NORMAL YEAST FLORA OF THE UPPER DIGESTIVE TRACT OF SOME WILD COLUMBIDS

Authors: KOCAN, R. M., and HASENCLEVER, H. F.

Source: Journal of Wildlife Diseases, 8(4) : 365-368

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-8.4.365

NORMAL YEAST FLORA OF THE UPPER DIGESTIVE TRACT OF SOME WILD COLUMBIDS

R. M. KOCAN, U.S. Bureau of Sport Fisheries and Wildlife, Patuxent Wildlife Research Center, Laurel, Maryland, U.S.A. 20810

H. F. HASENCLEVER, Laboratory of Microbiology, National Institute of Allergy and Infectious Diseases, National Institnutes of Health, Bethesda, Maryland, U.S.A. 20014

Abstract: Seven species of pigeons and doves were cultured for yeasts in the upper digestive tract. The following list gives the isolation rate for each columbid species and the yeasts cultured from them: feral pigeon *Columba livia* (Gmelin) 95% — *Candida albicans* (Robin) Berkhout, *C. tropicalis* (Castellani) Berkhout, *C. krusei* (Cast.) Berkhout, *C. guilliermondii* (Cast.) Langeron et Guerra, *Torulopsis glabrata* (Anderson) Lodder et De Vries, *Saccharomyces telluris* Van der Walt, and *Geotrichum* sp.; white-crowned pigeon *(C. leucocephala* Linnaeus) 56% — *S. telluris;* mourning dove *(Zenaidura macroura* Linnaeus) 24% — *C. albicans, C. tropicalis, C. guilliermondii,* and *Geotrichum* sp.; passerine ground dove *(Collumbigallina passerina* Linnaeus) 20% — *C. parapsilosis* (Ashford) Langeron et Talice, *Kloeckera apiculata* (Reess Emend. Klocker) Janke; zenaida dove *(Zenaida aurita* Temminck) 16% — *C. albicans, C. guilliermondii,* and *T. glabrata;* one moustasche dove *(Geotrygon mystacea* Gosse) — *C. guilliermondii;* ringed turtle dove *(Streptopelia rizoria* Linnaeus) 14% — *C. albicans* and *Geotrichum* sp. No signs of disease could be seen in the 139 birds that were examined, and it was concluded that these yeasts comprise a part of the columbid's normal microbial flora.

INTRODUCTION

There are numerous reports of Candidiasis in domestic poultry and occasional reports of the disease in wild birds.[1,2,4,5,9] The source of infection in these cases is probably endogenous, as it is in humans[5] since many individuals can be shown to harbor the causative organism *(Candida* sp.) without signs of disease.

Pigeons have also been reported to suffer from candidiases,[4] and cultures from the upper digestive tract of apparently healthy individuals are frequently contaminated with yeast-like organisms.[7] To determine the significance, rate of isolation and number of species of these organisms, we examined seven columbid species.

MATERIALS AND METHODS

Throat swabs were taken from seven species of columbids: feral pigeon *(Columba livia)* trapped at the National Zoological Park in Washington, D.C.; white-crowned pigeon squabs *(C. leucocephala)* swabbed in the nest in the Florida Keys; passerine ground dove *(Columbigallina passerina),* zenaida dove *(Zenaida aurita),* and moustasche quail dove *(Geotrygon mystacea)* — all three shot in the Virgin Islands; mourning dove *(Zenaidura macroura)* live trapped in Maryland and South Carolina; ringed turtle dove *(Streptopelia risoria)* reared in the laboratory.

