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Source: Journal of Wildlife Diseases, 11(1) : 130-135

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-11.1.130

SEASONAL OCCURRENCE OF *Haemoproteus columbae* KRUSE AND ITS VECTOR *Pseudolynchia canariensis* BEQUAERT

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Abstract: Seasonal prevalence of *Haemoproteus columbae* and its vector *Pseudolynchia canariensis* in the feral pigeon (*Columba livia*) population of Detroit, Michigan has been studied for 5 years. The greatest prevalence of *H. columbae* infection occurs during fall and winter and is lowest during the spring, correlating with changes in the vector population.

INTRODUCTION

Seasonal variation in the occurrence of avian haemosporidia of the genera *Plasmodium*, *Haemoproteus* and *Leucocytozoon* have been described.[1-3,5,6,8-12,14,15,17,19,21-25] Long term seasonal studies are lacking on selected populations of birds infected with *Haemoproteus columbae*, the cosmopolitan parasite of the domestic pigeon (*Columba livia*).[18] *Pseudolynchia canariensis*, the vector of *H. columbae* is an obligate ectoparasite, making it possible to study one host for the occurrence of a blood protozoan and presence of the vector. Comparison of data on the occurrence of *H. columbae* and *P. canariensis* in a specific population of hosts is therefore possible throughout the year. This report presents observations on the seasonal occurrence of *H. columbae* and *P. canariensis* in a pigeon population of Detroit, Michigan and prevalence of *H. columbae* infections in *P. canariensis*.

METHODS AND MATERIALS

Feral pigeons were obtained from sites in the city of Detroit. During April, 1966 through September, 1968, pigeons were collected by a pest control company at two factory sites. From March, 1969 through February, 1971, pigeons were periodically trapped on the campus of Wayne State University. Young pigeons were distinguished from adults by the appearance of feathers and nostril cere. Blood smears were made from each bird, stained by the Giemsa method and examined for the presence of parasites. To quantitate parasitemia, red blood cells and parasites in 25 oil immersion fields were counted and the number of gametocytes present was extrapolated to the number present per 10,000 red blood cells. The relative intensity of parasitemia was assigned numerical values of 1-4 for the following ranges of gametocytes per 10,000 RBC: 1 = 1-14; 2 = 15-399; 3 = 400-899; 4 = 900.

A plywood, fly tight cage, 40 x 40 x 30 cm, was used to examine birds for *P. canariensis*. This cage had an open bottom permitting its placement on any convenient flat surface. The top and one side were made of standard aluminum window screening; two sides had sleeved armholes to facilitate handling of birds and capture of flies. Birds were examined within the cage by ruffling their feathers and disturbing the flies present. Flies were recovered and stored alive in cotton stoppered shell vials.

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Salivary glands of flies were crushed and examined for living sporozoites of *H. columbae* and were stained by the Giemsa method to confirm the presence or absence of sporozoites. The fly midgut was microscopically examined for oocysts by gently rolling it under a coverslip.

RESULTS

Of the 754 pigeons examined for *H. columbae* from the factory sites, 78% were infected (Table 1). Monthly variations in the percent of pigeons infected suggest seasonal fluctuation in the parasite population. The prevalence of infected pigeons was low during the spring,

TABLE 1. Infections of **Haemoproteus columbae** and **Pseudolynchia canariensis** in Pigeons from Factory Sites.

Month and Year	No. Pigeons Examined	% Infected *H. columbae*	Mean Intensity Parasitemia	Ratio *P. canariensis* found/birds examined	% *P. canariensis* infected *H. columbae*	No. Young Pigeons
1966						
4	10	50	2.20	0	0	0
5	33	42	1.93	.06	0	0
6	16	50	2.50	.13	0	0
7	33	55	2.28	.12	0	4
8	94	69	2.18	.14	0	17
9	60	92	2.25	.62	8	18
10	15	93	2.43	1.27	10	0
11	19	95	2.61	.47	43	0
12	39	97	2.00	.15	25	0
1967						
1	10	100	1.80	0	0	0
2	22	97	2.05	.05	0	0
3	18	89	1.94	.11	100	0
4	23	87	2.35	.13	67	1
5	30	60	2.44	.13	0	10
6	23	87	2.90	.44	22	0
7	44	68	2.63	.07	0	0
8	52	83	2.56	.19	0	1
10	35	100	2.49	.43	44	0
11	24	96	2.44	.29	60	0
12	14	93	2.93	.35	25	0
1968						
1	13	92	1.58	.23	67	0
2	1	0	—	0	0	0
6	5	20	1.00	0	0	0
7	28	57	2.25	0	0	2
8	69	78	2.55	.04	0	1
9	24	91	2.36	.83	57	0

increased during the summer, became high in the fall and remained elevated during the winter months. Although of limited value, figures on the relative intensity of the infection indicate that parasitemia is high during summer and fall and low during winter and spring.

One hundred and seventy-nine *P. canariensis* were removed from 16% of the pigeons examined. In most instances one fly was collected per bird, but as many as nine flies were recovered from a single bird. Since birds were caged together before delivery to the laboratory, it is possible that flies could have transferred from bird to bird. Data on percentage of birds infected would not account for this variable, and therefore, the ratio of flies recovered to number of birds examined was utilized to indicate fly population density. The fly population increased during late summer, reached a peak in the fall and decreased, but did not completely disappear during the winter (Table 1). The increase in percent of *H. columbae* infected pigeons corresponds with the increase in population of the vector (Fig. 1). Eighty-eight of the flies recovered from these birds were examined for presence of sporozoites; 38% were infected. All midguts were examined but no oocysts were found. Infected flies were found throughout the year.

