

Newsletter of the Russian Society of Nematologists

Abstracts of the Eleventh International Symposium of the Russian Society of Nematologists (Russia, Cheboksary, 6-11 July, 2015)

BELOVA E.B., KOLSANOVA R.R., SHAGIDULLIN R.R., KALINNIKOVA T.B. & GAINUTDINOV M.KH. Synergism in toxic action of agonists of nicotinic acetylcholine receptors and acetylcholinesterase inhibitors on the organism of soil nematode *Caenorhabditis briggsae*.

It is known that toxic effects both of acetylcholinesterase (ACh-esterase) inhibitors and agonists of nicotinic acetylcholine receptors (nAChRs) are a consequence of hyperactivation of nAChRs in neurons and muscles. However, our experiments with soil nematode *Caenorhabditis briggsae* showed the existence of synergism in toxic effects of ACh-esterase inhibitor aldicarb and agonists of nAChRs levamisole and nicotine. This synergism was revealed either in enhancement of aldicarb toxic effect by low concentrations of nicotine and levamisole, which are subthreshold for worms' paralysis or in enhancement of levamisole or nicotine toxic effects by low concentrations of aldicarb. Agonist of muscarinic acetylcholine receptors (mAChRs) arecoline caused a strong rise of levamisole toxicity for *C. briggsae*. Therefore, the increase of levamisole toxic effect by low aldicarb concentrations can be explained by modulation of nAChRs' sensitivity by activation of mAChRs by a slight rise in acetylcholine level due to non-toxic slight ACh-esterase inhibition. On the other hand, the increase of aldicarb toxicity by low concentration of levamisole or nicotine can be the result of stimulation of acetylcholine release by activation of nAChRs in neurons if sensitivity of neuronal nAChRs is higher than that of muscle mAChRs. Synergism in toxic effects of aldicarb and levamisole supposes the possible efficiency of joint use of ACh-esterase inhibitors and agonists of nAChRs for pest control in agriculture. – **Research Institute for Problems of Ecology and Mineral Wealth Use of the Tatarstan Academy of Sciences, Kazan, 420087, Russia; E-mail: mgainutdinov@gmail.com.**

BELOVA E.B., KOLSANOVA R.R., SHAGIDULLIN R.R., KALINNIKOVA T.B. & GAINUTDINOV M.KH. The influence of environmental pH and temperature on the toxicity of pesticides – agonists of nicotinic acetylcholine receptors for organisms of soil nematodes *Caenorhabditis elegans* and *Caenorhabditis briggsae*.

Free-living soil nematodes *Caenorhabditis elegans* and *Caenorhabditis briggsae* are convenient model organisms for evaluation of the effectiveness of nematicides. In experiments with *C. elegans* and *C. briggsae* we have shown that pH and temperature are physical environmental factors which have great influence on the toxicity of nematicides. The pH rise from 6.0 to 8.0 caused the increase of toxicity of levamisole and nicotine. In *C. briggsae* this increase was stronger than in *C. elegans*. However pH changes in the range 6.0-8.0 did not affect the toxicity of other nematicides – pyrantel and aldicarb. Not only the rise of pH but also a temperature rise from 22 to 30°C caused increased sensitivity of *C. elegans* and *C. briggsae* to toxic effects of levamisole, nicotine and aldicarb. Temperature rise up to 30°C caused a stronger increase in levamisole and nicotine toxicity at pH 7.0 or 8.0 than at pH 6.0. As a result of synergism in effects of pH changes and temperature on toxicity of levamisole and nicotine, their toxicity at pH 8.0 and 30°C was 12-15-fold higher than at usual conditions (pH 6.0 and 20-22°C). Since pH and temperature of soil are very variable factors, it is evident from our data that their influence on the effectiveness of nematicides used in pest control can be very significant. – **Research Institute for Problems of Ecology and Mineral Wealth Use of the Tatarstan Academy of Sciences, Kazan, 420087, Russia; E-mail: mgainutdinov@gmail.com.**

BUTORINA N.N., UDALOVA ZH.V., KHASANOVA O.S., FILIMONOVA L.V., PETROSYAN V.G. & ZINOVIEVA S.V. Helminthological collections and prospects of their development.

The huge amount of material accumulated in the worldwide collections of nematode parasites dictates a need to develop specialised information retrieval systems (IRS) and databases (DB). It is essential to elaborate new means of information storage, presentation and exchange, making worldwide access to collection material user-friendly, quick and easy. Creation of a local version of Microsoft Access-formatted DB and IRS of the Helminthological Museum RAS is an example of such developments in Russia. Tabular and screen data entry forms were developed. A complete species label includes 27 indices, providing most important information on location in the museum, systematics and biology of

the parasite, specimen sampling, preparation and identification, bibliography. Information system of the Museum, Helminth_Sys, comprising IRS and DB, was designed for IBM-compatible computers, laptops and netbooks, employing Windows 2000/XP/2003/2008/Vista/7/8. It is planned to create a form for entry and viewing of illustrative material on helminth species, as well as to create a WEB-site devoted to IRS and DB of Helminthological Museum. The WEB-oriented system will include a special software module for data export from the system to the format of relevant international biodiversity databases GBIF (Support: RFBR 15-29-02528-ofi_m). – **Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: nbut@list.ru.**

DECRAEMER W.^{1,2}, PALOMARES-RIUS J.E.³, CANTALAPIEDRA C.², CASTILLO P.³ & SUBBOTIN S.A.^{4,5} The virus vector family Trichodoridae (Nematoda), a source of many unknown cryptic species.

The polyphagous root ectoparasitic family Trichodoridae occurs worldwide. Its major pest status is as vector of Tobraviruses, especially in the didelphic genera *Paratrichodorus* and *Nanidorus*, with 27% and 28.6% of vector species, respectively vs, so far, only 6% of vector species in *Trichodorus*. The current study deals with the biodiversity of Trichodoridae in Spain and in California, comparing both case studies. Surveys for trichodorids were carried out in both countries in cultivated and natural habitats. Identification of *Trichodorus*, and even more so for *Paratrichodorus* species, is hampered by the general difficulty to fix specimens properly, their largely conserved morphology and restricted number of diagnostic morphological features, overlap of morphometrics and co-occurrence of at least two species of the same genus in the same soil sample, often with a restricted number of specimens. Molecular analyses based on nuclear ribosomal RNA genes (D2-D3 expansion segments of 28S and partial 18S gene) clearly informs the comparative morphological study while the morphology and morphometrics helps the molecular research to interpret the results when dealing with co-occurrence of several species. Such an approach allowed us to differentiate cryptic species and to interpret formerly described species with wide range in diagnostic characters to represent species complexes. The integrative taxonomic approach for *Trichodorus* from Spain resulted in seven new *Trichodorus* species and in the discovery of about as many new *Paratrichodorus* species. The latter belong to two main clades: (1) a *P. hispanus* related group, characterised in male by large sperm cells with sausage-shaped nucleus and spicules with undulating outline of anterior blade part, and (2) a *P. allius* related group with small sperm and nucleus and nearly straight spicules with finely striated blade. The first group is common within the Iberian Peninsula, while the second group of species occurs in general in warmer (Mediterranean) to subtropical climates. For California, we focused on the genus *Trichodorus*, also resulting in several new species belonging two different clades, one clade of only Californian species including three subclades, in male characterised by the absence of ventromedian cervical papillae or the presence of either a single papilla or two papillae. The second clade grouped without clear relationship, two new species to a large clade including one Californian species, *T. obtusus* and the European species available in GenBank. The study is still in progress; so far two new species or MOTU of *Paratrichodorus* were discovered. This study strengthens the need for integrative taxonomy in this group of nematodes because of their high molecular biodiversity and similar morphology and morphometrics with examples of cryptic diversity. Based on our results, we discovered especially in Spain but also in California some apparent centres of speciation. – ¹Royal Belgian Institute of Natural Sciences, Brussels, 1000, Belgium. ²Ghent University, Department of Biology, Ghent, 9000, Belgium; E-mail: Wilfrida.Decraemer@UGent.be. ³Instituto de Agricultura Sostenible (IAS), Consejo Superior de Investigaciones Científicas (CSIC), Córdoba, 14080, Spain. ⁴University of California, Riverside, 92521, CA, USA. ⁵Plant Pest Diagnostic Centre, CDFA, Sacramento, 95814, CA, USA.

EFEYKIN B.D.^{1,2} The differences in morphology and nucleotide sequences between genera and species of nematomorphs.

Horsehair worms or nematomorphs (Nematomorpha) are worm-like organisms, parasitising at the pre-mature stage in the body cavity of different arthropods. Approximately 360 species of these worms are described up to now. An existing taxonomy of fresh-water nematomorphs is based on the differences in the superficial cuticular structures and the shape and cuticular armament of the male posterior end. In addition, molecular data for several loci can provide new features for species discrimination. Partial 18S and 28S and complete ITS1, 5.8S and ITS2 sequences were obtained and analysed for ten species: five of *Gordius*, two of *Chordodes* and three of *Gordionus*, as representatives of two families of freshwater Nematomorpha: Gordiidae and Chordodidae. Morphology of the cuticle surface of horse-hair worms was studied under light and scanning electron microscopes. It was established that 18S and ITS (ITS1+5.8S+ITS2) regions of ribosomal cluster are the most informative for molecular taxonomy of Nematomorpha (Support: RSF 14-50-00150). – ¹Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia. ²Institute for Information Transmission Problems, RAS, Moscow, 127051, Russia; E-mail: bocha19@yandex.ru.

FEDYAEVA M.A. & TCHESUNOV A.V. Midgut ultrastructure of some White Sea nematode species in connection with their type of feeding and the taxonomy position.

A survey of intestine structure of marine free-living nematodes is undertaken particularly in order to find an approach to study nematode digestion and diet. Seven species of different taxa and apparently different ways of feeding have been collected and fixed for transmission electron microscopy study at the White Sea Biological Station: *Bathylaimus* sp. (Enoplida, Tripyloididae), *Paracanthonus caecus* (Chromadorida, Cyatholaimidae), *Halichoanolaimus robustus* (Chromadoridae, Selachinematidae), *Desmodora communis* (Desmodorida, Desmodoridae), *Odontophora deconincki* (Araeolaimida, Axonolaimidae), *Sabatieria ornata* (Araeolaimida, Comesomatidae), *Paramonhystera filamentosa* (Mohysterida, Xyalidae) (Support: RFBR 15-04-02597-a). – **Biological Faculty, Lomonosov Moscow State University, Moscow, 119991, Russia; E-mail: mariaf92@mail.ru.**

FEDYAEVA M.A.¹, TCHESUNOV A.V.¹, NERETINA T.V.² & KONOVALOVA O.P.² Three marine nematode species of the families Draconematidae and Epsilonematidae from Great Salma of the White Sea.

