



TIZIANA FARINA (FAO)

Dr Juan Lubroth

Dr Juan Lubroth appointed Chief of the Animal Health Service (Chief Veterinary Officer of FAO)

On 1 October 2009, Dr Lubroth was appointed Chief of the Animal Health Service (Chief Veterinary Officer) of FAO in Rome, having joined the service in 2002. He has led several major initiatives for the control of transboundary animal diseases in Central Asia, South Asia and Southern Africa, and has served on the Advisory Committee of the Pan African Programme for the Control of Epizootics. He was the driving force behind cooperative initiatives of FAO, the World Health Organization (WHO) and the World Organisation for Animal Health (OIE) (page 37).

Avian influenza and Newcastle disease proficiency test in Africa and the Near East

This proficiency test was co-organized by FAO and the *Istituto Zooprofilattico Sperimentale delle Venezie* (IZSVE). It was the first experience of its kind for avian influenza (AI) and Newcastle disease (ND) in Africa and the Near East. The purpose was to evaluate the overall and individual technical capacities of national veterinary laboratories to diagnose AI and ND by serology and/or molecular tests (page 13).



IZSVE

Testing of proficiency test panels at IZSVE

FAO in action: pandemic H1N1 2009



CORTNEY PRICE (FAO)

FAO daily action planning meeting for pandemic H1N1 2009

Following the start of this pandemic in North America in April 2009, FAO deployed a technical mission in Mexico to investigate the potential role of swine in the epidemiology of human cases of pandemic H1N1 2009 (pH1N1). Since then, FAO and primary partners such as the World Organisation for Animal Health (OIE) and the World Health Organization (WHO) have worked together to clarify and collect daily information regarding the monitoring and evolution of pH1N1 transmission in animals (page 5).

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Pandemic H1N1 2009

Pandemic H1N1 2009: a need for global surveillance of influenza viruses in animal populations

Background

The pandemic H1N1 2009 (pH1N1), a novel lineage of the influenza A virus, was first diagnosed in April 2009 in humans in North America. Since then, the virus has spread rapidly among people and is currently causing a pandemic in the human population.¹ Infected humans usually show mild or moderate symptoms, with a small proportion progressing to severe disease and, in some cases, death. The virus has also been found in animals, raising additional concerns for public and animal health.

The pH1N1 virus consists of a combination of genes from four different influenza virus strains, with gene segments from the human influenza virus, swine influenza viruses from North America and from Asia, and the avian influenza virus from North America (Garten *et al.*, 2009). This particular combination of genes had never been reported among animal or human isolates anywhere in the world. Influenza viruses are known for their ability to change their antigenic structure and create new strains, possibly changing biological characteristics such as virulence, infectivity or host range. Gene exchange (reassortment) may occur among influenza viruses. When an animal or human is co-infected by two different viruses, viral ribonucleic acid (RNA) has the opportunity to mix, resulting in a new influenza virus. Because of innate receptors compatible with influenza viruses, swine and some avian species (e.g., turkeys) are of particular concern for their enhanced ability to become infected with the virus, which then replicates. This leads to the transmission of influenza viruses from various origins, and infection with more than one virus at a time, thereby creating the potential for viral reassortment.

Most of the existing serotypes of influenza viruses can be found among avian species, and aquatic wildfowl are seen as the endemic reservoir of most avian influenza viruses. Some of these viruses cause respiratory or digestive disease in birds, but for many avian influenza viruses, birds are healthy carriers. One lineage of H5N1 highly pathogenic avian influenza (HPAI), first discovered in 1996 in birds in Asia, has caused a major pandemic of HPAI in birds worldwide. Almost 62 countries/territories on three continents – Africa, Asia and Europe – have been affected, and H5N1 HPAI is ongoing in several endemic countries. Transmission of H5N1 HPAI from infected birds to humans has occurred, with development of severe disease and many deaths in exposed humans. This particular virus does not seem to spread efficiently from human to human.

A number of influenza A viruses circulate in swine populations. Three serotypes that are most commonly isolated are classic H1N1, H1N2 and H3N2. These influenza viruses

¹ www.who.int/wer/2009/wer8447.pdf.



are endemic in most pig populations worldwide and cause one of the most prevalent respiratory diseases in pigs. Several vaccines for these serotypes are available.

Pandemic H1N1 2009 in animals

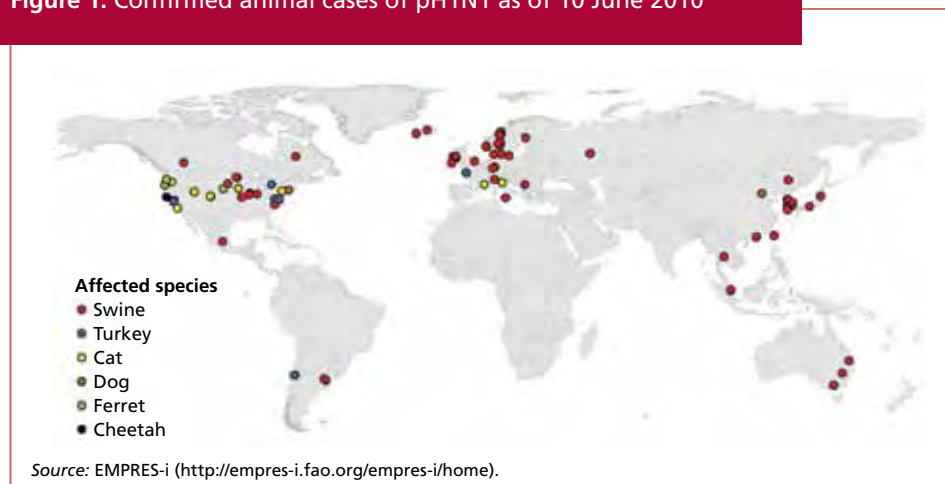
pH1N1 in animals has been reported from 23 countries, mostly in swine (Figure 1). The monitoring of pH1N1 is difficult because it is not a notifiable disease in many countries, although the World Organisation for Animal Health (OIE) has made specific recommendations to report it as an emergent disease. Some countries reported their initial cases, but ceased further reporting or ongoing surveillance in animal populations. Therefore the number of reported cases by country does not necessarily reflect disease occurrence and is biased by differences in the sensitivity of surveillance systems and in reporting practices.

Epidemiology of pH1N1 in animals

pH1N1 in animals, which affects primarily pigs, has been detected generally through clinical signs manifested by pigs following infection with the influenza virus. Although experimental studies have demonstrated that pig-to-pig transmission is possible, transmission from humans to animals is suspected to be frequent and the most likely mechanism of transmission of the virus to pigs. Typical clinical signs include nasal discharge, coughing and increased respiratory rate, but these are not always observed in pigs and are often mild. These signs can occur together with non-specific signs such as lethargy, inappetence and pyrexia.

Some studies have shown that virus shedding takes place from as early as day one post-inoculation and continues up to day nine post-inoculation; antibody response is reported to be detectable from day seven post-inoculation. Infected pigs have been found to be capable of transmitting the virus to naïve contact pigs within the same pen for at least three cycles of transmission (Lange *et al.*, 2009). This seems to be valid for the reported cases worldwide and for the results from infection studies with

Figure 1: Confirmed animal cases of pH1N1 as of 10 June 2010





MOISES VARGAS TERAN (FAO)

Each shed houses an average of 960 fattening pigs, Perote, Veracruz, Mexico

virus isolates (Lange *et al.*, 2009). Post-mortem inspections of experimentally infected pigs reported signs of mild to moderate catarrhal rhinitis with diffuse hyperaemia and increased mucosal secretion, as well as pulmonary pathology ranging from mild to extensive signs of acute lobular bronchopneumonia with lobular consolidations.

pH1N1 has been experimentally transmitted to poultry, although the results have not been reproduced in all transmission trials to chickens and turkeys. The pH1N1 virus has been isolated from turkeys showing only a drop in egg production in reported outbreaks in Canada and Chile. Reports indicate that the turkeys did not show any other signs of infection,

such as respiratory problems or increased mortality.

The genetic sequences of influenza virus isolates from many outbreaks in animals have been compared with human strains of pH1N1 occurring in the same locations. There was strong genetic homology in all of the reported comparisons, demonstrating that the same strain of the pandemic virus is circulating in humans and animals.

The majority of countries reporting cases in animal species have confirmed that farmers or farm workers have had an influenza-like illness or a confirmed diagnosis of pH1N1. In some cases, it has been reported that farm workers showed symptoms before the swine and turkeys, suggesting that transmission of the infection originated in humans. The same has been seen in other animals, including ferrets, cats, dogs and a cheetah.

In Norway, pig herds were free of swine influenza viruses (H1N1 and H3N2), as confirmed by an ongoing influenza surveillance system for all swine herds in the country. Cases of pH1N1 have been reported in this naïve population since October 2009. Many of the affected pig herds had been in contact with people diagnosed with pH1N1 or with influenza-like illness (Hofshagen *et al.*, 2009).

Points for discussion

There have been cases of pH1N1 in pigs where there is no concrete evidence that humans were the source of the infection. Pig-to-pig transmission has been found to occur in clinical trials, giving rise to the possibility that pH1N1 could become established in swine populations, as is the case with other influenza viruses. If this influenza becomes established in the swine population, pigs could act as reservoirs of the pH1N1 virus, creating the potential for reassortment with other swine or avian influenza viruses circulating, or the virus could mutate within pigs to produce a more virulent strain (Ma, Kahn and Richt, 2009).

Although the potential for transmission from pigs to humans exists, it is still considered to have a negligible impact on the dynamics of the pandemic in humans, which is spreading readily via human-to-human transmission. However, if pH1N1 becomes established and circulates widely in the swine population worldwide, it



cannot be excluded that swine or other animal species may act as reservoirs for human infections in the future.

pH1N1 is only one of many influenza virus strains. Although the gene segments have probably existed in the influenza pool for a long time, this genotype was not recognized, owing to limited monitoring of animal influenza viruses. New pathogenic strains of influenza virus will probably emerge in a similar manner in the future. As the gene components of the new pandemic virus are a combination of swine, human and avian influenza viruses, it is important to monitor not only pH1N1 in swine populations, but also other influenza viruses in populations of swine and other animal species, including wild birds and poultry. The detection of pH1N1 with gene segments from avian, human and swine viruses provides evidence that the mixing of new genetic elements in animal species can result in the emergence of viruses with pandemic potential.

Surveillance and monitoring of influenza viruses in animals, particularly swine, is essential for providing evidence and assessing the potential reassortment of influenza viruses that may result in a new and serious human and/or animal pandemic virus.

FAO in action

Following the start of this pandemic in North America in April 2009, FAO deployed a technical mission in Mexico to investigate the potential role of swine in the epidemiology of human cases of pH1N1. Since then, FAO and primary partners such as OIE and the World Health Organization (WHO) have worked to clarify and collect daily information regarding the monitoring and evolution of the pH1N1 situation in animals.

