УДК 619:616.98:579.869.1+619:616.98:579.869.2:636

L.V. PEROTSKA, PhD of Veterinary Science
Odessa State Agrarian University
V.V. NEDOSEKOV, Doctor of Veterinary Science
National University of Life and Environmental Sciences of Ukraine, Kyiv

ECOLOGICAL-EPIZOOTIC FEATURES OF SAPRONOSE INFECTIONS (ON THE EXAMPLE OF LISTERIOSIS AND ERYSIPELAS)

The aspects of circulation of sapronose infectious agents in biocenoses have been presented; it is established that strains with high level of parasitic adaptation have stable pathogenicity and do not lose the ability to saprophytic existence, whereas purely parasitic infectious strains form infectious circles of circulation. The processes of adaptive adjustment of strains are constant and dynamically variable.

Throughout long history of eradication of infections, there emerged theoretically grounded opinion (which later received practical confirmation) that without elimination of the pathogen as a species in general or maximum limit of its circulation in the host population – *not only eradication of the disease but even reduction of its incidence is impossible.*

This theory was almost accepted because the most widespread diseases – parasitoses – became the object of attention of specialists designed to deal with epizootics and epidemics. The nature of epizootic manifestation of these diseases due to high contagiousness is implemented by the apparent chain handover and distribution of «catching principle» from a sick organism to a susceptible one on the triple basis: the sick (the source of the pathogen) – transmission – a sensitive body, and further in the same way. It was assumed that all of the infectious agents are parasites, and environment plays no role in the biology of all pathogens at all, i.e. it serves only as a passive factor of transmission. That's why there was no doubt in the infectiousness and exogenous origin of infection. The rest of the phenomena of infectious pathology took a back seat.

But at the same time, during the period of formation and ambitious dominance of dogmas concerning the *mechanism of infection transmission*, there have always been enough questions and other views expressed by the acknowledged coryphaeus of epizootology, epidemiology and microbiology. In particular, M. Gamaleia (1939) once remarked: «It is impossible to assume that throughout all the evolution natural selection kept with persistent perseverance the huge mass of microbes, if they were accidental or harmful». The scientist's view induced to more thorough study of the ecological characteristics of microorganisms.

The perception of infectious diseases that may be caused by natural inhabitants of the environment (which are not parasites but lead free lifestyle) became the significant achievement and parity of the national science. The basis of this idea was the scientific work of D. Zabolotny (1899), E. Pavlovsky (1939). At that time the theory of natural focality of certain diseases of animals and humans was formulated [10].

The new stage of development of theory of natural focality of diseases is historically associated with V. Terskykh's (1958) scientific papers on sapronoses, natural reservoirs of pathogens of which are substrates of the environment [15]. However, as a result of destructive criticism of L. Gromashevsky, the doctrine on sapronoses wasn't supported by the epizootologists and epidemiologists of that time and was completely excluded from the scientific use and discarded for many years.

The rapid development of research on the ecology of pathogens in the environment beginning from 70–90s years of the last century and to this day has reinforced the doctrine of sapronoses while aligning it with the doctrine of natural focality of infectious diseases (V. Litvin, G. Somov, V. Pushkareva, V. Belyakov, V. Makarov, L. Kornienko and others) [5, 7, 8, 11, 14, 16].

Recent achievements have allowed to restore a parity between the two major environmental categories of contagious diseases – parasitoses and sapronoses that have great both scientific and practical importance.

The purpose of research. Disclosure of environmental and epizootic mechanisms of sapronose infections pathogens circulation in the northwestern Black Sea.

The subject of research – is environmental epizootic patterns of existence and circulation of pathogens of saprozoonose infections on example erysipelas and listeriosis.

MATERIALS AND METHODS

The materials of the research were: reporting documentation of SCVM for 1990–2012, the conception of ecological development of agricultural production, modern information of the world organizations OIE, WHO, FAO provided in the press [9, 12, 13, 16].

In the process of research the well-known methods of biological, environmental and epizootic studies and statistical analyzes were used.

RESEARCH RESULTS

According to current data, *sapronoses* are infections caused by pathogenic saprophytes.

