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## Most common pathogenic bacteria and their antimicrobial resistance in pigs

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Pathological material from pigs was investigated in the Veterinary Institute of Lithuanian Veterinary Academy and National Veterinary Laboratory during a 5-year period. Pathological material was investigated under suspicion of infections caused by pathogenic bacteria with the aim to isolate them and to determine their resistance to antimicrobials. In Lithuanian pig farms, among pathogenic and opportunistic bacteria most frequently *E. coli* and *Salmonella* spp. 176 strains of *E. coli* and 122 strains of *Salmonella* were isolated. The most common serotypes of *E. coli* were 08:K87, 0141:K85, and 0149:K91. Most of them contained fimbrial antigens F4, F5 or F6. *S. Choleraesuis* (79%) was the most common serovar among *Salmonella*. The highly pathogenic *S. Enteritidis* and *S. Typhimurium* were infrequent (respectively 3.3% and 2.5%). The HAP group (*Haemophilus*, *Actinobacillus* and *Pasteurella*) bacteria were also rather widespread: 84 strains of this group were isolated. The most frequent pathogens were *Actinobacillus pleuropneumoniae*, *Haemophilus parasuis* and *Pasteurella multocida*.

The bacteria isolated from pigs were comparatively resistant to antimicrobials. *E. coli* and *Salmonella* spp. were most susceptible to polymyxin B and fluoroquinolones. The resistance to other antimicrobials was higher, especially to lincomycin-spectinomycin and aminoglycosides.

25% of staphylococci were resistant to penicillin, and 50% of streptococci were resistant to gentamicin. Bacteria of the HAP group were susceptible to many antimicrobials. All investigated *Pasteurella multocida* were tetracycline-sensitive, whereas *Haemophilus* and *Actinobacillus* spp. were susceptible to chloramphenicol, ceftiofur and polymyxin B.

**Key words:** antimicrobials, *E. coli*, HAP, resistance, *Salmonella*

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### INTRODUCTION

Pathogenic bacteria are important in the etiology of pig diseases and cause great economical losses [18]. Bacteria can cause diseases by themselves or in association with viruses, mycoplasmas or other microorganisms. Some studies of infectious diseases in Lithuanian pig farms were carried out. Species of pathogenic bacteria, mycoplasmas, chlamydias or viruses were investigated [9, 11, 16, 24, 28, 29]. Bac-

teria occupy one of the most important places among all pathogens, particularly by their adaptability and ability to resist unfavourable environment.

Resistance of bacteria to antimicrobials has recently become a question of topical importance. Research works on this subject appear all over the world. Some works put emphasis on separate species or genera [6, 21, 26, 30] of bacteria, others concentrate on the resistance of bacteria to separate antibiotics or their groups [13, 25]. Of great im-

portance are studies on the sensitivity of pathogenic bacteria in different regions or countries [3]. Symposia and conferences devoted to the theme of resistance to antibiotics are held [27, 31]. Lithuania has not so far developed an apparent strategy to ensure the prudent use of antibiotics for veterinary purposes. The aim of the present work was to elucidate the most widespread pathogenic bacteria in Lithuanian pig farms and determine their resistance to antimicrobials.

## METHODS AND CONDITIONS

The pathological material of pigs was provided from different Lithuanian districts. Investigations were carried out at the Veterinary Institute of Lithuanian Veterinary Academy and in National Veterinary Laboratory.

