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SEASONAL VARIATION OF THE UPPER DIGESTIVE TRACT YEAST FLORA OF FERAL PIGEONS

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Abstract: Feral pigeons were sampled over a 16-month period to determine whether their normal yeast flora varied according to season. *Candida albicans* and *Saccharomyces telluris* occurred during the entire sampling period, with *C. albicans* reaching its highest levels between August and January and *S. telluris* peaking from March through May. *Candida krusei* was present for 10 months but exhibited no predictable variation in density. *Candida tropicalis, C. guilliermondii* and *Geotrichum* were isolated on several occasions while *C. lusitaniae, C. pseudotropicalis* and *Torulopsis glabrata* were each isolated once. The high levels of infection and frequency of occurrence of some yeast species make the feral pigeon highly suspect as a carrier and disseminator of potentially pathogenic yeast.

INTRODUCTION

Pigeons have been recognized as potential public health hazards for some time, particularly in the case of ornithosis and equine encephalitis.[1,2,6] They are also known to carry pathogenic yeasts,[4,7] but no studies have shown to what extent they play a role as reservoirs for these organisms.

Studies by Kocan and Hasenclever[4] on the normal mycotic flora of several species of columbids revealed that samples collected over a period of time contained different ratios of some species, while others appeared and disappeared with no apparent regularity. To determine whether this might be a cyclical phenomenon, 441 feral pigeons (*Columba livia*) were trapped over a 16-month period (excluding November and February due to poor trapping conditions) at the National Zoological Park in Washington, D.C. The male-female and adult-juvenile ratios were about even throughout the sampling period, probably the result of an active pest control program at the zoo. The number examined per month ranged between 19 and 51 mean = 30).

MATERIALS AND METHODS

Primary yeast isolations were made by culturing throat swabs in 5 ml Sabouraud's liquid medium containing 5000 units each of penicillin and streptomycin and incubated at 37C for 48 hours. The resultant growth was transferred to Sabouraud's agar plates from which colonies were picked for identification. Identifications were made using the morphological and physiological characteristics described for these species.[5] No attempts were made to identify other associated microbiological agents, although pox lesions were seen in about 2% of the young birds. The pigeons trapped in August were held in large flypens, fed commercial pigeon chow, and sampled along with newly trapped birds for two additional months in order to determine whether the observed changes of their yeast flora occurred as a result of endogenous changes in the birds or from changes in the local habitat or food source. The majority of the birds appeared to be in good health at the time of capture. Observations at the Zoo showed that they fed on a variety of food thrown them by visitors, but they