Species of the families Draconematidae Filipjev, 1918 and Epsilonematidae Steiner, 1927 (Desmodorida) are often designated as “walking-nematodes” because of their peculiar way of locomotion. These nematodes walk attaching alternately with anterior and posterior body ends in the same way as leeches or geometrid caterpillars. Species of both families use adhesive tubes (modified setae with strongly developed glands) to fasten temporarily onto substrates. Both families are widespread worldwide in the sea but especially common on hard surfaces of stones, in epigrowth, on macrophytes and shells as well as in coarse-granular sediments. However, both draconematids and epsilonematids were not recorded in the White Sea until recently. During our survey in the vicinity of the White Sea Biological Station of Moscow State University (Kandalaksha Bay) three species were revealed in various milieus. *Draconema ophicephalum* (Claparède, 1863) (Draconematidae) is often recorded for North Europe coasts but this species remains poorly studied, with unclear relation to congeners. We redefine *D. ophicephalum* collected from kelp rhizoids, using light and scanning electron microscopy. The second draconematid species, *Prochaetosoma marisalbi* differs from all other *Prochaetosoma* species particularly by non-thickened internal cuticle of the pharyngeal bulb. *Epsilonema steineri* Chitwood, 1935 (Epsilonematidae) dwells on sublittoral red algae, together with the previous draconematid species. *E. steineri* was initially discovered in the Barents Sea; it is also a poorly described species with unknown males. Detailed redescription of *E. steineri* is here proposed (Support: RFBR 15-04-02597-a). – **¹Biological Faculty, Lomonosov Moscow State University, Moscow, 119991, Russia; E-mail: mariaf92@mail.ru. ²Pertsov White Sea Biological Station, Biological Faculty, Lomonosov Moscow State University, Moscow, 119991, Russia.**

GUZEEVA E.A.¹, ZOGRAF J.K.^{2,3} & SPIRIDONOV S.E.¹ Morphological and molecular differences of two *Binema* (Thelastomatoidea) from the African mole cricket *Gryllotalpa africana*.

Nematodes of the genus *Binema* Travassos, 1925 are known to parasitise exclusively mole crickets (the family Gryllotalpidae). Three species of this genus (*Binema ornata* Travassos, 1925, *Binema* sp. 1 and 2) were reported from the hindgut of *Gryllotalpa africana* (Palisot de Beauvois, 1805) caught in soil tunnels near the Vostok Marine Biological Station (Vladivostok area). Partial sequences of the 18S and D2-D3 segment of the 28S rDNA were obtained for males and females of *B. ornata* and *Binema* sp. 1. On the basis of the morphological features, the females with a short trapezoid head capsule, 13-14 distinct cuticular annuli at the anterior end, a subulate tail filament, and capsules in the uteri containing 2 joined eggs with a bundle of thread-like polar filaments were identified as *B. ornata*. Females with the enlarged first annulus, 8-9 prominent cuticular annuli at the anterior end, a gradually tapering tail filament, and paired eggs with polar filaments extending into packs of lamellae were designated as *Binema* sp. 1. These two species differ in 17 bp of the 18S rDNA (the alignment length 700 bp) and in 96 bp of the D2-D3 28S rDNA (the alignment length 665 bp). Nucleotide differences in the D2-D3 28S rDNA of *Binema* sp. 1 with *Singhiella* sp. (a parasite of mole crickets from Vietnam) were lower than between this species and *B. ornata*. The partial 18S rDNA sequence of *B. ornata* studied revealed pronounced difference with *B. ornata* from India (JX852711 – 37 bp) and lower differences with *B. korsakowi* from India (JX852712 – 14 bp). The shorter 18S rDNA sequence of *Binema mirzaia* (KC763368 – only 420 bp) has demonstrated 58 bp differences with *B. ornata* and 70 bp differences with *Binema* sp. 1 from the Russian Far East. Complete correspondence of the 18S and 28S rDNA sequences proved that males with 103 µm long tail terminus, 8-9 pairs of genital papillae and 38 µm long spicule with developed capitulum and blade belong to *B. ornata*, whereas males with 51 µm long tail terminus, 7 pairs of genital papillae and 23 µm long spicule belong to *Binema* sp. 1. (Support: RFBR 14-04-01513-a, 14-04-31561-mol_a, RSF 14-50-00034, grant of the President of Russian Federation MK-3636.2015.4). – **¹Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: guzeyeva@mail.ru, s_e_spiridonov@rambler.ru. ²A.V.**

Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia. ³Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: zojulia@yandex.ru.

IESHKO E.P., MATVEEVA E.M. & LAVROVA V.V. Characteristics of the potato cyst nematode distribution across the host population under temperature variations.

Parasitic systems are typically characterised by high level of parasite aggregation inside host populations. Relationships between potato cyst nematode *Globodera rostochiensis* and potato *Solanum tuberosum* were used as the example to estimate the effect of ambient temperature on the parasite distribution. Before being infected with nematodes (10 cysts/plant), potato plants were exposed to low temperature treatments of varying duration, and then kept under conditions optimal for their growth and development. After the experiment, the distribution characteristics and the statistical parameters of nematode abundance were analysed. Control plants demonstrated the highest average infection rates and high upper limit values of maximum infection intensity. Constant low temperature (CLT) caused a decrease in mean infection intensity and variance nearly twice that of the control. The most significant differences in infection parameters were shown for short-term temperature drop (DROP): mean infection intensity decreased 5-fold and variance 17-fold compared to the control. Plant resistance after low temperature treatments is illustrated by nematode abundance distribution histograms: reliable differences (determined by Kolmogorov-Smirnov test at $P < 0.05$) in the distance between the distributions of cyst abundances were 0.32 (CLT) and 0.82 (DROP). The data prove that low temperature pre-treatment increased plant resistance to further nematode infection but the degree of resistance depended on the duration of the cold exposure. DROP treatment was shown to play a significant role in promoting non-specific plant resistance, presumably due to certain features of the plant physiological status under this type of treatment (Support: State Order 0221-2014-0004). – **Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia.**

IVANOVA E.S.¹, PERFILEVA K.S.² & SPIRIDONOV S.E.¹ Panagrolaimid nematodes suppressing the laboratory cultures of drosophilid flies in insectaria.

The suppression of the laboratory lines of *Drosophila* kept at the Department of Biological Evolution of the Moscow State University in the period from August 2013 up to June 2014 was induced by the mass development of unknown, small-sized nematodes in the nutrient medium in the culture flasks. The nematodes were washed out from the vials and used for the morphological and molecular-taxonomic study. The study of nematodes carried out by light and scanning microscopy revealed the characteristic features of panagrolaimid nematodes. Nucleotide sequences of the partial SSU rDNA (approx. 1000 bp) and D2-D3 segment of LSU rDNA (approx. 1100 bp) were obtained with primer pairs Nem18SF (CGC GAA TRG CTC ATT ACA ACA GC)-Nem18SR (GGG CGG TAT CTG ATC GCC) and LSU531 (CTT CGC AAT GAT AGG AAG AGC C)-LSU537 (GAT CCG TAA CTT CGG GAA AAG GAT), respectively. Sequences obtained were used for BLAST-search in NCBI GenBank and the affinity with a set of rhabditid nematodes was revealed. All the similar sequences were used to construct alignments (862 bp long for SSU and 951 bp long for LSU). Three methods of analysis demonstrate the similarity of the sequence of nematode from *Drosophila* cultures with panagrolaimids: *Panagrellus redivivus* and *P. dubius* in the LSU rDNA sequence and *P. redivivus*, *Panagrolaimus paetzoldi* and *Baujardia mirabilis* in the SSU rDNA. Both in SSU and LSU alignments, the difference between the species under study and *Panagrellus redivivus* was the lowest (46 bp and 39 bp correspondingly). In the LSU rDNA tree, the nematode from drosophilid cultures also clusters with a clade consisting of several panagrolaimid genera. Despite the revealed similarity, the nematodes studied cannot be assigned to the genera *Panagrellus*, *Panagrolaimus* or *Baujardia* forming a sister taxon to the clade of these three genera. The wider molecular-taxonomic study of panagrolaimids is needed for identification of this nematode (Support: RFBR 14-04-01513-a). – ¹**Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia.** ²**Biological Faculty, Lomonosov Moscow State University, Moscow, 119991, Russia; E-mail: ksenperf@mail.ru.**

IVANOVA E.S.¹, PHAM VAN LUC² & SPIRIDONOV S.E.¹ A new parasitic nematode with unusual morphology associated with terrestrial snails.

A new nematode-gastropod association was discovered. Unusual looking nematodes, small juveniles with the body densely packed with lipid globules and two lateral elephant-trunk-like appendages at mid-tail, were found in the mantle cavity of large snails (*Cyclophorus* sp.) in Vietnam. After 3-5 days of growth on the host cadaver, the juveniles reached the adult stage; however, its progeny did not produce an infective stage and died. No changes in the parameters and morphology of the parasitic juveniles occurred during their several months' long habitation inside the host mantle cavity. Such a scenario is indicative of a necromenic nature of relationships between the nematode and its host. The

examination of the morphology of the nematode showed that it represents a new genus and a species of the family Alloionematidae. From the two genera of Alloionematidae, *Alloionema* and *Rhabditophanes*, the new member of the family is more closely related to *Alloionema* in having 6 lips, similar shape of spicules and a gubernaculum and by its association with gastropods. The phylogenetic analyses of the partial SSU, LSU and ITS rDNA sequences pointed at *Alloionema appendiculata* as the closest species. *Alloionema appendiculata* is characterised by a very low intraspecific variability in 18S rDNA (< 0.2%). Difference between *A. appendiculata* and the newly found nematodes in 18S sequences varies from 7.6 to 8.0 %. The intraspecific variability in ITS rDNA of *A. appendiculata* accounts for 0.2-0.7%. The ITS rDNA sequences of *A. appendiculata* and the new nematode differ at 21-22% (Support: RFBR 14-04-01513-a). – ¹Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: elena_s_ivanova@rambler.ru. ²Viet Nam Museum of Nature, VAST, Ha Noi, Viet Nam.

KALINKINA D.S., SUSHCHUK A.A. & MATVEEVA E.M. Soil nematodes in the rhizosphere of woody plants on the Bolshoy Sovetsky Island.

Soil nematode fauna of the rhizosphere of introduced woody plants (*Abies balsamea*, *Abies sibirica*, *Larix sibirica*, *Larix gmelinii*, *Pinus sibirica*, *Quercus robur*, *Tilia cordata*) was studied in the botanical garden of Bolshoy Solovetsky Island. Native pine forest was chosen as a model cenosis for comparison. Nematode fauna included 50 genera, 10 of them were common for all biocenoses. Taxonomic diversity varied from 24 to 36 genera under introduced trees and was presented by 22 genera under pine stands. *Cephalenchus leptus*, *Nagelus leptus*, *Paratrichodorus pachydermus*, rare species for North-West of Russia were revealed. Nematode populations were observed in low abundance (216-615 individuals (100 g soil)⁻¹), except coniferous trees – *Abies* and *Pinus* (1342-2310 ind.). Nematode abundance in the rhizosphere of natural pine forest was 971 ind. (100 g soil)⁻¹. The dominant eco-trophic group in the nematode community structure was bacterial feeders; fungal feeders and nematodes associated with plants were observed in the second and third numbers. The significant share of plant-parasitic nematodes in the fauna was marked in the rhizosphere of *L. sibirica*, *P. sibirica* and *A. balsamea*. Eco-trophic structure of nematode community under natural pine stands differed from introduced plant rhizosphere: it was characterised by prevalence of bacterial-feeders, and complete absence of plant-parasitic nematodes. Analysis of ecological indices showed that the state of soil nematode communities reflects complexity, structured (stable) soil food web in the majority of investigated biocenoses, except *L. sibirica* and *P. sibirica* (Support: State Order 0221-2014-0004, RFBR 14-34-50855, 15-04-07675-a). – **Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia; E-mail: dania_22@mail.ru.**

KHOSA M.C.¹, McDONALD A.H.², DANEEL M.S.¹, DE WAELE D.³, FOUCHE G.⁴, TSELANYANE M.⁴ & CALITZ F.⁵ Phytochemical investigation of non-crop plant species on motility and hatching inhibition of *Meloidogyne incognita* race 2.

