



Symposium

Emerging Threats for Human Health

Impact of Socioeconomic and Climate Change on Zoonotic Diseases

August 13, 2018 in Yakutsk, Russia

Program and Abstract Book



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Table of Contents

Introduction	3
Organizers	4
Program	8
Abstracts – Oral Presentations	11
O1 – O20 Abstracts	12
Abstracts – Posters	35
P1 – P36 Abstracts	36
List of Participants	72
Notes	78

Emerging Threats for Human Health Impact of Socioeconomic and Climate Change on Zoonotic Diseases: An Introduction

Climatic, socio-cultural and economic changes as well as technological development have an immediate impact on the environment and human health in particular. Our steadily growing need for resources increases the pressure on the environment and narrows down untainted habitats for plants and animals (Gibb et al, 2018). These developments and globalization in general are important drivers of emerging and re-emerging infectious diseases, and promote the spread of zoonotic diseases. The global rise of drug resistance (e.g. MRSA) superimposes these threats and calls for immediate and comprehensive approaches across borders.

Arctic and subarctic regions are especially vulnerable to climate change, as rising temperatures and thawing of permafrost landscapes transform soil structures, vegetation and habitats. The risk of zoonotic diseases in the Republic of Sakha (Yakutia, Russia) has significantly increased, as higher temperatures lead to more favorable living conditions, prolonged vegetation periods and the expansion of habitats for pathogens and their vectors. Moreover, permafrost degradation may expose historic cattle and other burial grounds, thereby reviving deadly infections from the past (Revich, 2011) and endangering humans, their livestock, pet animals and wildlife.

Zoonoses are not the only health threats in today's Sakha. Climate, cultural and socio-economic changes also led to drastic effects on the health and wellbeing of indigenous people. In the course of modernization and urbanization, the traditional lifestyle of horse-breeders and hunters in dwellings and remote settlements steadily shifted towards sedentary urban lifestyles. This resulted in a troubling increase of chronic conditions, the most prevalent being diseases of the circulatory and digestive systems (Burtseva et al. 2014, Tatarinova et al. 2015). Rospotrebnadzor, the State Health Agency, lists a category of "gastroenterological diseases of

an unknown etiology" each year, giving room to speculate on yet unidentified food-borne diseases and/ or non-physiological, pathogenic changes in the microbiome and digestive tract.

Next to unravelling the causative agents, their biological mechanisms and epidemiological patterns of the aforementioned conditions, it seems necessary to develop a new behavioral strategy and individual attitude towards health preservation for indigenous people in Sakha. According to a recent study, there is a rather inadequate commitment to a healthy life-style among indigenous Yakuts. Although there is general awareness that health depends on diet, life-style and ecology, only natives of mature age develop an active attitude towards healthy living which seems rather related to progressive deterioration of their well-being and presence of chronic diseases. In younger age, most consider themselves healthy and hence ignore prevention of diseases (Ammosova, 2018).

'One Health' is a collaborative concept and practical approach that addresses imminent health threats for humans, animals, and their ecosystem in an integrated manner at a local, regional and global scale.

This requires cross-disciplinary partnerships and cooperation among professionals such as veterinarians, physicians, biologists, environmental scientists, sociologists, economists and public health professionals, as well as societal stakeholders.

This Symposium takes up current developments and challenges in Yakutia that subsequently shall be addressed jointly by linking scientific expertise, conceptual thoughts and infrastructure.

We are looking forward to a fruitful cooperation and an interesting meeting.

Dr. Irene Huber & Katerina Potapova
Hohenheim Research Center for Health Sciences

Organizers



Yakut State Agricultural Academy (YSAA)

YSAA is one of the largest higher education agricultural institutes in the North-East of Russia. The Academy employs 150 lecturers that teach and conduct research at four faculties, i.e. Agricultural Technologies, Timber Complex and Land Management, Veterinary Medicine, and Engineering, as well as at the College of Technologies and Management. Higher education at YSAA goes beyond the classroom. Being connected to local partners, students are sent to places where they broaden their knowledge by experience. Located in Yakutsk, the political, business and educational center of the Republic of Sakha, YSAA nurtures a network that shapes the future by working beyond disciplines, and building bridges between industry, agroindustrial corporations, governmental bodies and societal stakeholders. At the Center for Advanced Training in Agriculture, the Research Institute of Veterinary Ecology, the Oktyomtsy Experimental Farm, and various laboratories, YSAA develops solutions that address societal needs. International partnerships allow students to broaden their view and adjust research and education to international standards. YSAA trains a new type of specialists who will create change and find solutions for the future by integrating the wisdom, tradition and cultural values of Northern indigenous peoples. For more information: <http://ysaa.ru/>



Institute of Biological Problems of Cryolithozone SB RAN

The Institute is the leading scientific research institution for the training of scientific personnel for the research and protection of the biological diversity of the North. The Institute has interdepartmental laboratories of permafrost forest management, ecological biochemistry, floristics and phytocenology, ecology and stability of northern ecosystems, accounting and cadaster of hunting and commercial animals. Fundamental and applied research is focused on the protection of the unique and vulnerable ecosystems in Yakutia as well as adjacent territories of the permafrost zone. Main research topics are:

- Ecology of organisms and communities: structural and dynamic organization, functioning and stability of cryolithozone ecosystems;
- Biological diversity: optimization of use and protection of the biological resources of the permafrost zone;
- Sustainable integration of Yakutia's bioresources in economic circulation.

For more information, please visit: <http://ibpc.ysn.ru/>



North-Eastern Federal University in Yakutsk (NEFU)

The Institute of Health was established in 1995 as scientific research institution of the Academy of Sciences of the Republic of Sakha (Yakutia). In 2011, the Institute joined the North-Eastern Federal University as a separate structural unit. The Institute carries out research in the field of natural and human sciences focusing on (1) population studies addressing the state of adaptive mechanisms of both indigenous groups and newcomers to the harsh environmental conditions of the North, (2) fundamental principles of adaptation for the preservation of human health, (3) innovative products and technologies for diagnosis, treatment and prevention of diseases, (4) specific diseases, like Vilyui Encephalomyelitis, and other degenerative diseases of the brain.



The Medical Institute (established in 1957) with its 22 departments can be called the oldest higher medical school in North-East of Russia. The Institute is known both in Yakutia and beyond its borders for its training programs and expert scientific and pedagogical personnel. Students from Yakutia, Buryatia, Magadan, Irkutsk regions and from overseas (like Zambia, Peru, Afghanistan, Tajikistan, Kirgizistan) study here in 6 specialties, i.e. 2 Bachelor and 4 Master programs. The Clinic was established in 2002 with the goal to offer medical and preventive support, to train NEFU students, as well as to serve as a scientific and educational clinical base for the Medical Institute. It provides patients with outpatient care. The clinic has several scientific and educational laboratories, such as the laboratory of genomic medicine, laboratory of neurophysiological studies, laboratory of osteoporosis, laboratory of pathomorphology, histology and cytology, a microbiological laboratory, a research laboratory for cellular technologies and regenerative medicine.

For more information, visit: www.s-vfu.ru/en/Institutes/SRIH/



University of Hohenheim

Founded in 1818 after devastating famines, the University of Hohenheim not only is well-known for its high-level agricultural research but has traditionally always been committed to developing innovative solutions for some of society's pressing problems. To do so, the University of Hohenheim engages in a combination of scientific disciplines that is unique among German universities. Today, the University of Hohenheim is Germany's leading university in agricultural research and food sciences, as well as strong and unparalleled in natural, social, business, economic, and communication sciences. This combination makes it possible to find solutions for many global challenges. On all levels, the University of Hohenheim networks with partners who strengthen and complement its research and teaching offers. This includes many universities and research institutions with outstanding international reputation. For more information, visit www.uni-hohenheim.de

The Hohenheim Research Center for Health Sciences provides a dynamic platform for researchers, lecturers, young scientists and students dedicated to health topics and life sciences. In accordance with the One Health Concept, we promote high-level research across disciplines by

- joining expertise, e.g. in biology, immunology, health care and medicine, agriculture and food sciences, economics and social sciences
- building bridges between bench scientists, clinical investigators, health researchers, business and public stakeholders
- strengthening national and international networks for exchange, research projects and productive partnerships
- obtaining funds for integrated research projects focusing on major scientific and societal topics, including e.g. lifestyle, nutrition, aging, noncommunicable diseases as well as their social and economic impact.

For more information, visit www.health.uni-hohenheim.de

Organizers



Yakut Scientific Research Institute of Agriculture

Scientific support of agriculture in the Republic of Sakha (Yakutia)

Report of the Director, Dr. Ayaal I. Stepanov

The Federal State Budgetary Scientific Institution the "Yakut Scientific Research Institute of Agriculture named after M.G. Safronov" was founded on March 30, 1956. It is one of the largest institutes in the Far East of Russia. The main aim of the Institute is to conduct fundamental and applied scientific research, experimental and design work, introduce scientific achievements and advanced practices aimed at obtaining new knowledge in the agro-industrial complex that contribute to the technical, economic and social development. The Institute, from the day of its creation, pays much attention to the introduction of adaptable varieties of grain crops, perennial grasses, potatoes, fruit and berry crops, conservation and breeding of cattle, horses, reindeer and the development of veterinary preparations.

The staff of the Institute counts 144, including 82 researchers, 10 doctors of science, and 38 candidates of science. The Institute consists of four departments, a postgraduate study program, a scientific library, and 15 scientific subdivisions, whose management is carried out by six doctors and nine candidates of science.

According to the State task, seven persons are studying in the postgraduate program of the Institute. Postgraduate studying is carried out in accordance with the license for five scientific specialties.

The advisory body of the Institute is the Scientific Council which consists of 16 members, including seven doctors and nine candidates of science, as well as the board of directors, four scientific and methodological councils for economics, plant growing, animal husbandry, and veterinary.

The Institute employs the Council of Young Scientists, postgraduate students and specialists which includes 45 specialists under the age of 39, including ten candidates of science. The 'Small Agricultural Academy' is entrusted by the Order of the Head of the Republic of Sakha (Yakutia) with organization of scientific management of the activities of 80 rural agro-profiled schools throughout Yakutia.

The Institute has 203.1 hectares of land on permanent (unlimited) use. As a research and production (experimental) base, there are "Yuchyugeyskoe" and two small innovative enterprises: "Nauka" LLC, and the Scientific Production Center "Hotu-Bact" Ltd.



The main achievements of research and development work in recent years are: creation and introduction into production of eleven varieties of spring soft wheat, five varieties of spring barley, six varieties of oats, two varieties of winter rye, 14 varieties of perennial grass and leguminous herbs of various type of use, two varieties of potatoes, six varieties of blackcurrant, four varieties of wild strawberry; two breeds of horses, Megezhekskaya and Prilenskaya; 2 types of horses of the Yakut breed (Yansky, Kolymsky); development and production of new biological and veterinary preparations; development and introduction into production of new technologies for cultivation of crops, maintenance, feeding, reproduction and treatment of animals.

In 2017 were published ten monographs, 20 methodological guides and recommendations in the field of plant growing, animal husbandry, processing of agricultural products, veterinary biotechnology and environmental protection, as well as in the economy of agriculture. The Institute obtained 46 patents for invention and 15 for selective achievement and three certificates of state registered databases. 20 license agreements were concluded on a reimbursable basis.

Every year the Institute holds various seminars, scientific-practical conferences, and round tables. Scientists of the Institute take part in various Russian and international scientific and practical conferences, meetings, seminars and exhibitions. Every year, the agro-industrial exhibition 'Golden Autumn' takes place in Moscow, at which the development of our Institute has been awarded with seven gold and four silver medals.

Joint research is conducted with leading scientific institutions. International relations in the field of scientific and technical cooperation with foreign countries are being developed with the Heilongjiang Academy of Agricultural Sciences, the Institute of Natural Resources of Finland on the origin and adaptation physiology of the Yakut cattle, the Kazakh Research Institute of Livestock and Feed Production, the Kazakh National Agrarian University, and the National Academy of Sciences of Belarus for Agriculture.



LLC Scientific & production center „Khotu-Bact“

A small innovative enterprise LLC „SCIENTIFIC AND PRODUCTION CENTER KHOTU-BACT“ was established in 2013 at the Yakut Research Institute of Agriculture. LLC SPC „KHOTU-BACT“ is a participant of the Skolkovo Foundation, a resident of the Yakutia Technopark, and is the only enterprise in the North-East of Russia that develops and produces veterinary drugs. The scientific novelty of developments is protected by Russian patents. Production is licensed by the Russian Federal Service for Veterinary and Phytosanitary Supervision (Rosselkhoz nadzor).



Program

MONDAY, 13 AUGUST 2018

— REGISTRATION, WELCOME AND INTRODUCTION

09:15 Welcome address

Ivan I. Sleptsov, Rector, Yakut State Agricultural Academy, Yakutsk

09:30 Ludwig E. Hölzle, Head of Delegation, Research Center for Health Sciences, University of Hohenheim, Stuttgart, Germany

09:40 Zoonotic infections in Yakutia

Margarita E. Ignat'eva, Head of the Regional Office of the Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rosпотребнадзор) in Yakutia

— SESSION 1:

Overview over Zoonoses in Yakutia and in Germany

Chair: Konstantin R. Nifontov, Yakut State Agricultural Academy

09:55 Overview over zoonoses in Yakutia

Alexandr M. Okhlopkov, Regional Office of the Federal Service for Veterinary and Phytosanitary Surveillance (Rosselkhozнадзор) in Yakutia

10:10 Assessment of the epizootological situation of bovine tuberculosis in Yakutia

Galina P. Protod'yakonova, Yakut State Agricultural Academy

10:20 Prevention of infectious diseases of horses – problems, achievements, perspectives

Mikhail P. Neustroev, Yakut Research Institute of Agriculture, Yakutsk

10:30 Host-pathogen interaction in persistent bacterial infections

Ludwig E. Hölzle, University of Hohenheim, Stuttgart, Germany

10:45 Pharmacological efficiency of 1 β recombinant interleukin in cattle treatment and prevention of cryptosporidiosis

Ayan N. Nyukkanov, Yakut State Agricultural Academy

10:55 Coffee break

11:20 Epizootology of Anthrax in Yakutia

Mikhail P. Neustroev, Yakut Research Institute of Agriculture, Yakutsk

11:30 Anthrax – diagnostics, epidemiology, environment, therapy, vaccines, and phages

Wolfgang Beyer, University of Hohenheim, Stuttgart, Germany

11:45 Echinococcosis and alveococcosis research in Yakutia

Ludmila M. Kokolova, Yakut Research Institute of Agriculture, Yakutsk

11:55 Research on alveolar and cystic echinococcosis at the University of Hohenheim

Thomas Romig, University of Hohenheim, Stuttgart, Germany

12:10 A variety of harmful insects (Diptera) and ticks (Acari: Ixodida), study of their life cycle, and creation of preventive measures for agricultural animals

Alexandr D. Reshetnikov, Yakut Research Institute of Agriculture, Yakutsk

12:20 Tick related research at the University of Hohenheim

Marco Drehmann, University of Hohenheim, Stuttgart, Germany

12:35 Discussion: Knowledge Gaps and Cooperation Opportunities

12:45 Lunch

13:45 Poster Session

— SESSION 2:

Emerging Zoonotic Threats to Human Health (in Russia and in Germany)

Chair: Konstantin M. Stepanov, Yakut Research Center of Complex Medical Problems

14:30 Surveillance and control of zoonotic diseases in Germany – an overview and the case of Hepatitis E

Mirko Faber, Robert Koch Institute, Berlin, Germany

14:50 Viral Hepatitis E as a new zoonotic threat to human health

Sergey I. Semenov, Institute of Health, North-Eastern Federal University, Yakutsk

15:10 Discussion: Knowledge Gaps and Cooperation Opportunities

15:20 Coffee break

— SESSION 3:

Evidence Base of Climate Change and its Effects on One Health in Yakutia

Chair: Agafya Z. Platonova, Yakut State Agricultural Academy

15:50 Influence of global climate change on the natural environment of the center of the continental permafrost zone of the Northern Hemisphere (on the example of Yakutia)

Roman V. Desyatkin, Institute of Biological Problems of Cryolithozone SB RAS

16:00 Impact of climate and land use change on soil processes – evidence and perspectives

Sergey Blagodatskiy, Holger Pagel, University of Hohenheim, Stuttgart, Germany

16:15 Discussion: Knowledge Gaps and Cooperation Opportunities

— SESSION 4:

Emerging Diseases Threats: Integrating Local Knowledge and Socioeconomic Factors

16:25 Indigenous peoples of Yakutia and new health risks in connection with global change

Vyacheslav I. Shadrin, Inst. for Humanities Research and Indigenous Studies of the North SB RAS

16:35 Attitudes towards health among indigenous peoples under modern conditions

Elena P. Ammosova, Institute of Health, North-Eastern Federal University, Yakutsk

16:45 Rural everyday life in Yakutia in a changing environment

Liliia I. Vinokurova, Arctic Research Department, Institute for Humanities Research and Indigenous Studies of the North, SB RAS

16:55 Food products in combination with unique northern raw materials

Konstantin M. Stepanov, Yakut Research Center of Complex Medical Problems / Yakut State Agricultural Academy, Yakutsk

17:05 Bridging knowledge systems in nutrition and health research

Stefanie Lemke, Centre for Agroecology, Water and Resilience, Coventry University, UK / University of Hohenheim, Stuttgart, Germany

17:20 Discussion: Knowledge Gaps and Cooperation Opportunities

17:30 Concluding Remarks / End of the Symposium



ABSTRACTS
**Oral
Presentations**



Introduction

Introduction

01 Zoonoses in Yakutia

MARGARITA E. IGNAT'EVA¹, IZABELLA YU. SAMOYLOVA¹, VALENTINA I. GRIGORYEVA¹, LYUBOV V. BUDATSYRENOVA¹, VIKTOR F. CHERNYAVSKIY², OKTYABRINA N. SOFRONOVA²

¹ Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rospotrebnadzor), Regional Office in the Republic of Sakha (Yakutia)

² Federal Public Health Institution "Center for Hygiene and Epidemiology in the Republic of Sakha (Yakutia)"
Corresponding author: yakutia@14.rospotrebnadzor.ru

In the territory of the Republic of Sakha (Yakutia), for a long time there have been natural foci of infectious diseases common to humans and animals such as rabies, anthrax, leptospirosis, tularemia, listeriosis, pseudotuberculosis, yersiniosis, hemorrhagic fever with kidney syndrome and others [1,2,4,5].

Experts of the State Sanitary and Epidemiological Supervision monitor the circulation of zoonotic pathogens in the environment. Zoologists-entomologists annually leave for seasonal field work in different regions of the Republic in order to catch rodents, birds, arthropods, and to collect samples of water and soil. Then, the collected material is examined in the Laboratory of especially dangerous infections for zoonotic pathogens. Until 1990, pathogens responsible for tularemia were isolated in water samples of floodplains, lakes and from blood-sucking dipterous insects and ectoparasites [1,2]. At present, the causative agents and markers of tularemia and pseudotuberculosis are periodically determined in materials from rodents, the pathogens of intestinal yersiniosis were detected in food samples and in sewage, the virus of tick-borne encephalitis was detected in ticks (from 3% to 11%). In 2014, an avian influenza A (H5N8) virus was isolated from a wild migratory bird [6]. In 2018, a culture of listeria was identified in fish samples. The Veterinary Service registered cases of infection and the death of animals from anthrax up to 1993. According to archival materials in 26 districts,

285 permanently adverse points of anthrax were established. Currently, the Veterinary Service regularly informs about the detection of serological markers of leptospirosis in horses and reindeers, and of detection of rabies pathogens in wild and domestic animals.

According to laboratory environmental studies, 19 of the Republic's territories are adverse for tularemia. Here, according to epidemiological data, mass vaccinations against tularemia are conducted. Vaccinations against anthrax, rabies, and tick-borne encephalitis are provided for individuals from the "risk groups".