Bacteriological investigations were done using classical methods. The common media for isolation of bacteria were used: Tryptone Soy Agar, Tryptone Soy Broth, Nutrient Agar (Oxoid, Lab-M, England) and analogues. For cultivation of different bacteria, selective media were used: Endo Agar, SS Agar, Perfringens Agar Base (Oxoid, Lab-M, England), as well as adequate ingredients and needful supplements. For cultivation of fastidious bacteria, growth factors were used (Nicotinamide Adenine Dinucleotide (Sigma)). For isolation of staphylococci Manite Salt Agar (Oxoid, England), Baird Parker Medium (Lab M, England) and of streptococci Columbia Broth (BBL, USA), Eugon Agar (bio Merieux, France) were used. *E. coli* were incubated at 43 °C with the aim to inhibit the growth of saprophytic *E. coli*. Identification of isolated bacteria was done according to their growth, biochemical properties, according to Bergey's Manual of Determinative Bacteriology [2]. Some experiments were based on standard methods, e.g., ISO standard for isolation of *Salmonella* (ISO 6579–1993). Bacteria difficult to cultivate on media (*Brachyspira hyodysenteriae*) were examined microscopically.

For determination of biochemical properties, carbohydrates and amino acids in test tubes with indicators, as well as the commercial systems Intersistem (Liofilchem, Italy) and Crystal (BBL, USA) were used. *Escherichia coli* and *Salmonella* were serotyped by drop on glass or latex agglutination test with commercial sera. For *Salmonella* typing, SIFIN (Germany) and for *E. coli* the Sanofi Diagnostics Pasteur (France), Oxoid (England) and Bundesinstitut Veterinärmed (Germany) sera were used.

The resistance to antimicrobials was determined by the method of diffusion in agar gel according to Kirby–Bauer [1]. Mueller Hinton Agar II and Haemophilus Test Medium (Oxoid, England) were used.

For inoculation into media, 0.5 McFarland units of bacterial suspension (for *Haemophilus* and *Streptococcus* 1 McFarland unit) were used. The pH of media was  $7.4 \pm 0.2$ . Antibiotic discs (Becton Dickinson, USA) were used and the results were interpreted with special tables of this manufacturer. The concentrations of antimicrobials were standard: penicillin 10 U, oxacillin 1 µg, chloramphenicol 30 µg, enrofloxacin 10 µg, gentamicin 10 µg, polymyxin B 300 U, streptomycin 10 µg, tetracycline 30 µg, cefotiofur 30 µg. Resistance of the isolated bacteria to antimicrobials was determined.

## RESULTS AND DISCUSSION

Investigations involved 35 pig farms from all regions of Lithuania. Data listed in Table 1 reveal the most common pathogenic bacteria in pigs. *E. coli* was the most widespread pathogenic bacteria in Lithuanian pig farms: 176 *E. coli* isolates were obtained (19%) from 925 tested pigs, and 156 strains of isolated *E. coli* were serotyped; 20 strains did not agglutinate with agglutinating sera. According to the data of Table 2, the most widespread serotypes of *E. coli* were 0141:K85, 08:K87 and 0149:K91. Most of ETEC (enterotoxigenic) *E. coli* contained fimbrial antigens F4, F5 or F6. *E. coli* of serotype 0157

Microorganism genus	Number of investigated animals and isolated strains		
	Investigated	Isolated	%
<i>Salmonella</i> spp.	1237	122	9.9
<i>E. coli</i>	925	176	19.0
<i>Pasteurella multocida</i>	394	34	8.6
<i>Actinobacillus</i> and	256	50	19.5
<i>Haemophilus</i> spp.			
<i>Clostridium</i> spp.	134	15	11.2
<i>Staphylococcus</i> spp.	288	45	15.6
<i>Streptococcus</i> spp.	230	45	19.6

Serovar	Number of isolated strains
<i>S. Typhimurium</i>	3
<i>S. Derby</i>	2
<i>S. Agona</i>	1
<i>S. Choleraesuis</i>	96
<i>S. Enteritidis</i>	4
<i>S. London</i>	2
04 group	6
Not serotyped	8

has not so far been isolated in Lithuania. These serotypes are also widespread in all countries and our data coincide with the data of other authors [20].

