency1/

Hoffman, P., Prickett, J., Zimmerman, J., *et al.* 2008. Implementation and validation of swine oral fluid collection in a commercial system. *Proceedings of the 39th Annual Meeting of the American Association of Swine Veterinarians*, pp. 301-302. San Diego, California, USA.

Kittelberger, R., Rawdon, T., McFadden, A. & Clough, R. 2011. Diagnostic test methods for deer. Are we prepared for foot and mouth disease in cervidae? *VetScript*, 01/2011; September 21–25.

Prickett, J.R. & Zimmerman, J.J. 2010. The development of oral fluid-based diagnostics and applications in veterinary medicine. *Anim. Health Res. Rev.*, 11(2): 207–216.

Prickett, J., Kim, W., Simer, R., Yoon, K.-J. & Zimmerman, J. 2008. Oral-fluid samples for surveillance of commercial growing pigs for porcine reproductive and respiratory syndrome virus and porcine circovirus type 2 infections. *J. Swine Health Prod.*, 16(2): 86–91. http://www.aasv.org/shap/issues/v16n2/v16n2p86.pdf

Putman, R., Apollonio, M. & Andersen, R., eds. 2011. *Ungulate management in Europe: problems and practices.* Cambridge, UK, Cambridge University Press. 408 pp.

CONCLUSION

At Bobla Gora, with a total site attendance rate of 65 percent, samples of saliva were collected using NI methods from as much as 15 percent of the local population of wild boar (three family groups) and red deer (six herds) in just four days. One group of wild boar was sampled repeatedly. Twenty-two days of camera trap observations in Teteven showed that wild boar and roe deer attended salt licks nearly every day, thus providing opportunities for the continuous collection of saliva samples using this approach.

Overall, the bait types at Bobla Gora achieved an average uptake rate of 39.0 percent (ranging from 32 to 46 percent) and a swab recovery rate of 30.5 percent (24 to 37 percent). Maize cobs allowed saliva collection from two species, and had better target species uptake and swab recovery rates. Wild boar and red deer ate maize cobs equally frequently (20 to 25 percent). Generally, maize cobs appeared to be the most efficient bait for NI saliva collection, as they could cover two species and required an average exposure of 2.7 baits for each recovered sample from either wild boar or red deer. Vaccine baits targeted only one species (wild boar) and approximately half of them were taken by non-target species. Swab recovery rates from vaccine baits were close to those achieved with maize cobs at all maize-baited locations and at those baited for only wild boar. Collection of saliva at salt lick sites appears to be a feasible method for both deer species and wild boar, which occasionally lick the salt. More observations are needed to quantify these findings more accurately.

This NI sampling approach will be developed further through follow-up on experiments and laboratory tests, including species DNA and pathogen genome detection. However, several advantages can already be identified. First, the NI sampling does not involve the killing of animals, and no dispersal of potentially infected individuals occurs. Second, the sampling scheme can be adjusted according to the pathogen's stability in the environment, the level of disease risk, the season, and the composition, population density and susceptibility to disease of host species; the approach is easy to incorporate into existing game management practices worldwide, and samples can easily be collected by non-professionals such as hunters, gamekeepers and wildlife specialists. Third, the method is relatively inexpensive and available in developing countries, and also has the potential for application in extensive farming systems, such as for monitoring FMD in small ruminants attending salt licks or for sample collection from pigs (V. Milicevic, personal communication). The production of baits with swabs could be commercialized using existing wild boar attractants or salt licks for wild ruminants. 360

©FAO/Ishara Kodikara

ADVANCES

OFFLU helps WHO with pandemic preparedness

Contributors: Filip Claes **(FAO)**, Stephanie Sonnberg **(FAO/St. Jude Children's Research Hospital)**, Gwenaelle Dauphin **(FAO)**

The World Health Organization (WHO) Vaccine Composition Meeting for the Northern Hemisphere was held in Geneva, Switzerland from 18 to 21 February 2013. Giovanni Cattoli (*Istituto Zooprofilattico Sperimentale delle Venezie* [IZSVe], Italy) and Filip Claes, Sophie Von Dobschuetz and Stephanie Sonnberg (Food and Agriculture Organization of the United Nations [FAO]) collected and analysed the data from the OIE/FAO Network of Expertise on Animal Influenza (OFFLU) contributors, and prepared the OFFLU report for this meeting.

It is now established that three OFFLU laboratories – the Animal Health and Veterinary Laboratories Agency (AHVLA) in the United Kingdom of Great Britain and Northern Ireland, the Australian Animal Health Laboratory (AAHL) and IZSVe in Italy – receive standard ferret antisera produced at the WHO Collaborating Centres at Saint Jude Children's Research Hospital (Memphis, Tennessee, United States of America) and the Centers for Disease Control and Prevention (CDC, Atlanta, Georgia, United States of America) and provide antigenic data on their respective H5N1 isolates. OFFLU laboratories in India, Viet Nam and Egypt also contributed genetic data to the 2013 report. The OFFLU contributions, including the presentation of zoonotic avian influenza data (H5, H7, H9), were well appreciated and received by WHO.

At the 2013 Vaccine Composition Meeting, OFFLU contributed epidemiological data on 83 confirmed outbreaks of highly pathogenic avian influenza (HPAI) H5 in avian species (EMPRES-i),[1] which occurred between 22 September 2012 and 8 February 2013 in nine countries and territories, with most (n = 49) reported in Egypt. Most outbreaks occurred in domestic poultry and other domestic species, while one case of H5N1 infection was detected in a wild bird (a black-headed gull in China, Hong Kong SAR). In previous reporting periods, 206 outbreaks were reported from 12 countries and territories between 1 September 2011 and 13 February 2012, and 400 from 12 countries and territories between 1 February and 10 September 2012.

> " In February 2013, the tripartite (FAO/OIE/WHO) Executive Committee agreed that OFFLU's contribution to the WHO Vaccine Consultation Meeting should continue; a new agreement for four years is being prepared "

OFFLU contributors reported new H5 sequences from Egypt (clade 2.2.1), Nepal (clade 2.3.2.1), Viet Nam (clades 1.1 and 2.3.2.1), Bhutan (clade 2.3.2.1), India (clade 2.3.2.1) and Indonesia (clade 2.3.2.1). In total, OFFLU contributed 11 sequences from 2013, 81 from 2012, and one from 2011. The network also provided sequence information on H9N2 viruses circulating in birds in Egypt (chicken, turkey and unspecified avian species), Jordan (unspecified avian species) and Nepal (unspecified avian species).

During the Vaccine Consultation Meeting, one new H5 vaccine candidate was selected to increase coverage of the 2.3.4.2 clade: A/Guizhou/1/2013, a virus isolated from a recent human case in China. No new vaccine candidates were selected for H7 and H9. The final report of the consultation on the H5, H7 and H9 AI viruses has been posted on the WHO web site.[2]

The three-year formal agreement among WHO and FAO and the World Organisation for Animal Health (OIE) will expire in January 2014. In February 2013, the tripartite (FAO/OIE/WHO) Executive Committee agreed that OFFLU's contribution to the WHO Vaccine Consultation Meeting should continue; a new agreement for four years is being prepared.

A similar vaccine strain selection process exists for equine influenza: the OIE Expert Surveillance Panel on Equine Influenza Vaccine Composition meets annually and makes recommendations on vaccine strains. OFFLU will soon create an expert group (as a Technical Activity) on the selection of avian vaccine strains. This group will provide countries with recommendations and assistance on the selection of seed viruses for avian influenza poultry vaccines (subtype H5, H7 and others). 360

REFERENCES

Ampofo, W.K., Baylor, N., Cobey, S., Cox, N.J., Daves, S., Edwards, S., Ferguson, N., Grohmann, G., Hay, A., Katz, J., Kullabutr, K., Lambert, L., Levandowski, R., Mishra, A.C., Monto, A., Siqueira, M., Tashiro, M., Waddell, A.L., Wairagkar, N., Wood, J., Zambon, M. & Zhang, W. 2012. Improving influenza vaccine virus selection. Report of a WHO informal consultation held at WHO headquarters, Geneva, Switzerland, 14–16 June 2010. *Influenza and Other Respiratory Viruses*, 6: 142–152. doi: 10.1111/j.1750-2659.2011.00277.x

Claes, F., Kim, M. & Dauphin, G. 2012. OFFLU's contribution to the WHO consultation on the composition of influenza vaccines for the Northern Hemisphere. *EMPRES Transboundary Animal Diseases Bulletin*, 40: 36. http://www.fao.org/docrep/015/i2811e/i2811e.pdf

Dauphin, G., Kim, M. & Claes, F. 2011. Contribution to the World Health Organization consultation on the composition of influenza vaccines for the Southern Hemisphere 2012. *EMPRES Transboundary Animal Diseases Bulletin*, 39: 44–45. http://www.fao.org/docrep/015/i2530e/i2530e00.pdf

EMPRES-i. Global Animal Disease Information System. http://empres-i.fao.org/eipws3g/

OIE Expert Surveillance Panel on Equine Influenza Vaccine Composition. 2012. *Conclusions and recommendations.* http://www.oie.int/our-scientific-expertise/specific-information-and-recommendations/equine-influenza/

WHO. 2013. Vaccine Composition Meeting summaries. http://www.who.int/influenza/resources/documents/characteristics_virus_vaccines/en/index.html

[1] http://empres-i.fao.org/eipws3g/

[2] http://www.who.int/influenza/vaccines/virus/201209_h5h7h9_vaccinevirusupdate.pdf

©FAO

ADVANCES

Review of the submission and testing of animal health samples in RESOLAB member laboratories

Contributors: Charles Bebay **(FAO)**, Youssouf Kabore **(FAO)**, Gwenaelle Dauphin **(FAO)**

Since its launch in December 2007, the West and Central Africa Veterinary Laboratory Network for the Control of Avian Influenza and other Transboundary Animal Diseases (RESOLAB)[1] has been very active in building the capacities of its member countries,[2] including in procuring standardized laboratory reagents, conducting ring trials to test the overall efficiency of specific disease diagnoses, developing and maintaining a web site,[3] and strengthening the two Regional Support Laboratories (RSLs)[4] with support from the Food and Agriculture Organization of the United Nations (FAO).

The RESOLAB Coordination Unit conducts annual surveys to collect and compile laboratory data from its members for assessing the level of activities and the workflow of samples within the network. The last survey took place prior to the latest annual RESOLAB meeting, held in Dakar, Senegal from 3 to 7 December 2012. As part of FAO's IDENTIFY project,[5] raw data provided by member laboratories were used to assess the laboratories' performance against four criteria: diagnostic activities; implementation of quality assurance, including biosecurity and biosafety; disease reporting; and networking. This survey, to which 17 of RESOLAB's 23 member countries responded, aimed to map RESOLAB network activities in 2011 and 2012, to guide the development of an evidence-based annual work plan for RESOLAB.

The following sections present highlights from the survey results under three headings: diagnostic activities, quality assurance and networking.

DIAGNOSTIC ACTIVITIES

Concerning the laboratories' workflow, the surveys provided the following results:

- Laboratories' diagnostic activities are fully dependent on existing surveillance programmes and contributions from external donors.
- Between 2011 and 2012, the overall number of samples received by all laboratories increased by 6 percent. Blood/sera samples represented more than 50 percent of the total.
- Although the proportion of samples submitted for food safety testing remained low – 5 percent in 2011 and 19 percent in 2012 – it increased significantly between 2011 and 2012, by 293 percent.
- In 2012, more than three-quarters (78 percent) of the samples received were related to six diseases – African swine fever (ASF), peste des petits ruminants (PPR), avian influenza (AI), Newcastle disease (ND), foot-and-mouth disease (FMD) and rabies – up from 53 percent in 2011.
- Diseases fall into three groups according to changes in sample submission trends between 2011 and 2012:
  - high increase (more than 100 percent) in samples submitted: ASF, PPR and contagious bovine pleuropneumonia (CBPP);
  - no change, or low increase (less than 10 percent) in samples submitted: FMD and rabies;
  - major decrease (19 percent) in samples submitted: AI/ND.
- More than 50 percent of samples originate from national epidemiological surveillance networks, and laboratories collected from the field almost 300 percent more
- samples in 2012 than in 2011.
- In 2012, only 63 percent of the samples submitted were tested by the laboratories, down from 83 percent in 2011. In a 2011 survey, 19 of the 23 laboratories identified reasons for not performing testing: almost 80 percent lacked reagents; 47 percent lacked trained staff for performing reliable laboratory analyses; 42 percent mentioned a lack of appropriate equipment and/or poor equipment maintenance; and 31 percent had inadequate facilities, including power and water supply.