In the last century large outbreaks took place in Yakutia: of tularemia in 1959-1960, pseudotuberculosis in 1974, rabies in 1973, and between 1950-1980, there were cases of human infections with anthrax [1,2,4,5]. At present, there are occasional cases of yersiniosis. In 2018, a first local case of tick-borne encephalitis was registered.

There is a great interest in paleomicrobiological research. Together with the State Scientific Center of Virology and Biotechnology "Vector", studies of an Oymyakon mammoth calf were carried out, whose age was estimated to be more than 18 thousand years. A living aerobic gram-positive non-spore bacterial culture, classified as *Kurthia*, was isolated. In this study, a high concentration of viable thermotolerant aerobic bacteria was noted. The study has also shown that more genomic analysis is needed in order to understand the stability of the properties over time.

Conclusions:

On the territory of Yakutia, there are natural foci of infections common to humans and animals, and the circulation of pathogens in the environment is being analysed.

In the past century, there have been cases of mass zoonotic diseases in humans; today, due to preventive measures, only sporadic cases of certain diseases are recorded.

Modern methods of laboratory diagnostics, including those used in regional and all-Russian reference centers, allow us to identify a wide range of pathogens of natural focal infections, also including paleomicroflora, to perform their genomic analysis, and to identify sources, reservoirs and transmission mechanisms of infections.

The state sanitary and epidemiological surveillance conducted by the experts of the Rospotrebnadzor in cooperation with the Veterinary Service and leading scientific institutions of the country allows timely identification of trends in the development of the epidemic process of natural focal infections and adequately respond to the emerging epidemiological situation.

References:

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Session 1

Session 1

O2 Evaluation of the epizootological situation of tuberculosis in the Republic of Sakha (Yakutia)

GALIINA P. PROTOD'YAKONOVA¹, N.G. PAVLOV², A.E. DANILOVA³

¹ Prof. Dr. vet. sc., Chair of Parasitology and Epizootology of Animals, Yakut State Agricultural Academy

² Cand. vet. sc., Scientific and Practical Center "Phthisiology"

³ Student at the Russian State Agricultural University - Moscow Timiryazev Agricultural Academy

Corresponding author: gpet@list.ru

The Republic of Sakha (Yakutia) had a complicated epizootic situation for cattle tuberculosis for a long period. The purpose of this report is a retrospective study of the epizootic process of bovine tuberculosis in Yakutia.

In the 1950's-1980's in the Republic of Sakha (Yakutia), a high incidence of tuberculosis in agricultural animals was recorded, the criterion for the epidemic significance of animal tuberculosis was the frequency of allocation of bovine mycobacteria in people with tuberculosis.

The results of the studies served as the basis for the development of the state "Program of measures for the improvement of livestock farms with respect to the tuberculosis of cattle", the introduction of which made it possible to drastically improve the epizootic situation for this infection in the country by 1988.

Despite these measures, sporadic cases of tuberculosis in herds of cattle on small farms and private farms were recorded in 1996 and 2001.

To prevent further outbreaks, the Department of Veterinary of the Republic of Sakha (Yakutia) and the Scientific and Practical Center "Phthisiology"

have developed and implemented comprehensive measures which are scientifically evaluated and are accompanied by research on preventive and diagnostic tools.

Within this collaborative framework, the diagnostic value of the detection of mycobacterial tuberculosis DNA by PCR in blood samples of cattle from Republic's tuberculosis-free farms, previously unsuccessful, was investigated. At the same time and against the background of stabilization of the epizootic situation of cattle tuberculosis, the problem of nonspecific tuberculin reactions remains. Annually, in 15-18 out of 35 districts of the Republic, animals reacting to PPD-tuberculin for mammals are identified. Long-term studies on the causes of the etiology of nonspecific tuberculin reactions have shown that this infection is due to non-tuberculosis (atypical) mycobacteria.

The introduction of the system of scientifically based measures for the control and prevention of tuberculosis among cattle allowed for a significant improvement of the epizootological situation in Yakutia for this infection.

O3 Prevention of infectious disease of horses: problems, achievements, perspectives

MIKHAIL P. NEUSTROEV^{1*}, NADEZHDA P. TARABUKINA^{2*}

¹ Prof. Dr. vet. sc., Head of the Laboratory of Veterinary Biotechnology, Yakut Scientific Research Institute of Agriculture, Scientific and Production Center "Hotu-Bact", Ltd.

² Prof. Dr. vet. sc., Head of the Microbial Development Laboratory, Yakut Scientific Research Institute of Agriculture, Scientific and Production Center "Hotu-Bact", Ltd.

Corresponding author: hotubact@mail.ru

Infectious and invasive diseases play a significant role in horse breeding. The most common and causing significant economic damage results from horse strangles, salmonella abortion and rhinopneumonia of horses. In recent years, a spread of leptospirosis has been noted. A decrease in the level of immunobiological reactivity of foals and mares in the autumn and winter periods as a result of the influence of stress factors and infection with viral diseases has been established. The spread of viral diseases such as influenza and rhinopneumonia among breeds of horses has been noted. Therefore, the use of immunomodulators in inactivated vaccines is needed.

The vaccine against the horse strangles is made of an inactivated strangles *Streptococcus* strain *Str.equi* H-34. The vaccine against horse salmonella abortion is made from the strain *Sal.abortus equi* BN-12. The vaccine contains an immu-

nomodulator. The use of the vaccine ensures the recovery of farms from salmonellosis of horses, and prevents infection of humans.

The scientific novelty of the developments was proven and protected by 41 Russian patents for invention.

In the next five-six years, it is our aim to:

- test an inactivated vaccine against rhinopneumonia of horses under production conditions,
- test an associated vaccine against rhinopneumonia and salmonella abortion under production conditions,
- test an inactivated vaccine against rhinopneumonia, the horse strangles and salmonellosis under laboratory and production conditions,
- obtain a registration of the vaccine against the horse strangles in Mongolia, Kazakhstan and China.



Session 1

Session 1

O4 Host-pathogen interaction of persistent bacterial infections

LUDWIG E. HÖLZLE

Prof. Dr. med. vet, Chair of Livestock Infectiology and Environmental Hygiene, Institute of Animal Science, University of Hohenheim, Stuttgart, Germany

Corresponding author: Ludwig.Hoelzle@uni-hohenheim.de

The Department of Livestock Infectiology and Environmental Hygiene has three main foci in research, 1) environmental and animal hygiene (animal health), 2) zoonoses and veterinary public health, and 3) infection biology.

Within the first two topics, we are dealing with the establishment of diagnostic tools, development of vaccine candidates, epidemiology, disinfection, and novel strategies to prevent and treat infectious diseases. We are interested in animals as reservoirs of pathogens for humans, “emerging and re-emerging diseases”, novel vectors and reservoirs (plants, amoebae), and the role of climate change, and globalization/ tourism (novel chains of infection).

In the focus “infection biology”, we are investigating persistent bacterial infections caused by the non-cultivable bacterium *Mycoplasma suis* which causes infectious anemia in pigs. This bacterium is very interesting due to the fact that we found autoimmunity, immune modulation, and

endothelial damage during the infection. Anemia is caused by scavenging of nutrients, adhesion and invasion of the red blood cells, eryptosis, and autoreactive antibodies. To get insight into the molecular and cellular basis of the pathogenesis of this disease, we use several laboratory techniques such as microscopy (LM, EM, CLSM), serology (ELISA, WB), DNA tools, recombinant expression of proteins, genomics, proteomics, microarray techniques, RNA-Seq, metabolomics, cell cultures, and FACS (fluorescence-activated cell scanning).

Another disease connected with persistent infections is pseudotuberculosis in sheep and goat caused by *Corynebacterium pseudotuberculosis*. These bacteria can survive and multiply intracellular in macrophages as well as in epithelial cells. For this, they are taken up by the cells via a zipper-like mechanism and can get out of the phagosomes to multiply in the cell cytoplasm.

O5 Pharmacological efficiency of 1 β recombinant interleukin in cattle treatment and prevention of cryptosporidiosis

IVAN I. BOCHKAREV¹, AYAN N. NYUKKANOV², T.A. PLATONOV³, N.V. KUZ'MINA³

¹ Prof., Dr. biol. sc., Faculty of Veterinary Medicine, Yakut State Agricultural Academy

² Assoc. Prof., Dr. biol. sc., Faculty of Veterinary Medicine, Yakut State Agricultural Academy

³ Dr. biol. sc., Faculty of Veterinary Medicine, Yakut State Agricultural Academy

Corresponding author: ayan1976@mail.ru

For the first time in a veterinary setting, 1 β IL recombinant immunomodulator has been tested for cryptosporidiosis of cattle under experimental conditions. This fundamentally new approach for the prevention and treatment of cryptosporidiosis in cattle is based on a 1 β recombinant interleukin (1 β IL) that has been developed and is synthesized by the State Scientific Research Institute of Highly Pure Biopharmaceuticals of the Ministry of Health of the Russian Federation. The use of 1 β interleukin prior to infection, simultaneously with infection or upon infection lead to a better state of the animals treated and/ or to their complete recovery. This was accompanied by a significant increase in the immunological reactivity of the organism. The drug restored the normal content of leukocytes in peripheral blood, and also enhanced blast transformation of lymphocytes and their production of IL-2. The changes in the immune system observed upon the application of the drug allowed for a significant increase in body defenses of the animal,

an effective struggle against invasive agents, and restricted the development of the disease. IL-1 β immunomodulation in calves caused complex positive changes during the 1-2 months of observation. Effectiveness of the drug depended on dosage, frequency of application, the invasive process period, and individual parameters of the animals.

When using 1 β IL for preventive purposes, the drug (5-10 ng / kg weight) is injected once a day starting at the first day after birth, and applied three times at an interval of 48 hours.

For the purpose of treatment, the drug is used 10 ng / kg of weight once a day for 3 days. The possibility of correction of the immune status of animals with cryptosporidiosis and prevention has been confirmed.

The drug has an advantage over antibiotics and other chemical and pharmacological agents, since this drug, being able to substitute the natural immunity mediator, stimulates body defenses without eliciting toxic and allergic effects.

O6 Epizootology of Anthrax in Yakutia

G.T. DYAGILEV¹, MIKHAIL P. NEUSTROEV^{2*}

¹ Dr. vet. sc., Yakut Scientific Research Institute of Agriculture, Laboratory of Veterinary Biotechnology

² Prof. Dr. biol. sc., Head of the Laboratory of Veterinary Biotechnology, Yakut Scientific Research Institute of Agriculture

Corresponding author: hotubact@mail.ru

The first information about Anthrax in Yakutia dates back to 1811. For the period from 1811 to 1993, on the territory of the Republic the disease and mortality of domestic and wild animals with Anthrax was registered in 739 disadvantaged settlements and in 244 permanently disadvantaged settlements. The number of dead domestic and wild animals was 78.017, including cattle – 29.480 (37.7%), horses – 35.995 (46.1%), and deer – 12.537 (16.2%).

The territory of Yakutia is divided into four epizootic zones according to the level of incidence (repeatability and degree of disadvantage):

A) a zone with a high level of incidence and disadvantage which includes 9 administrative territories (districts) of Yakutia: Vilyuisky, Verkhnevilyuisky, Yakutsky, Nyurbinsky, Ust-Aldansky, Namsky, Srednekolymsky, Olekminsky, Amginsky (17 to 25 times);

B) a zone with an average level of incidence and disadvantage which includes the following districts: Suntarsky, Khangalassky, Oimyakonsky, Gorny, Churapchinsky, Megino-Kangalass-

ky, Oleneksky, Verkhoyansky, Tattinsky (6 to 15 times);

C) a zone with a low level of incidence and disadvantage which includes following districts: Verkhnekolymsky, Nizhnekolymsky, Neryungrinsky, Ust-Maysky, Lensky, Aldansky, Kobyaisky, Eveno-Bytantaisky, Tomponsky, Zhigansky, Mirninsky, Momsky (1 to 5 times);

D) area free of Anthrax. it includes mainly tundra areas of the polar regions of Yakutia: Anabarsky, Allaikhovskiy, Bulunsky, Ust-Yansky, Abyisky districts. In these areas Anthrax has never been recorded.

Multiple outbreaks of Anthrax in the same areas indicate the stationarity of the infection.

We have developed a cadastre of disadvantaged settlements for Anthrax. The presence of a large number of disadvantaged settlements and the long-term survival of the pathogen in environment causes a threat of epizootic situation. The threat is also confirmed by the results of our own forecasting methods.

O7 Anthrax: Diagnostics, Epidemiology, Environment, Therapy, Vaccines, and Phages ...

More than two decades of research at the University of Hohenheim, Stuttgart

WOLFGANG BEYER

PD Dr. med. vet. habil. Livestock Infectiology and Environmental Hygiene, Institute of Animal Science, University of Hohenheim, Stuttgart, Germany

Corresponding author: wolfgang.beyer@uni-hohenheim.de

The Anthrax laboratory of the University of Hohenheim has been working as a consultancy laboratory for *B. anthracis* for more than 20 years, mainly in duty of the veterinary service in Germany. It is well established as a cooperation partner for the leading anthrax laboratories in Europe and worldwide. The institute owns a large and still growing culture collection of aerobic endospore forming bacteria of European, Asian, and African origins.

Main topics of our research are:

- the development and validation of laboratory methods for the detection of *Bacillus anthracis* from environmental samples, including specimens suspicious to contain spores of intentionally released bacilli,
- the establishment and improvement of methods for forensic and molecular-epidemiological investigations of outbreaks of Anthrax,

- the investigation of the life cycle of members of *Bacillus cereus sensu lato* in environmental habitats and within living vectors,
 - the development and pre-clinical testing of non-living vaccines against Anthrax, comprising multiple recombinant proteins with various adjuvants or DNA vaccines,
 - the development and pre-clinical testing of novel therapeutics against Anthrax,
 - the role of temperate phages in the life cycle of *B. anthracis*,
 - the usage of lytic phages in decontamination of *B. anthracis*.
- The talk will give a short overview on the topics mentioned above.

O8 Echinococcosis and alveococcosis research in Yakutia

LUDMILA M. KOKOLOVA

Dr. habil. vet. sc., Head of Laboratory of Helminthology, Yakut Research Institute of Agriculture, Yakutsk
Corresponding author: kokolova_lm@mail.ru

Since 1998, studies at the Institute focused on cestodes in Yakutia, in particular *Echinococcus granulosus* and *Alveococcus multilocularis*. Tape worms have been studied in domestic and wild ungulates, domesticated and wild carnivores. *Echinococcus granulosus* (larva) was found in domesticated and wild reindeer, roe deer and elk, and also in humans.

Echinococcosis refers to the invasion of a human or an animal with a larval cystic (metacyclic) stage and a sexually mature stage (tapeworm). Two types of tapeworms belonging to the species *Echinococcus* are known, parasitising in two stages: *Echinococcus granulosus* (larva) is localised in the parenchymal organs in mice, lemmings, domesticated and wild reindeer, roe deer, elk and human. The sexually mature stage of *Echinococcus granulosus* is localised in the small intestine of domestic and wild carnivores, like dogs, wolves, and red foxes.

Tumors of *Echinococcus* most often are found in the lungs, liver and larynx of deer, lungs and liver of roe deer and elk, and liver and other internal organs of mouse rodents as well as in the liver, lungs and brain of humans. 627 rodents were exposed to helminthic autopsy: out of 107 house mice, four (3.74%) were infected by *Echinococcus granulosus* (larva); out of 300 bank voles - 18 (6.0%); narrow-headed voles - two, Northern red-backed voles - 61, and lemmings - 51.

From 61 bank voles - 4 (6.5%), and from 51 lemmings - 11 (21.3%). 2.512 domesticated deer were examined. Infection by *Echinococcus granulosus* (larva) was detected in 52 animals, which equals 2.07%. Moreover, 641 wild reindeer were examined: *Echinococcus granulosus* (larva) were detected in 33 animals which equals 5.14%. The highest proportion of infected animals was found in elk: out of 96, 54 were found to be infected by *Echinococcus granulosus* (larva), which equals $56.2 \pm 0.93\%$.

Alveococcus multilocularis, the mature stage is often found in arctic foxes (final hosts) and lemmings (intermediate hosts), in foxes and dogs, and other mice, but is very rare in humans and other mammals, i.e. almost not recorded.

There is a known a case of human disease that has been registered in 2014, and was characterised by its malignant course for more than ten years. The primary organ affected was liver, later, characteristic metastases in other organs, like the intestine and peritoneum, became manifest. The size of nodes of *Alveococcus* larvae reached 15-20 cm in diameter.

Yakutia belongs to the endemic regions with regard to echinococcosis and alveococcosis. These zoonotic helminthiases pose a great danger to agricultural, domestic, and wild animals but also to humans.

O9 Research on alveolar and cystic echinococcosis at the University of Hohenheim

THOMAS ROMIG

Dr. rer. nat., Parasitology, Institute of Zoology, University of Hohenheim, Stuttgart, Germany
Corresponding author: thomas.romig@uni-hohenheim.de

Echinococcosis affects more than one million people at any one time, and is recognized by the World Health Organization (WHO) as one of four priority neglected zoonotic diseases, along with rabies, cysticercosis and foodborne trematodes. Two forms of the disease are important, both occurring in Yakutia:

Cystic echinococcosis (CE), a debilitating and potentially fatal disease of humans, is spread worldwide with the highest public health and economic impact in resource-poor countries, and is transmitted in life cycles involving dogs or wild canids and domestic or wild ungulates. CE is caused by various pathogens of the cestode genus *Echinococcus*, whose complex taxonomic structure has only recently been established. Accordingly, transmission pathways and pathogenicity for humans and livestock are known to vary widely among the cryptic species of this *Echinococcus granulosus* cluster. Yakutia is a focus of CE within the Russian Federation, with high disease prevalence in domestic livestock (e.g. reindeer) as well as wild animals (e.g. moose, wolves). Molecular identification of few samples revealed the presence of at least two *Echinococcus* species and several diverse genotypes in animal hosts. The transmission seems to be highly complex, involving both domestic and wild animals. CE in humans is frequently reported, but here are no data on the impact of any of these parasite species on humans for lack of investigations.

Alveolar echinococcosis (AE) is caused by various genotypes of one species, *E. multilocularis*, which

is spread in cold and temperate climates throughout the Northern hemisphere. It is a primary wildlife parasite, transmitted in life cycles between wild canids (mainly foxes) and rodents. Humans are accidentally infected, but the resulting disease is malignant with unsatisfactory treatment options and leads to death without qualified medical intervention. In Yakutia, published prevalence data indicate the presence of hyperendemic foci. Recently, a genotype was found in Northern Yakutia that was previously thought to be restricted to America. Considering the vast North-South extension of Yakutia, the presence of different life cycles (involving different genotypes with divergent pathogenicity in humans) is expected, e.g. in Arctic tundra and in boreal forest zones (which, however, may or may not be linked through long-distance migration of arctic foxes, red foxes and wolves). There is a report about a specific transmission between domestic dogs and synanthropic rodents in central Yakutia, but no details on this have been published yet.

In conclusion, *Echinococcus* transmission in Yakutia (and the resulting risk for humans and livestock) is intense, and the contributions of different *Echinococcus* species and genotypes are complex and little understood. Molecular characterization of systematically sampled parasite isolates is expected to help identifying important transmission pathways and enable evidence-based control and prevention campaigns.