Each swab was streaked onto a Sabouraud's agar slant containing 5000 units each of penicillin and streptomycin (Microbiological Associates, Bethesda, Md.) and incubated for 72 hours at 37 C. Colonies picked from these slants were streaked onto Sabouraud plates and used for species identification. All yeasts isolated in this study were identified using the morphological and physiological characteristics described for these species.[9]

The antigenic groups (serotype) of the isolates of *C. adbicans* were determined by the method of Hasenclever and Mitchell.[6]

RESULTS

Each of the seven species of columbids examined was culturally positive for at least one yeast, with the common pigeon and mourning dove harboring the greatest number of different yeast species (Table 1). *Geotrichum* occurred in both of these and in the ringed-dove, and although it is not a true yeast, it is reported here because it takes on a yeast-like appearance at elevated temperatures (37-42 C). Five species of *Candida* were isolated and one species each of *Torulopsis, Saccharomyces,* and *Kloeckera.*

In no instance was there any evidence of these yeasts being associated with disease in the host. Only occasionally were concurrent isolations observed, even though as many as six species of yeast were found to occur in the same species of pigeon.

DISCUSSION

The high rate of isolation and the ability of the isolated organisms to grow at temperatures near that of the pigeon indicate that they are inhabitants of the upper digestive tract and are probably a part of the normal flora of their hosts, similar to *Candida, Lactobacillus,* and *Escherichia* in humans. Under certain conditions of stress these yeasts can probably become opportunists, while in healthy birds they remain harmless.

Most of the nine species of yeast isolated have been shown to be capable of producing disease, and many are also capable of a saprophytic existence. The following list gives a brief summary of each species: *Candida albicans* is primarily an inhabitant of the mucous membranes of the mouth, nose, and vagina but also extends into the intestinal tract and frequently occurs on the moist areas of the skin. It may be invasive but also can cause superficial lesions. Positive sputum cultures indicate that the bronchi may also be a suitable habitat.[5,9] *C. tropicalis* is primarily an inhabitant of the skin but has also been isolated from shrimp (U.S.), Kefir (Netherlands), cecal contents of a cow and the liver of an elephant.[5,9]

C. guilliermondii has been isolated from cases of endocarditis in man, the brain of shrimp, a brewery, buttermilk, leather, onions, air, gut of horses and cows, feces of a hippopotamus, gut of a crow *(Corvus albis),* sea water from southern California, and the gut of a marine fish *(Eutronacentrus leucosticus)* from Florida.[5,9]

C. krusei is nonpathogenic with a variety of animal sources. It has been isolated from the intestinal tract of a gull, pickle brine, fermenting cacao and dates.[5,9]

C. parapsilosis is a cause of human mycotic endocarditis and has also been isolated from diseased finger and toe nails, insect frass, pickled cucumbers, and the intestines of horses and pigs.[5,9]

Torulopsis glabrata has been isolated from the gastrointestinal and urogenital tracts of humans, liver of an elephant, gut of unspecified domestic animals, gut of gulls, baker's yeast, concentrated orange juice and fermenting juice of *Passiflora edulis* in India.[5,9]

Saccharomyces telluris has been isolated from soil, carious dentine, peritoneal fluid of a guinea pig, excreta of mice and rats, lung of a pullet, udder of a mouse, crop of a turkey poult and caecal contents of a horse and pig.[9]

Kloeckera apiculata has been isolated from soil, various species of *Drosophila* and a variety of vegetables.[9]

Geotrichum candidum is a saprophyte and an occasional pathogen of the respiratory and gastrointestinal tract of humans. It is ubiquitous in dairy products and other natural substrata.[3,5]

C. albicans was the most frequently encountered yeast, with approximately 80 percent being serotype A and 20 percent serotype B. This species was not isolated from the white-crowned pigeon and passerine ground dove. Since only a single moustasche quail dove was examined, no valid conclusions can be made concerning the number of yeasts inhabiting this bird.

The extremely high rate of occurrence of *C. albicans* in feral pigeons raises the possibility of their being involved in the dissemination of this yeast. These birds adapt readily to rural and urban environ-

TABLE 1. Yeast frequency and host-isolation rate for nine species of yeast cultured from the upper digestive tract of seven species of pigeons and doves.