Plant-derived metabolites have attracted the most attention of all prospective alternatives to pesticides, either as plant extracts, formulated phytochemicals or as organic amendments to soil. Plant extract and fractions of *Maerua angolensis* and *Tynanthus elegans* were tested for nematocidal activity in terms of mobility of second-stage juveniles (J2) inhibition of J2 hatch at 10 different concentrations (0.1-1.0 mg ml⁻¹) each in 96-well test plates. Four independent trials for each plant extract concentrate were arranged in a randomised-complete block design (RCBD), with the eight treatments in each test replicated four times each. *In vitro* bioassay studies confirmed that extract and fractions of varying polarity of both plant products from *M. angolensis* and *T. elegans* might be toxic to J2 of the root-knot nematode (RKN) *Meloidogyne incognita*. All extract/fractions tested of *M. angolensis* caused immobility of J2, whereas only three extract/fractions of *T. elegans* affected mobility of J2 adversely. Methanol/dichloromethane (B) and evaporated dichloromethane (D) were the only extract/fractions with potent activity at concentration levels 0.8 to 1.0 mg ml⁻¹ after 21 days of exposure in both plants *M. angolensis* and *T. elegans* on hatch inhibition. This information would provide further insight into the usefulness of these materials in RKN control in small-scale communities, domestic gardeners and commercial farming. – ¹ARC-Institute of Tropical and Subtropical Crops, Nelspruit, 1200, South Africa; Email: Mbokota@arc.agric.za. ²School of Environmental Sciences and Development, North-West University, Potchefstroom, 2520, South Africa. ³Laboratory for Tropical Crop Improvement, Catholic University of Leuven, Heverlee, 3001, Belgium. ⁴Biosciences, Council for Scientific and Industrial Research, Pretoria, 0001, South Africa. ⁵ARC Central Office, Pretoria, 0001, South Africa.

KHRUSTALEV A.V.¹, SHAITANOV V.M.¹ & SERYODKIN I.V.^{2,3} New data on prevalence of the eye worm, *Thelazia callipaeda*, in wild animals in Russian Far East with remarks on its morphology.

Thelazia callipaeda is a spirurid nematode selectively parasitic in eyes of carnivores and humans. It usually localises in a conjunctival sac causing medium to severe inflammation of conjunctiva such as conjunctivitis, keratitis and ulcers of

cornea. Within the Russian Federation, the infection of *T. callipaeda* was reported in dogs, cats, foxes and racoon dogs in the Russian Far East. Wild animals sampled in Primorskiy Krai were examined posthumously in the period from the winter 2012 to the summer 2014. Conjunctival sacs of the animals including the space under a nictitating membrane were examined for the presence of thelazids. In total, 544 animals were examined including 492 specimens of sables, 25 Siberian weasels, 11 racoon dogs, 4 American minks, 3 Amur leopard cats, 3 foxes, 2 yellow-throated martens and one specimen each of lynx, European badger, brown bear and Asian black bear. Morphological study of helminthes and their species identification were performed under light microscope. In total, 6.8% (37 out of 544) of examined animals were found infected by *T. callipaeda*. Helminths were detected in 28 sables from 492 examined, in 5 racoon dogs from 11, in 2 foxes from 3 and in one lynx and Asian black bear examined. Sable, Asian black bear and lynx were registered as hosts of *T. callipaeda* for the first time (until now, the only record of *T. callipaeda* infection in the lynx was from the zoo). Morphological study of helminthes and their species identification were performed under light microscope. Morphometric data for the nematodes originating from sables are presented. The patterns of sensory structures of the male posterior end were examined, since descriptions of these structures in the literature are contradictory. Thus, different authors report from 6 up to 12 of precloacal papillae in *T. callipaeda*, and from 2 up to 5 postcloacal ones. Our observations demonstrated extreme variability of the papillae count and allocation in *T. callipaeda*. It is also impossible to distinguish unequivocally between pre- and postcloacal papillae. The most typical pattern is 7 pairs of precloacal papillae; 2 pairs of paracloacal ones and 4 pairs of postcloacal ones. It was concluded that such variability in the number and distribution of papillae prevents the use of this feature in accurate species diagnostic in the genus *Thelazia* (Support: RSF 14-16-00026). – ¹K.I. Skrjabin All-Russian Institute for Fundamental and Applied Parasitology of Animal and Plants, Moscow, 117292, Russia. ²Pacific Institute of Geography, FEB RAS, Vladivostok, 690041, Russia. ³Far Eastern Federal University, Vladivostok, 690600, Russia.

KITAGAMI Y. & MATSUDA Y. Community and trophic structure of soil nematode in Japanese coastal pine forest.

Soil nematodes are supposed to be a key bio-indicator of soil food web conditions, and thus their community and trophic structure have been documented in varied ecosystems. However, there has been limited study of nematode ecologies in coastal system. Among such ecosystems, coastal pine forests, where there are harsh environmental conditions with poor nutrition, can be a model system to understand forest-soil biota interactions. The aim of this study was to determine the soil nematode community and trophic structure in a coastal pine forest. We established four 3×9-m² plots within a 50×30-m² area in pine stands in the central part of Japan. Three soil samples (3 cm in diameter and 20 cm depth) were collected from each plot at four times for one year. Free-living nematodes were extracted from a 200-g sub-sample using the Baermann funnel technique. The extracted nematodes were counted under stereo microscope and identified into the family or genus levels using light microscopy. They were further morphologically divided into five trophic groups: bacterivores, fungivores, herbivores, predators, or omnivores. A total of 24494 nematodes were retrieved per sub-samples ranging from 318±57 to 662±142 individuals. Among 19 taxa discriminated, members of the family Cephalobidae and Aphelenchoididae dominated and bacterivores and fungivores accounted for 42-48% and 34-51% throughout the study period, respectively. These results suggest that coastal pine forests harboured a consistent nematode community dominated by microbial trophic groups. We discuss factors affecting nematode assemblages in this system compared with previous studies. – Graduate School of Bioresources, Mie University, Tsu, 514-8507, Mie, Japan; E-mail: 515m109@m.mie-u.ac.jp.

KOLSANOVA R.R., BELOVA E.B., SHAGIDULLIN R.R., KALINNIKOVA T.B. & GAINUTDINOV M.KH. Activation of cholinergic system as adaptive reaction of soil nematodes *Caenorhabditis elegans* and *C. briggsae* in stressful environment.

It is known that central processes of nonspecific stress-reaction of human and rodents in answer to noxious environment changes include activation of cholinergic system in the brain. In our experiments with small organisms of soil nematodes *Caenorhabditis elegans* and *C. briggsae* it was shown that stressful changes in environment, such as noxious high temperature or 2-h starvation, also led to activation of nematodes' cholinergic system. This activation is revealed in the rise of the sensitivity of nematode swimming induced by mechanical stimulus to partial inhibition of acetylcholinesterase by aldicarb (8-32 µM). Noxious heat (15 min at temperature range 31-35°C) caused strong increase of behaviour sensitivity not only to aldicarb but also to agonists of nicotinic acetylcholine receptors levamisole and nicotine. Therefore heat stress activates synaptic transmission on postsynaptic level by sensitisation of nicotinic acetylcholine receptors. The escape or avoidance of noxious environment is one of well-known behaviour responses to unfavourable changes of environment. Therefore, the activation of nematode cholinergic system by stressful environmental conditions can be the mechanism of adaptive increase in speed of movement to escape noxious heat or

local environment with food deficit. – **Research Institute for Problems of Ecology and Mineral Wealth Use of the Tatarstan Academy of Sciences, Kazan, 420087, Russia; E-mail: mgainutdinov@gmail.com.**

KOSAKA H.¹ & KANZAKI N.² *Contortylenchus* sp. from the bark beetles, *Ips typographus* and *I. cembrae*, in Japan.

Ips bark beetles usually propagate on declining trees. However, if they occur in large outbreaks, they attack and kill healthy trees. *Ips typographus* is a pest of the spruce, *Picea* spp., and *I. cembrae* is a pest of the larch, *Larix* spp., in Japan. In the exploration of their natural enemies, the parasitic nematode *Contortylenchus* species was found from *I. typographus* and *I. cembrae*. The mother nematodes from the bark beetles show dorsally curved body shape, which is the typical characteristic of the genus. The mother nematodes were found directly or encapsulated in the haemocoel of beetles. It is unclear whether this difference means the existence of two nematode species or is part of the developmental process. The prevalence of nematode in *I. typographus* and *I. cembrae* was about 50% and less than 10%, respectively. The sequences of D2-D3 rRNA gene of the nematodes are closely related with those of *Contortylenchus* sp. on the GenBank. In addition to *Contortylenchus* species, two species of tylenchid parasitic nematodes were found in *I. typographus*. – ¹**Kyushu Research Centre, Forestry and Forest Products Research Institute, Kumamoto, 860-0862, Japan; E-mail: hkosaka@ffpri.affrc.go.jp.** ²**Forest Microbiology Division, Forestry and Forest Products Research Institute, Tsukuba, 305-8687, Japan; E-mail: nkanzaki@ffpri.affrc.go.jp.**

KUZNETSOV D.N.^{1,2}, AKSYONOV A.P.¹, BURAKOVA A.V.³, VERSHININ V.L.³, KUZNETSOVA N.A.⁴ & SPIRIDONOV S.E.¹ The results of molecular-phylogenetic analysis of Ostertagiinae nematodes (Rhabditida, Strongyloidea).

The Subfamily Ostertagiinae Skrjabin & Schulz, 1937 comprises a wide group of nematodes that parasitise the abomasum of domestic and wild ruminants. An infection with the ostertagiinae nematodes can lead to loss of productivity and decrease of immunity. A substantial species variety within the subfamily complicates the taxonomy of the Ostertagiinae. The generally acknowledged concept of the Ostertagiinae taxonomy is still lacking. Several attempts of analysis of the phylogenetic relationships within the Ostertagiinae suggested the existence of two separated evolutionary lines within this taxonomic group. The aim of the present study was to assess the phylogenetic relationships of the Ostertagiinae based on ITS1+5.8S+ITS2 rDNA sequences analysis. The sequences deposited in NCBI GenBank and the newly obtained sequences were used. The ITS1+5.8S+ITS2 rDNA sequences of *Spiculopteragia spiculoptera* from *Capreolus pygargus* (Russian Far East), *Trichostrongylus vitrinus*, *T. axei*, *T. colubriformis* from *Capreolus capreolus* (Ryazan Region) and *Oswaldocruzia filiformis* (*Rana ridibunda*, Ural Region) were obtained for the first time. The phylogenetic analysis was performed with maximum parsimony, neighbour joining and maximum likelihood methods. The obtained results confirm a hypothesis of two independent lines within the Ostertagiinae. One phylogenetic line is represented by *Spiculopteragia* and *Mazamastrongylus* genera and another one comprises *Ostertagia*, *Orloffia*, *Teladorsagia* and *Marshallagia* (Support: RFBR 13-04-00341-a). – ¹**Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: dkuznetsov@mail.ru.** ²**K.I. Skrjabin All-Russian Institute for Fundamental and Applied Parasitology of Animal and Plants, Moscow, 117292, Russia.** ³**Institute of Plant and Animal Ecology, UB RAS, Yekaterinburg, 620144, Russia.** ⁴**Central Research Institute of Epidemiology, Moscow, 111123, Russia.**

KUZNETSOV V.P., SLIVKO-KOLTCHIK G.A. & PANCHIN YU.V. Electrophysiological study of gap junctions in *Heterhabditis megidis* intestine cells.

