

Newsletter of the Russian Society of Nematologists

Tenth International Nematology Symposium of the Russian Society of Nematologists, Moscow (Golytsino, Bolshie Vyazemy), 1-5 July, 2013)

The All-Russian Institute of Plant Pathology in Golitsyno near Moscow hosted the biennial 10th International English-language Nematology Symposium of the Russian Society of Nematologists on July 1-5, 2013. The President of the symposium was Dr Mikhail V. Pridannikov, a researcher in the Institute. The symposium included 70 scientists working in different areas of nematology from 15 countries: Russia, Ukraine, Czech Republic, Bulgaria, Serbia, U.S.A., Italy, Belgium, Vietnam, Japan, Iran, India, Pakistan, Egypt, Turkey and the UK. The presentations were grouped into six oral thematic sessions, a poster session and a training course for young nematologists. The total number of presentations was 77, including 51 oral talks and 26 posters.

The International English-language Nematology Symposia have been held regularly by the Russian Society of Nematologists (RSN) every second year starting in 1995, usually under the sponsorship of the Russian Foundation for Basic Research and other scientific and educational funding agencies. The symposia provide efficient forums for exchanging experiences and forming personal links among researchers involved in the same fields of nematology. Consequently, the meetings facilitate the formulation of high priority future projects in applied and fundamental science. Because of the growing public awareness of environmental issues and biodiversity research as well as the realisation of the importance of nematodes as crop pathogens and biocontrol agents of insect pests, the RSN symposia attract scientists focused on general biology and ecology, as well as agricultural researchers from the academic, governmental and business sectors.

In the opening “History and Collection Resources” paper session, Plant Pathology Institute Director Prof. S.S. Sanin reviewed the major research directions and activities of the Institute, with special emphasis on research of plant diseases caused by nematodes. A. Ryss briefly reviewed the history of Russian nematology, using as an example the Zoological Institute of the Russian Academy of Sciences in St. Petersburg. He also described modern molecular research and the computer technology that has facilitated achievements in nematological taxonomy and created access to nematode collections and the valuable data associated with them. M.V. Pridannikov and G.G. Petelina summarized the achievements of the six-year international ISTC project on the biodiversity of nematodes in Russia. Z.A. Handoo, J.D. Mowery and D.J. Chitwood presented a lecture on the USDA Nematology Collection and its associated database as resources for identifying nematodes. W. Bert and coauthors reviewed the activities of a major global nematology educational center located at the University of Ghent, Belgium, where the intelligent integration of modern tools is advancing the study of nematode morphology, identification and evolution. A. Zhilokov and K. Kozhevnikov demonstrated the efficient e-registry system for specimens housed in the Collection of Pathogens of the PPI; the system described in this presentation was later demonstrated in the poster session because of the interest of enthused participants. Overall, participants at this session obtained a detailed impression of a resource-based approach to investigating nematode diversity and the multifaceted benefits of this approach, from applied purposes (*e.g.*, crop variety selection, crop rotation) to modern fundamental research (*e.g.*, genetic markers elucidating major evolutionary lines).

In the “Ecology and Biodiversity” session, talks were presented on survey methodology and practice, population studies, biogeographical studies, and environmental assessment. The most important contribution was that of Prof. Aldo Zullini (Milan, Italy), whose original approach to the biogeography of freshwater nematodes involved a faunistic analysis of taxa in relevant literature from 1905-2011 to create a historical biogeography of freshwater nematodes of the world. A. Mladenov described anthropogenic influences on nematode associations in mountain sport and resort areas in Bulgaria. A. Kudrin evaluated data on the impact of river flooding on nematode communities in the Russian North. B. Westerdahl presented several examples



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of methodological pitfalls that may occur during field investigations of nematode population cycles; she described original methodology to conduct such surveys with precision. E. Matveeva, A. Sushchuk and D. Dieva compared ecological indices in nematode communities under annual crops and perennial grasslands, explaining the observed differences within a framework of variations in the circulation of biogenic substances. The same team also presented a paper evaluating the “island” community formation theory as exemplified by soil nematode biodiversity in 26 northern islands. A. Ryss, M. Andreev and L. Kurbatova analysed the biodiversity of nematodes in Antarctica, based upon nematodes added to the Zoological Institute collection from surveys in 2003-2013. The list of 58 species was presented with conclusions on community succession and faunal historical formation, capitalising upon the fact that 90% of the species in Antarctica are endemic. Polar regions are among the strategic priorities of the Russian Federation, and their biodiversity is one of the major priorities in national scientific policy. Next, A.V. Tchesunov described the free-living nematodes of an unusual biotope, the hydrothermal vents along the Middle-Atlantic Mountain Chain. R. Khusainov presented data on the succession of nematodes in the wood of *Alnus glutinosa* and the associated changes in communities with the progression of time and associated biomass destruction. S. Tabolin presented an atlas of the soil nematodes in Moscow parks, including excellent illustrations of predatory nematodes previously unknown in Russia. Overall, this section synthesised knowledge about general processes regulating the communities of small organisms, the key factors influencing these communities, as well as the role of microbiota in elucidating the shifts of continental plates in the past.