For sapronose agents it is typical to have two ecological phases – parasitic and saprophytic (the ability to autonomous existence of populations in the ecosystems of soil, water and other substrates of the environment) and environmental specificity, which is expressed in a variety

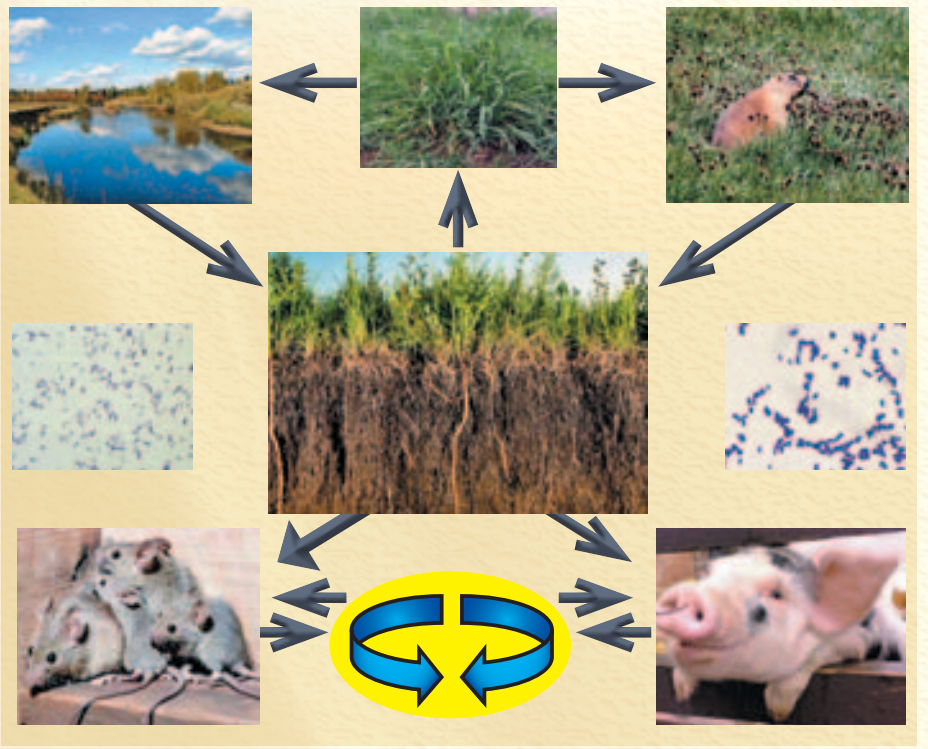

Fig. 1. Circulation of natural strains of microorganisms with minimal pathogenicity

of sudden changes in their habitat conditions [6].

Among dangerous sapronoses, such nosoforms as erysipelas and listeriosis attract special attention which have zoonotic properties and can affect animals and humans. The traditional epizootic and epidemiological aspects of these infections do not fit the realities of the current level of science. Thus, it is quite unclear why these organisms have both saprophytic and parasitic properties, besides, it is unclear why they spread among domestic animals but don't affect wild animals.

So, without a thorough study of ecological characteristics of those microorganisms as individual species and ecosystem components, their consideration will not have essential information suitable for the understanding of various parameters of epizootic process.

In favor of the relevance of the raised issues is the fact that today outdated approaches to the development of conceptual frameworks for measures to eradicate and prevent infectious diseases are continued to use. Thus, the modern Ukrainian conception on eradication of infections includes provisions that generally do not correspond to reality and the nature of environmental principles of the existence of species. The destruction of the pathogen without regarding its role in the ecosystem is not successful and is almost impossible. So, to put such tasks means to risk the consequences, one of which is the state of human health and society.

It should be noted that functioning of living beings (their population) is constantly affected by a variety of factors (biotic, abiotic) that need their aggregate consideration. Thus, it is important to take into account the potential abilities of living beings, their resistance or sensitivity to these factors. Of particular importance is the environmental adaptability and responses of the organism (population) to the external environment [1–6, 8, 11].