Caenorhabditis elegans, one of the most studied organisms in the world, has a rhythmic behaviour that is not controlled by the nervous system. During the defecation process, the action potential was generated about once per 50 s and spread through the gut cells, recruiting muscle cells into the process. Electrophysiological experiments in *C. elegans* are difficult because of the small cell size of this nematode. We suggest a new model organism *Heterhabditis megidis* that is closely related to *C. elegans* but has bigger gut cells suitable for electrophysiological methods. Our study demonstrates the important role of all-or-none hyperpolarization action potential in the nematode defecation rhythm. We reveal that this rhythm with a period up to 15 min is cell-autonomous. In addition, it was shown that gut cells are closely electrically coupled *via* gap junctions (Support: RFBR 15-04-06148-a). – **Institute for Information Transmission Problems, RAS, Moscow, 127051, Russia; E-mail: s.koltchik@gmail.com, empire.pat@gmail.com, ypanchin@yahoo.com.**

LAVROVA V.V. & MATVEEVA E.M. Temperature as management strategy for plant-parasitic nematode *Globodera rostochiensis* Woll.

The potato cyst-forming nematode (PCN), *Globodera rostochiensis* Woll., is a sedentary endoparasite of the root system and an economically important pest of potato crops. Development of second-stage juveniles (J2) inside the roots and female reproduction abilities are dependent on host physiological status. The aim of this study was to investigate the effect of changes in plant-host metabolism on quantitative and qualitative parameters of cysts produced on the roots. As an inductor of host resistance, short-term temperature drop before plant infection by PCN (DROP-variant) was used. Resistance of treated plants was expressed as the number of cysts and total number of eggs and J2 inside new-formed cysts relative to the same parameters in the control. Results have shown that final cyst population on DROP-treated plants was considerably reduced ($k_r = 2.7$ vs 4.0 in control). Cysts contained fewer eggs and J2 than in control (198 and 304, respectively). Their viability was also decreased (49% vs 99%) due to the large number of dead and immature eggs. This cyst content serves as evidence of disruptions in the syncytium formation in root tissues, which was insufficient for J2 development. Moreover, those J2 that succeeded in avoiding a cascade of plant immune responses and completed their life-cycle had reproductive disfunctions. Multiplication rate, taking into account egg viability, was decreased to 1.05. Thus, DROP-treatment of susceptible plants affects nematode development by mechanisms similar to resistant plants and can be used for establishing management strategies for plant-parasitic nematodes (Support: State Order 0221-2014-0004, RFBR 15-04-07675-a). – **Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia; E-mail: VVLavrova@mail.ru.**

LEBEDEVA D.I. & IAKOVLEVA G.A. Nematodes of mallard (*Anas platyrhynchos* L.) from South Karelia, Russia.

Mallard (*Anas platyrhynchos* L., 1758) is the most abundant species among the ducks breeding in Karelia. The 23 ducks were obtained from hunters of the Lake Ladoga Region (61°12' N, 32°54' E) in the autumn of 2010-2013. The parasitological study was conducted according to Dubinina (1971). Mallard nematode fauna was represented by eight species with a total prevalence of 78.3%. All species are common and widespread parasites of Anatidae. Species *Eucoleus contortus* (five worms) were found on the oesophageal walls of two mallards. Species *Echinuria uncinata* (one specimen in one bird) and *Tetrameres fissispina* (42 worms in five birds) were localised in the glandular stomach. Nematodes *Streptocara crassicauda* (45 specimen in seven birds) and *Epomidiostomum uncinatum* (three worms in three birds) were in the stomach muscle, but *Amidostomum acutum* (30 worms) was found in both parts of the stomach of 11 mallards. Nematodes *Capillaria anatis* were located in different intestine parts (nine worms in three birds). Two parasites of *Capillaria* sp. were found in caecum of one mallard. The presence of *Echinuria uncinata*, *Streptocara crassicauda* and *Tetrameres fissispina* indicate that mallards feed on different crustaceans (genera *Gammarus*, *Orehestia*, *Daphnia*, *Simocephalus*, *Asellus*, *Heterocypris*) serving as intermediate hosts for these parasites (Smogorzhevskaya, 1990; Sonin, Barush, 1996). Other nematodes are geohelminths. So birds are infected with their larvae by eating grass. Nematodes revealed in Karelian mallards may be the epizootic causative agents for Anatidae birds (Smogorzhevskaya, 1990) (Support: State Order 0221-2014-0004, grant of the President of Russian Federation MK-5350.2015.4). – **Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia; E-mail: galina_il87@mail.ru.**

LIMANTSEVA L.A.¹, YUSHIN V.V.^{2,3}, BERT W.⁴, CLAEYS M.⁴ & SLOS D.⁴ Spermatogenesis and sperm ultrastructure of *Anaplectus porosus* Allgen & Nofsinger, 1968 (Nematoda: Plectida).

For the first time ultrastructure of mature sperm cells and spermatogenesis were studied by TEM for the representative of the order Plectida. It was shown that *Anaplectus porosus* represent the “rhabditid” development pattern of spermatogenesis. In spermatogenesis of *A. porosus*, aberrant organelles appeared as FB-MO complexes in spermatocytes. In this stage, they look like fibrous material surrounded by membrane. They grow mostly in length and reach the maximum size at early spermatocyte. The complexes start to dissociate in late spermatocyte. In immature sperm, only separated MO could be observed. They look like round organelle (0.3-0.5 µm in diameter) with an internal system of membranes. The mature sperm cell of *A. porosus* is common for nematode habitus: bipolar cells, subdivided in main cell body (MCB) and pseudopod, devoid of organelles. Membranous bodies and mitochondria were located in MCB near the cell membrane. In this investigation, mature sperm with unusually small amounts of organelles was observed. Also, the amount of sperm cells in female spermatheca was not numerous – several cells only. These facts demonstrate some originality but are not unique among nematodes. – ¹**Russian Research Institute of Phytopathology, Bolshie Vyazyomy, 143050, Moscow Region, Russia; E-mail: Lutik47@yandex.ru.** ²**A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia.** ³**Far Eastern Federal University, Vladivostok, 690600, Russia.** ⁴**Ghent University, Department of Biology, Ghent, 9000, Belgium.**

MALYSHEVA S.V., GUZEEVA E.A. & AKSYONOV A.P. The morphology of the first stage juveniles of Rhigonematoidea and Ransomnematoida (Nematoda), parasitic in tropical millipedes.

Representatives of superfamilies Rhigonematoidea and Ransomnematoida (Nematoda: Rhigonematomorpha) inhabit a hind gut of tropical millipedes (Myriapoda: Diplopoda). Despite the large number of morphological and molecular data for both superfamilies, the question of the method of host infection (egg or juvenile?) still remains open. To get closer to answering this question an experiment to examine the development of the fertilised eggs of these nematodes using the hanging drop technique to study the morphological and morphometric features of the first stage juvenile. Embryonic development of Rhigonematoidea representative was completed on the 15th day after the beginning of observations. No moulting inside the egg and hatching of the juvenile was observed. The cuticle was annulated and free of any formations. In fertilised eggs of Ransomnematoida, a representative juvenile was observed on 6th day of the development, which extended up to 21 days. No moulting inside the egg was noted. In some cases spontaneous hatching from the eggshells was marked. The cuticle was well annulated with a lateral field consisting of two longitudinal cuticular folds. Immediately after hatching the molt of the first-stage cuticle was observed; the second-stage cuticle became distinguishable underneath. All previously described Rhigonematomorpha juvenile belong to the second-, third- and fourth-stage juveniles. This partly confirms the assumption of Sudhaus (2010) that, at least, the egg and the first, and perhaps even the first- and the second-stage juveniles of these nematodes develop in the external environment (Support: RFBR 14-04-31561-mol_a, grant of the President of Russian Federation MK-3636.2015.4). – **Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: malysheva24@gmail.com.**

MALYSHEVA S.V., TETERINA A.A & EFEYKIN B.D. Analysis of the complete mitochondrial genome in poorly known representatives of nematoda: challenges and possible approaches.

Nematodes represent probably one of the most promising terrains for the reconstruction of parasitism origin, as they include taxa of different ranks with both free-living and parasitic forms. Study of poorly known taxa such as Rhigonematomorpha (Nematoda: Chromadorea), will provide new data on the evolutionary groups, which may represent special evolutionary pathways of parasitism origin. Sequencing of mtDNA in such groups of nematodes may require a more thorough approach. Special attention should be given to the collection of material, seasonal fluctuations in number of host animals, the process of selection of the material and its subsequent fixation, allowing the study by different methods, including light and electron microscopy. Careful analysis of reference mitochondrial genomes of closely related species will allow determining the location of several gene patterns of different degree of conservativeness suitable for further work. Thus, we can mention a few general rules for the gene arrangement in *Ascaridia* sp., *Cucullanus robustus* and *Rhigonema thysanophora* (Rhigonematomorpha) (*i.e.*, genes *cox1*, *rrnS*, *cox3* and *nad4* remain in similar relative positions). Optimisation of DNA extraction protocol and PCR parameters, as well as the selection and design of primers for sequencing of selected mitochondrial genes are also an integral part of the work when dealing with poorly known taxa. The study of mitochondrial genomes in parasitic nematodes plays a very important role for the subsequent reconstruction of the evolutionary history of the emergence and development of parasitism in Nematoda (Support: RFBR 14-04-31561-mol_a, grant of the President of Russian Federation MK-3636.2015.4). – **Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: malysheva24@gmail.com.**

MATVEEVA E.M. & SUSHCHUK A.A. Features of soil nematode communities in relation to natural biocenose type: effectiveness of assessment parameters.

Monitoring of soil nematodes in the Republic of Karelia has provided extensive data on the taxonomic diversity, abundance, community structure and ecological indices derived from nematode fauna analysis. The large data pool allowed for checking the effectiveness of these parameters for assessing soil ecosystem conditions of natural biocenoses. Pine (n = 25) and spruce (n = 15) forests and meadows (n = 72) were investigated. It was shown that the nematode abundance and taxonomic richness exhibited high variations regardless of the type of biocenosis. Nematode fauna in the meadows was more diverse (30 genera against 23-25 in the forests). The proportion of plant parasites in the nematode community structure increased significantly in meadows compared with forests (11.7% vs 0.7-1.5%). In natural coenoses enrichment and channel indices derived from nematode fauna were associated with vegetation type. In meadows nematode communities were characterised by high *EI* and low *CI* values compared with forest biocenoses (*EI*: 43.8 vs 21.5-27.6; *CI*: 29.6 vs 61.9-66.4). However, using discriminant analysis it was found that only the *CI* index enables clear differentiation between nematode communities of meadow and forest habitats (66.07% of cases were correctly classified). According to Ferris *et al.* (2001), ecological indices are the most informative parameters due to integration of both qualitative (eco-trophic groups, *c-p* scale) and quantitative (nematode abundance) characteristics of

nematode communities (Support: State Order 0221-2014-0004, RFBR 15-04-07675-a, Fundamental Research Programme of the Department of Biological Sciences of RAS (2015-2017)). – **Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia; E-mail: matveeva@krc.karelia.ru.**

MIKHAILOV K.G. Arachnid study in Russia/USSR, with special reference to spider faunistics.

A brief historical overview of arachnological research (excluding acarology) in Russia is provided. The three main periods are described as follows: (1) preliminary data accumulation (eighteenth century-1860s); (2) descriptive faunistics (1870s-1967); and (3) descriptive taxonomy (1968-present). A fourth, analytical period, is still underway. Three main arachnological groups, or schools, can be recognised in Russia, based on Perm University, Leningrad (St Petersburg) University, in cooperation with Zoological Institute, Russian Academy of Sciences, and Lomonosov Moscow State University. Calculations of the number of spider species in the post-Soviet republics and different physiographical areas are provided on the basis of the latest, 2013, revision based on comprehensive literature data covering more than 2,600 sources published between 1770 and June 2013; 3,340 spider species belonging to 629 genera and 50 families are recorded from the ex-USSR territory. This project started in 1981 is the history is briefly reviewed. In addition, additional data on pseudoscorpion fauna of the same territories are provided. – **Zoological Museum, Lomonosov Moscow State University, Moscow, 125009, Russia; E-mail mikhailov2000@gmail.com.**

MILOVANKINA A.A. & FADEEVA N.P. Meiobenthic and nematode distribution in Razdolnaya River Estuary (the Sea of Japan, Amurskii Bay).

