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Authors: TIKASINGH, E.S., WORTH, C.B., SPENCE, L., and AITKEN, T.H.G.

Source: Journal of Wildlife Diseases, 18(2) : 133-139

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-18.2.133>

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AVIAN POX IN BIRDS FROM TRINIDAD

E.S. TIKASINGH,^[1] C.B. WORTH,^[2] L. SPENCE^[3] and T.H.G. AITKEN^[4]

Abstract: Over a 7-year period in Trinidad, 9,514 birds were examined for avian pox and four species were found infected: the golden-headed manakin, *Pipra erythrocephala* (7% infected), the white-bearded manakin, *Manacus manacus* (5%), the violaceous euphonia, *Euphonia violacea* (1%), and the bare-eyed thrush, *Turdus nudigenis* (<1%). The elaborate courtship displays of manakins may have a bearing on a "common source" type of infection. The apparently abrupt appearance of the disease at three localities in Trinidad in 1964 perhaps indicates introduction of the virus by migratory birds.

INTRODUCTION

The only report of avian pox in the Caribbean region is that of Kirmse and Loftin (1969) who recorded the infection in 16 species of birds in Panama, with the highest prevalence in Swainson's thrush, *Hylocichla ustulata*.

In Trinidad, during long-term arbovirus investigations in which birds were netted, bled, banded, and released, pox-like lesions were first observed in October 1964 — on the toes of the golden-headed manakin, *Pipra erythrocephala*. Many *Pipra* had already been handled by that date, and one of us (CBW) was familiar with poxvirus of juncos (Worth, 1956); obviously, however, the condition may have been present earlier and escaped notice. In any case, all manakins netted thereafter were scrutinized with particular care and other species examined at least casually. This paper reports our observations at eight localities during the period October 1964 through July 1971.

MATERIALS AND METHODS

The localities chosen for bird-netting were associated mainly with arbovirus studies, and most have been described in detail elsewhere (Downs et al., 1968; Tikasingh, 1974; Tikasingh et al., 1973). All but Santa Cruz and Mayaro are situated in the high-rainfall area of northeastern and east-central Trinidad (ca. 250 cm per year).

Netting sessions usually were held one morning per week from dawn (6:00 a.m.) to 9:00 or 10:00 a.m. or when bird activity markedly declined. Japanese mist nets, Type A (12 m), were employed throughout, the number operated at each session varying between 5 and 13. Initially we used U.S. Fish and Wildlife Service bands, but later we substituted our own numbered bands except in the case of migrant birds.

For virus isolation attempts, biopsied material from a lesion was triturated in 0.4 ml of bovine albumin diluent (BAD) containing 800 units of penicillin and 0.8 mg per ml of streptomycin; 0.1 ml of this

[1] Caribbean Epidemiology Centre (PAHO WHO), P.O. Box 164, Port-of-Spain, Trinidad, West Indies.

[2] R.D., Delmont, New Jersey 08314, USA.

[3] Banting Institute, Toronto, Ontario M5S 1A1, Canada.

[4] Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, Connecticut 06510, USA.

material was inoculated onto the chorio-allantoic membranes (CAM) of two to four 10-day-old chick embryos. On occasion, triturated material was rubbed directly into denuded and abraded feather follicles of young chickens. If a chicken lesion was observed, biopsy material was triturated in BAD with antibiotics and then inoculated into chick embryos. Titration was done in the CAM of chick embryos.

No attempt was made to identify the virus or to compare it with other pox-viruses isolated elsewhere. A bird was considered positive if the characteristic lesion was present. For determining seasonal prevalence, birds found positive on first capture were counted only that once, regardless of their status on recapture. However, 15 initially negative birds subsequently acquired lesions, and these 15 were each counted twice.

RESULTS

Laboratory Studies

When triturated material (TRVL 59110) from the toes of a golden-headed manakin was rubbed into denuded and abraded feather follicles of young chickens, it produced nodular lesions in the skin. Material from the follicles, inoculated onto the CAM of chick embryos, produced an edematous and mildly inflammatory thickening resembling a pox reaction. In one instance, where serial passage was done, a titer of 10^{-3} was obtained. Inoculation of feather follicles of young chickens with concentrated egg membrane suspensions gave irregular results, and even the positive reactions were of a mild nature.

Material from eight of 16 golden-headed manakins and one of three white-bearded manakins produced the typical pox reaction in chick embryos, usually within 7 to 8 days.

Prevalence in Native Birds

During the 7-year period, 9,514 birds (including 3,077 recaptures), represent-

ing 31 families and 112 species, were examined for lesions (Table 1). Pox lesions were found in four species: the golden-headed manakin, the white-bearded manakin, the violaceous euphonia (*Euphonia violacea*), and the bare-eyed thrush (*Turdus nudigenis*).

In the case of the golden-headed manakin, 116 of 1,674 individual netted birds had lesions on their feet and three had lesions around the eyes. Table 2 summarizes the findings by year and locality. At the most productive locality, Turure Forest, where netting techniques were consistent over a 40-month period, results can be compared on a monthly basis. As shown in Table 3, rainy-season epizootics occurred in August-December 1967 and again in May-August 1968, when the prevalence of infection reached as high as 35% (June). During 1969 and 1970, the proportion of infected birds fell drastically.