Between 2005 and 2009, the number of samples (for serology and pathogen detection) from passive surveillance remained fairly stable within RESOLAB, with an average of 21 327 samples submitted per year, while the number of samples from

CONTINUED

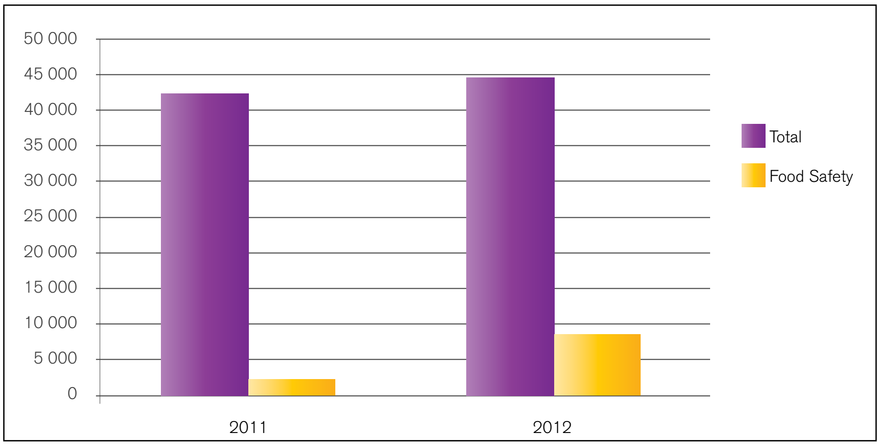


Figure 1: Total numbers of samples received in 2011 and 2012 by national veterinary laboratories

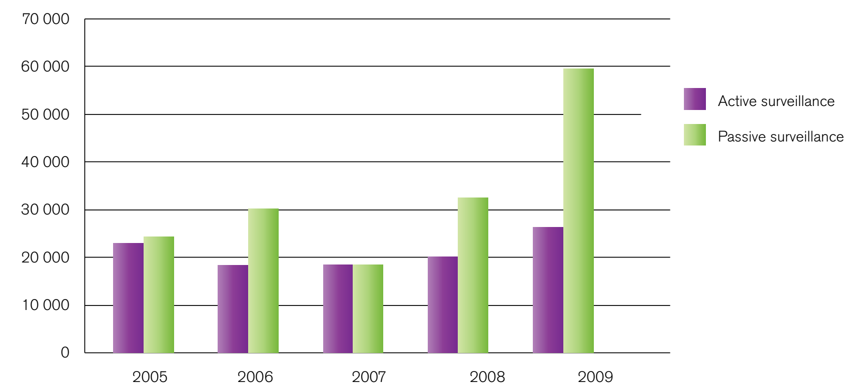
[1] In December 2012, RESOLAB was divided into RESOLAB-CA for Central Africa and RESOLAB-WA for West Africa.

[2] Benin, Burkina Faso, Cape Verde, Cameroon, Central African Republic, Chad, the Congo, Democratic Republic of the Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, the Niger, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone and Togo.

[3] http://www.fao-ectad-bamako.org/

[4] *Laboratoire National d'Elevage et de Recherches Vétérinaires* in Dakar (Senegal) and the National Veterinary Research Institute in Vom (Nigeria).

[5] Funded by the United States Agency for International Development (USAID) under its Emerging Pandemic Threats (EPT) programme.



Notes: These are rough estimates; the number and sizes of respondent countries vary from year to year. Most of the samples received were sera.

Figure 2: Total numbers of animal health samples submitted to RESOLAB national veterinary laboratories between 2005 and 2009 from active and passive surveillance

active surveillance increased 2.5 times, with an annual average of 33 064 samples submitted.

The survey also identified the sources and levels of funding for laboratory activities. Between 2005 and 2009:

- only 28 percent of the laboratories were legally permitted to generate incomes (mainly from testing activities) and use these independently of central agency decisions;
- government funding accounted for less than 25 percent of the annual budgets of 69 percent of the laboratories;
- development partners provided 50 percent of the annual budgets of 68 percent of the laboratories and 100 percent of the budgets of 27 percent of the laboratories.

QUALITY ASSURANCE, INCLUDING BIOSAFETY AND BIOSECURITY

In 2010, RESOLAB members agreed to follow International Organization for Standardization (ISO) 17025 standards by gradually implementing a quality assurance (QA) approach to ensure that diagnostic activities are conducted in a reliable, safe and biosecure manner. During regional QA training sessions conducted by FAO with technical support from *France Vétérinaire International*, each laboratory defined its own long-term objectives for implementing QA. Table 1 presents results of the 2012 survey, based on self-assessments to measure progress towards the QA objectives defined in 2010. The main reasons laboratories gave for not achieving their QA objectives by 2012 were:

i. lack of funding;
ii. lack of skilled personnel for high-level technical duties on QA;
iii. delayed delivery of services and materials to improve the biosafety and biosecurity level of the laboratory.

Table 1: Progress towards the QA objectives defined by RESOLAB member countries in 2010

Progress	Number of respondent laboratories
0–25% completed	4
25–50% completed	6
50–75% completed	4
75–100% completed	3
> 100% completed	0

NETWORKING

Networking is essential for improving, maintaining and measuring laboratory capacities to perform complex, multidisciplinary and high-level science-based diagnostic activities. Networking facilitates collaboration with other laboratories through activities such as sample submission for pathogen characterization, sequencing services, participation in proficiency testing, information sharing and the exchange of scientists at both the regional and global levels. The number of samples submitted to RSLs and/or World Organisation for Animal Health (OIE)/FAO Reference Centres is a good indicator for evaluating the level of collaboration among laboratories.

Between 2011 and 2012:

- the number of samples shipped to OIE/FAO Reference Centres decreased by 26 percent, from 471 to 347;
- the number of samples shipped to RSLs decreased by 69 percent, from 140 to 43.

CONCLUSION

- The level of samples reaching RESOLAB member laboratories does not enable the sustained development of testing skills.
- Surveillance activities are dramatically low in member countries. The number of samples generated from passive surveillance has remained fairly stable over the years. Most samples are related to active surveillance activities, so are initiated when outbreaks occur and vary according to disease occurrence.
- Very little support is requested from RSLs and OIE/FAO Reference Centres; the support requested varies from year to year.
- Laboratories are starting to implement QA by adopting step-wise yearly objectives, but culture change and funding remain challenging.
- Laboratory diagnostic activities are generally severely underfunded and remain highly dependent on development partners, especially for staff training, the acquisition and maintenance of equipment and the provision of reagents. However, the level of dependence varies among laboratories.
- Requests for food safety testing, particularly from the private sector, are increasing. These new areas can enable laboratories to augment their workflows significantly, generate revenue, and develop and strengthen their relationship with new partners such as the animal industry sector.

These data can help the planning of:

- laboratory activities and resource allocation (human resources, funds) to optimize the use of existing, limited resources;
- veterinary services in general (surveillance, post-vaccination monitoring activities, etc.) and/or other activities that require laboratory diagnostic capacities, including requests from the private sector;
- the provision of communications material for developing advocacy documents, raising awareness and improving funding; such materials might be used at:
  - the national level, where comparing national-level with regional data could help national authorities to identify gaps that require filling;
  - the regional level, as regional economic communities can adjust their mechanisms and funding levels for the animal health sector. 360

©FAO/Jose Cendon

ADVANCES

Opportunities for public–private partnerships between animal health laboratories and livestock producers in Africa

Contributor:s Charles Bebay **(FAO)**, Gwenaelle Dauphin **(FAO)**

Projections for 2030 show that per capita consumption of livestock products will increase only modestly – meat by 40 percent, milk by 20 percent and eggs by 53 percent – and will only slightly exceed the consumption levels of 1970. However, total demand will more than double between 2000 and 2030, because of rapid population growth in sub-Saharan African.[1] Part of this demand will be fulfilled by meat imports. Studies conducted by the African Union's Interafrican Bureau for Animal Resources (AU-IBAR) found that:[2]

- the predicted gap in human requirements for animal protein will be worth US$2 billion per annum by 2030;
- each year, 25 percent of livestock die because of preventable animal diseases, but this statistic masks the extremely destructive capacity of diseases such as Newcastle disease, which affects poultry – the most affordable livestock for poor people – and can lead to 100 percent flock mortality.

Rapidly developing animal value chains in sub-Saharan Africa require intensified disease prevention/control and food safety monitoring, providing veterinary laboratory staff with opportunities to apply the techniques that they have learned through many years of support from the Food and Agriculture Organization of the United Nations (FAO) and other partners. Support to laboratories has consisted of capacity building, provision of laboratory equipment and reagents, and assistance with networking, but the limited public resources available cannot guarantee rapid, reliable and sustainable laboratory diagnostic services. Recent surveys conducted within the West and Central Africa Veterinary Laboratory Network for the Control of Avian Influenza and other Transboundary Animal Diseases (RESOLAB)[3] demonstrated that between 2005 and 2009 (see separate article on page 19):

- only 28 percent of the laboratories could generate incomes;
- 69 percent of the laboratories derived less than 25 percent of their budgets from their respective governments;
- 68 percent of the laboratories derived more than 50 percent of their budgets from development partners, and 27 percent derived 100 percent from this source.

Partnerships between laboratories and livestock producers can enhance the overall competitiveness of the livestock industry by providing objective assessments and options that enable the private sector to choose effective and efficient treatments and solutions to problems, such as reducing the random use of antibiotics in the poultry sector, or identifying pathogens and potential public health threats before they are introduced into the food chain. Reliable diagnostic services also promote international trust, leading to enhanced trade with economic benefits.

Good client relationships between laboratories and the private sector depend on several factors: Does the administrative status of the laboratory allow the development of partnerships with the private sector? Are the size and needs of the private sector partner looking to invest attractive to a laboratory? Is the laboratory capable of reporting to the competent authorities and managing confidentiality issues?

CONTINUED

Table 1: Country typology combining laboratory capacity with the importance of the livestock industry in RESOLAB country members (laboratory category specified in brackets)

Type A	Type B	Type C
Small laboratories (category 1 or 2) with modest market potential and a weakly structured livestock production industry	Medium to advanced laboratories (category 2 or 3) with medium market potential and a moderately structured livestock production industry in a rebuilding economy	Medium to advanced laboratories (category 2 or 3) with significant market potential and a well-structured livestock production industry
Benin (2)	Guinea (2)	Cameroon (3)
Cape Verde (1)	Democratic Republic of the Congo (3)	Chad (3)
Congo (2)	Burkina Faso (2)	Côte d'Ivoire (2)
Central African Republic (2)		Ghana (3)
Equatorial Guinea (1)		Mali (3)
Gabon (1)		Niger (2)
Gambia (2)		Nigeria (3)
Guinea-Bissau (1)		Senegal (3)
Liberia (1)		
Sao Tome and Principe (1)		
Sierra Leone (1)		
Togo (2)		

1 http://www.fao.org/ag/againfo/programmes/en/pplpi/docarc/rep-0509_growthandpoverty_SSA.pdf
2 http://www.au-ibar.org/index.php?option=com_flexicontent&view=items&cid=101&id=288&Itemid=148
3 RESOLAB is composed of RESOLAB Central Africa – Cameroon, Central African Republic, Chad, the Congo, Democratic Republic of the Congo, Equatorial Guinea and Gabon; and RESOLAB West Africa – Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Nigeria, the Niger, Sao Tome and Principe, Senegal, Sierra Leone and Togo.

Table 2: Opportunities and needs identified for each laboratory visited

	Cameroon	Democratic Republic of the Congo	Rwanda
Laboratory name, date of creation and diagnostic capacities	*Laboratoire national vétérinaire* (LANAVET), created in 1982. Routine testing including serology, polymerase chain reaction (PCR), pathogen identification (bacteriology and parasitology). Good networks at the regional and global levels	The *Laboratoire vétérinaire de Kinshasa* (LVK), established by Belgium in the early 1950s. Routine testing including serology, PCR, pathogen identification (bacteriology and parasitology). Good networks at the regional and global levels	The National Veterinary Laboratory, created in 1985. Routine testing including serology, PCR, pathogen identification (bacteriology and parasitology). Good networks at the regional and global levels
Poultry sector	**Opportunities***:* About 50% of the flock is raised in commercial production systems. 7 000 commercial poultry farmers, 50% in southern regions **Needs identified***:* Post-vaccination monitoring (PVM) (hatcheries and farms), parasitic analyses, antibiograms, bromatological analyses for poultry and pig industries, etc.	**Opportunities**: Limited: economy undergoing reconstruction after almost 20 years of civil war. Few alternative livestock units with limited possibility to provide laboratory diagnostic services **Needs identified:** PVM (hatcheries and farmers), parasitic analyses, antibiograms, bromatological analyses for poultry and pig industries, etc.	**Opportunities**: Poultry production increasing near Kigali, with support from the Rwanda Poultry Industry Association (RPIA)
Pig sector	**Opportunities:** Many pig production units supported by the national pig production development programme **Needs identified:** African swine fever (ASF)-free controls for recovery programmes in ASF-affected zones, PVM for erysipelas	**Opportunities**: Very few: pig production affected by the economic collapse, but some commercial farms being established near Kinshasa and other large cities in Bas-Congo Province **Needs identified**: ASF-free controls	**Opportunities**: Very few
Small ruminants	**Opportunities:** 7 million head (about 50% goats and 50% sheep), with three-quarters in the three northern regions **Needs identified:** PVM against peste des petits ruminants (PPR) in affected zones	**Opportunities**: Recovery programmes for people affected by the civil war; recent PPR outbreaks in Equateur and Bas-Congo Provinces **Needs identified**: Disease surveillance and PVM in PPR-affected areas	
Large ruminants	**Opportunities:** 6 million head, concentrated in the three northern regions; 2 main trade flows (mostly live animals): • towards large cities in the south (Douala and Yaoundé) • towards Nigeria **Needs identified:** PVM against contagious bovine pleuropneumonia (CBPP) and foot-and-mouth disease (FMD)	**Opportunities**: Very few: most cattle raising is in eastern provinces, out of reach of LVK services and with very poor connections to Kinshasa	**Opportunities**: "One family, one cow" programme, started in 2006, has provided 136 000 cows and boosted milk production **Needs identified**: Brucellosis control at the 36 milk collection centres (Nyangatare zone)
Dairy sector	*Opportunities*: Low production but increasing private sector investment (yoghurt production) supported by public/donor funds *Needs identified*: Food safety issues and brucellosis control		

RESOLAB laboratories are classified into three categories[4] based on their capacity to deliver reliable and timely diagnostics services at international standards, from category 1 for the lowest capacity, to category 3 for the highest.

