



## CHAPTER II

### LITERATURE REVIEW

#### 2.1 AVIAN INFLUENZA

Avian influenza has been recognized as a highly lethal generalized viral disease of poultry since 1901. In 1955, a specific type of influenza virus was identified as the causal agent of what was then called fowl plague. It has since been found that AI viruses cause a wide range of disease syndromes, ranging from severe to mild, in domestic poultry (Geering & Bruce, 1970).

#### 2.2 AETIOLOGY

AI viruses are members of the family Orthomyxoviridae. The influenza viruses that constitute this family are classified into types A, B or C based on differences between their nucleoprotein and matrix protein antigens (Food and Agriculture Organization of the United Nations [FAO], 2007). AI viruses belong to type A. Type A occurs in human, birds, pigs, horse, minks, seals, whales, while types B and C occur in humans only.

Influenza viruses are further categorized into 16 subtypes according to the antigens of the haemagglutinin (H) and 9 neuraminidase subtypes (N) projections on their surfaces. To date, all highly pathogenic isolates have been influenza A viruses, that cause generalized respiratory disease belonging to H5 or H7 subtypes

(World Organisation for Animal Health [OIE], 2006). H5N1 is the technical term for a particularly lethal sub-type of AI, and just one of the sub-types of the disease. H5N1 can be transmitted to humans, although this is very difficult unless they come into close contact with infected birds (FAO, 2007). The pathogenicity of AI viruses is correlated to the ability of trypsin to cleave the haemagglutinin molecule into two subunits. Highly pathogenic strains of H5 and H7 viruses have several amino acid residues at the cleavage site. Trypsin sensitivity and amino acid sequencing can be used diagnostically to determine whether or not an isolated virus is potentially pathogenic (Geering & Bruce, 1970).

The virus is inactivated at 53°C in 3 hours and at 60°C in 30 minutes. For complete inactivation in the meat, a core temperature of 70°C for at least 1 second is necessary and in eggs 60°C for 210 seconds (3.5 minutes) (OIE, 2006).

### **2.3 EPIDEMIOLOGY AND EPIZOOLOGY**

Most outbreaks probably start with direct contact with secretions from infected birds, especially faeces, eggs, blood or respiratory secretion. Indirectly transmission can be via contaminated feed, water, equipment, and clothing (OIE, 2006). Many of the strains that circulate in wild birds are either non-pathogenic or mildly pathogenic for poultry. There is evidence that H5 viruses of low pathogenicity may mutate and become highly pathogenic. All domestic and wild avian species are susceptible. Until now disease has been documented in fowl, ducks, geese, turkeys, guinea fowl, quail,

ostrich and pheasants as well as in other species eg pigs, cats, tigers, horse. Many species of wild birds particularly waterbirds and seabirds are susceptible, but infections in these birds are generally subclinical.

Once AI is established in domestic poultry, it is a highly contagious disease and wild birds are no longer an essential factor for spread. Infected birds excrete virus in high concentration in their faeces and also in nasal and ocular discharges. Once introduced into a flock, the virus is spread from flock to flock by the usual methods involving the movement of infected birds, contaminated equipment, egg flats, feed trucks, and workers. The disease generally spreads rapidly in a flock by direct contact, but on occasions spread is erratic (FAO, 2007).

Airborne transmission of avian influenza virus from farm to farm is not likely. Birds are readily infected via instillation of virus into the conjunctival sac or the trachea. Preliminary field and laboratory evidence indicates that virus can be recovered from the yolk and albumen of eggs laid by hens at the height of the disease. The possibility of vertical transmission is unresolved; however, it is unlikely infected embryos could survive and hatch. This does not mean that broken contaminated eggs could not be the source of virus to infect chicks after they hatch in the same incubator. The hatching of eggs from a diseased flock would likely be associated with considerable risk (FAO, 2007). The incubation period in birds is usually 3 to 5 days, and can take up to 21 days, depending on the virus strain, the dose of virus, the species, and the age of the bird.

Incubation in humans is 1-2 weeks before the first symptoms.

In the first year of the occurrence of the AI virus, death used to occur within 24-48 hours after the appearance of the clinical signs but these days it is much faster; poultry deaths occur within a few hours. Mortality can reach 100% within 1-2 weeks.

## **2.4 CLINICAL SIGNS**

### **Symptoms in the birds**

The clinical signs are very variable and are influenced by factors such as the virulence of the infecting virus, species affected, age, sex, concurrent diseases and environment.

HPAI appears suddenly in a flock and many birds die either without premonitory signs or with minimal signs of depression, inappetence, anorexia, respiratory signs, excessive lactimation, ruffled feathers, watery diarrhea, or sudden deaths. Hens may at first lay soft-shelled eggs, but soon stop laying. Sick birds often sit or stand in a semi-comatose state with their heads touching the ground. Facial oedema is one of the signs, also oedema of and cyanotic coloring of combs and wattles. Petechial or ecchymotic haemorrhages are often present. Birds are excessively thirsty. Neurological signs such as torticollis and ataxia may also be seen (FAO, 2007).

### **Symptoms in Humans**

Evidence-based reports published in the New England Journal of Medicine, by the US Centers for Disease Control and Prevention (CDC), and by the World Health

Organization (WHO) indicate early symptoms may be flu-like and most likely include fever, headache, cough, and shortness of breath. Additionally, diarrhea, sore throat, abdominal pain and muscle pains have been noted in multiple cases. Nearly all cases have clinical findings of pneumonia and pulmonary infiltrates. As progression of disease ensues, more life-threatening complications occur including respiratory distress and ultimately respiratory failure (Center for Excellence in Disaster Management & Humanitarian Assistance [COE-DMHA], 2007).