Of 1,249 individual white-bearded manakins examined, 56 had lesions on their feet and nine had lesions around the eyes (Table 4). Infected birds of this species were observed only at Turure Forest (5%) and Aripo-Waller Field (3%). The monthly findings at Turure (Table 5) point to an epizootic there in July-September 1968.

A single violaceous euphonia (of 92 examined) and a single bare-eyed thrush (of 631 examined) were found infected at Turure in 1968.

DISCUSSION

Although Kirmse and Loftin (1969) suggested that mosquitoes might be responsible for spread of avian pox in Panama, the finding of the disease in only four species of birds in Trinidad does not support the theory; more species should have been involved. The island's two species of manakin do, however, lend themselves to the "common source" type of infection. Thus, males congregate at fixed display grounds, often used for many years, and females resort there to

TABLE 1. Bird families, number of species, and number of individuals (including recaptures) examined for avian pox in Trinidad, 1964-1971.

Families	No. species	No. birds	Families	No. species	No. birds
Tinamidae (Tinamous)	1	1	Formicariidae (Antbirds)	7	143
Cathartidae (New World Vultures)	1	2	Cotingidae (Cotingas)	3	21
Accipitridae (Hawks)	1	1	Pipridae (Manakins)	2	4,219
Columbidae (Pigeons and Doves)	8	275	Tyrannidae (Tyrant Flycatchers)	16	557
Psittacidae (Parrots)	1	1	Hirundinidae (Swallows)	1	5
Cuculidae (Cuckoos and Anis)	2	32	Troglodytidae (Wrens)	2	79
Strigidae (Owls)	2	4	Mimidae (Mockingbirds)	1	16
Caprimulgidae (Nightjars)	1	3	Turdidae (Thrushes)	3	715
Apodidae (Swifts)	4	32	Sylviidae (Old World Warblers)	1	25
Trochilidae (Hummingbirds)	7	52	Vireonidae (Vireos)	3	65
Trogonidae (Trogons)	2	4	Coerebidae (Honeycreepers)	5	958
Alcedinidae (Kingfishers)	2	20	Parulidae (Wood Warblers)	6	205
Galbulidae (Jacamars)	1	32	Icteridae (Grackles and Troupials)	4	79
Picidae (Woodpeckers)	4	23	Thraupidae (Tanagers)	10	1,211
Dendrocolapitidae (Woodhewers and Woodcreepers)	3	170	Fringillidae (Finches)	6	551
Furnariidae (Ovenbirds)	2	13	Totals	112	9,514

TABLE 2. Golden-headed manakins examined for avian pox from various localities^a in Trinidad, 1964-1971.

Year	BBF	BV	VO	TF	AWF	Other ^b	Totals	% pos.
1964	7/138 ^c	2/12	1/8			0/1	10/159	6
1965	11/52	1/14	0/7				12/73	16
1966		0/11	1/13				1/24	4
1967				28/197			28/197	14
1968				47/399		0/3	47/402	12
1969				3/442			3/442	1
1970			0/1	6/191	1/28	0/2	7/222	3
1971					8/155		8/155	5
Totals	18/190	3/37	2/29	84/1,229	9/183	0/6	116/1,674	
% pos.	10	8	7	7	5	0		7

^aBBF, Bush Bush Forest; BV, Brazil Village; VO, Vega de Oropouche; TF, Turure Forest; AWF, Aripo-Waller Field.

^bFort Read (1964), Mayaro (1968), Santa Cruz (1970).

^cNo. positive/No. examined.

TABLE 3. Monthly prevalence of avian pox in golden-headed manakins, Turure Forest, Trinidad, July 1967 - October 1970.

Month	1967	1968	1969	1970
Jan.		2/24 (8) ^a	1/22 (5)	0/14 (0)
Feb.		2/22 (9)	0/28 (0)	2/11 (18)
Mar.		1/23 (4)	0/39 (0)	0/26 (0)
Apr.		2/21 (10)	0/40 (0)	0/12 (0)
May		2/9 (22)	0/51 (0)	1/26 (4)
June		6/17 (35)	0/52 (0)	0/31 (0)
July	0/24 (0)	4/29 (14)	0/42 (0)	0/15 (0)
Aug.	5/33 (15)	8/72 (11)	0/20 (0)	0/7 (0)
Sept.	2/22 (9)	0/22 (0)	1/44 (2)	2/26 (8)
Oct.	7/48 (15)	12/55 (22)	0/31 (0)	1/23 (4)
Nov.	5/39 (13)	8/81 (10)	0/48 (0)	
Dec.	9/31 (29)	0/24 (0)	1/25 (4)	
Totals	28/197(14)	47/399(12)	3/442(1)	6/191 (3)

^aNo. positive/No. examined (% positive).

mate, afterward fanning out widely to build solitary nests in which males have no part. In the case of the golden-headed manakin, whose display grounds are situated on specific twigs of certain trees, contamination of such perches might well lead to general spread of infection in the same way that athlete's foot is disseminated from gymnasium locker rooms. The display grounds of the white-bearded manakin, located close to the

forest floor, could become contaminated in similar fashion. Possibly, then, these two species exhibit a higher prevalence of the disease, not because they are more susceptible to infection, but as a consequence of their mating behavior. In Panama Kirmse and Loftin (1969) also found manakins (*Pipra mentalis* and *Manacus vitellinus*) infected with avian poxvirus and these showed the highest prevalence compared with other native birds.