FAO's recommendations to countries detecting the virus infection in animals include the following:

- Farms or holdings with swine should implement movement restrictions after a confirmatory diagnosis of the pH1N1 virus. Such restrictions should be in force until at least one week to ten days after the last animal has recovered. In industrial pig farming systems, restriction measures may rapidly cause overcrowding. In such circumstances, clinically healthy animals may be sent for regular slaughter, under veterinary inspection, to avoid animal welfare issues.
- Animals suffering from swine influenza can be separated from healthy herd-mates and allowed to recover; there is no need to cull affected animals. In a suspected outbreak, movement restrictions should be in place until a laboratory diagnosis is available.
- Biosecurity and personal protection: Animal handlers and veterinarians should wear protective gear and ensure that proper cleaning and disinfection is conducted on equipment and material used among units, to minimize the risk of spreading pathogens among pigs at different locations and of being infected by zoonotic agents, including influenza. Workers in one house should not be allowed to visit or work in other houses or to have pig sites of their own. Bio-

pH1N1 is only one
of many influenza
virus strains



security in pig herds should be increased to prevent transmission on fomites and mechanical vectors such as vehicles.

- Vaccination for swine influenza: In high-risk areas, a swine influenza vaccine can be used on swine, as long as it is considered effective against the circulating strain and is permitted by the relevant authorities.

Since May 2009, after the first cases were detected in swine, FAO has been giving technical assistance to countries to support surveillance activities and harmonize the response to pH1N1 in animal species. At the request of individual countries, FAO is supporting projects to design and implement surveillance strategies for pH1N1 and other influenza viruses in swine populations in Africa, Asia, Central America and the Andean region of South America.

This FAO technical assistance aims to provide a global framework that coordinates the early detection of and rapid response to pH1N1 and other influenza viruses in swine populations. FAO's technical response to the pandemic threat includes the design and publication of technical material on the epidemiology of pH1N1 in animals, food safety assurance,² updates on the disease/epidemiological situation and, in particular, the publication of guidelines for surveillance of pH1N1 in swine populations.³

FAO has been giving technical assistance to countries to support surveillance activities and harmonize the response to pH1N1 in animal species

FAO also recommends that countries take advantage of existing syndromic surveillance of respiratory diseases in pig and poultry populations, which can provide valuable information for scanning surveillance (passive surveillance) as an important component in the early detection of influenza viruses. Timely notification by local farmers and private veterinarians of pigs with influenza-like illness plays a major role in supporting early detection and effective response to pH1N1 in animals.

At the global level, FAO is partnering OIE and others in the worldwide OIE/FAO Network of Expertise on Animal Influenza (OFFLU). This network addresses the need to monitor the many aspects of the potential reassortment of influenza viruses, and their impacts on animal and human health.

Risk communication strategies by veterinary services and public health systems are important for dealing with the uncertainties regarding the role of animal species in the epidemiology of pH1N1, including its maintenance and transmission between species. FAO continues to monitor the situation and to stress the need for enhanced monitoring of influenza viruses in animal populations (particularly swine and poultry). The One-World-One-Health (or One-Health, as recently proposed) approach recognizes the intimate linkages among the human, animal and ecosystem health domains, which appear to be the most appropriate route for addressing issues such as pH1N1 and other influenza viruses. It proposes an international, interdisciplinary, cross-sectoral approach to disease surveillance, monitoring, prevention and control, the mitigation of emerging diseases, and environmental conservation.

² www.fao.org/ag/againfo/programmes/en/empres/ah1n1/docs/consumers_30_04.pdf.

³ www.fao.org/ag/againfo/programmes/en/empres/ah1n1/docs/h1n1_guidelines_fao.pdf.



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Highly pathogenic avian influenza

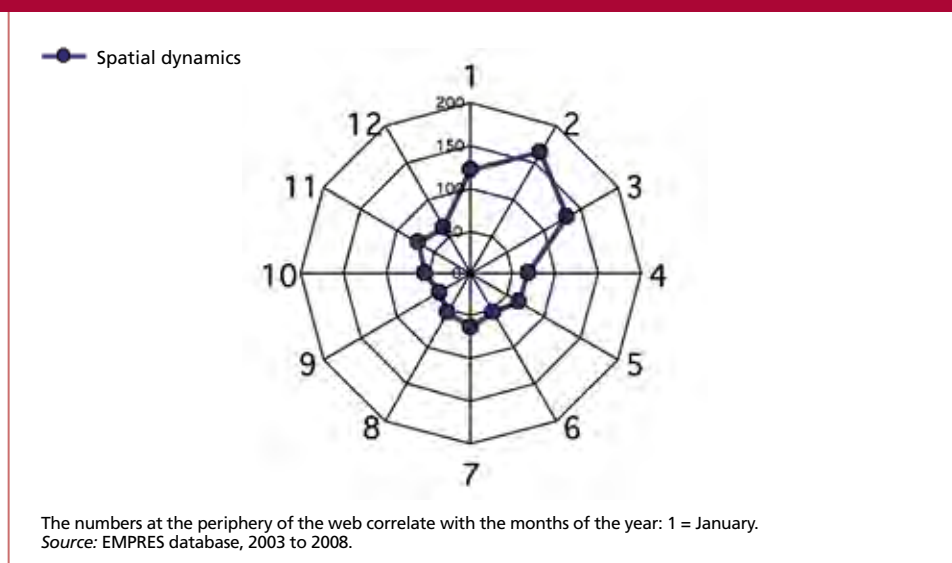
“Wetland meat”: an overlooked source of H5N1?

Why is H5N1 most active in winter?

Along with many other infectious diseases of wildlife (Altizer *et al.*, 2006), epizootics of H5N1 highly pathogenic avian influenza (HPAI) have a specific seasonal pattern. An analysis of the dynamics of global disease-affected areas (Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases information database [EMPRES-i], December 2003 to October 2008) shows that outbreaks occur most often in the winter months of January to March (Figure 1), which is strikingly different from the seasonal occurrence of low pathogenic avian influenza (LPAI) viruses in both poultry and wild birds (Halvorson, Kelleher and Senne, 1985; Gill *et al.*, 2006; Nooruddin *et al.*, 2006; Ip *et al.*, 2008). In the countries where H5N1 has become endemic in poultry this can be explained by the seasonality of agricultural production cycles or certain cultural practices, such as the Tet festival (Pfeiffer *et al.*, 2007), but elsewhere it seems to be triggered by critical environmental events, such as cold waves (Lui *et al.*, 2007). In February 2008, an FAO Crisis Management Centre – Animal Health (CMC-AH) mission to Turkey collected direct evidence that several primary introductions of the H5N1 HPAI virus to poultry occurred as a result of hunters feeding domestic chickens with apparently infected game waste – viscera and feathers (Newman and Honhold, 2008) – shortly after arrival of the cold weather.

Further evaluation has provided better insight into how wild bird harvesting and actions by hunters may be a more important mechanism responsible for the seasonal spread of HPAI than previously recognized.

Figure 1: Monthly global dynamics of AI-affected area (n 2*2 degrees grid cells)





Harvesting of waterfowl

The harvesting (e.g., sport or subsistence hunting) of migratory waterfowl is an important socio-economic activity and cultural practice in all the regions affected by H5N1. In a group of 14 countries and territories in the European Union (EU) and neighbouring Caspian and Black Sea region – Armenia, Azerbaijan, Bulgaria, Georgia, Islamic Republic of Iran, Kazakhstan, Romania, Russian Federation (Astrakhan, Dagestan, Kalmykiya and Krasnodar), Turkey, Turkmenistan and Ukraine – a total of about 8 million officially registered hunters harvest at least 11 to 15 million waterfowl a year (Krivenko, 1991; Wesel, 2005). Exact numbers are difficult to obtain because it is impossible to differentiate recreational from subsistence hunting, and legal hunting from poaching, in non-EU countries.

However, waterfowl are not taken by only legal sport hunters. In Asia and Africa, extensive published evidence and occasional news or expedition/mission reports suggest that the illegal trapping or poisoning of birds for consumption is a very widespread practice, particularly where outbreaks of H5N1 have been recorded repeatedly (Afghanistan, Bangladesh, China, Egypt, India, Indonesia, Myanmar, Nepal, Nigeria, Pakistan, Republic of Korea, Thailand and Viet Nam). The scale of this illegal harvest, which is a far cheaper alternative to hunting with shotguns, remains largely unknown, but seems to exceed the legal harvest in developed countries. It is reported to have increased substantially over the last decade because of an increasing human population, urban development and growing demand for food. The most striking examples come from China, where in 1993 as many as 300 000 ducks were deliberately poisoned for food at Poyang (Boyang) Lake (Anonymous, 1993), and more than 2 tonnes of *Funandan* (a typical poisoning chemical used by poachers) was spread in the lake at Dongting Lake National Nature Reserve to harvest wintering geese (Lei, 1999; Markkola *et al.*, 1999), giving rise to questions about the longer-term ecological impacts of these practices.

In other parts of East and South Asia, deliberate mass poisoning of waterfowl is common, with hundreds to thousands of waterfowl killed at a time (BirdLife International, 2003; Kwon, Wee and Kim, 2004). In Africa, where many people also rely on bushmeat consumption, water birds are commonly hunted/trapped/poisoned for food or because they are viewed as aquacultural or agricultural pests (FAO, 1994; Berutti *et al.*, 2005; Bhima, 2006; BirdLife International, 2009). The current proportion of waterfowl meat in the diet of local populations is not known, but there is little doubt that the situation is similar in other developing countries, owing to socio-economic conditions, cultural practices, and seasonal food supply shortages.

Water birds in fishing nets

Inland and coastal fisheries have a strong but largely overlooked potential for introducing avian diseases, especially in arid areas. On the Azov Sea in Ukraine, from November to March each year, as many as 164 000 water birds (primarily diving ducks, *Aythya* sp. and grebes) may get entangled in fishing nets (Koshelev *et al.*, 2003). Consumption of by-catch is common. Fishers take entangled birds opportunistically,



MAKEN AND ASSOUDI, 2009

Waterfowl sold at a market in northern Islamic Republic of Iran

and also catch birds intentionally. There is insufficient information to quantify the scale of the waterfowl by-catch globally, but seabird by-catch is well documented and significant, and there is little doubt that inland fisheries may account for as many wild bird contacts with humans and domestic animals as other means of harvesting waterfowl. The proportion of birds utilized as food by people or domestic animals varies depending on the region, socio-economic situation, season and captured species. However, even the extraction of dead birds from nets, and their subsequent handling, provides opportunities for the contamination of fishing equipment, clothing, boats, captured fish, people and animals, both domestic and wild.

Wintering waterfowl: easy prey

Overall, the harvesting of waterfowl reaches a peak during winter time in the northern hemisphere, when most outbreaks of H5N1 are reported globally. This is very well evidenced in several case studies conducted in northern Islamic Republic of Iran (Balmaki and Barati, 2006; Ashoori, 2008), Lake Chilwa in Malawi (Bhima, 2006), and Lake Manzala in Egypt (BirdLife International, 2009), and in information from tropical countries such as India, Bangladesh, Nepal, Thailand and Viet Nam. During peak cold periods in temperate regions, or drought in the tropics, in January and February, wintering waterfowl are physiologically stressed, face scarcity of food resources, and become concentrated owing to limited roosting sites, making them highly vulnerable to hunting, trapping or poisoning. For example, at Lake Poyang, the poisoning of geese is reported to be most serious after snowfalls (Markkola *et al.*, 1999). Clinically affected waterfowl may be difficult to detect by observation, but are also more prone to being harvested, particularly inexperienced and immunologically naïve juveniles. In addition, human populations in developing countries often face seasonal food shortages in winter, and turn to wintering waterfowl as an alternative abundant source of protein (Bhima, 2006).