Considering the situation in nature, the question arises how animals survive in the biocenosis, which holds the agent. Understanding of this phenomenon is achieved through a generalized analysis of current data on the ecology of pathogens and environmental ecosystems. According to these data, sapronose pathogens, whose typical representatives are Erysipelothrix and Listeria. They are the common components of natural biocenoses, inhabited by dense populations of rodents and ungulates, which are major consumers of vegetation. Excessive density of these animals contributes to the destruction of vegetation and undermines the ecosystem, so it includes a special fuse, such as Listeria and erysipelas bacillus. They are evolutionarily adapted to prolonged circulation and survival in the soil in the ground microbiocenoses. It is in the soil they are in a symbiotic relationship with plants (due to the inclusion of their root microflora) and penetrate from the soil solution in the capillary system of plants, moving to the end of leaflets. Eating plants by animals, even dry, leads to ingress of microorganisms in the intestine, where there are favorable conditions for mass reproduction and accumulation, satisfying microorganism, as a species, for periodic mass reproduction. An example is the presence of erysipelatous bacilli in the body of free-living murine rodents that form the vector pathogen reservoir, maintaining its circulation and existence. This symbiotic relationship is not broken, but saprophytes for survival in rodent body must have *special* properties which prevent their destruction by macrophages and antibodies. Thus, the microorganisms of the soil complex, such as Listeria and erysipelatous bacilli primarily use warm-blooded animals as a kind of incubator – accumulator that gives these microorganisms selective advantage over other soil types. Simultaneously, these pathogenic microorganisms with existing properties *(special)* «train» the immune system of warm-blooded animals and are a stable ecological community, destroying alien species for it (in the absence of these immune defense) that randomly or periodically fall into the territory of the biological community and could undermine its condition. Similarly, they also do at their home in case of over-breeding, because the immune status of the warm-blooded decline in too dense populations. This phenomenon occurs earlier than animals use all the food and will die of starvation. Thus, *infectious regulation* of populations of the warm-blooded and biological community as a whole, allows automatically to main-

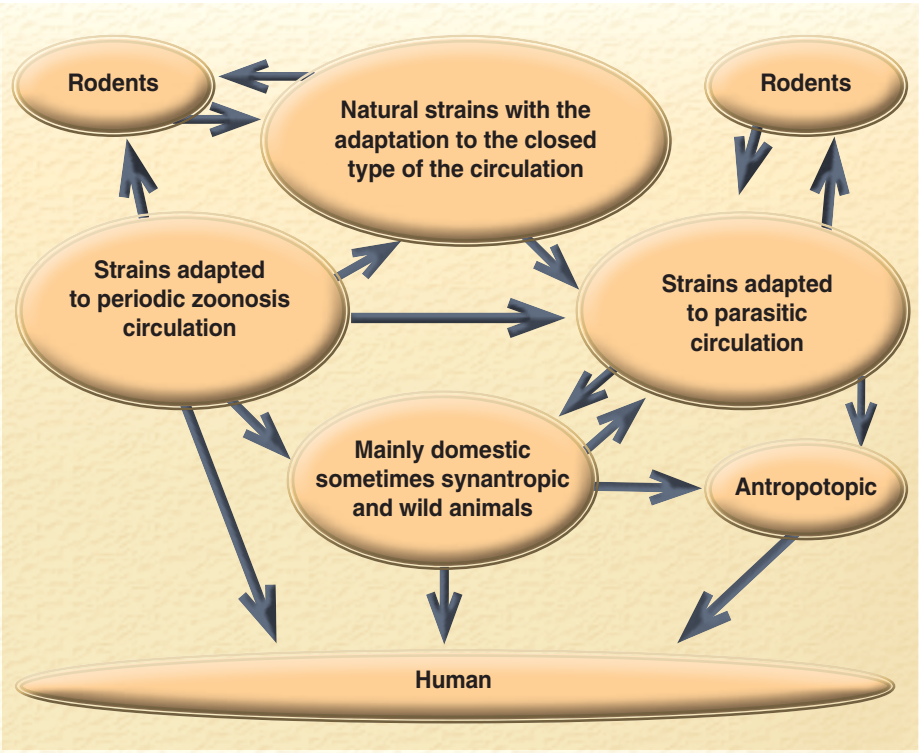

Fig. 2. The ways of agents spreading with different levels of pathogenicity

tain the composition of the ecosystem in any phase of its periods.

Such natural strains with minimal pathogenicity circulate in a closed circuit: rodents – soil – plant – rodents, maintaining this subsystem normal, being a *necessary component* for the ecosystem, ecological community and rodent populations (Fig. 1).

It is known that the population of the pathogen as any species is always *heterogeneous*, providing adaptation and survival of the species as a whole. Therefore, among the populations of Listeria and erysipelatous bacillus in natural ecosystems, strains with different levels of pathogenicity (for all occasions) are present. The most pathogenic of them are able to reach both humans and domestic animals due to soil and water, plant foods and vegetable crops, through rodents etc. In addition, they are able to reach a person through infected animals and products from them. Finally, some strains possessing strong parasitic adaptation had to continue to evolve as a parasite for which was typical specialization expressed in species specificity. Thanks to that fact, the particular strains are fully adapted to parasitism in certain types of animals or in humans (Fig. 2).

