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INTERRELATIONSHIPS OF PARASITES OF WHITE-WINGED DOVES AND MOURNING DOVES IN FLORIDA[1]

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Abstract: The parasites of indigenous populations of mourning doves *(Zenaida macroura)* in north and south Florida were compared with those of an introduced population of white-winged doves *(Z. asiatica)* in south Florida. Thirty-two species of parasites including 5 protozoans, 7 nematodes, 2 trematodes, 2 cestodes, 7 acarines, 7 mallophagans, and 2 dipterans were found. Of these, 16 were common to both species of doves. Mourning doves from north Florida showed a more diverse parasite fauna than did the white-winged or mourning dove populations from south Florida. Nematodes were the most common parasites in all three populations; infected doves contained one or two nematode species per dove. Total helminth burdens per infected dove averaged 13.1 for white-winged doves, 19.9 for mourning doves in south Florida, and 6.6 for mourning doves in north Florida. The prevalence of infections by *Trichomonas gallinae* was higher in white-winged doves (97%) than in mourning doves in south Florida (17%) or in mourning doves in north Florida (1%). The high prevalence of this parasite in expanding populations of white-winged doves may pose a threat to mourning dove populations since some strains of *T. gallinae* are pathogenic.

INTRODUCTION

Twelve subspecies of white-winged doves *(Zenaida asiatica)* are distributed from southwestern United States to northern Chile. Despite their limited distribution in the United States, white-winged doves have become important game birds in southern Texas and Arizona.[3]

A population of at least 6,000 white-winged doves has become established in southern Florida (Homestead) due to an accidental introduction there in 1962.[18] This area is located in an agricultural region which produces a variety of vegetable crops and contains many hectares of avocado and citrus groves which are used as nesting cover by the doves. Since other parts of Florida contain similar types of habitat, wildlife biologists have been concerned with the possible spread of white-winged doves throughout the state. The present study was initiated to determine the relationships between the parasites of white-winged doves and the state's indigenous population of mourning doves *(Z. macroura)*.

MATERIALS AND METHODS

A total of 182 white-winged doves from Homestead, Dade County, Florida was captured using cannon-nets in October 1977 and October 1978. In July and August, 1978, 53 mourning doves were collected by shotgun in the same area. An additional 92 mourning doves were caught in Stoddard live-traps in Gainesville, Alachua County, Florida,

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an area of north Florida where interspecific contact with the white-winged dove is considered to be non-existent. Thirty-five squabs (1-14 days of age) were removed from nests for *Trichomonas* studies; 19 were white-winged doves and 11 were mourning doves from Homestead, and five were mourning doves from Gainesville.

Blood smears were prepared from the brachial vein of each bird. The smears were stained with Giemsa after fixation in absolute methyl alcohol, and at least 10,000 erythrocytes were examined microscopically (100x, 400x, 1000x) to detect blood protozoans and microfilariae. From each of 46 doves (18 white-winged doves and 13 mourning doves from Homestead, and 15 mourning doves from Gainesville) 1 cc of blood was inoculated intravenously into domestic pigeons *(Columba livia)* to diagnose *Plasmodium* spp.[6] Blood smears were prepared from the recipient pigeons twice a week for four weeks and examined microscopically. The mouth, esophagus, and crop of each dove was swabbed to detect *Trichomonas gallinae*. If this initial exam proved negative, a throat swab was cultured in Diamond's medium.[4] Bone marrow was extracted from the femur of each dove and a wet preparation made with normal saline to detect the presence of trypanosomes.[12] Fecal samples were placed in 2% potassium dichromate solution to allow for sporulation and identification of coccidial oocysts. Breast muscles were examined macroscopically for zoitocysts of *Sarcocystis* sp., and an artificial digestion technique was used to detect zoites.[1]

The age of doves was determined by techniques described by Swank[14] and Wight.[17] The feathers of each dove were brushed over a white pan for the removal of ectoparasites which were preserved in 70% alcohol and later mounted in Hoyers medium. Recovering, killing, fixing, preserving and staining helminths followed the techniques described by Kinsella and Forrester.[8] Representative specimens of all parasites encountered have been deposited in the U.S. National Parasite Collection, Beltsville, Maryland, and assigned the accession numbers 75564-75591, and 75901-75902. Representative blood films have been deposited also in the International Reference Center for Avian Haematozoa at St. John's Newfoundland (Accession nos. 80452-80466).

Statistical tests (z and Student's t) were employed to compare the prevalences and intensities of parasite infection between the three populations of doves examined. Indices of similarity and diversity also were prepared.[7] A helminth profile similar to those presented by Uhazy and Holmes[16] was used to reflect dominance by showing the percentage that each species contributed to the total helminth population.

