



Review Article

The Question of Eradication – Newcastle Disease Virus

BAN-BO Bebanto Antipas^{1*}, Bidjeh Kebkiba² and Dzhupina Simon Ivanovich³

¹Faculty of Exact and Applied Sciences - University of N'Djamena

²Livestock Research Institute for Development

³Faculty of Agrarian Sciences - Russian University of Friendship of Peoples

*Corresponding author

ABSTRACT

Since 1926, the causative agent of Newcastle disease has been identified characterized and means of struggle now seem to be well-known. As with many infectious agents, the European Directive and the OIE recommend at the onset of the disease stamping out «strict or partial" (EEC, 92; OIE, 2008). Live and attenuated vaccines have been produced, control measures are recommended to fight against this disease. But despite this Newcastle disease remains one of the diseases most formidable poultry species *Gallus gallus* and epizootic situation is still quite complex. Her household content in the rural population remains the main reservoir of the causative agent of this disease that threatens large industrial poultry farms. The vectors may be economic activities of people, the movement of wild and domestic animals, but remain highly dangerous wild birds; crows and jackdaws. Epizootic process of Newcastle disease involving domestic and wild birds of different species contributes to increased virulence of the virus. Knowledge about the hosts of the virus allows distinguishing between mandatory or compulsory, in the body he lives in hidden mode and is the main source of the pathogen. The functions of such owners do crows and jackdaws, and potential owners are chickens. Since the elimination of crows and jackdaws is very problematic, it remains problematic and the eradication of the virus of this disease. The main source of the pathogen and the cause of the spread of the disease remains sick poultry.

Keywords

Newcastle disease,
Virus,
Host,
Epizootic process,
Eradication,
Poultry

Introduction

Virus Newcastle disease infects thousands of chickens and losses related to maintenance, disinfection, slaughter, etc. number in the trillions of dollars worldwide. Since 1926, the causative agent of the disease was identified, characterized and means of struggle now seem well-known ones. Several authors argue that the most

effective means of control remains preventive prophylaxis. As with many infectious agents, the European Directive, OIE, recommended in case of occurrence of this disease *stamping out* the "strict or partial" (EEC 1992; OIE, 2008). Live and attenuated vaccines have been produced,

control measures are recommended to fight against this disease. But despite this, Newcastle disease remains one of the diseases most formidable bird species *Gallus gallus* and epizootic situation is still quite complex (Lancaster, 1976; Vindevogel and Duchatel, 1993; Alexander, 1997, 2003; Spradbrow 1988; Syurin *et al.*, 1998; Rodin *et al.*, 1998; Bakool *et al.*, 2002; Starov, 2003; Gruzdev, 2005; Dortmans, 2011, etc.). This paper describes the nature of the hosts that harbor the virus of Newcastle disease in order to help eradicate.

Problematic

We still admit that the epidemiological situation of Newcastle disease in developed countries has improved considerably during the period 1960–1980. But sporadic slub however reported in the reports of the OIE (2008). Factory farms are generally the most affected by the virus. In underdeveloped countries Newcastle disease virus is almost endemic in poultry farming villagers and continues to wreak havoc among the poultry population (Ban-bo, 2009; Ban-bo *et al.*, 2012). According to Werner (1994) the appearance of most of Newcastle disease outbreaks in Germany from 1993 to 1994 was related to poultry farming in rural households.

At the onset of Newcastle disease virus in an industrial operation, total or partial *stamping out* is one of the most applied measures for several years in the countries of the European Economic Community (EEC, 1992). The socio-economic consequences associated with different measures are most important: compulsory slaughter of birds, purchase of veterinary products and disinfectants, disinfection of buildings and production areas, equipment and tools, recycling or destruction of birds, etc. (Lancaster, 1976; Vindevogel and Duchatel

1993; Spradbrow, 1988; Ban-bo *et al.*, 2012).

For many countries in Africa, Asia and South America where poultry is raised in rural households and family farms, the control measures are not strictly enforced. Domestic and wild birds, domestic or wild mammals are drinking and share the food on the same land: bin, ponds and surface water. The hygienic deficit favors the presence of virus carriers (crows, hawks, sparrows, mammals, etc.) in these feeding and drinking places (Ban-bo *et al.*, 2012). Also, it has been proven that the patient in scavenging is the main source of infection and spread of the virus not only in rural areas but also in industrial farms (Werner, 1994). Poultry, even healthy carrier is healed and able to spread the disease. Rural households then become reservoir of the virus, threatening industrial farms. Such a situation is a real obstacle to the development of industrial poultry (Awan *et al.*, 1994; Okroshidze *et al.*, 1999; Ban-bo, 2009, etc.).

