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ANTIMICROBIAL RESISTANT *Salmonella* spp. ISOLATED FROM DOUBLE-CRESTED CORMORANTS (*Phalacrocorax auritus*) AND COMMON LOONS (*Gavia immer*) IN FLORIDA[□]

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Abstract: Antimicrobial resistant *Salmonella* spp. were found in double-crested cormorants and common loons in Florida. Single or multiple drug resistance occurred in all *Salmonella agona* isolates from cormorants, primarily to ampicillin, sulfonamids, streptomycin, neomycin, and kanamycin. Similar patterns of resistance were found in *S. agona* isolates from common loons. In addition, isolates of *S. saint paul* from loons were found resistant to tetracycline and streptomycin, while 2 of 7 isolates of *S. infantis* were resistant to tetracycline only.

INTRODUCTION

Saad and Farrar⁷ recently reported antimicrobial resistance patterns of *Salmonella* isolates from man and domestic animals in Georgia and South Carolina. They found that 16% of the *Salmonella* isolates from man were resistant to one or more antibacterials, and that among isolates from domestic animals, 21% showed single or multiple drug resistance. These authors also tabulated earlier published reports on the overall prevalence of resistance to one or more antimicrobial agents among *Salmonella* isolates from man in the United States, showing a resistance rate of 16 to 32% in several other areas.

We have been unable to find any reports on the occurrence of antimicrobial resistance in bacteria isolated from wild animal species, except one describing resistant *S. typhimurium* from crows and a kite in Japan.⁸ The purpose of the present report is to describe antimicrobial resistance patterns found in *Salmonella* spp. isolated from double-crested cormorants and common loons in Florida.

MATERIALS AND METHODS

Sources of *Salmonella* Isolates:

The *Salmonella* spp. used in this study were isolated from various wildlife species submitted to the Laboratory of Wildlife Disease Research, College of Veterinary Medicine, University of Florida, Gainesville. Fourteen *Salmonella* spp. were isolated from 28 of 168 raccoons (*Procyon lotor*) (17%),² 27 were isolated from 190 common loons (*Gavia immer*) (14%),⁹ 10 were isolated from 124 free ranging lizards (*Reptilia*, *Lacertilia* sp.) (8%),⁶ and 12 were isolated from 104 double-crested cormorants (*Phalacrocorax auritus*) (11%). Most isolations were made from intestinal tracts; however, occasional isolations were made from internal organs.

The *Salmonella* spp. were isolated and identified by methods previously described.^{5,9} All isolates were serotyped by personnel at the Veterinary Services Diagnostic Laboratory, USDA, Ames, Iowa 50010, USA.

Antimicrobial Susceptibility Tests:

The isolates were tested by the Kirby-Bauer, Sherris standardized single disk

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method on Mueller-Hinton medium,¹ as described by Difco Laboratories, using the following Bacto-Sensitivity Disks (Difco): Ampicillin (10 μ g), Chloramphenicol (30 μ g), Colistin (10 μ g), Cephalothin (30 μ g), Furadantin (300 μ g), Kanamycin (30 μ g), Neomycin (30 μ g), Nalidixic Acid (30 μ g), Polymyxin B (300 units), Tetracycline (30 μ g), Streptomycin (10 μ g) and Triple Sulfa (300 μ g).

RESULTS AND DISCUSSION

Antimicrobial resistant *Salmonella* spp. were found only in double-crested cormorants and common loons.

In the case of the cormorants, all submitted from the Tampa Bay area, there were 7 isolations of *S. agona*, 4 isolations of *S. typhimurium*, and one isolation of *S. infantis*. Only the *S. agona* isolates showed antimicrobial resistance. One isolate was resistant only to ampicillin; 2 were resistant to both streptomycin and sulfonamids; one was resistant to ampicillin, kanamycin, neomycin, streptomycin and sulfonamids; 2 were resistant to ampicillin, kanamycin, neomycin, tetracycline, streptomycin, and sulfonamids; one was resistant to all of the above antimicrobials plus cephalothin.

The common loons were submitted from both the Atlantic and Gulf coasts of Florida, and 8 different *Salmonella* serotypes were found among the 23 isolates that were typed. Among 7 *S. infantis* isolates, 2 were resistant to tetracycline only; of 5 isolates of *S. saint paul*, 3 were resistant to both tetracycline and streptomycin. All 4 isolates of *S. agona* showed multiple resistance patterns, being resistant to ampicillin, kanamycin, neomycin, streptomycin, and sulfonamids, with 3 of the 4 isolates resistant to tetracycline. There was no

antimicrobial resistance in 3 isolates of *S. montevideo*, or in single isolates of *S. muenchen*, *S. newport*, *S. typhimurium*, and *S. blockley*.

In this study, multiple drug resistance in *S. agona* isolates from both loons and cormorants was most striking. The principal other resistance pattern was the tetracycline and streptomycin resistance in isolates of *S. saint paul* from loons.

Salmonella agona, *S. infantis*, and *S. saint paul* were among the 7 most frequently reported serotypes isolated from infections in man during 1975.³ It is tempting to speculate that the antimicrobial resistance of the same serotypes isolated from loons and cormorants originated from treated infections of man and domestic animals. In the present study striking multiple drug resistance occurred in *S. agona* isolates from both cormorants and loons from the Tampa Bay area. In fact, all of the cormorants from which *Salmonella* spp. were isolated came from the Tampa Bay area, and all of the *S. agona* isolates from common loons were from birds submitted from that area. The Tampa Bay area is well supplied with hospitals, sewage plants, feed mills, slaughter plants, poultry plants, and other potential sources of pollution of Tampa Bay, and thus, a potential source for the *S. agona* found there in these water birds. It is probable that other birds in this area, if surveyed for enteric infections, would also prove to harbor *S. agona*.

The first isolations of *S. agona* in the United States were from Peruvian fishmeal shipped to the southeastern states in 1970, and subsequently, this serotype was found associated with infections in man.⁴ Similar findings were reported from England, the Netherlands, and Israel, following isolations from Peruvian fishmeal.

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