Since 2010, to support control of transboundary animal diseases (TADs), development of the livestock industry and control of food-borne diseases, FAO has assisted national laboratories in sub-Saharan Africa in engaging in a private–public partnership (PPP) approach. A first study, conducted in 2010, aimed to identify potential private sector funding sources for national veterinary laboratories in West and Central Africa. Results of this study included the categorization of RESOLAB member laboratories (categories 1, 2 or 3) according to their technical capabilities. Based on this categorization and the importance of the animal industry in each country, countries were then grouped into a three-stage typology (A, B and C) as shown in Table 1.

Although the classification of laboratories into three categories was carried out in a separate study, it should be noted that the size of the market is closely correlated to laboratory capacity: for example, laboratories in categories 1 and 2 are located in countries where the animal industry is weakly structured and the market potential is low; while laboratory capacities are higher where the market potential is more significant.

The first study also confirmed the quasi-monopolistic status of public veterinary laboratories, given their almost exclusive hold on technical expertise at the national level and their membership in regional and international scientific networks. The modern poultry sector and the pig industry were identified as the most valuable sectors for laboratories providing diagnostic services.

[4] http://www.fao-ectad-bamako.org/fr/A-classification-for-the

Table 3: Key actions for improving PPP in the three countries visited

Action	Proposed timeline
Revise the legal status of national laboratories	Medium term
Establish satellite laboratories at locations convenient for livestock holders, and improve relations between central and district laboratories	Medium/long term
Equip laboratories with skills in public relations, marketing and client management	Short term
Target animal producers with products and services tailored to their needs	Short term
Integrate laboratory activities into public policies on livestock production, disease surveillance and food quality and safety	Medium/long term

Results of the study were presented during the annual RESOLAB coordination meeting in December 2010 in Bamako, Mali, when participants recommended that FAO continue its promotion of PPPs by: i) increasing the number of pilot countries;[5] and ii) exploring additional mechanisms for implementing a sustainability strategy for veterinary laboratory activities. A working group on perspective and development was established within RESOLAB.

The private sector expects specific services from the laboratories: diagnostic testing for TADs and other diseases affecting production, such as parasitosis; reliable and rapid test results; customer-oriented services, such as antibiograms, regular vaccination monitoring of herds/flocks and interpretation of findings; confidentiality; and acceptable prices, although in most countries there are no other laboratories providing competition. The first study called for a second one to define the specific practical actions that laboratories should take to improve their relationships with the animal production sector.

The second study was conducted in 2012 in Cameroon (category C), the Democratic Republic of the Congo (category B) and Rwanda (not a member of RESOLAB but probably belonging to category B). Information on laboratory resources was collected and analysed, and meetings with key representatives of the livestock value chain (livestock/meat, poultry, pigs and dairy) and heads of laboratories identified the opportunities for laboratories and the laboratory services that are needed, including pricing and delivery requirements (Table 2).

Because the laboratories provide public services, they depend mainly on public or external funding, both of which are very limited. At each of the laboratories visited, diagnostic services for the private sector generated less than 1 percent of the total budget.

The benefits of extending laboratory services to producers should be clearly identified, practical and tangible. Ensuring access to these benefits will require policy-makers and government leaders to take action in the five key areas listed in Table 3.

The next step in this PPP initiative will include similar surveys in the United Republic of Tanzania and Uganda (2013), building on those already conducted in other countries and addressing laboratories' needs for the development of communication and advocacy materials. 360

Acknowledgements: Thanks to the consultants who conducted studies and country missions; the United States Agency for International Development (USAID) for funding the initiative under the IDENTIFY project; and national authorities and private sector players for sharing opinions and information.

©FAO/Ishara Kodikara

A veterinarian holding a blood sample taken from a cow for testing to make sure the rinderpest virus has not returned

[5] The study surveyed 23 RESOLAB countries, but visited only three: the Democratic Republic of the Congo, Ghana and Mali.

ADVANCES

Development of a risk assessment methodological framework for potentially pandemic influenza strains: the FLURISK project

Contributors: Marco De Nardi **(IZSVe)**, Sophie von Dobschuetz **(RVC and FAO)**, Andrew Hill **(RVC and AHVLA)**, Ilaria Capua **(IZSVe)** and the **FLURISK consortium**

BACKGROUND

The influenza virus of swine origin that unexpectedly became the most recent human pandemic virus, and the avian influenza viruses that are causing human health concerns have prompted many organizations to revise their approaches to influenza research and pandemic preparedness, fostering interdisciplinary collaboration and a holistic view in line with the One Health vision.

International organizations have funded meetings driven by the One Health approach, including the One Flu Strategic Retreat in Castelbrando, Italy, 1 May 2011;[1] the Operationalizing "One Health" Meeting in Stone Mountain, Georgia, United States of America, 4 to 6 May 2010;[2] and the Food and Agriculture Organization of the United Nations (FAO)/World Organisation for Animal Health (OIE)/World Health Organization (WHO) Joint Scientific Consultation in Verona, Italy, 27 to 29 April 2010.[3] Recommendations from these meetings make it clear that greater understanding of the viruses is needed to improve the ability to assess their potential public health threat systematically. Only a global effort that takes into account the knowledge generated by both veterinary and public health sectors can successfully tackle the complex issue of pandemic risk. To address some of the recommendations arising from the meetings, in December 2011, the European Food Safety Authority (EFSA) awarded a grant for implementation of the FLURISK project, which started in February 2012 for a duration of 20 months.

OBJECTIVES AND PROJECT STRUCTURE

The principal objective of the FLURISK project is to develop and validate an influenza risk assessment framework (IRAF) for ranking animal influenza A strains according to their potential to cross the species barrier and cause human infection.

To improve the understanding of virological and epidemiological risk factors for pandemic influenza at the human–animal interface, the central questions FLURISK aims to answer are:

1. What is the current knowledge on the characteristics of influenza viruses related to species jumps and on influenza epidemiology in animals?
2. What are the scientific community and institutional stakeholders doing in terms of influenza virus surveillance, monitoring and control?
3. What evidence is there for the transmission of animal influenza viruses to humans, and how is this identified by existing surveillance?
4. What scientific gaps identified in project activities need to be addressed urgently through focused research priorities?
5. What viral characteristics are associated with the ability of an animal influenza A virus to cross the species barrier and cause human infection?
6. What epidemiological risk factors are associated with the transmission of influenza viruses between species, and what are the drivers of influenza spread within animal populations?
7. How can the pandemic risk posed by a given animal influenza A virus be graded?

To provide answers to these questions FLURISK brings together recognized European human and veterinary medicine research institutes, reference laboratories and universities, fostering cross-disciplinary expertise and collaboration. Members of the project consortium are the *Istituto Zooprofilattico Sperimentale delle Venezie* (IZSVe, Italy, Project Coordinator), the Animal Health and Veterinary Laboratories Agency (AHVLA, United Kingdom of Great Britain and Northern Ireland), the Royal Veterinary College (RVC, London, United Kingdom), the National Institute for Public Health and the Environment (RIVM, the Netherlands), the *Institut Pasteur* (IP, Paris,

The FLURISK consortium during the kick-off meeting at Legnaro (Italy), 1 to 3 February 2012

[1] http://www.cdc.gov/onehealth/pdf/castelbrando/executive-summary.pdf
[2] http://www.cdc.gov/onehealth/pdf/atlanta/meeting-overview.pdf
[3] http://www.fao.org/docrep/012/ak761e/ak761e00.pdf

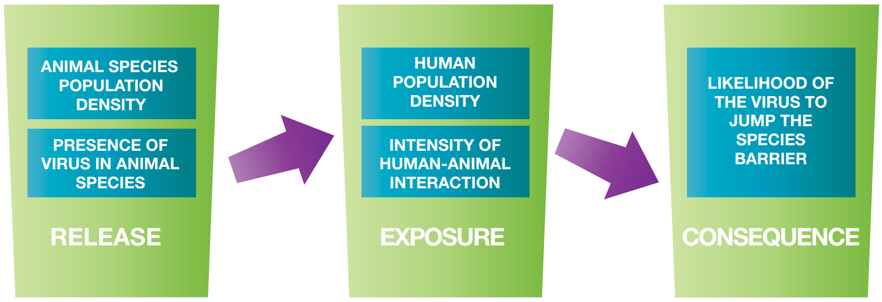


Figure 1: FLURISK simplified risk assessment structure

France), the University of Ghent (UniGhent, Belgium) and two external advisers – FAO (Rome, Italy) and the Centers for Disease Control and Prevention (CDC, Atlanta, United States of America). Experts from OIE, the European Centre for Disease Prevention and Control (ECDC), WHO and the OIE/FAO Network of Expertise on Animal Influenza (OFFLU) are invited to take part in relevant meetings and project activities as external observers.

Activities and tasks for fulfilling the project's objectives have been divided into four integrated work packages (WPs):

- WP1: review and assessment of influenza virus epidemiology and surveillance programmes;
- WP2: development and validation of the influenza risk assessment framework (IRAF);
- WP3: identification of scientific gaps and research priorities;
- WP4: project management and coordination.

WP1 is led by RVC; WP2 by RVC/AHVLA; and WP3 and WP4 by IZSVe. WP1 will provide the necessary data and information for developing and validating the IRAF in WP2. Any gaps in scientific knowledge and data availability identified in WP1 and WP2 will be included in WP3, which will complete the gap analysis by identifying future research priorities.

DEVELOPMENT AND VALIDATION OF THE INFLUENZA RISK ASSESSMENT FRAMEWORK

The project aims to develop an epidemiological model for application within a risk assessment framework following the format of release, exposure and assessment of the consequence (OIE, 2012)[4] as shown in Figure 1.

Development of the IRAF takes the following factors into consideration:

- *Global approach*: The IRAF will be applicable at a global level, so it has to be designed to incorporate data and information pertaining to pathogenic viruses occurring in Europe, Africa, Asia and the Americas.
- *Flexibility*: The IRAF should be sufficiently flexible to allow new research outputs to be incorporated in a timely and efficient manner.
- *Work in data-scarce environments*: The system should be able to cope with different levels of data and information availability, depending on the context – data may be scarce, of poor quality or non-existent.
- *Robustness*: The IRAF should be robust and flexible enough to produce reliable risk estimations for different scenarios.

To validate the FLURISK IRAF, ten currently circulating or historic animal influenza strains will be assessed and ranked into three categories:

1. animal influenza virus strains that have already caused human infection;
2. animal influenza virus strains that have not yet jumped the species barrier to infect humans, but that possess qualitative characteristics suggesting that a jump is relatively likely;
3. animal influenza virus strains that are very unlikely to jump the species barrier to infect humans.

Virological and epidemiological data were gathered in WP1 to characterize the selected strains.