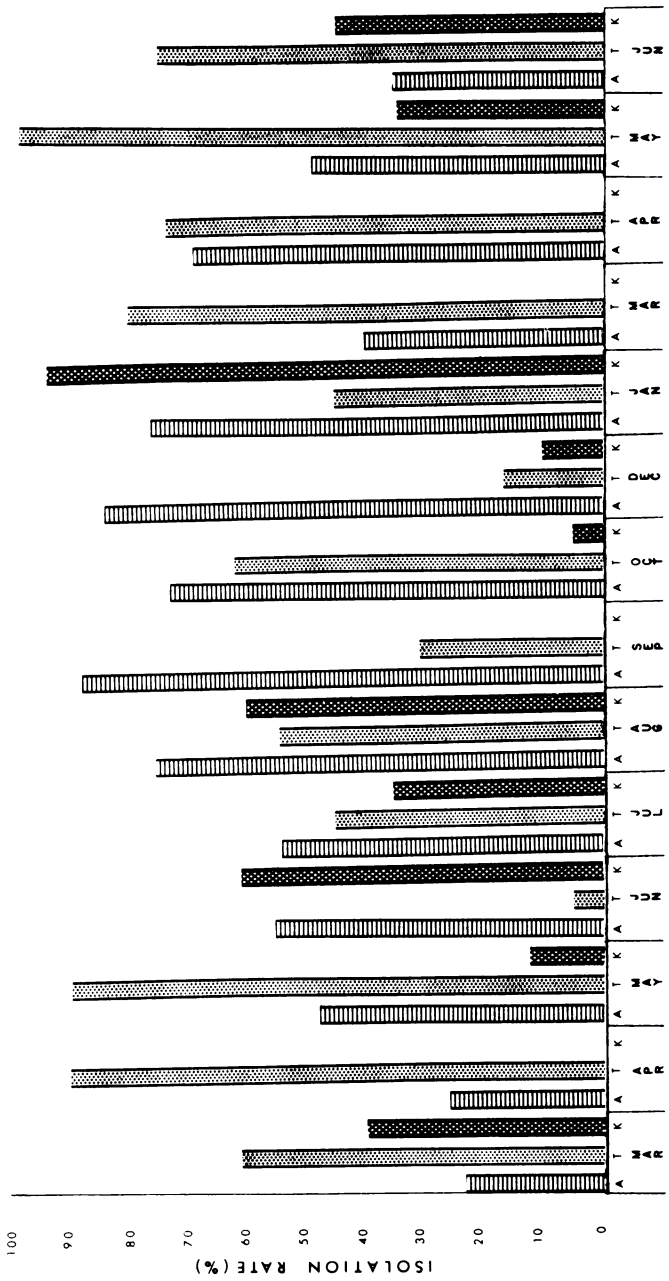

FIGURE 1. Frequency of occurrence of three most commonly encountered oral yeasts of feral pigeons over a 16-month period. A—**C. albicans;** T—**S. telluris;** K—**C. krusei.** Total sampled = 441; mean per month = 30 pigeons (range 19 - 51).

were primarily found congregated at feed troughs which contained pelletized food for the hoofed stock.

RESULTS

Candida albicans and *Saccharomyces telluris* were present for the entire sampling period while *C. krusei* appeared during 10 of the 16 months. *Candida albicans* was most prevalent from August through January while *S. telluris* was most prevalent from March through May. Both species were present in over 60% of the birds during their peaks and ranged between 20 and 60% for most of the time between peaks. *Candida krusei* exhibited no particular cyclical variation during the sampling period even though it fluctuated between 0 and 95% (Fig. 1).

Candida tropicalis occurred in 3% of the birds in January and March; *C. guilliermondii* appeared in 3 to 28% of the birds in January, May, June and September; and *Geotrichum* appeared in 4 to 28% of the birds in March, June, July, September and October. *Candida lusitaniae* and *C. pseudotropicalis* appeared in June in 14 and 3%, respectively, and *Torulopsis glabrata* appeared in July in 24% of the birds.

The group of 20 pigeons which was sampled for 3 consecutive months (Aug.-Oct.) showed *C. albicans* and *C. krusei* to remain essentially the same in both captive and newly trapped pigeons while *S. telluris* steadily decreased in the captive flock (Table 1).

In order to determine whether diurnal yeast shedding might not be responsible for the observed differences in monthly isolation rates, a series of samples was taken from eight pigeons every 4 hours for 4 days. There was no indication of any change in the oral flora of these birds, indicating that the time of day samples were taken did not influence the observed incidence of infection.

DISCUSSION

The regularity of occurrence of *C. albicans, C. krusei* and *S. telluris* would indicate that they were a part of the normal flora of pigeons. Closer examination, however, shows that *S. telluris* gradually disappears from a population of *Columba livia* when held in captivity. The cause for *S. telluris*' continued presence under natural conditions is unknown, but appears to be related to factors in the environment which were not duplicated for the captive pigeons. A different serotype of this yeast appears in other columbid species and in particularly high numbers in white-crowned pigeons (*C. leucocephala*).[3] In this case the organisms did not disappear when the birds were confined, even though their normal fruit and seed diet was changed to mixed grain.

The similarity in occurrence of *C. albicans* and *C. krusei* in captive and wild birds indicated that they fluctuate as a result of endogenous changes in the bird, rather than with external environmental factors.

TABLE 1. Comparison of yeast isolation rates for wild and captive pigeons for the same 3-month period.

Yeast		Aug.	Sept.	*Oct.*
C. albicans	wild	75%	88%	73%
	captive	75%	65%	63%
C. krusei	wild	60%	0%	4%
	captive	60%	0%	6%
S. telluris	wild	55%	32%	62%
	captive	55%	24%	6%

The causes for seasonal fluctuations in these three species of yeast is not understood. Since the overall incidence of infection in the pigeons does not drop very low at any one time, it is doubtful that their role as carriers or disseminators is significantly affected during any season —if such a role exists.

The six species which sporadically appeared were transient in their association with the pigeons, and were probably acquired from the local environment. This does not necessarily eliminate the pigeon as a potential disseminator of these species when they are infected.

A monthly comparison of temperature and precipitation throughout the sampling period showed a mean January temperature of 3.5C and a mean July temperature of 25.1C. These are both within 0.83C of the normal means. At no time during the study did the mean monthly temperature fall below freezing, and only trace amounts of snow fell during the sampling period. Precipitation ranged between 2.76 cm and 32.43 cm with a yearly mean of 11.6 cm. There was no correlation between incidence of yeast and climatological highs and lows.

Since environmental factors of some type appear to affect the presence of various yeasts, it could be assumed that pigeons collected in different geographical locations would have different yeast flora. Any evaluation of the pigeon's role as a carrier of these organisms would depend on the local environment as well as the time of year.

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