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EXPERIMENTAL TRANSFER OF *TRICHOMONAS GALLINAE* (RIVOLTA, 1878) FROM WHITE-WINGED DOVES TO MOURNING DOVES

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ABSTRACT: Isolates of *Trichomonas gallinae* (Rivolta, 1878) from white-winged doves, *Zenaida asiatica* (L.), were transferred experimentally to young mourning doves, *Zenaida macroura* (L.). Twenty-three of 25 mourning doves developed infections with isolates of *T. gallinae* from 25 white-winged doves. In addition, eight of eight rock doves (*Columba livia* Gmelin) were infected with duplicate isolates. All infected recipient birds harbored avirulent isolates except for one mourning dove which died from extensive oral lesions. However, repeated attempts using this isolate of *T. gallinae* to produce lesions in additional recipients were unsuccessful. Despite the findings of this study, it was suggested that future dove management strategies consider the possibility of disease outbreaks involving white-winged doves and susceptible populations of mourning doves.

INTRODUCTION

Breeding populations of white-winged doves, *Zenaida asiatica* (L.), were first recognized in Florida in the southern citrus-growing areas of the state in 1959 (Saunders, 1980). Because citrus orchards are abundant throughout the state, the possibility of increased interaction of expanding populations of white-winged doves with Florida's indigenous mourning doves, *Zenaida macroura* (L.), led to a study by Conti and Forrester (1981) on the interrelationships of parasites between the two species. In that study, a high prevalence of *Trichomonas gallinae* (Rivolta, 1878) in white-winged doves and a contrasting low prevalence in mourning doves was a significant finding. Speculation that white-winged doves might be carriers of virulent strains of *T. gallinae* which could adversely affect susceptible populations of mourning doves led to the present experimental study.

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MATERIALS AND METHODS

Experimental transfer of *T. gallinae* from infected white-winged doves to susceptible mourning doves was attempted matching 25 donor and 25 recipient birds. In addition, attempts were made to infect eight rock doves (*Columba livia* Gmelin) with eight of the 25 donor isolates. Recipient mourning doves were collected as nestlings from Alachua County in north-central Florida. They did not harbor infections of *T. gallinae* as determined by swabbing and culture techniques, and subsequently were hand-raised. Other surveys in Alachua County have shown nestling, juvenile, and adult mourning doves to be virtually free of *T. gallinae* infection (Shamis, 1977; Conti and Forrester, 1981). Therefore, an assumption was made that the nestling mourning doves used as recipients were not infected previously. The rock doves were reared in captivity by adults which were *T. gallinae*-free. White-winged doves were either shot or live-trapped with cannon-nets from two separate populations approximately 72 km apart in southern Florida (Broward and Dade Counties). Trichomonads from white-winged doves shot in the field were kept alive by culture (Diamond, 1957). Collection and/or rearing of white-winged doves, mourning doves, and rock doves was performed in the summers of 1982 and 1983. Experimental columbids were housed individually in cages with separate food and water containers. Commercial pigeon chow, grit, and water were provided ad libitum.

Transmission experiments involved three different methods: (1) direct transfer (DT), where-

by mourning doves and/or rock doves were contaminated orally with a cotton-tipped applicator stick which had just swabbed the crop, esophagus, and mouth of a white-winged dove donor; (2) normal saline suspensions (NSS), whereby mourning doves and/or rock doves were inoculated orally with 1 ml of normal saline containing trichomonads that originated from a white-winged dove donor; and (3) culture, whereby mourning doves and/or rock doves were inoculated orally with approximately 1×10^6 organisms (determined by hemocytometer counts) in culture medium. In 1982, if a mourning dove and/or rock dove recipient did not develop an initial infection via DT, then the same recipient was reinoculated with the same donor isolate using the NSS method. If the NSS method failed, then the culture method of inoculation was used. The culture method was the only technique used in 1983. The DT and NSS methods in 1982 did not allow quantification of the number of *T. gallinae* transferred; however, it was hoped that these methods would duplicate more closely the natural transfer of not only the trichomonad organism, but also associated yeasts and bacteria.

In 1982, recipient mourning doves were 3–8 wk old when inoculation attempts were first made, and no mourning dove was older than 11 wk when second or third inoculation attempts were made. The rock doves were 4–17 wk old at the first establishment of *T. gallinae*. In 1983, mourning doves were 13–26 wk old when inoculated and possessed most or all of their adult plumage. Examination for the presence of trichomonads or associated lesions in recipient mourning doves and rock doves began on the 5th day postinfection (DPI) and continued every other day until 21 DPI. Wet mounts of direct swabs were made, and in the case of a negative result, culture medium was used. A negative wet mount plus two consecutive negative cultures on a single recipient was taken to mean that the bird was negative and examination was discontinued. All birds were killed at 21 DPI. Lesions observed at necropsy were fixed in 10% buffered formalin and later sectioned and examined by routine histological procedures.