CONCLUSION

By taking into account all the known relevant epidemiological and virological risk factors, the IRAF will provide an open, documented and systematic approach for identifying and evaluating the pandemic potential of animal influenza viruses. However, the IRAF will not be used to make predictions, but rather to define priorities. It will assist in identifying the animal influenza viruses that are most likely to represent a threat to humans from a global perspective. 360

REFERENCE

OIE. 2012. *Terrestrial Animal Health Code.* Paris, France. http://www.oie.int/index.php?id=169&L=0&htmfile=titre_1.2.ht

FLURISK MEMBERS

Istituto Zooprofilattico Sperimentale delle Venezie (IZSVe)
Roberta Bassan
Ilaria Capua (Project Coordinator)
Giovanni Cattoli
Marco De Nardi (Project Manager)
Isabella Monne
Olga Munoz

Royal Veterinary College (RVC)
Dirk Pfeiffer
Katharina Stärk
Kim Stevens
Sophie von Dobschuetz[5]
Barbara Wieland

Animal Health and Veterinary Laboratories Agency (AHVLA)
Jill Banks
Andrew Breed
Sharon Brookes
Ian Brown
Tamsin Dewe
Kate Harris
Andy Hill[6]
Louise Kelly
Rowena Kosmider

National Institute of Public Health and Environment (RIVM)
Gudrun Freidl
Arie Havelaar
Marion Koopmans
Adam Meijer

University of Ghent (UniGhent)
Karen van der Meulen
Kristien van Reeth

Institut Pasteur (IP)
Vincent Enouf
Jean Claude Manuguerra
Sylvie van der Werf

Centers for Disease Control and Prevention (CDC)
Sue Trock

Food and Agricultural Organization of the United Nations (FAO)
Gwenaelle Dauphin

World Organisation for Animal Health (OIE)
Gounalan Pavade

[5] And the Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.
[6] And the Royal Veterinary College (RVC), London, United Kingdom of Great Britain and Northern Ireland

[4] http://www.oie.int/index.php?id=169&L=0&htmfile=titre_1.2.htm

©FAO/Saeed Khan

ADVANCES

Avian influenza and Newcastle disease: from the role of farming practices and wild bird ecology to disease surveillance and control

Contributor: Marie-Noël de Visscher* **(CIRAD, UR AGIRs , Gripavi project coordinator)**

INTRODUCTION

Following the rapid spread of highly pathogenic avian influenza (HPAI) H5N1 viruses in 2005–2006 from Asia to Europe and North and West Africa, concerns arose that H5N1 viruses could become established in these regions and spread across the entire African continent. Newcastle disease (NCD) is already a recurring and widely distributed problem in African poultry. Based on experience gained from previous Food and Agriculture Organization of the United Nations (FAO) projects in Africa, the Gripavi research project (Box 1) Ecology and Epidemiology of Avian Influenza and Newcastle Disease in Tropical Countries was designed to improve understanding of the ecological and epidemiological factors involved in the maintenance and spread of avian influenza and NCD viruses. Aiming also to assess prevention and control measures, it was coordinated by the International Cooperation Centre of Agricultural Research for Development (CIRAD), France, and implemented from 2007 to 2011 with financial support from the French Ministry of Foreign Affairs. In collaboration with national and international research groups, studies were conducted in five African countries and Viet Nam, and included field studies on wild and domestic avian host populations, and poultry market chains. (Circulation of influenza viruses in domestic pigs was also studied but the results are not included in this article.)

Box 1: The Gripavi research project

The Gripavi research project is part of a set of monitoring and research programmes in Africa: FAO's Technical Cooperation Programme (TCP) projects on Emergency Assistance for Early Detection and Prevention of Avian Influenza (2005–2007) and Satellite Tracking Study of Wild Birds (2006–2008); and the Epidemiology of Avian Influenza in Africa (EPIAAF) projects Identification of Risk Factors in Domestic Birds (2007–2008), funded by FAO, Emergency Measures for Strengthening Diagnostic Capabilities of the African Laboratories for the Control of Avian Pests (2006–2010), funded by the Ministry of Foreign Affairs (France), and the Global Avian Influenza Network for Surveillance (GAINS), funded by USAID, for wild bird surveillance in southern Africa.
More information from: *http://gripavi.cirad.fr/en/*

H5N1 HIGHLY PATHOGENIC AVIAN INFLUENZA IN NORTH VIET NAM: CLEAR IDENTIFICATION OF RISK FACTORS AT THE REGIONAL AND LOCAL LEVELS

Studies on the spatial determinants of major epidemics in Viet Nam showed that China was a source of HPAI H5N1 for north Viet Nam, through illegal imports of poultry. Communes or villages located along the roads that connect the two countries present a higher risk of infection and often report outbreaks during the early stages of an epidemic (Desvaux 2012; Trevennec *et al.*, 2011). Low levels of H5N1 circulation have also been observed in remote villages of ethnic minorities living close to the border with China (Trevennec *et al*, 2011). Field surveys indicate that large numbers of spent hens, day-old chicks and ducklings are illegally imported to meet the demand for good genetic material or because of high consumer demand for poultry meat during the New Year (Tet) celebration (Desvaux, 2012).

At the local level, the existence of natural or artificial water bodies appears to be strongly correlated with outbreak probabilities (Desvaux *et al.*, 2011; Desvaux, 2012). Several risk factors related to poultry trade movements – such as the presence of at least one poultry trader in the village – were also identified as drivers of the local dissemination of the virus from one village to another (Trevennec *et al.*, 2011; Desvaux *et al.*, 2011).

Serological and virological prevalence studies conducted on domestic poultry populations in the Red River Delta area provided indirect evidence that vaccinated populations with low levels of immunity can contribute to persistence of the virus within the poultry population (Box 2). More precisely, it is hypothesized that the virus is maintained in ducks on long production cycles (and, to a lesser extent, in non-vaccinated Muscovy ducks on long production cycles) and that non-vaccinated broilers or ducks on shorter production cycles probably contribute to virus dissemination through the farming management system used to raise them (Desvaux *et al.*, 2012a). Under these conditions, broiler chicken flocks, which are generally not as well vaccinated as layers and breeders, act as effective sentinels of HPAI virus in a village by showing clinical signs after infection.

AVIAN INFLUENZA IN AFRICA: VIGILANCE IS STILL REQUIRED

In 2012, six years after the first cases in Africa, most of the African continent remains free of HPAI H5N1 virus, although HPAI H5N1 is endemic in Egypt.

Large-scale surveillance studies of more than 15 000 wild birds conducted in 20 countries across Africa found no healthy wild birds infected with HPAI H5N1 viruses (Gaidet *et al.*, 2012a; 2012b). This result is consistent with the findings of all the global-level monitoring programmes conducted since 2006. However, these intensive surveys

* e-mail: visscher@cirad.fr

Box 2: Avian influenza and NCD vaccination issues

In Viet Nam, cross-sectional serological and virological surveys carried out from the end of 2008 to June 2010 improved understanding of the epidemiology of the H5N1 disease in a vaccination context and enabled evaluation of the vaccination programme implemented in Viet Nam. The results of using an inactivated H5N1 vaccine in northern Viet Nam highlighted the difficulties in maintaining good flock immunity throughout the year in poultry populations (Desvaux *et al*., 2012b; 2012a). This finding was confirmed by follow-up on the H5 antibody kinetics in birds vaccinated with the Re-1 vaccine under field conditions. Sero-protection did not last more than three to four months (and even less for ducks) (Desvaux, 2012). Studies also demonstrated that vaccination coverage could be improved by simple actions to prevent vaccination failure and to optimize and harmonize the different protocols used for chickens and ducks.

Phylogenetic analyses of NCD viruses revealed some original velogenic strains never before described in Africa (Servan de Almeida *et al*., 2009; Maminiaina *et al*., 2010; Hammoumi *et al*., in press). For example, the new genotype XI, presumably derived from an ancestor close to genotype IV, which was introduced into Madagascar probably more than 50 years ago, is specific to the island (Maminiaina *et al*., 2010). A new genotype and sub-genotype (XIV and VIf) were also detected in West Africa and Ethiopia respectively, and seem to be specific to these regions (Hammoumi *et al*., in press). Under experimental conditions, different levels of protection after vaccination have been observed in poultry vaccinated with current vaccines based on genotype II strains and challenged with genotype XI. Under these conditions, clinical protection is normally acquired, but virus excretion – and hence "silent" circulation – can occur. This might explain why sporadic outbreaks with "new" genotypes in chickens vaccinated with "old" genotypes are observed in Madagascar and elsewhere in Africa.

revealed widespread circulation of low pathogenic avian influenza (LPAI) viruses – the precursors of most HPAI viruses found in poultry – in a large number of wild bird species and in all regions of Africa (Gaidet *et al*., 2012a; 2012b; Guerrini *et al*., in press). Globally and locally, the prevalence of LPAI viruses was relatively low (1 to 15 percent) and, despite wide geographical and taxonomic coverage, no clear hot-spot for avian influenza infection was found (Gaidet *et al*., 2012a). Seasonal and geographical variations in the prevalence of LPAI viruses across Africa were positively related to the local density of the wildfowl community and to the wintering period of Eurasian migratory birds (Gaidet *et al*., 2012b). Higher prevalences were systematically found in wild ducks of the *Anas* genus than in other duck species, whatever their foraging behaviour (dabbling or diving) or geographical origin (Eurasian or Afro-tropical), suggesting the existence of intrinsic differences in receptivity to infection among duck taxonomic groups. Repeated sampling in Mali and Zimbabwe showed, for the first time, the continuous circulation of LPAI viruses throughout the year in wild bird communities in Africa (Cappelle *et al*., 2012; Caron *et al*., 2011).

Studies aimed at characterizing and evaluating contact and pathogen transmission probabilities between wild and domestic birds are key elements in estimating the sanitary risks for domestic poultry. In the inner Niger Delta, in Mali, the spatial distribution of wild ducks was modelled using environmental data to evaluate the contact rate and the probability of avian influenza virus circulation among wild birds (Cappelle *et al*., 2010). The results indicated that transmission is likely to be greater during the period of flood recession at the end of the dry season, or in years of low rainfall and low flooding, when high densities of aquatic wild birds congregate on the few remaining water bodies. Also in Mali, satellite tracking of African wild ducks showed that the end of the dry season is a propitious period for contacts between domestic poultry and wild ducks (Cappelle *et al*., 2011), because the two populations share the same remaining flooded habitat close to villages. LPAI virus was also found in domestic birds in villages bordering wetlands (Molia *et al*., 2010a). In Zimbabwe, a detailed analysis of the bird communities living at the interface between villages/poultry farms and natural wetlands identified the wild bird species with potential to act as "bridge species" – species with ecological characteristics (abundance, habitat requirement, mobility, feeding behaviour) that foster contacts with both wild ducks and poultry – which may therefore transmit the virus between wild and domestic bird populations (Caron *et al*., 2010).

Identifying risk situations suggests ways of making surveillance more effective. Rather than systematic monitoring of wild birds, which is expensive and difficult to implement, surveillance should focus on specific seasons and sites, such as wetlands with high concentrations of wild birds that are close to farms. In the inner Niger Delta, for instance, analyses indicate that surveillance should target migratory ducks at the end of their wintering period in Africa – when they are at their highest density (February to March) – particularly in years of low rainfall. Such monitoring could also include domestic birds, targeting areas of contact with wild birds, such as in Mopti and Bamako market, where large quantities of wild birds are sold alongside domestic poultry during periods when a sharp decline in the Niger River level creates good conditions for hunting.

NEWCASTLE DISEASE IN AFRICA: A WIDESPREAD DISEASE RELATED TO BREEDING AND TRADING PRACTICES

While the prevalence of influenza viruses is fairly limited in African domestic bird populations, NCD is a recurring and widely distributed problem, especially in backyard farms. In more than 22 000 samples from domestic and wild birds collected and analysed in the Gripavi project, NCD virus prevalences of between 3.5 and 6 percent were found in domestic birds (using polymerase chain reaction [PCR]), against less than 1 percent for avian influenza viruses. Figures for wild birds were about 1 to 3 percent for NCD and less than 1 percent for avian influenza.

Studies in Mali, Ethiopia and Madagascar all emphasize the importance of trade in virus spreading (Rasamoelina Andriamanivo *et al*., 2012; Chaka *et al*., 2012b; Molia *et al*., 2010a). Investigations showed that attendance at a market and the vicinity of traders are correlated to a higher prevalence of NCD virus on farms. In Madagascar, the risk of infection at the district (Fokontany) level is statistically related to the density of trade flows (Rasamoelina Andriamanivo *et al*., 2012). Similarly, the risk of virus circulation increases in markets because of the high density of domestic birds coming from different areas.

Farming practices also affect virus circulation. In Mali, the risk of infection is lower on commercial farms applying health protection measures (biosecurity) than on small and traditional farms with little protection (Molia *et al*., 2011). In Ethiopia, NCD virus prevalence and exposure levels decrease when backyards are cleaned more regularly and drinking places are protected. In Madagascar, two types of farming are more susceptible to infection by the NCD virus: small backyard farms that do not apply biosecurity measures, and factory

CONTINUED

©FAO/ Marion Jourdan

Live duck market in Madagascar

©FAO/ Nicolas Gaidet

Garganey duck caught in a mist-net in the inner Niger Delta, Mali

farms, which have more frequent contacts with the outside (visits by veterinarians, purchases of food and chicks) (Rasamoelina Andraiamanivo *et al*., 2012). Contact with the outside also plays an important role in traditional farms in Ethiopia, where the infection rate is higher if breeders renew their poultry through outsourcing, and the exposure level decreases when eggs and chicks come from the farm's own stock (Chaka *et al*., 2012a).

Although common and widespread, NCD is poorly monitored in Africa. Its control relies mainly on vaccination, which is often unavailable to small farmers, or individual prevention strategies such as seasonal destocking. The Gripavi project has tested other approaches to monitoring or controlling avian infections such as NCD. A network system analysis approach applied to the poultry sector in Ethiopia, Mali and Madagascar identifies major exchange nodes and paths for domestic bird circulation. This approach enables the visualization of potential paths of bird and virus movements and evaluation of the degree to which farmers, markets or villages are connected. When virus is introduced or emerges at a point in the network, it is therefore easier to identify key paths or network nodes for epidemic monitoring and control (Rasamoelina Andraiamanivo *et al*., 2012).

