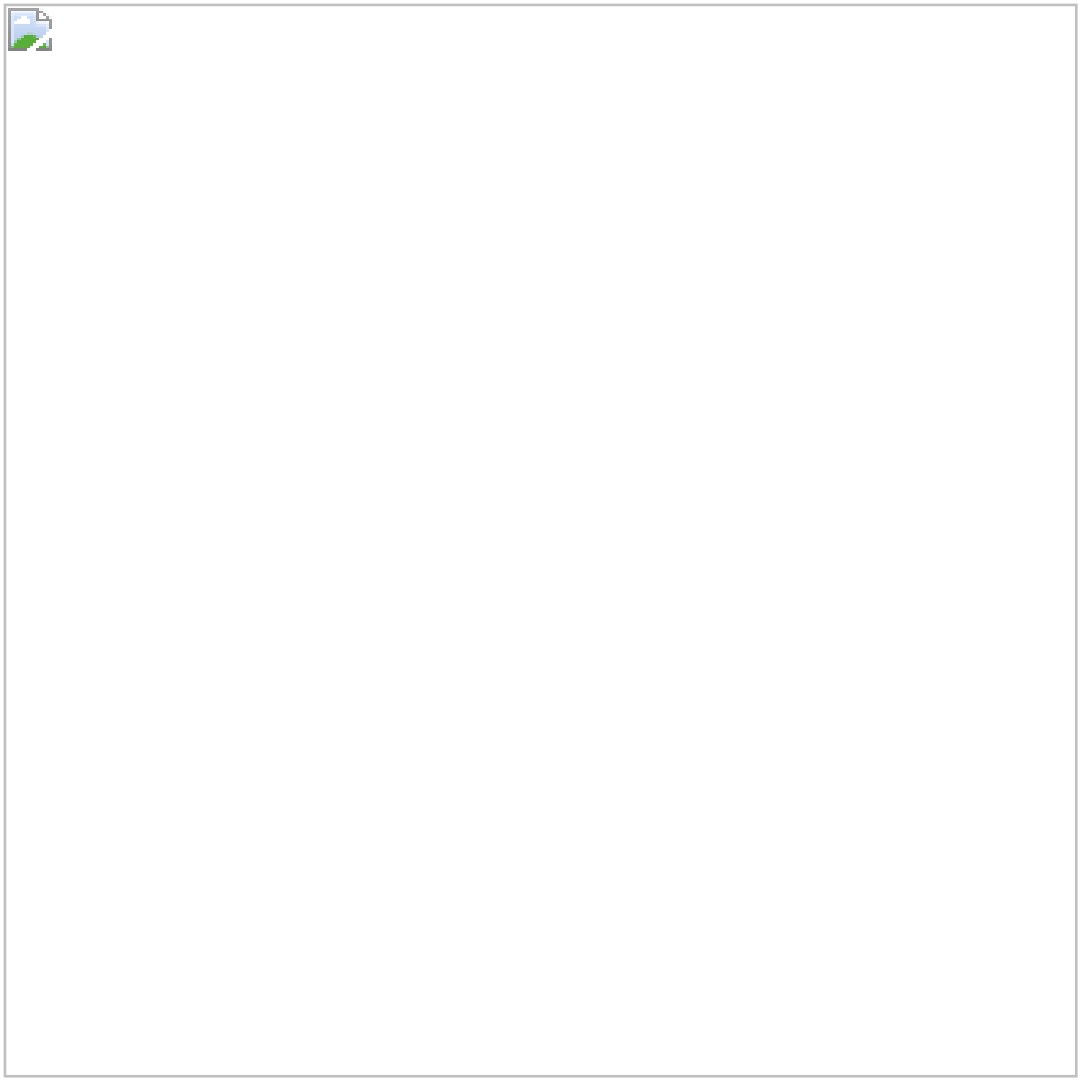

# AVIAN POX IN MIGRANT AND NATIVE BIRDS IN PANAMA

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# CASE REPORTS AND BRIEFER ARTICLES

