FURTHER STUDIES ON TRICHOMONIASIS IN BIRDS

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INTRODUCTION

IN a recent publication Levine, Boley and Hester (1941) give a thorough review of the literature dealing with the infection of birds and mammals (inoculation into mice, rats and guinea pigs) with *Trichomonas gallinae* (= *columbae*). To the list of birds already known to have harbored this pathogenic *Trichomonas* they have added as new (experimentally infected) hosts the Bob-white, Canary, English Sparrow and duck (type not given). They were unable to infect two Ring-necked Pheasants and a Starling, and found nine freshly caught English Sparrows free from a natural infection with this trichomonad.

It is the purpose of this paper to present the results of the examination of a large series of various types of birds for the presence of *T. gallinae.*

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OBSERVATIONS

The birds used in this survey were examined while alive, or a very short time after their death. Material from the upper digestive tract was examined microscopically and by culture. The results are as follows:

Pigeons (*Columba livia*).—In all, two hundred and forty-two birds were examined. Of these, 35.5 per cent were free of *T. gallinae,* 64.5 per cent were infected. The birds were of three groups. Eight were bought in a Philadelphia market (source unknown)—all were positive. Forty-seven came from three separate pigeon farms raising squabs for market—one bird only was negative. The re-

TABLE 1

DATA ON INFECTED RAPTORIAL BIRDS

Type bird	*Mode of infection*	*Result*
Cooper's Hawk	Fed partly on pigeon.	Developed large caseous areas in mouth and throat. Caseation extended deep into tissues of pharynx. Throat completely closed. Bird died.
Red-tailed Hawk	Mouth smeared with material directly from the mouth of a positive pigeon.	Mouth and crop filled with large caseous areas. One large, firm, adherent mass involved the whole floor of the crop. Few small areas in the esophagus. Bird died.
Red-shouldered Hawk	Fed heads and crops of five positive pigeons.	No caseation. Excessive salivation noted, and membranes of mouth and crop much inflamed. Bird died.
Red-shouldered Hawk	Mouth smeared with material directly from the mouth of a positive pigeon.	Bird remained alive and healthy. Positive for *T. gallinae* after 49 days. Banded and released.
Red-shouldered Hawk	Fed heads and crops of seven positive pigeons.	Bird remained alive and healthy. Mouth and crop swarming with *T. gallinae* after 38 days.
Golden Eagle	Fed pigeons regularly.	Bird in extremely poor condition at time of death. Mouth and crop a mass of caseation. One area in crop so extensive that skin of neck inseparably adherent to it.
Pigeon Hawk	Bird accidentally allowed to eat one pigeon head.	No lesions or caseation. Much inflammation and excessive salivation at time of death.
Sparrow Hawk	Accidentally fed positive pigeon crop.	No lesions or caseation. Again much inflammation of the mouth and throat membranes, accompanied by excessive salivation. Bird died.
Sparrow Hawk	Food accidentally contaminated with positive pigeon-crop material.	Mouth, crop, throat, and even nasal sinuses, thoroughly involved with large caseation. Bird died.
Sparrow Hawk	Mouth smeared with positive material directly from positive pigeon mouth.	Bird remained completely healthy. Positive for *T. gallinae* when banded and released 110 days after infection.
Duck Hawk	Found infected in the eyrie. Probably contracted from the food-pigeons.	Bird remained alive and well for over two years as a trained falcon in the writer's hands. Finally flew off.
Duck Hawk	Sister to the above bird. Same method of infection undoubtedly.	Bird also remained completely healthy until it was released at four months.

maining one hundred and eighty-seven pigeons were taken from fourteen different locations in three States (Pennsylvania, Maryland and New Jersey). These were wild birds in every sense of the word and were caught for the most part in barns and other buildings at night. Slightly over one-half, 54.5 per cent, were positive for *T. gallinae.*

None of the birds was examined as a direct result of symptoms attributable to *T. gallinae.* Some few were old, others had visceral bacterial lesions, but by far the majority were healthy, normal pigeons.

Doves.—In this series, twenty-six birds of five species were available as follows:

10 Mourning Doves (*Zenaidura macroura carolinensis*)
5 Graceful Ground Doves (*Geopelia c. cuneata*)
2 Laughing Doves (*Streptopelia s. senegalensis*)
5 Ring-necked Doves (*Streptopelia d. decaocto*)
4 Blue-headed Quail-doves (*Starnoenas cyanocephala*)

Of these, only the Mourning Doves were wild birds. The others were caged in the collection of the Philadelphia Zoölogical Garden. None was positive for *T. gallinae.*

Domestic Turkey (Meleagris gallopavo).—A small flock of twelve birds which had the run of a farm in Pennsylvania were all negative for this parasite.