The examples are Listeria strains – agents of antroponotic forms of listeriosis, which are now actively circulating among people (being transferred sexually and alimentary by contact), having lost connection with the ground phases of existence. A similar phenomenon is demonstrated by the pathogenic strains of swine, which turned into explicit parasites and circulate exclusively among pigs as agents of septic infections. These agents are still likely to leave properties to short-term survival in the environment that would give them the advantage of a wide range of ways and factors of transmission to warm-blooded host, in case of activation of its population immunity.

Summing up the given data on environmental and epizootic gradation of strains in monospecies populations of saprophytic agents, it is possible to understand and explain all the problematic aspects of modern development processes of epizootic and epidemic situations with erysipelas and listeriosis. Taking into account the fact that their highly pathogenic strains adapted to animals and humans have lost dependence on natural mechanisms of regulation and became purely parasitic, it is possible to review the status and structure of the various reservoirs, sources, factors and modes of transmission of agents both in nature and in the stockbreeding and society, while detailing precisely ways and sources of human infection.

CONCLUSIONS

1. Epizootic aspects of circulation of saprozoonotic infections pathogens, including Listeria and Erysipelothrix, are based on complex multilevel mechanisms of their environmental adaptation to living in biocenoses of different levels of organization, state and composition of which determine the circles of circulation and their components.

2. Natural strains in stable primary biocenoses circulate in chains by type – rodents-soil-plants-rodents.

3. Strains with high parasitic adaptation have stable pathogenicity, but do not lose the ability to saprophytic existence, therefore, form a universal range of circulation, including soil and root communities, and warm-blooded animals.

4. Purely parasitic strains are hardly capable of saprophytic existence and form only infectious circles of circulation, based on direct transmission from infected to intact animals.

5. The processes of adaptive adjustment of strains are constant and dynamically variable.

THE LIST OF LITERATURE

1. **Беляков В.Д.** Саморегуляция паразитарных систем: (молекулярно-генетические механизмы) / В.Д. Беляков, Д.Б. Голубев, Г.Д. Каминский. – Л.: Медицина, 1987. – 240 с.
2. **Бузолева Л.С.** Выживаемость и адаптивная изменчивость штаммов Listeria monocytogenes в морской и речной воде / Л.С. Бузолева, В.Е. Терехова // Ветеринарная патология. – 2004. – № 4. – С. 31–35.
3. **Воронин Е.С.** Рожа свиней: профилактика и меры борьбы / Е.С. Воронин, М.В. Романова. – М.: ВНИИТЭИагропром, 1987. – 115 с.
4. **Гинцбург А.Л.** Некультивируемые формы бактерий и их роль в сохранении возбудителей сапронозов во внешней среде / А.Л. Гинцбург, Ю.М. Романова // Журнал микробиологии, эпидемиологии и иммунобиологии. – 1997. – № 3. – С. 116–121.