Marketing and distribution of wetland meat

It is very important to understand that as well as the poultry trade, which has been widely implicated in the spread of H5N1, there is also extensive trade of wild waterfowl in many developing countries. Along with classic examples from northern Islamic Republic of Iran and Egypt (Photos, this page; Savage, 1963; Goodman and Meininger, 1989), where live or dead birds are openly sold at markets, most il-

legal waterfowl harvest goes to restaurants or is marketed within local communities (e.g., roadside sales, for celebrations or the preparation of traditional medicines, etc.), making it nearly impossible to quantify. Long-distance movement of both live



wild birds and their meat to sell at higher prices in the cities is particularly common for this kind of business. A more comprehensive investigation of migratory waterfowl's role in local economies in developing countries is crucial to understanding the global dynamics of H5N1 and other avian diseases for which wildlife is a reservoir. Information about patterns of seasonal incidence, environmental conditions at the time of outbreaks, and numbers of people harvesting waterfowl legally or illegally are likely to show that some of the H5N1 introductions for which the source of the virus remains unknown (based on epidemiological investigations) could be related to hunting, poaching, cleaning and marketing of wild birds, rather than direct contacts between live wild and domestic birds at shared wetland habitats.

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Contributor: S. Khomenko (FAO)



Avian influenza and Newcastle disease

Avian influenza and Newcastle disease proficiency test for 26 countries in Africa and the Near East

This proficiency test was co-organized by FAO and the *Istituto Zooprofilattico Sperimentale delle Venezie* (IZSve) – the FAO/World Organisation for Animal Health (OIE) Reference Laboratory for avian influenza (AI) and Newcastle disease (ND) – between September and October 2008. It was the first experience of its kind for AI and ND in Africa and the Near East. The purpose was to evaluate the overall and individual technical capacities of national veterinary laboratories to diagnose AI and ND by serology and/or molecular tests. Such an evaluation is of value to the international community, because it objectively measures the outputs of the investments made over the last five years, especially through projects related to the detection of highly pathogenic avian influenza (HPAI) virus. It also enables the identification of training and capacity building requirements, and gives regions, countries and laboratories an opportunity to measure their technical skills and reliability.

Testing of proficiency test panels at IZSve



Participating countries

FAO established a list of 26 participating countries, provided all contact information and discussed the technical aspects of this exercise with IZSve. Taking into account the prevalence and impact of ND in the regions considered, a panel of samples for both serological and virological detection of both diseases was included in the proficiency test panel. All the listed countries were invited to participate in an explanatory letter. A few weeks before the test, FAO regional network coordinators (based at regional animal health centres) requested the laboratories to check reagent availability. IZSve prepared all panels, coded them and shipped them to FAO Headquarters, from where they were dispatched at low temperature to each country, through FAO representations. Only a few shipments encountered delays in delivery.

Of the 26 participating laboratories, 24 were invited to participate in both serology and molecular proficiency tests, while two were invited to run only the serological part of the exercise.

As this was the first international proficiency test for AI/ND organized in these regions, participants were requested to apply the laboratory protocols they were familiar with, so as to facilitate the exercise and obtain a picture of the current situation. Because many of the laboratories involved had only limited or very recent experience of AI testing, it was also decided to supply blind serum or virus sample panels exhibiting medium to high antibodies or antigen titres, respectively. On request, FAO also supplied eight laboratories with reference reagents prepared by IZSve, such as reference AI and/or ND freeze-dried antigens and antisera.

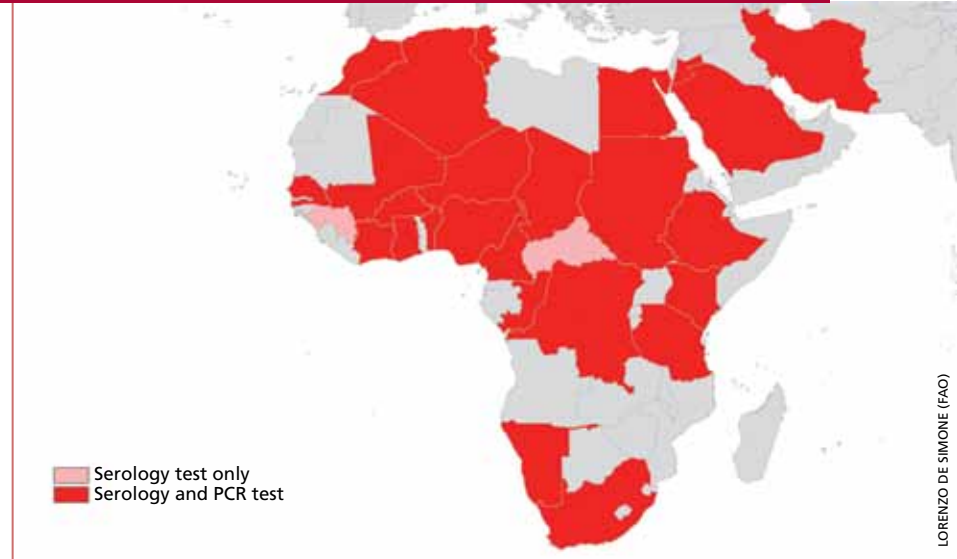
It should be noted that two countries – Egypt and South Africa – also received proficiency panels from Veterinary Laboratories Agency (VLA, Weybridge, United Kingdom) (European polymerase chain reaction [PCR] panels) in 2008.

Table 1: Participating countries in the AI/ND proficiency test

| Region | Country/territory |
|-----------------|--|
| West Africa | Benin |
| | Burkina Faso |
| | Chad |
| | Côte d'Ivoire |
| | Ghana |
| | Guinea * |
| | Mali |
| | Niger |
| | Nigeria |
| | Senegal |
| Central Africa | Cameroon |
| | Central African Republic * Democratic Republic of the Congo |
| Near East | Egypt |
| | Islamic Republic of Iran |
| | Jordan |
| | Saudi Arabia |
| East Africa | Ethiopia |
| | Kenya |
| | Sudan |
| Southern Africa | Namibia |
| | South Africa |
| | United Republic of Tanzania |
| Northern Africa | Algeria |
| | Morocco |
| | Tunisia |

* Only serology tests.

Figure 1: Countries invited to participate in the AI/ND proficiency test





Overall results of the proficiency test

All the countries invited to take part in the proficiency testing were willing to participate and agreed to submit their results: 25 of the 26 countries submitted their results. Half of the countries sent results within less than one month; one country sent results after nine months; and five countries faced problems conducting some of the tests, owing to a lack of reagents, even though they had been informed about the arrival of specimens. Table 2 shows the overall results.

Table 2: Overall results of the 2008 proficiency testing

| | Number of countries |
|--------------------------------|---------------------|
| Participants | 26 |
| Submitted results | 25 |
| Serology and molecular results | 19 |
| Conventional RT-PCR* | 14 |
| Real-time RT-PCR* | 12 |

* RT-PCR = reverse transcription polymerase chain reaction.

Serological proficiency test

All 25 of the laboratories that submitted results performed serological assays: 14 performed the agar gel immunodiffusion (AGID) test for detection of type A influenza antibodies; 12 performed enzyme linked immunosorbent assay (ELISA, type A); and 23 performed haemagglutination inhibition (HI) tests. The serology panel is described in Table 3. Tables 4 and 5 provide more insights into the serological results.

Table 3: Composition of the serology panel, ten coded sera

| Serum | HI titre | Techniques that could be applied |
|------------------|----------|----------------------------------|
| H5N1 | 1:512 | ELISA AI type A Ab* |
| H5N2 | 1:256 | ELISA H5 Ab |
| H5N2 | 1:64 | AGID |
| H7N1 | 1:256 | HI test |
| H7N1 | 1:32 | |
| H9N2 | 1:1024 | Expected information |
| NDV ¹ | 1:512 | Negative/positive AI-Ab |
| NDV | 1:64 | Specific Ab subtype |
| H10N1 | 1:64 | HI titre |
| SPF ² | - | |

¹ Newcastle disease virus.

² Specific pathogen-free.

The table illustrates the serum samples panel and the HI antibody titre for each serum.

* Ab = antibodies.

Table 4: Overall serological results

| Test | Subtype | Number of laboratories performing the test | Number of laboratories providing correct results |
|-------|---------|--|--|
| HI | All | 23 | * |
| | H5 | 22 | 18 |
| | H7 | 22 | 17 |
| | H9 | 16 | 14 |
| | NDV | 21 | 17 |
| ELISA | Type A | 12 | 11 |
| | H5 | 3 | 3 |
| AGID | | 14 | 7 |

* Various combinations.

Table 5: Correct HI test results (all subtypes) for the ten coded sera

| Number of correct results | Number of laboratories |
|---------------------------|------------------------|
| 10/10 | 1 |
| 9/10 | 14 |
| 8/10 | 4 |
| 7/10 | 2 |
| 6/10 | 1 |

In summary:

- subtype-specific antibodies were often well detected by HI in most laboratories, although incorrect titration of HI antibodies was often observed (titres more than 2 log² higher than expected);
- the level of correct results obtained with ELISA was high (11 out of 12);
- only seven laboratories were able to provide correct results with AGID (at more than 90 percent correct).

Virology proficiency test

Table 6 describes the panel for virology testing.

Table 6: Composition of the virology panel, ten coded antigens

| Virus/subtype | Isolate name | EID ₅₀ * | Techniques that could be applied |
|---------------|------------------------------|---------------------|---|
| H5N1 | A/mallard/Italy/3401/05 | 10 ^{4.83} | Conventional or real-time RT-PCR - for M/H5/H7/(N1) genes - for NDV |
| H5N1 | A/mallard/Italy/3401/05 | 10 ^{4.83} | |
| H5N3 | A/duck/Italy/775/04 | 10 ^{4.84} | |
| H7N1 | A/turkey/Italy/2962/03 | 10 ^{6.37} | Expected information Virus identification/subtype |
| H7N1 | A/turkey/Italy/2962/03 | 10 ^{5.37} | |
| NDV | Ulster 2C | 10 ^{5.26} | |
| NDV | Ulster 2C | 10 ^{4.26} | |
| H9N2 | A/mallard/Italy/3817-34/05 | 10 ^{5.03} | |
| H4N8 | A/cockatoo/United Kingdom/72 | 10 ^{5.26} | |
| - | Allantoic fluid | - | |

* Egg infectious dose, 50 percent.

The table illustrates the virus strains (inactivated) panel and the virus load (expressed in EID₅₀) for each sample.



Of the 25 countries that submitted results, 19 performed RT-PCR – conventional, real-time or both. The overall results are given in Table 7: 14 countries performed conventional RT-PCR (Table 8); 12 performed real-time RT-PCR (Table 9); and seven performed both.