Fifty-four (8%) of the birds examined were young birds, collected between May and September. Percent of infection in young birds was higher (78%) during the summer and fall than during the spring (18%). Infected young birds had a higher mean parasitemia (3.11) than that of adults (2.16) collected during the same months. Occurrence of *P. canariensis*, as indicated by the ratio of flies recovered to number of birds examined, was also much higher in young birds (.389) than in adults (.244) collected during the same months.

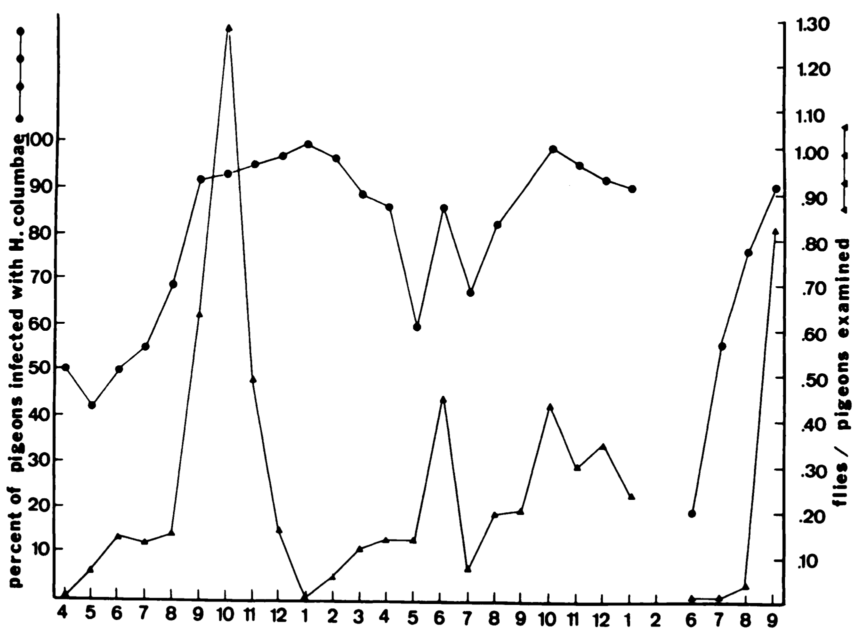

FIGURE 1. Relationship between seasonal occurrence of **H. columbae** infections and fluctuations in the population of **P. canariensis.**

It was not possible to collect birds every month of the year from the Wayne State University campus. Ninety-eight percent of the 96 birds examined were infected with *H. columbae* (Table 2). Highest parasitemia occurred between June and November, as observed in birds from the factory sites. The population of *P. canariensis* in this group followed the same general pattern of seasonal variation described for birds collected from the factory sites.

TABLE 2. Infections of **Haemoproteus columbae** and **Pseudolynchia canariensis** in Pigeons from W.S.U. Site.

Month and Year	No. Pigeons Examined	% Infected *H. columbae*	Mean Intensity Parasitemia	Ratio *P. canariensis* recovered Birds/examined	No. Young Pigeons
1969					
4	8	75	2.00	0	0
5	1	100	2.00	0	0
1970					
6	18	83	2.33	0	0
7	16	100	2.00	.125	0
8	9	89	2.22	.778	0
9	14	100	2.21	.774	0
10	15	100	2.26	1.556	0
11	7	100	2.43	.750	1
1971					
1	6	83	1.60	0	0
2	2	100	1.50	0	0

DISCUSSION

Seasonal peaks of haemosporidian occurrence are generally observed during the spring and summer and have been suggested to be due to spring relapse associated with physiological changes occurring during reproduction[4,10,12,24] or migratory bird movements.[13,15,19] Seasonal occurrence of *H. columbae* differs from other haemosporidia in that the greatest prevalence of infection occurs during fall and winter and a spring relapse is not present. Lack of spring relapse in *H. columbae* may be explained by the absence of seasonal reproductive cycles,[26] non-migratory behavior of pigeons and presence of the vector throughout the year.

Increased occurrence of *H. columbae* in birds during fall and winter can be explained by increased periods of transmission during summer and fall. Periods of most active transmission may be indicated by increased numbers of initial infections characterized by a higher parasitemia.[7] Infections in young birds can be assumed to be initial infections. Relative parasitemia level and percent of infected young birds were highest during summer and fall, indicating these seasons are periods of active transmission. Population of the vector increases in the fall, further substantiating the periods of increased transmission observed in this study. A similar correlation between increased fly population and occurrence of *H. columbae* was made by Jochen[16] in a smaller number of pigeons over a 9 month period. The prevalence of transmission probably becomes less during the colder months when the vector population decreases in size, resulting in a lower percent of infected birds during the spring. Absence of a seasonal occurrence of *H. columbae* in pigeons has been reported from Pretoria, South Africa.[20] The difference in these results and those of the present study can be explained by the apparent lack of seasonal fluctuations in the vector population in South Africa.

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Received for publication 18 August 1974