Estuaries are unique regions in the aquatories under the influence between fresh and marine waters. This study investigates species composition, distribution, and patterns of change in the meiobenthic community in the environmental gradient of Razdolnaya River Estuary in the autumn 2013. Razdolnaya River's estuary meiobenthos is characterised by significant fluctuations in the density and taxonomic composition. Eight taxonomic groups Amphipoda, Bivalvia, Chironomidae, Harpacticoida, Nematoda, Oligochaeta, Polychaeta, Turbellaria were presented. Nematodes were dominant in all stations, and Harpacticoida or Oligochaeta were the second. The density of the total meiofauna community ranged between 6,000 ind. m⁻² and 35,000 ind. m⁻². The density of free-living nematodes ranged from 2,000 ind. m⁻² to 20,500 ind. m⁻². A total of 21 nematode species were recorded at the studied stations, divided into groups: primarily marine species; euryhaline species, which prefer habitats with increased or decreased salinity; and freshwater species (Support: FEFU 14-08-01-21-i, RFBR 14-04-32160-a). – **Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: schugoreva@mail.ru.**

MORDUKHOVICH V.V.¹, FADEEVA N.P.¹, SEMENCHENKO A.A.¹ & ZOGRAF J.K.^{1, 2} Putative new species of *Pseudochromadora* Daday, 1899 (Nematoda, Desmodoridae) from Russkiy Island (the Sea of Japan).

The genus *Pseudochromadora* was established by Daday in 1899 with type species *P. quadripapillata*. The genus numbers ten valid species. The representatives of putative new species *Pseudochromadora* were found in shallow subtidal muddy sediment in Russkiy Island (the Sea of Japan, the vicinities of Vladivostok). This new species of *Pseudochromadora* differs from other species of the genus through the combination of the following characters: the position of cephalic setae; the position of amphids and shape of the fovea amphidialis; six longitudinal rows of somatic setae; the presence of interdigitation of body annuli at the level of lateral alae; no pre-cloacal supplements; gubernaculum structure. The sequences of D2-D3 region of 28S rRNA and 18S rRNA of the new species are provided (Support: FEFU 14-08-01-21-i, RSF 14-50-00034, RFBR 15-29-02736-ofi_m). – ¹**Far Eastern Federal University, Vladivostok, 690600, Russia.** ²**A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia; E-mail: zojulia@yandex.ru.**

MORDUKHOVICH V.V.¹, FADEEVA N.P.¹, YAGODINA V.D.¹ & ZOGRAF J.K.^{1, 2} Description of *Adoncholaimus* sp. and redescription of *Admirandus multicavus* Belogurov et Belogurova, 1979 (Oncholaimidae: Adoncholaimidae) from Peter the Great Bay (the Sea of Japan).

Two species of Adoncholaiminae from the coastal area of Peter the Great Bay are described and illustrated. *Adoncholaimus* Filipjev, 1918 contains 22 valid species, which occur in marine, brackish and freshwater environments. Our specimen of *Adoncholaimus* is similar to *A. daikokuensis* Shimada and Kajihara, 2014 in the absence of a ventral swelling on tail; body length; spicule length; numbers of pairs and position of terminal pores of the Demanian system. Nevertheless, our specimen differs in the presence of a gubernaculum, buccal cavity length and de Man's ratios a and c. *Admirandus multicavus* was described by Belogurov & Belogurova (1979) in Russian in an edition that is not easily accessible. Here we provide redescription of *A. multicavus* expanded by the SEM images (Support: FEFU 14-08-01-21-i, RSF 14-50-00034, RFBR 15-29-02736-ofi_m). – ¹**Far Eastern Federal University, Vladivostok, 690600, Russia.**

²A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia; E-mail: zojulia@yandex.ru.

NGUYEN THI XUAN PHUONG¹, NGUYEN DINH TU¹, NGUYEN VU THANH¹ & VANREUSEL A.² An investigation on biodiversity of free-living marine nematodes from the Tien Yen Estuary, Vietnam.

The free-living marine nematodes of the Tien Yen Estuary were investigated in May 2012 to describe the biodiversity patterns and to understand the differences in diversity of different taxonomic ranks at different spatial scales. Five stations of the Tien Yen Estuary were established (TY1, TY2, TY3, TY4 and TY5) along a 10 km long transect at the mouth of the river. The nematode densities varied between 92 ind. 10 cm⁻² and 2330 ind. 10 cm⁻², illustrating marked variability. In total, 122 nematode species were found in the Tien Yen Estuary belonging to 27 families of six orders, in which Linhomoeidae and Chromadoridae were the most abundant families. *Bathylamus ignavus*, *Terschellingia longicaudata* and *Dichromadora affinis* were the most abundant species. The PERMANOVA analysis indicated significant differences between stations at both genus and species level. Based on Multi-Dimensional Scaling analysis (MDS) analysis, all samples from TY3 were clearly separated from other samples both at genus and species level. The estimate of nematode biodiversity at genus and species level indicated high values based on Shannon-Wiener index, Margalef index and the Hill indices (N1, ninf) but again TY3 was different by showing lowest biodiversity values. The increase in number of genera and species with increasing sampling intensity indicated that the diversity was underestimated and would have been higher if we had considered more replicates per station and more sampling stations. Additive partitioning of species richness revealed that the beta fraction related to the difference between stations was the most important contributor to the total gamma diversity, which revealed the differences in patchiness (Support: NAFOSTED 106.12-2012.31, VLIR-UOS). – ¹Institute of Ecology and Biological Resources, VAST, Ha Noi, Viet Nam; E-mail: ntxphuong.iebr@gmail.com. ²Ghent University, Department of Biology, Ghent, 9000, Belgium.

OSIPOV D.V.¹, IVANOVA E.S.² & SPIRIDONOV S.E.² Panagrolaimid nematodes provoking a lethal infection in Theraphosidae spiders: the taxonomic affiliation.

Massive propagation of nematodes in and around a mouth can lead to the death of large Theraphosidae spiders in zoos and private collections. To identify the causative agent of this pathogenic process, the nematodes were collected from chelicerae of the spiders belonging to the species *Idiothele mira* Gallon, 2010, *Brachypelma smithi* (F.O.P., Cambridge, 1897) and *Grammostola rosea* (Walckenaer, 1837). The partial sequences of SSU rDNA (primers Nem18SF – CGC GAA TRG CTC ATT ACA ACA GC and Nem18SR – GGG CGG TAT CTG ATC GCC) and LSU rDNA (LSU531 – CTT CGC AAT GAT AGG AAG AGC C and LSU537 – GAT CCG TAA CTT CGG GAA AAG GAT) for the nematode were obtained. Phylogenetic analysis was performed with three different methods (maximum likelihood – ML, neighbour joining – NJ, and maximum parsimony – MP). In SSU rDNA analysis, the nematodes from spiders cluster together with sequences obtained for different *Panagrolaimus* species, including *P. rigidus*, and unidentified isolates. The clade combining *Panagrolaimus* species and nematodes of spiders was strongly supported under all methods of analysis. It constitutes a single clade in the analysis of the partial LSU rDNA sequence (D2-D3 segment) but with low support values (< 40%). The nucleotide differences between studied nematodes of the genus *Panagrolaimus* were around 25 bp, whereas nematodes from spiders differed from them by 80 bp average per the 766 bp long alignments. In the 869 bp long SSU rDNA alignment, the differences between *Panagrolaimus* species were 25 bp maximum, and 140 bp minimum between the nematodes from spiders and all other panagrolaimids with known sequences. – ¹Moscow Zoo, Moscow, 123242, Russia; E-mail: spiders2000@rambler.ru. ²Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: s_e_spiridonov@rambler.ru.

PANOVA O.A.¹ & SPIRIDONOV S.E.² Internal transcribed spacer sequences (ITS DNA) of *Toxocara* in identification of species and detection of intraspecific groups.

Accurate identification of different stages of the life cycle of *Toxocara* can be achieved only with effectively working specific primers. Primers, which are able to reveal not only the differences between the species but also intraspecific groups, will be helpful in the studies of toxocarosis in Russia. Pronounced differences in the sequence of D2-D3 expansion segment of large ribosomal subunit (LSU rDNA) and cytochoxidase I gene sequences of mitochondrial DNA (*cox 1* mtDNA) were demonstrated (Panova & Spiridonov, 2014) and some level of intraspecific variability was reported. The internal transcribed spacer region of ribosomal DNA is quite variable in the majority of nematodes and widely used for species discrimination, population and biogeographic studies. Our attempt to sequence directly PCR products obtained for *Toxocara canis* failed as multiple peaks were observed in all chromatograms. At the

same time, the corresponding sequence of *T. cati* was readable. It was presumed that some polymorphic sites in the sequences of *T. canis* were responsible for such a failure. To overcome this problem the cloning of *T. canis* PCR products obtained with pair of primers for ITS rDNA region (18S proposed by Vrain *et al.*, 1991 and AB28 proposed by Curran *et al.*, 1994) was performed. Still, not all the clones produced readable chromatograms. An analysis of chromatograms demonstrated that multiple peaks were observed in the part of sequence 'behind' two fragments: polyA for forward primer and PolyT for reverse primer. Readable sequences demonstrated very low intraspecific variability of ITS rDNA region in *T. canis*. Some substitutions characteristic for separate geographical isolates were also detected. Significant differences with the ITS rDNA sequences of *T. canis* published in NCBI GenBank are also observed (Support: RSF 14-16-00026). – ¹**K.I. Skrjabin All-Russian Institute for Fundamental and Applied Parasitology of Animal and Plants, Moscow, 117292, Russia.** ²**Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: s_e_spiridonov@rambler.ru.**

PEREVERTIN K.A. A critical point models and *hormesis* phenomenon in plant nematology.

The phenomenon of *hormesis* – stimulation of plants at low densities of nematodes - unfortunately has been little studied in nematology. Examples of practical studies (Swanson & McElroy, 1977; Slinger & Bird, 1978) and even deductive theoretical explanations in a log-linear model by Oostenbrink (1966) did not result in accounting for *hormesis* in CPM (critical point models) Y (yield) = $f(P)$ (pre-plant nematode density). However, the classical exponential model by Seinhorst (1965) gives allows for the type of relationship when density (P) is less than T (tolerance limit). For an adequate localisation zone for *hormesis*, we propose preliminary calculation of T_{st} by statistical methods as the invasive load density above which to determine the significant difference of yield losses from 0. Really, the situation for $P < T_{st}$ and $P > T_{st}$ can be seen as different biological processes. Therefore, it is illogical when algorithmisation fitting to CPM includes T , which depends on the behaviour of host-parasite system at high-level densities. The proposed principle of allocating data in the range $[0; T_{st}]$ allows for a fresh review of experimental data processed by us earlier with Sagitov A.O. The phenomenon of *hormesis* is marked for *Meloidogyne* on cucumber and carrots and heteroderids on sugar beet and subsequently discussed (Perevertin, 2009, 2010). A parabolic curve has been recognised as the best model, the maximum extremum was in the range of 0.4-0.8 T (most often was nearly 0.6 T). One of the universal forms of dependence $Y = -0.4P^2 + 0.4P + 1$; $P < T_{st}$ Little attention is paid to *hormesis* earlier due to its lack of demand in the agricultural practices, but doubtless it has theoretical importance. – **Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: perevertink@mail.ru.**

POPOVA E.N.^{1,2} & ROMANENKO N.D.¹ On the study of population dynamics of virus-vector nematodes in natural and agrocenoses of Russia.