Session 1

Session 1

O10 A variety of harmful insects (Diptera) and ticks (Acari: Ixodida), study of their life cycle, and creation of preventive measures for agricultural animals

O11 Tick-related research at the University of Hohenheim

ALEXANDR D. RESHETNIKOV¹, ANASTASIYA I. BARASHKOVA², EVGENIY N. POPOV³

MARCO DREHMANN*, ALEXANDER LINDAU, MARION WASSERMANN, UTE MACKENSTEDT

¹ Prof. Dr. vet. sc., Head of Laboratory of Arachnoentomology, Yakut Research Institute of Agriculture

Department of Parasitology, Institute of Zoology, University of Hohenheim, Stuttgart, Germany

² Dr. habil. biol. sc., Laboratory of Arachnoentomology, Yakut Research Institute of Agriculture

Corresponding author: marco.drehmann@uni-hohenheim.de

³ Doctoral student, M.Sc., email: polard2013@yandex.ru

Corresponding author: adreshetnikov@mail.ru

Global warming causes a change in the fauna, life cycles and the harmfulness of insects and ticks for farm animals. Studies of our Laboratory of Arachnoentomology have shown an appearance of new, previously unidentified species in the arthropod fauna of the Republic of Sakha (Yakutia). Such invasive species might represent novel vectors that transfer dangerous zoonotic diseases to farm and other animals. Already, the economic damage caused by zoonotic diseases previously unknown is very high. After a long period of well-being in Yakutia, in 2008 an aggressive form of pyreplasmidosis of reindeer occurred, the regional focus of which was found in the Gorny District. In the settlement Tomtor, 189 deer (57.9%) of the herd stock died, while in the area of Tapsylyn the infection caused 105 (77%) animals deceased. Another unexpected finding in Yakutia was the tick species *Ixodes persulcatus*, which is a vector transmitting many dangerous blood borne parasitic diseases. In the Primorsky tundra, previously unidentified species of *Hybomitra* flies were found, i.e. *Hybomitra montana* and *H. nigricornis*. For plains pastures species like *Chrysops divaricatus*, *Chr. suavis*

and *Hybomitra aequitincta* were identified, and in the basin of the Kolyma River a previously observed type of midges, i.e. *Simulium posticum*, was observed. Given the massive attacks of blood-sucking mosquitoes on herds of domestic reindeer during the summer months, the average annual damage amounts to 1,940.84 thousand rubles. The economic effect for one year per one herd of reindeer is 1,875.49 thousand rubles, the economic effect per one ruble of costs is 28.7 rubles.

We have developed effective preventive technologies to protect farm animals from harmful arthropods. These innovative technologies are protected by more than ten patents of the Russian Federation. Research in our laboratory is performed by competent staff and we cooperate with leading scientific institutions in Russia, e.g. the All-Russian Scientific Research Institute of Fundamental and Applied Parasitology of Animals and Plants named after K.I. Skryabin, the A.N. Severtsov Institute of Ecology and Evolution and the All-Russian Scientific Research Institute of Veterinary Entomology and Arachnology.

1. Tick diversity and distribution

We are studying the density, diversity and distribution of ticks in Germany. Therefore, we are collecting ticks either from hosts or by flagging and identifying the species by morphological characteristics and with molecular methods. This also comprises the detection of tick species previously unknown in Germany, like *Hyalomma rufipes*.

2. Tick-borne diseases

Tick-borne diseases are not equally distributed in Germany. Therefore, we collect ticks in different areas in Germany to detect pathogens like TBE-Virus, *Borrelia*, *Rickettsia*, and others by means of Light-Cycler-PCR. The identification of pathogens in ticks is a prerequisite for understanding the distribution of tick borne diseases in Germany.

3. Tick control

Biological and chemical approaches of tick control are being developed and tested in our laboratory, in controlled tick plots, and in gardens. We focus on entomopathogenic fungi in an 'attract and kill' approach. The test of the "Ixogon Zeckenrolle", a product commercially available in Europe, has just been finished.

4. Behavioural studies

By using partially automated techniques we study tick behaviour under special conditions, i.e. in certain seasons or circadian phases. The ticks are kept in a controlled environment in the laboratory or in a tick plot and monitored by cameras. An image recognition program has been developed to measure tick activity.

1. Barashkova A.I. 2017. Bloodsucking dipterans on insects (Insecta, Diptera: Tabanidae, Culicidae, Simuliidae) of the agroecosystems of Yakutia: Abstract of the thesis of Doctor of Biological Sciences. 48 p. <http://dlib.rsl.ru/viewer/01006653982?page=1> (in Russian).

2. Reshetnikov A.D., Barashkova A.I. 2017. Technology of protection of reindeer from bloodsucking dipterous insects and imago gadfly under the conditions of tundra. 11 p. <https://elibrary.ru/item.asp?id=30691359> (in Russian).



Session 2

Session 2

O12 Surveillance and control of zoonotic diseases in Germany – an overview and the case of Hepatitis E

MIRKO FABER

Dr. med., Department of Infectious Disease Epidemiology, Robert Koch Institute, Berlin, Germany
Corresponding author: FaberM@rki.de

Outbreaks of highly pathogenic diseases such as Severe Acute Respiratory Syndrome (SARS), avian influenza or Ebola have shown that zoonotic infections can be a serious threat to public health and keep the world in suspense for several months.

Although less dramatic, zoonoses also play an important role for public health on a daily basis. In Germany, more than half of all infectious diseases that are mandatorily notifiable according to the Infection Protection Act (IfSG) are zoonoses.

They include diseases

- with a high incidence (e.g., salmonellosis, campylobacteriosis),
- with a high case fatality (e.g., HUS/STEC, listeriosis, tularaemia, anthrax),

- that can cause outbreaks (e.g., trichinellosis, brucellosis, hantavirus disease),
- that can be climate sensitive (e.g., Tick-borne encephalitis (TBE), borreliosis, hantavirus disease) or emerging (e.g., hepatitis E).

In this presentation, we would like to give examples of epidemiological surveillance, research and outbreak investigations with regard to selected zoonotic pathogens that are relevant to public health in Germany.

A focus will be on the epidemiology of Hepatitis E, a foodborne infection, mainly transmitted via consumption of pork and game meat and causing nearly 3.000 notified clinical cases in 2017.

O13 Viral Hepatitis E as a new zoonotic threat to human health in Yakutia

SERGEY I. SEMENOV¹, SNEZHANA S. SLEPTSOVA², KONSTANTIN M. STEPANOV³

¹ Research Institute of Health, North-Eastern Federal University, Yakutsk

² Medical Institute, North-Eastern Federal University, Yakutsk

³ Yakutsk Scientific Center of Complex Medical Problems, Yakutsk

Corresponding author: insemenov@yandex.ru

Introduction: Hepatitis E, previously considered a tropical infection, is a new threat for human health around the world. According to some estimates, one-third of the world's population is infected with the Hepatitis E virus (HEV). In many European countries, the detectability of serological markers of HEV in donors varies between 1.3% (in Italy) to 52% (in France). The risk groups are farmers and hunters.

Methods: ELISA tests were performed for the presence of a-HEV-IgG in 148 persons, including 64 persons in pastoral areas, and 12 persons in reindeer breeding areas. 13 persons were patients with chronic hepatitis B and C, and a group of "conditionally healthy" individuals consisted of 59 persons.

Results: Markers of viral Hepatitis E (a-HEV-IgG) were found in 21.8 % of the population from pastoral areas and in 16.6% of reindeer herding areas. Our studies have shown a high circulation of HEV among "conditionally healthy" individuals (21.2%) and patients with viral Hepatitis B and C (22.4%). Among 19 patients with chronic Hepatitis B, anti-HEV-IgG was detected in 21.0% (4 out

of 19), while Hepatitis C markers were found in 31.5% of cases. Notably, HCV-RNA was only detected in 21.0% of these cases. A similar situation is observed in patients with chronic viral Hepatitis C. Among 68 patients diagnosed with Hepatitis C, markers of Hepatitis E, Hepatitis B (HBsAg), and Hepatitis D were detected in 25%, 11.7% and 4.4% of cases, respectively. In fact, a quadruple infection (HCV+HEV+HBV+HDV) was established for some individuals. Whether this co-distribution of other Hepatitis markers is significant in either of the patients groups needs to be verified for larger patient cohorts.

Conclusion: According to our study results, there is a high incidence and infection of the Yakut population with all known Hepatitis viruses. An increased circulation of the Hepatitis E virus in the Russian Arctic was observed. Further research with larger proband cohorts are needed to assess the degree of infection with Hepatitis viruses in the Yakut population and to determine their specific viral genotypes, as well as their mode of transmission and host adaptation.



Session 3

Session 3

O14 Influence of global climate change on the natural environment of the center of the continental permafrost zone of the Northern Hemisphere (on the example of Yakutia)

ROMAN V. DESYATKIN*, ALEXEY R. DESYATKIN

Institute of Biological Problems of Cryolithozone, Siberian Branch, Russian Academy of Sciences, Yakutsk
Corresponding author: rvdes@ibpc.ysn.ru

Current changes in the climate, primarily increasing air temperatures, have exerted a considerable impact on the state of permafrost landscapes and ecosystems in Eastern Siberia. The 2-3°C rise in mean annual air temperature over the last three decades has resulted in a ground temperature increase of 0.4-1.3°C, which in turn has led to deepening of seasonal thaw and intensification of cryogenic processes. In forest-free and disturbed locations underlain by the ice complex, permafrost has begun to degrade resulting in thermokarst development and landscape reshaping. Permafrost degradation makes the land useless for agriculture and other purposes, and poses a potential threat to human life and activities. Increasing air temperatures have triggered changes in the ecology of Eastern Siberia.

Many animals and plants have shifted their ranges and this may well be the precursor of a general northward shift of the natural zones. The gradual expansion of the habitats for many animal and plant species from south to north also contributes to an invasion of new plant and animal species into the northern areas, including crop pests and pathogens.

In warming climate, cryogenic processes cause local redistribution of the ecosystems, the mechanisms of which have not been understood adequately yet. Permafrost ecosystems respond to global warming quite rapidly. This makes the study of their changes somewhat easier, but still requires meticulous attention to observations, research, and analysis of the processes under way.

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O15 Impact of climate and land use change on soil processes - evidence and perspectives

SERGEY BLAGODATSKIY¹, HOLGER PAGEL², ELLEN KANDELER², CHRISTIAN POLL², THILO RENNERT², THILO STRECK²

¹ Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), University of Hohenheim

² Institute of Soil Science and Land Evaluation, University of Hohenheim, Stuttgart, Germany

Corresponding author: sergey.blagodatskiy@uni-hohenheim.de

The transformation of heterogeneous and diverse landscapes of Yakutia (Central Siberia) is strongly affected by current and forthcoming climate change, which can be seen in this region as gradual increase of mean annual and maximum summer temperatures (Desyatkin and Desyatkin, 2017). The warming in this region is ten times faster than the global average value (Schuur et al., 2015), and leads to accelerated permafrost thawing as well as increasing forest fire frequency and total lake area (Boike et al., 2016).

Considering these changes in the frame of “One Health”, we need to account for several interrelated components: people and animal migration and distribution, availability of soil resources for agriculture and stock raising, and emission of greenhouse gases from land and soil. Greenhouse gas emissions may particularly become critical due to a positive feedback loop: additional CO₂ and CH₄ emitted in response to climate warming will increase the greenhouse effect and further accelerate the rise of the land surface temperature. The major source of greenhouse gas emissions from soil is the mineralization of soil organic matter (SOM).

This process is strongly controlled by temperature and moisture and is an integral component of “soil health”, i.e. the capacity of soil to function according to its potential and management strategies (Doran, 2002; Wall et al., 2015). Soil health is considered as essential for maintaining human well-being and the conservation of biodiversity.

For collaborative research on soil health in Yakutia, we propose to focus on the impact of land use and climate change on SOM mineralization. This will be based on our previous experience on measuring and modeling of land use impact on SOM turnover (Blagodatskii et al., 2008; Demyan et al., 2016; Larionova et al., 2003), emission of greenhouse gases (Lamers et al., 2007; Van Den Berg et al., 2016; Wizemann et al., 2014), small-scale spatiotemporal dynamics of SOM, pesticides and soil-microbiome interactions (Kramer et al., 2016; Pagel et al., 2016; Preusser et al., 2017), temperature sensitivity of SOM decomposition and impact of global warming (Ali et al., 2018; Blagodatskaya et al., 2016; Crowther et al., 2016) as well as composition and stability of SOM and organo-mineral associations (Rennert et al., 2014, 2018).

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Session 4

Session 4

O16 Indigenous peoples of Yakutia and new health risks in connection with global change

VYACHESLAV I. SHADRIN

Arctic Research Department, Institute for Humanities Research and Indigenous Studies of the North, Siberian Branch, Russian Academy of Sciences
Corresponding author: odul_shadrin@mail.ru

Indigenous peoples of the North in Russia present diverse ethnic groups with less than 50.000 persons in total. They live in their original territories and pursue their traditional way of live. The group members share a sense of ethnic identity. The term indigenous peoples of the North in the Russian Federation comprises 41 groups, with the total number of 240.000, in 34 regions and in 2/3 of the territory of Russia. In the Republic of Sakha (Yakutia), 40.000 indigenous peoples live in 81 settlements of 21 administrative districts. 65 % of them live in rural areas. These ethnic groups are Evenki, Even, Yukaghir, Dolgan, Chukchi and also Russian Arctic old-settlers.

As elsewhere in the world, and especially in the Arctic regions, the indigenous peoples of Yakutia face several challenges due to the global changes of today:

1) Traditional occupations are based on ancient knowledge that accumulated over thousands of years which helps to survive under extreme weather conditions. The whole nomadic life was built on the ability to predict weather for different periods as the basis for choosing suitable times for migration. Changed weather conditions, the altered water regime, and the impossibility to make accurate weather forecasts negatively impact the traditional economies and threaten the lives of both humans and animals. The traditional knowledge was based on the principle of "We are part of our land and of our water", but now people tend to speak more of "The nature doesn't trust us anymore."

2) The weather has ceased to be stable in terms of the number of natural disasters, temperature changes, storms, floods, increased precipitation.

3) The global warming leads to permafrost melting which reveals old burial sites of animals and humans that died during outbreaks, presenting new threats to health.

4) Also new species of animals and insects can spread new diseases further to the North. Our people observe changed behaviours of wild animals like wild reindeers, bears and wolves causing new threats to livestock and humans.

5) There is an increasing number of diseases related to climate change (prolonged heat periods, extended forest fires, smoke etc). Previously unknown health conditions like asthma have increased in the last years. Another health threat is increased exposure to ultraviolet radiation.

6) Water safety is one of the major health issues for humans and animals alike. In recent years, the pollution of water has sharply increased due to the melting of permafrost.

7) One of the biggest social changes is the altered diet, including reduction of natural products.

8) Infrastructure problems like erosion of shores, destruction of roads, houses, air bases occur more frequently. Due to the earlier river ice melting, the winter road season is shorter. Many infrastructure buildings operate under emergency conditions.

9) Last but not least, the industrialisation processes in the vulnerable ecosystems where the indigenous peoples live present a considerable ecological concern. Climate change has increased the availability of mineral resources. This leads to an increase in land seizures from traditional land use. Our elders say, "We can adapt to all changes, but we can't adapt without our land".

O17 Attitudes towards health among indigenous peoples under modern conditions

ELENA P. AMMO SOVA*, RAISA N. ZAKHAROVA, AFANASIY FEDOROV, M.E. BALTAKHINOVA

¹ Research Institute of Health, North-Eastern Federal University, Yakutsk
Corresponding author: ammosovael@mail.ru

Introduction: The Republic of Sakha (Yakutia) is located in the North of Russia. Yakutia has a harsh, extreme continental climate. From time immemorial, all measures of health protection have been inextricably linked with the way of life of northern peoples, their unique traditions and world views. Over the last century, the traditional way of life in Yakutia has radically changed in most areas: the rural type of dwelling is gradually replaced by urban settlements, physical labour is replaced by mental work, the diet and nutrition behaviours have undergone fundamental changes, and technogenic transformation replaced informational isolation. All of the above factors lead to stress, destabilisation of health-preserving behaviours, and negatively affect the health of the inhabitants of the North.

Methods: This study has been conducted and centered around the questionnaire "Attitude to health" developed by R.A. Berezovskaya (2001) and that is based on a value-motivation scale. The concept of "Psychology of social relations" provided the theoretical base. Answers of 292 participants of the study living in rural Yakutia were analysed.

Results: The study revealed that health is considered a vital value and a priority for the ma-

majority of participants in the study. Despite this, the responses analysis indicates that most respondents do not recognise responsibility for their own health: they showed an unsatisfactory level of commitment to a healthy lifestyle and a rather passive attitude towards their health. Most respondents underevaluate the role of health in their lives, and do not realise the importance of health as an instrumental value. Health as an instrumental value scores behind the values such as persistence and hard work, and takes a lower place compared to its terminal value. People of mature age more actively engage in health promoting activities, which probably is associated with the awareness of a slow deterioration of well-being and the presence of chronic diseases. Younger people focus their life towards other activities, most of them think of themselves as healthy and therefore do not need to deal with measures preventing diseases.

Conclusion: In the new environment, the self-preserving behavioral skills of the indigenous peoples of the North, which previously helped to survive in harsh climatic conditions, have become inadequate. Nowadays, it is necessary to form a new strategy of behavior aimed at preserving the health of the population.



Session 4

Session 4

O18 Rural everyday life in Yakutia in a changing environment

LILIIA I. VINOKUROVA

Dr. hist. sc., Arctic Research Department, Institute for Humanities Research and Indigenous Studies of the North, Siberian Branch, Russian Academy of Sciences, Yakutsk
Corresponding author: lilivin@mail.ru

The indigenous peoples of the Republic of Sakha (Yakutia) still live in rural areas, which helped to preserve traditional activities and ethnic cultures. In rural space, the main occupations of indigenous peoples are horse and cattle breeding, reindeer herding, as well as hunting and fishing. These traditional activities are linked to and affected by the natural environment and climate directly. Therefore, all social consequences of environmental changes become manifest in the space of everyday life. The indigenous population of the Republic of Sakha (Yakutia) is represented by Sakha (Yakuts), Russian old-settlers, and small indigenous peoples of the North. The latter group, the northern minorities of Yakutia, are the Evenks, Evens, Yukagirs, Dolgans and Chukchi. We believe, that the natural environment is a fac-

tor in the development of human's spiritual life; it is a fertile ground for attachment to native places. The self-perception of a person is formed under the influence of the natural and cultural environment in which he or she was born and grew up. Here, we will present the analyses of field materials collected in rural areas of Yakutia during the last ten years. The data obtained comprise interviews with and life stories of residents of villages in the arctic and central districts of the Republic. Our observations highlight some interesting aspects of the perception of climate and weather changes by different groups of rural residents. For example, the historical comparative points of ecological and health phenomena in rural everyday life are highly valuable.

O19 Food products in combination with unique northern raw materials

KONSTANTIN M. STEPANOV

Prof. Dr. vet. sc., Yakut Science Centre of Complex Medical Problems / Yakut State Agricultural Academy
Corresponding author: stenko07@mail.ru

In the Far North, there are unique animal and vegetable raw materials for production of specialized ingredients. It should also be emphasized that the products of processing of wild berries and wild-growing edible plants should occupy a proper place in the composition of foodstuffs, ensuring their delivery to the widest masses of the population, increasing the biological value of food without increasing its caloric content, which is especially important for preventing the violation of fat metabolism and cardio-vascular diseases.

Under extreme conditions of the Far North, reindeer produce a high amount of biologically active substances. Accordingly, the drugs and products that are derived from these animals are most valuable. A unique combination of substances in the meat of reindeer prevents the formation of body fat in the human body.

The meat of domestic reindeer contains the greatest number of essential amino acids in comparison with beef, pork and lamb.

As a result of many years of research on the actual nutrition of the population living in the North, medical, biological, and technological requirements for the composition, nutritional value and food safety based on local raw materials have been formulated. Moreover, regulatory and technical guidelines for the production and processing of food have been developed, and standards have been obtained. The technologies developed take into account the population structure and specificity, as well as material and technical support provided by the food processing enterprises of the Republic of Sakha (Yakutia). This ensures product quality, and promotes its further improvement, the expansion of assortment as well as the preservation of health of the Yakut population.



Session 4

O20 Bridging knowledge systems in nutrition and health research

STEFANIE LEMKE

¹ Research Centre for Agroecology, Water and Resilience, Coventry University, Coventry, United Kingdom

² Department of Societal Transition and Agriculture, Institute for Social Sciences in Agriculture, University of Hohenheim, Stuttgart, Germany

Corresponding author: ac0447@coventry.ac.uk

Food systems, and the social relations that shape them, provide an entry point for exploring structural issues such as access to land and other resources needed to grow, collect, or hunt food; the traditions and cultural practices of growing, preparing, and eating food; and the relationships and power dynamics between various actors and institutions involved in the production, processing, and consumption of food. Food plays an important role for wellbeing and health, in Indigenous, non-Indigenous, and urban contexts. There is renewed attention on the role of local food and knowledge systems for achieving more sustainable production and consumption.