Table 7: Overall RT-PCR test results

| Test | Number of laboratories performing the test | Number of laboratories giving $\geq 66\%$ correct results |
|----------------------|--|---|
| Conventional M gene | 10/19 | 9/10 |
| Conventional H5 gene | 14/19 | 8/14 |
| Conventional H7 gene | 7/19 | 4/7 |
| Real-time M gene | 12/19 | 11/12 |
| Real-time H5 gene | 11/19 | 8/11 |
| Real-time H7 gene | 8/19 | 6/8 |

Table 8: Conventional RT-PCR results

| Test | Number of correct results | Number of laboratories |
|---------|---------------------------|------------------------|
| Gene M | 10/10 | 2 |
| | 9/10 | 1 |
| | 8/10 | 4 |
| | 6/10 | 2 |
| | 2/10 | 1 |
| Gene H5 | 3/3 | 6 |
| | 2/3 | 2 |
| | 1/3 | 5 |
| | 0/3 | 1 |
| Gene H7 | 2/2 | 4 |
| | 0/2 | 3 |

The table reports the number of laboratories that submitted correct results by conventional RT-PCR test for type A A1, H5 and H7.

Table 9: Real-time RT-PCR results

| Test | Number of correct results | Number of laboratories |
|---------|---------------------------|------------------------|
| Gene M | 10/10 | 6 |
| | 9/10 | 3 |
| | 8/10 | 1 |
| | 6/10 | 1 |
| | 5/10 | 1 |
| Gene H5 | 3/3 | 6 |
| | 2/3 | 2 |
| | 1/3 | 2 |
| | 0/3 | 1 |
| Gene H7 | 2/2 | 6 |
| | 1/2 | 1 |
| | 0/2 | 1 |

The table reports the number of laboratories that submitted correct results by real-time RT-PCR test for type A influenza, H5 and H7.



Results of these proficiency tests were submitted by e-mail to all participating laboratories and were presented to participating laboratories at annual regional laboratory meetings organized by FAO, in Mali for the West and Central Africa region (December 2008), Algeria for the Northern Africa region (February 2009), and Rwanda for the East Africa region (July 2009).

Conclusion

An excellent level of participation was observed from the invited countries. The results have helped countries and regional laboratory networks to adjust their training needs and improve the targeting of interventions. The majority of veterinary laboratories (19/25) in Africa and the Near East are currently equipped for molecular diagnostic tests, such as conventional or real-time RT-PCR. However, the overall results suggest that diagnostic capacities still need to be improved, although some laboratories already have adequate capacity for diagnosing AI, identifying the main subtypes, and differentiating with ND. It is interesting to note that a relatively simple serological test – the AGID test – provided many false results, and only 50 percent of the laboratories achieved more than 90 percent correct results. The causes of this should be investigated, and additional training will probably be needed, focusing on specific issues such as strengthening capacities in HPAI differential diagnosis. Good laboratory practices and quality assurance in national veterinary laboratories should be implemented as soon as possible. At present, samples must be submitted to international reference laboratories for the confirmation of results and advanced characterization of animal influenza viruses. FAO has created an e-mail account¹ that provides countries with assistance for international shipment.

It should be highlighted that most national laboratories in developing countries do not routinely receive many samples for AI/ND diagnostics, so are unable to develop and maintain technical skills in this area. Proficiency tests are of limited use in laboratories that do not test samples routinely, but the results provide an indicator of progress made. The sustainability of diagnostic capacities is critical; a number of HPAI projects will end in the short term. It is essential that regional laboratory networks support the sustainability of diagnostics activities. Efforts are already being made in several laboratories and regions, but these initiatives need full support from the international community.

In addition to this large-scale international proficiency test, in 2009 FAO supported a regional proficiency test in the Southern African Development Community (SADC) region on the detection of antibodies against avian influenza, with technical assistance from VLA. FAO contracted the Onderstepoort Veterinary Institute to run this regional test, which had 12 participating laboratories in ten participating countries and was based on standard operating procedures for haemoagglutination (HA)/HI developed within SADC. FAO will carry out a second regional proficiency test in SADC in 2010, coordinated by the Botswana National Veterinary Laboratory, and will seek to support and assist such regional initiatives in the future.

¹ empres-shipping-service@fao.org.



Challenges

Shipment remains the most delicate, and the most costly, part of this exercise. The availability of good-quality reagents is also a challenge in many countries.

Next round

In 2009, ISZVe and FAO planned to send new proficiency panels, similar to those sent in 2008, to 30 selected countries (18 from the 2008 list, plus 12 from Central Asia and Eastern Europe). An additional 18 countries from West and Central Africa also received proficiency panels, as part of the activities implemented under the West and Central African Veterinary Laboratory Network (RESOLAB). Overall results are being analysed. In 2010, another round is planned for more than 40 countries.

Acknowledgements

All collaborative staff are acknowledged for their logistics and technical support.

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Contagious caprine pleuropneumonia

Detected for the first time in Tajikistan

Field observations

In November and December 2008, in Khatlon Province of Tajikistan, there were reports of a disease affecting sheep and goats (mainly goats), with a clinical description consistent with peste des petits ruminants (PPR). Occurrences of such cases were reported from four villages in the districts of Muminabad, Shuraabad and Yavaan, with morbidity averaging about 50 to 60 percent and a case fatality rate of 20 to 30 percent.

These cases were not confirmed by laboratory testing. A presumptive diagnosis of PPR was made, based on clinical, pathological and epidemiological observations. Of note is that Khatlon is the province with the highest density of sheep and goats in Tajikistan.

During May and June 2009, a disease with a similar clinical and pathological pattern was observed in the districts of Vahdat, Fayzabad, Nurabad, Roghun and Rasht in Direct Ruled District (DRD) Province.

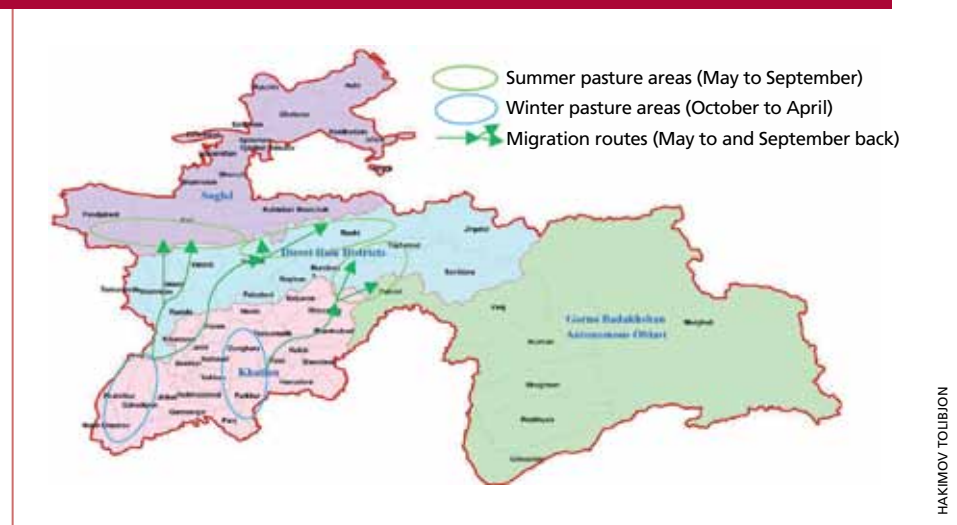
The disease was observed in villages located along the migration route of sheep and goats brought from Khatlon Province to summer pasture in DRD (see Figure 1). Disease onset was observed two weeks after the animals moving to summer pasture had crossed the affected villages. Apparently, the disease was no longer present after mid-June 2009, so its overall duration in these villages appeared to be approximately one month.



SANGIMUROD MURVATULLOEV (FAO)

Animal movement to summer pastures, Tajikistan

Figure 1: Migration route of sheep and goats from Khatlon Province to DRD



HAKIMOV TOLIJON



From the clinical point of view, the disease was mainly characterized by respiratory signs (coughing and laboured respiration). Pathological findings were indicative of pneumonia, and straw-like fluid in the pleural and pericardium cavity was observed in some subjects. Of note, and different from what may be observed with PPR, cases occurred mainly, if not exclusively, in goats, even in mixed flocks of sheep and goats.

The number of goats dying over this period was estimated at about 1 000 to 1 200.

PPR is present in Tajikistan, but this rapid observation led to consideration of the possibility of contagious caprine pleuropneumonia (CCPP), which had never been reported in Tajikistan.

Laboratory activities

No tissue samples were available from the cases occurring in November and December 2008, but there were samples from the cases in May and June 2009: i) tissue samples from four dead goats collected in July and early August 2009 from the districts of Fayzabad and Roghun; and ii) 20 serum samples from live goats in the districts of Fayzabad (six samples), Nurabad (nine) and Roghun (five). The serum samples were collected from live animals in villages where clinical cases had been observed. All were tested for PPR (antigen and antibodies) in the National Veterinary Laboratory in Dushanbe.

Test results from the tissue samples were inconclusive, while those from the serum samples yielded the following results for PPR antibodies:

- Fayzabad: three positives out of six tested;
- Nurabad: three positives out of nine tested;
- Roghun: one positive out of five tested.

An FAO field mission by GTFS/INT/907/ITA project staff was carried out in August 2009, when it was not possible to observe clinical cases, so only retrospective information was obtained. It was decided that a differential diagnosis should be obtained for aetiologies with similar clinical signs, such as CCPP.

On 10 September 2009, seven tissue and 19 serum samples from goats were therefore sent to the International Cooperation Centre of Agricultural Research for Development (CIRAD) in Montpellier, France. The samples were collected from Rogun, Fayzabad and Nurobod Districts.

In early October, preliminary test results indicated that even in the absence of *Mycoplasma* spp. isolation (due to heavy bacterial contamination), real-time polymerase chain reaction (PCR) products specific for *Mycoplasma capricolum* subspecies *capripneumoniae* (Mccp) had been detected. The amplified product was sequenced and compared with existing Mccp sequences. The sequence was identical to AF378156, obtained from an Mccp strain

Fibrinous pneumonia, with thickened pulmonary pleura and enlarged lymph node



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Fibrinous pneumonia, with necrosis of parenchyma of the lungs



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Fibrinous pneumonia with straw-coloured fluid in thorax and adhesion of lungs to chest wall

in the United Arab Emirates isolated in 1991 (Dr Francois Thiaucourt, CIRAD, personal communication).

Preliminary consideration

This was the first report of CCPP in Tajikistan. It cannot be excluded that a co-infection of PPR-CCPP may have occurred; in the absence of a rapid diagnostic procedure for CCPP in the country, an early detection system based on clinical signs is currently being implemented. Field veterinarians are being trained and recommended to report respiratory syndromes in small ruminants. On detection of suspected clinical cases, an early response mechanism will be implemented, using antibiotic treatment of clinically affected animals and emergency vaccination against PPR in healthy animals.

