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# Avian Influenza Viruses and Paramyxoviruses in Wintering and Resident Ducks in Texas

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ABSTRACT: Cloacal swabs were collected from teal (*Anas crecca, Anas cyanoptera, Anas discors*), mottled duck (*Anas fulvigula*) and northern pintail (*Anas acuta*) in Brazoria County, Texas, USA, during February 2001, mottled ducks during August 2001, and blue-winged teal (*A. discors*) during February 2002. Prevalence of avian influenza virus (AIV) infections during each sampling period were 11, 0, and 15%, respectively. The hemagglutinin (H) subtypes H2 and H7 were detected in both years, while the H8 subtype was detected in 2001 and the H1 subtype was detected in 2002. Avian paramyxovirus type 1 (APMV-1) was isolated from 13% of mottled ducks sampled in August 2001 and 30.7% of teal in February 2002. The season of isolation of both viruses and the majority of the AIV subtypes detected in this study are not typical based on previous reports of these viruses from North American ducks.

*Key words:* Avian influenza virus, avian paramyxovirus, mottled duck, pintail, teal, Texas.

Wild birds represent the natural reservoir for avian influenza viruses (AIVs) and avian paramyxoviruses (APMVs), both of which are potential health threats to domestic poultry worldwide (Alexander, 2000). Although there has been significant progress in understanding the epidemiology of AIV and APMV in wild-bird populations, questions remain relating to the maintenance of these viruses in nature. In previous surveys of North American ducks, the prevalence of AIV infections have been consistently highest during the late summer and fall seasons. This has been attributed to the concentration of immunologically naive juvenile ducks during premigration staging and, in general, few AIVs have been isolated from ducks on their wintering grounds or during other seasons (Webster et al., 1992). Although 15 of the 16 known hemagglutinin (H) subtypes have been represented in AIVs isolated from wild waterfowl (Sharp et al., 1997; L'vov et al., 2001), the predominate subtypes reported from North American ducks are the H3, H4, and H6 subtypes (Sharp et al., 1993).

Wild ducks also are considered the natural hosts of the APMV-1 (*Newcastle disease virus*), APMV-4, APMV-6, APMV-8, and APMV-9 serotypes (Alexander, 2000). Prevalence of APMV infections in wild ducks may vary due to multiple factors, including location, species, sex, age, and season of sampling (Stallknecht et al., 1991). However, the epidemiology of APMV is poorly understood and, unlike AIV, clear seasonal peaks in the transmission of APMV have not been detected.

Most studies investigating the prevalence of AIV and APMV infections in wild ducks have focused on mallards (*Anas platyrhynchos*) captured during the fall season in Canada and the northern half of the United States. However, because isolation of both AIVs and APMVs has been documented in ducks wintering on the Gulf Coast of the United States (Stallknecht et al., 1990b, 1991), additional information on the epidemiology of these viruses in wintering waterfowl is warranted. The objective of this study was to determine if AIVs and APMVs were present in migratory and resident duck species in the Gulf Coast region of Texas, with an emphasis on winter-time sampling.



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Ducks were captured at prebaited sites using rocket nets over a freshwater marsh that is artificially and seasonally inundated at Peach Point Wildlife Management Area in Brazoria County, Texas (28°56′55″N, 095°26′17″W). Trapping sites were baited for approximately 1 wk prior to sampling. Cloacal swabs were collected by Texas Parks and Wildlife Department personnel using sterile cotton-tipped applicators (Puritan®, Hardwood Products Company, Guilford, Minnesota, USA) and placed in 3 ml of Brain Heart Infusion media (Becton Dickinson and Co., Sparks, Maryland, USA) supplemented with penicillin G (10,000 units/ml), streptomycin (2 mg/ml), kanamycin (0.6 mg/ml), gentamicin (1 mg/ml), and amphotericin B (0.02 mg/ml) (Sigma Chemical Company, St. Louis, Missouri, USA). Samples were stored on ice in the field, shipped overnight (approximately 24–72 hr on ice total), and frozen at −70 C until processed.