Especially for Indigenous Peoples, their food systems, nutrition and health are threatened by environmental degradation and loss of biodiversity, loss of cultural and spiritual heritage, competing demands for land for production of food or fuel, and unsustainable and unhealthy consumption patterns and lifestyles. Public health care systems have often suppressed Indigenous worldviews and practice, resulting in barriers to health care and education.

In order to design appropriate public health policies and programmes, in line with the One Health concept, it is critical to understand how people

perceive concepts such as 'health', 'health care', 'nutrition' and 'environmental change', and how these are interrelated. It is further important to understand the current practices of producing, processing, storing, preparing and consuming food. Relevant questions in research on public health promotion are for example: how have loss of land and other resources impacted livelihoods, lifestyles and diets; who is in charge of producing, processing and preparing food; what is the role of local leaders; how is traditional and local knowledge transferred; who are role models for the youth; what are underlying reasons for mistrust toward public health care and how could they be overcome; what are factors that can enhance capacity and resilience of individuals and communities?

Bridging Indigenous and Western research approaches, conducted in partnership of researchers and local actors, can lead to co-designing public health policies and programmes. Examples of good practice from research on food systems, nutrition, public health and environmental impacts illustrate how this has led to initiatives promoting sustainable and healthy nutrition and lifestyles.



ABSTRACTS
POSTER

P1 The results of microbiological studies of representative of mammoth fauna preserved in frozen soils of Yakutia

MIKHAIL M. NEUSTROEV

Dr. biol. sc., Republican Information and Analytical Center for Environmental Monitoring / Ministry of Ecology of the Republic of Sakha (Yakutia), Yakutsk
Corresponding author: spoiler-men@mail.ru

Due to the permafrost, Yakutia is one of the amazing places on the planet where scientists can find the remains of fossil animals that have survived thousands of years.

The study of the microbiota of representatives of mammoth fauna is relevant for various aspects of modern microbiology and biotechnology such as psychrophilia, cryoanabiosis, features of ecology and evolution of microorganisms.

Results: The microbiological studies on soft tissues of the Mokhsunuokhsky, Yukagirsky, Malolyakhovsky mammoths, the Oimyakonsky and Khromsky young mammoths, the Kolyma woolly rhinoceros, the young mammoth Yukka, and the Yukagir horses and bisons, as well as of the Omolovsky young elk allowed the isolation of 64 strains of microorganisms, including 42 strains of bacteria assigned to the genus *Bacillus*. According to biochemical and physiological properties, they are attributed to the nine species: *B. megatherium*, *B. subtilis*, *B. alvei*, *B. brevis*, *B. popilliae*, *B. steurothermophilus*, *B. circulans*, *B. pumilus*, and *B. laterosporus*. All strains have been proven non-pathogenic for laboratory animals.

We have investigated antagonistic activity and antibiotic stability of *Bacillus* strains isolated from paleomicroflora of mammoths. All strains show varying degrees of antagonistic properties in relation to pathogenic and conditionally patho-

genic microorganisms: *Salmonella*, *Escherichia*, *Shigella*, *Staphylococcus*, *Streptococcus*, *Proteus*, *Micobacterium* and microscopic fungi such as *Aspergillus*, *Penicillium*, and *Alternaria*.

Notably, antibiotic resistance of bacteria of the genus *Bacillus* isolated from paleomicroflora has been observed.

Moreover, *Bacillus* strains isolated from mammoths release strong bacteriocins, stopping the growth and development of other microorganisms. The strongest bacteriocins were produced by strains of *B. subtilis* isolated from the soft tissues of the Kolyma woolly rhinoceros and the Oimyakonsky young mammoth.

The study allowed for the first time to certify and deposit strains of bacteria *B. subtilis* "Kolyma-7/2k" and *B. subtilis* "Oimyakon-6/1" isolated from the Kolyma woolly rhinoceros and Oimyakon young mammoth in the Collection of Useful Microorganisms of the All-Russian Scientific Research Institute of Agricultural Microbiology in St. Petersburg (2010) for further modern biotechnological research.

Methods for restoring northern ecosystems have been developed using the strains of *Bacillus subtilis* "Kolyma-7/2k" and *B. subtilis* "Oimyakon-6-1", isolated from paleomicroflora. Two patents of the Russian Federation for inventions have been granted.

P2 Microbiota and sanitation of underground glaciers in storage of foodstuffs

NEUSTROEV, MIKHAIL P.^{1,2}, TARABUKINA, N.P.¹, MAKSIMOVA, A.N.², STEPANOVA, A.M.¹

¹ Yakut Scientific Research Institute of Agriculture named after M.G. Safronov, Yakutsk

² Prof. Dr. vet. sc., Yakut State Agricultural Academy, Yakutsk

Corresponding author: hotubact@mail.ru

The whole territory of the Republic of Sakha (Yakutia) is occupied by permafrost, which directly relates to the sharp continentally climate and low temperatures. In the Republic, for a long time and until now, storage of food raw materials and food products in glaciers is widespread. The use of natural cold for the processing and storage of food products is possible because of the permafrost and an extremely long winter season, which lasts in some regions up to eight-nine months.

However, inadequate design and improper operation of underground refrigerators lead to premature deterioration of stored food and a decrease in quality.

Securing hygienic standards and carrying out the necessary works for sanitation are difficult due to the lack of effective means and scientifically-based regimes.

The aim of this work is the study of microbiota and the development of effective methods and modes of reorganization of the glaciers in the permafrost for food storage. The total microbial contamination of the glacier surface ranges from $2,8 \times 10^2$ to $60,0 \times 10^3$ colony forming units in 1 cm^2 , and in air samples from $1,4 \times 10^2$ to $23,6 \times 10^3$ colony forming units / cm^3 . The microbial community of underg-

round glaciers used for food storage is mainly characterized by soil spore-forming aerobic bacteria of the genus *Bacillus*, by toxic and mold fungi of the genera *Aspergillus* and *Mucor*, as well as by pathogenic *Yersinia*, which can be dangerous and lead to food-borne diseases when foodstuff becomes contaminated.

Sanitation fluid was applied in the form of atomized spray through the containment cylinder at the temperature of the glacier, i.e. $-21,0 \pm 0,8 \text{ }^\circ\text{C}$.

As peracetic acid was shown to be an effective sporicide when tested against spores of *Bacillus subtilis* (Leaper, 1984), 1% solutions of peracetic acid of NCA, at a consumption of 300-400 ml/m², have been applied. After an exposure of 18 hours, ice surfaces contaminated with pathogens of intestinal, coccal, and spore infections could be reliably disinfected.

Electrochemically activated anolite (with an active chlorine content of 0.1 mg/ml) with addition of 0.5% NCA solution, and a flow rate of 300 ml/m² and an exposure time of 5 hours, completely disinfected the ice surfaces contaminated with *Sal. abortus equi BN-12*, *Str. equi H-34*, and *Bac. subtilis TNP-3*.



Poster Session

Poster Session

P3 Sanitation of the udder of cows after milking using *Bacillus subtilis* strains

SARGYLANA V. DULOVA¹, NADEZHDA P. TARABUKINA²

¹ Doctoral student, Yakut Scientific Research Institute of Agriculture, Yakutsk

² Scientific supervisor, Prof. Dr. vet. sc., Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: sargylana.dulova@mail.ru

Bacteria of the genus *Bacillus subtilis*, isolated from the permafrost soils of Yakutia, have an antibacterial property with respect to pathogenic and potentially pathogenic microorganisms, as well as the ability to stimulate the immunobiological reactivity of the animal organism.

Particular attention should be paid to the treatment of the udder after milking. It is recommended to treat the udder with a special device that provides a protective film and prevents penetration of microorganisms into the teat canal, as the teat canal remains open, and a "soft vacuum" is created which draws air and dirt into the teat canal.

Treating the skin of the udder with "Probiodez 3+5" (a hygienic product based on strains of *B. subtilis*) two times a day after milking, significantly reduces the microbial contamination on the nipples of the cow udder. At the end of a 30-day trial, the number of mesophilic aerobic and facultative anaerobic microorganisms on the nip-

ples of the udder of the test group decreased by 42.6 times as compared to the untreated control group.

Thus, in the course of the experiment, it was established that the use of probiotic sanitary and hygienic product "Probiodez 3+5" after milking helps to reduce the number of mesophilic aerobic and facultative anaerobic microorganisms, the number of spore forming bacteria, as well as the number of *Staphylococcus* and *Escherichia*. Notably, the treatment did not show any side effects and no allergic skin reactions of the cow udder were observed.

The scientific novelty of this approach has been filed for by patent application No. 2018106423 from 2/20/2018, and granted by obtaining a patent for inventions of the Russian Federation.

The practical significance of this research is that probiotic drugs can be used for sanitation of objects of veterinary supervision.

P4 Development and production of biological protection means of agricultural animals, plants and environmental protection

NADEZHDA P. TARABUKINA*, MIKHAIL P. NEUSTROEV

Prof. vet. sc., Yakut Scientific Research Institute of Agriculture, Yakutsk / LLC Scientific and Production Center "Khotu-Bact"

Corresponding author: hotubact@mail.ru

At present in the EU, the use of antibiotics is banned in breeding and agricultural producing in order to ensure safety of food products and the environment. Against this background, research for the development and innovation of safe and effective probiotics as an alternative to antibiotics has been accelerated not only in Russia but worldwide.

In the recent decade, at the Yakut Research Institute of Agriculture a range of innovative probiotics on the basis of biologically active and unique local natural strains of bacteria has been developed.

Biological properties of preparations based on a strain of bacteria *Bacillus subtilis* "TNP-3" and *Bacillus subtilis* "TNP-5", and isolated from the permafrost soils of Yakutia can be summarized as follows:

- marked antagonistic action against many pathogens and opportunistic pathogens (*Streptococcus*, *Staphylococcus*, *E. coli*, *Salmonella*, *Brucella*, *Campylobacter*, *Mycobacterium*, *Leptospira*, and viruses) as well as some of toxigenic fungi (*Penicillium*, *Aspergillus*, *Stachybotrus*) and soil microorganisms, pathogens of fungal diseases (*Rhizoctonia-solani*, *Streptomyces*, *Fusarium oxysporum*);
- stimulation of beneficial intestinal microflora development;
- increasing the immunobiological reactivity of the organism treated;
- complex enzymatic activity: proteolytic, gelatinase, amylase, cellulase, B-gluconase and marked

xylanase and fructosyltransferase;

– non-suppressive to growth and development of beneficial microflora such as *Lactobacillus* and *Bifidus* bacteria;

– resistance to a wide range of antibiotics, so it is possible to use it in combination with antibiotics. The preparation is recommended after serious illness with antibiotic treatment, as it rapidly eliminates dysbiosis of the intestine.

The preparations are effective as a component of inactivated vaccines, mineral and vitamin feed additives, premixes and animal feed, bacterial fertilizers for increasing soil fertility and crop in the prevention and treatment of respiratory, digestive, reproductive, pyo-necrotic wounds, mycotoxicosis, microbiocenosis adjusting, immunobiological reactivity of the animal organism and promising for fodder (haylage, silage). They are widely used in livestock farms of the Republic, successfully tested on the farms of the Novosibirsk and Amur regions, the Republic of Buryatia and Mongolia.

The preparations are superior to many foreign and Russian probiotics in performance and the broad spectrum of possible applications.

The scientific novelty of the development is protected by 24 patents of Russian Federation. The production is certified and organized with the laboratory for the development of microbial preparations of the Yakut Research Institute of Agriculture.



Poster Session

Poster Session

P5 The effect of climate change on the threat of zoonotic diseases in the Arctic region (on the example of Yakutia)

KONSTANTIN R. NIFONTOV*, M. POTAPOV, N. STRUCHKOV, A. PROKOPIEVA

¹ Yakut State Agricultural Academy, Yakutsk, Russian Federation

Corresponding author: kosnif@yandex.ru

Reindeer breeding, horse breeding and livestock production has always been an integral part of the national economy of Russia, providing for specific types of raw materials and food. The production is adjusted to the extreme climatic conditions and also to the social, economic and cultural features of the country.

In order to increase meat production, it is necessary to use effectively the available potential of local breeds of horses, cattle and reindeers which are well acclimatized to climatic conditions of the Republic of Sakha (Yakutia). Moreover, efficient diagnostic and monitoring systems for zoonoses are essential to prevent disease outbreaks in farm animals, and to ensure biologically safe and qualitative livestock products.

For a long time, there have been natural foci of a number of infectious and parasitic diseases of humans and animals on the territory of Yakutia, such as anthrax, rabies, brucellosis, leptospirosis, tularemia, necrobacteriosis, echinococcosis, alveococcosis, trichinosis, etc.

The occurrence of new infectious diseases caused by changes in climate and socioeconomic circumstances is likely and has been confirmed by history, e.g. with the spread of brucellosis of reindeer and pseudotuberculosis, diseases previously unknown to Yakutia.

The goals and objectives of the study presented include monitoring of new forms of diseases of northern animals in connection with global warming and the development of methods for optimizing therapeutic measures and disease prevention, and for obtaining biologically safe products of animal origin.

Work has been carried out at scientific, practical, methodological and experimental levels using an integrated system approach that includes veterinary medicine, zootechnology and economics. The novelty and effectiveness of research is associated with the development of innovative approaches that link scientific methodology to commercialization.

P6 Cestodiasis infection of the fish of the middle course of the Lena River under the conditions of increasing anthropogenic impact

PLATONOV, T.A., KUZMINA, N.V., NYUKKANOV, A.N.*

Yakut State Agricultural Academy, Corresponding author: ayan1967@mail.ru

The study of fish populations under the conditions of anthropogenic load is one of the tasks, the results of which are necessary for understanding the mechanisms of the stability of biological systems. When contaminated from industry, the greatest impact is experienced by water bodies, which due to their characteristics are concentrators of toxicants. Therefore, here in the north-east of Russia as well as all over the world, the issue of qualitative depletion of aquatic ecosystems becomes important. In this respect, the left tributary of the Lena River, the Viliuy River, where intensive mineral development is being conducted, is a convenient model for investigating the impact of man-made load on the ecosystem under current conditions. The advantage of parasitic objects over other biological test objects is that "parasites accumulate all the changes occurring in the reservoir and more fully than other hydrobionts" and, therefore, can serve as a more revealing object for assessing the state of the river basin.

For the investigation, the regions with different anthropogenic load were selected: the middle course of the Lena River and its left tributary, the Viliuy. For the period of 2011-15, there is a slight increase in the prevalence of the pike with *Diphyllobothrium latum* plerocercoids. The prevalence of the pike aged 4, 5, 6 years old is equal to 28.5, 33.3, and 36.3%, the infection intensity is from 1-5 specimens, the abundance index is 0.64, 0.55 and 1.09 specimens respectively. The infection of the pike aged 7, 9, 10 years old is 62.5, 60.0, 100%, with the infection intensity 1-8 specimens, the abundance index is 2.0, 3.4 and 4.25 specimens respectively. The total infection of the pike with plerocercoids of diphyllbothriasis is 45.0%, the abundance index is 1.4 specimen.

The total infection of the burbot in the Viliuy River with *Triaenophorus nodulosus* plerocercoids is 36.8%. The prevalence of the burbot aged 4-5-6-7

years old is 16.6, 25.0, 44.4 and 36.3%, respectively, the infection intensity is from 1-3 specimens, the abundance index reaches 2.0 specimens.

Along the Viliuy River, 49 specimens of the burbot were examined by the method of complete helminthological dissection. According to the research, *Diphyllobothrium latum* plerocercoids has not been found in fish. Out of 49 specimens of the burbot in 36.7% of them the larval stage of *Triaenophorus nodulosus* has been found with the infection intensity 1-3 specimens.

Thus, in the present period, with a high anthropogenic load on water bodies, a gradual decrease in the degree of infestation of fish with the plerocercoids of *Diphyllobothrium latum* is being observed. This leads to a gradual destruction of the foci of diphyllbothriasis and their attenuation which has an important epizootological value. Taking into account the constant discharge of waste waters by various industrial and household enterprises into reservoirs and their slow transition to non-waste technologies, in the coming years the flow of pollutants into the environment is likely to continue. There is a shift of complex specialized systems with a great variety of species to much simpler monotypes. Stable changes in the environment which cause a constant excess of the maximum impact on the reservoir lead to occurrence of new biotopes and a stable change in the existing biocenoses, structural and species rearrangement of aquatic communities. The processes of self-purification go to a fundamentally different level. Therefore, the parasitological situation in the reservoir is an indicator of its sanitary state, since a specific parasitological situation corresponds to a reservoir of a certain degree of contamination. Parasites are able to withstand only a certain level of pollution, the excess of which leads to their disappearance in the fauna that primarily depends on the stability of their hosts.



Poster Session

Poster Session

P7 The helminths and helminthiasis of reindeer in Yakutia

LUDMILA M. KOKOLOVA*, INNOKENTII I. GRIGOR'EV

Laboratory of Helminthology, Yakut Research Institute of Agriculture, Yakutsk
Corresponding author: kokolova_lm@mail.ru

Reindeer husbandry is the main ecology and traditional way of life and the main production activity of the inhabitants of the mountain-taiga zone of the Republic of Sakha (Yakutia). Further development of reindeer husbandry, increase in productivity and profitability of reindeer husbandry are not possible without reliable organization and effective protection of domestic reindeer from parasitic diseases, e.g. helminthiasis, which cause significant economic damage in farms engaged in breeding of domestic reindeer.

Research results revealed that in all reindeer husbandry areas of the mountain-taiga zone of Yakutia parasitic diseases are common in domestic reindeer. Using a cohort of 1.143 deer, 43 parasitic species were detected upon helminthological intestinal opening, including 3 species of trematodes, 6 species of cestodes (4 of which parasitizing in the larval stage), 27 species of nematodes, 2 species of the simplest unicellular blood-parasites and 1 species of larvae of lingvats, as well as 4 other parasites: 2 species of gadfly larvae, 1 species of imago oribatid mite, and 1 species of ixodine mite.

In this study, the most epizootologically significant infections and causative nematodes are: **Ostertagiosis**: *Ostertagia* species are found in 54.9 ± 2.8% of deer, an average of 61.5 ± 4.12 specimens; **Nematodirosis**: *Nematodirus skrjabini* parasitizing in the small intestine was found in 52.8 ± 3.1%, with (II) 44.4 ± 1.5 ex. ; **Dictyokuiales**: a species *Dictyocaulus viviparus* parasitizing in bronchi 34.7 ± 1.72% of deer, 13.2 ± 2.1 specimens; **Trichostrongylosis**: *Trichos-*

trongylus columbriformis, *Trichostrongylus axei* parasitizing in abomasum and intestines in 27,4 ± 1,2%, with (II) 63 ± 3,2 copies.

As for trematodes, the following picture emerged: **Paramphistomatosis**: the species *Paramphistomum cervi* in 26.7 ± 1.37% to 1536 ± 86.1 specimens, **Cotylophoronosis**: the species *Cotylophoron skrjabini* in 27,7 ± 6,4% up to 308 specimens.

Cestode infections revealed the following numbers: **Moniesiosis**: the species *Moniezia rangiferina* in 41.5 ± 1.58% with (II) 2-8 ± 1.1 specimens; **Avitellinosis**: species *Avitellina arctica* Kolmakov 13.3 ± 0.3% with (II) 3-11 ± 2.1 specimens. Larval stages of the family. **Taeniidae cysticercosis**: *Cysticercus parenchimatosa* parasitizing in the liver in 56.7% with EI averaging 67.9 ± 2.4 ex.; type *Cysticercus tarandi* parasitizing in the muscle tissue an average of 12.6 ± 1.6% of deer at an intensity of infestation (II) from 23 to more than 1000 specimens, heart muscle in 31.9 ± 1.5%, with (II) from 9 to 56 ex. ; type *Cysticercus taenuicollis* in 8,7 ± 0,8%, with (II) - 2,0 ± 0,1 eks; **Laryngeal Echinococcosis**: species *Echinococcus granulosus* larva laryngeal echinococcosis in 5.1 ± 0.13% with (II) of 2-3 echinococcal cysts in the liver or in the lungs. According to the degree of occurrence, associations of 10 types of infestations were identified: kotolidony + moniezii + ostertagia + haemonchus + oesophagostoma + nematodir + trichostrongylus + strongyloid + cysticerci + linguatula larvae were observed in 14.1 ± 0.8% of the reindeer.