Most bird species are considered susceptible to NCD virus, and NCD cases have been previously reported in some wildlife species, especially cormorants and pigeons. The Gripavi project's testing of more than 9 000 wild birds for NCD found three main new results: an average of about 3 percent PCR-positive birds for NCD, compared with about 1 percent for avian influenza virus, associated with virus circulation in all the tested families; higher NCD prevalence in wild than domestic birds in Mali in the dry season (Miguel *et al*., 2012); and the circulation of strains that are closely related phylogenetically in several species of wild and domestic birds. All major NCD control programmes in Africa should therefore take into account the poorly understood wild bird component.

FARMERS – AT THE HEART OF SURVEILLANCE AND CONTROL SYSTEMS

For endemic NCD, as for the now endemic H5N1 HPAI in Viet Nam, poultry farmers occupy a central position in surveillance and control processes. Surveillance networks for avian pests can be well organized, as in Mali (Molia *et al*., 2010b), but they always rely on farmers for the notification of suspected cases. The reporting rate is very low (about 17 percent in Mali), because of several factors such as fatalism and poor perception of the value of reporting suspected cases (Molia *et al*., 2012). Experience in Madagascar showed that it is extremely difficult to mobilize actors for long-term and effective surveillance over large territories. Network analysis, which identifies the most central nodes, could partially solve the problem by improving the targeting of surveillance sites without reducing the sensitivity of the system (Rasamoelina Andraiamanivo *et al*., in preparation).

In endemic areas such as Viet Nam, farmers are observed to be more involved in managing sanitary problems. They implement their own disease management and surveillance practices, and their collaboration with the authorities' surveillance network is limited. In these "informal" surveillance networks, information on health is transmitted rapidly over a radius of no more than a few kilometres. These networks define cases according to local knowledge of diseases, encouraging farmers to adopt measures that minimize the predicted effects of disease – such as by selling sick or exposed animals – rather than tackling the causes. As a result, farmers' perception of diseases is different from that of veterinary agents: farmers do not operate in the same "epidemiological territory", do not define diseases in the same way, and do not target the same objectives for control.

At the village or commune level, it appears that communities seek a compromise between economic interests and virus containment at a tolerable or acceptable level (Desvaux and Figuié, 2011).

CONCLUSIONS

Although no major health crisis linked to the H5N1 virus has occurred at the continental level in Africa, the work outlined in this document shows that vigilance must continue. Highly pathogenic strains of avian influenza are present in some countries where control measures cannot always keep them under control, and conditions in several parts of the continent are conducive to the persistence or emergence of potentially dangerous pathogens in both wild and domestic birds. More attention should also be paid to NCD surveillance, as this widespread virus is poorly controlled by veterinary services, which give it little consideration. In both Africa and Asia, risk factors were found mainly in poultry breeding and trading practices, and breeders are at the heart of monitoring and control systems. In addition, wild birds can carry some of the virus strains they share with domestic birds, and their role is likely to be mostly in virus introduction, under specific conditions.

By bringing together a multidisciplinary team (from ecology, epidemiology, virology and sociology) on common research issues, the Gripavi project helped to improve understanding of the risk of avian influenza and NCD introduction and spread. The scientifically based outputs of the project can contribute to improving the efficiency of HPAI and NCD surveillance and control strategies. The next step would be to implement the recommendations on an operational scale, through close cooperation among farmers, technical services and research teams. 360

REFERENCES

Cappelle, J., Gaidet, N., Iverson, S.A., Takekawa, J.Y., Newman, S.H., Fofana, B. & Gilbert, M. 2011. Characterizing the interface between wild ducks and poultry to evaluate the potential of transmission of avian pathogens. *Int. J. Health Geogr.*, 10(60): doi:10.1186/1476-072X-10-60.

Cappelle, J., Servan de Almeida, R., Fofana, B., Dakouo, M., Balanca, G., Gil, P., Albina, E. & Gaidet, N. 2012. Circulation of avian influenza viruses in wild birds in Inner Niger Delta, Mali. I*nfluenza other Respir. Viruses*, 6(4): 240–244.

Caron, A., de Garine-Wichatitsky, M., Gaidet, N., Chiweshe, N. & Cumming, G.S. 2010. Estimating dynamic risk factors for pathogen transmission using community-level bird census data at the wildlife/domestic interface. *Ecology & Society*, 15(3): 25.

Caron, A., Abolnik, C., Mundava, J., Gaidet, N., Burger, C.E., Mochotlhoane, B., Bruinzeel, L., Chiweshe, N., de Garine-Wichatitsky, M. & Cumming, G.S. 2011. Persistence of low pathogenic avian influenza virus in waterfowl in a southern African ecosystem. *EcoHealth*, 8(1): 109–115.

Caron, A., de Garine-Wichatitsky, M., Ndlovu, M. & Cumming, G.S. 2012 Linking avian communities and avian influenza ecology in southern Africa using epidemiological functional groups. *Veterinary Research*, 43(1): 73.

Chaka, H., Goutard, F., Roger, F., Bisschop, S.P.R. & Thompson, P.N. 2012a. Household-level risk factors for Newcastle disease seropositivity and incidence of Newcastle disease virus exposure in backyard chicken flocks in Eastern Shewa zone, Ethiopia. *Prev. Met. Med.*, 109(3–4): 312–320.

Chaka H., Goutard F., Bisschop S.P.R. & Thompson P.N. 2012b. Seroprevalence of Newcastle disease and other infectious diseases in backyard chickens at markets in Eastern Shoa Zone, Ethiopia. *Poultry Sciences*, 91(4): 862–869.

Cumming, G.S., Caron, A., Abolnik, C., Cattoli, G., Bruinzeel, L.W., Burger, C.E., Cecchettin, K., Chiweshe, N., Mochotlhoane, B., Mutumi, G.L. & Ndlovu, M. 2011. The ecology of influenza A viruses in wild birds in southern Africa. *EcoHealth*, 8(1): 4-13.

Desvaux, S. 2012. *Epidemiology of the highly pathogenic avian influenza H5N1 in Northern Vietnam: applications for surveillance and control.* Perth, Australia, Murdoch University. (Ph.D. thesis) http://researchrepository.murdoch.edu.au/10631/2/02Whole.pdf

Desvaux, S. & Figuié, M. 2011. Formal and informal surveillance systems: how to build bridges? *Epidemiology et santé animale* (59-60): 352-355

Desvaux, S., Grosbois, V., Pham, T.T.H., Fenwick, S., Tollis, S., Pham, N.H., Tran, A. & Roger, F. 2011. Risk factors of highly pathogenic avian influenza H5N1 occurrence at the village and farm levels in the Red River Delta Region in Vietnam. *Transbound. Emerg. Dis.*, 58(6): 492–502.

Desvaux, S., Garcia, J.M., Nguyen, T.D., Reid, S.A., Ngoc, A.B., Roger, F., Fenwick, S., Peiris, J.S.M. & Ellis, T. 2012a. Evaluation of serological tests for H5N1 avian influenza on field samples from domestic poultry populations in Vietnam: consequences for surveillance. *Vet. Microbiol.*, 156(3–4): 277–284.

Desvaux, S., Grobois, V., Pham, T.T.H., Dao, D.T., Nguyen, T.D., Fenwick, S., Roger, F., Ellis. T. & Peyre, M. 2012b. Evaluation of the vaccination efficacy against H5N1 in domestic poultry in the Red River Delta in Vietnam. *Epidemiology & Infection*, 141(04): 776–788.

Gaidet, N., Ould El Mamy, A.B., Cappelle, J., Caron, A., Cumming, G.S., Grosbois, V., Gil, P., Hammoumi, S., Servan de Almeida, R., Fereidouni, S.R., Cattoli, G., Abolnik, C., Mundava, J., Fofana, B., Ndlovu, M., Diawara, Y., Hurtado, R.F., Newman, S.H., Dodman, T. & Balança, G. 2012a. Investigating Avian Influenza Infection Hotspots in Old World Shorebirds. *PLoS ONE*, 7(9): e46049. doi:10.1371/journal.pone.0046049

Gaidet, N., Caron, A., Cappelle, J., Cumming, G.S., Balança G., Hammoumi, S., Cattoli, G., Abolnik, C., Servan de Almeida, R., Gil, P., Fereidouni, S.R., Grosbois, V., Tran, A., Mundava, J., Fofana, B., Ould El Mamy, A.B., Ndlovu, M., Mondain-Monval, J.Y., Triplet, P., Hagemeijer, W., Karesh, W.B., Newman, S.H. & Dodman, T. 2012b. Understanding the ecological drivers of avian influenza virus infection in wildfowl: a continental scale study across Africa. *Proc. Biol. Society*, 279(1731): 1131–1141.

Guerrini, L., Paul, M., Leger, L., Rasamoelina Andriamanivo, H., Maminiaina, O.F., Jourdan, M., Molia, S., Rakotondravao, R. & Chevalier, V. forthcoming. Environmental patterns for the risk of avian influenza transmission in Lake Alaotra region, Madagascar. *International Journal of Health Geography*, in press.

Hammoumi, S., Servan de Almeida, R., Gil, P., Briand, F.X., Molia, S., Gaidet, N., Cappelle, J., Chevalier, V., Balança, G., Traoré, A., Grillet, C., Maminiaina, O.F., Samaké, K. & Bezeid, O.E.M.A. forthcoming. New avian paramyxoviruses type I strains identified in Africa provide new outcomes for phylogeny reconstruction and genotype classification. *Plos One*, in press.

Maminiaina, O.F., Gil, P., Briand, F.X., Albina, E., Keita, D., Rasamoelina Andriamanivo, H., Chevalier, V., Lancelot, R., Martinez, D., Rakotondravao, R., Rajaonarison, J.J. Koko, M., Andriantsimahavandy, A.A., Jestin, V. & Servan de Almeida, R. 2010. Newcastle disease virus in Madagascar: Identification of an original genotype possibly deriving from a died out ancestor of genotype IV. *PLoS One*, 5(11): e13987. doi:10.1371/journal.pone.0013987.

Miguel, E., Grosbois, V., Berthouly-Salazar, C., Caron, A., Capelle, J. & Roger, F. 2012. A meta-analysis of observational epidemiological studies of Newcastle disease in African agro-systems (1980–2009). *Epidem. Infect.*, 14(6): 1117–1133.

Molia, S., Traoré, A., Gil, P., Hammoumi, S., Lesceu, S., Servan de Almeida, R., Albina, E. & Chevalier, V. 2010a. Avian influenza in backyard poultry of Mopti region, Mali. *Trop. Anim. Health Prod.*, 42(5): 807–809.

Molia, S., Lapeyre, S., Sidibé, M.S., Sissoko, K.D., N'Diaye, M.R., Diall, M. & Doumbia, L. 2010b. Semi-quantitative evaluation of the epidemiosurveillance network for highly pathogenic avian influenza in Mali. *Epidémiol. et santé anim.*, 57: 91–103.

Molia, S., Samaké, K., Diarra, A., Sidibé, M.S., Doumbia, L., Camara, S., Kanté, S., Kamissoko, B., Diakité, A., Gil, P., Hammoumi, S., Servan de Almeida, R., Albina, E. & Grosbois, V. 2011. Avian influenza and Newcastle disease in three risk areas for H5N1 highly pathogenic avian influenza in Mali. Avian Dis., 55(4): 650–658.

Molia, S., Kamissoko, B., Sidibé, M.S., Diakité, A., Diall, M. & N'Diaye, M.R. 2012. Deficient reporting in avian influenza surveillance, Mali. *Emerg. Infect. Dis.*, (18)4: 691–693.

Rasamoelina Andraiamanivo, H., Lancelot, R., Maminiaina, O.F., Rakotondrafara, T.F., Jourdan, M., Renard, J.F., Gil, P., Servan de Almeida, R., Albina, E., Martinez, D., Tillard, E., Rakotondravao, R. & Chevalier, V. 2012. Risk factors for avian influenza and Newcastle disease in smallholder farming systems, Madagascar highlands. *Prev. Vet. Med.,* 104(1–2): 114–124.

Rasamoelina Andraiamanivo, H., Duboz, R., Lancelot, R., Maminiaina, O.F., Jourdan, M., Rakotondramaro, T.M.C., Rakotonjanahary, S.N., Servan de Almeida, R., Rakotondravao, R., Durand, B. & Chevalier, V. under submission. Analysis of poultry trading network in Lake Alaotra and its implication for surveillance of Newcastle disease.

Servan de Almeida, R., Maminiaina, O.F., Gil, P., Hammoumi, S., Molia, S., Chevalier, V., Koko, M., Rasamoelina Andriamanivo, H., Traoré, A., Samaké, K., Diarra, A., Grillet, C., Martinez, D. & Albina, E. 2009. Africa, a reservoir of new virulent strains of Newcastle disease virus? *Vaccine*, 27(24): 3127–3129.

