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Soils of sea coasts as habitats of extraorganismal populations, agents of Saprozoonoses

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The quantitative study of the soil bacteria as *Listeria monocytogenes* and *Yersinia pseudotuberculosis*, their dynamics and growth in number in the soils of sea coast (mid-flight and maritime soils) has been carried out. The investigated bacteria revealed good multiplication in all researched soils preferring maritime soil nevertheless. The effect of the humus influence on multiplication of pathogenic bacteria has been investigated also. It has been determined, that multiplication of pathogenic bacteria depends on the humus content and this is one of the limiting factors in the researched soils. It has been established, that the abiotic properties of coastal soils have direct positive influence on preservation and multiplication of pathogenic microflora in them. This is promoted by degree of soil saturation by the bases, capacity exchange of cations and humus quantity.

The fact of saprophytic existence of pathogenic microorganisms in environment is doubtless. The agents of saprozooses, long conserved in soil and water, are of especial interest. The vital program of such microorganisms consists in continuous transition from an environment into an organism of the warm-blooded animals and man, where they live as parasites, and returning in an environment, where they function as saprophytic. The *Listeria monocytogenes* and *Yersinia pseudotuberculosis* refer to them. Occurrence of these bacteria in soil biogeocenoses is of the known fact, but the mechanisms of their adaptation and forms of occurrence in soil ecosystems are objects to be studied. There are some data on the pathogenic bacteria in arable soils in the scientific literature. But these data is very few. So, an indication of this bacteria from soils of sea coast is unknown for today. Accounting of that the purpose of the work is to study abiotic factors of the soils of sea coast and their influenced on *L. monocytogenes* and *Yseudotuberculosis* preservation and propagation.

The question on possibility existence of pathogenic *Listeria* and *Yersinia* in various soils was studied by many researchers. Authors approved, that *L. monocytogenes* are capable of the long conservation, within 6-12 months, and multiplication in soils and *Y. pseudotuberculosis* in soils are given.

The high degree of *Listeria* multiplication in soil is proved: for instance, for 6 days at 18-20°C their concentration increased 3000 times. At low positive temperatures and sufficient humidity there is an accumulation of *Listeria* in soil, by that the seasonal fluctuations of bacteria amount have been observed. The period of bacteria multiplication is in spring and autumn seasons. In winter the stabilization of their numerosity takes place. In summer characterized by high temperatures and aridity, the bacteria amount decreases in soil. The researches, carried out in Germany, proved a role of ground as environment of *L. monocytogenes*. During these researches 154 strains have been isolated from the identical number of samples taken from the ground and only 16 strains from the excrements of animals.

The analysis of the literary data shows, that the researchers, as a rule, have considered existence of pathogenic microorganisms in ground without taking into account soil chemical and physical-chemical characteristics. In the literature there are no data on multiplication of pathogenic bacteria in various types of soils. The ground is multicomponent system, characterized by different temperatures, acidity, humidity, various humus structure and variable microocenoses. Therefore microorganisms, living in ground, are much effected by all above mentioned factors. Hence, it is important to consider with their influence upon increase and multiplication of saprozooses agents. Nowadays there are some data on *Listeria* existence in arable soils (it should be noted that these works are not numerous), but as for their indication from the sea coastal soils it is unknown for today.

Accounting of that the necessity to study the abiotic and biotic factors of sea coastal soils and their influence on *Listeria* and *Yersinia* growth and multiplication is obviously seen. While studying it is planned to reveal the regularities of *L. monocytogenes* and *Y. pseudotuberculosis* distribution in soils having various genesis and ecological conditions of formation. That will allow to forecast an enhancement in multiplication of saprozoosic infectional agents. These studies contribute to reveal

the factors promoting not only preservation, but also propagation of these bacteria in sea coastal soil ecosystem. The economic and ecological significance of the sea coasts is widely recognized. The first one is connected with relatively large density of population in the seaside areas caused by the appropriate conditions to live in there. It should be noted, that about 1/3 population of the Earth is concentrated on a coastal strip of the World Ocean, 50 km in width. The biocenoses of the sea coasts are under high anthropogenic (man-made) effects. For instance, various coastal and maritime ecosystems of the Mediterranean countries are most subjected to influence of the destroying factors of environment, including tourist visiting, melioration and agriculture development and pollution by pesticides.