P8 Strongilyatoses of herd breeding horses

LUDMILA M. KOKOLOVA*, LUBOV YU. GAVRIL'EVA

Laboratory of Helminthology, Yakut Research Institute of Agriculture, Yakutsk
Corresponding author: kokolova_lm@mail.ru

Horse breeding is a traditional and important branch of animal husbandry in Yakutia. One of the obstacles to increase the productivity of herd horse breeding are diseases caused by helminths, which are widespread on the territory of Yakutia. Helminth infections cause damage by decreasing the productivity of animals and increasing the mortality numbers in young animals. It is known that the use of anti-helminth drugs have side effects in animals. Along with their helminthocidal activity they cause functional changes in the body of animals, which has been shown in various studies in the field of veterinary medicine.

Today, there is a global interest in the use of natural means of protecting the health of animals and humans. In this regard, the development of scientifically based, environmentally safe and effective methods of correction from helminth-bacterial etiology and post-dehelminthization dysbacteriosis is an urgent task for the veterinary medicine in the Far North.

The results of our research show that 42 different species of *Strongyloides* parasitize in herd breeding horses in the Central and Western zones of Yakutia. The most common *Strongyloides* are the species *Strongylus equinus*, *Alfortia edentates*,

Delafondia vulgaris and numerous species of Trichonematidae. In a coprological examination of 455 horses, we identified *Strongylus equinus* in 44.4%, *Alfortia edentates* in 44.4%, *Delafondia* in 75% and Trichonematidae in 100% of this cohort.

The results of coprological studies of horses for the detection of eggs and larvae of *Strongylus equinus*, *Alfortia edentates*, *Delafondia vulgaris* and Trichonematidae showed that the extent of invasion of the major Strongilyatoses of horses was 95% in the Namsky district, 93.1% in the Megino-Kangalassky district, 100% in the Suntarsky and Nyurbinskiy districts.

The combined use of anti-helminthics, an Equisect pasta and the probiotic "Sakhabactisubtil" allowed for a relatively rapid recovery of the qualitative and quantitative composition of the intestinal microflora. It was shown by increased numbers of lacto- and bifidobacteria and a decrease of pathogenic and opportunistic microorganisms.

Thus, the complex therapeutic options developed for Strongilyatoses are effective, promising, ecologically safe and may also be applied preventively to avoid Strongilyatoses of herd breeding horses in Yakutia.



Poster Session

P9 Influence of keeping conditions and climate on the development of lice - *trichodectes pilosus* in herd horses of the western zone of Yakutia

LUDMILA M. KOKOLOVA*, LUBOV YU. GAVRIL'eva

Laboratory of Helminthology, Yakut Research Institute of Agriculture, Yakutsk
Corresponding author: kokolova_lm@mail.ru

Currently, in the Republic of Sakha (Yakutia), breeding horses in the herd is widespread almost everywhere and has both a productive and a working direction. One of the serious problems for the further development of herd horse breeding is the infection of horses with parasites.

Early warming and the arrival of spring in April led to the appearance of ectoparasites previously unidentified in horse herds in Western Yakutia. The horse biting lice are ectoparasites of mammals belonging to the Mallophaga order. Mallophaga order includes up to 2,500 species, of which about 50 parasites can be found in mammals, and the others in birds. Lice cause itching, rash, hair loss and hyperkeratosis of the skin in animals. Moreover, they can carry infectious and invasive pathogens, causing for instance infectious anemia of horses and dipylidiosis of carnivores.

The aim of the work presented was to study the distribution of lice in horse bands in Western Yakutia. Together with N.N. Plavil'schikov, we conducted a clinical examination of 80 horses in the horse band of the farm "Syrdyk Suol", Suntarskiy District.

Lice were found in each horse (100%) of the herd, irrespective of age. 10 adult horses and 10 foals of the current year were found to be heavily infested with lice, the rest (60 horses) showed a moderate level of parasites. Clinical examination of the skin areas infested by lice revealed disheveled hair of unequal length. In the hair, lar-

ge amounts of exfoliated epidermis and shell of lice has accumulated, and bald patches and focal dermatitis was found on the neck, shoulders, groin, and tail root. Moreover, careful hair examination detected *Trichodectes pilosus*, small wingless insects of yellow or light brown color, probably also causing some itching.

The treatment of lice infested horses was conducted as follows: Animals were subcutaneously injected in the forearm region with "Aversect-2" (1 ml/ 50 kg of animal weight) once, and twice sprayed with a 0.01% "Entomozan-C" aqueous solution in an interval of 10 days. Before the disinfection, all remains of food and water were removed. Animals were kept in the corral for 1.5 hours after treatment, and then released from the corral. All works with "Entomozan-C" was carried out using personal prevention measures.

The treatment of the 20 severely infested horses with the preparations "Aversect-2" and "Entomozan-C" was highly successful and yielded a 100% release from lice.

Conclusion

For the first time and in 100% of the animals of a farm horse biting lice - *Trichodectes pilosus* - were found under the extreme weather conditions of Western Yakutia.

It is necessary to strictly control the veterinary and sanitary condition of animals and their places of maintenance, as well as the timely isolation of animals infested by lice to avoid the spread of these parasites.

Poster Session

P10 Predatory fungi as natural enemies of nematodes

LUDMILA M. KOKOLOVA*, SVETLANA M. STEPANOVA

Laboratory of Helminthology, Yakut Research Institute of Agriculture, Yakutsk
Corresponding author: kokolova_lm@mail.ru

Predatory fungi, Hyphomycetes, are found in all parts of the world and in different climatic zones; more than 100 species are known to date.

It is established that predatory fungi exist in the soil in the form of chlamydo-spores. Studies have confirmed the widespread prevalence of carnivorous fungi in nature.

For the first time, we isolated two strains predatory fungi of the genus *Arthrobotrys oligospora* from the permafrost soils of the Republic of Sakha (Yakutia). To isolate predatory nematophagous fungi, the collection of the material was carried out in various areas and analyzing samples from different sources, i.e. soil of horse pasture, tree trunks, rotting plant residues, food residues, and animal feces.

Predatory hyphomycetes living in the permafrost soil of Yakutia can become natural regulators of the number of *Strongyloides* larvae in horses of herd breeding.

The appearance of the colonies of the fungus *Arthrobotrys oligospora* has a neutral red color. According to the morphological structure, the isolated fungi are multicellular, consisting of thin-walled, monopodially branching threads located without a definite order, with a regular contour and simple septa.

The isolated pure culture of fungi *Arthrobotrys*

oligospora exhibits a very high attractant and nematophagous effect, forming traps in the form of adhesive loops and plexuses trapping the *Strongyloides* larvae, digesting their contents.

The nematophagous activity of strains of pure culture of *Arthrobotrys oligospora* of nematode larvae is estimated by the number of formed hamstring loops and the ability to capture mobile nematode larvae. Based on the results of experimental studies, a high degree of predation of strains of *Arthrobotrys oligospora* was determined with respect to the *Strongyloides* of horses and their larvae. The rapid growth of macroconidia and the formation of hawking loops in the presence of *Strongyloides* larvae were observed in the experiments, the ability and rate of capture of living larvae, killing and digestion of their contents, the rate of increase in the biomass of the fungus, and the formation of more macroconidia, depending on the number of nematode larvae.

We have developed a technique for obtaining a biologically active preparation against the *Strongylatosis* infestation of herd breeding horses. For this, mycelial mass of strains of *Arthrobotrys oligospora* are used either on oats or in a liquid form for experimental use.



Poster Session

Poster Session

P11 Features of the epizootic situation of bovine tuberculosis in the Republic of Sakha (Yakutia)

NATALYA A. OBOEVA

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: natalyaoboeva@mail.ru

Tuberculosis of humans and animals in Russia remains one of the hard-to-solve problems of human and veterinary medicine. According to the Information and analytical center of the Rosselkhoz nadzor for 2017, the epizootic situation of bovine tuberculosis in the country has worsened as compared to 2016 (the number of diseased animals for 2016 was 535, and for 2017: 1340).

Tuberculosis of cattle in the territory of Yakutia was officially registered in 1922 and for more than 60 years the epizootic situation for this disease remained tense. The disease was recorded mainly in the central and western economic zones. Since 1988, the Republic has recovered from this infection. However, in 1996-1998 and 2001, sporadic outbreaks of the disease were recorded again. Back then, laboratory examinations confirmed tuberculosis cases in cattle and, in 2001 also human infections were registered.

Recovery of livestock could be achieved by complete replacement of the disadvantaged herds with healthy animals. At the same time, with the official welfare of the Republic on tuberculosis, there is

a problem of allergic reactions to tuberculin. The number of animals showing allergic reactions over the past ten years ranged from 0.02% to 0.09%, which introduces ambiguity into the epizootic situation. No less important is the epidemiology of tuberculosis, since there were recorded cases of mutual tuberculosis infections of cattle and their owners during the period of relatively good epizootic situation.

According to the results of bacteriological studies of biomaterial from tuberculosis-responsive cattle, non-tuberculosis mycobacteria were isolated. 11 types of non-tuberculous mycobacteria persisting in cattle in tuberculosis-safe herds in Yakutia were identified. Studies on the identification of cultures of non-tuberculous mycobacteria have shown that 77% of mycobacterial cultures belong to the type IV group according to Runyon's classification, while only cases of the isolation of photochromogenic, scotochromogenic and nonphotochromogenic mycobacteria were noted.

As the most fast-growing mycobacteria were identified *M. vaccae* which is a feature of the region.

P12 Disease Strangles of horses in Yakutia

EVDOKYA I. ELBYADOVA*, MIKHAIL P. NEUSTROEV

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: elbyadova@bk.ru

One of the most common infectious diseases among horses is the Strangles, which occurs in almost all districts of the Republic. Basically, young animals get sick from 6 to 12 months of age.

The disease is characterized by the defeat of the mucous membranes of the upper respiratory tract, pharynx and the development of abscesses of regional lymph nodes. The causative agent of this disease is *Streptococcus equi*.

The fight against the horse strangles starts with the identification of sick animals and their separation from healthy individuals. For intervention and treatment different therapeutic and preventive measures are available. In the early 2000s, scientists of the Yakut Scientific Research Institute of Agriculture developed and implemented an inactivated vaccine with immunomodulators against horse strangles. The vaccine was made on the basis of *Streptococcus equi* strain N-34, which was deposited in the collection of the All-Russian State Control Institute of Veterinary Preparations. Comprehensive production trials have shown a high efficiency (up to 95%) of this vaccine for the prevention of horse strangles. However, currently the vaccine

is not produced due to the expiry of the patent registration in the Russian Federation. Thus for the moment, there is no Russian vaccine against the horse strangles commercially available.

At present, we strive to further develop vaccines against the horse strangles. A new strain of *Streptococcus equi* was identified and isolated to develop a new effective vaccine against the horse strangles.

This strain, *Streptococcus equi* N-5/1, was identified based on its morphological, tinctorial, cultural and genetic properties and confirmed being the causative agent for horse strangles.

Using complementary immunomodulators, a new effective vaccine against equine strangles has been developed on the basis of *Streptococcus equi* N-5/1 strain. The culture liquid of the bacterial strain *Bacillus subtilis* TNP-3, deposited in the All-Union State Scientific and Control Institute of Veterinary Preparations was used as the immunomodulator. The new vaccine is completely harmless to animals and has a high immunogenic ability.

To date, this vaccine is in the approval stage in the Rosselkhoz nadzor registry.



Poster Session

Poster Session

P13 Rhinopneumonia of horses in Yakutia

ANDRIAN A. POPOV*, **MIKHAIL P. NEUSTROEV**

Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: andrian.popov.94@bk.ru

Rhinopneumonia (viral abortion of mares, sexual exanthema, rhinotracheitis of horses) is a viral illness characterized by inflammation of the mucous membranes of the upper respiratory tract, and in mares - by abortions in the second half of the trough. The causative agent is a DNA-containing virus (F.M. Orlov, 1997). In young horses rhinopneumonia can cause rhinitis and pneumonia (K.P. Yurov, 1999).

At present, the European part of Russia has studied the epizootology of rhinopneumonia influenza and developed measures for the prevention by vaccines.

For the first time, in 1993 the circulation of the rhinopneumonia virus in Yakutia was established by Neustroev M.P. (V.F. Butkovsky, 2003).

Rapid spread of the disease is facilitated by a large accumulation of horses in farms and settlements, the transfer of horses between regions for reasons of breeding, horse competitions and/ or commerce, as well as stress of pregnant mares and foals, and keeping adult horses in one place. The disease also occurs in small farms and herds with grazing housing (M.P. Neustroev, 1994,

2007, K.P. Yurov, 1997).

According to the research of the Neustroev group, the causative agent of rhinopneumonia maintains viability and pathogenicity up to 110 days during spring and summer months (April-August), i.e. when atmospheric temperature ranges from -16°C to +33°C and relative humidity is between 33 and 43%.

In Russia a viral vaccine against rhinopneumonia is available (dry culture SV/69), but this vaccine was not widely used in extreme conditions of Yakutia, as it needs a two-fold administration. Revaccination occurs in January-February, when the pregnancy of mares reaches 8-9 months, which contradicts the instructions for the use of the vaccine. Also, the vaccination of herds during winter causes certain difficulties due to high snow cover and the danger of abortion of traumatic nature.

The development of new effective vaccines against infectious diseases will contribute to the increase of livestock and horse breeding products of the Republic of Sakha (Yakutia).

P14 Epizootic condition of the brucellosis of northern reindeer in the Republic of Sakha (Yakutia)

EVGENIY S. SLEPTSOV, **NIKOLAY V. VINOKUROV***

Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: nikolaivin@mail.ru

This poster summarizes the material available for the dynamics of brucellosis in reindeer herding in disease hotspots, i.e. areas of elevated disease occurrence or risk in the Republic of Sakha (Yakutia). Data analysis demonstrates how the effectiveness of brucellosis diagnostics of reindeer has changed over the past 28 years. While initial statistics displayed a correlation coefficient of $r = -0.02$, after 2007 the picture changed dramatically, and the direct correlation coefficient already amounted to 0.9 ($r = +0.9$). That is, the number of reacting animals with a high degree of reliability depended on the number of animals examined.

The analysis of the epizootic state with regard to brucellosis of domestic reindeer for the different habitats (tundra, forest-tundra, mountain taiga and taiga territorial-climatic zones in Yakutia) was carried out from 1988 to 2016. The percentage of positively reacting to brucellosis of reindeer in the tundra zone is, on average, 2-3 times higher than that of the mountain taiga and forest-tundra zone. Percentage of infected animals in unfavourable areas in 1988-1990 was very high and was 2.0-5.2%. As a result of ongoing anti-brucellosis measures, the number of infected animals in 2008-2010 decreased significantly and is 0.6-1.3%. However, the number of unfavourable areas remains unchanged, correlating with some stabilization of livestock

dynamics.

The number of disease hotspots (disadvantaged areas) shows a strong tendency to decrease: from 19 districts in 1988 to eight in 2017. The contamination of reindeer in the tundra zone of the Republic has significantly decreased (by 1.4-3.9 percent) and to date ranges from 0.6-1.3 percent. Infection with deer brucellosis in the mountain taiga and forest-tundra zones is 0.1-2.2 percent, incidence of brucellosis in animals from the taiga zone have not yet established.

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Poster Session

Poster Session

P15 Veterinary and sanitary examination of semipermeable fish (chir and omul) in the basins of the rivers Yana and Kolyma with Diphyllbothriasis

M.N. SIDOROV, D.N. NEUSTROEV

Yakut State Agricultural Academy, Yakutsk
Corresponding author: nir06@mail.ru

The first and the most important rule of feeding the population of the Far North is the ecological safety of products, which must be confirmed by adequate veterinary-sanitary expertise. Evaluation of slaughter products of domestic, wild commercial animals, feathered wildfowl, and fish is mandatory to exclude and eliminate raw material contaminated with parasites and pathogens.

Of special relevance nowadays is the problem of getting good-quality and ecologically safe products at all stages of food processing. In all developed countries, in case of excess of feeding products the most actual problem on that stage is problem of quality and safety of food.

Modern conditions of market economy provide knowledge and improvement of veterinary-sanitary evaluation of fish products. Study of species, amount, migration routes, and commodity characteristics of the commercial semi-anadromous fish (chir, omul, and other species) in Yakutia are poorly understood. That's why an integrated approach is needed. Parasitological, organoleptic, and physico-chemical researches are necessary for an objective assessment of fish safety.

To date, as competition between imported and domestic production is obvious, it is necessary to ensure quality and safety of local products, to meet scientific and technical standards, and to raise production efficiency to an internationally competitive level. Food industry and traders

must make sure that foodstuff for the population is safe and rich in health promoting ingredients.

The goal of our work is to ensure a scientific rationale and the development of veterinary-sanitary expertise for the evaluation of the biological and ecological safety of slaughter products of wild animals, sea mammals, birds, and fish in the Arctic zones of Yakutia. For this, the following scientific areas have to be addressed:

- organoleptic research
- physico-chemical indicators
- microbiological research
- veterinary/ medical diagnostics of pathogens and diseases caused.

Based on the results of our work, for the first time guidelines for the veterinary-sanitary assessment of semi-anadromous fish (chir, omul, and other species) will be available in Yakutia. Moreover, practical suggestions and recommendations for using some of the semi-anadromous fish as an ecological safe feeding product will be presented.

Based on the assessment and characterization of species, their amount, migration routes and commodity characteristics, we will also develop scientific recommendations for industrial fishing in the East Siberian Sea and in the Laptev Sea.

The results shall provide a scientific base and rationale for the ecological safety of food raw materials and of feeding products in these regions.

P16 Heavy metals in commercial fish of the Arctic rivers of Yakutia

N. POPOVA, A. ABRAMOV

Yakut State Agricultural Academy, Yakutsk
Corresponding author: nir06@mail.ru

In recent decades, environmental pollution has spread and now is recorded everywhere. Water bodies are contaminated with various chemical substances, among which heavy metals are most challenging, because of their high toxicity for living organisms and their ability to accumulate in cells. Our research goal was the evaluation of heavy metal contamination in the waters and main commercial fish species that were caught in the lower reaches of Arctic rivers of Yakutia, i.e. Lena, Yana, Indigirka and Kolyma. These sampling areas were chosen because lower reaches and river deltas are fish nursery grounds and therefore possible hotspots of contaminant accumulation in river basins. Dynamics of pollution in the waters of arctic rivers is characterized by seasonal variation. The highest concentration of pollutants is observed during spring-summer seasonal flood. Main water pollutants are phenols, organic substances, as well

as Fe, Mn, Cu, and Zn compounds. Especially near major population centers and mining enterprises, rivers are polluted, including contamination with heavy metals.

The content of heavy metals in the muscular tissue of various fish species examined was not high; their concentration is diverse and varies in the range of standard sanitary requirements, i.e. the Maximum Permissible Concentration for alimentary raw materials and food products. By absolute numbers, the content of Zinc, Copper and Iron is the highest, indicating that these metals are prevailing in the environment and waters. On top of it, they are of great biological and physiological importance in the life cycle of water organisms, so they accumulate in their cells. The low accumulation of lead, cadmium and mercury in fish can be explained by the generally low content of these elements in pure form, in water and the Earth crust.

P17 Application of probiotics in poultry farming

ANNA M. STEPANOVA

Dr. vet. sc., Microbial Development Laboratory, Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: stepanova_anna1985@mail.ru

Currently, in Russia there is active development and introduction of effective probiotic preparations for agricultural animals in order to obtain nutritious and safe animal products.