There are different *E. coli* categories associated with animal colibacillosis such as enterotoxigenic, verotoxigenic, attaching and effacing, septicemic, uropathogenic. Enterotoxigenic *E. coli* is the most common category in pigs. This category includes serotypes that affect newborn piglets and cause extraintestinal disease in preweaned and weaned pigs, manifested clinically by sudden death and pathologically by lesions caused by endotoxic shock. These strains most often belong to serotypes O8, O149, and O157 and are gene probe positive for haemolysin, K88 (F4) fimbriae, heat-labile enterotoxin I (LT-I), and heat-stable enterotoxin b (STb) [10]. Most of *E. coli* isolated by us contained these antigens, particularly K88 (F4). Verotoxigenic *E. coli* was associated with oedematous disease in 4–8 week old pigs [23].

In the last years, agents of pig salmonellosis were also rather widespread. 122 strains of *Salmonella* (9.9%) were isolated from 1237 pigs. So far, the variety of *Salmonella* serovars in Lithuanian farms has been small. The most widespread serovar was *S. Choleraesuis* (79%) (Table 3). The genus *Salmonella* consists of two species: *S. enterica* and *S. bongori*. Species names were arbitrarily given to serovars for convenience reasons in medical practice. The serovar *S. Choleraesuis* depends to the species *Salmonella enterica* subsp. *enterica*. Analogous data are presented also by authors from the neighbouring countries. For example, in Poland in 2001 19 isolates from 33 depended to the serovar *Salmonella Choleraesuis* [14]. In recent years, new and by far more variable *Salmonella* serovars have been registered in Lithuania. This may be accounted for by an increasing flow of animal products and fodder imported from other countries. Data from other

countries about salmonella serovars' prevalence vary. There is a great variety of salmonella serotypes in some countries, particularly in the U.S.A [5]. At present, more than 2500 *Salmonella* serovars are known. Most of them are extremely rare. Only a few serovars (e.g., Enteritidis, Typhimurium, Choleraesuis, Hadar, etc.) are distributed worldwide and are important from the epidemiological point of view.

*Salmonella Choleraesuis* preferentially infects pigs and can cause increased morbidity and mortality resulting in millions of lost income for the pork industry. This serovar is more common in Eastern Europe. However, in West European countries *Salmonella Typhimurium* replaced this serovar.

*Salmonella* and *E. coli* can be mentioned as the most common agents of digestive tract infections [15], although the primarily intestinal bacteria, *Salmonella* and *Escherichia coli*, are widespread in the environment and commonly found in farm effluents, sewage and in any material subject to faecal contamination. Salmonellosis and colibacillosis have been recognized in all countries, but they appear to be most prevalent in areas of intensive animal husbandry, especially poultry or pigs and dairy cattle reared in confinement. Salmonellosis and colibacillosis can affect all species of domestic animals; young animals, pregnant and lactating animals are those most susceptible. Some serotypes only affect certain hosts, e.g., *S. Choleraesuis* or *E. coli* O149:K91 in pigs, although most serotypes may cause a disease in a wide range of animal species. Enteric disease is the commonest clinical manifestation, but a wide range of clinical signs that include acute septicaemia, abortion, arthritis and respiratory disease may be seen. Many animals, however, may also be infected but show no clinical illness. Such animals may be important in relation to the spread of infection among the herds and as causes of human food poisoning.

Bacteria of the HAP group are rather widespread in Lithuanian pig farms. Fifty *Haemophilus* and *Actinobacillus* isolates were obtained (19.5%) from 256 pigs. *A. pleuropneumoniae* and *H. parasuis* are equally widespread, *P. multocida* is more infrequent (34 strains (8.6%) were isolated). *P. multocida* in most cases acts as the secondary agent. Only in one case highly virulent *Pasteurella* was isolated from the blood.

Forty-five strains of *Staphylococcus* and the same number of *Streptococcus* were isolated (15.6% and 19.6%, respectively). The most widespread among staphylococci (pathogenic in pigs) were *S. hyicus* and *S. aureus*. The isolated streptococci belonged to different groups.

Among clostridia the most frequent was *C. perfringens*, type C.