Contributors: M. Amirbekov (Chief of Veterinary Officers, State Veterinary Department, Tajikistan),
S. Murvatulloev (GTFS/INT/907/ITA FAO Project National Coordinator)
and G. Ferrari (GTFS/INT/907/ITA Project Leader)



Rift Valley fever

Rift Valley fever in Madagascar: an updated map of the distribution of the disease in 2008

Introduction

Rift Valley fever (RVF) is an arthropod-borne zoonotic disease caused by a ribonucleic acid (RNA) virus of the *Phlebovirus* genus of the family Bunyviridae. As well as being a severe threat to human health, RVF outbreaks cause high economic losses to farmers through the death and abortion of RVF-infected animals, and indirect impacts on food production, food safety, rural micro-economies, international trade and the welfare of the poorest people.

The presence of RVF in Madagascar was demonstrated during an entomological investigation in 1979, when the virus was isolated from mosquitoes collected in the moist-tropical primary forest of Perinet, Moramanga District (120 km east of the capital, Antananarivo). No signs of the disease were reported in animals or humans, but a serological survey confirmed that RVF virus (RVFV) was circulating at a very low level (less than 1 percent) in livestock. Then, in April 1990, during the rainy season, RVF was identified as being responsible for a significant wave of abortions in cattle in Fenoarivo Atsinana District, on the eastern coastal plain. Of 15 suspected human cases tested in hospitals, one died and five were confirmed. Seroprevalence among cattle owners in the village where livestock abortions were recorded reached 9 percent, with a large majority of the victims being young men. The following year, from February to April 1991, severe rates of abortion in cattle were reported in the central highlands, around Antananarivo, and six fatal human cases were confirmed.

RVF outbreaks had a dramatic impact on countries in the Horn of Africa (Kenya and Somalia) and on the United Republic of Tanzania in late 2006 and the first half of 2007, and on the Sudan in September 2007. Southern African countries (Swaziland and South Africa) and islands in the Indian Ocean (the Comoros and Mayotte) were affected in 2007 or 2008. In Madagascar, RVF was officially reported to the World Organisation for Animal Health (OIE) on 9 April 2008, when samples sent to the OIE Reference Laboratory (Onderstepoort Veterinary Institute, South Africa) tested positive for the disease. The central part of Madagascar had experienced livestock mortality since December 2007, but these cases had been erroneously attributed to prevalent tick-borne diseases. During the first half of 2008, human cases were reported in the south and centre and on the eastern coast of the island. The *Institut Pasteur de Madagascar* (IPM) confirmed 67 human cases from 134 tested. From January to May 2008, 22 out of 119 animal cases were confirmed, and from November 2008 to May 2009,



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Oxen in rice field in the highlands of Madagascar

IPM confirmed another 19 out of 47 human cases and 24 out of 88 animal cases, while the Ministry of Health reported 712 suspected human cases between January and May 2009.

Following an official request from the Government of Madagascar, an emergency mission of experts from FAO, the World Health Organization (WHO) and OIE was deployed and helped to develop a national action plan. With financial support from the United Nations Central Emergency Response Fund and the Office of United States Foreign Disaster Assistance, the national authorities have been implementing projects, with technical support from FAO, since June 2008. Preliminary results are reported in the following sections.

Evaluation of the extent of the outbreak

A country-wide, cross-sectional survey of livestock (cattle, sheep and goats) was conducted, using two stratification factors: ecoclimatic characteristics and bovine density. More than 4 000 cattle and small ruminants from 30 of Madagascar's 111 districts were sampled. The survey was conducted over a short period (August 2008) to assure the consistency of results.

Serological analyses were performed by the *Laboratoire National de Diagnostic Vétérinaire* (LNDV). Molecular analyses were conducted at IPM, which also trained LNDV technicians and conducted an inter-laboratory trial with LNDV.

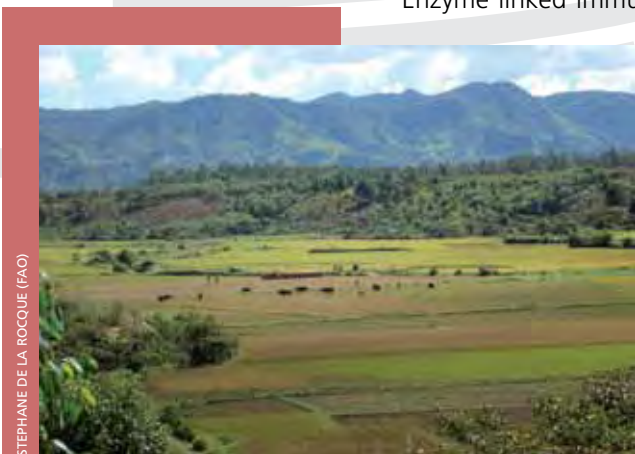
Enzyme linked immunosorbent assay (ELISA) serological assays for the detection of immunoglobulin G (IgG) and immunoglobulin M (IgM) were performed. IgG can persist for months or even years after infection, so is used as a reliable indicator of past contact with the virus. In contrast, IgM has low persistence. IgG-positive/IgM-negative samples were therefore considered as past infection, while IgM-positive samples were considered as recent infection.

IgM was detected in nine cattle (0.3 percent) and 33 small ruminants (3.3 percent). Of the 33 IgM-positive small ruminant samples, 25 were IgG-negative. Most of these samples were collected in the southern and north-western districts (Figure 1).

Past infections (IgG-positive/IgM-negative) were detected in 887 cattle (25.8 percent) and 244 small ruminants (24.7 percent) and in all areas, confirming the wide circulation of RVF. In most areas, the prevalence in cattle was between 15 and 35 percent, with lowest values in the country's south (Figure 2); prevalence increased with age in districts of the south and northwest.

Sentinel surveillance and passive surveillance systems

Specific standard operating procedures (SOPs) for passive surveillance and guidelines for RVF surveillance and emergency response were developed, as well as a case definition to facilitate the reporting of suspected cases. Guidelines for sampling,



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Rice fields in the highlands of Madagascar



Figure 1: Prevalence of immunoglobuline M (recent infection) in cattle

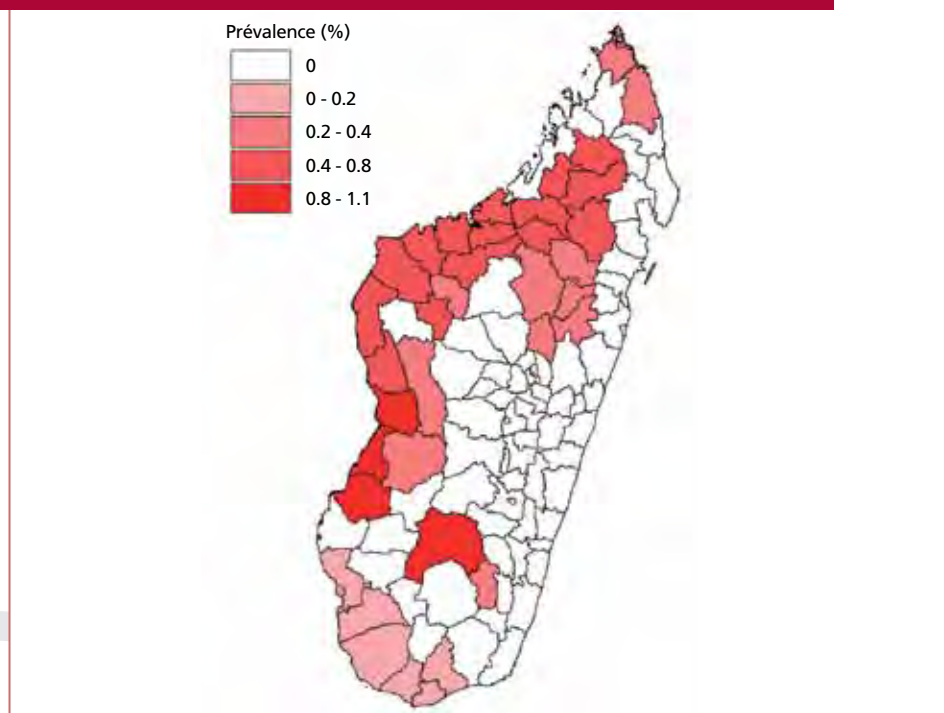
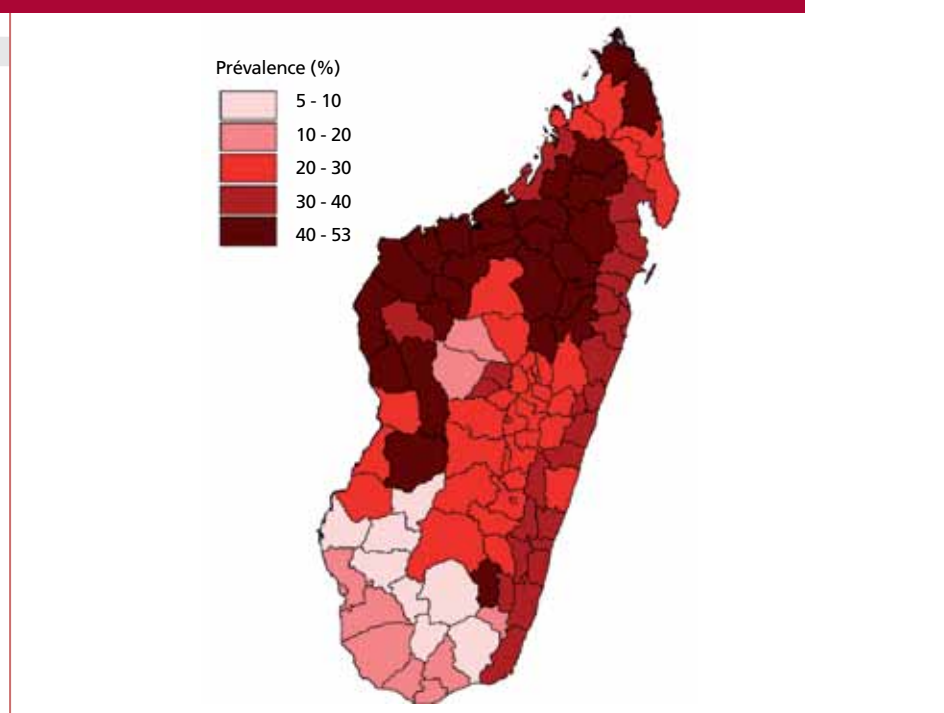


Figure 2: Prevalence of immunoglobuline G (past infection) in cattle





Protocols for the surveillance and control of RVF in Madagascar

types of samples to be collected, procedures for sending samples to the central facilities, and information material to be provided about collection were described in the surveillance protocol, and presented during training workshops.

Thirteen sites were selected for the establishment of sentinel herds. On each site, a veterinarian visited livestock owners every week and informed the central *Direction des Services Vétérinaires* (DSV) about cases of mortality, morbidity and abortion, via SMS. Written reports were produced monthly. After compilation and analysis, DSV sent a weekly consolidated situation report to the decentralized units. Then, DSV, LNDV and IPM disseminated all the biological and clinical surveillance data by e-mail to all RVF actors: the Ministry of Livestock, the Ministry of Health, IPM, LNDV, FAO and WHO.

