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Prevalence of Newcastle Disease Viruses in Wild and Captive Birds in Central Nigeria

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Abstract: Newcastle disease (ND) is an acute rapidly spreading, contagious, nervous and respiratory disease of domestic and wild birds caused by the Avian Paramxyovirus 1, the Newcastle disease (ND) virus. ND is endemic in Nigeria. The reservoir status of wild and captive birds for ND virus in central Nigeria is assessed in this study. Cloacal swabs were taken from one hundred and sixty three birds caught from five Local Government Council areas of Plateau, Benue and Kaduna States in central Nigeria. A total of thirteen ND Viruses were isolated from the three States. Viz: 8 isolates from Plateau, 4 from Benue and 1 from Kaduna State. One hundred and fifty three of the birds sampled belonged to 30 avian species in 10 Orders while ten birds were unidentified. Only 7% of the species in three Orders yielded ND viruses. The 13 isolates were characterized using the Mean death time of the Minimum lethal dose (MTD/MLD); Intracerebral Pathogenicity index (ICPI) Intravenous Pathogenicity index (IVPI) and the Reverse transcriptase polymerase chain reaction (RT/PCR). The results show that 12 of the isolates were of the lento genic strain while 1 isolate belonged to the Merogenic strain. The implication of these findings on the poultry industry in the country is discussed.

Key words: Newcastle disease, status, birds and wild

INTRODUCTION

Poultry production in Nigeria has witnessed a rapid growth in the last decade as a commercial enterprise involving hundreds of thousands of birds. This increase in the production activity is greatly pronounced on the Jos plateau in the central region of the country. It has given rise to new challenges especially that of diseases control (Hassan *et al*., 2006).

Newcastle disease (ND) poses a serious threat as it has economic and ecological impact on pet, free-living, as well as domestic birds. An average of 200-250 outbreaks of the disease is reported in Nigeria annually (Okeke and Lamorde, 1988). The virus strains prevalent in nature are highly virulent (velogenic) and are kept in circulation by vast populations of wandering local chickens, apparently normal ducks and free-flying birds (Nawathe *et al*., 1975; Adu *et al*., 1985; Ibu *et al*., 2000). The isolation of velogenic viscerotropic ND virus from wild birds during ND outbreaks in poultry has led to the suggestion that wild birds could be important vehicles for the spread of the disease in the country (Haruna *et al*., 1993; Echeonwu *et al*., 1998). However, reports of ND virus isolations in epizootiological surveys of wild birds in Nigeria are scanty. The role of these birds in the maintenance of the disease in localities is therefore obscure. Such information is necessary for strategic planning for ND control in the country (Nawathe, 1988). In this study, a survey of ND viruses was conducted on wild birds obtained from three states in central Nigeria to determine their carrier status.

MATERIALS AND METHODS

Sample collection and viral isolation: A total of one hundred and sixty three (163) apparently healthy wild and captive birds were caught at random from Vom, Miango, Museum, Kasuwan Kaje localities in Jos North and Jos South Local Government Council Areas (LGAS) of Plateau state; Wurukun, Udei and Guma localities in Makurdi and Guma LGAS of Benue state and Gwantu, Fadan Karshe, and Ungwar Mailafia localities of Sanga LGA of Kaduna state, all in central Nigeria.

Cloacal swabs coated with feces were collected from the birds unto a transport medium containing antibiotics. After sample processing, 0.2ml volumes of the supernatant fluid were used to inoculate 9-11 day-old embryonated chicken eggs (Hanson, 1980). Following primary isolation, the infective allantoic fluid was passed three times in eggs prior to serological identification.