RESULTS AND DISCUSSION

Thirty-two species of ecto- and endoparasites were recovered from the 362 doves examined. The total number of parasite species for each dove population was as follows: white-winged doves, 23 species; mourning doves from Homestead, 15 species; mourning doves from Gainesville, 21 species. Of these, 16 were common to both species of doves.

Ectoparasites. In general, doves were found to have light ectoparasite infestations, usually with fewer than 10 lice or mites per bird. Some ectoparasites were common to all three species of doves, whereas others were present on only one species of dove (Table 1). Louse flies were common on both species of doves, but usually escaped while the birds were being handled. As a result, the actual prevalence of this ectoparasite was higher than what is given in Table 1.

Endoparasites. No infections of *Plasmodium, Trypanosoma* or microfilariae were detected. The prevalence, intensity of infection, and location within the host of the protozoan and helminth parasites are pre-

TABLE 1. Prevalence of ectoparasites collected from white-winged doves and mourning doves in Florida, 1977-1978.

Parasite	Mourning doves, Gainesville (49)[a]	Mourning doves, Homestead (47)	White-winged doves, Homestead (119)
Acarina			
Diplaegidia columbae	55.1[b]	31.9	49.6
Falculifer sp.	63.3	31.9	2.5
Dermoglyphus sp.	2.0	0	3.4
Cheyletiellidae	0	0	0.8
Neonyssus triangulus	0	0	0.8
Neonyssus zenaidurae	10.2	2.1	0
Ixodidae	0	0	0.8
Mallophaga			
Columbicola macrourae	18.4	53.2	20.2
Bonomiella columbae	16.3	31.9	0
Bonomiella sp.	0	0	42.9
Physconelloides wisemani	0	0	5.0
Physconelloides zenaidurae	6.1	31.9	0
Hohorstiella spp.[c]	0	2.1	10.1
Diptera			
Stilbometopa podopostyla	0	0	0.8
Pseudolynchia canariensis	0	0	0.8

[a]Total number of doves examined.
[b]Percent infestation.
[c]A complex of two species, *H. paladinella* and an undescribed species.

sented in Tables 2 and 3. The results showed a similarity in parasite species composition among the three dove populations. Only five species of endoparasites *(Haemoproteus sacharovi, Aproctella stoddardi, Tetrameres columbicola, Capillaria obsignata* and *Killigrewia delafondi)* were not found in both whitewings and mourning doves; however, along with the trematodes and other cestodes, they occurred so infrequently and in such low numbers that their potential impact on dove populations was considered negligible. Comparisons of prevalence and intensity of infection were conducted on the more common species such as the nematodes *Ascaridia columbae, Ornithostrongylus* spp., and *Dispharynx nasuta,* and the protozoans *Trichomonas gallinae, Haemoproteus maccallumi, Eimeria* sp., and *Sarcocystis* sp. There were significant differences in the prevalences and intensities of infection of many of these parasites among the three populations of doves. Statistically higher ($P < 0.05$) prevalences of infection of *Ornithostrongylus, Trichomonas* and *Haemoproteus* were noted in the two species of doves from south Florida as compared to mourning doves from north Florida. The reverse was true for the prevalence of infection of *Dispharynx. Eimeria* was more prevalent in mourning doves than white-winged doves, and *Sarcocystis* showed no significant differences among the three populations of doves with respect to prevalence. Infec-

tion with *Ascaridia* did not reveal any species or area trends when analyzed statistically. The most notable result regarding intensity of helminth infection was the significantly higher ($P < 0.005$) nematode burdens of *Ornithostrongylus* in the two species of doves from south Florida as compared to mourning doves in north Florida. Additional details on these analyses have been presented elsewhere.[2]

When all parasites were considered as a unit, indices of similarity computed for each of three possible dove comparisons were moderately high (white-winged doves X mourning doves, Homestead = 65.7; white-winged doves X mourning doves, Gainesville = 46.7; mourning doves, Homestead X mourning doves, Gainesville = 52.6). This was indicative of similar parasite faunas among the three populations of doves in both areas of Florida. Simpson's indices of diversity showed that of these three populations, mourning doves from Gainesville had the most equitable distribution of parasites (diversity index = 0.14), while the doves from Homestead showed a concentration of dominance by a few parasite species (white-winged doves = 0.23; mourning doves = 0.27). This dominance is evident in the helminth profile (Fig. 1). Based upon both indices (similarity and diversity), there is closer similarity between different doves in the same area (white-winged and mourning doves in Homestead) than between the same host species in different areas (mourning doves in Homestead and Gainesville).