The establishment of this surveillance system was a major improvement for the veterinary and public health authorities. In spring 2008, suspected and confirmed cases in animals were reported, mainly around Antananarivo, but FAO experts had detected RVF-infected animals in some remote areas during their initial investigations with veterinary services. This demonstrated the country's limited capacity to identify and report animal disease outbreaks during the 2007/2008 rainy season. In autumn 2008, a month after the first training of veterinarians organized by FAO and DSV, a veterinarian in the remote districts of Fianarantsoa I and Fianarantsoa II launched an alert when acute deaths among cattle were reported. Implementation of local control measures immediately after detection of the first cases prevented the disease from spreading outside the region. This first alert of the new wave of outbreaks was made possible by the surveillance network. An evaluation of the sentinel herds-based surveillance system was carried out in October 2009.

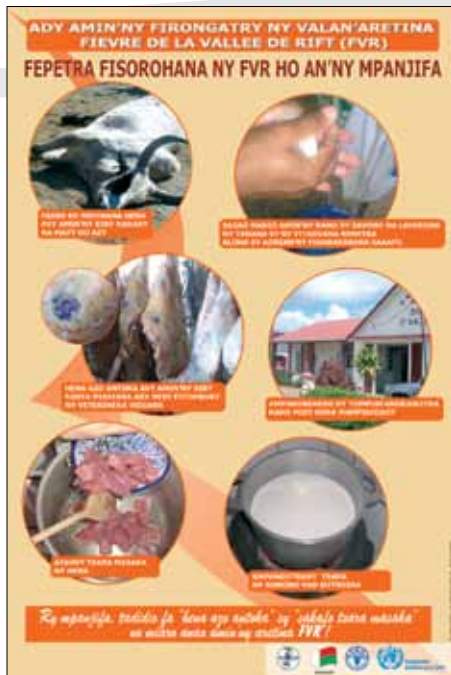
Prevention of human contamination and control of the spread of the disease

A field mission was organized in eight districts, to assess the level of knowledge of RVF among the general population and at-risk workers, and to guide the development of appropriate communication materials. Documents were produced, copied and disseminated for this awareness campaign, and three short films and one radio message (in six dialects) were broadcast on radio and TV during the 2007/2008 rainy season (Figure 3). In October 2008 the Ministry of Education included RVF as part of the school curriculum. FAO developed a chapter on RVF in a manual on natural disasters.

An intensive campaign was developed for professionals working in slaughterhouses. Training, the distribution of personal protective equipment (PPE), including boots, gloves, aprons and masks, and information campaigns were organized in 2008 and 2009. A tamper-free stamp was also supplied, for use in the meat certification process.



Figure 3: Communication material for the training and awareness campaign in the at-risk populations





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Early morning scene at a slaughterhouse in the capital; close contact with infected blood is of major risk for humans

Identification of vectors

RVFV is transmitted by numerous species of arthropods, with mosquitoes belonging to the genera *Aedes*, *Anopheles*, *Culex*, *Eretmapodites* and *Mansonia* playing a major role. However, the species involved in transmitting RVF in Madagascar are not known. FAO supported entomological investigations by IPM in areas where RVF cases have been confirmed. More than 7 000 mosquitoes were collected in the districts of Fianarantsoa I and II. Of these, more than 4 000 were unfed mosquitoes belonging to 12 different species. Viral genetic material was detected in three mosquito species belonging to the genera *Anopheles* and *Culex*, making them good vector candidates for RVF in Madagascar.

Points for discussion

The results of the cross-sectional, country-wide sero-survey in livestock suggest that RVFV has circulated in the recent past in all regions of Madagascar. These results complement those of a post-outbreak serological survey conducted in humans over recent months (Andriaman-dimby *et al.*, 2010). In this study, no evidence of RVF in humans was found in southern districts, while results confirmed that RVFV had circulated in some livestock, and traces of recent infection were also found. Based on this large-scale survey, the whole of Madagascar should be considered affected by RVF.

The increase of IgG prevalence with age in southern and northwestern areas suggests that virus transmission occurs annually. This hypothesis is also supported by the results of a sero-survey performed in 1996, when the detection of some IgM-positive animals originating from southern areas indicated that the virus was circulating during an inter-epizootic period (Zeller, 1998). RVF sentinel surveillance in livestock will contribute to exploring the hypothesis of RVF-endemic areas in Madagascar.

Animal transportation for trade probably played a major role in the extent of the disease in Madagascar. Livestock from the southern breeding areas embarked on boats in the port of Tulear, from where they travelled to different destinations in Madagascar, including significant numbers of animals reaching the slaughterhouses around Antananarivo. RVFV could be transferred from these possibly endemic areas to other parts of the country in a very short period, with viremic animals.

Sentinel herd surveillance was successfully implemented, and the first evaluation of the system was positive. One of the keys to this success has been the contracting of local, private veterinarians to undertake field surveillance. Their weekly visits to the communities bring veterinarians closer to livestock owners, while increasing their incomes. However, RVF outbreaks usually occur after (very) long inter-epidemic periods (the previous outbreak in Madagascar occurred in 1991), and the mobilization of actors can only be sustained if the sentinel surveillance system is expanded to integrate surveillance for other diseases. For example, several zoonotic diseases provoke abortions in livestock (e.g., brucellosis, Q fever, RVF and Wesselsbron virus), so a surveil-



lance network for abortive diseases in ruminants would probably ensure the continued involvement of veterinarians and the authorities, at limited cost.

It is important to undertake long-term surveillance and training projects. Without continuous awareness among the actors, Madagascar may not be ready if another outbreak occurs in a few years time. One constraint is the rapid turnover of staff at the decision-making level. To deal with this constraint, which is also seen in many other countries, FAO has produced guidelines for the implementation of RVF surveillance and control; these are currently being reviewed for publication.

Acknowledgements

The authors are grateful to the FAO office in Antananarivo (Amadou Moustapha Kamara and Marco Falcone), the *Direction des Services Vétérinaires* in Antananarivo (Lanto Tiana Razafimanantsoa, Marcellin Biarmann and Peter Fenozara), the *Institut Pasteur de Madagascar* (Jean-Marc Reynes, Soa Fy Andriamandimby and J.-T. Rafisandratantsoa), the *Laboratoire National de Diagnostic Vétérinaire* in Antananarivo (R. Rabenarivahiny, L. Rabibisoa, F. Ravaomanana and T. Randriamparany) and the regional Emergency Centre for Transboundary Animal Disease Operations (ECTAD) animal health centre in Gaborone (Susanne Munstermann) for their support and involvement in this study. The work was supported by funds from the United Nations Central Emergency Response Fund and from a FAO Technical Cooperation Programme (TCP) project.

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Communication

International simulation exercise for foot-and-mouth disease red alert, 7 to 10 September 2009, Gura Humorului Locality, Suceava County, Romania

From 7 to 10 September 2009, the National Sanitary Veterinary and Food Safety Authority (NSVFSA) of Romania, in close cooperation with the Technical Assistance and Information Exchange (TAIEX), organized its first simulation exercise for foot-and-mouth disease (FMD), which was held in Gura Humorului Locality, Suceava County.

Suceava County was chosen because of the important number of FMD-susceptible animals held in backyard production systems, and the vicinity of neighbouring countries (Ukraine and the Republic of Moldova) in which the epidemiological situation of FMD is not entirely known. The exercise was attended by 130 participants, including representatives of the veterinary administration at the central and local levels, county inspectorates for emergency situations (CIES), the national group of experts for FMD, the Romanian Veterinary Body and other stakeholders. International participants came from Denmark, Germany, Lithuania, the Republic of Moldova and the United Kingdom.

This was not a real-time alert exercise, but was instead organized to test – to the extent possible – the capacity for analysis and decision-making of local responsible people.

The work was organized in two parts: a one-day preparatory seminar to refresh participants' knowledge of FMD; and the exercise itself, carried out over the following three days.

The goals of the FMD simulation exercise were to:

- test the Romanian Contingency Plan and Operational Manual for FMD, issued by the central veterinary authority;
- test the response capacity of county sanitary veterinary and food safety directorates (CSVFSDs) in the event of FMD outbreak;
- test cooperation and coordination capacities within the local disease control centres of CSVFSDs and CIES.

The scenario used for the simulation related to primary and secondary FMD outbreaks in Suceava County, and the exercise coordinator presented themes for working groups at a plenary session. The exercise also included a risk analysis.

Interactive techniques were used to stimulate exchanges of views and discussions between presentations and during the working group sessions.

The simulation had three phases:

- The first phase used videos to present the actions and measures to be taken in response to a primary outbreak.
- The second phase required participants to analyse the situation and decide on the actions and measures to take in a suspected or confirmed FMD outbreak.
- The third phase required participants to analyse the situation and decide on the actions and measures to apply to re-establish FMD-free status.



EUGEN PAVEL

Working groups on the third day of the exercise, Gura Humorului, Suceava County, Romania

The results of the work carried out by each working group were presented in plenary after each session

These presentations reflected the active discussions and constructive work conducted during the working group sessions. In particular, they demonstrated that the participants were able to make decisions in a crisis. The presentations also highlighted the need for close cooperation between CSVFSDs and CIES during outbreaks.

A crisis centre was organized to demonstrate how such a component of local disease control centres (LDCCs) functions. On the second day of the exercise, demonstrations showed how field samples should be collected, labelled and sent to a laboratory, and how to handle epidemiological data and data related to compensation payments for farmers.

The last day was dedicated to evaluating the simulation exercise and preparing conclusions and recommendations.

The TAIEX experts' conclusions and recommendations

Based on participants' views, TAIEX experts were able to draw the following general observations, conclusions and recommendations:

- The simulation exercise was well prepared and planned and had clear objectives.
- Implementation of the simulation exercise was very well guided and controlled by the supervisory team.
- It was a challenge for participants to understand the activities to be implemented by NSVFSA at the central and county levels and by CIES in the event of FMD entering Romania.
- Participants were familiarized with the application of FMD legislation and the control measures described in the Romanian FMD Contingency Plan and Operational Manual.

The FMD simulation exercise was successful. It highlighted the complexity of the issues associated with applying control and eradication measures in the field in the event of a suspected or actual FMD outbreak, and provided valuable training for veterinarians and others involved in the control and eradication of FMD.

In 2010, Romania's NSVFSA intends to carry out a simulation exercise at the central level, to verify the functionality of the contingency plan. It is recommended that NSVFSA also arrange local-level simulation exercises, to train personnel in all the counties.

Based on information received from M. Mihaita, Senior Officer, National Sanitary Veterinary and Food Safety Authority of Romania, and organizer and coordinator of the simulation exercise



Meetings

Global Rinderpest Eradication Programme

The FAO Global Rinderpest Eradication Programme (GREP) was established as a coordination platform for promoting global eradication of rinderpest and verifying freedom in infected countries, with a deadline of 2010.

During the GREP consultative workshop held in September 2007, FAO and the World Organisation for Animal Health (OIE) were requested to select a mechanism for making a global announcement that the world was free of rinderpest owing to the success of GREP. The same meeting also recommended that rinderpest virus sequestration activities be carried out to reduce the risk of environmental recontamination through escape of the rinderpest virus, which is known still to exist in research, diagnostic and vaccine manufacturing laboratories. These recommendations were reinforced during the June 2009 GREP meeting.