The third oral session was devoted to the structure and developmental biology of nematodes. V. Yushin (Russia) and M. Claeys and W. Bert (Belgium) described a comparative analysis of the protein bodies (containing major sperm protein) in sperm cells across the phylum Nematoda. The formation of protein bodies in spermatogenesis was illustrated in detail for *Panagrellus redivivus*, a popular laboratory model, by J. Zograf and K. Yakovlev. E. Guzeeva and V. Yushin described the previously unknown spermatogenesis of the exotic Thelastomatidae. D. Slos, M. Claeys, W. Bert and V. Yushin discussed spermatogenesis of *Ditylenchus* spp.; they revealed that sperm cell formation was of the rhabditoid type, whereas earlier studies with less data erroneously classified it as a peculiar, aberrant developmental type. A. Shoshin and E. Shoshina concluded this section with an analysis of the symmetry of the cephalic region of the family Tobrilidae, describing the most primitive head type among the 13 studied species and proving that hexaradial symmetry is the dominated pattern for the tobrilid head. This session showed that advanced study of organismal development at the cellular level continues to be a reliable method to construct evolutionary lines, in conjunction with molecular data.

In the fourth session (Molecular Research), S. Subbotin presented a general review of the global DNA barcoding programme, including impressive examples of how molecular data have altered classical views about nematode classification and geographical migration of species and races. T. Janssen and W. Bert described their research integrating karyotypic and multigenic molecular analysis to construct a precise phylogeny of *Pratylenchus*. E.A. Khudyakova and S.V. Sudarikova briefly illustrated the real-time PCR automated technology known as FLASH-PCR for prompt identification of quarantined nematode species by Russian plant quarantine laboratories. Next, V. Oro presented a genetic analysis of geographic isolates of the barley cyst nematode *Heterodera avenae* in Serbia. S. Spiridonov and coauthors then described the differences among Arctic *Trichinella* species with respect to their cytochrome oxidase *cox*b mitochondrial gene sequences, stressing the value of the numerous and rich endemic reservoirs of parasitic helminths in the Russian Arctic. Different species of pinworms (*Pseudonymus* spp.) from different water-inhabiting beetle species were shown to have distinct genetic differences (E. Guzeeva, I. Kosevich and S. Spiridonov). Overall, this session excellently displayed the increase of molecular nematode research in Russia, under the leadership of the Institute of Ecology and Evolution in Moscow.

The fifth session was devoted to host-parasite interactions. E. McGawley *et al.* described research revealing differences among reproduction and pathogenicity of six geographic isolates of *Rotylenchulus reniformis* from the USA. Data from microplot and glasshouse trials support the hypothesis that there are distinct virulence phenotypes of this nematode in the southern USA. Next, A. Ryss utilized a wide range of parasitological examples in a comparative application of Pavlovsky's theory of vector-borne endemic infections to nematode-caused diseases of plants and animals. Nematodes may play different roles in infections: as the infective agents, as vectors, or as key members of mutualistic pathogen associations consisting of nematodes, bacteria, fungi and viruses of plants. O. Kulinich and coauthors presented convincing molecular data on the role of bacterial ectosymbionts of wood-inhabiting nematodes (*Bursaphelenchus* spp.) in the wilt of coniferous trees in Russia. Because the distinct range of symbiotic

bacteria was correlated with wilt symptoms, high risk areas for pine wilt disease could be drawn on a climatic map of Russia. H. Kosaka (Japan) described an interesting comparative analysis of interactions of Japanese isolates of the entomopathogenic nematode *Sphaerularia vespae* with hymenopterous hosts from the hornet genus *Vespa*. The talk of A. Schhukovskaya, O. Tkachenko and A.A. Shesteporov described the mycotrophic feeding of nematodes belonging to the genera *Aphelenchus*, *Aphelenchoides* and *Paraphelenchus* on the *Microdochium* fungus causing white mold of winter wheat; the species were peculiarly able to feed and grow well at a low temperature (5°C). Overall, this session summarised the interactions of nematodes with their hosts, vectors and symbionts, often within a framework of vector-borne infection theory at the taxonomic level of nematode orders. Additionally, differences in reproduction rates and pathogenesis among species and geographic populations were analyzed in different nematode taxa.