For virus isolation, samples were thawed, vortexed, and centrifuged at 1,500 × G for 15 min. The supernatant was inoculated (0.25 ml/egg) via the allantoic route into four 9-day-old specific-pathogen-free (SPF) embryonated chicken eggs. Eggs were incubated at 37 C for 72 hr and hemagglutination testing was completed as previously described (Stallknecht et al., 1990b). For negative samples, amnio-allantoic fluid was pooled by sample, diluted 1:10 in sterile phosphate-buffered saline, and repassaged into two additional eggs. All isolates were typed using hemagglutinin inhibition and neuraminidase inhibition tests at the National Veterinary Services Laboratory, Veterinary Services Laboratories, Ames, Iowa, USA.

During 2001 and 2002, 258 ducks were sampled and 57 hemagglutinating agents were detected. Fifty (87.7%) of the isolates were recovered on the first egg passage. Prevalence by year, month, and species is presented in Table 1. The sex and age of the birds were not consistently recorded and were not included in the analysis. Species diversity reflects the Texas Parks and Wildlife Department's trap success and personnel available to collect swabs on sampling days.

Based on previous reports of the low prevalence of AIV infections in Gulf Coast wintering ducks (Stallknecht et al., 1990b), the >10% isolation rate during both winters was unexpected. In addition, the subtypes isolated in this study have not been frequently detected in ducks. For example, of more than 3,100 isolates from North American ducks during 1974–90, the H2, H7, and H8 each represented <1% of the total isolates (Webster et al., 1976; Boudreault et al., 1980; Hinshaw et al., 1980, 1985, 1986; Kocan et al., 1980; Smitka and Maassab, 1981; Deibel et al., 1985; Nettles et al., 1985; Kawaoka et al., 1988; Stallknecht et al., 1990b; Slemons et al., 1991; Alfonso et al., 1995). The more commonly reported H subtypes from ducks, including the H3, H4, and H6, were not detected in this study.

The distinctly different AIV-subtype assemblage in ducks tested in this study suggest that ducks in wintering areas, such as the coastal region of Texas, may play a unique role in the maintenance of many AIVs. This may be especially true for the less common AIV H subtypes. Although our sample size was small given the considerable population of ducks wintering in the management area (approx. 20,000; T. Merendino, pers. comm.), it is interesting that none of the AIV subtypes typically associated with ducks were detected, and AIV infection prevalence greater than 10% was detected during February in both years. This suggests that previously uncommon AIV subtypes may be transmitted among these wintering ducks. This is further supported by the isolation of H10N7 AIVs from a blue-winged teal and a northern shoveler (*Anas clypeata*) sampled during April 2000 approximately 100 miles south of Brazoria County (unpublished data).

Our results may represent the combined effects of multiple factors, including prior exposure and acquired immunity, host mi-

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TABLE 1. Occurrence of avian influenza virus (AIV) and avian paramyxovirus (APMV) isolated from ducks, Brazoria County, Texas, USA.

| Year | Month | Species | No. | AIV | APMV | No. serotype isolates |
|---|---|---|---|---|---|---|
| 2001 | February | Blue-winged teal (*Anas discors*) | 32 | 7 (0.22±0.14)[a] | 0 | H2N4 (*n*=3)<br>H7N3 (*n*=3)<br>H7N4 (*n*=1) |
| | February | Cinnamon teal (*Anas cyanoptera*) | 2 | 1 (0.5±0.7) | 0 | H8N4 (*n*=1) |
| | February | Green-winged teal (*Anas. crecca*) | 29 | 2 (0.07±0.09) | 0 | H7N3 (*n*=1)<br>H8N4 (*n*=1) |
| | February | Mottled duck[b] (*Anas fulvigula*) | 3 | 0 | 0 | |
| | February | Northern pintail (*Anas acuta*) | 30 | 1 (0.03±0.06) | 0 | H8N4 (*n*=1) |
| | August | Mottled duck | 87 | 0 | 11 (0.13±0.07) | APMV-1 (*n*=11) |
| 2002 | February | Blue-winged teal | 75 | 11 (0.15±0.08) | 24 (0.32±0.11) | H1N4 (*n*=2)<br>H1N3 (*n*=2)<br>H2N4 (*n*=1)<br>H2N9 (*n*=1)<br>H7N3 (*n*=3)<br>H7N4 (*n*=2)<br>APMV-1 (*n*=23)<br>APMV-7 (*n*=1) |

[a] No. (prevalence ± SD).
[b] Resident species; all others, wintering species.

gratory patterns, or environmental influences on the virus.

