Newcastle Disease B1 Vaccine Strain in Wild Rock Pigeons of Atlanta, Georgia

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Summary: In 2012, free-ranging Rock Pigeons (Columba livia) were sampled in metro Atlanta, Georgia to ascertain the prevalence of pigeon paramyxovirus-1 (PPMV-1), a subset of avian paramyxovirus-1 (APMV-1) commonly isolated from pigeons, primarily affecting the neurological system. APMV-1, also known as Newcastle disease virus (NDV), is highly contagious, and infection with a virulent strain causes Newcastle disease (ND) that is spread to susceptible birds through direct contact, or aerosolized droplets of, virus infected saliva and feces. While antibodies for PPMV-1 were previously detected in 66% of Rock Pigeons (2002-2003) at nearby sites, only 6% of 71 Rock Pigeons tested positive for hemagglutination inhibition (HI) for APMV-1 in this 2012 study. Although HI confirmed the presence of APMV-1 antibodies, they cannot distinguish antibodies of APMV-1 from PPMV-1. Oral and cloacal swabs from 72 pigeons underwent virus isolation, with 12 Rock Pigeons actively shedding virus (7%) at time of capture. Sequencing identified the strain as the Newcastle disease B1 poultry vaccine, as opposed to the expected wild-type PPMV-1 strain. Moreover, the presence of the APMV-1 strain vaccine strain was negatively correlated with pigeon condition, measured as the weight-to-wing chord ratio and mean retention growth bar width. As the B1 vaccine is not normally used for pigeons, these results suggest improper vaccine packaging in poultry, and/or lack of biosafety measures to prevent contact with wild birds may release live vaccines into the environment. The association between reduced weight and infection may be explained by antifouls in wild birds due to immunological energetic reallocation. Escape of live NDV vaccines needs further study as it may have far-reaching ecological and economic implications.

Introduction

Within ecological systems, viral spillover from reservoir hosts often results from stochastic, repeated transmission events into a susceptible population [1]. Transmission and maintenance of novel pathogens are dependent upon individual and population parameters, such as sociality, density, body condition, immune competence, nutrition, habitat enclosure, and heterogeneous community assembly [2-5].

The use of live vaccines in agriculture poses an unusual complexity in viral epidemiology, as the degree of protection conferred to poultry is often relative to the degree of vaccine homology and attenuation [6]. Crucial implications arising from vaccine shedding include the potential for infections to be transferred to other bird species, which may increase the risk of disease transmission to managed and non-managed poultry [7].

Materials and Methods

Wild Rock Pigeons were captured during daylight hours using a combination of hand-nets, drop-nets, mist-netting, and ground traps, with demographic attributes including age, sex, and body condition recorded. Individual body condition was assessed using two indices: weight to wing chord ratio and ptilochronology [17,18]. Weight to wing chord ratio was calculated as body mass divided by the length of the un-flattened longest primary [18]. For ptilochronology, the right outermost tail feather (retrix 6) was collected for analysis of feather growth bars with the top 2/3 of each feather measured using 0.01 mm electronic calipers. In a darkroom, feather samples underwent RNA extraction and PCR and sequenced using Fusion (F) gene specific primers [6].

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