Most doves were infected with one or two species of helminths; 17 doves (eight white-winged doves from Homestead and nine mourning doves from Gainesville) were free of helminths. More than 80% of the doves harbored nematodes and more than 90% of all the recovered helminths were nematodes. The most common species were *Ascaridia columbae* and *Ornithostrongylus* spp., followed by *Dispharynx nasuta*. Total helminth burdens per infected dove averaged 13.1 (range, 1-105) for white-winged doves, and 19.9 (range, 1-87) and 6.6 (range, 1-27) for mourning doves in south and north Florida, respectively.

Of the parasites encountered in this study, infections by *Trichomonas gallinae* would be of most concern. Virulent strains of *T. gallinae* have been known to cause acute disease, at times in epizootic proportions.[5] We found a very high prevalence of *T. gallinae* in white-winged doves from Homestead (97%),

TABLE 2. Location and prevalence of protozoan parasites of white-winged doves and mourning doves in Florida, 1977-1978.

Parasites	Mourning doves, Gainesville	Mourning doves, Homestead	White-winged doves, Homestead
Trichomonas gallinae (1)[a]	89 (1.1)[b]	53 (17.0)	67 (97.0)
Haemoproteus maccallumi (2)	88 (26.1)	53 (98.1)	127 (92.1)
Haemoproteus sacharovi (2)	88 (1.1)	53 (0)	67 (0)
Eimeria sp. (3)[c]	45 (33.3)	53 (49.1)	67 (6.0)
Sarcocystis sp. (4)	45 (8.9)	44 (6.8)	67 (10.4)

[a]Numbers in parentheses indicate site in host: (1) mouth, esophagus, crop; (2) blood; (3) feces; (4) pectoral muscle.

[b]Number of doves examined and (percent infected).

[c]An undescribed species.

TABLE 3. Location, prevalence, and intensity of infection of helminth parasites of white-winged doves and mourning doves in Florida, 1977-1978.

Parasite	Mourning doves, Gainesville (49)[a]		Mourning doves, Homestead (47)		White-winged doves, Homestead (119)	
	Percent Infection	Mean intensity and (range)/ infected bird	Percent Infection	Mean intensity and (range)/ infected bird	Percent Infection	Mean intensity and (range)/ infected bird
Nematoda						
Ascaridia columbae (1)[b]	38.8	4.4 (1-14)	10.6	6.8 (1-16)	43.7	9.1 (1-47)
Ornithostrongylus spp. (1)[c]	30.6	2.3 (1-9)	97.9	19.2 (1-71)	79.0	10.2 (1-104)
Dispharynx nasuta (2)	36.7	5.8 (1-25)	4.3	8.0 (1-15)	4.2	1.4 (1-3)
Aproctella stoddardi (3)	18.4	2.4 (1-9)	0	—	0	—
Tetrameres columbicola (2)	2.0	1.0 (1)	2.1	1.0 (1)	0	—
Capillaria obsignata (1)	0	—	0	—	0.8	2.0 (2)
Trematoda						
Tanaisia bragai (4)	2.0	12.0 (12)	0	—	0.8	3.0 (3)
Brachylaima sp. (1)	2.0	1.0 (1)	0	—	0.8	2.0 (2)
Cestoda						
Killigrewia delafondi (1)	2.0	1.0 (1)	0	—	0	—
Raillietina spp. (1)[d]	2.0	1.0 (1)	0	—	3.4	2.5 (1-7)

[a] Total number of doves examined.
[b] Numbers in parentheses indicate site in host: (1) small intestine; (2) proventriculus; (3) body cavity; (4) kidney.
[c] A complex of two species: *O. quadriradiatus* and an undescribed species.
[d] A complex of at least two species.