	Feral pigeon	White-crowned pigeon	Mourning dove	Passerine ground dove	Zenaida dove	Moustache quail dove	Ringed turtle dove
Host-isolation Rate/	95/100	23/41	9/37	3/15	6/38	1/1	2/15
Yeast Frequency	95%	56%	24%	20%	16%	100%	14%
Candida albicans	63%	—	67%	—	67%	—	50%
C. tropicalis	4%	—	11%	—	—	—	—
C. krusei	7%	—	—	—	—	—	—
C. guilliermondii	2%	—	11%	—	17%	100%	—
C. parapsilosis	—	—	—	33%	—	—	—
Torulopsis glabrata	9%	—	—	—	16%	—	—
Saccharomyces telluris	13%	100%	—	—	—	—	—
Kloeckera apiculata	—	—	—	66%	—	—	—
Geotrichum sp. [a]	4%	—	11%	—	—	—	50%

(a) Not a true yeast, but it is reported here because of its yeast-like properties.

ments and are frequently associated with human dwellings, making them ideal as a constant source of the organism. The ubiquitousness of the other yeasts found in feral pigeons might be the result of their association with this bird, or they may at least rely on the bird as a means of transport. Further work on the pigeon's role in the biology of these yeasts is certainly warranted on the basis of the existing data.

Yeasts, probably *S. telluris*, could be seen on direct microscopic examination of the crop contents of white-crowned pigeon squabs, but could not be seen in any of the other birds examined. In addition, the serotype of *S. telluris* found in the white-crowned pigeon was different from that isolated from the feral pigeon and may have some evolutionary significance.

K. apiculata has not previously been known to grow at 37 C or above. Since prior to this report it has been isolated from soil in cooler climates, one might speculate that a temperature selection occurred in the warmer climates and the organism was consequently able to grow at the elevated temperature of the ground dove.

Further work on other columbid species will probably result in the isolation of more yeast species and possibly some evolutionary host-microbial relationships, as well as epidemiologic factors associated with the transimission and dispersion of yeasts and yeast-like fungi.

Acknowledgements

We wish to express our appreciation to Alexander Sprunt IV and Gene Knoder, National Audubon Society, Tavernier, Florida 33070 for aid in obtaining the samples from white-crowned pigeons; to Cletus Kurtzman, Northern Regional Research Laboratory, Peoria, Illinois 61604, and to D. Yarrow, Centralbureau voor Schimmelcultures, Delft, the Netherlands for their contributions in the identification of *Saccharomyces telluris;* and to Herman Phaff, University of California, Davis, Califonia 95616 for assistance in identifying *Kloeckera apiculata.*

LITERATURE CITED

1. BACLE, J. F., and C. H. BIGLAND. 1962. Avian mycology survey in Alberta. J. Amer. vet. med. Assoc. 141: 476-480.
2. BLAXLAND, J. D., and I. H. FINCHAM. 1950. Mycosis of the crop (Moniliasis) in poultry, with particular reference to serious mortality occurring in young turkeys. Brit. vet. J. 106: 221-231.
3. CARMICHAEL, J. W. 1957. *Geotrichum candidum.* Mycologia 49: 820-830.
4. CHUTE, H. L. 1965. Diseases caused by fungi. In *Diseases of Poultry.* H. E. Beister and L. H. Schwart, ed. Iowa State Univ. Press, Ames, Iowa. 494-511.
5. CONNANT, N. F., D. T. SMITH, R. D. BAKER, and J. L. CALLOWAY. 1971. Candidiasis. In *Manual of Clinical Mycology* 3rd. ed. W. B. Saunders Co., Philadelphia and London. 325-364.
6. HASENCLEVER, H. F., and W. O. MITCHELL. 1961. Antigenic studies of Candida. I. Observation of two antigenic groups in *Candida albicans.* J. Bact. 82: 570-574.
7. HONIGBERG, B. M. 1957. The use of mycostatin (Nystatin) in isolation of axenic cultures of trichomonads. J. Parasitol. 43: 43.
8. KEYMER, I. F., and P. K. C. AUSTWICK. 1961. Moniliasis in partridges *(Perdix perdix).* Sabouraudia 1: 22-29.
9. LODDER, J. 1970. *The Yeasts: A Taxonomic Study.* North Holland Pub. Co., Amsterdam and London.

Received for publication May 11, 1972