Hosts and epizootic process

The issue of improving the eradication of the virus of Newcastle disease process remains relevant and is of a special character. Epizootic process of the virus seems to be the preferred track its eradication process because the -C evolves from one host to another. For some guests, the epizootic process is severe, while in others the process is shy. According to the World Organization for Animal Health (OIE), the many species of birds, both domestic and wild are hosts of the virus of Newcastle disease. The morbidity and mortality vary by species and depending on the viral strain in question. Among poultry, chickens are the most susceptible; regarding ducks and geese, they seem to be less

sensitive (Lancaster, 1976; Vindevogel and Duchatel 1993; Spradbrow, 1988; Alexander, 2003; OIE, 2008; OVF, 2013. Ban-bo *et al.*, 2014).

A host is an organization that hosts a parasite, a mutual partner or commensal partner, providing, in general, the board and lodging. Knowledge of types of birds, host of Newcastle disease virus, contributes significantly to the eradication of this disease. Some use the term primary host or definitive host to designate the body in which the parasite reaches maturity; secondary host or intermediate host to designate the organization that hosts the parasite only for a short transition period. Dzapina (2004) used the terms "mandatory hosts" for poultry in whom the process of epizootic pathogen is shy, and "potential hosts" for poultry epizootic process where the pathogen is severe.

The virus of Newcastle disease has been isolated from several species of domestic and wild fowl, domestic and wild mammals, pigs. These biological organisms can participate in the mechanism of transmission of pathogens. (OIE, 2008; Ban-bo, 2009; Xuan *et al.*, 2012; Ban-bo *et al.*, 2013, 2014). The categorization of the hosts of the virus of Newcastle disease in the process of manifestation of the disease seems to be decisive for the orientation of the controls.

Potential hosts

Based on the clinical, epidemiological and histopathological lesions observed in the bird population, chickens seem more sensitive than other species: ducks, geese, turkeys, partridges, pheasants, quail; guinea fowl (Kaleta and Baldauf, 1988; Collins *et al.*, 1993, 1998; Starov, 2003; Gould *et al.*, 2001; Alexander, 2003). Epizootic outbreaks of the infectious disease were observed for

the first time among these species. Naive and young chickens seem more susceptible than adults. Epizootic process is potentially severe among the avian population age group.

Required hosts

Several authors report that the virus of Newcastle disease of chickens was isolated in wild birds: crows, hawks, sparrows, pigeons, geese, penguins, parrots and other birds clinically healthy (Syurin *et al.*, 1998 Lvov, 2000; Alexander *et al.*, 1997; Schelling *et al.*, 1999). The fact that these birds do not show severe disease, they are called mandatory hosts of the virus of chicken Newcastle disease. It is important to note that very often, the virus of the disease is isolated in village farms and rural households where domestic poultry does not show clinical signs of the disease (Kaleta and Baldauf, 1998; Schelling *et al.*, 1999; Otim *et al.*, 2006).

Of course, these findings do not mean that mandatory hosts cannot be a source of infection or the cause of animal diseases in large poultry farms. Rather, they are the main sources of Newcastle disease. Many cases have been reported by some authors (Wemer, 1994; Rodin *et al.*, 1998; Starov, 2003; Alexander, 1997; Kommers, 2001, etc.) under which poultry rural households are both sources of infection and reservoir of Newcastle disease virus.

Mixed host

Some hosts can be both definitive host and intermediate host. It has been proven that on farms where the virus of Newcastle disease appeared for the first time can be a reservoir of this agent (Spradbrow, 1988; Alexander, 1997, 2003; OIE, 2008). From this point of view, it can stay as long as the source of

disease spread when conditions are favorable. Poultry becomes both intermediate and definitive host. In the theory of epizootic process Dzapina, (2004) confirms that in some potential hosts situations can become mandatory hosts. On the other hand, the infectious agent of a binding B can be transmitted to a potential host in the presence or absence of factors favoring the spread of the disease. When the factors favoring the spread of the disease do not exist and that the infectious agent is not growing, and then we are in the presence of a biological topic.

The transmission of the infectious agent can be made in the absence of any factors favoring disease development. Such conversion is possible when an infectious agent of a given species, considered as potential due to the manifestation of the epizootic process can be transmitted vertically that is to say the mother to child. This possibility of transmission of Newcastle disease virus in chickens from egg to chick was observed by many authors (Bagdanov *et al.*, 1985; Skutari 1987; Rodin *et al.*, 1998; Kaleta and Baldauf, 1988; FVO, 2013, etc.).

