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Studies Carried on at the Microbiological Laboratories, White

Russian SSR Acad Sciences

by

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CONCERNING THE WORK OF THE MICROBIOLOGICAL LABORATORY OF
THE ACADEMY OF SCIENCES BELORUSSIAN SSR

~~Under the set-up~~
 The administration of the Academy of Sciences BSSR includes
~~the organization and the work of the microbiological laboratories~~
 of the Institute of Development, Water and Swamp Project Develop-
 ment, the Peat Institute, Agricultural Institute and Institute of
 Theoretical Medicine, *are organized and active.*

INSTITUTE OF WATER AND SWAMP PROJECT DEVELOPMENT
 (S. P. Skoropanov, director)

The laboratories of physics and biochemistry of the Institute
 (directed by I. S. Lupinovich, member of the Academy of Sciences
 BSSR) are investigating the chemical and microbiological processes
 taking place in natural swamp soils, and the evolution of peat under
 the influence of development and agricultural use.

On the subject "Changes in peat soils in connection with their
 development and agricultural exploitation" (T. F. Golub, F. P. Vavulo)
 projects have been conducted in three swamp areas of the BSSR: Minsk,
 Kossovsk (Brestoskoy oblast) and Vasilev (Vedrich sovkhos Polessk^{aya}
 oblast). Investigations were made of the microflora in samples taken
 from regions of the natural swamp, newly and previously-cultivated
 fields, according to cross-section profile to a depth of one meter.

The investigation covered the general quantity of microorganisms,
 non-sporozoic and sporozoic forms, fungi and actinomycetes, cellulose-
 destroying microorganisms, nitrating and denitrating, nitrogen-fixing
 and other groups of bacteria. The lower peats of the Minsk station

of Vedrich sovkhos and the Kossovsk station are sufficiently rich in microorganisms. There are many bacteria, somewhat fewer actinomycetes and still less representation by mold fungi.

In natural peats the number of bacteria in the upper layer (0-10 centimeters, 10-20 centimeters) equals 2-5 million per gram of dry soil. According to the profile the richest sowing layer of peat is soil from 0-20 centimeter. During the warm part of the year the deeper layers have over 1 million bacteria. With the development of an unsown area the soil shows a deepening of the biogenic layer. In previously-cultivated peaty soils this deepening is also quite apparent.

During different periods the analysis of the bacterial distribution in different layers shows a natural variation. Thus in the peaty soil of the natural swamp at the Kossovsk station there are less sapro-phytes than in the soil of the natural swamp of Vedrich' sovkhos. But to the extent that the region of the Kossovsk station is drained, there appears a great number of microorganisms to a depth of 40 centimeters.

Among the soil bacteria at the Kossovsk station there is a large number of yellow-pigmented forms, which may be associated with the relatively low process of mineralization.

According to the total quantity of bacteria in the total upper layer of soil of Vedrich' sovkhos, the natural and previously-cultivated areas do not differ significantly. Draining, and still more, plowing, of the soils causes a noticeable increase in the number of bacteria.

Virgin peat bogs contain a great number of bacillary forms.

During a sizeable part of the vegetative period most of the bacteria are in the form of spores, as a result of which there is a weak development of mineralization processes. With development and particularly with plowing there is a decline of both bacillary forms and their relative percentage of the total number of bacteria.

Thus the acceleration of mobilization processes is reflected graphically in the total number of bacteria and number of spores found in the soil.

The sporozoid forms in which virgin peat bogs are richest are *Bac. cereus*, *Bac. idosus*, *B. megaterium*.

In virgin peat bogs *B. mycoides* and *B. mesentericus* are seen in very small numbers. In the soils of the Kossovsk station, in contrast to the swampy areas of Vedrich' sovkhos, there is a smaller amount of mold forms, which indicates the great poverty of the particular soil in nutritious substances. With the development and cultivation of peaty soils there is usually a lowering in the number of mold bacteria (*bac. idosus*) and very frequently there is a decline of *B. cereus*. In most cases (particularly in the second half of the year) there is an increase in the quantity of *Bac. mycoides*. No significant changes in the quantity of microorganisms of other groups were observed.

