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TABLE OF CONTENTS

AGRICULTURAL SCIENCES

1. *Hryhoriv Ya., Maidanskyi A.* 14
THE PRODUCTIVITY OF SPRING WHEAT IN THE WESTERN REGION OF UKRAINE
2. *Sokolovska I. M., Koreniuk L. M.* 18
YIELD OF SOYBEANS DEPENDING ON PREDECESSORS AND FERTILIZATION SYSTEMS IN THE CONDITIONS OF THE NORTHERN STEPPE OF UKRAINE
3. *Забалуєва Д. Т., Артемчук І. П.* 23
ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ БІОЛОГІЧНИХ ПРЕПАРАТІВ ДЛЯ ЗАХИСТУ РОСЛИН СОЇ ВІД ГРИБНИХ ХВОРОБ
4. *Сніжок О. В., Першута В. В.* 29
ЗАЛЕЖНІСТЬ ФІТОСАНІТАРНОГО СТАНУ ПОСІВІВ СОНЯШНИКУ ВІД ПОГОДНИХ УМОВ
5. *Юркевич Є. О., Валентюк Н. О., Дяченко С. П., Дімов С. П.* 34
УРОЖАЙНІСТЬ ЗЕРНА ГОРОХУ ТА ЙОГО ЯКІСТЬ В ЗАЛЕЖНОСТІ ВІД ЗАСТОСУВАННЯ БІОДЕСТРУКТОРІВ В ЕКОЛОГІЧНОМУ ЗЕМЛЕРОБСТВІ
6. *Юркевич Є. О., Валентюк Н. О., Бистров В. О.* 41
ЕФЕКТИВНІСТЬ ВПЛИВУ ПОЗАКОРЕНЕВОГО ПІДЖИВЛЕННЯ НА УРОЖАЙНІСТЬ ТА ЯКІСТЬ НАСІННЯ ВИСОКООЛЕЇНОВОГО ГІБРИДУ СОНЯШНИКУ В СТЕПУ УКРАЇНИ
7. *Юркевич Є. О., Валентюк Н. О., Дяченко С. П., Теслюк М. М.* 47
ВПЛИВ МІНІМІЗАЦІЇ ОСНОВНОГО ОБРОБІТКУ ҐРУНТУ ПІД ПШЕНИЦЮ ОЗИМУ НА ЇЇ ПРОДУКТИВНІСТЬ В УМОВАХ СТЕПУ УКРАЇНИ

BIOLOGICAL SCIENCES

8. *Волюков Ю. М., Старосила Є. В.* 54
МЕТАУГРУПОВАННЯ РІЗНОТИПНИХ ВОДНИХ ОБ'ЄКТІВ: ОСОБЛИВОСТІ ВЗАЄМОДІЙ ВІЛЬНОЖИВУЧИХ ТА СИМБІОТИЧНИХ СКЛАДОВИХ ЛОКАЛЬНИХ УГРУПОВАНЬ ГІДРОБІОНТІВ
9. *Давидов О. А., Козійчук Е. Ш., Григор'єва Г. Є., Жорова А. В.* 61
ДОМІНУЮЧІ КОМПЛЕКСИ МІКРОФІТОБЕНТОСУ ТА ФІТОЕПІФІТОНУ ЗАТОК ВЕРХНЬОЇ ДІЛЯНКИ КАНІВСЬКОГО ВОДОСХОВИЩА

MEDICAL SCIENCES

10. *Cherkasova V. S., Vovk O. O., Kovalenko N. I.* 65
ANALYSIS OF ANTIBIOTIC RESISTANCE OF *K. PNEUMONIAE* IN LOWER RESPIRATORY TRACT DISEASES

MEDICAL SCIENCES

ANALYSIS OF ANTIBIOTIC RESISTANCE OF *K. PNEUMONIAE* IN LOWER RESPIRATORY TRACT DISEASES

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Introductions. Respiratory tract infections cause significant morbidity and mortality globally and are the most common infectious diseases in humans. *Klebsiella pneumoniae* is a concerning pathogen that can cause life-threatening infections in otherwise healthy individuals. Importantly, although strains of *K. pneumoniae* have been acquiring antimicrobial resistance, the effect on virulence is unclear. Increasing antimicrobial drug resistance can limit the choice of antibiotics used for the treatment of infectious diseases and further poses a negative impact on patient outcome.

Aim. Analysis of the results of monitoring antibiotic resistance of *K. pneumoniae* isolated from patients with diseases of the lower respiratory tract.