Table 3. Serotypes of *E. coli* isolated from pigs (n = 156)

Serotype	Number of isolated strains
O8:K87	20
O9:K35	6
O78:K80	8
O108:K-	12
O138:K81	15
O139:K82	4
O141:K85	42
O147:K89	3
O149:K91	25
ETEC containing fimbrial antigens (F4, F5, F6)	21

Investigations of swine dysentery were carried out by the method of microscopy of 292 tests, 41 cases (14.0%) were positive.

*Leptospira* is also rather widespread in some farms. According to the data of National Veterinary Laboratory, the serological tests of 10048 pigs carried out in 1999 revealed that 900 of them were seropositive (8.9%), though this disease was proved neither clinically nor pathologically.

Results of bacterial resistance to antimicrobials are shown in Tables 4–9. As one can see from Table 4, the smallest number of *E. coli* isolates were resistant to polymyxin B (4.8%), enrofloxacin (8.3%) and ceftiofur (9.0%). Fifteen strains (27%) were resistant to three or more different groups of antimicrobials.

The smallest number of *Salmonella* (Table 5) was resistant to polymyxin B (0%), neomycin (15.4%) and gentamicin (17.4%). The greatest number of *Salmonella* were susceptible to polymyxin (80%), ampicillin (70%), chloramphenicol and enrofloxacin (66.6%).

*Pasteurella* (Table 6) was most susceptible to tetracycline (100.0%), enrofloxacin (91.0%) and ceftiofur (85.7%).

Bacteria of the *Actinobacillus-Haemophilus* group are very susceptible to many antimicrobials (Table 7).

These bacteria demonstrated a 100% susceptibility *in vitro* to ceftiofur, polymyxin B and chloramphenicol.

Of all staphylococci, 75% were susceptible to penicillin (Table 8). However, even one fourth of them were penicillin-G resistant. All staphylococci were susceptible or medium susceptible to aminoglycosides except streptomycin (25% resistant).

Antimicrobial	Number of strains tested	Resistance					
		Susceptible	%	Resistant	%	Intermediate	%
Ampicillin	31	19	61.3	8	25.8	4	12.9
Chloramphenicol	22	10	45.5	12	54.5		
Gentamicin	47	15	31.9	17	36.1	15	31.9
Neomycin	43	17	39.5	9	20.9	17	39.5
Polymyxin B	21	15	71.4	1	4.8	5	23.8
Tetracycline	26	4	15.4	16	61.5	6	23.0
Enrofloxacin	48	35	72.9	4	8.3	9	18.6
Linco-Spectin	45	23	51.0	15	33.3	7	15.5
Ceftiofur	11	8	72.7	1	9.0	2	18.2
Sulfamethoxazole-trimethoprim	9	2	22.2	6	66.6	1	11.1

Antimicrobial	Number of strains tested	Resistance					
		Susceptible	%	Resistant	%	Intermediate	%
Ampicillin	20	14	70.0	5	25.0	1	5.0
Chloramphenicol	18	12	66.6	6	33.3		
Gentamicin	23	12	52.1	4	17.4	7	30.4
Neomycin	26	14	53.8	4	15.4	8	30.7
Polymyxin B	10	8	80.0	0	0	2	20.0
Tetracycline	18	4	22.2	9	50.0	5	27.7
Enrofloxacin	24	16	66.6	5	20.8	3	12.5
Linco-Spectin	25	15	60.0	8	32.0	2	8.0

Antimicrobial	Number of strains tested	Resistance					
		Susceptible	%	Resistant	%	Intermediate	%
Ampicillin	12	8	66.6	0	0	3	25.0
Gentamicin	7	1	14.2	1	14.2	5	71.4
Neomycin	11	7	63.6	0	0	4	36.4
Tetracycline	7	7	100.0	0	0	0	0
Enrofloxacin	11	10	91.0	0	0	1	9.0
Linco-Spectin	11	6	54.5	3	27.2	2	18.1
Ceftiofur	7	6	85.7	0	0	1	14.2

Table 9 contains data on the resistance of *Streptococcus* to antimicrobials. No streptococci resistant to penicillin were isolated, but 29.4% of them were medium susceptible; 29.2% were resistant to neomycin and even half of the strains were resistant to gentamicin and lincomycin-spectinomycin. Faecal streptococci demonstrated the highest resistance.