Raptorial birds.—A total of forty-one birds was examined, of which only two—a pair of nestling Duck Hawks—were found naturally infected with *T. gallinae.* Thirty-two were negative on first examination. Three of these (one Red-tailed Hawk, one Red-shouldered Hawk and a Sparrow Hawk) were subsequently purposely infected. Seven other positive birds, received from various sources, were also available for study. The thirty-two initially uninfected birds were as follows:

2 Cooper's Hawks (*Accipiter cooperi*)
2 Goshawks (*Astur a. atricapillus*)
1 Red-tailed Hawk (*Buteo b. borealis*)
4 Red-shouldered Hawks (*Buteo l. lineatus*)
1 Golden Eagle (*Aquila chrysaëtos canadensis*)
8 Duck Hawks (*Falco peregrinus anatum*)
5 Sparrow Hawks (*Falco s. sparverius*)
1 Pigeon Hawk (*Falco c. columbarius*)
2 Prairie Falcons (*Falco mexicanus*)
2 Screech Owls (*Otus asio naevius*)
1 Barn Owl (*Tyto alba pratincola*)
2 Great Horned Owls (*Bubo v. virginianus*)
1 Snowy Owl (*Nyctea nyctea*)

The data on the twelve infected birds may be found in Table 1. From this table it can be seen that seven birds died of the infection, four with extensive caseous lesions in the upper digestive tract, and three without lesions, but showing an inflammation of the membranes of the mouth and throat, accompanied by a profuse salivation. These birds all appeared to die of starvation, eating less and less as the infection progressed and finally refusing all food a day or so before death. In those with caseous involvements, actual mechanical obstruction often prevented swallowing. Those with no caseation seemed to experience such actual discomfort on swallowing that they, too, refused to eat, though they would frequently grab at food and tear it apart vigorously, still refusing to swallow even the smallest pieces. Evident discomfort was registered by all these birds throughout the period of infection by frequent gaping, swallowing and regurgitation movements. The other five birds remained alive and healthy despite their trichomonads.

Other birds.—All the birds in the following list were found to be entirely negative for *T. gallinae.*

1 Great Blue Heron (*Ardea h. herodias*)
1 Mallard Duck (*Anas p. platyrhynchos*)
1 Ruffed Grouse (*Bonasa u. umbellus*)
3 Bob-white (*Colinus v. virginianus*)
6 Ring-necked Pheasants (*Phasianus colchicus torquatus*)
1 Woodcock (*Philohela minor*)
1 Yellow-billed Cuckoo (*Coccyzus a. americanus*)
1 Nighthawk (*Chordeiles m. minor*)
3 Flickers (*Colaptes auratus luteus*)
1 Downy Woodpecker (*Dryobates pubescens medianus*)
3 Barn Swallows (*Hirundo erythrogaster*)
1 Blue Jay (*Cyanocitta c. cristata*)
4 Crows (*Corvus b. brachyrhynchos*)
6 Catbirds (*Dumetella carolinensis*)
5 Robins (*Turdus m. migratorius*)
1 Hermit Thrush (*Hylocichla guttata faxoni*)
1 Gray-cheeked Thrush (*Hylocichla minima aliciae*)
15 Starlings (*Sturnus v. vulgaris*)
1 Louisiana Water-Thrush (*Seiurus motacilla*)
3 Purple Grackles (*Quiscalus q. quiscula*)
3 Cowbirds (*Molothrus a. ater*)
26 English Sparrows (*Passer d. domesticus*)
3 White-throated Sparrows (*Zonotrichia albicollis*)

Summary of birds examined.—The above groups include a total of four hundred and twelve individual birds, representing forty-four species, twenty-two families and eleven orders. The total birds positive for *T. gallinae* (infected from all causes) were one hundred and

sixty-eight (40.8 per cent), of which twelve were raptores and one hundred and fifty-six were pigeons. The negative birds—two hundred and forty-four (59.2 per cent)—included twenty-nine hawks and owls, eighty-six pigeons and one hundred and twenty-nine other types. Of the three hundred and twenty-two strictly wild birds (not including the Domestic Turkeys, commercial pigeons, caged doves, etc., but including the barn pigeons, freshly caught raptores and other birds), only two types were infected, namely, pigeons (one hundred and two) and hawks (two Duck Hawks).

DISCUSSION

One interesting fact revealed by this study is that such a high percentage of adult wild Common Pigeons harbor *Trichomonas gallinae*. They then constitute an important source in the spread of this parasite to whatever bird should feed upon them or eat and drink from vessels contaminated by them in their wanderings.

It should be noted that none of the ten wild Mourning Doves or none of the four species of caged doves, reared originally by regurgitational feeding as is the case with all columbid birds, was positive.

As a continuation of the experiments reported in abstract form by the writer, with Shelanski, in 1936 and again in 1937, we find three types of reaction to infection with *T. gallinae* in birds of prey. Some become positive and remain healthy; others, while showing signs of critical distress ending in death, develop no lesions; and still others show severe, obstructing, caseous involvements, also terminating in death. All of these birds swarm with the trichomonads, in the upper digestive tract only. It must be admitted that the possible rôle played by viruses or bacteria in these latter cases is as yet incompletely understood.

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