Other authors such as Alexander (1997) Starov (2003) Kommers *et al.* (2001) found that chickens vaccinated against Newcastle disease could manifest the disease, but the event is still shy in these birds. If confirmed, it is likely that after several passages of the virus from mother to egg and egg to chicken or hen, the host may become mandatory, so do not manifest the disease, but can transmit the virus. Such predisposition may specify health prophylaxis. These observations were confirmed by some authors (Goater, 1985; Alexander, 1997; Rodin *et al.*, 1998; Kommers *et al.*, 2001; Starov, 2003; and others) showing that vaccinated birds are healthy carriers of Newcastle disease virus. This feature of the manifestation of the virus

Newcastle disease can be confirmed or refuted by experimental research.

Hypothesis Newcastle disease virus control

The manifestation of the epizootic process in the host leads us to review the eradication of the virus of Newcastle disease in the poultry population. Several authors have shown that rural poultry farms are the reservoir of the virus of Newcastle disease. And the virus of this disease has an ability to persist in the body of this population (Bogdanov *et al.*, 1985; Awan *et al.*, 1994; Rodin *et al.*, 1998; Spradbrow, 1988; Alexander, 1997, 2003; Otim *et al.*, 2006; OIE, 2008).

Poultry, mixed in its composition with different ages, different disease first appears. Some species such as adult ducks, shyly show clinical signs of the disease or not at all, which makes them mandatory hosts; while others such as chickens in all age groups, show an acute form of the disease: they are potential hosts. Socio-economic activities of men, domestic and wild animals, including crows, pigeons and jackdaws play an important role in the spread of the virus (Rodin *et al.*, 1998; Bakulov *et al.*, 1999; Starov, 2002, 2003; Birman *et al.*, 2005; Alexander, 1997, 2000).

Epizootic process of Newcastle disease appears to be increasing in virulence in the presence of other domestic and wild hosts. Skutar (1971, 1987) Nassonov (2005), Alexander (1997, 2000) and others, admit that the appearance of the disease is linked to industrialization, concentration of birds, and the disregard of sanitary measures in factory farms. The same observations were made by us, by moving the sick chickens with a high density area to another less dense area. During the same period of time,

the mortality rate has fallen sharply in the less dense poultry (12–22%). By analogy, in the natural environment, the peaks of Newcastle disease manifestation observed from October to December and from April to June, cereal abundance of periods of high concentration of birds on the feeding grounds and watering birds, and socio-economic activities confirm this thesis (Ban-bo, 2009).

In all cases, potential hosts as mandatory are able to spread the virus of Newcastle disease in the poultry population. This explains the isolation of the virus Newcastle disease in chickens most of the domestic poultry population as wild, and even mammals.

The function of the required hosts of the virus is attributed to poultry category that shows less clinical signs of the disease. In the organs and tissues of these lives and the virus is released without major constraints. These hosts are the main sources of infection and spread. These are: ducks, geese, crows, hawks, sparrows, etc.

The function of potential host for all ages confused chickens. This species severely manifest the disease because of the deemed favorable environment for the explosion of the virus. It is the secondary source of infection and spread of the virus in the environment and nearby farms. The total or partial *stamping out* set up by the veterinary services is generally oriented achievement poultry) (potential host, which is the secondary source of virus infection, without much worry of the main sources of infection from obligatory guests that are probably wild fowl. This practice certainly limits the spread of this disease, but the virus continues to circulate in the immediate environment, including mandatory hosts. Control measures must take into account the presence of these hosts for example by

limiting access (Ban-bo, 2009). Sporadic appearances and homes of Newcastle disease epizootics observed here and there show the limitations of this approach in the fight. Since the issue of mandatory eradication hosts seems unlikely and difficult; the issue of eradicating Newcastle disease remains a major problem for the industrial and commercial poultry.

Knowledge of host lets you know which hosts (domestic as wild) are required, which are potential, which are both mandatory and potential that wild birds, reptiles, etc. are closer to the poultry farm. This knowledge emphasizes the sources of infection: primary and secondary, and directs us to Newcastle disease control strategies. Control measures should take into account not only the presence of potential hosts, which are the sources of secondary infection (sick chickens) but also compulsory hosts, primary infection sources (crows, hawks, sparrows, ducks, geese etc.) that roam around farms for example by limiting access.

The completion of such work is extremely important for any poultry operations and even is a priority in the definition of the strategy, not only against Newcastle disease but also other infectious diseases.

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