RESULTS AND DISCUSSION

All of 18 mourning doves and eight rock doves in 1982 and five of seven mourning doves in 1983 developed infections with *T. gallinae* following one of the three methods of inoculation (Table 1). A mourning dove and a rock dove used as uninoculated controls were *T. gallinae*-free throughout the experiment during 1982. Infections were established readily by inoculation of culture media containing large numbers of trichomonads, but the DT and NSS methods were less reliable (Table 1). Infections of *T. gallinae* were maintained in recipient mourning doves and rock doves from 7 to 21 days regardless of the method of inoculation and/or species of host recipient used. Some recipients exhibited slight salivation and reddening of the mouth. One bird which succumbed was a mourning dove infected by DT at 3 wk of age in 1982. Lesions appeared on 11 DPI and grew to extreme proportions until it died 24 DPI. A large, caseous growth in the pharyngeal region apparently interfered with the feeding process. Histologically, the oropharynx contained a large abscess with macrophages and giant cells in its periphery. Colonies of coccoid bacteria were present within the exudate. The epidermis of the oropharynx revealed spongy degeneration and focal ulceration. No evidence of poxvirus or fungal infection was seen.

To determine the virulent nature of the trichomonads in the mourning dove that died with oral lesions, the organism was placed into three groups of birds (I, II, III), each group containing one mourning dove and one rock dove. Group I contained uninfected young birds which had never been infected previously with *T. gallinae*; Group II contained uninfected young birds which lost their infection after a previous exposure to different avirulent isolates of *T. gallinae* by the DT method; and Group III contained young birds which were infected with different isolates of avirulent *T. gallinae*. One ml of saline containing trichomonads (NSS method) from the mourning dove with lesions was inoculated into each of the birds in the three groups. Groups I and III maintained asymptomatic infections for 21 days, while Group II never became in-

TABLE 1. Experimental transfer of *Trichomonas gallinae* from white-winged doves into young mourning doves and rock doves.

Method of inoculation	Year	Mourning doves		Rock doves	
		No. inoc.	No. pos.	No. inoc.	No. pos.
Direct transfer (DT)	1982	18	11	8	7
Normal saline suspension (NSS)	1982	7[a]	1	1[b]	0
Culture	1982	6[c]	6	1[d]	1
	1983	7[e]	5		

[a] These mourning doves were the seven found to be negative by DT above.
[b] This rock dove was the one found to be negative by DT above.
[c] These mourning doves were the six found to be negative by DT and NSS above.
[d] This rock dove was the one found to be negative by DT and NSS above.
[e] These seven mourning doves were not inoculated previously by DT or NSS methods.

fected. It appeared that a previous infection protected the Group II birds from reinfection. Superimposed infection of the Group III birds did not alter the potency of the avirulent isolate already present in them, and they may have been immune as well. The isolate of questionable virulence was assumed to be avirulent since no lesions developed in the birds in Group I.

Since we still possessed the white-winged dove (alive) from which the lesion-producing isolate was obtained, we attempted further infections. Three uninfected mourning doves and three uninfected rock doves were used as recipients for *T. gallinae* from this white-winged dove. This time, only one mourning dove and one rock dove were inoculated by the NSS method, while the remainder were given 1×10^6 trichomonads in culture medium. All six birds maintained generally heavy infections lasting at least 21 DPI, but none developed lesions.

In 1960, Stabler (1961) inoculated 11 nonimmune rock doves with isolates derived from 11 white-winged doves in Texas. All 11 rock doves became infected, but no lesions appeared. Ours is the first experimental transmission of *T. gallinae* from white-winged doves into uninfected young mourning doves. In the case of the one white-winged dove isolate which was associated with lesions and death in a mourning dove recipient, the chronology of events prior to death of the bird was somewhat unusual. Virulent forms usually result in mortality after 8 days (range 4–18) postinfection (Stabler, 1954) as opposed to the 24 days which occurred in this study. These results are difficult to explain, but could be related to immunodeficiency in the mourning dove that developed lesions. It is also possible that the lesions were a result of bacterial invasion secondary to the trichomonad infection.

Although the possibility exists that white-winged doves may serve as asymptomatic carriers of virulent strains of *T. gallinae* which could be harmful to indigenous mourning dove populations, the results of our study do not support this idea. While this information is encouraging, future management strategies should not be based solely on these results since small numbers of doves from only two populations were examined. White-winged doves, like rock doves, are more social than mourning doves and tend to aggregate in large numbers, factors which would implicate them as potentially excellent reservoir hosts for infection with *T. gallinae*. Since avirulent isolates have been transformed into virulent isolates by genetic manipulation in the laboratory (Stabler et al., 1964; Honigberg et al., 1971), a similar situation could possibly occur in nature.

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