TABLE 4. White-bearded manakins examined for avian pox from various localities^a in Trinidad, 1964-1971.

Year	BBF	BV	VO	TF	AWF	Other ^b	Totals	% pos.
1964	0/15 ^c	0/12	0/3			0/3	0/33	0
1965	0/3	0/12	0/14			0/1	0/30	0
1966		0/5	0/4			0/1	0/10	0
1967				0/138			0/138	0
1968				42/386		0/8	42/394	11
1969				4/297			4/297	1
1970			0/23	6/167	1/49		7/239	3
1971					3/108		3/108	3
Totals	0/18	0/29	0/44	52/988	4/157	0/13	56/1249	
% pos.	0	0	0	5	3	0		5

^aSee Table 2.^bFort Read (1964, 1965, 1966), Mayaro (1968).^cNo. positive/No. examined.

TABLE 5. Monthly prevalence of avian pox in white-bearded manakins, Turure Forest, Trinidad, July 1967 - October 1970.

Month	1967	1968	1969	1970
Jan.		0/5 (0) ^a	1/17 (6)	0/12 (0)
Feb.		0/14 (0)	1/10 (10)	0/19 (0)
Mar.		0/24 (0)	0/17 (0)	3/37 (8)
Apr.		1/42 (2)	0/57 (0)	0/9 (0)
May		1/15 (7)	0/27 (0)	1/18 (6)
June		0/23 (0)	1/21 (5)	0/24 (0)
July	0/36 (0)	4/40 (10)	0/29 (0)	1/13 (8)
Aug.	0/27 (0)	16/60 (27)	0/16 (0)	0/8 (0)
Sept.	0/22 (0)	15/59 (25)	0/37 (0)	1/17 (6)
Oct.	0/24 (0)	3/38 (8)	0/21 (0)	0/10 (0)
Nov.	0/23 (0)	2/50 (4)	1/26 (4)	
Dec.	0/6 (0)	0/16 (0)	0/19 (0)	
Totals	0/138(0)	42/386(11)	4/297 (1)	6/167(4)

^aNo. positive/No. examined (% positive).

We did not try to determine the prevalence of infection in manakins on a sexual basis because the similar plumage of females and young males within the two species makes accurate differentiation difficult. Since each male tends to remain close to his own display area, the infection is perhaps spread by females who visit more than one male.

October 1964 brought abrupt recognition of the disease in golden-headed manakins at three localities (Bush Bush

Forest, Brazil Village, and Vega de Oropouche), and it therefore seems possible that the virus was introduced into the island from known foci in the North Temperate Zone (see Kirmse, 1967). At Bush Bush Forest, the infection rate rose from 4% in October 1964 (24 birds examined) to 41% in February 1965 (13 examined), which clearly suggests a highly susceptible population. Snow (1962a; 1962b) who handled 625 individual golden-headed and 217 white-

bearded manakins in the Arima Valley of Trinidad several years earlier, made no mention of pox lesions in those birds.

A wave of blackpoll warblers, *Dendroica striata*, was observed passing through Trinidad's forests in October 1964. None of the 10 birds netted had lesions, nor is it known whether this species is afflicted with pox in North America, although pox has been reported in the Cape May warbler (*Dendroica tigrina*) in New Jersey, U.S.A., by Kirmse et al. (1966).

Although no observations were made on the annual display cycle of manakins during the study period, the peak prevalence of pox at Turee might be correlated with periods of intense display. Snow (1962b) noted two such

periods in one year for the golden-headed manakin: in February and in May. Environmental factors could, of course, shift peak intensities of display corresponding to the breeding season, which normally occurs from January to August with heightened activity from May onward.

The high prevalence of pox in 1967-1968 may have increased immunity in the manakin population and thus brought about the lowered prevalence in 1969 and 1970. The unexpected clearing of forested areas close to our netting sites in March 1969 may also have contributed to lowered prevalence, by causing abnormal movements of the birds, removal of highly infective perches, and possibly reduction of the mosquito populations if these are involved in transmission.

Acknowledgements

The studies and observations of this paper were conducted by the Trinidad Regional Virus Laboratory (now the Caribbean Epidemiology Centre) with the support and under the auspices of the Governments of Trinidad and Tobago, Jamaica, Guyana, and the Eastern Caribbean Territories, the Ministry of Overseas Development of the United Kingdom Government, and The Rockefeller Foundation.

The authors thank Mr. R. Martinez, Mr. A. Guerra, and Mr. A.E. Green for technical assistance.

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Received for publication 16 November 1977