Based on numerous published reports of the prevalence of H3, H4, and H6 AIV subtypes from ducks sampled during late summer and fall, population immunity to these specific subtypes should be high. Prior exposure and resulting immunity has been suggested as an explanation of the low prevalence of AIV infections in adult ducks versus juvenile ducks (Hinshaw et al., 1985; Webster et al., 1992) and is consistent with our failure to isolate AIVs representing the H3, H4, or H6 subtypes in this study. As evidence suggests that natural infections of AIV do not afford cross-protection between AIV subtypes (Suss et al., 1994), it is possible that wintering ducks would remain susceptible to those subtypes that do not predominate during the premigration and migration periods.

The species composition of ducks sampled in this study also may have influenced our results because it is plausible that the infected birds detected in Texas represent birds with little or no previous exposure to AIVs. Blue-winged teal, from which most of the AIVs were isolated, generally depart the breeding grounds earlier than most species, often arriving on the wintering grounds by September (Bellrose, 1980). This suggests that these early migrants may have minimal or no previous AIV exposure and thus represent a susceptible population on wintering areas. Avian influenza viruses have been reported from this species cohabiting with other ducks species during migration (Hinshaw et al., 1980;) as well as upon arrival to wintering areas in Louisiana (Stallknecht et al., 1990b). Although the prevalence of AIV infection was low in Louisiana, the more common H3, H4, and H6 subtypes pre-

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dominated in birds sampled during the fall.

Although information is limited, persistence of AIV in water is influenced by the temperature, salinity, and pH and variation in environmental persistence between individual AIV isolates has been detected under experimental conditions (Stallknecht et al., 1990a). Although speculative, it may be possible that environmental conditions as well as variation in waterfowl populations influence local subtype diversity.

Both APMV-1 and APMV-7 have been previously reported from wild ducks (Stallknecht et al., 1991), although APMV-7 is generally associated with pigeons and doves (Alexander, 2000). The 30.7% APMV-1 infection rate detected in this study is the highest prevalence reported from wintering ducks. However, based on negative results from the first year of sampling, APMV-1 infections in these ducks may be a sporadic event.

Given the strong bias toward sampling ducks, especially mallards, during the fall season, it is not surprising that the ecology of both AIVs or APMVs are not fully understood. From these results, it appears that some of the assumptions regarding the seasonality of transmission and the virus subtype host associations of AIVs are not as clear as previously thought and that our understanding of APMV in wild ducks is incomplete. The transmission and maintenance of both of these viruses in free-living duck populations involves multiple interactions between many host species, many different subtypes of viruses, and occurs within many different environments. For these reasons, care must be taken in generalizations regarding the epidemiology of both AIVs and APMVs.

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## LITERATURE CITED

ALEXANDER, D. J. 2000. Newcastle disease and other avian paramyxoviruses. Revue Scientifique et Technique (International Office of Epizootics) 19: 443–462.

ALFONSO, C. P., B. S. COWEN, AND H. VAN CAMPEN. 1995. Influenza A viruses isolated from waterfowl in two wildlife management areas of Pennsylvania. Journal of Wildlife Diseases 31: 179–185.

BELLROSE, F. C. 1980. Ducks, geese and swans of North America. Stackpole Books, Harrisburg, Pennsylvania, 541 pp.

BOUDREAULT, A., J. LECOMTE, AND V. S. HINSHAW. 1980. Antigenic characterization of influenza A viruses isolated from avian species in Ontario, Quebec and Maritimes during the 1977 season. Revue Canadienne De Biologie 39: 107–114.

DEIBEL, R., D. E. EMORD, W. DUKELOW, V. S. HINSHAW, AND J. M. WOOD. 1985. Influenza viruses and paramyxoviruses in ducks in the Atlantic Flyway, 1977–1983, including an H5N2 isolate related to the virulent chicken virus. Avian Diseases 29: 970–985.

HINSHAW, V. S., R. G. WEBSTER, AND B. TURNER. 1980. The perpetuation of orthomyxoviruses and paramyxoviruses in Canadian waterfowl. Canadian Journal of Microbiology 26: 622–629.