Poultry is one of the priority livestock industries. Along with the support of traditional livestock industries in Yakutia, industrial poultry farming is being developed in the Far North, to meet the demand of dietary food such as eggs and meat. On the basis of strains of *B. subtilis* TNP-3 and *B. subtilis* TNP-5 isolated from permafrost soils, our Institute has developed a probiotic drug "Nord-Bact". The aim of this study was to establish a method and protocol for the use of probiotic "Nord-Bact" in industrial poultry farming, starting at the incubation stage of eggs and including the whole life cycle up to the egg-producing hens and meat producing broilers.

Results:

1. Sanitation of hatching eggs: As compared to chemical disinfectants, probiotic "Nord-Bact" helps to reduce embryonic mortality 2.7 times; increase the output of chickens by 1 %; ensures the establishment of balanced intestinal microbiota from the first days of life of chickens.

Method of use: Eggs are sprayed once with "Nord-Bact" (1×10^9 *B. subtilis* CFU/ml at the rate of 0.1 to 1 egg) before placing them in the incubation cabinet.

2. The use of the probiotic "Nord-Bact" on young birds: the probiotic preparation corrects intestinal dysbiosis; takes an active part in metabolism, affects the vitamin and mineral complex of the body, improves the quality of meat in biochemical composition. Moreover, it preserves the number of young birds up to 99.65%, and increases

weight by 10.3 % (as compared to plan).

3. Effects on laying hens: "Nord-Bact" significantly increases the content of vital minerals and vitamins in the yolk, protein, and shell. It reduces the battle eggs by 1.4 % and the contamination of eggs by 4.7 %; productivity as such is increased by 4%. The use of probiotic "Nord-Bact" together with antibiotics not only prevents dysbacteriosis, but also retains the concentration of vitamins, macro- and microelements in the egg, which is reduced by antibiotic therapy alone.

"Nord-Bact" was shown to provide microbiological safety of egg products and organic waste. Application of the probiotic "Nord-Bact" on organic waste of poultry was used to obtain microbiologically safe feed additives.

How to use: Probiotic "Nord-Bakt" containing *B. subtilis* TNP-3 and *B. subtilis* TNP-5 at a concentration of 5×10^7 CFU/Gol, was applied once daily with water for 10 days each month.

The results of our studies have been patented by the Russian Federation:

- "The rehabilitation method of hatching eggs of chickens" by MP Neustroev, NP Tarabukina, MA Neustroev, MP Fedorova, SI Parnikova, No. 2009105956121 (007985) 02.07.2010 g

- "Method of improving the quality of egg products chickens" by MP Neustroev, AM Stepanova, NP Tarabukina, MP Fedorova, SI Parnikova, DD Neustroev/ No. 2477055 from 10.03.2013 g.

- "Method of preparation of feed additives from poultry manure with the use of bacterial strains *Bacillus subtilis* TNP-3-DEP" and "*Bacillus subtilis* TNP-5-DEP" by Neustroev, MP., Tarabukina, NP, Neustroev, DD, Stepanova, AM, Parnikova, SI.

P18 The use of probiotics based on strains of *Bacillus subtilis* bacteria in the industrial pig production

MARFA P. SKRYABINA

Dr. vet. sc., Microbial Development Laboratory, Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: agronii@mail.ru

The Yakut Scientific Research Institute of Agriculture in recent decades has developed a number of innovative probiotic preparations based on biologically active, natural strains of *Bacillus subtilis* bacteria isolated from the permafrost soils of Yakutia, such as "Sakhabactisubtil", "Nord-Bact", "Hongurinobact" and culture liquid from strains of *Bacillus subtilis* bacteria "TNP-3" and "TNP-5". The preparations are used for the prevention and treatment of gastrointestinal diseases of agricultural animals; the strains antagonize the bacteria, viruses and fungi. They produce a complex of enzymes (protease, gelatinase, amylase, cellulase, β -glucanase, xylonase, fructosyltransferase), which enhances the antagonistic properties of preparations and contribute to a more pronounced probiotic effect. In addition, the preparations are active inducers of endogenous interferon, increase immunobiological reactivity and normalize the metabolism of the body, improve digestibility of feeds,

and contribute to an increase in weight.

The use of probiotic preparations for pigs, starting from the period of newborn to slaughter, positively influences their microbial composition. The safety of pigs rises by 34-53%, the incidence of diseases decreases, the average daily weight gain increases, and the quality of meat improves:

Protein content increases by 3.9%, carbohydrates by 12%, fat by 8.4%, the concentration of vitamins (A, B12, B3, D, B1, B2, E, B, E) and trace elements of iron by 14%, fluorine by 11.6%, potassium by 4.6%, and the cholesterol content is reduced by 14.3%.

Taken together, our studies strongly indicate that the use of probiotic preparations "Hongurinobact", "Sakhabactisubtil" and the culture liquid of the bacterial strain *Bacillus subtilis* "TNP-3", positively influence body functions of livestock, resistance, growth rate of pigs in various age groups, and the quality of meat.



Poster Session

Poster Session

P19 Issues of preservation of the valuable gene pool of the Yakut breed

VARVARA V. ROMANOVA*, **RUSLAN G. POPOV**

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: varvara.romanova.59@mail.ru

Because of the small number of modern population of Yakut cattle, the urgent question about the conservation of genetic resources and the gene pool of the breed arises. In recent years, a comprehensive genetic comparison of Russian breeds of cattle (including native Yakut cattle) with breeds around the world has been carried out.

According to SNP marker analyses and resulting genetic distances, Yakut cattle proved to be most distinct from all cattle breeds studied. Yakut cattle also displayed a lower level of genetic diversity as compared to Eurasian breeds of cattle. The latter observation could easily be explained by prolonged genetic and geographical isolation. On the other hand, Yakut cattle could also have the effect of a founder and bottle neck due to the small number of the original population. Analyzing cluster distribution, Buryat cattle recently exported from Mongolia for reintegration into Russia, proved to be closest to Yakut cattle. It is interesting that Buryat cattle have more common haplotypes with the Yakut cattle and the Wagyu cattle from Japan than with other Turano-Mongolian breeds. This indicates a common pedigree of these breeds. Also, Yakut cattle were found in the same cluster of phylogenetic tree as Hanwoo

cattle from Korea. The genetic uniqueness and adaptability of the Yakut cattle to harsh conditions makes it a valuable material for use in breeding work.

Breeding of adapted types of cattle is of high importance on a regional scale. Using STR marker polymorphisms, we analyze the characteristics of the unique allelofond of the breeding stock of Yakut cattle. Our genetic and genealogical studies are the basis for new breeds.

Our goal is to obtain new, highly effective genotypes of livestock adapted to the harsh climatic conditions of the Republic as well as to the characteristics and demands of industrial feed and milk production technology.

Our top priority, however, is the preservation of a valuable gene pool of the Yakut breed.

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P20a The Yakut cattle

YANA L. SHADRINA*, **STEPAN I. ZAROVNYAEV**

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: yanalina_12@mail.ru

Yakut cattle are the only native Siberian breed preserved in purity and selected by the extreme conditions of the Far North. As of January 1st, 2018, the number of the Yakut cattle was 1.666 animals, including 678 cows - a threatening status. The Yakut cattle is of great value for keeping and breeding because of its high adaptability to extreme conditions, exceptional quality and good taste of meat and milk, as well as its resistance to diseases.

Yakut scientists Z.I. Ivanova, R.G. Popov, I.A. Ammosov in collaboration with Juha Kantanen from the MTT Agrifood in Finland, obtained data on the genetic polymorphism of microsatellite DNA of the Yakut cattle, with the following results:

1. The Yakut cattle represent the last pure Siberian Turano-Mongolian breed.
2. Genetic distances of microsatellite DNA markers prove that Yakut cattle descended from Middle East breeds approximately 10,000 years ago.

3. The genetic order of the Y-chromosomes indicates proximity of Yakut cattle to some European and Middle Eastern cattle.

4. Analysis of mitochondrial DNA showed that haplogroups T3, T2 are characteristic for Middle Eastern cattle breeds, while T4 was only found in East Asia. This indicates that the Yakut cattle divide prehistoric paternal pedigrees with domesticated Middle Eastern and European cattle, and maternal ones with Middle Eastern cattle, as well as in haplogroup T, possibly with cattle of East Asia.

5. Analysis of autosomal DNA markers showed that Yakut cattle have differentiated from other breeds studied and display lower levels of genetic diversity than a number of Eurasian breeds of cattle. This observation can be explained by long-term geographical and genetic isolation and/ or may be attributable to a founder's effect caused by a small number of animals in the original population.

P20b The problem of conservation of the gene pool of the Yakut cattle

STEPAN I. ZAROVNYAEV*, **YANA L. SHADRINA**

Yakut Scientific Research Institute of Agriculture, Yakutsk, Corresponding author: s-zarovnyaev@mail.ru

The biological diversity of species is the key to continuing the prosperous and stable existence and development of mankind on Earth. This fully applies to breeds of farm animals. Breeds of livestock are lost with great speed. In Europe, half the breeds of livestock existed at the turn of the 19-20th centuries, died out in the 80s of the 20th century. At present and as a result of the displacement of highly specialized commercial breeds, the threat of extinction of the Yakut cattle is evident. Of the remaining 1,500 breeds of livestock 41% are on the verge of extinction. Aboriginal Yakut cattle on the territory of Yakutia were kept in purebred until 1929. Back in 1928, Sakha counted 555,193 cattle heads.

A sharp reduction was noted between 1961-90, the number dropped to 986 (cows 355). Yakut cattle is a monument of traditional culture of the northern cattle-breeding Sakha. The cattle is famous for its high fat content (4.5-6%) and high taste qualities of meat and milk. The gene pool of the Yakut cattle is used for breeding Yakutsk-Simmental and Yakut-Kholmogory types. The use of various DNA markers, methods of genomic and gene selection in the conservation and private genetics of domesticated species provides an opportunity to obtain data on the genetic potential (value, originality) of the breed important for the scientific substantiation of the conservation of aboriginal Yakut cattle.

P21 Species diversity of micromycetes in feed for cattle

ANZHELA A. BYLGAEVA

Laboratory of Veterinary Biotechnology, Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: bylgaevaaa2014@mail.ru

The study of the species diversity of micromycetes in cattle feed plays an important role in maintaining animal health. From the quality of feed depends the microbiocenosis of cows and hence the productive longevity of animals.

An analysis of the study results of the biodiversity of microscopic fungi showed the presence of 16 genera of micromycetes: *Fusarium*, *Alternaria*, *Mucor*, *Penicillium*, *Aspergillus*, *Rhizopus*, *Stachybotrus*, *Trichoderma*, *Cladosporium*, *Acremonium*, *Geotrichum*, *Aureobasidium*, *Hormonema*, *Arthrographis*, *Malbranchea*, *Microascus*. At the same time, micromycetes of the genera *Aspergillus*, *Penicillium*, *Geotrichum* and *Trichoderma* were the most prominent from soil samples. From the hay - *Mucor*, *Penicillium*, *Aspergillus*, from haylage - *Rhizopus*, *Mucor* and yeast-like; grain-forage - *Fusarium*, *Rhizopus*, *Mucor*, *Aspergillus*; from combined feeds - *Rhizopus*, *Mucor*, *Aspergillus*.

53 species of micromycetes belonging to 7 families (Moniliaceae, Mucoraceae, Tuberculariaceae, Pleosporaceae, Dematiaceae, Monascaceae, Saccharomycetaceae) and 10 genera (*Fusarium*, *Mucor*, *Penicillium*, *Rhizopus*, *Aspergillus*, *Alternaria*, *Stachybotrus*, *Absidia*, *Monascus*, *Candida*) were isolated and identified in feed of plant origin. The dominant position in the hay contamination belongs to *Mucor racemosus* (65.7%). At the same time, the frequency of detection of allocated toxic species of *Aspergillus*

flavus (31.4%), *Penicillium citrinum* (28.6%) and *A. niger* (22.8%) is relatively high and relatively equal. These four species can be considered dominant in the fungi complex of seeded feed. The potential producers of mycotoxins are 67.92% of them, which are producers of aflatoxins and trichothecene toxins. Mycotoxicological analysis of plant feed from the Central Yakutia was used to isolate mycotoxins Aflatoxin B1, T-2 Toxin, Zearalenone and Ochratoxin A (in background amounts).

The Yakut Scientific Research Institute of Agriculture offered effective and safe measures for the prevention of mycotoxicosis by creating conditions that reduce the possibility of developing toxic fungi and the formation of mycotoxins; improvement of the sanitary quality of feed using the probiotic preparation "Sakhabactisubtil" as a preservative (patent for the invention "Method of biological fight against hay molding" No. 2292132, February 27, 2007); decrease in the sensitivity of animals to the action of mycotoxins with the use of the probiotic preparation "Sakhabactisubtil" as an immunostimulating, probiotic, prebiotic, antagonistic agent (patent for the invention "Method for the prevention of mycotoxicosis of animals" No. 2297842, February 15, 2007).

Currently, work is underway to expand the arsenal of funds for the prevention and treatment of mycotoxicosis in farm animals using natural sorbents.

P22 Analysis of DNA polymorphism of Yansky type of Yakut breed horses with RAPD-PCR analysis

LYUBOV G. KOZLOVA

Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: klg_14@mail.ru

In preliminary experiments, a set of 25 decanucleotide primers was tested (designed by Operon Technologies, USA) for RAPD-PCR, of which 17 primers were selected, giving the most informative picture of the distribution of bands (DNA fragments). The studied micropopulations of horses of the Yansky type of the Yakut breed differed in frequency of occurrence of the bands. For example, fragments 550, 500, 600, 750, 550, 450 in length are found only in the horses of the Stolby area and are completely absent from RAPD spectra in the horses of the areas of Adyachcha and Tabalakh. The difference in frequencies is insignificant, but still allows judging the degree of polymorphism in a certain population. So, with the help of primers ORA 10, ORA 11, ORS 02, all DNA fragments in all micropopulations of horses of the Yansky type of Yakut breed were detected.

The results of assessing the informativeness of multilocus markers for studying the polymorphism of distant the Yansky type micropopulations of the Yakut breed of horses showed that 17 primers are

the most polymorphic.

According to the results of PCR analyses, data on the molecular masses of microsatellite areas of DNA isolated from the hair bulbs of the Yakut breed horses of the Yansky type were obtained. One amplicon of the spectrum was considered as one locus of DNA. The largest number of amplicons in all samples is located within the range of 1500-300 bp. The most polymorphic sequences are the primers ORA 08, ORA 9, ORA 10, ORA 11, ORA 17, ORA 18, ORV 15, ORV 18, ORV 20, ORS 02 and ORS 03.

Unique alleles for three micropopulations of Yansky type horses of Yakut breed have been revealed. Thus, alleles of 1200-380 bp in length are found only in the micropopulation of horses from the region of Tabalakh, alleles of 1500-350 bp in length are found only in the micropopulation of horses from the area of Adyachcha, alleles of 3000-300 bp in length are found only in the micropopulation of horses from the Stolby area.



Poster Session

P23 Northern reindeer husbandry is the basis of the indigenous Arctic ethnic groups life

N.S. ROBBEK

Dr. agr. sc., Senior Scientist, Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: nrobbek@mail.ru

Northern reindeer husbandry is a traditional and economically viable industry of the Russian polar regions, and it is the only industry where in the sector of employment representatives of indigenous Arctic ethnic groups are dominant. Reindeer livestock breeding gives peoples of the North high-caloric, ecologically clean venison, fur and hides. Distinctive features of venison are variety of nutritious fat and proteins in most favorable balanced state, which facilitates easy assimilation by the human body. Reindeers can easily survive the harsh climate of Arctic regions; it is a key feature of reindeers that allows the people of the North obtain cheap, low in cholesterol, highly-nutritious meat that is not polluted with chemical additives, antibiotics, stimulants and etc.

Sakha Republic (Yakutia) is the one of the biggest reindeer husbandry regions in Russia. Reindeer husbandry in Yakutia always was traditionally high cultured. Yakutia saved the herding system of reindeers, in which reindeer herders live year-round in search of food continuously throughout the year, along with a herd on the seasonal pastures.

There are 3 breeds of reindeer in Yakutia – Evenk, Evenki and Chukot (harghin), Evenk breed being 60% of total number of reindeers in Yakutia.

Breeding of this particular reindeers is traditional, environmentally sound and economically viable activity of indigenous Arctic ethnic groups of Yakutia. Reindeer for them is a trusty transport, source of meat, velvet antlers, hides, blood and other types of production.

Reindeer husbandry as a type of livestock breeding in Yakutia is in difficult situation today. The main goal is to make the reindeer husbandry viable. At the same time, one of the promising areas for increasing the efficiency of agricultural production is the creation of a regional cluster that includes divisions of municipal authorities that provide regulatory, legal, investment and financial-budgetary mechanisms regulating the use of reindeer pastures, technology for traditional reindeer husbandry, the way of life of the reindeer communities, management of matching breeds on natural and climatic zones, application of advanced scientifically grounded methods of livestock breeding, maintenance of technologies, pre-fattening before slaughter, waste-free technology of slaughtering reindeer in mechanized slaughterhouses, with further primal cuts of reindeer carcasses according to the scheme and packing in vacuum packaging for further implementation.

Poster Session

P24 Reindeer husbandry at the Municipal Unitary Enterprise Agribusiness (MUE AB) "Kanchalansky" of the Chukotsky Autonomous Region

EGOR D. ALEKSEEV¹, STANISLAV M. AN'E², MOTRENA V. ALEKSEEVA¹

¹ Yakut State Agricultural Academy, Yakutsk

² Chief zootechnician MUE AB «Kanchalansky», Anadyr district of the Chukotka Autonomous Region
Corresponding author: klg_14@mail.ru

The poster presents an example how reindeer breeding is organized and regulated in Chukotsky Autonomous Region.

Based on the documents submitted by this farm, on the exhaustive list of documents required in accordance with the order of the Ministry of Agriculture of Russia of November 17, 2011 No. 430 "On approval of the Administrative Regulations of the Ministry of Agriculture of the Russian Federation on the presentation of a state service for identifying the types of organizations that carry out activities in the field of breeding livestock, a survey of the livestock of the Chukot breed reindeer, checking of the pedigree records, organization of grazing, inspection of the infrastructure of the tundra routes of herds". The Commission, established by the

Order of the Department of agricultural policy and management of natural resources of Chukotka autonomous region of September 16, 2013 No. 254 "On the establishment of a commission to review the list of documents for determining the types of organizations for livestock breeding and epizootic welfare" considered that the subsidiary of the MUE AB "Kanchalansky" meets the requirements for breeding reproducer. Requirements are approved by the Order of the Ministry of Agriculture of Russia of November 17, 2011 No. 431 "On approval of Rules in the field of livestock breeding 'Types of organizations that carry out activities in the field of livestock breeding' and on the recognition of repealed orders of the Ministry of Agriculture of Russia".



Poster Session

Poster Session

P25 Clinical and morphological characteristics of limb (autopodium) arteries of the thoracic extremity of reindeer in postnatal ontogenesis

M. POTAPOV¹, K. KIRIKOV¹, S. FEDOTOV², K. NIFONTOV^{1*}, N. STRUCHKOV¹

¹ Yakut State Agricultural Academy, Yakutsk

² Prof. Dr. vet. sc., Moscow State Academy of Veterinary Medicine and Biotechnology

Corresponding author: kosnif@yandex.ru

Under the conditions of modern Russian economy, reindeer husbandry occurs to be promising branch of agronomic culture. We get from the reindeer not only meat and byproducts, but also fur, hide and endocrine raw material, velvet antlers.

As a main branch of northern livestock breeding, reindeer husbandry has a great value to the life, economy and culture of the Northern people.

To the agricultural development under the conditions of Far North, reindeer husbandry occurs to be promising trend, comprehensive research of the structure and evolution of the reindeers can make a difference in the development of reindeer husbandry. In practice, veterinary specialists often encounter with the limb diseases of infectious and non infectious etiology. For the effective in-

roduction of medical, diagnostic and preventive measures, specialists should know about age regularities of the changes of organ systems and tissues of reindeer.

