

DECLARATION

I, **BRUNO STEPHEN JULY PHIRI** do hereby declare that the work contained in this thesis being submitted herein are my own, and that it has not been previously submitted to any university for the award of a degree or any other qualification.

Signature:

Date:

CERTIFICATE OF APPROVAL

This thesis submitted by **BRUNO STEPHEN JULY PHIRI**, has been approved as fulfilling the requirements for the award of the degree of **MASTER OF SCIENCE IN VETERINARY MEDICINE** at the University of Zambia.

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ABSTRACT

This study described the prevalence of avian influenza viruses in wild waterfowl and domestic birds on the wetlands of Northern Zambia (Luapula and Northern Provinces). The purpose of the research was to establish if there are any influenza viruses circulating in this region in order to determine the level of risk Zambia faces as a country. However, the wild migratory waterfowl were also investigated for Newcastle disease viruses since these birds are known to be carriers of orthomyxoviruses and paramyxoviruses. The study was motivated by lack of information about influenza viruses, migratory bird activities and presence of free-range poultry on the wetlands of Northern Zambia.

Four types of birds were investigated, namely wild migratory ducks and geese, village chickens and domestic ducks. Cloacal, tracheal swabs and faecal samples were examined in the Biosafety level-3 laboratory in the School of Veterinary Medicine at the University of Zambia. A total of 294 paired cloacal and 294 paired tracheal swabs were collected from hunted wild migratory waterfowl around the wetlands of Bangweulu, Mweru and Tanganyika Lakes in Northern Zambia. In addition, a total of 448 paired cloacal and 448 paired tracheal swabs were collected from village chickens and domestic ducks in the study area. Furthermore, a total of 2,500 fresh environmental faecal samples were collected of which 2,000 were from wild migratory waterfowl and 500 from village chickens and domestic ducks. Avian influenza virus subtypes and Newcastle Disease virus were isolated by egg inoculations. These viruses were characterised by Haemagglutination, Haemagglutination inhibition and Neuraminidase inhibition tests. The major findings include the isolation of one H6N2 (A/duck/Bangweulu/1/11), one H9N2 (A/duck/Bangweulu/2/11) and one H6N2 (A/duck/Bangweulu/3/11) subtypes of avian influenza virus from two faecal samples of Knob-billed ducks (*Sarkidiornis melanotos*) on the Bangweulu wetlands of Zambia. However, isolates H11, H12 and H13 were not fully identified. In addition, NDV/duck/Bangweulu/1/11 Newcastle Disease virus was also isolated from one of the faecal samples of the same species of ducks.

The study has demonstrated the presence of H6N2 and H9N2 subtypes of avian influenza virus and Newcastle disease virus in wild Knob-billed ducks (*Sarkidiornis melanotos*) that inhabit the wetlands of Northern Zambia. This suggests that wild Knob-billed ducks could be carriers of avian influenza and Newcastle disease viruses. Although Zambia is still free of avian influenza, its outbreak would be devastating to the poultry industry and the local economy. Arising from the findings, the researcher has made some recommendations for enhancing influenza prevention and control in Zambia. The most notable of these is that surveillance of avian influenza viruses should be continued and it should be extended to other water bodies and rivers of Zambia, frequented by these wild migratory ducks and other wild birds. There should be a deliberate Newcastle disease vaccination programme for poultry on the wetlands. Further studies should be done in order to trace the origin of avian influenza and Newcastle disease viruses isolated.

DEDICATION

I dedicate this work to my parents, Mr. Stephen July Phiri and Mrs. Tilile Thandiwe (Zulu) Phiri who struggled to give me the parental care and guidance I needed throughout my childhood. I also dedicate this work to my lovely wife, Agness Jim Phiri and my three children, Bruno, Rene and Terry for their encouragement, emotional and spiritual support.

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LIST OF ABBREVIATIONS

| | |
|-------|--|
| AI | Avian Influenza |
| AIV | Avian Influenza virus |
| AIVs | Avian Influenza Viruses |
| DDCCs | District Development Coordinating Committees |
| GMAs | Game Management Areas |
| HA | Haemagglutination |
| HI | Haemagglutination Inhibition |
| HPAI | Highly-Pathogenic Avian Influenza |
| HP | Highly-pathogenic |
| IBD | Infectious Bursal Disease |
| LP | Low-Pathogenic |
| LPAI | Low-Pathogenic Avian Influenza |
| MAL | Ministry of Agriculture and Livestock |
| ND | Newcastle Disease |
| NDV | Newcastle Disease Virus |
| NDVs | Newcastle Disease Viruses |
| NA | Neuraminidase |
| NI | Neuraminidase Inhibition |
| INRP | Integrated National Response Plan |
| PDCCs | Provincial Development Coordinating Committees |
| PBS | Phosphate Buffered Saline |

| | |
|------|---------------------------|
| RBCs | Red Blood Cells |
| ZAWA | Zambia Wildlife Authority |
| WHO | World Health Organisation |
| WWF | World Wild Fund |