Virus identification and Characterization: The virus isolates were identified using a standard Haemagglutination Inhibition (HI) test (OIE, 2004). The Newcastle disease virus Lasota freshly harvested, processed and stabilized in glycerin was used as positive control antigen. The ND hyperimmune serum

Table 1: Strains of ND Virus isolates obtained from free-flying birds

Isolate No	HA titre	Eid50 log10	Mdt	ICPI	ICPI	PCR	Strain
PI038	256	8.5	58.43	1.25	1.6	Avirulent	Merogenic
PI029	256	7.83	63.95	0.10	0	Avirulent	Lento genic
PI032	256	7.75	64	0.3	0	Avirulent	Lento genic
BN7	64	6.83	64.28	0	0	Avirulent	Lento genic
Jz13	128	6.83	58.56	0.42	0	Avirulent	Lento genic
KD4	128	8.17	92.6	0.28	0	Avirulent	Lento genic
BN2	256	8.2	155	0.00	0	Avirulent	Lento genic
BN11	256	7.25	103	0.22	0	Avirulent	Lento genic
Jz2	64	7.5	80.8	0.20	0	Avirulent	Lento genic
BN8	512	7.83	91	0.68	0	Avirulent	Lento genic
Jz4	128	6.75	81.60	0.30	0	Avirulent	Lento genic
Jz6	128	5.80	61	0.25	0	Avirulent	Lento genic
PI016		7.75		0.69	0	Avirulent	Lento genic

Fig. 1: PCR products of characterized virus isolates.

Fig. 2: Owl.

control was prepared locally from the same vaccine strain.

The assessment of virus virulence was based on the results of the Mean death time (MDT), Intracerebral pathogenicity index (ICPI), the Intravenous pathogenicity index (IVPI) and the Triple One – Step Reverse transcriptase / Polymerase chain reaction (RT-PCR) (Creelan *et al.,* 2002; OIE, 2004).

RESULTS

From one hundred and sixty three wild and captive birds

Fig. 3: Peacocks and peahen.

sampled, thirteen (13) Newcastle disease virus isolates were obtained. Twelve of the viruses were of the Lento genic strain while one isolate belonged to the Merogenic strain (Table 1; Plates 1-5). The thirteen (13) ND viruses were isolated from seven (7) of the 30 different species of birds sampled (Table 2). The seven species belonged to 4 different orders (Table 3). Four of the ND virus isolates were each obtained from birds captured in Jos South and Jos North Local Government Council Areas (LGAS) of Plateau State, three from Guma LGA of Benue State, one from Makurdi LGA of the same state while one isolate was obtained from Sanga LGA of Kaduna state (Table 4).

DISCUSSION

Newcastle disease (ND) is enzootic in Nigeria. The disease is widespread among village and exotic chickens (Fatumbi and Adene, 1979; Ezeokoli *et al.,* 1984; Gomwalk *et al.,* 1985; Abdu *et al.,* 2004). The isolation of non-velogenic ND virus strains in this survey is an indication that mild strains of the virus are prevalent among wild birds in the sampled area. The sources of these mild strains in the wild are unknown. However, unregulated immunization of exotic chickens with live lento genic and merogenic vaccines is common (Ibu *et al*., 2002; Ibrahim *et al*., 2005b). The absence of a velogenic strain in this survey is at variance with the commonly held view that wild birds are carriers of the virulent ND viruses and may play a major role in the maintenance of the disease in domestic poultry (Majiyagbe and Nawathe, 1981; Haruna *et al*., 1993). However, the recent revelation that the highly virulent strains could evolve from viruses of low virulence by mutation (Alexander *et al.,* 1997; Gould *et al*., 2001) underscores the significance of the findings in the present study. There is therefore the need to determine the nucleic acid sequences of these mild strains and their sequences compared with those of the existing velogenic strains from Nigeria to establish evolutionary relationships.