Population dynamics of all taxonomic groups of nematodes, including nematode vectors of plant viruses, were studied in meadow, swamp and agrocenoses in the Moscow Region during the growing seasons (May-September) of 2012-2014. Plant viruses and their nematode vectors occurred both in natural and agrocenoses. The dangerous ectoparasitic vector species *Longidorus elongatus* was the most common in the rhizosphere of both wild and cultivated plants in high numbers (on raspberry, strawberry, black and red currants and others). For the first time a large number of *L. elongatus* (240 individuals (1000 g soil)⁻¹) was revealed in the rhizosphere of spirea in natural biocenoses. Two peaks of increased numbers of nematodes of all taxonomic groups and species *L. elongatus* (late-spring – early-summer and late-summer – early-autumn population peaks) were observed. Nematode numbers declined in the dry season in the middle of summer, mainly in July. Identified fluctuations in numbers conform to previous data and depend on climatic and soil conditions and species of host plants. The findings have both scientific and practical significance, can be used in phytoparasitological research and implementation of protective measures to reduce and suppress the size of parasitic nematode complexes, including virus vectors and dangerous viral infections they transfer. – ¹**Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: cenologypathlab@mail.ru.** ²**Institute of Geography, RAS, Moscow, 119071, Russia; E-mail: en_popova@mail.ru.**

ROMANENKO N.D.¹, TABOLIN S.B.¹ & POPOVA E.N.^{1,2} Biological diversity of phytoparasitic nematodes on the territory of European Russia.

Twenty-two regions of the European Russia were observed during last decade (2004-2014). It was found the three plant-parasitic groups of nematodes dominated both in numbers and distributions. These were: 1) ring nematodes (*Mesocriconema rusticum*, *M. xenoplax*, *Criconema annuliferum*), 2) virus- vector nematodes (*Xiphinema diversicaudatum*, *X. brevicolle*, *Longidorus elongatus*, *Trichodorus similis*, *T. primitivus*, *Paratrichodorus teres*, *P. pachydermus*), 3) ectoparasitic plant root nematodes-tylenchids, including spiral nematodes (*Tylenchorhynchus dubius*, *Helicotylenchus canadensis*, *H. digonicus*, *H. pseudorobustus*, *H. vulgaris*, *Rotylenchus fallorobustus*). Root-knot

nematodes, cyst nematodes and lesion nematodes-pratylenchids were the most common among endoparasites. The representatives of genera *Aphelenchoides* and *Ditylenchus* were the most widespread among plant pathogenic foliar (leaf and bud) and stem nematodes. At present the list of plant-parasitic nematodes we found consists of more than 120 species, including more than 110 species of obligate plant root parasites. – ¹Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: cenologypathlab@mail.ru. ²Institute of Geography, RAS, Moscow, 119071, Russia; E-mail: en_popova@mail.ru.

RYSS A.YU.¹, McCLURE M.² & SUBBOTIN S.A.^{3, 4} Phylogeny and systematic of the family Aphelenchoididae.

The results of phylogenetic analyses of 18S rRNA, D2-D3 28S rRNA, ITS rRNA gene sequences of the Aphelenchoididae revealed that some morphologically well defined genera were splitting into several unrelated clades or distinct species groups. Incongruence of morphological and molecular groupings within Aphelenchoididae may be explained by convergent evolution of morphological and biological features. Several new morphological characters used earlier only in species diagnoses and now associated with main phylogenetic clades were also revealed. Ectoparasites and endoparasites with different generation numbers in life histories and host ranges were distributed in closely related clades in phylogenetic trees. *Bursaphelenchus* species groups differed in entomophilic dauer stages and insect vectors taxa. The main morphological evolutionary trends within the Aphelenchoididae were: i) shift of the secretory-excretory pore toward to the lip region in advanced endoparasites; ii) formation of unique glandular and sensilla patterns on tail tips of ectoparasites; iii) development of diagnostic combinations of the head structures: sensilla, lip disc and cephalic disc (Support: ZIN RAS research plan “Diversity of the parasitic systems and adaptations of parasitic worms”). – ¹Zoological Institute, RAS, Saint Petersburg, 199034, Russia; E-mail: nema@zin.ru. ²University of Arizona, Tucson, 85721, AZ, USA. ³Plant Pest Diagnostic Centre, CDFR, Sacramento, 95814, CA, USA. ⁴Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia.

RYSS A.YU.¹ & MOKROUSOV M.V.² The analysis of climatic and biological parameters for the pest spread risk modeling of the wood nematode species *Bursaphelenchus* spp. and *Devibursaphelenchus teratospicularis* (Rhabditida: Aphelenchoidea).

Based on the forest woody species wilt areas survey in Nizhnyi Novgorod Region in August 2014, the possible factors of the pest spread risk modelling were analysed for six species of the genus *Bursaphelenchus* and *Devibursaphelenchus teratospicularis* using six parameters. They included: plant host species, beetle vector species, average temperatures in July and January, and annual precipitation. It was concluded that these parameters in the evaluated wilt spots correspond to climatic and biological data of the already published woody plants wilt records in Europe and Asia caused by the same nematode pest species. It was proposed that the annual precipitation of 600 mm and average July temperature of 25°C or higher are the critical combination that may be used to develop the predicative risk modelling in the forests’ and parks’ wilt monitoring (Support: RSF 14-14-00621). – ¹Zoological Institute, RAS, Saint Petersburg, 199034, Russia; E-mail: nema@zin.ru. ²Lobachevsky State University of Nizhni Novgorod, Nizhny Novgorod, 603062, Russia.

RYSS A.YU.¹ & POLYANINA K.S.² Nematode impact in the Dutch elm disease in NW Russia: entomophilic dauers in *Scolytus* spp. and their adult stages in wood.

Dutch elm disease (DED) with causative agents fungus *Ophiostoma novo-ulmi* and bark beetle vectors *Scolytus scolytus* and *S. multistriatus* devastated the park ornamental *Ulmus* spp. in St Petersburg and suburbs, thus decreasing the attraction of sightseeing places for tourism economy. Our goal was to evaluate the possible role of the nematode impact in DED, because the association of pest agents seems to be similar to the Pine Wood Disease (PWN), the quarantined wilt of conifers which include beetle vectors, *Ophiostoma* spp. and the nematode *Bursaphelenchus xylophilus*. In the result of survey in St Petersburg parks the following nematodes were found in mass quantities: *Bursaphelenchus* n. sp. (in press), *Aphelenchoides* spp., *Laimaphelenchus deconincki*, *Ektaphelenchus* sp., *Cryptaphelenchus* sp., *Ditylenchus* sp., *Nothotylenchus* sp., and *Rhabditolaimus ulmi*. The dauers of *Bursaphelenchus* n. sp., *Aphelenchoides* spp. and *Rhabditolaimus ulmi* were found in adult beetles and larvae of *Scolytus* spp. (Support: RSF 14-14-00621). – ¹Zoological Institute, RAS, Saint Petersburg, 199034, Russia; E-mail: nema@zin.ru. ²Saint Petersburg State Forest Technical University, Saint Petersburg, 194021, Russia.

RYSS A.YU.¹ & POLYANINA K.S.² Xylobiont nematodes parasitizing elm *Ulmus glabra* in parks of St. Petersburg, Russia.

As a result of survey of the dying elm trees *Ulmus glabra* in parks of St Petersburg, several nematode species belonging to the genera *Bursaphelenchus*, *Laimaphelenchus*, *Aphelenchoides*, *Nothotylenchus*, *Neoditylenchus* and *Panagrolaimus*, *Rhabditolaimus* were detected. Nematode list includes plant pathogenic, mycotrophic and bacteriotrophic genera. A new nematode species, *Bursaphelenchus* sp., involved in the association of Dutch elm disease pathogens, is described. As a result of dissection of *Scolytus multistriatus* and *S. scolytus* larvae and adult beetles from the dying elm trees, it was shown that *Scolytus* spp. elm bark beetles vectored both fungus *Ophiostoma novo-ulmi* and a group of nematode species at the transmission juvenile stages (dauer) (Support: RSF 14-14-00621). – ¹Zoological Institute, RAS, Saint Petersburg, 199034, Russia; E-mail: nema@zin.ru. ²Saint Petersburg State Forest Technical University, Saint Petersburg, 194021, Russia.

RYSS A.YU.¹, PRIDANNIKOV M.V.^{2,4} & SUBBOTIN S.A.^{3,4} Characterisation of plant-parasitic nematodes described by V.I. Romaniko from Chelyabinsk Region, Russia.

Three species of plant-parasitic nematodes described in 1960-1968 in Chelyabinsk Region, Russia by V.I. Romaniko were sampled from type localities and studied both morphologically and molecularly. *Pratylenchus globulicola* Romaniko, 1960 was collected from roots of *Ribes nigrum*, *Pisum sativum*, *Medicago sativa*, *Triticum* sp. and *Avena sativa*. The result of phylogenetic analysis of rRNA gene sequences showed that this species belongs to the *P. pseudopratisensis* group, which was also confirmed by morphology of lip region, genital system and tail shape of females. Re-descriptions of *Aphelenchoides emiliae* Romaniko, 1966 belonging to the *A. fragariae* group collected from *Hordeum jubatum* and *Paraphelenchus zae* Romaniko, 1968 found from *Zea mays* and *Calamagrostis* sp. were also provided (Support: ZIN RAS research plan “Diversity of the parasitic systems and adaptations of parasitic worms”, ISTC Project 3721p). – ¹Zoological Institute, RAS, Saint Petersburg, 199034, Russia; E-mail: nema@zin.ru. ²Russian Research Institute of Phytopathology, Bolshie Vyazyomy, 143050, Moscow Region, Russia. ³Plant Pest Diagnostic Centre, CDFR, Sacramento, 95814, CA, USA. ⁴Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia.

SHOSHINA E.A.¹, SHOSHIN A.V.¹ & YUSHIN V.V.^{2,3} Ultrastructure of supplements in free-living nematode *Eutobrilus grandipapillatus* (Brakenhoff, 1914).

Supplements are widely distributed in nematode males as pre-cloacal sense organs whose structure has not been studied and whose functions are not clearly understood. We studied the ultrastructure of the supplements in fresh-water tobrilid nematode *Eutobrilus grandipapillatus* (Triplonchida, Tobrilina). Tobrilid supplements have a characteristic complicated structure that includes an ampoule, a cap with a central spinule and a torus. As with other nematode sense organs, the supplements of *E. grandipapillatus* includes three basic components: dendritic processes, two supportive (sheath and socket) cells, and modified cuticle. The ampoule of each supplement is of cuticular nature and may be interpreted as a hypertrophied endocuticle. The bulbulus contains processes of sheath and socket cells and dendrites. The movement of the outer parts of the supplement occurs *via* contraction of underlying modified muscle cells. There is special cuticular transformation in the supplementary apparatus called ventral folding, which is a thickened exocuticle. The supplement structure has features of both mechanoreceptor and chemoreceptor, and probably it has a dual function (Support: RSF 14-50-00034, RFBR 14-04-00334_a, 15-34-50635). – ¹Zoological Institute, RAS, Saint Petersburg, 199034, Russia; E-mail: midsummer92@mail.ru. ²A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia. ³Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: vvyushin@yandex.ru.

SLIVKO-KOLTCHIK G.A., KUZNETSOV V.P. & PANCHIN YU.V. Electrical oscillation potentials in intestine cells of nematode *Heterorabditis megidis*.