Table 7. *Actinobacillus-Haemophilus* resistance to antimicrobials (n = 13)

Antimicrobial	Number of strains tested	Resistance					
		Susceptible	%	Resistant	%	Intermediate	%
Ampicillin	8	7	87.5	1	12.5	0	0
Gentamicin	10	3	30.0	1	10.0	6	60.0
Neomycin	12	4	33.3	2	16.6	6	50.0
Tetracycline	7	6	85.7	0	0	1	14.3
Enrofloxacin	12	7	58.3	2	16.6	3	25.0
Linco-Spectin	11	8	72.7	2	18.2	1	9.0
Ceftiofur	4	4	100.0	0	0	0	0
Chloramfenicol	5	5	100.0	0	0	0	0
Polymyxin B	8	8	100.0	0	0	0	0

Table 8. *Staphylococcus* resistance to antimicrobials (n = 11)

Antimicrobial	Number of strains tested	Resistance					
		Susceptible	%	Resistant	%	Intermediate	%
Ampicillin	8	6	75.0	1	12.5	1	12.5
Gentamicin	8	7	87.5	0	0	1	12.5
Neomycin	10	7	70.0	0	0	3	30.0
Tetracycline	6	3	50.0	3	50.0	0	0
Enrofloxacin	11	10	91.0	1	0	0	9.0
Linco-Spectin	7	4	57.1	2	28.6	1	14.3
Penicillin	8	6	75.0	2	25.0	0	0
Streptomycin	8	3	35.1	2	25.0	3	37.5

Table 9. *Streptococcus* resistance to antimicrobials (n = 31)

Antimicrobial	Number of strains tested	Resistance					
		Susceptible	%	Resistant	%	Intermediate	%
Ampicillin	25	24	96.0	0	0	1	4
Gentamicin	20	5	25.0	10	50.0	5	25
Neomycin	24	9	37.5	7	29.2	8	33.3
Tetracycline	11	3	27.3	7	63.7	1	9.1
Enrofloxacin	27	12	44.4	3	11.1	12	44.4
Linco-Spectin	23	9	39.1	12	52.2	2	8.7
Ceftiofur	11	8	72.7	1	9.1	2	18.2
Penicillin	17	12	70.6	0	0	5	29.4
Sufamethoxazole-trimethoprim	9	2	22.2	3	33.3	4	44.4

Among pathogenic bacteria able to cause diseases in pigs, *E. coli* and *Salmonella* spp. are belong to those most widespread in Lithuania. The serotype variety of these bacteria is not great. However, the developing trade relations with other countries contribute to the increasing variability of these serotypes. No such dangerous bacteria as toxigenic *E.*

*coli* 0157:H7 or multiresistant *Salmonella* Typhimurium DT 104 have been isolated in Lithuania. There is a strong tendency showing that every year the isolation of salmonella from pigs decreases, most probably because of the strong politics of the Food and Veterinary Service, as monitoring of eradication of salmonellosis in Lithuania has been implemented. The resistance of *Salmonella* to different antimicrobials is rather variable. For this reason any treatment in farms requires an antibiogram.

The most widespread agents of pulmonary diseases belonged to the HAP group. *A. pleuropneumoniae* most frequently acts as an agent of infectious diseases and *Pasteurella multocida* as a secondary agent. Though bacteria of this genus are rather sensitive to ambient factors and chemicals they can be resistant to some antibiotics. There are evidences that the level of resistance may be rather high. For example, in Switzerland 97–100% of *Pasteurella multocida* strains – depending on toxigenity – were resistant to lincomycin.

Data on the prevalence of *Haemophilus parasuis* in Lithuania are rather scanty. However, this agent most often causes diseases in piglets after stresses (weaning).