Trevennec, K., Chevalier, V., Grosbois, V., Garcia, J.M., Ho, T.H., Berthouly–Salazar, C., Peiris, J.S. & Roger, F. 2011. Looking for avian influenza in remote areas. A case study in Northern Vietnam. *Acta Tropica*, 120(3): 160–166.


©FAO/Laura Khiari

FAO IN ACTION

Peste des petits ruminants is spreading and threatening new African countries

Contributors: Clarisse Ingabire **(FAO)**, Felix Njeumi **(FAO)**

BACKGROUND

Peste des petits ruminants (PPR) is spreading to some previously uninfected territories in Africa. This has been the case particularly from 2006 to 2012, when the virus extended its range southwards in Africa as far as parts of the United Republic of Tanzania in 2008 and the Democratic Republic of the Congo in 2012. It also advanced into North Africa, to Tunisia in 2006, Morocco in 2008 and Algeria in 2011. PPR was first suspected in Angola towards the end of 2011, when high mortalities were recorded among small ruminants in the northern enclave Province of Cabinda. Angola's estimated total small ruminant population is 6.3 million head of sheep and goats.

Mortalities of both goats and sheep were also observed between late 2011 and early 2012 in two other Angolan provinces bordering the Democratic Republic of the Congo – Zaire and Uíge. The presence of the disease in the neighbouring Democratic Republic of the Congo, and the mortalities of small ruminants in these provinces led to strong suspicions of an incursion of PPR.

Angola confirmed the presence of PPR by both polymerase chain reaction (PCR) and enzyme-linked immunosorbent assay (ELISA) methodologies, detecting virus and post-exposure antibodies respectively. Concurrently, because of the risk factors, the government took additional measures to prevent spread of the disease, including by controlling animal movements inside the country and banning imports of animals from the Democratic Republic of the Congo.

FURTHER SUPPORT PROVIDED BY CMC-AH/FAO

The Government of Angola requested support from the Food and Agriculture Organization of the United Nations (FAO) in assessing the epidemiological situation and strengthening response capacity. In October 2012, FAO/OIE Crisis Management Centre – Animal Health (CMC-AH) deployed an international expert team to conduct field investigations.

The team identified the main risk factors that could contribute to the spread of PPR to unaffected areas. Movements of animals were of obvious importance. More intense surveillance systems and laboratory networks were crucial factors in determining effective control of the disease once introduced.

CONTROL MEASURES RECOMMENDED

Given the importance of small ruminants for rural populations, especially the poorest groups, PPR can deprive many people of a crucial livelihood and so have a significant socio-economic impact on communities. Regarding the risk factors and the current epidemiological situation, it was recommended that Angola implement a vaccination campaign immediately, to control and contain the disease and prevent its spread to central and southern parts of the country.

It is necessary for many countries in the region to strengthen veterinary services, improve laboratory diagnostic capacity and raise awareness among the population, to enhance recognition of the disease and promote early reporting. Efforts should also be directed to finalizing strategies and legislation for the control of PPR, and FAO encourages countries to engage in dialogue on collaboration and partnerships for tackling this transboundary animal disease with other countries and interested bodies in the region. 360


©FAO/Laura Khiari

Luanda cattle market, Angola

©FAO/Ludovic Plee

FAO IN ACTION

Recurring Rift Valley fever outbreaks in West Africa encourage FAO to develop a forecasting tool for better prevention of the disease

Contributors: Ludovic Plee **(FAO)**, Carlene Trevennec (**FAO**), Vincent Martin **(FAO)**

RIFT VALLEY FEVER IN MAURITANIA

In early August 2012, an unofficial report from *Carrefour de la Republique Islamique de Mauritanie* (CRIDeM) and published by Promed [1] stated that numerous camels were dying in southern regions of Mauritania (Guidimgha, Brakna, Gorgol and Trarza). The animals were said to show internal bleeding and respiratory distress or to have wasted away suddenly. A sound diagnosis of the ailment affecting the Mauritanian camel population was not reported at the time. Suspicions of pasteurellosis in camel herds were also reported in the media.

Information received from country officials indicated that significant rainfall had been reported in southern Mauritania, along with increased cases of fever in humans, most likely caused by malaria. These climatic conditions were clearly favourable for mosquito populations.

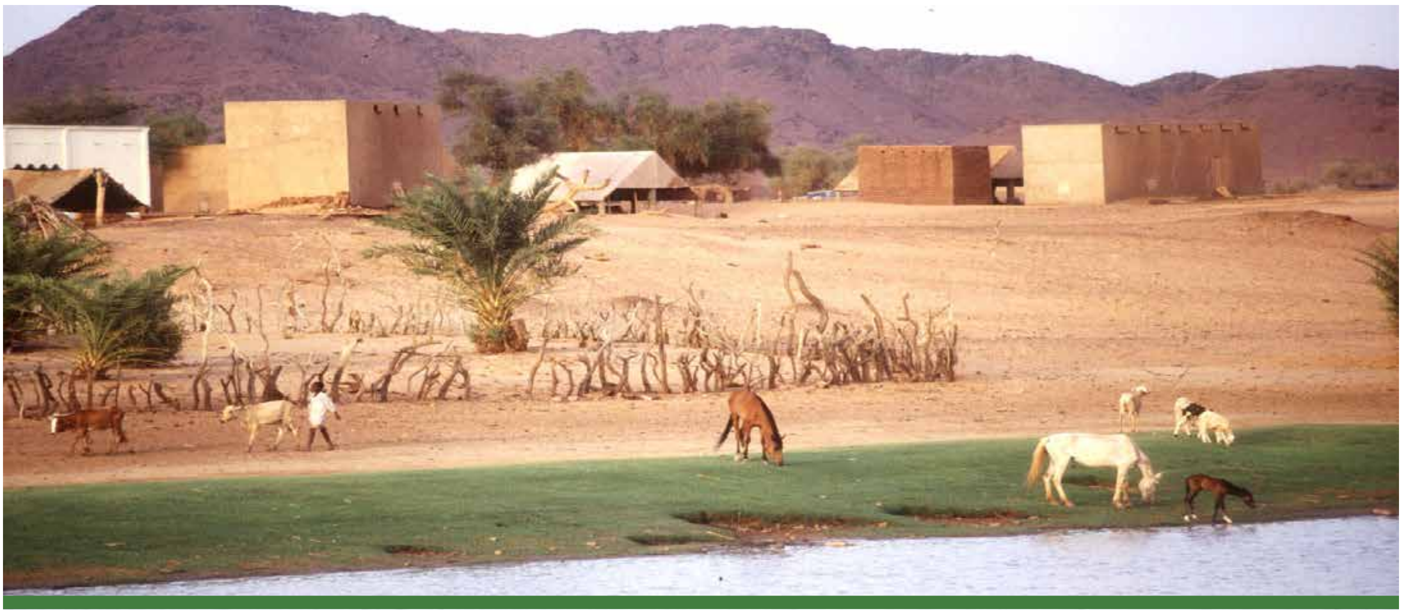
On 2 October 2012, the first suspected case of Rift Valley fever (RVF) infection in humans was reported in the Mauritanian capital, Nouakchott, in an individual originating from one of the southern regions where camel deaths had been reported. RVF was confirmed in several other patients in these regions and was officially reported to the World Health Organization (WHO) on 4 October. The previous RVF outbreak in Mauritania occurred in the northern region of Adrar in late 2010, and this early recurrence of the disease was a significant concern for the national authorities.

Following a request from the Chief Veterinary Officer, a joint mission of the FAO/OIE Crisis Management Centre – Animal Health (CMC-AH) and the FAO Subregional Office for North Africa (SNE) was deployed in early November, with experts in epidemiology and risk management, animal health and laboratory diagnostics. The mission was joined by the coordinator of the Veterinary Epidemio-surveillance Network (REPIVET) of the Mediterranean Animal Health Network (REMESA). Through collaboration with the Mauritanian Network for Animal Disease Epidemiosurveillance (REMEMA) and the FAO and WHO offices in Nouakchott, funding was obtained from the United Nations Central Emergency Response Fund (CERF) to support the country's response plan, at both the human and animal levels.

After initial assessment, the mission observed that recommendations from the first CMC-AH mission on RVF in Mauritania, in early January 2011, had laid the foundation for greatly enhanced communication and coordination between veterinary and public health actors at the central and local levels. It had also led to better control of vectors of the disease, increased use of repellents to keep these vectors away from animals, public awareness campaigns, and reinforced control and implementation of good practice in slaughterhouses during Eid festivities, to protect the food chain and mitigate the risks of RVF transmission to humans during slaughtering activities. These responses demonstrated the Mauritanian animal health authorities' proactivity in mitigating increased risk of RVF in the general population after the outbreaks had been identified.

The main recommendations from the joint CMC-AH/FAO-SNE response team were to strengthen coordination and the sharing of information between the Ministries of Public Health and of Rural Development as a routine activity, improve the identification of disease dynamics in human and animal populations that

CONTINUED



©FAO/ Ivo Balderi

Mauritania, Le Bheyr lake is of vital importance for the microclimate of the zone. Apart from providing grazing ground along its shores, it becomes a place for fishing and a crossing point for migratory birds in December and January

[1] http://www.promedmail.org/direct.php?id=20110803.2343


©FAO/ Carl de Souza

Chad, camel herders tending their herd

could lead to major zoonotic outbreaks, and maintain and increase capacity at the National Livestock and Veterinary Research Centre (CNERV); the Mauritanian authorities were recommended to assume greater ownership in coordinating the work of supporting agencies, including FAO, WHO and the World Organisation for Animal Health (OIE), and to develop an RVF emergency plan.

FAO IN ACTION FOR PREVENTING RVF

Because both the geographical and seasonal distributions of many vector-borne diseases are linked to climate, the use of climate-related environmental factors as predictive indicators – in association with regular disease surveillance activities – has proved appropriate when early warning systems for these diseases are being established. These systems have shown potential in anticipating major vector-borne epidemics and mitigating the associated public health and economic impacts. RVF is one of the diseases for which effective early warning systems have already been developed.

FAO sees that application of an early warning system would significantly strengthen the capacity of animal health services to prepare for RVF outbreaks in Mauritania.

The objective of an RVF early warning system (RVF-EWS) is to assess the risk of a major RVF epidemic before it occurs and to enable national veterinary services to anticipate the event and react promptly and effectively to prevent the disease's devastating impact on animal and human health. Risk assessments and alerts generated by an RVF-EWS can be translated into visual decision-support tools, such as risk maps, which decision-makers can use for planning targeted interventions and developing communication and sensitization campaigns in the face of an epidemic. The main challenge of an RVF-EWS is that RVF epidemiology varies according to the agro-ecosystem (semi-arid versus humid), and the best model for predicting RVF outbreaks will depend on the region and its landscape and climate characteristics (e.g., western Africa versus eastern Africa).

In the semi-arid ecosystems of the Horn of Africa, the RVF modelling approach developed by the National Aeronautics and Space Administration's (NASA's) Goddard Space Flight Center (GSFC) identifies areas with positive Normalized Difference Vegetation Index (NDVI) and rainfall anomalies (above the long-term averages for NDVI and rainfall). Areas with persistent positive anomalies represent suitable habitats for RVF vectors. These predictions were successfully used in 2006 in the Horn of Africa to implement enhanced RVF surveillance activities for animals and human populations two to six weeks before the first RVF cases were identified. In October 2012, FAO revived NASA's model and published risk maps for winter 2012/2013 in *EMPRES Watch* (Volume 2, December 2012)[2] to warn countries about a potential risk of RVF outbreaks. During the at-risk months (November to March), the risk maps were updated as soon as near real-time data were released.

In other semi-arid areas, where the accuracy of NASA's model predictions has not been proved, FAO is testing and calibrating the algorithm to produce updated risk maps. For areas of southern Africa, climatic and environmental time-series data (long-term estimates of rainfall, temperature and NDVI) are currently analysed using an innovative spatio-temporal statistical method recently developed to predict malaria events. For western Africa, FAO takes part in other modelling approaches led by the International Cooperation Centre of Agricultural Research for Development (CIRAD), France, to assess the possibilities of forecasting RVF outbreaks. Statistical models developed for temporary water ponds in Senegal, based on landscape, climatological and rainfall parameters (Soti *et al.* 2012; Mondet *et al.*, 2005), will be used to predict relative vector abundance and thus forecast outbreaks in the RVF endemic area of Senegal and Mauritania.

In temperate and tropical agro-ecosystems of eastern Africa, where no or only few outbreaks have been reported, FAO has initiated forecasting activities based on knowledge-driven risk mapping (i.e., existing knowledge), including multiple-criteria decision analysis (MCDA), which is being developed at FAO in collaboration with CIRAD. The development and use of such models does not require local disease data, except for model validation, which facilitates application of the models to predict events of concern even where there is no historical record of such events. The MCDA method uses a logic based on a weighted linear combination framework of known risk factors. This approach enables scientists to determine how suitable a changed environment is for RVF outbreaks, in areas that are usually free. In the long term, the approach might be applied to other agro-ecosystems in Africa. 360

REFERENCES

Anyamba, A., Chretien, J.P., Small, J., Tucker, C.J., Formenty, P.B., Richardson, J.H., Britch, S.C., Schnabel, D.C., Erickson, R.L. & Linthicum, K.J. 2009. Prediction of a Rift Valley fever outbreak. *Proc. Natl Acad. Sci.* USA, 106(3): 955-959. doi: 10.1073/pnas.0806490106. i

Mondet, B., Diaïté, A., Ndione, J.A., Fall, A.G., Chevalier, V., Lancelot, R., Ndiaye, M. & Ponçon, N. 2005. Rainfall patterns and population dynamics of *Aedes* (Aedimorphus) *vexans arabiensis*, Patton 1905 (Diptera: Culicidae), a potential vector of Rift Valley fever virus in Senegal. *J. Vector Ecol.*, 30(1): 102–106.