## AVIAN POX IN MIGRANT AND NATIVE BIRDS IN PANAMA

There are few reports of avian pox infection in birds taken in the neotropics. Pox was found in wild canaries *(Serinus canaria)* and Seed-finches *(Sporophila sp.)* in Brazil (Reis and Nobrega, 1937, Arch. do Inst. Biol. Sao Paulo, Brazil, 8:211); it was reported from a Guanay Cormorant *(Phalacrocorax bougainvillei)* in Peru (Avila, 1953, Bolet. Cientifico de la Cia Admora, Guano), and in a Red-tailed Tropic Bird *(Phaeton rubricauda)* in Hawaii (Locke, Wirtz and Brown, 1965, Bull. Wildl. Dis. Assn. 1 (4): 60-61). A specimen of the Green-tailed Towhee *(Chlorura chlorura),* in the Royal Ontario Museum, Toronto, which was collected in South-western Mexico, (date and exact locality unknown) was found with pox lesions on the tarsus of the right foot (Kirmse, unpublished). This species, which breeds in western United States, winters in Mexico.

This paper reports the results of observations on pox infections discovered in migrant and native species of birds captured in the Republic of Panama during autumn and winter of 1967, as part of a netting and banding program of the Florida State University Center for Tropical Studies. It was supported in part by PHS Research Grant AI 06072 from the U.S. National Institutes of Health.

### Methods

The netting and banding program was started on 15 September, 1967 and continued until 6 December, 1967. During this time, 4492 wild birds, both migrants and locals, were trapped and banded on three different locations (Table 1.): (1) Curundu, Canal Zone (8°59'N - 79°51'W, second growth deciduous forest, scrub and grass, 15-20 September); (2) Cerro Punta, Chiriqui Province (elev. 5,500 feet, high forest representing the lower Montane Wet Forest Life zone of Holdridge, coffee and vegetable clearings, 8°15'N - 82°37'W, 20 September to 6 December); and (3) Almirante Bocas del Toro Province (9°18'N - 82°24'W, near the Caribbean coast, tropical Wet Forest with broad-leafed evergreen trees and land under cacao and banana cultivation, 5 October to 5 November). In Almirante the banding party stayed as guests at the Gorgas Memorial Laboratory's field station, which was established several years ago to study the ecology of arthropod-borne viruses. The majority of birds captured in this study (3896) were caught at this station using up to 70 mist nets daily. At Cerro Punta, work was carried out from the Volcan de Chiriqui Tropical Field Station, jointly operated by the Florida Audubon Society and Florida State University. As a routine, birds collected from the nets were either deposited in holding bags and brought to the field station or they were processed at the net site and released. Birds were weighed, measured, banded and examined for pox lesions and ectoparasites. From cases with skin proliferations, biopsies were taken and fixed in 75% alcohol or in 10% formalin. Some of the biopsy material was pooled according to species and was refrigerated until shipping was possible. In very severe cases of disease, whole birds were collected and after 10% formalin had been injected into the abdominal cavities, they were immersed in formalin and stored in glass jars or plastic bags, for later examination. All pox material collected was shipped without refrigeration from the Canal Zone to the laboratory at the Department of Avian Pathology, Wildlife Diseases and Virus Research, University of Guelph, Canada, where it was studied by the senior author. Here the pooled pox lesion materials were stored frozen; fixed specimens were embedded in paraffin blocks from which sections were cut and stained with hematoxylin and eosin. The frozen tissues were later ground in buffered saline pH 7.57, to make 10% suspensions and 750 units of penicillin and