The sixth session (Management of Nematodes) was the most numerous with respect to number of presentations. The fundamentals of resistance and tolerance of plants were reviewed by a team led by S.V. Zinovieva; they also described the roles of jasmonic and salicylic acids in genetic and induced resistance in general and in the immune processes of tomatoes infected with root-knot nematode in specific. In the same project dealing with the resistance of tomatoes to *Meloidogyne* spp., O. Baicheva *et al.* described the interactions of chitosan with salicylic acid in host resistance to nematodes. Several presentations were devoted to the application of natural compounds to suppress pathogenic nematodes; for example, alkaloids from the yew *Cephalotaxus fortunei* toxic against root-knot and pinewood nematodes (Y. Wen, D. Chitwood *et al.*) A range of medicinal plants was described as a source for natural nematicides in Egypt by M. Abd-Elqawad *et al.* S. Vaish described the use of extracts of *Catenaria anguillulae* to control phytoparasitic nematodes on agricultural crops in India. N. Esfahani reviewed non-chemical methods to control nematodes in Iran. E. Noweer described the isolation and identification of nematode-antagonistic fungi from the economically important irrigation zone in Giza, Egypt. N.D. Romanenko and coauthors gave a presentation on the survey, identification and culture of antagonistic fungi collected in Russia. A. Saifullah (Pakistan) presented new electron micrographs depicting the association between the antagonistic fungus *Trichoderma* (a common potato symbiont) and the potato cyst nematode *Globodera rostochiensis*, illustrating the potential of this fungus to control potato pests. The importance of genetic resistance to nematodes as a resource for selection of new crops was presented in lectures of A. Dabadat *et al.* on wheat resistant to cyst and lesion nematodes in Turkey, and E.P. Ieshko and E. Matveeva on local resistant varieties of potatoes exhibiting a range of resistance to *Globodera rostochiensis*. The potential of pest insect control by entomopathogenic Steinernematidae was described by M. Abd-Elqawad for Egypt. In general, this session was dominated by biologically based nematode control and management strategies using modern plant and mycological resources as well as genetically developed new resistant crop varieties.

As usual, the poster session was a plural mosaic of presentations devoted to different topics, generally related to areas highlighted in the oral sessions. Data obtained from regional surveys in apple orchards of Iran, including long lists of plant-pathogenic nematodes and seasonal dynamics, were presented by S. Mehdizadeh and E. Shokoohi; the same research strategy was used by V. Migunova and S. Lychagina to study vegetable crops in glasshouses in the Saratov region of Russia. Soil nematode biodiversity in coniferous forests of natural reserves of the Chernigov region in Ukraine was examined by T. Zhilina and V. Shevchenko; D. Dieva, E. Matveeva and A. Suschuk successfully analyzed nematode community data to elucidate areas contaminated with heavy metals in Karelia (northwest Russia). The results of the long-term international ISTC project on the biodiversity of nematodes in Russia were illustrated in two posters of M. Pridannikov *et al.* The first poster contained data on collections prepared during this survey project (with D. Chitwood, Z. Handoo, D. Shumilina, G. Petelina and S. Zinovieva); the second poster (with K. Butova) presented a detailed map with lists of records and hosts of *Meloidogyne hapla*. Because root-knot nematodes are among the most dangerous of crop pests, they were studied also by O. Baicheva in their reservoir hosts – eleven common weeds in potato fields in Bulgaria. Such an easy transition to a new group of hosts indicates the very high parasitic flexibility of these nematodes. Their ability to find new hosts everywhere and occupy secondary “sleeping” reservoirs creates the need to examine these reservoirs in typical pre-plant surveys.

Because of the importance of advanced morphological studies in developing nematode classifications, understanding of evolutionary adaptations and identifying species, posters under this topic included the following: marine Desmoscolecida (A.V. Tchesunov), a nicely illustrated anatomy of plant-parasitic nematodes as a part of a university nematology course (E. McGawley and K. Winchell), a new method of transmission electron microscopy involving high pressure freezing and automatic freeze substitution dehydrating agents and fixatives (M. Claeys, V. Yushin, W. Bert), and male pre-tail genital papilla

(supplements) as a character to study phylogeny of Tobrilidae (A. Shoshin and E. Shoshina). Insect-vectored pathogenic nematodes of woody plants are a major threat to natural reserves and forestry; to control insect-vectored nematodes, one must understand their individual development and interactions with vectors during their life cycles. Two posters from the Czech Republic were devoted to this problem: S. Grucmanova and J. Halusa studied the life cycles of five widespread nematode species tracing the adaptive conjugation of nematode with vector life history; K. Mikušková and colleagues (V. Čermák, M. Čudejčková, K. Tománková, V. Gaar) found a new *Bursaphelenchus* species in the peat substrate associated with hop seedlings; morphology of adult and juvenile stages and association links with its beetle vector were excellently illustrated.