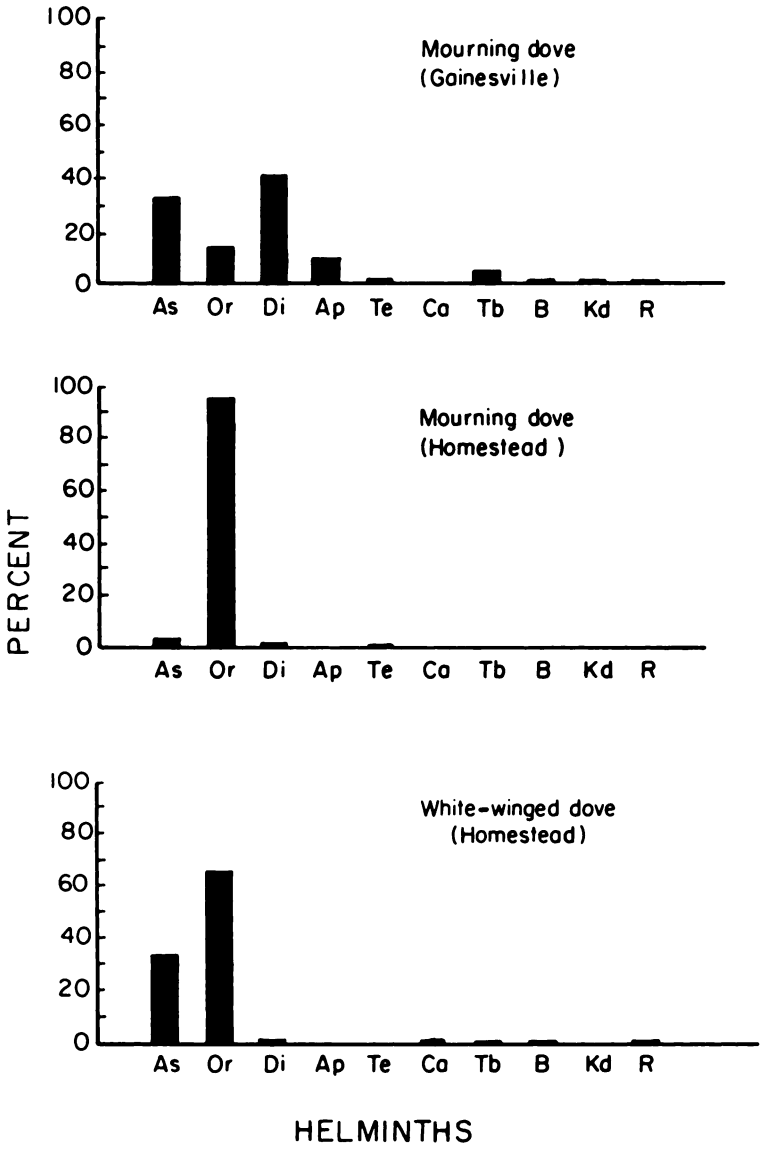

FIGURE 1. Helminth profiles of three dove populations in Florida. As = *Ascaridia columbae;* Or = *Ornithostrongylus* spp. (a complex of two species: *O. quadriradiatus* and an undescribed species); Di = *Dispharynx nasuta;* Ap = *Aproctella stoddardi;* Te = *Tetrameres columbicola;* Ca = *Capillaria obsignata;* Tb = *Tanaisia bragai;* B = *Brachylaima* sp.; Kd = *Killigrewia delafondi;* R = *Raillietina* spp. (a complex of at least two species). Percentages are based upon 1,450 helminths collected from white-winged doves in Homestead, 936 helminths from mourning doves in Homestead, and 262 helminths from mourning doves in Gainesville.

with lower prevalence levels in mourning doves from both Homestead (17%) and Gainesville (1%). The high prevalence of *T. gallinae* in white-winged doves is comparable to findings in southern Texas and Arizona.[11,15] Even more interesting is the close similarity in the prevalence of infection of mourning doves from southern Arizona (where localized epizootics have occurred) and mourning doves from southern Florida. Straus[13] and Sileo[10] reported prevalences in Arizona of 20% and 15%, respectively, as compared to the 17% prevalence found in doves in Homestead, Florida in this study. We can only speculate whether or not the high prevalence of infection in mourning doves from Homestead was a result of their interaction with white-winged doves.

In contrast to infected mourning doves, white-winged doves usually had large oral populations of *T. gallinae* upon direct microscopic examination of throat swabs. However, of all the adult and juvenile doves examined, lesions associated with *T. gallinae* were present in only one bird, a juvenile mourning dove from Gainesville. *Trichomonas gallinae* was found in only one of five nestling mourning doves from Gainesville. The infected squab also had a large caseous lesion in the oral cavity typical of those caused by virulent strains. All 19 nestling white-winged doves were positive for *T. gallinae*, while only six of 11 mourning dove nestlings from the same area were infected. Lesions were not observed in any of these infected squabs from Homestead.

The finding of two virulent infections of *T. gallinae* in doves from Gainesville, and the low prevalence of this parasite might indicate that the population is susceptible; however, uninfected doves have been shown to be highly resistant to virulent strains of *T. gallinae* due to an acquired immunity through previous infection.[9] Conversely, since all doves from Homestead were free of lesions, the strain of *T. gallinae* that exists in that area may be nonvirulent. Yet, the heavy oral infections and high prevalence of *T. gallinae* in white-winged doves may incriminate this dove as an asymptomatic carrier of a mildly virulent strain. In any case, the pathogenicity of the strains of *T. gallinae* in white-winged doves should be determined to safeguard the health of indigenous populations of mourning doves in Florida. In addition, the impact of several other common parasites such as the nematodes and other protozoans shared by all three populations of doves should be further studied.

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