Soti, V., Tran, A., Degenne, P., Chevalier, V., Lo Seen, D., Thiongane, Y., Diallo, M., Guégan, J.F. & Fontenille, D. 2012. Combining hydrology and mosquito population models to identify the drivers of Rift Valley fever emergence in semi-arid regions of West Africa. *PLoS Negl. Trop. Dis.*, 6(8): e1795. doi: 10.1371/journal.pntd.0001795.

[2] http://www.fao.org/docrep/017/ap392e/ap392e.pdf

NEWS

What's new in EMPRES-i?[1]

Contributors: Fairouz Larfaoui **(FAO)**, Ettore De Maio **(FAO)**, Alessandro Colonna **(FAO)**, Julio Pinto **(FAO)**

EMPRES-i IS NOW AVAILABLE AT DATA.FAO.ORG

The data portal of the Food and Agriculture Organization of the United Nations (FAO)[2] is an innovative web-based platform that brings together maps – as well as statistics, pictures and (soon) documents – on nutrition, food and agriculture from throughout FAO, making them all available from one convenient location.

The Global Animal Disease Information System (EMPRES-i) has been included in this global catalogue of data as the global FAO animal health reference database. This single point of entry for FAO databases will allow FAO users to connect through a single window to recover all the data available from the different databases available in the portal, leading to improved analysis and understanding of disease risks and the dynamics of drivers of disease emergence and spread.

More information is available at: http://data.fao.org/database?entryId=d6c36114-51f9-40fc-bec1-8eea8f74d2a0

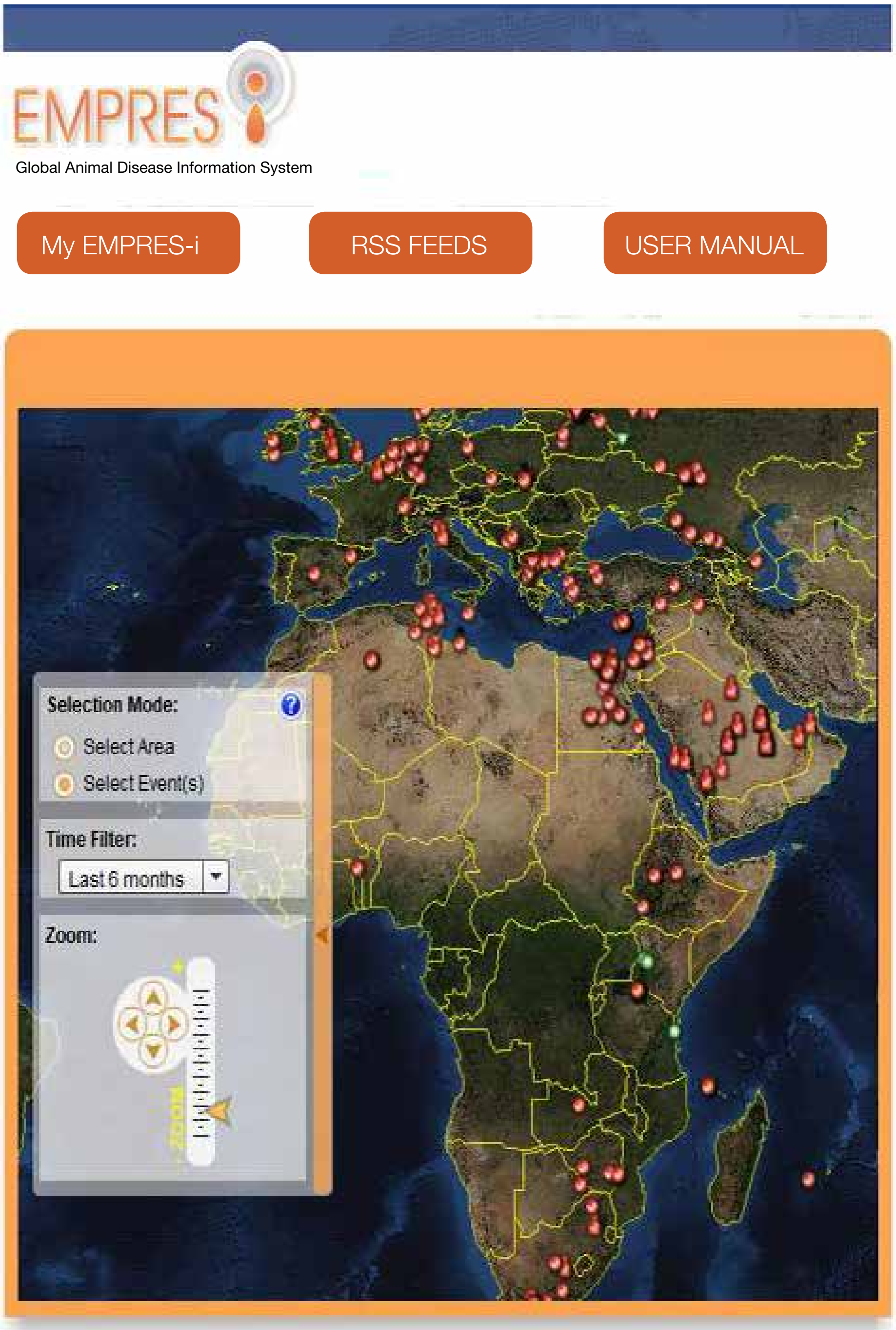
IMPROVED ANALYSIS TOOL IN EMPRES-i

New features for mapping and graphic functions have been developed in the analysis component of EMPRES-i.

DISEASE MAPPING

The disease mapping component is part of the disease event module of EMPRES-i and enables easy access to and retrieval of information on animal disease events worldwide, according to criteria defined by the user. The mapping component enables animal disease events to be geographically represented and is under continuous development. Each event is represented by a geo-referenced unique location. Layers from other FAO databases can be added, such as data on livestock populations, human demographics, biophysical conditions and animal health status. New features recently developed in EMPRES-i enhance the display of the geographical distribution of disease events on a map.

One of the features recently released makes it possible to display more than one disease event and visualize different subtypes of a disease on a single map – for example, different foot-and-mouth disease types or avian influenza subtypes. A marker symbol on the map can be customized according to the disease/subtype, the status of the disease outbreak (suspected/confirmed/denied) and the animal species affected. The added value of this feature is in enabling the user to tailor a map by modifying the shapes and colours of the markers and the text of the title and legend. Another new feature allows the customization of layers, such as the borders



Disease mapping in EMPRES-i

CONTINUED

[1] http://empres-i.fao.org
[2] http://data.fao.org

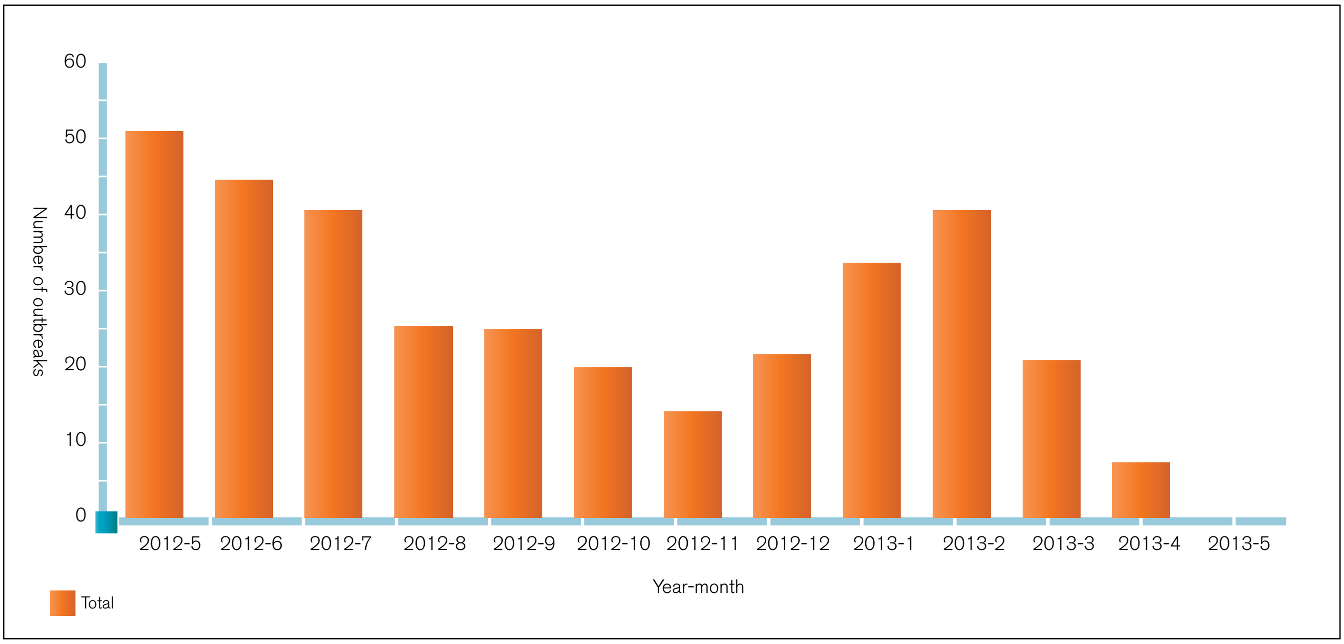


Figure 1: EMPRES-i chart showing the number of outbreaks of a disease per month

and colours of countries and seas. The map can be then exported in JPEG format.

This mapping component is designed for users who are not necessarily familiar with advanced Geographic Information System (GIS) tools such as ARC GIS.

The mapping component is accessible from the EMPRES-i home page by clicking on "disease event" to obtain access to two main features:

- **i.** the default query (disease events map – all diseases [last 6 months]), by clicking on "advanced map";
- **ii.** personalized disease event queries, by clicking on "advanced search".

Users also have access to a new help function for guidance on how to apply new features of the EMPRES-i disease mapping component.

GRAPHICS

The recently released graph component makes it easy to produce simple line, bar and pie charts according to such variables as disease, serotype, time and number of outbreaks. The component can be accessed by setting a disease query in the EMPRES-i home page via "disease event", "advanced search" and "exporting to a graph". The graphs can also be customized (e.g., by changing the colours of the columns, etc.) and exported in other formats (e.g., JPEG).

These enhancements of the mapping and graphic components of EMPRES-i will provide significant flexibility to EMPRES-i users in customizing, displaying and analysing worldwide animal disease information.

EMPRES-i: http://empres-i.fao.org 360

NEWS

Publications

EMPRES WATCH

In the Russian Federation, ASF has persisted since 2008 and continues to spread. The disease is endemic in most of the south and is on its way to becoming endemic in Tverskaya Oblast, not far from Moscow, where some of the highest pig and wild boar densities are found. More than 600 000 pigs have died or been culled from 2007 to mid-2012 because of ASF. Overall losses, including indirect ones, were estimated at around 30 billion roubles or US$1 billion. Since 2008, the Food and Agriculture Organization of the United Nations (FAO) has repeatedly warned of the high risk of ASF spreading to neighbouring countries and the likelihood that it will then establish in these newly infected areas. Such developments could lead to the expansion of ASF into Eastern Europe and beyond. Analysis of the situation, production and marketing systems in the Russian Federation enables a better understanding the epidemiology and spread patterns of the disease in the region, and the identification of critical areas for improved disease management. FAO, in collaboration with the All-Russian Scientific Research Institute of Veterinary Virology and Microbiology (National Reference Laboratory on ASF) in Pokrov, has prepared a comprehensive overview on the subject. This technical publication is based largely on those findings. The knowledge provided here will inform veterinary services, animal health professionals, pig producers and decision-makers in Europe, and in other countries around the globe.