TABLE 1. *Avian Pox Cases, Panama, 1967*

| Species | No. Pox Cases/ Total No. Birds | Date | Location | Method of Diagnosis: Histopathology | Method of Diagnosis: Virus Isolation |
|---|---|---|---|---|---|
| PIPRIDAE | | | | | |
| Red-capped Manakin *Pipra mentalis** | 1/6 | Oct. 17 | A | 1 | 0 |
| Golden-collared Manakin *Manacus vitellinus** | 9/103 | Oct. 8-24 | A | 9 | 0 |
| TYRANNIDAE | | | | | |
| Traill's Flycatcher *Empidonax traillii**(MW) | 1/280 | Oct. 26 | A | 1 | 0 |
| TURDIDAE | | | | | |
| Swainson's Thrush *Hylocichla ustulata* (MT) | 128/1169 | Oct. 13-31 | A | 58 | 70 (pooled) |
| Gray-cheeked Thrush *Hylocichla minima* (MT) | 26/436 | Oct. 13-28 | A | 19 | 7 (pooled) |
| Wood Thrush *Hylocichla mustelina* (MW) | 4/36 | Oct. 22-31 | A | 3 | 1 |
| Veery *Hylocichla fuscescens** (MT) | 2/105 | Oct. 13-27 | A | 2 | 0 |
| PARULIDAE | | | | | |
| Mourning Warbler *Oporornis philadelphia** (MW) | 1/56 | Oct. 21 | A | 1 | 0 |
| Ovenbird *Seiurus aurocapillus** (MW) | 1/90 | Oct. 15 | A | 1 | 0 |
| Louisiana Waterthrush *Seiurus motacilla** (MW) | 1/8 | Sept. 24 | C.P. | 1 | 0 |
| THRAUPIDAE | | | | | |
| Summer Tanager *Piranga rubra** (MW) | 1/13 | Oct. 16 | A | 1 | 0 |
| Common Bush-Tanager *Chlorospingus ophthalmicus** | 1/18 | Sept. 25 | C.P. | 1 | 0 |
| Blue-gray Tanager *Thraupis episcopus** | 1/12 | Sept. 20 | C.Z. | 1 | 0 |
| FRINGILLIDAE | | | | | |
| Thick-billed Seed Finch *Oryzoborus funereus** | 1/63 | Oct. 12 | A | 1 | 0 |
| Variable Seedeater *Sporophila aurita** | 1/136 | Oct. 10 | A | 1 | 0 |
| Blue-black Grosbeak *Cyanocompsa cyanoides** | 1/25 | Oct. 13 | A | 1 | 0 |

Remarks: * = new hosts for avian pox virus
A = Almirante
C.P. = Cerro Punta
MT = migrant, transient
MW = Migrant, winters in Panama
C.Z. = Canal Zone (Curundu)

750 micrograms of streptomycin per ml were added. These suspensions were then inoculated, in 0.1 or 0.2 ml amounts per egg, on the chorioallantoic membranes (CAM) of 10 to 13-day-old embryonated chicken eggs. After 4 to 7 days the CAMs were harvested for further passages and for histological examination. In addition, several one-day-old chickens were injected intradermally with each suspension of lesion materials or suspensions of first passage CAMs. Both common and scientific names used follow E. Eisemann (The Species of Middle American Birds, *Trans. Linn. Soc.* N.Y. 7, 1955).

## Results

Tumorous skin proliferations suggestive of avian pox infection were found only on the feet and legs of the birds. These were pinhead-sized to small bean-sized nodules, dull white to yellowish-brown or dark brown in color. Multiple tumors were not as common as single lesions. Of the 266 cases observed, most of the lesions were distributed on the tarsus (38.3%); the middle toes carried 26% of the tumors and the hind toes 24%. The remaining 11.7% were distributed on the medial and lateral toes and on the hock (1.1%).

### *Swainson's Thrush*

The highest incidence of avian pox was found in migrating thrushes *(Turdidae)* in Almirante. Approximately 10% of the Swainson's Thrushes *(Hylocichla ustulata)* were infected. It is of special interest that this species is the single most abundant migrant captured by netting in autumn in Panama; it is not normally a winter resident, and it passes rapidly through Panama to wintering grounds in South America. Lesion biopsies taken from 70 of the 1169 Swainson's Thrushes trapped, were pooled and shipped to the laboratory. There, pox was isolated by inoculation of lesion tissue suspensions on the CAM of embryonated chicken eggs. The diagnosis of pox infection was confirmed by demonstration of intracytoplasmic inclusion bodies in histological sections of lesions from 58 additional Swainson's Thrushes. Lesions which showed such extensive necrosis in histological sections that intracytoplasmic inclusions of pox could not be demonstrated, were omitted from these results. It was observed that cases with pox were in direct correlation with the number of migrating birds. The first case of the disease occurred on 13 October, when 5 Swainson's Thrushes were banded. This was followed by a peak of 22 cases on the day when the largest number of birds of this species was caught, ie. 200 on 22 October. The number of pox cases subsided toward 31 October when in 10 Swainson's Thrushes trapped, the last case of pox infection was observed. This shows that there was no increase in the percentage of birds with pox lesions as the migratory bird captures increased.