———, J. M. WOOD, R. G. WEBSTER, R. DEIBEL, AND B. TURNER. 1985. Circulation of influenza viruses and paramyxoviruses in waterfowl originating from two different areas of North America. Bulletin of the World Health Organization 63: 711–719.

———, V. F. NETTLES, L. F. SCHORR, J. M. WOOD, AND R. G. WEBSTER. 1986. Influenza virus surveillance in waterfowl in Pennsylvania after the H5N2 avian outbreak. Avian Diseases 30: 207–212.

KAWAOKA, Y., T. M. CHAMBERS, W. L. SLADEN, AND R. G. WEBSTER. 1988. Is the gene pool of influenza viruses in shorebirds and gulls different from that in wild ducks? Virology 163: 247–250.

KOCAN, A. A., V. S. HINSHAW, AND G. A. DAUBNEY. 1980. Influenza A viruses isolated from migrating ducks in Oklahoma. Journal of Wildlife Diseases 16: 281–285.

L'VOV, D. K., O. Z. GORIN, S. S. YAMNIKOVA, V. I. ZLOBIN, N. D. L'VOV, M. A. KHASNATINOV, I. T. FEDYAKINA, V. M. CHUMAKOV, E. A. NEPOKLONOV, AND T. I. ALIPER. 2001. Isolation of influenza A viruses from wild birds and muskrat in the western area of East Asian migration route. Voprosy Virusologii 46: 35–39.

NETTLES, V. F., J. M. WOOD, AND R. G. WEBSTER. 1985. Wildlife surveillance associated with an outbreak of lethal H5N2 avian influenza in domestic poultry. Avian Diseases 29: 733–741.

SHARP, G. B., Y. KAWAOKA, S. M. WRIGHT, B. TURNER, V. HINSHAW, AND R. G. WEBSETER. 1993. Wild ducks are the reservoir for only a limited number of influenza A subtypes. Epidemiology and Infection 110: 161–176.

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———, ———, D. J. JONES, W. J. BEAN, S. P. PRYOER, V. HINSHAW, AND R. G. WEBSTER. 1997. Coinfection of wild ducks by influenza a viruses: Distribution patterns and biological significance. Journal of Virology 71: 6128–6135.

SLEMONS, R. D., M. C. SHIELDCASTLE, L. D. HEYMAN, K. E. BEDNARIK, AND D. A. SENNE. 1991. Type A influenza viruses in waterfowl in Ohio and implications for domestic turkeys. Avian Diseases 35: 165–173.

SMITKA, C. W., AND H. F. MAASSAB. 1981. Ortho- and paramyxoviruses in the migratory waterfowl of Michigan. Journal of Wildlife Diseases 17: 147–151.

STALLKNECHT, D. E., M. T. KEARNEY, S. M. SHANE, AND P. J. ZWANK. 1990a. Effects of pH, temperature, and salinity on persistence of avian influenza viruses in water. Avian Diseases 34: 412–418.

———, S. M. SHANE, P. J. ZWANK, D. A. SENNE, AND M. T. KEARNEY. 1990b. Avian influenza viruses from migratory and resident ducks of coastal Louisiana. Avian Diseases 34: 398–405.

———, D. A. SENNE, P. J. ZWANK, S. M. SHANE, AND M. T. KEARNEY. 1991. Avian paramyxoviruses from migrating and resident ducks in coastal Louisiana. Journal of Wildlife Diseases 27: 123–128.

SUSS, J., J. SCHAFER, H. SINNECKER, AND R. G. WEBSTER. 1994. Influenza virus subtypes in aquatic birds of eastern Germany. Archives of Virology 135: 101–114.

WEBSTER, R. G., W. J. BEAN, O. T. GORMAN, T. M. CHAMBERS, AND Y. KAWAOKA. 1992. Evolution and ecology of influenza A viruses. Microbiological Reviews 56: 152–179.

———, M. MORITA, C. PRIDGEN, AND B. TUMOVA. 1976. Orthoviruses and paramyxoviruses from migrating feral ducks: Characterization of a new group of influenza A viruses. Journal of General Virology 32: 217–225.

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