Distal section of thoracic extremity, which reindeer uses to stand on the ground, provokes certain practical interest of veterinarians. It often gets traumatized, which, in summer period, leads to necrotic stomatitis.

A more comprehensive and in-depth study of distal sections of extremity vessels of reindeer can help to clarify the regularities of morphologic development of limb (autopodium) extremity vessels of various functional values adaptation to habitability conditions, including extreme conditions of Far North.

P26a Comparative dynamics of the domestic Arctic reindeer's haematic picture by climatic and economic zones of breeding zones

TUYARA I. DMITRIEVA^{*}, TATYANA D. RUMYANTSEVA, ALEKSANDRA I. PAVLOVA

¹ Yakut State Agricultural Academy, Yakutsk

Corresponding author: dark_dell@mail.ru

Climate and ecology of Arctic is characterized by extremely expressed continentality and severity. Due to low temperatures during summer months, the vegetation of plants lasts only for 60 to 90 days, along with this, freezings stop only at the end of June and the fall starts in the second half of the August. The territory is divided into 1) tundra, 2) forest tundra and 3) the Northern taiga. Due to climate conditions, there is no agricultural land for farming in the North, and the animal ration of food is poor. With that knowledge in mind, from the physiological state of animals that live here, it is distinct that they have considerable adaptive potential.

Adaptive features of animals are expressed in the general haematic picture by the seasons of the year. In the present work, data on quantitative and qualitative determination of the indices of blood composition of domestic reindeer by age groups and their comparative dynamics for the seasons of the year are studied. The experiment group is Evenki breed of reindeer bred in the tundra and taiga zones. Research has established that morphological composition of blood of the reindeer bred in the tundra zone is different from reindeer bred in the taiga zone. All the indicators are within the norms of the physiological standard.

P26b Comparative dynamics of the haematic picture when organism of an animal experimentally exposed to cold and heat

TUYARA I. DMITRIEVA^{1*}, LENA I. ARZHAKOVA², DARIMA K. GARMAEVA²

¹ Yakut State Agricultural Academy, Yakutsk

² North-Eastern Federal University in Yakutsk

Corresponding author: dark_dell@mail.ru

In the report, there are results of experimental research, main goal of which was examination of the changes in cellular composition of the haematic picture of rats, depending on the cold and heat exposure time, as well as results of analysis of literature data about thermal influence on well-being of an animal and human, structure of immu-

ne system, and properties and behavior of natural adaptogens. Obtained results testify, that thermal influence on an organism affect the activity of cells, which provide reaction of specific and non-specific immune response, in particular, from the side of the erythrocytes, thrombocytes and leukocytes.



Poster Session

Poster Session

P27 Northern domestic reindeer herding of the Republic of Sakha (Yakutia)

VALERIY I. FEDOROV

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: vfedorov_09@mail.ru

The northern domestic reindeer herding of the Republic of Sakha (Yakutia) is concentrated in 21 uluses (regions) from 35 uluses and forms the basis of the way of life, economy, culture, employment of the indigenous peoples of the North and defines the socio-economic appearance of northern settlements. Reindeer herding also serves as a locomotive for the development of hunting, fishing, arts and crafts, gathering of wild plants and the consolidating that began in the North. According to the specifics of the industry, reindeer herding in the process of the annual production cycle covers huge territories and performs an important state function to ensure employment of the population of the North and the development of huge empty areas of the country. Out of 196 million hectares of reindeer pastures found in Yakutia, and on the remaining 130 million hectares the stocks of feed are so small that grazing of large herds is impossible. Out of 66 million hectares, only 37 million hectares have

been transferred to the use of reindeer husbandry, which include the natural pastures of the tundra, forest-tundra and northern taiga zones. As of January 1, 2017, in all categories of farms in the Republic of Sakha (Yakutia) there are 156 814 heads of northern domestic reindeer, Evenk and Chukchi (hargin) breeds, 110 reindeer herding enterprises employ 1,792 reindeer herders and chum laborers. To date, the following pedigree registers have been registered with the State Tribal Register of the Ministry of Agriculture of the Russian Federation: Khatystyr in Aldansky district, a pedigree reproducer for breeding the Evenk reindeer breed; Olenek Municipal Unitary Enterprise of the Oleneksky district, a pedigree reproducer for breeding Evenk reindeer; the Municipal Unitary Enterprise (MUP) Primorsky and MUP "Borogonskoe" of the Bulunsky district, breeding reproducers of the Evensk breed of reindeer.

P28 Experience and perspectives preservation of agro-biodiversity under permafrost

NADEZHDA N. STOROZHEVA

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: nadeshda_stor@mail.ru

Since 1979, more than 10 thousand seeds of crop from the collection of the Vavilov Institute of Plant Industry were stored in an underground laboratory of the Melnikov Permafrost Institute of the Siberian Branch of the Russian Academy of Sciences (RAS), at a depth of about 11-12 meters at the temperature $-2,5^{\circ}$ / $-2,70^{\circ}\text{C}$. Sowing qualities of seeds were tested after storage for 17-23 years. Research has shown that all samples preserved high sowing qualities. The comparative assessment of growth and development rhythm, morphological and physiological parameters between samples from seeds after long storage and their new analogues showed a lack of morphobiological anomalies as well as mutational changes.

Collection of seeds of important crop varieties of the Research Institutions of Siberia and the Rus-

sian Far East was initiated to laying for long storage under permafrost since November 2009 by the Yakut Scientific Research Institute of Agriculture. Seeds of 92 varieties were collected from 8 Research Institutions of the Siberian Branch of the RAS. In 2010, laying of seeds was carried out in underground glacier of Ust-Aldansky District of the Republic of Sakha (Yakutia). In December 2012, near the capital Yakutsk the so called Underground Storage was built by the Siberian Branch of the RAS and the Government of the Republic of Sakha. The Underground Storage could house 100 thousand samples of seeds. All samples of crops were laid at the beginning of 2013. Researches of sowing qualities and the study of biomorphological parameters in the field has been tested every 5 years to establish extend safe storage.



Poster Session

Poster Session

P29 Physiological features of pure bred coarse-wooled sheep and its cross-breed

IVAN V. ALFEROV

Senior Research Officer, Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: agronii@mail.ru

The method of hybridization is one of the ways to improve the adaptive qualities of domestic animals to certain conditions used by humans for a long time. Thus, in the application of hybridization, the breeds of merino sheep and arharomerinos were excreted. A number of researchers note the probability of transferring features of behavior and habits by inheritance from parents to descendants. From this it follows that wild species, when crossing with domestic sheep, can transfer to descendants not only useful, but also unwanted signs, such as late ripeness, low technological qualities of wool and behavioral patterns such as savagery, timidity and aggressiveness, which is highly undesirable in further management of hybrids.

The problem of acclimatization and adaptation of sheep is historically associated with methods of animal husbandry in specific climatic and weather conditions. At the same time, acclimatization, being a special case of adaptation to a complex of external natural and climatic factors, is

an integral part in the general biological problem of the evolution of animals, which determines its relevance at all times.

E.Ya. Borisenko noted that acclimatization is the means to live, reproduce and develop correctly in a new geographical area, under new climatic conditions and preserve economic and useful qualities for the sake of which animals are bred. We conducted a hematological study of the blood of coarse-wooled sheep, cross-breed of Buubei coarse-wooled sheep and a big-horn on the ability to acclimatize under the conditions of central Yakutia. The blood sampling was carried out at the end of the spring period. The result of the conducted analyses shows that coarse-wooled sheep has a negative ability to acclimatize under the conditions of the Far North (Central Yakutia), the first and the second generation cross breed fit to the standart physiological indices, thus developed cross breed are suitable for the farms of the Republic of Sakha.

P30 Regional indicators of the quality of life of the population of the Republic of Sakha (Yakutia)

R.N. ZAKHAROVA, T.M. KLIMOVA, A.I. FEDOROV, E.P. AMMO SOVA, M.E. BALTAKHINOVA

North-Eastern Federal University named after M.K. Ammosov, Yakutsk
Corresponding author: prn.inst@mail.ru

The aim of the study was to investigate the quality of life of the population of the Far North.

The work was carried out within the framework of the state task of the Ministry of Education of the Russian Federation No.AAAA-17-117021310139-5 "Clinical and genetic aspects of diseases characteristic of the indigenous inhabitants of Yakutia under modern conditions".

Data collection was conducted in various regions of Yakutia using questionnaires. A total of 1042 residents were surveyed in the region, of which 53% were women, and 47% were men. As a tool for data collection, the SF-36 questionnaire was used, which contains eight health scales (concepts). The

indicators of the quality of life were standardized according to the USA general population in accordance with the recommendations of the developers.

The results of the study showed that the average values of the quality of life scales of the population in the study region are below 50% of the "ideal" 100% value. The quality of life of the population of Yakutia is lower than in Russia, both in physical and mental health. The daily activities of respondents were limited not only by the physical health, but also by their mental state, particularly in the Arctic regions of Yakutia.



Poster Session

Poster Session

P31 Viral Hepatitis B, C and D and their outcomes in the Republic of Sakha (Yakutia)

S.S. SLEPTSOVA*, M.N. ANDREEV, S.I. SEMENOV, I.F. BILYUKINA, V.K. SEMENOVA

North-Eastern Federal University in Yakutsk

Corresponding author: sssleptsova@yandex.ru

The Republic of Sakha (Yakutia) is one of the most disadvantaged territories of the Russian Federation for the prevalence of hemocontact viral hepatitis B, C and D, as well as their adverse outcomes like cirrhosis and primary liver cancer. This unfavorable epidemiological situation is associated with the climatic and geographic features (i.e. the Far North conditions), with prevalence of immunodeficiency, those frequency is increasing under the influence of an unfavorable ecological situation, as a notable characteristic of Yakutia. According to official statistics, in 2017 there were 328 cases of chronic hepatitis B (CHV) (34.2 per 100,000 cases), and 501 cases of chronic hepatitis C (CHC) (52.1 per 100,000). In the structure of chronic viral hepatitis, the proportion of CHB and CHC in 2017 was 39.5% and 60.5% respectively. Currently, according to the state register "Chronic viral hepatitis in the Republic of Sakha (Yakutia)", 15.145 persons are registered, 6.417 of them with chronic hepatitis B; 6.781 with chronic hepatitis C; 1.101 with chronic hepatitis D; 641 with mixed forms; 4 with unverified etiology; 385 of them with cirrhosis of the liver (LC); and 27 persons with primary liver cancer (PLC). The highest prevalence of hemocontact viral hepatitis is observed in the Suntar, Ust-Aldansky, Neryungrinsky, Myrninsky, and Khangalassky districts as well as in the capital Yakutsk. With Buryatia, Tyva and Tyumen regions, Yakutia is among the regions of Russia with the highest incidence rates in patients with viral hepatitis. For the period from 2000 to 2015, the incidence rates of liver cancer exceeded 4-5 times in Yakutia in comparison to the Russian Federation. High incidence of CVH and its outcome in the central,

polar and western regions of Yakutia can be explained by insufficient levels of qualified medical and preventive care in these regions. Significant coefficients of rank correlation ($p < 0.05$) between incidence of CVH B, C and D with outcomes in cirrhosis (rsp = + 0.94) and liver cancer (rsp = + 0.83), and between chronic hepatitis D with cirrhosis (rsp = + 0.94) and liver cancer (rsp = + 0.89) has been shown. However, there was no statistically significant association for CHC and CHB separately. The main cause of the liver cirrhosis was a HDV infection (51.72%), which is explained by more severe course and rapid transition of this infection into liver cirrhosis. In the structure of the causes of HCC, the greatest percentage has chronic viral hepatitis C (41.38%) which is characterized by a latent course and detection in the late stages of the disease (37.9%). The mortality rate after cirrhosis and liver cancer in 2016 was 4.5 cases per 100 thousand inhabitants. For the 2009-2016, this indicator doubled (in 2009: 2.3, and in 2016: 4.5 per 100 thousand of inhabitants). The study of the long-term incidence of viral hepatitis B, C and D in Yakutia clarified the frequency of various nosological forms of the disease (chronic hepatitis, cirrhosis and liver cancer). Also the frequency in regions of Yakutia, and the prevalence of viruses of hepatitis B, C and D with a progressive course of the disease had been identified. A new specialized hepatological center in Yakutsk is recommended to establish a preventive system and treatment in various stages for patients with chronic viral hepatitis, including in the cirrhotic stage and with the primary liver cancer.

P32 The impact of lifestyle transformation on the health of the indigenous population of Yakutia

T.M. KLIMOVA¹, **E.P. AMMOSOVA²**, **R.N. ZAKHAROVA²**, **M.E. BALTAKHINOVA²**, **A.I. FEDOROV²**

¹ Medical Institute, North-Eastern Federal University, Yakutsk, email: biomedyk@mail.ru

² Research Institute of Health, North-Eastern Federal University, Yakutsk

Corresponding author: ammosovael@mail.ru

Introduction: Lifestyle transformation has a significant impact on human health. In this situation, the northern populations are vulnerable groups. For mitigation of effects of lifestyle transformation on the health and the monitoring of the situation, it is necessary to assess the current health status and address potential future negative health outcomes. **Methods:** To characterize the health status and nutrition statistical data of the Federal State Statistics Service of the Republic of Sakha (Yakutia) were used. Basal metabolic rate, seasonal variation of thyroid function present results of a study among indigenous adult population from Central Yakutia (Berdigestyakh, 62°N/126°E). Participants: healthy adults-volunteers (>19 years old). Time of study: two field seasons in August/September 2009 and January 2011. Methods: BMR – indirect calorimetry, anthropometry, health measures, hormonal measures, questionnaire on sociodemographics & lifestyle. Prevalence of metabolic disorders present results of study among indigenous adult population from Central (Berdigestyakh, 62°N/126°E) and northern (Zhigansk, 66°N/123°E) Yakutia. Participants: indigenous adults (≥20 years old). Time of study: 2009 and 2010, May-July. Methods: anthropometry, health measures, hormonal measures, lipid and glucose measures, questionnaire. **Results:** Traditional Yakut food contains large amounts of fats and proteins. It is a component of adaptation to cold stress. In the end of the XIX century, traditional nutrition per one member of middle income family consisted of 80% of the products of animal origin. Modern diet of Yakut people includes 11-13% of protein, 27-34% fat and 53-62% of car-

bohydrates. Result of study among the Yakut has documented elevated basal metabolic rates and declines in thyroid hormone levels (fT3 and fT4) during the winter. It is response to extreme cold stress. Socioeconomic transition brings changes almost in every aspect of life of the circumpolar population (i.e. increase of psycho-emotional stresses, changes in physical activity, nutrition, traditional subsistence activities etc). It is accompanied by failure of established mechanisms of evolutionary adaptation to extreme factors and lead to development of pathological conditions. Stress on human organism caused by adaptation, the influence of complex environmental factors suggest low life expectancy, i.e. high rates of morbidity and mortality among the population of northern regions. **Conclusion:** In sum, the study has shown the indigenous Yakut's marked elevated basal metabolic rates, seasonal changes in thyroid function, high prevalence of metabolic disorders, as well as increase of morbidity and mortality. These populations carry the double burden of the adverse effects of both natural and socio-economic factors affecting health. In face of lifestyle transformation and ongoing climate change, these groups are among the most vulnerable. Climate warming is expected to impact the spectrum of diseases, increase the scope of infectious diseases, the numbers of cardiovascular events, of stress factors, and a changing diet. Therefore, it is necessary to forecast possible trends in health and consider possible measures to maintain the health and life of population in the changing environment.

P33 The biological value of fats of freshwater fish

ALEXEY F. ABRAMOV, VALENTINA T. VASILIEVA, TATIANA V. SLEPTSOVA, NIKOLAY A. MATVEEV*, SEMEN M. TIMOFEEV

Yakut Scientific Research Institute of Agriculture, Yakutsk
Corresponding author: agronii@mail.ru

The results of research on the biological value of fillet fat and freshwater fish of the rivers of Yakutia (*Stenodus leucichthys*, *Coregonus nasus*, *Coregonus autumnalis*, *Coregonus muksun*, *Coregonus sardinella*, *Coregonus peled*, *Coregonus pidschian*). It is established that fats of these fish differ in high content of unsaturated (mono- and polyunsaturated) fatty acids those ratio to saturated fatty acids ranges in fillet from 1.0: 0.22 to 1.0: 0.32, in the belly part from 1.0: 0.24 to 1.0: 0.28. This indicates high biological performance of fats of freshwater fish in Yakutia.

For the study, the fish of the autumn catch were quick-frozen at a temperature of no higher than -30°C in a modular plant for freezing products (MUZ-07-10), followed by storage in glaciers and freezers with a temperature not higher than -15°C. The obtained samples from all parts of the fish were combined into homogeneous batches and resulted in an average sample of each species. Determination of the biochemical composition of fish and fish products was determined by infrared spectroscopy using the SpectraStar model 2200 infrared analyzer from Unity Scientific USA, calibrated on the basis of conventional standard chemical methods in the Laboratory of processing of agricultural products and biochemical analyzes of the Yakut Research Institute of Agriculture in Yakutsk.

Freshwater fish of the rivers of Yakutia are distinguished by good biological efficiency due to low

content of saturated fatty acids and high content of mono- and polyunsaturated fatty acids.

In winter, a large amount of easily digestible mono- and polyunsaturated fatty acids and fat-soluble vitamins accumulate in the belly of freshwater fish, which is a good source of energy during emergency wintering conditions for fish.

The indigenous people of the northern regions of Yakutia consume fresh fish, including *stroganina* from fresh-frozen fish, which provides the body with easily digestible fatty acids and the main groups of fat-soluble vitamins (A, E, D) and serves as prevention of diseases of the cardiovascular system as well as of Vitamin B-1 deficiency diseases (beriberi).

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P34 Veterinary and sanitary assessment of kumis, the national drink of the Sakha people

MARGARITA S. SAVVINOVA*, VIKTORIYA K. EVSYUKOVA, MIKHAIL N. SIDOROV, ALENA A. ALEKSANDROVA, VARVARA V. MATARKINA

Yakut State Agricultural Academy, Yakutsk
Corresponding author: msavvinova@mail.ru

Kumis is a dairy product processed from mare's milk, as a result of lactic acid and alcohol fermentation using lactobacillus and yeast. Traditionally, kumis has been valued for its beneficial effects on human health. Yet effects can vary. Depending on the starter culture, the duration and conditions of preparation, kumis turns out to be different. On one hand, kumis can be quite strong, the increased alcohol content can intoxicate, leading the consumer into an excited and intoxicated state. On the other hand, kumis can have calming effect, leading a person into a drowsy state. Given its popularity, it is necessary to conduct quality analysis and veterinary-sanitary assessment of commercially available kumis in the Far North.

For the organoleptic evaluation of mare's milk and kumis, conventional methods were used such as examination of appearance, color, smell, taste and consistency. To assess the physico-chemical properties of kumis, following activities were carried out: the determination of acidity, and the proportion of milk fat and protein. A microbiological research looked for presence of pathogenic microorganisms, *S. aureus*, CGB, lactic-acid microorganisms and mold.

Kumis is prepared following the traditional method according to the technical guideline "Yakut kumis" that was developed in 1998 by the staff of the Yakut Research Institute of Agriculture (No 9222-001-00670207-98). Taste examination of kumis samples from different producers, according to organoleptic indicators such as appearance, consistency, color, taste and smell showed that they suit the standards for fresh products, and meet the requirements of

the technical regulation for milk and dairy products (No. 9222-010-00670203-2004).

According to physio-chemical data on acidity levels, samples of kumis from various producers proved to be weakly acidic at 80-85°C (cf. standard values of 80-90°C) and meet all the requirements for kumis specifications. Mass fraction of fat in 1,5% (cf. standard value has to be no less than 1,0) also corresponds to fresh product norms and the technical regulation for milk and dairy products.

At microbiological research of microorganisms in all samples of kumis from different producers, microorganisms, CGB, *S. aureus*, lactic acid microorganisms were not detected.

The microbiological analyses revealed no pathogens in all samples. Also all samples were pure when filtering the samples, no particles of mechanical impurities were observed on the filter.

