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Review

Newcastle disease in pheasants (*Phasianus colchicus*): A review

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Abstract

Newcastle disease (ND) is regarded throughout the world as one of the most important diseases of poultry, not only due to the serious disease and high flock mortality that may result from some ND virus (NDV) infections, but also through the economic impact that may ensue due to trading restrictions and embargoes placed on areas and countries where outbreaks have occurred. All ages of pheasants are purported to be highly susceptible to infection with NDV, but clinical signs and mortality levels in infected birds vary considerably. This article reviews the available literature relating to infections in pheasants, describing the clinical presentation of the disease and the epidemiological role these hosts may have in the spread of ND.

Keywords: Pheasant; Newcastle disease; Review

1. Introduction

1.1. Pheasants

The term 'pheasant' usually refers to varieties and hybrids of the 'ring-necked pheasant' (*Phasianus colchicus*). Other species, such as the golden pheasant (*Callonetta leucophyrs*), make up only a tiny proportion of the pheasant population reared as game birds. Pheasants are predominantly reared in large numbers in parts of Europe for shooting as a sport on game bird 'estates'. Although at one time rearing pheasants was labour intensive and involved the use of surrogate domestic hens in the hatching and rearing stages, the usual practice now is to obtain the eggs from pheasants retained from the previous year and these are hatched in hatcheries similar to those used for commercial domestic fowl. The birds are then reared semi-intensively until released through pens that allow the pheasants to move out gradually into the cover where they will live extensively and be driven from to be shot. There is considerable trade, both nationally and internationally in day-old and older chicks and, to a lesser extent, hatching eggs.

The number of pheasants released each year, and of those surviving in the wild is difficult to estimate. Parrott et al. (2003) quoted a survey by Compass Research for the UK Countryside Alliance in which it was estimated that in 2000–2001 some 11 million birds were killed in professional 'shoots' on game bird estates in the United Kingdom. This figure probably corresponds to numbers approaching 30 million pheasants being released, as Turner and Sage (2003) reported that only 30.5% of pheasants released were shot on the estate where they were released and only 16% survived the game bird shooting season. Earlier, Tapper (1999) had estimated annual figures of 20 million pheasants released and 8 million resident birds in the UK.

1.2. Newcastle disease

Newcastle disease (ND) is regarded throughout the world as one of the two most important diseases of poultry, not only due to the serious disease and high flock mortality that may result from some ND virus (NDV) infections, but also because of the economic impact that may ensue due to

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trading restrictions and embargoes placed on areas and countries where outbreaks have occurred.

ND is listed as notifiable by the World Organisation for Animal Health (OIE), and within the OIE Terrestrial Animal Health Code for International Trade (OIE, 2005), justifiable trade restrictions may be put in place to prevent the introduction of virulent NDV by live birds, poultry meat and poultry products to countries free of ND.

In the current virus taxonomy NDV, or avian paramyxovirus type 1 (APMV-1), is classified with the other avian paramyxoviruses, in the genus *Avulavirus*, sub-family *Paramyxovirinae*, family *Paramyxoviridae*, order *Mononegavirales* (Lamb et al., 2005) i.e. it has a negative sense, single-stranded, filamentous RNA genome and a glycoprotein/lipid membrane.

Kaleta and Baldauf (1988) reported that natural or experimental infection with NDV has been described in 27/50 orders of birds, and suggested that despite no record of infection of birds in some orders, it is likely that all would be susceptible to infection. They reported a high level of susceptibility in Phasianiformes (including gallinaceous birds), Psittaciformes, Struthioniformes and Columbiformes. This statement is well supported by the fact that these species have been affected in many recent outbreaks of NDV across the world (Alexander, 2001). All ages of pheasants are highly susceptible to ND, and infection with NDV often leads to death, which is preceded by a range of clinical signs (Higgins, 1982). In this article, it is intended to review the literature available describing infections in pheasants.

2. Newcastle disease in pheasants

2.1. The disease

As with other birds, clinical signs in pheasants infected with NDV can be quite varied and presentation will depend on a number of factors including the host, environmental conditions and the strain of the infecting virus. This was confirmed by Muller et al. (1990), who recorded a range of clinical signs in pheasants infected experimentally, but reported that none could be considered pathognomonic and that diagnosis required the isolation and identification of virus.

Clinical signs that have been reported in pheasants infected with virulent strains of NDV include nervous signs, in-coordination, depression, failure to feed, watery white/green diarrhoea, egg production problems and head shaking (Alexander et al., 1997a; Al-Hilly et al., 1980; Borland, 1972; Geral et al., 1976; Jørgensen et al., 1999; Lage et al., 1974). Reports of respiratory signs seem to be mixed, some reports comment the notable absence of respiratory signs (Borland, 1972; Muller et al., 1990) and some report their presence (Al-Hilly et al., 1980; Jørgensen et al., 1999).

Mortality levels in infections can vary considerably. For example, in an outbreak in free living pheasants in Denmark, the mortality at the different sites ranged between 22 and 77% (Jørgensen et al., 1999). In an outbreak of ND in young pheasants on a shooting estate in the UK in 2005, even in the worst affected pen the mortality did not exceed 3% (Aldous et al., 2007). However, in two experimental infection studies clinical signs developed into 100% mortality in unvaccinated birds (Lage et al., 1974; Muller et al., 1990). High morbidity and mortality of Japanese pheasants infected during enzootic outbreaks of NDV in Japan has also been reported (Ozai et al., 1987). However, in a study by Geral et al. (1976) experimental infection of pheasants and two types of partridges demonstrated an inconsistent relationship between virus dose and host mortality, with some individual birds demonstrating resistance to disease.

Post mortem findings in pheasants infected with virulent strains of NDV have included facial oedema, submucosal haemorrhages, proventricular haemorrhages, kidney lesions, spleen lesions, haemorrhagic ulcers on the intestine and varying degrees of enteritis and tracheitis (Borland, 1972; Geral et al., 1976; Higgins, 1982; Jørgensen et al., 1999; Lage et al., 1974; Muller et al., 1990).

2.2. Vaccination

Vaccination of pheasants against ND has been practiced using a range of schedules and regimens similar to those used for chickens (Borland, 1972), and does offer protection from disease signs, but not necessarily from virus replication (Beer, 1976; Capua et al., 1994; Muller et al., 1990). The implications of this for internationally traded live birds was demonstrated when vaccinated pheasants imported into Italy and swabbed as part of a surveillance programme were found to be excreting the pigeon variant of virulent NDV (PPMV-1) in the absence of ND-related disease signs (Capua et al., 1994).

3. History of Newcastle disease in pheasants

Despite the claims of some authors, it is not clear when ND was first recorded in pheasants. Several publications in the 1940s discussed ND infections in the birds (Brandly et al., 1946; Levine et al., 1947; Wagener, 1948) and these probably represent the earliest recognition of the disease in pheasant. Beer (1976) reported that the first outbreak of ND in free-living pheasants in the UK was in 1963. In the earliest reports pheasants were often infected during epizootics in chickens and there was debate as to whether the pheasants introduced the disease to chickens or vice versa. What is clear is that when outbreaks of ND have been widespread in chickens, pheasants have also been affected. For example, during the extensive ND epidemic in poultry that began in Essex (UK) in 1970, isolations of NDV were made from submissions of pheasants over a seven-month period from birds showing clinical signs (Borland, 1972).

Virus diseases of game birds can occur following spread from domestic poultry and wild birds. NDV, infectious lar-