African swine fever in the Russian Federation: risk factors for Europe and beyond http://www.fao.org/docrep/018/aq240e/aq240e.pdf 36


EMPRES EMERGENCY PREVENTION SYSTEM

empres watch

VOL 28 May 2013 EMPRES-LIVESTOCK@fao.org | www.fao.org/ag/empres.html

African swine fever in the Russian Federation: risk factors for Europe and beyond

Contributors: Sergei Khomenko [a], Daniel Beltrán-Alcrudo [a], Andriy Rozstalnyy [a], Andrey Gogin [b], Denis Kolbasov [b], Julio Pinto [a], Juan Lubroth [a], Vincent Martin [a]
[a] Food and Agriculture Organization of the United Nations (FAO)
[b] All-Russian Scientific Research Institute of Veterinary Virology and Microbiology (Pokrov, Russian Federation)

Contents

Introduction

African swine fever (ASF) is one of the most severe viral pig diseases. Some genotypes can cause up to 100 percent mortality in pigs and wild boar, such as the genotype II virus introduced into Georgia in 2007 (Chapman *et al.*, 2011), which spread throughout the Caucasus (Beltran-Alcrudo *et al.*, 2008) into the Islamic Republic of Iran (Rahimi *et al.*, 2010), the Russian Federation (Beltran-Alcrudo *et al.*, 2009) and, in July 2012, into Ukraine (Dietze *et al.*, 2012). Without the availability of effective vaccines or treatment, outbreaks of ASF have been controlled in some countries by stamping out and through the implementation of strict movement bans of swine and their products. However, these measures are difficult to implement unless the veterinary services are well-equipped, have reliable, trained personnel and sufficient and timely access to funds (for operations and adequate compensation). In addition, extensive culling implies economic losses and shortfalls in available food, particularly for the poorest farmers and households. One of the most important challenge is to get the outbreaks reported by the farmers.

GIVEN THE WORRISOME DEVELOPMENTS IN THE RUSSIAN FEDERATION, EUROPEAN COUNTRIES HAVE TO BE ALERT AND READY TO PREVENT AND TO REACT EFFECTIVELY TO ASF INTRODUCTIONS INTO THEIR TERRITORIES FOR MANY YEARS TO COME.

In the Russian Federation, ASF has persisted since 2008 and continues to spread. The disease is endemic in most of the south and is on its way to becoming endemic in Tverskaya Oblast, not far from Moscow, where some of the highest pig and wild boar densities are found. Over 600 000 pigs have died or have been culled from 2007 to mid-2012 due to ASF. Overall losses, including indirect ones, were estimated at around 30 billion roubles or US$ 1 billion (Anonymous, 2012).

Since 2008, the Food and Agriculture Organization of the United Nations (FAO) has repeatedly warned of the high risk of ASF spreading to neighboring countries and the likelihood that it will then establish in these newly infected areas (Beltran-Alcrudo *et al.*, 2008 and 2009; FAO, 2010; Dietze *et al.*, 2012). Such developments could lead to the expansion of ASF into Eastern Europe and beyond.

The analysis of the situation in the Russian Federation and its production and marketing systems here presented, allows us to better understand the epidemiology and spread patterns of the disease in the region, and to identify critical areas for improved disease management. FAO, in collaboration with the All-Russian Scientific Research Institute of Veterinary Virology and Microbiology (National Reference Laboratory on ASF) in Pokrov, has prepared a comprehensive overview on the subject. This technical publication is based largely on those findings. The knowledge provided here will better inform veterinary services, animal health professionals, pig producers and decision-makers in Europe, and in other countries around the globe.

Countries immediately bordering the Russian Federation, particularly Ukraine, Republic of Moldova, Kazakhstan and Latvia, are most vulnerable to ASF introduction and endemic establishment, largely because the biosecurity of their pig sector is predominantly low. The prevention of ASF spread into Ukraine is particularly critical for the whole pig production sector in Europe. Given the worrisome developments in the Russian Federation, European countries have to be alert. They must be ready to prevent and to react effectively to ASF introductions into their territories for many years to come.

CONTACTS @ HQ

FAO-EMPRES, Rome, Italy
fax: (+39) 06 57053023
e-mail: empres-livestock@fao.org

Vincent Martin
EMPRES Head (OIC)
Infectious Diseases/EMPRES
tel.: (+39) 06 57054102
e-mail: vincent.martin@fao.org

Samia Metwally
Animal Health Officer (Virology)
tel.: (+39) 06 57055838
e-mail: samia.metwally@fao.org

Ahmed El Idrissi
Animal Health Officer (Bacteriology) and Global Programming Unit
tel.: (+39) 06 57053650
e-mail: ahmed.elIdrissi@fao.org

Julio Pinto
Animal Health Officer (Epidemiology)
Global Early Warning System (GLEWS)
tel.: (+39) 06 57053451
e-mail: julio.pinto@fao.org

Carlene Trevennec
Veterinary Epidemiologist
tel.: (+39) 06 57055296
e-mail: carlene.trevennec@fao.org

Felix Njeumi
Animal Health Officer (Disease Management)
tel.: (+39) 06 57053941
e-mail: felix.njeumi@fao.org

Daniel Beltrán-Alcrudo
Animal Health Officer (Disease Ecology)
tel.: (+39) 06 57053823
e-mail: daniel.beltranalcrudo@fao.org

Akiko Kamata
Animal Health Officer
tel.: (+39) 06 57054552
e-mail: akiko.kamata@fao.org

Gwenaëlle Dauphin
EMPRES Laboratory Unit Coordinator and OFFLU focal point
tel.: (+39) 06 57056027
e-mail: gwenaëlle.dauphin@fao.org

Béatrice Mouillé
Assistant of Identify Project Coordinator
tel.: (+39) 06 57054456
e-mail: beatrice.mouille@fao.org

Keith Sumption
Executive Secretary
European Commission for the Control of Foot-and-Mouth Disease (EUFMD)
tel.: (+39) 06 57055528
e-mail: keith.sumption@fao.org

Eoin Ryan
Animal Health Officer
European Commission for the Control of Foot-and-Mouth Disease (EUFMD)
tel.: (+39) 06 57055191
e-mail: eoin.ryan@fao.org

Elizabeth Parker
Animal Health Officer (Programming Unit)
tel: (+39) 06 57055428
e-mail: elizabeth.parker@fao.org

Sergei Khomenko
Disease Ecology and Wildlife
tel.: (+39) 06 57056493
e-mail: sergei.khomenko@fao.org

James Zingeser
Veterinary Epidemiologist
tel.: (+39) 06 57055918
e-mail: james.zingeser@fao.org

Sherrilyn Wainwright
Veterinary Epidemiologist
tel.: (+39) 06 57054584
e-mail: sherrilyn.wainwright@fao.org

Klaas Dietze
Animal Health Officer
tel.: (+39) 06 57053968
e-mail: klaas.dietze@fao.org

Cecilia Murguia
Information Management and Web Officer
tel.: (+39) 06 57056520
e-mail: cecilia.murguia@fao.org

Fairouz Larfaoui
Disease Intelligence
tel.: (+39) 06 57053331
e-mail: fairouz.larfaoui@fao.org

Sophie von Dobschuetz
Veterinary Epidemiologist
tel.: (+39) 06 57053717
e-mail: sophie.vondobschuetz@fao.org

Caryl Lockhart
Veterinary Epidemiologist (spatial and network analysis)
Global Early Warning System (GLEWS)
tel.: (+39) 06 57054946
e-mail: caryl.lockard@fao.org

Filip Claes
OFFLU scientist
tel.: (+39) 06 57053525
e-mail: filip.claes@fao.org

CONTACTS @ Joint FAO/IAEA Division

Gerrit Viljoen
Head, Animal Production and Health Section
tel.: (+43) 1 260026053
e-mail: g.j.viljoen@iaea.org

Adama Diallo
Head, Animal Production and Health Laboratory
tel.: (+43) 1 2600 28355
e-mail: adama.diallo@iaea.org

CONTACTS @ AFRICA

Cheikh Ly
Animal Production and Health Officer
FAO Regional Office for Africa
Accra, Ghana
tel.: (+233) 0302 675000 ext. 2502
e-mail: cheikh.ly@fao.org

Berhanu Bedane
Animal Production and Health Officer
FAO Sub-Regional Office for West Africa, Accra, Ghana
tel.: (+233) 0302 675000/030/7010930 ext. 3144
e-mail: behanu.bedane@fao.org

Emmanuelle GuerneBleich
Livestock Officer
FAO Sub-Regional Office for Eastern Africa, Addis Ababa, Ethiopia
tel.: (+251) 11 5517230/33
e-mail: emmanuelle.guernebleich@fao.org

Youssouf Kabore
Epidemiologist
Regional Animal Health Centre for Western and Central Africa, Bamako, Mali
tel.: (+223) 2024 9293/9292
e-mail: youssouf.kabore@fao.org

Bouna Diop
Regional Manager
Regional Animal Health Centre for East Africa, Nairobi, Kenya
tel.: (+254) 20 3674333720/3674000
e-mail: bouna.diop@fao.org

Charles Bebay
Regional Manager a.i
FAO ECTAD Western and Central Africa
FAO IDENTIFY Project Liaison Officer for sub Saharan Africa, Bamako, Mali
tel.: (+ 223) 20 24 92 93
mobile : (+ 223) 90 50 20 38
e-mail : Charles.Bebay@fao.org

Sam Okuthe
Epidemiologist
Regional Animal Health Centre for East Africa, Nairobi, Kenya
tel.: (+254) 735 999 022
e-mail: sam.okuthe@fao.org

Mokganedi Mokopasetso
National Project Officer
Emergency Centre for Transboundary Animal Disease Operations (ECTAD)
Southern Africa
Gaborone, Botswana
tel.: (+267) 3953100
e-mail: mokganedi.mokopasetso@fao.org

CONTACTS @ Latin America and the Caribbean

Tito E. Díaz Muñoz
Senior Animal Production and Health Officer
Latin America and the Caribbean
Santiago, Chile
tel.: (+56) 2 3372250
e-mail: tito.diaz@fao.org

Deyanira Barrero León
Regional Coordinator for Foot-and-Mouth Disease
Latin America and the Caribbean
Santiago, Chile
tel.: (+56) 2 9232206
e-mail: deyanira.barrero@fao.org

Cedric Lazarus
Livestock Development Officer
Sub-Regional Office for the Caribbean, Barbados
tel.: (+246) 4267110 ext. 245
e-mail: cedric.lazarus@fao.org

Alejandro Acosta
Livestock Development Officer
Sub-Regional Office for Central America, Panama
tel.: (+507) 3 01 0326
e-mail: alejandro.acosta@fao.org

CONTACTS @ Near East

Mohammed Bengoumi
Animal Production and Health Officer
FAO Sub-Regional Office for North Africa, Tunis, Tunisia
tel.: (+216) 71903236 ext. 236
e-mail: mohammed.bengoumi@fao.org

Markos Tibbo
Livestock Officer
Animal Production and Health Officer (OIC)
FAO Regional Office for the Near East, Cairo, Egypt
tel.: (+202) 3331 6143/6000 ext. 2803
e-mail: markos.tibbo@fao.org

CONTACTS @ Asia

Joachim Otte
Senior Animal Production and Health Officer
Secretary of the Animal Production and Health Commission
Asia and the Pacific, Bangkok, Thailand
tel.: (+66) (0)2 6974326
e-mail: joachim.otte@fao.org

Boripat Siriaroonrat
Coordinator for HPAI in Wild Birds in the Asian Region, Bangkok, Thailand
tel.: (+66) (0)2 6974317
e-mail: boripat.siriaroonrat@fao.org

Subhash Morzaria
Regional Manager
Emergency Centre for Transboundary Animal Disease Operations (ECTAD) Asia and the Pacific, Bangkok, Thailand
tel.: (+66) (0)2 6974138
e-mail: subhash.morzaria@fao.org

Carolyn Benigno
Animal Health Officer
Asia and the Pacific, Bangkok, Thailand
tel.: (+66) (0)2 6974330
e-mail: carolyn.benigno@fao.org

Mohinder Oberoi
Sub-Regional Manager
Emergency Centre for Transboundary Animal Disease Operations (ECTAD) Regional Support Unit (SAARC)
Kathmandu, Nepal
tel.: (+977) 1 5010067 ext. 108
e-mail: mohinder.oberoi@fao.org

empres360 CONTACT

EMPRES-Animal Health 360 is an EMPRES-Animal Health publication. The Emergency Prevention System (EMPRES) is an FAO programme, founded in 1994, with the goal of enhancing world food security, fighting transboundary animal and plant pests and diseases and reducing the adverse impact of food safety threats. EMPRES-Animal Health is the component dealing with the prevention and control of transboundary animal diseases.

To subscribe to this bulletin or ask information about EMPRES-Animal Health send an e-mail to **empres-animal-health@fao.org** or fax to **+39 06 57053023**
For more information visit as at **http://www.fao.org/ag/empres.html**

EMPRES-Animal Health can assist countries in the shipment of samples for diagnostic testing of transboundary animal diseases (TADs) at FAO reference laboratories and centres. Please contact **EMPRES-Shipping-Service@fao.org** for information prior to sampling or shipment. Please note that sending samples out of a country requires an export permit from the Chief Veterinarian's Office of the country and an import permit from the receiving country

EMPRES
EMERGENCY PREVENTION SYSTEM

Recommended citation
FAO. 2013. *EMPRES-Animal Health 360*, No. 42, October 2013. Rome

Photos cover clockwise from top left: ©FAO/Sia Kambou; ©FAO/Sabine Michiels; ©FAO/Giuseppe Bizzarri; © FAO
Main cover photo: ©FAO/Munir Uz Zaman
Back cover photo: ©FAO/Giulio Napolitano

I3470E/1/10.13