As the more modern identification methods of bacteria as, for example,

PCR have been introduced in Lithuania not long ago, there are no generalized data on some bacterial diseases caused by the agents that are difficult to cultivate on nutrient media. However, judging from clinical manifestations, the course of disease, pathological anatomical changes and results of serological tests we may assume that in Lithuanian pig

farms the cases of leptospirosis, swine dysentery, proliferative ileitis and mycoplasmosis are not infrequent. Some bacterial diseases occur only in separate pig-breeding farms as a result of vaccination (erysipelas). These diseases are important in pig-breeding farms worldwide [5, 8, 10, 14, 23].

Bacteria isolated from pigs are comparatively resistant to antimicrobials. *Enterobacteriaceae* (*Escherichia coli* and *Salmonella* spp.) were most susceptible to polymyxins and fluoroquinolones. They showed an increasing resistance to other antimicrobials such as lincomycin-spectinomycin and aminoglycosides in particular. Bacteria of the HAP group were susceptible to many antimicrobials. There are variable data on antimicrobial resistance of different bacteria in different regions. It depends on a geographical region, the politics of using antimicrobials and on some other factors. Our data differ not much from data obtained in other countries [7, 8, 12, 13, 19, 22, 25]. For example, in Poland 63% of isolated *Salmonella* Choleraesuis were multiresistant [14]. Some species of bacteria are more resistant in Lithuania; others are more susceptible. Data from Lithuania are not sufficient to make a clear statistical analysis or to compare these data with analogous data from different regions, particularly in the countries in which the monitoring of bacterial resistance has been performed for many years.

Microbial resistance to antibiotics is a worldwide problem in human and veterinary medicine. It is generally accepted that the main risk factor for the increase in the antibiotic resistance is an extensive use of antibiotics. This has led to emergence and dissemination of resistant bacteria and resistance genes in animals and humans. In both populations antibiotics are used for therapy and prophylaxis of infectious diseases [4]. Most of resistance-increasing medicines, in regard to human health, are used in the health care sector. The antimicrobial agents used in animal care are also significant, not only in the sense of increasing the resistance in animal pathogens but also in bacteria transmitted from animals to humans [17].

## CONCLUSIONS

1. *E. coli* and *Salmonella* spp. were the most frequently isolated bacteria in pig farms. 79% of isolated *Salmonella* belonged to the serovar *Salmonella choleraesuis*. The most common serotypes among *E. coli* were 0141:K85, 08:K87 and 0149:K91.

2. *Haemophilus suis*, *Actinobacillus pleuropneumoniae* and *Pasteurella multocida* were the most common pathogens among the agents of respiratory disorders in pigs. Bacteria of this group were suscep-

tible to many antimicrobials used in veterinary practice.

3. Some pathogenic bacteria, particularly *Salmonella* spp. and *E. coli*, tend to be more resistant to antimicrobials than others.

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#### LABIAUSIAI PAPTITUSIOS PATOGENINĖS BAKTERIJOS KIAULĖSE IR JŲ ATSPARUMAS ANTIMIKROBINĖMS MEDŽIAGOMS