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Poster Session

Poster Session

P35 Selection of perennial grasses in Yakut Research Institute of Agriculture

VALENTINA I. ALEKSEEVA*, **VENERA M. KORYAKINA**

Laboratory of selection and seed-growing of grain and forage crops, Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: valu_7@mail.ru

Harsh environment of Yakutia and the need of stable yields and high quality feed require varieties that are adapted to arid conditions and salinity of soils, resistant to flooding, pests and diseases. Also some perennial grasses provide valuable under snow fodder for horses during winter pastures.

Nine species of perennial grasses were created and zoned in Yakut Research Institute of Agriculture. To increase the productivity of haymaking *alaas* lands of the Eastern zone, following varieties were developed: the Lenskaya *Roegneria mutabilis*, the Toybokhoysky *Agropiron repens* and the Amginsky *Elymus sibiricus*. These varieties are characterized by high cold and drought resistance, and durability up to 4-5 years. The yield of green mass is 100-120 centner/ha, of the seeds: 1-2 c/ha. Erkeani *Bromopsis inermis* was planted on floodplain hayfields, and is characterized by high hay yield (28.9 c/ha) and seeds yield (1.9 c/ha), as well as by high cold and drought resistance.

For planting long-term pasture areas for year-round use for winter under snow pasture of horses, the varieties "Manchaary" and "Bootur" of *Psathyrostachys juncea* are used. These have

productive longevity, are resistant to trampling, drought and are salt-tolerant. The variety of *Festuca rubra* "Meryunskaya" is recommended for recreation of disturbed lands, ground lawns, as well as a component for pasture grass mixtures. Among the leguminous herbs, the *Medicago falcata* varieties "Yakut yellow" and the *Melilotus albus* "Nemyugunsky" are zoned. The yield of green mass of yellow *Medicago falcata* is 250-300 c/ha, of white *Melilotus albus*: 160-180 c/ha. The yield of seeds, depending on the moisture content of the vegetation period, in *Medicago falcata* of the "Yakut yellow" is 0,5-1,0 c/ha, sweet-grass "Nemyugunsky": 2.0-4.0 c/ha.

In 2017, a variety of *Bromopsis inermis* "Aystal" was created, which is distinguished by a high seed yield of 1.9 centners per hectare, lining (44-54 per cent), and is high-resistant. It is recommended for sowing on the hayfields of the Leno-Amginsky interfluvium of Central Yakutia.

At present, the task is to bring out new varieties of *Elymus sibiricus*, resistant to extreme conditions of Yakutia, with a stable hay and seed yield, with high fodder qualities resistant to diseases and manufacturability.

P36 Efficiency of local strains of nodule bacteria *Sinorhizobium meliloti* in the cultivation of sickle alfalfa under the conditions of Central Yakutia

VILENA B. BORISOVA*, **AYAAL I. STEPANOV**

Yakut Scientific Research Institute of Agriculture, Yakutsk

Corresponding author: vilena.borisova.89@mail.ru

Aim of this research project is to study the influence of local strains of nodule bacteria and mineral fertilizers on soil fertility and the biomass of sickle alfalfa. The tasks were as following:

- to study the effect of local strains of nodule bacteria and mineral fertilizers on the soil fertility, accumulation of biological nitrogen and the productivity of alfalfa;

- to assess the effect of local strains of nodule bacteria and mineral fertilizers on the symbiosis in alfalfa.

Objects of research were the Yakut yellow sickle alfalfa, local strains of nodule bacteria "Yakutsky No 1" and "Yakutsky No 2" of *Sinorhizobium meliloti*, and mineral fertilizers.

The field experiment started in 2018 at the scientific stationary of the Yakut Scientific Research Institute of Agriculture in the Khangalassky district. There were 23 variants in the experiment, the repetition was four times, the sowing was in broad rows with between-rows distance of 30 cm, the placement of the plots was randomized, the registered area of the plots was 25 m².

One of the most important problems of the modern agriculture is the possibility of fixing the atmospheric nitrogen. The biological fixation of nitrogen occurs by microorganisms that inhabit the soil.

Nodule bacteria are the genus of nitrogen-fixing bacteria that form nodules on the roots of leguminous plants. They absorb atmospheric molecular nitrogen and convert it to nitrogen compounds

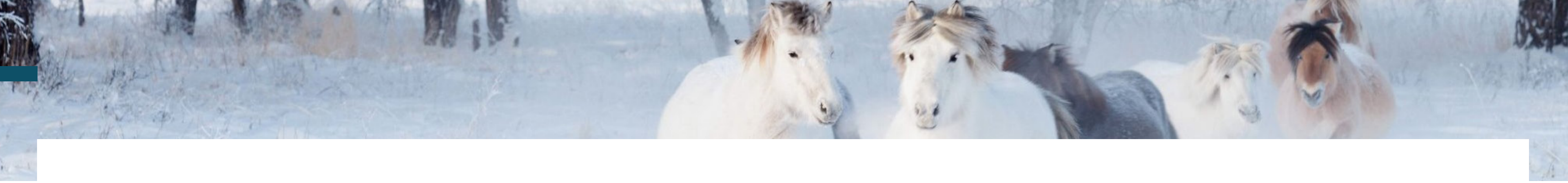
assimilated by plants, which, in turn, provide other plants with nutrients.

A useful quality of alfalfa is its biological property to grow in symbiosis with nitrogen-fixing nodule soil microorganisms forming nodules on its roots. As a result of their vital activity, nitrogen compounds that are accessible and necessary for the growth of alfalfa and other agricultural plants accumulate. Treatment of the seeds with strains of active nodule bacteria before sowing allows enriching the plant root system, and thus promoting active binding of the molecular nitrogen.

Bacteria contribute to the optimal use of mineral and organic fertilizers. Breeding in the root zone, bacteria protect them from penetration of microflora that cause plant diseases. Rational use of bacterial preparations makes it possible to significantly increase the productivity of agricultural crops with a lower consumption of nitrogenous fertilizers and an increase in the biological activity of the soil.

In the Yakut Scientific Research Institute of Agriculture, two patents of local strains of nodule bacteria "Yakutsky No 1" and "Yakutsky No 2" were obtained from the Yakut yellow alfalfa variety, the author of which is Maria Yakovleva, Cand. agr. sc., Lecturer, Senior Researcher of the Laboratory of Potato Growing and Agroecology.

Based on these strains, the Laboratory of agroecology produces biological preparations for increasing the productivity of soil and agricultural crops.



List of Participants

ABRAMOV, ALEKSEY F.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

ALEKSEEVA, MOTRENA V.

Yakut State Agricultural Academy
amotryona@yandex.ru

ALEKSEEVA, VALENTINA I.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

ALEKSEEVA, VERONIKA N.

Yakut State Agricultural Academy
nir06@mail.ru

AMMOSSOVA, ELENA P.

North-Eastern Federal University in Yakutsk,
Institute of Health
ammosovael@mail.ru

BARASHKOVA, ANASTASIYA I.

Yakut Scientific Research Institute of Agriculture
aibarashkova@mail.ru

BELEVTSOVA, VALENTINA I.

Yakut Scientific Research Institute of Agriculture
vibvega@yandex.ru

BEYER, WOLFGANG

University of Hohenheim, Stuttgart, Germany
wolfgang.beyer@uni-hohenheim.de

BLAGODATSKIY, SERGEY

University of Hohenheim, Stuttgart, Germany
sergey.blagodatskiy@uni-hohenheim.de

BOCHKAREV, INNOKENTIY I.

Yakut State Agricultural Academy
nir06@mail.ru

BORISOVA, VILENA B.

Yakut Scientific Research Institute of Agriculture
vilenab.borisova.89@mail.ru

BUDATSYRENOVA, LYUBOV V.

Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rosпотребнадзор), Regional Office in Yakutia
yakutia@14.rospotrebnadzor.ru

BURTSEVA, IRINA A.

Yakut State Agricultural Academy
nir06@mail.ru

BYLGAEVA, ANZHELA A.

Yakut Scientific Research Institute of Agriculture
bylgaevaaa2014@mail.ru

DAYANOVA, GALINA I.

Yakut Scientific Research Institute of Agriculture
dajanova@mail.ru

DESYATKIN, ALEKSEY R.

Institute of Biological Problems of Cryolithozone, Siberian Branch, Russian Academy of Sciences
desyatkinar@rambler.ru

DESYATKIN, ROMAN V.

Institute of Biological Problems of Cryolithozone, Siberian Branch, Russian Academy of Sciences
rvdes@ibpc.ysn.ru

List of Participants

DMITRIEVA, TUYARA

Yakut State Agricultural Academy
dark_dell@mail.ru

DREHMANN, MARCO

University of Hohenheim, Stuttgart, Germany
marco.drehmann@uni-hohenheim.de

DULOVA, SARGYLANA V.

Yakut Scientific Research Institute of Agriculture
sargylana.dulova@mail.ru

EFREMOVA, SARGYLANA P.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

EGOROVA, IRINA K.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

ELBYADOVA, EVDOKIYA I.

Yakut Scientific Research Institute of Agriculture
elbyadova@bk.ru

EVSYUKOVA, VICTORIYA K.

Yakut State Agricultural Academy
viktoriya-snow@mail.ru

FABER, MIRKO

Robert Koch Institute, Berlin, Germany
FaberM@rki.de

FEDOROV, AFANASIY I.

North-Eastern Federal University in Yakutsk,
Institute of Health
prn.inst@mail.ru

GAVRIL'EVA, LUBOV' YU.

Yakut Scientific Research Institute of Agriculture
lubov.gavrileva86@mail.ru

GOGOLEVA, PRASKOV'YA A.

Yakut State Agricultural Academy
nir06@mail.ru

GRIGOR'EV, INNOKENTIY I.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

HÖLZLE, LUDWIG E.

University of Hohenheim, Stuttgart, Germany
ludwig.hoelzle@uni-hohenheim.de

HUBER, IRENE

University of Hohenheim, Stuttgart, Germany
irene.huber@uni-hohenheim.de

IGNAT'EVA, MARGARITA E.

Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rosпотребнадзор), Regional Office in Yakutia
yakutia@14.rospotrebnadzor.ru

IL'INA, ELENA N.

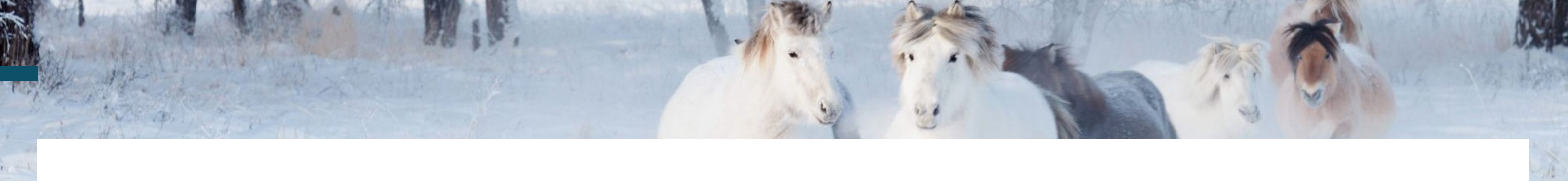
Yakut State Agricultural Academy
nir06@mail.ru

IVANOV, REVORIY V.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

IVANOVA, NARIYA D.

Yakut State Agricultural Academy
nariyaiv9@mail.ru



List of Participants

KHAJEHEI, FOROUGH

University of Hohenheim, Stuttgart, Germany
f.khajehei@uni-hohenheim.de

KOKOLOVA, LUDMILA M.

Yakut Scientific Research Institute of Agriculture
kokolova_lm@mail.ru

KOZLOVA, LYUBOV'

Yakut Scientific Research Institute of Agriculture
klg_14@mail.ru

KUZ'MINA, NATAL'YA V.

Yakut State Agricultural Academy

LEMKE, STEFANIE

University of Coventry, UK /
University of Hohenheim, Stuttgart, Germany
ac0447@coventry.ac.uk

MAKSIMOVA, ANNA N.

Yakut Scientific Research Institute of Agriculture
anna1n2maximova@gmail.com

MAKSIMOVA, KHARITINA I.

Yakut Scientific Research Institute of Agriculture
tinamaksimova56@mail.ru

MATCHAKHTYROV, GRIGORIY N.

Yakut State Agricultural Academy
nir06@mail.ru

MATVEEV, NIKOLAY A.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

NEUSTROEV, MIKHAIL M.

Ministry of Ecology of the Republic of Sakha (Yak.)
spoiler-men@mail.ru

NEUSTROEV, MIKHAIL P.

Yakut Scientific Research Institute of Agriculture
hotubact@mail.ru

NIKITINA, ANASTASIYA A.

Department of Veterinary, Republic of Sakha (Yak.)

NIKOLAEVA, FEVRON'YA V.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

NIKONOVA, TAT'YANA A.

Yakut State Agricultural Academy
nir06@mail.ru

NIFONTOV, KONSTANTIN R.

Yakut State Agricultural Academy
kosnif@yandex.ru

NYUKKANOV, AYAN N.

Yakut State Agricultural Academy
ayan1967@mail.ru

OBOEVA, NATALIYA A.

Yakut Scientific Research Institute of Agriculture
natalyaoboeva@mail.ru

OKHLOPKOV, ALEKSANDR M.

Federal Service for Veterinary and Phytosanitary
Surveillance, Regional Office in Yakutia

OKHLOPKOVA, POLINA P.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

PAGEL, HOLGER

University of Hohenheim, Stuttgart, Germany
holger.pagel@uni-hohenheim.de

List of Participants

PANKRATOV, V.V.

Yakut State Agricultural Academy
nir06@mail.ru

PAVLOVA, ALEKSANDRA I.

Yakut State Agricultural Academy
nir06@mail.ru

PETROVA, LIDIYA V.

Yakut Scientific Research Institute of Agriculture
pelidia@yandex.ru

PLATONOVA, AGAF'YA Z.

Yakut State Agricultural Academy
nir06@mail.ru

POPOV, ANDRIAN

Yakut Scientific Research Institute of Agriculture
andrian.popov.94@bk.ru

POPOV, EVGENIY N.

Yakut Scientific Research Institute of Agriculture
polard2013@yandex.ru

POPOV, RUSLAN G.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

POTAPOV, MIKHAIL D.

Yakut State Agricultural Academy
nir06@mail.ru

POTAPOVA, KATERINA

University of Hohenheim, Stuttgart, Germany
katerina.potapova@uni-hohenheim.de

PROKOP'EVA, A.

Yakut State Agricultural Academy
nir06@mail.ru

PROTOD'YAKONOVA, GALINA P.

Yakut State Agricultural Academy
gpet@list.ru

PROTOPOPOVA, ANNA

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

PUDOV, ALEKSEY G.

Yakut State Agricultural Academy
agro-on-line@yandex.ru

RESHETNIKOV, ALEKSANDR D.

Yakut Scientific Research Institute of Agriculture
adreshetnikov@mail.ru

ROBBEK, NIKOLAY S.

Yakut Scientific Research Institute of Agriculture
nrobbek@mail.ru

ROMANOVA, VARVARA V.

Yakut Scientific Research Institute of Agriculture
varvara.romanova.59@mail.ru

ROMIG, THOMAS

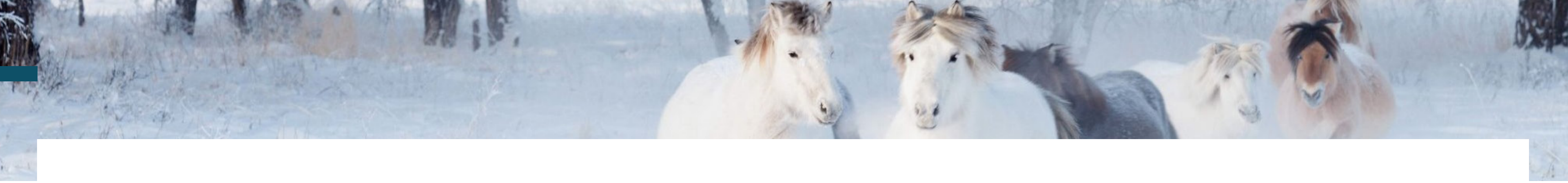
University of Hohenheim, Stuttgart, Germany
thomas.romig@uni-hohenheim.de

SAVVINOVA, MARGARITA S.

Yakut State Agricultural Academy
msavvinova@mail.ru

SEMENOV, SERGEY I.

North-Eastern Federal University in Yakutsk,
Institute of Health
insemenov@yandex.ru



List of Participants

SHADRIN, VYACHESLAV I.

Institute of for Humanities Research and Indigenous Studies of the North, Siberian Branch, RAS
odul_shadrin@mail.ru

SHADRINA, YANA L.

Yakut Scientific Research Institute of Agriculture
yanalina_12@mail.ru

SIDOROV, ANDREY A.

Yakut State Agricultural Academy
nir06@mail.ru

SIDOROV, MIKHAIL N.

Yakut State Agricultural Academy
tomsid@list.ru

SKRYABINA, MARFA P.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

SLEPTSOV, EVGENIY S.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

SLEPTSOV, IVAN I.

Yakut State Agricultural Academy
nir06@mail.ru

SLEPTSOVA, SNEZHANA S.

North-Eastern Federal University in Yakutsk,
Medical Institute
sssleptsova@yandex.ru

STEPANOV, AYAAL I.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

STEPANOV, KONSTANTIN M.

Yakut Research Center of Complex Medical Problems / Yakut State Agricultural Academy
stenko07@mail.ru

STEPANOVA, ANNA M.

Yakut Scientific Research Institute of Agriculture
stepanova_anna1985@mail.ru

STEPANOVA, SVETLANA

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

STARKOV, NIKOLAY F.

Yakut State Agricultural Academy
nir06@mail.ru

TARABUKIN, NIKOLAY I.

Yakut State Agricultural Academy
nir06@mail.ru

TARABUKINA, NADEZHDA P.

Yakut Scientific Research Institute of Agriculture
hotubact@mail.ru

TIKHONOVA, VALENTINA V.

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

TIMOFEEV, SEMEN

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

VASIL'EV, SERGEY V.

Yakut State Agricultural Academy
nir06@mail.ru

List of Participants

VINOKUROV, NIKOLAY

Yakut Scientific Research Institute of Agriculture
nikolaivin@mail.ru

VINOKUROVA, LILIYA I.

Institute of for Humanities Research and Indigenous Studies of the North, Siberian Branch, RAS
lilivin@mail.ru

YAKOVLEVA, MARIYA T.

Yakut Scientific Research Institute of Agriculture
mariyatimofeevna@mail.ru

YAKOVLEVA, NARIYA

Yakut Scientific Research Institute of Agriculture
agronii@mail.ru

ZAKHAROVA, RAISA N.

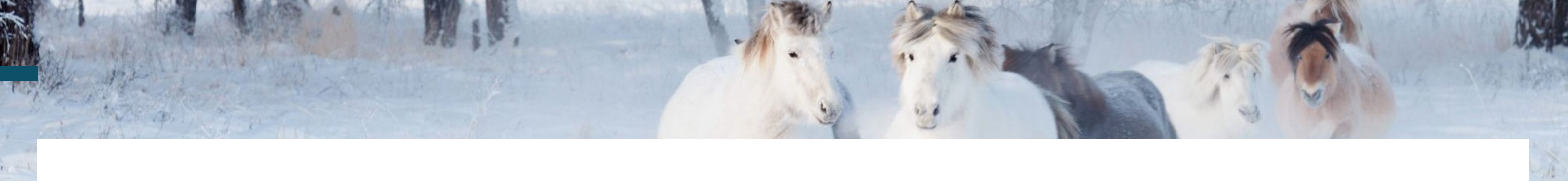
North-Eastern Federal University in Yakutsk,
Institute of Health
prn.inst@mail.ru

ZANDANOVA, TUYANA N.

Yakut Scientific Research Institute of Agriculture
tuyana35@mail.ru

ZAROVNYAEV, STEPAN I.

Yakut Scientific Research Institute of Agriculture
s-zarovnyaev@mail.ru



Notes

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Wollgrasweg 43, 70599 Stuttgart, +49 (0)711 459 24615, fzg@uni-hohenheim.de
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