Based on the absence of new outbreaks since 2001 and on consistent epidemiological evidence, FAO is confident that global eradication has been achieved. Considering the role that livestock plays globally in the livelihoods of the poor, this is a major FAO success story, and the Director-General's statement at the inaugural session of the World Summit on Food Security held in Rome in November 2009 included the following:

... in 1994 FAO initiated the Global Rinderpest Eradication Programme to control a dreadful disease that killed more than 1 billion cattle in the 1970s and 1990s. Between 1994 and 2009, about 170 countries and territories succeeded in eliminating rinderpest. We are now working with OIE to declare the world free from rinderpest in 2010 or 2011. It will be the first animal disease to be eradicated in the world and the second disease in human history after smallpox.

As an immediate follow-up activity, FAO's Animal Health Service (AGAH) organized two high-level workshops in Rome.

GREP – CVO Rinderpest Virus and Vaccine Sequestration Workshop

The workshop was held at FAO Headquarters from 30 November to 2 December 2009. It was attended by more than 50 chief veterinary officers (CVOs) or their representatives from countries previously affected by rinderpest where vaccination has been critical in controlling and eliminating the disease over the last 25 years, and was opened by the Assistant Director-General (ADG) of FAO's Agriculture and Consumer Protection Department (AGD), Dr Traoré.

The objectives of the workshop were to: i) review the rinderpest situation in previously infected countries, and plan for the global announcement of rinderpest eradication; ii) assess statements from CVOs (or their representatives) regarding a rinderpest-free world; iii) identify modalities for virus and vaccine sequestration/registry; and iv) agree on activities for the post-rinderpest eradication phase.



In addition to CVOs, laboratory researchers, rinderpest experts and representatives of partner institutions – OIE, the African Union, through the Interafrican Bureau for Animal Resources (IBAR) and the Pan African Veterinary Vaccine Centre (PANVAC), the World Health Organization (WHO) and FAO reference centres – the meeting was also attended by a representative from the Biological Weapons Convention Implementation Support Unit, a WHO-associated expert on smallpox eradication/sequestration, and donor representatives.

Outcome of the workshop

Participants expressed their commitment to rinderpest virus and vaccine sequestration; emphasized the need to formulate a post-eradication strategy to monitor the rinderpest-free world; and agreed to encourage their respective governments to increase (or at least maintain) budget allocations for safe and clean livestock sector development (taking biological diversity, including wildlife, into account).

FAO/OIE Joint Committee

FAO and OIE established the FAO/OIE Joint Committee (JC) in June 2009.

Its objectives are to: i) advise the Directors-General of FAO and OIE about potential gaps and risks to issuing a firm statement declaring the end of rinderpest virus circulation in the world; ii) draft a joint FAO/OIE text for the global declaration of rinderpest freedom in mid-2011; and iii) draft an international agreement outlining principles and responsibilities for oversight, and regulation actions to maintain rinderpest freedom post-declaration.

The JC met in a closed session on 3 December 2009 when the seven-member panel of selected experts met for the first time to agree their terms of reference and review the global effort to prove freedom from rinderpest, taking into consideration the statements of the CVOs (or their representatives) at the CVO Rinderpest Virus and Vaccine Sequestration Workshop.

The JC is to provide a report of its findings to the Directors-General of FAO and OIE, expressing whether or not it is confident that the world can be declared free of rinderpest and/or recommending the actions to be taken in this regard.

Dr William Taylor was elected as Chairperson of the JC, with Dr James Pearson as Vice-Chairperson.

The meeting was opened by Dr Traoré, who indicated that FAO sought guidance about the security of a final declaration and that a communication to this effect was an expected output of the JC's deliberations. He stressed that the JC was composed of independent experts, chosen on merit, and that its decisions must be based on science. He indicated that the JC was expected to assume an independent profile and was free to meet in closed session if it so wished.

The meeting and JC members were briefed by Dr Vallat, the Director-General of OIE, who indicated that the two organizations had now agreed to present a joint declaration of global freedom from rinderpest at the General Session of OIE in May 2011 and at the 2011 FAO Ministers' Conference.



Outcome of the JC meeting

An interim declaration in accordance with the GREP deadline of 2010 was discussed. The final target should remain the OIE General Session in May 2011, with the accreditation of all countries, and the FAO Conference in June 2011, with ministers' adoption of the global declaration documents.

Two options are foreseen for these documents: i) an international treaty/agreement, which may need ratification; and ii) resolutions referring to the guidance to be developed. The two options should be evaluated and presented to both FAO and OIE before the end of 2010. The documents should also reflect the post-global declaration strategy, including monitoring post-eradication, and virus sequestration, with modalities for the use of vaccines and research after the global declaration.

Foot-and-Mouth Disease Week in Istanbul, 8 to 9 October 2009

The Foot-and-Mouth Disease (FMD) Week in Istanbul included four meetings: the FAO-European Commission for the Control of Foot-and-Mouth Disease (EUFMD)¹/European Commission/World Organisation for Animal Health (OIE) Tripartite Group meeting on control of FMD and other exotic disease in the southern Balkans/Aegean region; the Controlling Transboundary Animal Diseases in Central Asian Countries (GTFS/INT/907/ITA) Tripartite final review meeting on Controlling Transboundary Animal Diseases; the 78th Session of the Executive Committee of EUFMD; and the first annual progress meeting for the west Eurasia roadmap on FMD control 2010 to 2020.

The 78th Session of the Executive Committee of EUFMD considered the current risk situation and recent events in FMD epidemiology in the region, and reviewed progress on actions due to be concluded in 2009 and on the redirection of EUFMD's programme following adoption of the Strategic Plan for 2009 to 2012 at the 38th Session. On behalf of all members and observers, the Chairperson proposed a vote of thanks to Dr Pakdil for the excellent support and hospitality. He considered that the FMD Week in Istanbul had been an excellent idea, bringing together major players in FMD control in Europe and west Eurasia to enable the sharing of information and positions. He thanked the Secretariat for its efforts in managing three major meetings in one week, and all participants for their inputs.

The 1st regional workshop to review progress of the West Eurasia FMD Network was also held in Istanbul, organized by FAO in consultation with OIE, and hosted by the Ministry of Agriculture of Turkey. The workshop was convened as a joint meeting under the FMD projects implemented by EUFMD (FAO) in Turkey, Trans-Caucasus, the Islamic Republic of Iran and the Syrian Arab Republic, and in the GTFS/INT/907/ITA project for Central Asian countries. On behalf of both organizations, FAO sent



Roadmap 2009 participants

¹ www.fao.org/ag/eufmd.html.



ALDO DEKKER

Slovenia 2009

invitations to chief veterinary officers (CVOs) and to FAO national consultants on FMD (EUFMD or GTFS projects). A total of 15 countries in west Eurasia were represented, with the Russian Federation represented by the OIE Reference Laboratory Federal Governmental Institute, Centre for Animal Health (FGI-ARRIAH). The objectives of the workshop were to:

- review progress in FMD control in west Eurasia, towards the vision of freeing the region of clinical FMD by 2020, using the vision statement and regional roadmap developed at the Shiraz (Islamic Republic of Iran) meeting in November 2008;
- share information on FMD virus circulation within the ecosystem, to assist the planning of preventive measures in the short term.

The Standing Technical Committee of EUFMD met in September 2009, in a closed session, in Kranska Gora (Slovenia).

The objectives of the meeting were to:

- develop immediate and longer-term (two to four-year) action plans to address the issues/priorities identified at EUFMD's 38th Session;
- review progress on research studies commissioned/ongoing since the closed session in 2008;
- provide guidance/recommendations to EUFMD on issues arising from project activities or plans for the new four-year programme.



News

Juan Lubroth, Chief of Animal Health Service and Chief Veterinary Officer of FAO

Juan Lubroth (DVM, Ph.D., Dipl. ACVPM) is currently FAO's Chief Veterinary Officer. He previously served for seven years as the Senior Officer of FAO's Animal Health Service and Head of the Infectious Diseases Group/Emergency Prevention System in charge of worldwide surveillance, capacity building, and progressive control of transboundary animal diseases. A United States national raised in Spain, he received his bachelor degree in biology from Whitman College in Washington State and worked as a wildlife biologist before continuing studies at the University of Georgia in the United States of America, where he earned both a master's degree in medical microbiology and a DVM, in 1985. After a stint as a wildlife veterinarian with the South-eastern Cooperative Wildlife Disease Study, University of Georgia, he joined the diagnostic services section of the Foreign Animal Disease Diagnostic Laboratory, Plum Island Animal Disease Center, United States Department of Agriculture. He was stationed in Mexico at the Mexico-United States Commission for the Prevention of Foot-and-Mouth Disease and other Foreign Animal Diseases, returning for advanced studies in the United States of America. He received a master of philosophy degree in arbovirology and epidemiology of infectious diseases in 1992, and a Ph.D. in 1995, both from the School of Epidemiology and Public Health at Yale University School of Medicine. He was posted as the Pan American Foot-and-Mouth Disease Center/Pan American Health Organization Visiting Scientist in Brazil, before being named Head of Diagnostic Services and Head of Reagents and Vaccines at Plum Island.

In 2002, Juan joined the Animal Health Service of FAO. He has worked extensively throughout Latin America, North Africa and the Near East. He has been instrumental in several major initiatives for the control of transboundary animal diseases in Central Asia, South Asia and Southern Africa, and has served on the Advisory Committee of the Pan African Programme for the Control of Epizootics. He has been the driving force behind several important cooperative initiatives of FAO, with the World Health Organization (WHO) and the World Organisation for Animal Health (OIE), including the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs), the Global Early Warning and Response System for Transboundary Animal Diseases (GLEWS), and establishment of the Crisis Management Centre – Animal Health (CMC-AH). As an expert in animal health and infectious disease transmission, he is often called on to assist in bringing animal production and health perspectives to WHO's work on issues related to zoonoses, biological safety of laboratories, and matters regarding bioterrorism and agroterrorism.

On 1 October 2009, Juan was appointed Chief of the Animal Health Service (Chief Veterinary Officer of FAO) and Head of the Emergency Centre for Transboundary Animal Disease Operations (ECTAD), headquartered in Rome.

*Dr Juan Lubroth*

Meetings and publications

Meetings and events

- Foot-and-Mouth Disease Virus Workshop: early pathogenesis and transmission, Pirbright, United Kingdom, 21 to 22 January 2010.
- Field Epidemiology Training Programme Wildlife Module, Bangkok, Thailand, 8 to 12 February 2010.
- Scientific Task Force on Avian Influenza and Wild Birds, FAO Headquarters, Rome, Italy, 15 to 17 March 2010.
- Rinderpest and differential diagnosis training, Vom, Nigeria, March 2010.
- Wildlife capture training (sampling for rinderpest and other diseases), Nairobi, Kenya, March 2010.
- Foot-and-Mouth Disease International Symposium and Workshop, Melbourne, Australia, 12 to 14 April 2010.



FAO Animal Production and Health publications

FAO Animal Production and Health Manual No. 7: *The AVE systems of geographic information for assistance in epidemiological surveillance* (available at www.fao.org/docrep/012/i0943e/i0943e00.htm).

FAO Animal Production and Health Manual No. 3: *Preparing for highly pathogenic avian influenza, revised edition* (available at www.fao.org/docrep/012/i0808e/i0808e00.htm).