The composition of bacillary forms in all the analyzed peats did not differ significantly from the composition of these forms in weakly mineralized soils.

Peats are fairly rich in microflora which decompose cellulose. Basically, these microorganisms are found in the 0-20 centimeter

layer. In deeper layers they are found less frequently. With development and cultivation, the layers containing active cellulose-decomposing microflora are markedly increased. Of the cellulose microorganisms in peaty soils, a large quantity of Cytophaga were found in peats of Vedrich' sovkhov, fungi of the genus Dematium in the soils of the Kossovskoy station, as Trichoderma.

In deeper soils one often finds actinomycetes and myxobacteria - Polyangium. The predominant form among the cellulose microorganisms in the soils of the Kossovskoy swamp areas is Dematium. This serves as additional evidence for the lesser agronomic value of these soils in comparison with the soils of Vedrich' sovkhov.

The nitrating bacteria of the virgin peats of the Vedrich' sovkhov only show some activity during the summer period. The process of nitration is suppressed during spring and fall. In contrast to the soils of natural swamps of Vedrich' sovkhov, virgin swamp areas of the Kossovskoy station show the development of nitrate-fixers, which is connected, in all probability, with the lowering of the ground water due to the drainage of the whole territory. With development and sowing of peat bogs, the nitrating bacteria develop energetically.

Nitrogen-fixing bacteria are met sporadically in both the natural and developed turfs in both swampy areas.

Virgin peat bogs in developed regions show a sizeable number of actinomycetes (from 1.5 to 2.5 million per gram of soil), but still fewer than bacteria. More actinomycetes are observed in the soils during the summer period than during fall; they are concentrated in the upper layers.

Mold fungi are found in both cultivated and uncultivated turfs in relatively large quantities, compared to mineralized soils. Their number varies during the vegetative period, in individual cases reaching several thousand buds in 1 gram of soil, in the upper layers. The most commonly found forms of fungi are Penicillium, Mucor, Trichoderma, Cladosporium and others. In virgin soils Trichoderma is the predominant form.

Two years of accumulated material have been examined, which will allow the elucidation of the methods of influencing the processes taking place in the soil, in the near future, with the goal of speeding the acculturation of peat bogs and sharply increasing its fertility.

Experiments on "The influence of bacterial fertilization on the productivity of a series of agricultural crops in lowland turf soils" were carried out in 1946-1949, by means of field and vegetative experiments.

On the basis of the data for four years one can note the positive action of nitrogen-genesis in lowland peaty soils on crops of oats, barley, vernalized wheat, red, rose and white clover, kok-saghyz, sugar beet, saradella and potato.

"Nitragin" increases the crop of clover in the sowing year; trichoderma increases the crop and quality of sugar beet, barley and wheat. Some increase in the crops of kok-saghyz and oats are obtained with the use of "phosphobacterin".

In 1949 there were attempts to use local strains of nitrogen-bacteria, obtained from peaty soil. Some of the local strains of

nitrogen-bacteria increased the crops of oats and vernalized wheat from 10 to 24 per cent in field experiments, and the crops of ram-ose wheat, in vegetative experiments, by up to 70 per cent.

INSTITUTE OF SOCIALISTIC AGRICULTURE

(D. I. Lappo, director)

The microbiological laboratories of the institute are occupied with a study of the microflora of the soils of the Poleskoy lowlands; the microbiological processes in the use of peat as a fertilizer for soils, and phenomena of antagonism of soil microorganisms with respect to certain phytopathogenic bacteria (*Ps. campestris* and *Ps. phaseoli*).

"Microflora of the Soils of the Poleskoy Lowlands" (A. I. Yezupchik) contains the collected materials obtained during the period of the 1948 and 1949 expeditions on the distribution of some physiological groups of microorganisms, according to genetical boundaries dependent on difference in soil and vegetative cover of woody and cultivated soils in various stages of acculturation. The studies were carried out on the following groups of soils of the Poleskoy lowlands: (1) sod-humus-gley; (2) peat-humus-gley; (3) sod-podzolic; (4) sod-podzolic-gley; (5) sod-humus-carbonate; (6) sod-humus-ortstein.