## **2.5 DIFFERENTIAL DIAGNOSIS**

The following diseases must be considered in the differential diagnosis:

- Newcastle disease
- Infectious laryngotracheitis
- Duck plague
- Acute poisonings
- Acute fowl cholera and other septicaemic diseases
- Bacterial cellulitis of the comb and wattles

Less severe forms of the disease may be confused with, or complicated by, many other diseases with respiratory or enteric signs. AI should be suspected in any disease outbreak in poultry that persists despite the application of preventive and therapeutic measures for other diseases (FAO, 2007).

## **2.6 MEASURES TO IMPLEMENT IN THE EVENT OF SUSPECTED OUTBREAK**

A suspected outbreak is the occurrence of any massive and sudden mortality without apparent cause, associated with respiratory disorders and/or decrease of appetite, drinking and egg production and affecting mostly layers, broilers and turkeys irrespective of age. Any suspicion of AI must be reported by the farmer/owner and/or veterinarian to the veterinary authorities as soon as possible. The authorities in charge must then immediately institute additional investigations, to be conducted by accredited State agents. This reaction must be swift since birds can be infected and transmit the virus even before showing any symptoms (OIE, 2006).

## **2.7 REGULATION OF CONDUCT IN THE EVENT OF A SUSPECTED OUTBREAK**

The general approach to be selected and the combination of actions to be taken with regard to controlling marketing, imposition of movement restrictions, quarantine measures, culling, and any vaccination, varies according to the local set of circumstances and from country to country. There is no single solution applicable to all scenarios, and a balance must always be found to find effective, feasible and socially acceptable control measures that safeguard the short and long term livelihoods of farmers and the health of the population. It remains, however, that in the face of an emergency with multiple outbreaks suggesting HPAI levels of bio-security (prevention and containment) must immediately be raised appropriate to the risk, and there must be early detection and rapid plus safe culling of infected groups

of birds, and those considered in contact with them, in order to halt disease spread. FAO organizes international expert panels to review the latest outcomes in terms of scientific progress and to translate these findings into practical recommendations for the control and prevention of the disease. Therefore, it is essential that country emergency plans are reviewed frequently and regularly in order to assimilate new scientific knowledge in this fast-moving field.

In the case of an AI outbreak villagers are obliged to:

- Immediately inform the local veterinary authority
- Quarantine the sick birds, especially from the rest of the flock
- In case of deaths, remove unaffected birds from the proximity of the carcasses and keep in quarantine those that have been in contact
- Adopt movement restrictions of animals, products and material from the unit (farm, household) ie no bird products or tools may exit the compound/village until the veterinary authorities have taken appropriate decisions
- Keeping products (meat or eggs or feathers) of infected or dead birds away from humans

As soon they are informed about suspected outbreaks veterinarians are obliged to:

- Visit the location as quickly as possible, taking the necessary precautions and equipment needed for sampling (cold chain). This also means changing clothes before entering the premises, also disinfection of vehicle and materials before exiting the area
- Confirm the order of (temporary) quarantine of the farm or village until the results of the investigation are known

- Conduct an on-site epidemiological investigation
- Take the necessary samples to be dispatched to the reference laboratory.

#### **Within the infected area of suspected outbreak**

- Quarantine (prohibition to move any animal, animal product, material or equipment)
- Restriction on movements of persons and vehicles (incoming and outgoing)
- Take the appropriate samples and send them immediately to the competent laboratory
- Conduct an epidemiological investigation into the possible origin of the outbreak and assess the risk of spread of the infection beyond the infected perimeter
- Proceed with precautionary culling of all sick and sensitive animals in the outbreak area without waiting for confirmation from the laboratory
- Dispose of the carcasses (incineration or burial) and thereafter disinfect the area.

#### **In the affected outbreak area**

- Maintain the prohibition of animal movements (strict quarantine measures effectively enforced)
- Restriction of movements of humans: limited possibility of exit of infected area with compulsory passage through an inspection checkpoint with disinfection of the means of transport
- If not carried out yet: stamping-out of all birds in the infected area and incineration and/or burial of the dead or slaughtered animals and of their products
- Ensure complete disinfection of infected buildings, equipment/materials and premises



- Prohibit any repopulation on the premises for at least 21 days (sanitary void)

#### **Around the affected outbreak area**

In a radius of 3 or 5 km (limits fixed according to the concentration of poultry present and the associated epidemiological risks):

- Conduct full stamping-out of all poultry present in this area (if compensation is foreseen) and/or
- Vaccinate all unaffected poultry (in Thailand vaccination is prohibited)
- Prohibit all movements of poultry and of their products and limit the movements of persons (compulsory passage through an inspection checkpoint with disinfection of the means of transport)

#### **In a radius of 5 to 10 km (or beyond)**

- Prohibit all movements of poultry and of their products
- Limit the movements of person (compulsory passage through an inspection checkpoint with disinfection of the means of transport)

#### **In the remaining part of the territory**

- Prohibit poultry markets and other gatherings of birds (fights, fairs, exhibition, etc.)
- Strengthen the surveillance of poultry farms
- Strengthen bio-security in poultry farms
- Strengthen movement controls inside the country and at the borders

The limits of the various areas (infected, protection) are defined by the health authorities of each country in the national emergency preparedness plan.

**Reminder:** Safety standards for persons:

To wear safety goggles for the eyes, N-95 or FFP2 masks for the nose and the mouth, disposable overalls, strong rubber or plastic gloves to protect hands (OIE, 2006).