FAO Animal Production and Health Manual No. 5: *Oiseaux sauvages et l'influenza aviaire – Une introduction à la recherche appliquée sur le terrain et les techniques d'échantillonnage épidémiologique* (available at www.fao.org/docrep/012/a1521f/a1521f00.htm).

FAO Animal Production and Health Manual No. 8: *Preparation of African swine fever contingency plans* (available at www.fao.org/docrep/012/i1196e/i1196e00.htm).



New staff

James Zingesser

Jim Zingesser (DVM, M.PH) joined the Animal Health Service in August 2009. He received his doctorate in veterinary medicine from Michigan State University (1979) and his master in public health degree from the University of Michigan (1990). After working in the Veterinary Division of the Jamaican Ministry of Agriculture, Jim joined the Epidemic Intelligence Service of the United States Centers for Disease Control and Prevention (CDC) in 1989. During his 20-year career as a public health epidemiologist, he helped establish the first health management information system in Cameroon and co-authored a manual on surveillance and control of epidemic meningitis in that country. He was the deputy medical director of refugee camps in Zaïre (now Democratic Republic of the Congo), directed Guinea worm eradication and trachoma control programmes for The Carter Center and worked with the



World Health Organization (WHO) on polio eradication. In 2008, he returned to his veterinary roots when he joined CDC's One Health Office as the first CDC scientist assigned to work at FAO Headquarters.

Sherrilyn Wainwright

Sherrilyn Wainwright (DVM, M.PH) is an epidemiologist in FAO's Animal Health Service, working with the Global Early Warning and Response System for Transboundary Animal Diseases (GLEWS), the Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) and the Crisis Management Centre – Animal Health (CMC-AH). She worked for the United States Department of Agriculture with the Risk Assessment Team on brucellosis at the wildlife-livestock interface; highly pathogenic avian influenza (HPAI) and foot-and-mouth disease (FMD) laboratory capacity; and the Emergency Management Response System (EMRS). She was a field Veterinary Medical Officer, an Area Epidemiologist and, at the United States Centers for Disease Control and Prevention (CDC), an epidemiologist, also interning at the Division of Vector-Borne Infectious Diseases. She received her doctorate of veterinary medicine from Texas A&M University and a master of public health from John Hopkins University. Her response missions to outbreaks have included HPAI, FMD, Q-fever, *Brucella melitensis*, Rift Valley fever, Nipah virus, bovine spongiform encephalopathy and exotic Newcastle disease in Malaysia, Bosnia and Herzegovina, Kenya, the Republic of Korea, France, Bolivia, Mexico and the United States of America.



Contributions from FAO Reference Centres

FAO/OIE World Reference Laboratory for FMD, Pirbright, United Kingdom

Report from FAO World Reference Laboratory for FMD, July to December 2009

| Country | No. of samples | Virus isolation in cell culture/ELISA ¹ | | | | | | | | RT-PCR ⁵ for FMD (or SVD) virus (where appropriate) | | |
|--------------|----------------|--|----------|---|----------|----------|----------|------------------------|------------------|--|------------|-----------|
| | | FMD ² virus serotypes | | | | | | SVD ³ virus | NVD ⁴ | Positive | Negative | |
| | | O | A | C | SAT 1 | SAT 2 | SAT 3 | | | | | Asia 1 |
| Bangladesh | 31 | 17 | - | - | - | - | - | - | - | 14 | 29 | 2 |
| Botswana | 4 | - | - | - | - | 4 | - | - | - | - | 4 | - |
| Ethiopia | 11 | 6 | - | - | - | 2 | - | - | - | 3 | 9 | 2 |
| Israel | 3 | - | 2 | - | - | - | - | - | - | 1 | 2 | 1 |
| Kenya* | 55 | 4 | - | - | 5 | - | - | - | - | 46 | 20 | 31 |
| Malawi | 1 | - | - | - | - | 1 | - | - | - | - | 1 | - |
| Malaysia | 21 | - | - | - | - | - | - | - | - | 1 | 12 | 9 |
| Mozambique | 1 | - | - | - | 1 | - | - | - | - | - | 1 | - |
| Pakistan | 15 | - | 4 | - | - | - | - | 3 | - | 8 | 15 | - |
| Saudi Arabia | 2 | 2 | - | - | - | - | - | - | - | - | 2 | - |
| South Africa | 2 | - | - | - | - | - | 2 | - | - | - | 2 | - |
| Sri Lanka | 4 | 1 | - | - | - | - | - | - | - | 3 | 3 | 1 |
| Swaziland | 2 | - | - | - | 2 | - | - | - | - | - | 2 | - |
| Uganda | 1 | - | - | - | - | - | 1 | - | - | - | 1 | - |
| Yemen | 8 | 5 | - | - | - | - | - | - | - | 3 | 6 | 2 |
| Total | 161 | 35 | 6 | | 8 | 7 | 3 | 3 | | 79 | 109 | 48 |

¹ FMD (or SVD) virus serotype identified following virus isolation in cell culture and antigen detection ELISA.

² Foot-and-mouth disease.

³ Swine vesicular disease.

⁴ No FMD, SVD or vesicular stomatitis virus detected.

⁵ Reverse transcription polymerase chain reaction for FMD (or SVD) viral genome.

* Four samples not tested.



FAO World Reference Laboratory for Rinderpest, Pirbright, United Kingdom

Report from FAO Reference Laboratory for Rinderpest, July to December 2009: samples received for serology

| Country | Sample | Species | Disease | Result |
|---------------------------|--------------|---------|----------------------------------|--|
| Nepal | 30 x sera | Caprine | Peste des petits ruminants virus | Negative |
| Somalia | 1 621 x sera | | Rinderpest virus | 3 x strong pos (PI 82–93) 6 x weak pos (PI 50–65) |
| United States of America* | 54 x sera | Bovine | Rinderpest virus | Negative |
| Yemen | 40 x sera | Various | Rinderpest virus | 5 strong pos (PI 70–90) 1 weak pos (PI 48–55) |

* All the United States of America samples were for a commercial company checking bovine serum, not diagnostic samples.

Report from FAO Reference Laboratory for Rinderpest, July to December 2009: diagnostic samples received for virus detection

| Country | Sample | Species | Disease | Diagnostic technique | Result |
|--------------------------|---------------------------------|---------------------|----------------------------------|----------------------|----------------|
| Egypt | 5 x cDNA | | Peste des petits ruminants virus | rtRT-PCR | 3/5 positive |
| Islamic Republic of Iran | 1 x tissue 4 x cell cultures | Isolated from sheep | Peste des petits ruminants virus | rtRT-PCR | Ongoing |
| Nepal | 3 x tissues 17 x swabs | Caprine | Peste des petits ruminants virus | rtRT-PCR | 14/20 positive |
| Yemen | 9 x swabs | Bovine | Rinderpest virus | RT-PCR | All negative |
| Yemen | 10 x swabs/ epithelia | Ovine and caprine | Peste des petits ruminants virus | rtRT-PCR | All negative |



FAO/OIE Reference Laboratory for Rinderpest and Peste des Petits Ruminants, Montpellier, France

Report from FAO Regional Reference Laboratory for PPR, International Cooperation Centre of Agricultural Research for Development (CIRAD), Montpellier, France, July to December 2009

| Country | Species | Sample | Number of tests | Number of PPRV positives/doubtful | Test | Nature of the test Confirmatory or tentative |
|---|---------------------|-------------|-----------------|-----------------------------------|--|--|
| PPRV¹ with differential diagnosis for RPV² | | | | | | |
| Sudan | Ovine/caprine/camel | Tissue | 528 | 62 | RT-PCR ³ , QRT-PCR ⁴ | Confirmatory |
| Bangladesh | Caprine | Tissue | 14 | 6 | QRT-PCR | Confirmatory |
| Cameroon | Caprine | Serum | 103 | 0 | C-ELISA ⁵ | Tentative |
| Kenya | Wildlife | Sera | 864 | 1 | C-ELISA | Confirmatory |
| Tajikistan | Caprine | Tissue | 14 | 0 | RT-PCR, QRT-PCR | Tentative |
| | | Serum | 19 | 6 | C-ELISA | Confirmatory |
| Zimbabwe | Wildlife | Blood | 240 | 0 | QRT-PCR | Tentative |
| Vaccine contaminants | | | | | | |
| PANVAC Ethiopia | - | PPR vaccine | 3 | | Quality control ⁶ | Pass |

¹ Peste des petits ruminants virus.

² Rinderpest virus (all samples remained negative).

³ Reverse transcription polymerase chain reaction.

⁴ Quantitative reverse transcription polymerase chain reaction.

⁵ Competitive enzyme linked immunosorbent assay.

⁶ Sterility test + PCR (RPV, PPRV, bovine viral diarrhoea [BVD] virus, mycoplasma) + titration (cytopathic effect [CPE]) visualized by immunofluorescence test using an anti-PPR monoclonal antibody (anti-PPRV Mab) + sequencing.



Stop the press

From January to June 2010, there have been reports of more transboundary animal diseases (TADs) across the world.

Foot-and-mouth disease (FMD) serotype A was reported in China (January 2010) and the Republic of Korea (January and March 2010). FMD serotype O was reported in China (February to May 2010), Japan (April to June 2010), Mongolia (April and May 2010) and the Republic of Korea (April to June 2010). Although China often reports FMD outbreaks, these are the first FMD outbreaks in a long time for all the other affected countries in the region. Japan's last reported outbreak was in 2000, in 2002 in the Republic of Korea and in 2005 in Mongolia. Kazakhstan reported an FMD outbreak in June 2010; the last reported outbreak was in 2007.

Rift Valley fever (RVF) continues to be reported all across South Africa. There were also an outbreak reported in Namibia in May 2010.

African swine fever (ASF) was reported in domestic pigs and wild boar in the south of the Russian Federation (January to June 2010), with most of the outbreaks concentrated in the north coast of the Bacl Sea and along the border with Ukraine. Two outbreaks were also and in northern Armenia (March 2010).

Highly pathogenic avian influenza (HPAI) was reported in poultry in Bangladesh, Bhutan, Cambodia, Egypt, India, Indonesia, Lao People's Democratic Republic, Myanmar, Nepal, Romania and Viet Nam. In addition, cases of H5N1 infection in wild birds were reported in China, Bulgaria, Indonesia and Mongolia. The number of officially reported outbreaks in 2010 peaked in February and starting to gradually decline. In March, the Danube Delta experienced outbreaks in two backyard poultry premises in Romania, followed by a common buzzard in Bulgaria. These are the first poultry outbreaks in Europe since October 2008 and are most similar to the Clade 2.3.2. isolates identified in poultry outbreaks in Nepal. In addition, Bhutan reported its first H5N1 HPAI outbreaks ever. Lao People's Democratic

Republic and Myanmar experienced the reoccurrence of the disease in poultry after over a year with no reported outbreak.

Pandemic H1N1 2009 was reported in pigs in Asia – China (Hong Kong SAR), Japan and the Republic of Korea; in Europe – Denmark; and in the Americas – the USA. The disease was also reported in turkeys (in France and the USA), in cats in the USA and in skunks in Canada.

Unknown disease: About 1,200 dead antelopes were found in May 2010 on the Kazakstan and Russian Federation border.



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