The quantity of microorganisms in these soils is not identical. The largest quantities of them are contained in soils and sod (humus-carbonate) of peat-humus-gleys. Material obtained in the future will be supplemented with data which allows the elucidation of the microbiological peculiarities in each of the listed and other soils

of the Poleskoy lowlands, with the goal of developing improvements in the control of biochemical processes in the soil and raising their fertility.

Another work project involved a survey of separate physiological groups of microorganisms in the preparation of various peaty composts. Addition of alkali to the compost follows the goal of strengthening the preparatory mineralization of the peat and makes its humic compounds more mobile upon adding composts to soils, etc. The action of various doses and types of alkali, in the preparation of composts, was studied, with respect to their influence on separate physiological groups of bacteria, both in the composts themselves and when they were added to soil.

Ye. I. Gurinovich studied some of the properties of phytopathogenic bacteria which can be used for their classification. Detailed studies were made of the serological properties of three members of the genus *Pseudomonas* and the closeness of the antigens of *Ps. malvacearum* and *Ps. phaseoli* was proven.

Studies by Ye. S. Gurinovich prove the possibility of studying strains of phytopathogenic bacteria of the genus *Pseudomonas*, using the immunization of rabbits by antibodies, by reactions with homologous antigens, giving agglutination and complex formation. According to the experimental data, direct agglutination and adsorbing reactions are the most important, from the antigenic point of view, with strains of *Ps. phaseoli* and *Ps. malvacearum*. The variation in the character of agglutination in the precipitation of *Pseudomonas phaseoli* (large-flocculet precipitate) and *Pseudomonas malvacearum* (small-granular precipitate) allows the postulation of peculiarities of structure of the somatic and flagellate antigens of these forms. *Pseudomonas campestris* is characterized by a species serological

specificity, which allows it to be differentiated from the Ps. phaeo-
seoli and Ps. malvacearum by immunological reactions.

Studies are being made at the Institute of the microbiological
processes which take place in peat on its heating, with the goal of
developing measures in the battle with spontaneous combustion.
(N. M. Kurbatova).

INSTITUTE OF THEORETICAL MEDICINE

(N. I. Grashchenkov, director)

The basic problem of the Microbiological laboratory of this
Institute is the study of the microbiology and epidemiology of scler-
oma. This problem, the most important in the regional pathology
of the BSSR, is being worked on together with other scientific
research institutes and the clinics of medical institutes of the
BSSR.

Studies have been made on the bacteriological diagnosis of
scleroma, the clinical significance of serological reactions, the
chemistry and biochemistry of the scleroma bacilli, variation phen-
omena in connection with the biochemical characteristics of capsul-
ated and non-capsulated forms of the microbe, the influence of strep-
tomyacin on the viability of scleroma bacillin in the organisms of
laboratory animals. The epidemiology of scleroma was studied by
means of expeditions to the region of sickness. The materials
obtained over the last year are presented in the scientific texts
and monographs of B. Ya. El'bert and his coworkers.

There is scientific-practical interest in the study of the
classification of the microbes of the family Enterobacteriaceae,

in the development of methods for culturing ^{inactivating} microbes of the typhus-dysenteric group for ^{purposes of} ~~the~~ acceleration of diagnosis, and in the biology of *Ps. pyocyanea* (A. B. Chernomordik).

Questions in the study of antibiotic and chemical-preparations have been investigated in the Laboratory for Antibiotics (F. I. El'berin) and the Laboratory of Professor A. Ya. Prolopchuka.

The virological laboratory has been functioning since 1949. During 1949 studies were made on the virusology of poliomyelitis, tick encephalitis, lymphocytic meningitis, and the biological ties between the viruses of tick and Scotch encephalitis.

The Laboratory for the Virology of Grippe (R. P. Kukharensko) has conducted investigations on the cultivation of the grippe virus in chick embryos and on the laboratory diagnosis of grippe in the BSSR.

The great aid, given the microbiological laboratories of the AN BSSR by the Institutes of the Academy of Science USSR and by the Academy of Medical Science, will allow future intensification of Belorussian microbiology and virusology, leading to an even more successful fulfillment of the tasks which face us in further improving the economy and public health administration of the BSSR.

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