Central pattern generators (CPGs) are cellular networks or single cells that produce rhythmic patterned outputs in isolation from sensory feedback. Cellular and molecular mechanisms of circadian (about 24 h) and fast (with period of seconds) rhythms are well studied, while less attention has been paid to ultradian rhythms with shorter periods (minutes to hours). Calcium wave CPG in the nematode gut is a successful biological model for ultradian rhythms studies. Here we show that intestine CPG cycling could be perturbed by shifting gut cells membrane potential, suggesting participation of plasma membrane voltage gated channels. At the same time we demonstrate, that CPG cycling persist in experiments where membrane potential was continuously clamped at steady voltage levels, which excludes the involvement of plasma membrane voltage gated mechanisms by definition. We suggest that two distinct pacemakers, one based on plasma membrane channels and another based on intrinsic calcium release mechanisms coordinate

intestinal CPG cycling (Support: RFBR 15-04-06148). – **Institute for Information Transmission Problems, RAS, Moscow, 127051, Russia; E-mail: s.koltchik@gmail.com, empire.pat@gmail.com, ypanchin@yahoo.com.**

SMOL N. International impact of the Belgian Nematology Course.

The International Master Course in Nematology at Ghent University, Belgium started in 1992 and is still continuing. Over these years the course programme has been regularly reviewed and improved based on interaction between the staff and the students and on new scientific developments. More than 20 years' experience in coordinating the International Master Course in Nematology at Ghent University provides the basis for an overview illustrated by personal stories from the lecturers, who have educated about 300 young nematologists, as well as from those who obtained the title of Master in Nematology and spread out all over the world. What was the impetus that decided young people from all over the world to come to Ghent? After completing the course, where did they go and what were their career developments? How many became internationally renowned as nematologists or in which other field? What is their scientific impact based upon publications? In which topics did they become experts? What possible factors inhibited the future career of some of them? Finally how well known is this course and is there still a need for it? Is the course financially sustainable? – **Ghent University, Department of Biology, Ghent, 9000, Belgium; E-mail: Nic.Smol@UGent.be.**

SPIRIDONOV S.E.¹ & ODOYEVSKAYA I.M.² In search of molecular markers to study intraspecific nucleotide variability in *Trichinella*.

Mitochondrial sequences of *Cox b* mtDNA gene proved to be effective for species identification of *Trichinella* species (Rosenthal *et al.*, 2008). The microsatellite analysis is used to infer the relationships between intraspecific groups of trichinellids (Dunams-Morel *et al.*, 2012). In attempt to find cheaper and technologically easier alternative to the microsatellite analysis the sequences of *Cox 1* mtDNA and ITS2 rDNA were studied. Modified primers 37F and 42R of Hu *et al.* (2002) were used as a basis for primer design. The sequences of these primers were changed in accordance with characteristic substitutions of trichinellid *Cox 1* mtDNA the primers 37F_Tri (GCA GTA AAT TTA GAA TTT AAA C) and 42R_Tri (CCT AAT ATT CAT GGT GTT CAT A) were proposed. Approximately 1200 bp-long amplicon was obtained with these primers for eight *Trichinella* strains. Characteristic differences in two positions were found between the *Trichinella spiralis* strains from Central Europe and Eastern part of the Russian Federation. Several pairs of primers were designed for amplification of ITS2 rDNA, but finally the pair Tri58s_F_5, complementary to the 5.8S rDNA (CGG TGG ATC RCT TGG CTC GTA CG), and reverse primer AB28_R, complementary to the 5'-end of 28S rDNA (CGA CCG CTT ATT GAT ATG C) were used to amplify 900 bp amplicon. The comparison of sequences obtained for six Russian *Trichinella* isolates with NCBI GenBank data demonstrated clear differences between Russian isolates of *T. nativa* and genotype T6 of *Trichinella* from Nearctic. In general, intraspecific differences between distant species (*e.g.*, between *T. spiralis* – *T. nativa*) were on the level of 35-40 bp (> 12%), and between closely related species (*e.g.*, *Trichinella murrelli* – *T. nativa*) – on the level of > 14 bp (> 4.7%) (Support: RFBR 14-04-01064-a). – ¹**Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: s_e_spiridonov@rambler.ru.** ²**K.I. Skrjabin All-Russian Institute for Fundamental and Applied Parasitology of Animal and Plants, Moscow, 117292, Russia.**

SUMAYA N.H.N.^{1,2}, MOLINA C.¹, STRAUCH O.¹ & EHLERS R.-U.¹ Genetic improvements of longevity of the entomopathogenic nematode, *Heterorhabditis bacteriophora*.

The commercial use of the entomopathogenic nematode (EPN) *Heterorhabditis bacteriophora* as a biocontrol agent is limited due to its relatively short shelf-life. Longevity of infective juveniles (IJ) during storage and in-transit to end users is drastically limiting due to the short life span of the IJ. IJ longevity is influenced by factors like temperature, desiccation and other environmental stresses. Recent studies have demonstrated the potential of genetic selection to improve heat- and desiccation tolerance in *H. bacteriophora* (Mukuka *et al.*, 2010a, b, c; Anbesse *et al.*, 2013a, b). Genetic improvement programmes for *H. bacteriophora* are ongoing and currently we unravel the role of oxidative stress in the life-span of EPN using the EN01 commercial line. We determined that the variation in reactive oxygen concentrations directly influence IJ longevity measured as time lapse until 50% (LT₅₀) and 90% (LT₉₀) of IJ populations have died. For selection, best-surviving 10% within IJ populations under oxidative stress were propagated for consecutive selection cycles. An increase in survival of 6 days for both LT₅₀ and LT₉₀ among selected populations was already observed after two selection cycles. Furthermore, selected nematodes from oxidative-stress assays showed a higher tolerance to desiccation (water potential or A_w value of 0.88) than the non-selected nematodes (A_w = 0.9). (Support: BIOCOTES Project, Deutscher Akademischer Austauschdienst). – ¹**E-nema GmbH, Schwentental,**

24223, Germany; E-mail: nanettehope.sumaya@gmail.com. ²Faculty of Agricultural and Nutritional Science, Christian-Albrechts-University of Kiel, Kiel, 24118, Germany.

SUSHCHUK A.A. & MATVEEVA E.M. Salt march nematode communities of the White Sea coast under the high variability of habitats.

The influence of high variable marsh habitats on soil nematode communities were investigated in the Nyukhcha river estuary on the Pomorian coast of the White Sea (Republic of Karelia, 63°59'08" N, 36°19'12" E). It was shown that flooding regime determined taxonomic composition and diversity, population densities and eco-trophic structure of nematode communities. The fauna richness and the total number of nematodes were increased with decreasing of flooding frequency and duration: 12 genera and very low population density (58 ind. (100 g soil)⁻¹) occurred in permanently submerged ecotope; 24-33 nematode taxa and higher abundance (from 200-500 up to 1100 individuals) were revealed in periodically or rarely flooded coastal meadows. The highest nematode density was found in the unflooded area. Analysis of nematode fauna indicated that flooding is a key factor in the formation of nematode communities only in the permanently submerged site due to a limited resource pool, shortening of soil food chains and simplification of soil food webs: under complete dominance of bacteriotrophs some eco-trophic groups were absent in the communities. For example, it was found that markedly unstable environmental conditions of coastal ecosystems were unfavourable for stylet-bearing nematodes, which are obligatory or facultatively connected with plants. They were found to increase in numbers only in rarely or unflooded biotopes. Here a vegetation type became one of the main ecological factors affecting nematode fauna (Support: State Order 0221-2014-0004, RFBR 14-34-50929, 15-04-07675-a). – **Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia; E-mail: anna_sushchuk@mail.ru.**

TABOLIN S.B. Nematodes of the orders Mononchida and Dorylaimida in the Central Nonchernozem zone of Russia.

During the years 2011-2014, soil samples were collected from various regions in the Central Nonchernozem zone of Russia. The most widespread mononchid nematodes in the collected soil samples were *Clarkus papillatus*, *Coomansus parvus*, *Mylonchulus brachyuris*, *M. sigmaturus*, *M. sexcristatus*, *Prionchulus punctatus*, *Tigronchoides ginglymodontus* and *Anatonchus tridentatus*. *Prionchulus vescus* and *Mylonchulus parabrachyuris* were recorded for the first time in the European part of Russia. The most widespread Dorylaimid nematodes in the collected soil samples were Aporcelaimidae (*Aporcelaimellus obtusicaudatus*, *A. krygeri*), Dorylaimidae (*Mesodorylaimus bastiani*, *Mesodorylaimus centrocerus*), Qudsianematidae (*Ecumenicus monohystera*, *E. carteri*, *Discolaimus major*, *Microdorylaimus miser*, *M. parvus*), Nordiidae (*Enchodelus macrodorus*, *Pungentus maorium*), Paraxonchiidae (*Paraxonchium laetificans*), and Tylencholaimidae (*Tylencholaimus mirabilis*). *Longidorus elongatus* was the most widespread plant-parasitic nematode of the group. *Aporcelaimellus medius* was recorded for the first time in Russia. A comprehensive list of nematodes of the orders Dorylaimida and Mononchida recorded from the Central Nonchernozem zone of Russia was compiled for the first time. – **Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: stabolin@mail.ru.**

TREBUKHOVA YU.A.¹, PAVLYUK O.N.¹ & ZOGRAF J.K.^{1, 2} The community of free-living marine nematodes in the area of South Kirinsky gas and condensate field (continental slope of the Sakhalin Island, the Sea of Okhotsk).

For studying the environmental situation in the area of South Kirinsky gas and condensate field (where the construction of engineering structures is planned) marine biota (phytoplankton, zooplankton, ichthyoplankton, microphytobentos, meiobenthos, macrobenthos) is being monitored. Meiobenthos samples collected in October and November 2014 from 25 stations were used for this research. Water depths ranged between 24 to 91 m. The sediment samples were represented by silted sands. Nematodes were the dominant group of meiofauna made up from 38.47 to 93.34% of the total meiobenthos density (112.7-1323.9 ind. 10 cm⁻²). A total of 104 species belonging to 24 families and 40 genera were identified, dominated by the representatives of *Daptonema*, *Dichromadora*, *Sabatieria*, *Enoplolaimus*, *Enoploides* and *Richtersia* genera. Non-selective deposit-feeders (1B) dominated among nematodes with different feeding types, namely representatives of the family Xyalidae. Species composition of nematodes in this area differs significantly from the one at the similar type of bottom sediments in the Sea of Japan (Support: RFBR 14-04-00334-a, RSF 14-50-00034). – ¹**A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia. ²Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: zojulia@yandex.ru.**

TSKITISHVILI E.T.¹, JGENTI L.O.², ELIAVA I.J.¹, TSKITISHVILI T.D.¹, BAGATHURIA N.L.¹ & GIGOLASHVILI M.G.¹ Soil Invertebrates in Ajara Protected Areas (Western Georgia).

This paper is based on the results of faunistic investigations of soil nematodes, earthworms and oribatid mites collected in Ajara protected areas (Mount Mtirala, gorges of the rivers Ajaristskali and Kintrishi). During the research process in the studied ecosystems 138 forms of nematodes were registered, from which 108 forms were determined to species level and 30 to genus level. The recorded nematodes belong to two subclasses, eight orders and 28 families. By quantity and diversity the order Dorylamida occupies the first place. The other orders are characterised by nearly similar quantitative indices. *Dorylamida* – 92 forms; *Enoplida* – 13 forms; *Mononchida* – 10 forms; *Areolaimida* – 8 forms; *Tylenchida* – 6 forms; *Rhabditida* – 5 forms; *Aphelenchida* – 3 forms; *Monhysterida* – 1 form. All ecological groups have been revealed in our material with different percent indices: 1) omnivores and nematodes of undetermined trophic specialisation (47 forms) 33%; 2) microphages and saprophages (35 forms) 25.4%; 3) predators (24 forms) 18%; 4) algophages (17 forms) 12.4%; 5) plant-parasitic nematodes (12 forms) 9.1%; and 6) microphages (3 forms) 2.1%. A total of 30 species of earthworms were recorded in vegetation belts in the Ajara region; 21 species have been detected in the mixed deciduous forest and 20 species in broad-leaved forest belt. Eight species of earthworms were found in dark-coniferous forest. The subalpine belt is represented by eight species and the alpine belt by four species. Thirteen species occur in a single zone only, *i.e.*, they are monozonal species, eight species were found in two zones (bizonal species), five species occur in three zones (trizonal species), and four species occur in all zones (everyzonal species). As a result of our investigations 116 species of oribatid mites have been recorded. Two of them are new species for science and five of them were recorded for the first time in Kintrishi reserve territory. This was the first attempt to study soil invertebrates in Adjara for many years and the obtained data are important. Our investigations are continuing. – ¹Institute of Zoology, Iliia State University, 0162, Tbilisi, Georgia; E-mail: eka.tskitishvili@iliauni.edu.ge. ²Batumi Shota Rustaveli State University, Batumi, 6010, Georgia.