#### S a n t r a u k a

Lietuvos veterinarijos akademijos Veterinarijos institute ir Nacionalinėje veterinarijos laboratorijoje buvo atlikti kiaulių patloginės medžiagos bakteriologiniai tyrimai siekiant nustatyti labiausiai paplitusias patogenines ir sąlyginai patogenines kiaulėms bakterijas. Tyrimams medžiaga paimta iš kiaulių patloginių parenchiminių organų bei kai kuriais atvejais iš tų vietų, kuriose tikimybė išskirti įtariamus sukėlėjus buvo didžiausia. Tyrimai atlikti įtarus, kad kiaulių infekcines ligas sukėlė patogeninės arba sąlyginai patogeninės bakterijos. Nustatytas išskirtų bakterijų atsparumas antimikrobinėms medžiagoms. Tyrimais buvo nustatyta, kad kiaulių fermose labiausiai paplitusios *E. coli* rūšies bakterijos. Išskirti 176 šios rūšies bakterijų izoliatai. Iš jų dažniausios buvo O141:K85, O149:K91 ir O8:K87 serotipų ešerichijos. Dauguma iš jų turėjo adhezyvinius antigenus F4, F5 arba F6. Išskirti 122 salmonelių izoliatai. Net 79% išskirtų salmonelių padermių priklausė *S. Choleraesuis* serovariantui. Patogeninės *S. Enteritidis* ir *S. Typhimurium* išskirtos kur kas rečiau (atitinkamai 3,3 ir 2,5%). Dažnai kiaulių fermose parazituoja ir HAP grupės (*Haemophilus*, *Actinobacillus* ir *Pasteurella*) bakterijos. Išskirti 84 šių bakterijų izoliatai. Dažniausios šios grupės bakterijų rūšys buvo *Actinobacillus pleuropneumoniae*, *Haemophilus parasuis* ir *Pasteurella multocida*.

Iš kiaulių patloginės medžiagos išskirtos bakterijos *in vitro* buvo atsparios tam tikrų grupių antibiotikams ir kitoms antimikrobinėms medžiagoms. Salmonelės ir ešerichijos buvo jautriausios polimiksinams ir fluorochinolonams. Tuo tarpu pastebimas pakankamai didelis atsparumas kitoms antimikrobinėms medžiagoms, pavyzdžiui, linkomicinui, spektinomycinui, aminoglikozidų grupės antibiotikams. Ketvirtadalis išskirtų stafilokokų buvo atsparūs penicilinui, o net pusė tirtų streptokokų – gentamicinui. HAP grupės bakterijos buvo gerokai jautresnės įvairių grupių antimikrobinėms medžiagoms.

**Raktažodžiai:** antimikrobinės medžiagos, *E. coli*, HAP, atsparumas, *Salmonella*

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### БОЛЕЕ РАСПРЕДЕЛЕННЫЕ ПАТОГЕННЫЕ БАКТЕРИИ СВИНЕЙ И ИХ УСТОЙЧИВОСТЬ К АНТИМИКРОБНЫМ ВЕЩЕСТВАМ

#### Резюме

Бактериологические исследования патологического материала свиней проводились в Институте ветеринарии Литовской ветеринарной академии и Национальной ветеринарной лаборатории в течение пяти лет с целью выделить патогенные бактерии и установить их устойчивость в отношении антимикробных веществ. Исследования проводились во время вспышек заболеваний свиней при подозрении, что этиологическим фактором болезней являются патогенные или условно-патогенные бактерии. Бактериологические высевы осуществлялись из паренхиматозных органов, а в отдельных случаях – из тех мест, откуда выделить предполагаемые бактерии наиболее вероятно. Более всего выделено бактерий вида *E. coli*. Из них чаще всего устанавливали

серотипы O141:K85, O149:K91 и O8:K87. Часто они имели адгезионные антигены F4, F5 или F6. Также часто выделяли сальмонеллы. Самым распространенным сероваром сальмонелл был серовар *S. Choleraesuis* (79%). Патогенных *S. Enteritidis* и *S. Typhimurium* выделено намного реже (соответственно 3,3 и 2,5%). Довольно распространены были также бактерии группы НАР (*Haemophilus*, *Actinobacillus* и *Pasteurella*). Выделены 84 изолята этой группы, наиболее часто виды *Actinobacillus pleuropneumoniae*, *Haemophilus parasuis* и *Pasteurella multocida*.

Большинство выделенных сальмонелл и эшерихий *in vitro* были чувствительны к полимиксинам и фторохинолонам, но устойчивы к линкомицину, спектиномицину, антибиотикам группы аминогликозидов. Устойчивы к пенициллину были 25% стафилококков, а 50% стрептококков были устойчивы к гентамицину. Бактерии группы НАР были более чувствительны к антимикробным веществам разных групп.

**Ключевые слова:** антимикробные вещества, *E. coli*, НАР, устойчивость, *Salmonella*