Material and methods. The work uses the results of the study of microorganisms isolated from patients with pathology of the lower respiratory tract, who were treated at the Pulmonology regional diagnostic center in Lviv. Clinical material – sputum, lavage, washing water obtained during bronchoalveolar lavage. An automatic bacteriological analyzer Vitec-2 compact bioMarieux (France) was used to identify isolated pure cultures of bacteria and determine the sensitivity of bacteria to antibiotics.

The calculation of indicators for assessing the effectiveness of the administration of antimicrobial drugs was carried out in accordance with Order No. 1614 dated 03.08.21 "On the organization of infection prevention and infection control in health care institutions and institutions providing social services/social protection of the population".

Results and discussion. The work analyzed the resistance of *Klebsiella pneumoniae* to several groups of antibiotics, namely penicillins, including combined, cephalosporins, carbapenems, fluoroquinolones, aminoglycosides, tetracyclines, macrolids, polyenes (table). The largest number of resistant strains was found to penicillins, including those combined with beta-lactamase inhibitors (benzylpenicillin– 67 % of resistant strains, piperacillin+tazobactam – 57 %, amoxicillin+clavulanic acid – 41 %). Next were representatives of fluoroquinolones, to which 30-31 % (for ciprofloxacin and levofloxacin) and 37 % of the studied strains (for moxifloxacin) were resistant. Macrolide antibiotics azithromycin and clarithromycin were ineffective in 27 and 41 % of cases, respectively. The frequency of resistant isolates to cephalosporins ranged from 15 % (to ceftriaxone) to 27 % (to cefotaxime and ceftazidime). Aminoglycoside antibiotics had slightly lower rates of *Klebsiella pneumoniae* resistance to them, namely: amikacin – 15 %, gentamicin – 16 %, tobramycin – 24 %. The results for carbapenems were compared with them (imipinem – 16 %, meropenem – 21% of resistant strains).

Table

Antimicrobial resistance indicators of *Klebsiella pneumoniae*, isolated from patients with lower respiratory tract pathology

Antibiotic	Total isolates	Frequency of drug resistant isolates, %	Frequency of antibiotic consumption	Antimicrobial resistance
Azithromycin	33	27	0,03	0,008
Clarithromycin	29	41	0,03	0,01
Amikacin	384	15	0,01	0,001
Gentamicin	345	16	0,001	0,0002
Tobramycin	243	24	0,0001	0,00002
Amoxicillin+clavulanic acid	51	41	0,02	0,008
Piperacillin+tazobactam	46	57	0,01	0,005652
Benzylpenicillin	6	67	0,0007	0,0005

Imipenem	352	16	0,008	0,001
Meropenem	338	21	0,1	0,021006
Cefepime	320	25	0,08	0,02
Cefotaxime	90	27	0,05	0,013333
Ceftazidime	356	27	0,01	0,002725
Ceftriaxone	13	15	0,04	0,006154
Levofloxacin	114	31	0,4	0,122807
Ciprofloxacin	349	30	0,0004	0,00012
Moxifloxacin	71	37	0,02	0,007324
Colistin	46	2	0,0003	0,00001
Doxycycline	11	9	0,0002	0,00002

The greatest sensitivity of *Klebsiella pneumoniae* was shown to doxycillin and colistin (9 and 2 % of resistant strains, respectively).

When taking into account the frequency of antibiotic consumption, resistance indicators change significantly. Due to the high frequency of consumption of levofloxacin (0,4) and meropenem (0,1), their antimicrobial resistance indices were the highest (0,122807 and 0,021006, respectively). The next significant indicator of resistance was detected for cefepime, which had a consumption frequency of 0,08 and a resistance index of 0,02. The frequency of consumption of amoxicillin+clavulanic acid and piperacillin+tazobactam was lower. However, with a significant number of isolated resistant strains, their index was also quite high (0,008 for amoxicillin+clavulanic acid and 0,0056 for piperacillin+tazobactam). In the case of macrolids, the rather high values of the resistance index (0,008 for azithromycin and 0,01 for clarithromycin) were influenced by both the significant number of resistant strains and the frequency of consumption (0,03).

The low frequency of consumption of ciprofloxacin (0,0004) and benzylpenicillin (0,0007) reduced the resistance indices, despite the rather high frequency of resistant isolates. Indices of antimicrobial resistance to tobramycin, doxycycline and colistin had the lowest values.

Conclusions. Levofloxacin and meropenem proved to be the least effective in antimicrobial resistance indices. Doxycycline and colistin with an insignificant frequency of resistant strains and a low frequency of consumption had the lowest resistance indices.