In the investigations the samples of the marshland and maritime meadow soils (coast of the Peter the Great Bay, Primorye Territory), collected from the upper horizon (0-0.1 m) have been used. The referential strains *L. monocytogenes* ("II", "A", "K", "10CN", "4B", "1/2A") and *Y. pseudotuberculosis* ("H-557", "282", "512", "907", "H-2781", "H-3515"), typical on their biological and biochemical properties, have been studied. *Listeria* strains were sent from the Russian State Institute of Veterinary Preparations Control (Moscow). *Yersinia* Strains were sent from Museum of Russian Centre on Yersiniosis and Pseudo-Tuberculosis (Research Institute on Epidemiology and Microbiology of the Siberian Branch of the Russian Academy of Medicines Sciences (RI EM SB RAMS), Vladivostok).

During our experiments it was established, that all researched strains of bacteria multiplied best of all in maritime soil, where their concentration increased on 3.2 Lg. In the marshland soil less intensive multiplication of bacteria has been observed, and increase in their number did not exceed 1.6 Lg. *Yersinia* multiplied better than *Listeria* in both types of soils. The multiplication of bacteria in the coastal soils depended on individual characteristics of strains. The strain "K" *L. monocytogenes* well multiplied both in marshland and maritime soils. The strain 2781 *Y. pseudotuberculosis* revealed intensive multiplication in marshland soil, whereas in maritime soil a number of microorganisms sharply reduced, and only some solitary colonies have been grown in eighth day.

In addition to influence of the individual characteristics of the bacteria strains (*L. monocytogenes* and *Y. pseudotuberculosis*), the multiplication of *Listeria* and *Yersinia* yet depends on influence characteristics of sea coastal soils themselves. On pH size of water extract it is seen, that the marshland soil is subacid (pH = 6.1) and maritime soil is neutral (pH = 6.76). The subacid and neutral media of the researched soils are favorable for *L. monocytogenes* and *Y. pseudotuberculosis* multiplication.

The obtained results, namely more active multiplication of *Listeria* and *Yersinia* in maritime soil, account for that the maritime soil has more saturation by the bases (87.35 %), more capacities of cation exchange (46.08 %), than marshland soil (85.99 and 6.78 accordingly). It shows that in maritime soil there is higher concentration of calcium ions and magnesium, which are necessary for normal growth and multiplication of pathogenic bacteria. The maritime soil has more contents of the exchange bases than those in marshland soil: Ca^{2+} - 20 mg /100r of soil, Mg^{2+} - 5.2 mg/100r of soil; Ca^{2+} - 21.9 mg/100r of soil, Mg^{2+} - 8.7 mg/100r of soil respectively.

Humus content is one of the limiting factors at multiplication of pathogenic bacteria in the researched soils. Humus content in marshland soil is 2.06 %, in maritime it is 5.43 %. Therefore, humus content influence on multiplication of pathogenic bacteria has been investigated. For that the pure preparations of humus acids as ammonium humates were produced. The results of experience have shown, that *L. monocytogenes* and *Y. pseudotuberculosis* well multiplied both as on humates of maritime meadow soil (achieving multiplication of bacteria up to 6 Lg *L. monocytogenes* strain 10CN and 6.4 Lg - *Y. pseudotuberculosis* strain 512), and on humates of marshland soil (up to 5 Lg *L. monocytogenes* strain 10CN - and 5.9 Lg - *Y. pseudotuberculosis* strain 512), nevertheless preferring the humates, produced from maritime meadow soil (the difference in 1Lg at *L. monocytogenes* and 0.5Lg at *Y. pseudotuberculosis* is insignificant) (Fig.2).

Marshland and maritime soils differ in stocks of highly soluble salts in 20 cm layer; they have 1.87 kg/m² and 4.33 kg/m² respectively. General fractional void volume of marshland soil is 76.1 %, and the later of maritime is 44.5 %. Natural humidity – 69.8 % of volume for marshland soil and 63.2 % of volume for maritime soil. Degree of water saturation – 92.6 and 85.5 respectively. On physical sand and physical clay content marshland soil are characterized as combined-sandy type (sum of particles > 0.01 mm (fraction of physical clay) 96.1 %), and maritime soil is light clay, (55.5 %).

Thus, it has been concluded, that the abiotic characteristics of sea coastal soils affect direct positive influence on preservation and multiplication of pathogenic microflora in them. This is promoted both by a degree of saturation by the bases, capacities of cationic exchange, humus quantity in these soils and strain properties of the bacteria.

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