Molecular analysis of the genetic differences among *Heterorhabditis bacteriophora* geographic isolates were successfully used to discover new biocontrol agents with potential use against insect pests in Iran (E. Sediqi, E. Shokoohi, J. Karimi); similar analysis was provided for an Iranian population of the spiral nematode *Helicotylenchus digonicus* (M. Nadi, E. Shokoohi, A. Troccoli). B. Efeykin *et al.* used ribosomal protein sequence analysis to reconstruct the macro-phylogeny of the Ecdysozoa (the group of phyla of molting animals, including Nematoda), devoting close attention to the apomorphies shared by the Nematomorpha and Nematoda. Finally, V. Lavrova, V. Sysoyeva and E. Matveeva described molecular changes associated with temperature priming, *i.e.*, a brief exposure of plants to changes in temperature to increase their resistance against nematodes, thereby elucidating cellular mechanisms involved in this old farmers' method.

As with the oral presentations, a large share of the posters dealt with the biological control of pathogenic nematodes. A promising future for biologically based methodologies could be seen in posters describing the use of extracts of medicinal plants against nematodes (S. Jamali and E. Shokoohi; M. Rashidifard, E. Shokoohi *et al.*), the application of chestnut tannins against *Globodera pallida* (M. Renco, N. Sasanelli), and the control of root-knot nematode with the antagonistic fungus *Aphanocladium album* to a degree not different from the chemical control treatment (N. Sasanelli *et al.*) The poster presentations of N.D. Romanenko, S. Tabolin, A. Titova, and K. Perevertin were devoted to nematode control in potato and strawberry fields. M. Kokand and E. Shokoohi described the culture of the predatory nematode *Mylonchulus* isolated in Iran; in addition to such cultures being useful in laboratory bioassays, mass cultures of predatory nematodes may be useful for controlling some of their prey, *i.e.*, plant-parasitic nematodes. Finally, the first research in Russia on the effects of nematode pathogenicity on grasslands discovered a decrease in dry weight of plant species (V. Chizhov, K. Perevertin, N. Butorina); this discovery has important ramifications for cattle-producing and sport areas.

One day of the international symposium was selected for a training course for young nematologists: *i.e.*, undergraduate, master's and Ph.D. students. The course was sponsored by the nongovernmental Dynasty Foundation, which focuses on modern advanced educational programmes for young Russian scientists. Lectures and practical lessons were given on the following topics: digitization of biological collections with 3D technology (for nematodes, exemplified by the GBIF and Fauna Europaea standards) (A. Ryss); predictive models for potato epiphytotics caused by the potato cyst nematodes (A. Shesteporov); an introduction to molecular methods of diagnostics and phylogeny (S. Subbotin); the molecular and genetic fundamentals of plant resistance, with description of mechanisms used by pathogenic nematodes to overcome these immune barriers (S. Zinovieva); and the basic principles of biocontrol and the adoption of biocontrol technology into actual agricultural practices (B.A. Borisov). A master class involving modern optical equipment presented by a representative of the Zeiss Company in Russia attracted much attention from students interested in efficient tools for studying nematode morphology and diagnostics of species. Generally, the school covered the major areas of nematological knowledge, thereby compensating for the insufficient focus on nematodes in Russian universities in courses of general biology, zoology, entomology and plant pathology.

The social aspects of the symposium were perfectly organised. The President of the Afro-Asian Society of Nematologists, Dr. El-Shawadfy M. Mousa, presented certificates bestowing the title of Honorary Member of AASN to three RSN members – S. Spiridonov, M. Pridannikov and A. Ryss – for their contributions to the science of nematology and for their development of collaborations with nematologists in Asia and Africa. The Russian Society of Nematologists awarded the title of Honorary Member of RSN to two famous European nematologists: Prof. Maurice Moens (Belgium) and Prof. Roland Perry (UK) for their long term assistance to Russian nematologists in research and education, as well in scientific and editorial help to prepare the publications in leading nematological journals. The symposium participants also were

treated with guided tours at historical places: the estates of the poet Alexander Pushkin and Prince Golitsyn, and old monasteries of the period before Peter the Great where medieval painter Andrei Rublev created his famous icons. Informal talks during the cultural programme involving further discussions on the symposium contributions promoted future collaboration.

The symposium summarised the achievements of nematologists in Russia and partner countries during the past two years. Major advances were described in high priority areas in fundamental science (*e.g.*, diagnostics, phylogeny, biodiversity research, biogeography, symbiotic and antagonistic associations of nematodes with other organisms) and applied nematology (biocontrol, environmental bioindicators, and biogeographical mapping of nematode isolates and biocontrol agents). The training course for young nematologists, which provided introductory chapters into scientific research as it is actually conducted, was also intensively scheduled and efficiently organised.

Alexander Ryss, Mikhail Pridannikov and David Chitwood