UDALOVA ZH.V.¹, LAVROVA V.V.², MATVEEVA E.M.² & ZINOVIEVA S.V.¹ Induced systemic resistance in plants against sedentary parasitic nematodes.

Sedentary plant endoparasitic nematodes can cause detrimental yield losses in crop plants making the study of detailed cellular, molecular, and whole plant responses to them a subject of importance. In present investigation the mechanisms of induced plant resistance to sedentary nematodes were studied. Biogenic elicitors, chitosan, arachidonic acid (AA), salicylic acid (SA), jasmonic acid (JA) for the modulation of immune plant responses, were used. The effects of biogenic elicitors were investigated on the systems: potatoes – *Globodera rostochiensis* and tomato – *Meloidogyne incognita*. Treatment of plants with biogenic elicitors induced significant changes in morpho-physiological and population parameters of the parasite, indicating deterioration in living conditions (reduced fertility, changes in age-sex structure of the population). There were also changes in the protective reactions of plants (content of phytoalexins, PR-proteins and stimulated the formation of reactive oxygen forms). Investigations were also carried out to examine changes in the expression of the genes (*H1* and *Gro1-4*) in two cultivars of potato resistant and susceptible to *G. rostochiensis* after short-term exposure to low temperature (abiogenic elicitors). Low-temperature exposure of susceptible plants induced activation of gene expression of both *H1* and *Gro1-4* in roots and *H1* gene in leaves. The transcriptional activity, both in genetic and induced resistance, of R-genes not only in roots but also in leaves, the latter being tissues remote from the site of direct lesion nematodes, indicates the development of systemic defense response of plants in response to infection. (Support: RFBR 15-04-04625-a). – ¹Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: udalova.zh@rambler.ru. ²Institute of Biology, Karelian Research Centre, RAS, Petrozavodsk, 185910, Russia; E-mail: matveeva@rc.karelia.ru.

UDALOVA ZH.V. & ZINOVIEVA S.V. Steroid compounds and their participation in relationship of plants and parasitic nematodes.

Literature data on steroid metabolism of plant-parasitic nematodes and our own research on the feasibility of regulating the number of pathogenic nematodes using plant steroids are presented. Steroidal compounds are essential components of cell membranes, play a significant role in the regulatory process and are signalling molecules. It has been shown that it is possible to influence the steroids metabolism of nematodes or the mevalonate pathway in plants, enhancing their immune properties. Analysis of a number of steroid compounds, glycoalkaloids, saponins and ecdysones extracted from plants of the Solanaceae, Labiatae and Dioscoreaceae, showed that all the tested compounds can affect the development of the nematode to varying degrees. In the system tomato *Solanum esculentum* Mill.-root-knot nematode *Meloidogyne incognita* (Kofoid & White) Chitwood the highest activity of steroidal glycoalkaloids were α -tomatin and α -chaconine, of saponins-tomatozide. In the example of α -tomatin treated tomato plants analysed the activity of protease inhibitors, which are agents disrupting nematodes. Processing plants with α -tomatin increases the

activity of trypsin inhibitors in the tomato tissues, an index characterising the degree of resistance to nematodes. (Support: RFBR 15-04-04625-a). – **Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: udalova.zh@rambler.ru.**

YUSHIN V.V.^{1,2} An overview on male gametes of Ecdysozoa.

The metazoan clade Ecdysozoa indicates a close relationship between the moulting phyla: Arthropoda (including Pycnogonida, Euchelicerata, Myriapoda, Crustacea, and Hexapoda), Tardigrada, Onychophora, Nematoda, Nematomorpha, Kinorhyncha, Loricifera and Priapula. These taxa demonstrate all styles of reproduction but the trend to an internal insemination is clear. A spermatozoon with a rounded head, which includes an acrosome and a nucleus with the nuclear envelope, the middle part with the mitochondria, a proximal centriole and a basal body, and a flagellum is traditionally considered as *primitive* (plesiomorphic) and is found in ecdysozoans that retained the external fertilization (Priapula, Xiphosura, Myriapoda). *Modified spermatozoa* are flagellate but extremely elongated sperm cells that appear together with the development of copulation and internal fertilisation, when male gametes function under specific conditions within the genital tubes of females. Modified spermatozoa of convergent superficial similarity are widespread in ecdysozoan phyla: Pycnogonida, Crustacea, Hexapoda, Tardigrada, Onychophora, Loricifera and Priapula. In animals with internal fertilisation, modification of spermatozoa can proceed so far that it is difficult or wholly impossible to recognise the primitive prototype in the mature gametes. Drastically modified (aflagellate) spermatozoa are defined as *aberrant*. Analysis of the development and structure of aberrant sperm of ecdysozoans show shared features: (1) the absence of a flagellum and an axoneme; (2) an amoeboid shape and amoeboid motility due to cytoskeleton components; (3) the poor condensation of nuclear chromatin; (4) the absence of a nuclear envelope; (5) multiple unmodified mitochondria; (6) the absence of an acrosome; (7) unique membranous components; (8) the large size of spermatozoa due to prominent cytoplasm filled with a great number of components. These features may be demonstrated in a variety of examples in most ecdysozoan phyla: Euchelicerata, Myriapoda, Crustacea, Hexapoda, Nematoda, Nematomorpha, Kinorhyncha. One of the most striking examples of aberrant male gametes is the amoeboid sperm of nematodes. Nematode spermatozoa can reach a large size that is unusual for male gametes; many of them move using pseudopodia. The cytoplasm of nematode spermatozoa includes unique cellular organelles and a special motor protein has been detected, which is characteristic only in the nematode sperm but never found in other cells of Metazoa. The aberrant spermatozoa have many distinct morphological features that are used for phylogenetic analysis in chelicerates, decapod crustaceans and insects. (Support: RFBR 14-04-00334-a, RSF 14-50-00034). – ¹**A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia.** ²**Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: vvyushin@yandex.ru.**

ZOGRAF J.K.^{1,2} & GUZEEVA E.A.³ Ultrastructure of spermatozoa of hair-worm *Gordionus alpestris* (Villot, 1885) (Parachordodidae, Chordodoidea).

Ultrastructural studies of the spermatozoa of species of the Nematomorpha have been done only for three species (*Gordius aquaticus*, *G. panighetensis* and *Pseudochordodes bedriagae*) belonging to the superfamily Gordioidea. It was shown that all spermatozoa described are similar and present in all other Gordiida. An examination of *Gordionus alpestris* (Villot, 1885) belonging to another nematomorph superfamily Chordodoidea (family Parachordodidae) has allowed us to add new information on ultrastructure of Gordiida. Spermatozoa of *G. alpestris* were studied using scanning and transmission electron microscopy. Spermatozoon consists of a broader anterior part and a slender posterior region. The anterior part contains an acrosomal complex composed of an acrosomal tube surrounded by an acrosomal sheath. The acrosomal tube expands at its ends. Anterior expansion forms an acrosomal vesicle, while the posterior one adjoins to a rod-shaped nucleus devoid of a nuclear envelope. The nucleus is surrounded by an electron-transparent halo and a multivesicular complex formed by three layers of vesicles with different electron density arranged asymmetrically. No mitochondria are present. In general, spermatozoa of *G. alpestris* are similar to that described for other gordiids. Based on our own and literature data, we may conclude that, typical for hair worms, spermatozoa may be described as the aberrant type of spermatozoa devoid of flagellum, mitochondria and nuclear envelope. Typically, it is a bipolar cell with elongated anterior acrosome and rod-shaped posterior nucleus surrounded by the multivesicular complex. So far, such type of spermatozoa has been found in both superfamilies of the order Gordiida and could be considered as an autapomorphy for this order (Support: RFBR 14-04-00334-a, RSF 14-50-00034). – ¹**A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia.** ²**Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: zojulia@yandex.ru.** ³**Centre of Parasitology, A.N. Severtsov Institute of Ecology and Evolution, RAS, Moscow, 119071, Russia; E-mail: guzeyeva@mail.ru.**

ZOGRAF J.K.^{1, 2}, TREBUKHOVA YU.A.¹ & PAVLYUK O.N.¹ Putative new species of the genus *Phanodermopsis* (Enoplida, Phanodermatidae) from the Far Eastern seas.

The deep-sea nematofauna remains very poorly studied at both global and regional scales. Information on the deep-sea free-living nematodes of the Northwestern Pacific remains extremely limited. As part of studies to improve our knowledge of deep-sea nematodes, benthic studies were carried out in the Sea of Japan. The putative representative of the genus *Phanodermopsis* was discovered in the samples. The new species is characterised by the relatively short body, weak developed cephalic capsule and short pipe-shaped spicules. The described species is closest to *Phanodermopsis attenuatum* Wieser, 1953 and *Phanodermopsis ingrami* Mawson, 1958 in de Man's indexes. However, the described species is two times shorter. Unfortunately, most of the descriptions of *Phanodermopsis* species have been done on the females or juveniles. This fact makes it difficult to compare our species with those described earlier. That is why the revision of this genus is necessary. In present work we revise the genus *Phanodermopsis* and propose three valid species to the date (Support: FEFU 14-08-01-21-i, RSF 14-50-00034, RFBR 15-29-02736-ofi_m). – ¹A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia. ²Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: zojulia@yandex.ru.

ZOGRAF J.K.^{1,2} & YAKOVLEV K.V.¹ Ultrastructural study of MSP localisation in free-living nematodes.

The nematode spermatozoa are considered to represent an aberrant type of male gametes. In general, the nematode spermatozoon is an amoeboid cell subdivided into an anterior pseudopodium and posterior main cell body. As was shown, major sperm protein (MSP) is able to form filaments in the cytoplasm of spermatozoa and plays role on the cellular locomotion. During spermatogenesis MSP is accumulated in the gametes in the form of the fibrous bodies (FB). In the course of sperm activation in the female reproductive system fibrous bodies dissociate and form pseudopodium cytoskeleton. However there are groups of nematodes with late appearance of FB or their early dissociation during spermiogenesis. In the present work we have shown that the absence of fibrous bodies in spermatocytes and early spermatids of *Enoplus brevis* (Enoplida, Enoplidae) indicates the absence of MSP at these stages of spermatogenesis. By contrast, unusual early dissociation of FB during spermiogenesis of *Panagrellus redivivus* (Rhabditida, Panagrolaimidae) results in dissociation of MSP in the sperm cytoplasm. Such a difference in MSP appearance could be explained by the differences in life cycles and reproductive strategy of these nematodes (Support: RFBR 14-04-00334-a, RSF 14-50-00034). – ¹A.V. Zhirmunsky Institute of Marine Biology, FEB RAS, Vladivostok, 690041, Russia. ²Far Eastern Federal University, Vladivostok, 690600, Russia; E-mail: zojulia@yandex.ru.