### *Gray-cheeked Thrush*

Of 436 Gray-cheeked Thrushes *(Hylocichla minima)*, 19 had nodular skin lesions in which typical pox inclusion bodies were seen in histologic sections. Suspensions of pooled and refrigerated lesions from 7 cases were inoculated on the CAMs of 13-day-old embryonated chicken eggs. After 3 days of incubation, membranes harvested showed whitish opaque streaks along the large vessels. After 6 days membranes were covered with minute white pocks and were considerably thickened. Histological examination confirmed the diagnosis of avian pox. The Gray-cheeked Thrush is an autumn transient in Panama, though not so abundant as the Swainson's Thrush.

### *Veery*

Two of 105 Veerys *(Hylocichla fuscescens)* another transient thrush species, were diagnosed histologically for avian pox infection.

### *Wood Thrush*

Histological sections from 3 of 36 Woodthrushes *(Hylocichla mustelina)* contained hyperthrophied epithelium with vacuoles and intracytoplasmic inclusion bodies. From lesions of a fourth case, attempts were made to isolate pox virus on the CAM of 13-day-old chicken embryos. Pox lesions appeared first after 3 days of incubation and after 6 days there were diffuse lesions on the thickened membranes but few individual pocks

were recognizable. Histological sections showed necrosis and inclusion bodies in both the ectoderm and endoderm of the CAM. Groups of 4 one-day-old chickens were injected with wild bird pox strains isolated from the 3 species of thrushes. Both CAM suspension materials and suspensions of lesion tissues were used to inject intradermally into the skin of the plucked scalp, the eyelids and the legs of 4 chickens each, leaving 4 more chickens as controls in separate units. Primary lesions were observed 12 days after injection but only in the chickens which had been injected with CAM material and only on the scalp where the slightly hyperthrophied epithelium revealed few intracytoplasmic inclusions in histological sections. No skin reactions were seen at the other sites of inoculations, ie. the eyelids and the legs and no lesions were found in chickens inoculated with the original wild bird lesion materials directly. All the controls were negative. After 3 weeks all of the chickens were challenged with a fowl pox virus strain known to be highly virulent for chickens. At the same time, new one - day - old chickens were injected intradermally with this fowl pox strain and housed in separate units. After 5 to 8 days, all fowl pox injected chickens developed extensive primary lesions which showed typical avian pox inclusion bodies in proliferated epithelial cells.

The Wood Thrush is a widespread, though not abundant, winter resident in Panama.

*Other Species*

In addition to the diagnosis in the thrushes described above, pox infection was diagnosed histologically in 20 other wild birds representing 12 species. Six of these cases were migrating or wintering birds, the balance were local neotropical species (table 1). The birds, which apparently represent new host records for avian pox virus include: Red-capped Manakin *(Pipra mentalis)*, Golden-collared Manakin *(Manacus vitellinus)*, Traill's Flycatcher *(Empidonax traillii)*, Louisiana Waterthrush *(Seiurus motacilla)*, Ovenbird *(Seiurus aurocapillus)*, Mourning Warbler *(Oporornis philadelphia)*, Blue-gray Tanager *(Thraupis episcopus)*, Summer Tanager *(Piranga rubra)*, Common Bush-Tanager *(Chlorospingus ophthalmicus)*, Blue-black Grossbeak *(Cyanocompsa cyanoides)*, Variable Seedeater *(Sporophila aurita)*, and Thick-billed Seed Finch *(Oryzoborus funereus)*.