5. **Зайцева Е.А.** Распространение бактерий рода Listeria на территории Приморского края / Е.А. Зайцева // Ветеринарная патология. – 2004. – № 4. – С. 28–31.
6. **Коренберг Э.И.** Основы современных представлений о природной очаговости болезней / Э.И. Коренберг // РЭТ-ИНФО. – 2000. – № 3. – С. 18–20.
7. **Корнієнко Л.Є.** Сапронозні інфекційні хвороби тварин / Л.Є. Корнієнко, В.В. Недосєков, В.О. Бусол, Л.М. Корнієнко, В.О. Ушкалов, А.М. Головко. – Біла Церква, 2009. – 300 с.
8. **Литвин В.Ю.** Обратимый переход патогенных бактерий в покоящееся (некультивируемое) состояние: экологические и генетические механизмы / В.Ю. Литвин, А.Л. Гинцбург, В.И. Пушкарева и др. // Вестник РАМН. – 2000. – № 1. – С. 7–13.
9. **Отчет** ВОЗ по зоонозам / Доклад комитета экспертов ВОЗ // Серия технических докладов ВОЗ. – № 763. – Женева, 2009. – 217 с. (англ.).
10. **Павловский Е.Н.** Современное состояние учения о природной очаговости болезней человека / Е.Н. Павловский // Природно-очаговые болезни человека / Под ред. Н.Н. Павловского. – М-Л.: Медгиз, 1960. – С. 6–40.
11. **Пушкарева В.И.** Листерии в растениях: экспериментальное изучение колонизации, численности и изменчивости / В.И. Пушкарева, В.Ю. Литвин, В.В. Троицкая // Журнал микробиологии, эпидемиологии и иммунобиологии. – 1996. – № 5. – С. 10–12.
12. **Сайт ВОЗ** в Интернете [Электронный ресурс]. – Режим доступа: http://www.who.int.
13. **Сайт МЭБ** в Интернете [Электронный ресурс]. – Режим доступа: http://www.oie.int.
14. **Сомов Г.П.** Некоторые аспекты экологии возбудителей сапронозов / Г.П. Сомов, Л.С. Бузолева // Эпидемиология инфекционных болезней. – 2002. – № 1. – С. 8–11.
15. **Терских В.И.** Сапронозы (о болезнях людей и животных, вызываемых микробами, способными размножаться вне организма во внешней среде, являющейся для них местом обитания) // Журнал микробиологии, эпидемиологии и иммунобиологии. – 1958. – № 8. – С. 118–122.
16. **Global** health situation and projection – estimates. WHO, 1992, WHO/HST 92.1.

Одержано 11.02 2014

Еколого-епізоотологічні особливості сапронозних інфекцій (на прикладі бешихи та лістеріозу). *Л.В. Пероцька, В.В. Недосєков*

Представлено аспекти циркуляції збудників сапронозних інфекцій в біоценозах; встановлено, що штами з високим рівнем паразитичної адаптації мають стабільну патогенність і не втрачають здатності до сапрофітного існування, натомість суто паразитичні штами формують лише інфекційні кола циркуляції. Процеси адаптаційного пристосування штамів є постійними й динамічно змінними.

Эколого-эпизоотологические особенности сапронозных инфекций (на примере рожи и листериоза). *Л.В. Пероцкая, В.В. Недосеков*

Представлены аспекты циркуляции возбудителей сапронозных инфекций в биоценозах; установлено, что штаммы с высоким уровнем паразитической адаптации владеют стабильной патогенностью и не утрачивают способности к сапрофитному существованию, в то время как исключительно паразитические штаммы формируют только инфекционные круги циркуляции. Процессы адаптационного приспособления штаммов являются постоянными и динамически меняющимися. ○

УДК 636.09:615.375:57.063.8

В.О. УШКАЛОВ, докт. вет. наук, чл.-кор. НААН, професор
О.В. МАЧУСЬКИЙ, канд. вет. наук
В.А. КОВТУН, мол. наук. співробітник
Державний науково-контрольний інститут біотехнології і штамів мікроорганізмів, Київ

СТВОРЕННЯ КОЛЕКЦІЇ ПРОМИСЛОВО ПЕРСПЕКТИВНИХ ПРОБІОТИЧНИХ ШТАМІВ НА БАЗІ НАЦІОНАЛЬНОГО ЦЕНТРУ ШТАМІВ МІКРООРГАНІЗМІВ. НОРМАТИВНО-ПРАВОВЕ ЗАБЕЗПЕЧЕННЯ

Проаналізовано сучасний стан нормативно-правового забезпечення виробництва пробіотиків для тварин. Встановлено наявність правового вакууму в зазначеному питанні. Проаналізовано міжнародні й національні документи, які регулюють дану галузь. Окреслено можливі шляхи поступового вирішення питання й окреслено роль і необхідність створення колекції промислово перспективних пробіотичних штамів на базі Національного центру штамів мікроорганізмів.

Слово «пробіотик» (дослівно – «для життя») є відносно новим терміном і в цей час використовується для найменування бактерій, які благотворно впливають на людей і тварин [7]. Термін запропонували в 1965 р. учені Ліллі та Стіллуелл – на противагу антибіотикам. Концепцію пробіотиків на початку XX ст. визначив І.І. Мечников. Він висунув теорію про те, що бактерії молочної кислоти сприяють поліпшенню здоров'я й довголіттю. З часом вона набувала дедалі більшого поширення, викликаючи інтерес у світі науки й серед практиків.

Нині як пробіотичні найбільш поширені штами лакто- й біфідобактерій. Препарати, створені на основі цих мікроорганізмів, благотворно впливають