Table 2: Avian species sampled and birds carrying the ND virus isolates

O	Common name	Species	No.of species sampled	No. carrying ND viruses	Percentage carrying N.D. Viruses
1.	Dove	*Streptopelia decipiens*	6	-	0.00
2.	Pegeon	*Goura cristata*	13	-	0.00
3.	Crow	*Cornus cornix*	8	2	25
4.	Vulture	*Gyps africanus*	8	1	14.28
5.	Hawk	*Accipiter tachiro*	7	2	28.57
6.	Owl	*Tito alba*	5	1	20
7.	Swallow	*Hirundo rustica*	18	-	0.00
8.	Kite	*Milvus migrans*	3	1	33
9.	Eagle	*Aquila spilogaster*	9	1	11.11
10.	Buzzard	*Buteo buteri*	2	-	0.00
11.	Parrot	*Psittacus erithacus*	2	-	0.00
12.	Patridge	*Perdix perdix*	2	-	0.00
13.	King red hen	*Gallus gallus*	1	-	0.00
14.	Hammer cob	-	1	-	0.00
15.	Swift	*Chactura pelagica*	1	-	0.00
16.	Cockoo	*Clamator glanderius*	1	-	0.00
17.	Nightingale	*Lusciana megarhunchos*	1	-	0.00
18.	Sparrow	*passer domesticus*	20	4	25
19.	Kingfisher	*Corythornus lecontei*	1	-	0.00
20.	Skylark	*Landa arvensis*	1	-	0.00
21.	Great tit	*parus major*	1	-	0.00
22.	Myna	*Gracula religiosa*	1	-	0.00
23.	Parakeet	*Conuropsis carolinensis*	1	-	0.00
24.	Cockatoo	*Calyptorhynchus funereus*	1	-	0.00
25.	Egret	*Columba livia*	9	-	0.00
26.	Thrush	*Garulax leucolophus*	2	-	0.00
27.	Guinea fowl	*Numida Meleagridis*	12	-	0.00
28.	Peacock	*Afropavo congolensis*	2	-	0.00
29.	Greese	*Anseranas*	2	-	0.00
30.	Waterfowl	*Anas discors*	12	-	0.00
31.	Unidentified	-	10	1	10
	Total	-	163	13	7.98%

Table 3: Order of birds sampled and viruses isolated

Order	No of samples	No +ve	% +ve	No -ve	% -ve
Passeriformes	53	6	11.32	47	88.68
Columbiformes	19	-	-	19	100
Falconiformes	29	5	17.24	24	82.76
Strigiformes	5	1	20	4	80
Galliformes	18	-	-	17	100
Apodiformes	1	-	-	1	100
Cuculiformes	1	-	-	1	100
Coraciformes	1	-	-	1	100
Cicomiformes	11	-	-	9	100
Anceriformes	15	-	-	14	100
Unidentified	10	1	10	9	90
Total	163	13	7.98	153	93.86

Table 4: Distribution of NDV isolates according to states/lgas

State	Lga	No. of birds sampled	No of Isolates
Plateau	Jos south	49	4
	Jos North	59	4
Benue	Guma	26	3
	Makurdi	2	1
Kaduna	Sanga	27	1
Total		163	13

The thirteen ND viruses were isolated from nine species of birds belonging to three different orders. Newcastle disease virus is widely known to maintain a broad host range among the avian species (Kaleta and Baldauf, 1988). The later group reported the detection of ND virus antibodies in 16 species of birds in Nigeria. The 7.8% virus isolation rate obtained here appears to be higher than the 3.2% reported by other workers in similar surveys elsewhere (Tumova *et al*., 1982).

Fig. 4: River eagle.

Fig. 5: Pegeon

The presence of mild strains of the virus in localities could be responsible for the variability in the responses of village poultry to sporadic outbreaks of ND in the country. It could also be responsible for vaccine failures commonly observed in commercial flocks (Ugochuckwu, 1982; Nawathe, 1985). The village chickens which outnumber commercial poultry by 8 to 1 in Nigeria are frequently seen roaming side by side with wild birds scavenging for food in the localities (Adene, 2004). Most workers in commercial poultry farms seem to hail from households where free-range chickens are kept. There is therefore a direct linkage between wild birds and the village poultry on the one hand and between village poultry and the commercial farms via the personnel on the other.

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