Lesions which can be confused with pox lesions were seen in 2 birds. Diffuse skin proliferations covering toes, tarsus and shanks in Buff-throated Saltators *(Saltator maximus)* were attributed to cnemidocoptic mite infestation.

The families previously reported as hosts for the virus, in which pox infections were found in this study, included Turdidae (4 species), Fringillidae (3 species) and Parulidae (3 species). Other families in which pox was found for the first time are Tyrannidae (1 species), Thraupidae (3 species) and Pipridae (2 species).

**Discussion**

Individuals of the 4 migratory thrush species with up to 10% pox lesions had been observed previously with extremely small lesions, easily overlooked. Two of these (the Swainson's Thrush and the Gray-cheeked Thrush) had been seen at the beginning of migration in early September 1965, just before the birds left Canada on their way South (P. Kirmse, 1966, Bull. Wildl. Dis. Assn. 2 (2): 30-35).

Catbirds *(Dumatella carolinensis)* are abundant wintering birds at Almirante, especially from late autumn on. None of the 93 birds captured there showed any signs of the disease, though pox has been reported in this species elsewhere (Kirmse et al., Ontario Bird Banding, 2: 15-18, 1966). It is of interest that pox was not found among native species of thrushes in this study. It seems obvious that pox infection in the migrant thrushes, manifested by well-developed lesions on the feet, was carried during migration from the North American continent to Panama, and since all of these thrushes except the Wood Thrush are only transient visitors to Panama, it is likewise obvious that they would carry the infection on to South America where they are widely distributed in winter. Under the conditions of heavy rainfall and abundance of mosquitoes at Almirante and elsewhere along the Atlantic coast of Panama where these autumn thrush

migrants tend to concentrate, the situation seems apt for spread of infection to local wild birds and domestic fowl.

Other migrant species found with pox infections include some which migrate on to South America and others which winter in Panama. Especially interesting is the case of the Trail's Flycatcher, representing a new family, which was found with pox infection when re-trapped on October 26, 1967. Small pea-sized lesions were located on the right tarsus and right middle toe. The bird had been first trapped and banded on October 12, 1967, at the same location, without any sign of a lesion. Flycatchers, because of their feeding habits, are thought unlikely to be bitten by mosquitoes, but this surprising result was probably due to the abundance of mosquitoes in this particular area, where the nearby swamp forest supplies ideal reservoirs, and also to the high prevalence of pox virus in other migrating wild birds during this time.

Lack of immunity to fowl pox was evidence that the previous infection of the chickens with the thrush pox strains did not protect them against superinfection with fowl pox virus. Cross-immunity experiments with different avian pox strains have given variable results also in the past (Irons, V., 1934, Am. J. Hygiene, 20: 329-351). Only a few wild bird strains have been able to immunize against infection with a pox virus from another species. It was possible to immunize chickens with avian pox viruses from the Sage Grouse *(Centrocercus urophasianus)* (DuBose, 1965, Bull, Wildl. Dis. Assn. 1 (2): (6), from the Blue grouse *(Dendragapus obscurus)* (Dickenson, E. M., 1942, Station Bulletin 411, Oregon Agric. Expt. Station Corvallis, 5-27), and the Sooty Grouse *(Dendragapus fuliginosus)* (Syverton and Cowan, 1944, Am. J. Vet. Res. 5: 215-222). All of these wild birds, however, are gallinaceous birds. In smaller wild birds, the pox strains seem to be more host specific. The pox viruses of the small wild birds usually do not cause the typical clinical picture of fowl pox in chickens, nor are they able to immunize chickens against superinfection with fowl pox virus.

As suggested by the high percentage of avian pox infection in wild birds in Panama, the potential role of migratory birds in the distribution of avian diseases should not be underestimated and their importance as carriers of diseases in general from temperate to tropical and tropical to temperate America is worthy of further investigation.

Investigations of the kind reported in this paper can often most profitably be carried out in close cooperation with general biological projects, in our case a bird-banding program, to take advantage of the logistic arrangements provided and of the large amount of otherwise unused materials which become available.

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