Antimicrobial Susceptibility of Bordetella avium and Bordetella bronchiseptica Isolates

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Two veterinary pathogens, Bordetella bronchiseptica and Bordetella avium, were tested for their antimicrobial susceptibilities. Of the 20 antimicrobial agents tested, both species were consistently resistant to penicillin and cefuroxime but susceptible to mezlocillin, piperacillin, gentamicin, amikacin, and cefoperazone.

Bordetella bronchiseptica and Bordetella avium are important respiratory pathogens of swine and poultry, respectively. B. bronchiseptica is associated with atrophic rhinitis, a slow erosion of nasal turbinates in the snout. In a 1984 U.S. survey, 69% of midwestern hogs had some degree of atrophic rhinitis (11). B. bronchiseptica has also been isolated from rodents, felines, canines, and humans (2, 3, 6, 7, 9).

B. avium (formerly Alcaligenes faecalis) is the causative agent of turkey coryza. Infected young turkeys experience ocular-nasal discharge, tracheal collapse, and decreased weight gains; but mortality is usually low (10). No comprehensive epidemiological studies on the incidence of B. avium infection are available.

To date, in vitro antimicrobial susceptibility studies with these two organisms have been conducted with either small numbers of isolates (4) or against panels with limited numbers of antimicrobial agents (1, 12). The present study examined the antimicrobial susceptibilities of strains of B. bronchiseptica and B. avium to 20 antimicrobial agents, including several newer cephalosporins.

Forty-eight isolates of B. bronchiseptica and ten isolates of B. avium were tested in this study. Strains of B. bronchiseptica included 25 clinical isolates, 3 from humans and 22 from swine; 12 laboratory stock strains; and 11 American Type Culture Collection stock strains. Strains of B. avium included eight isolates from turkey flocks, one laboratory stock strain, and one American Type Culture Collection stock strain. Two human isolates and seven laboratory strains were provided by Terrence A. Kurzynski, State Laboratory of Hygiene, University of Wisconsin, Madison (8). Eight laboratory strains of B. bronchiseptica and one strain of B. avium were provided by Allison Weiss, Medical College of Virginia, Richmond. Two clinical isolates of B. avium were also provided by L. H. Arp, Iowa State University, Ames.

Strains were stored at −70°C in litmus milk and passaged twice on Trypticase soy agar with 5% sheep erythrocytes (BBL Microbiology Systems, Cockeysville, Md.), with incubation at 37°C for 24 h before testing.

Antimicrobial susceptibility testing was done by broth microdilution in cation-supplemented Mueller-Hinton broth by using Beckman panels (Beckman Instruments, Inc., Brea, Calif.) for all antimicrobial agents tested except rifampin and ampicillin-sulbactam (Prepared Media Laboratories, Tualatin, Oreg.). The following 20 antimicrobial agents were tested against all study isolates at the indicated ranges of concentrations: penicillin, 0.015 to 2.0 μg/ml; ampicillin, 0.25 to 16 μg/ml; ampicillin-sulbactam, 0.03/0.015 to 16/8 μg/ml; ticarcillin, 4 to 64 μg/ml; mezlocillin, 2 to 4 μg/ml; piperacillin, 1 to 64 μg/ml; gentamicin, 1 to 8 μg/ml; tobramycin, 1 to 8 μg/ml; amikacin, 2 to 32 μg/ml; cephalothin, 1 to 16 μg/ml; cefuroxime, 0.5 to 32 μg/ml; cefoperazone, 2 to 32 μg/ml; ceftazidime, 0.5 to 32 μg/ml; cefotaxime, 0.5 to 32 μg/ml; ceftriaxone, 0.5 to 32 μg/ml; chloramphenicol, 0.25 to 16 μg/ml; erythromycin, 0.12 to 8 μg/ml; rifampin, 0.015 to 4 μg/ml; trimethoprim-sulfamethoxazole, 0.5/9.5 to 32/608 μg/ml; and tetracycline, 0.25 to 16 μg/ml.

The inoculum was a suspension of the organism in

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<th>TABLE 1. MICs for B. bronchiseptica and B. avium*</th>
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* Forty-eight isolates of B. bronchiseptica and ten isolates of B. avium were tested using a broth microdilution method.

* 90%, MIC of 90% of strains tested.

* SXT, Trimethoprim-sulfamethoxazole (expressed as the MIC of trimethoprim).

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Mueller-Hinton broth, diluted to correspond to a 0.5 McFarland turbidity standard and then further diluted to give a final concentration of approximately 10⁵ CFU/ml. The panels were then incubated for 20 to 24 h at 35°C in ambient air. Wells were examined macroscopically for growth. The MIC was defined as the lowest concentration of antimicrobial agent resulting in complete inhibition of growth.

The MICs of the antimicrobial agents are shown in Table 1. When compared with the B. avium isolates, the B. bronchiseptica isolates were less susceptible to most of the agents tested. Overall, the most active agents against the B. bronchiseptica isolates were piperacillin (MIC for 90% of isolates tested, 4 µg/ml) and tetracycline (MIC for 90% of isolates, 2 µg/ml). A number of agents were highly active against the B. avium isolates, with the notable exception of tetracycline and trimethoprim-sulfamethoxazole.

The results of the MIC determinations correlate closely with recent reports (1, 4, 5, 8, 12), and similar results with disk diffusion methods were observed (9). Although, we report slightly lower trimethoprim-sulfamethoxazole and tetracycline MICs for 90% of isolates than Kurzynski and associates, the range of MICs is essentially the same (8).

The objective of the present study was to characterize the antimicrobial susceptibility patterns of two species of Bordetella that are commonly isolated from animals. These two species of Bordetella have some similarities in their antimicrobial susceptibilities, along with some notable differences. Because of these differences and the lack of uniform in vitro susceptibility of all isolates, adequate therapy may require antimicrobial susceptibility testing.

LITERATURE CITED