ABSTRACTS OF THE XXVI ANNUAL MEETING OF ONTA, 04-08 OCTOBER 2004, PUERTO VALLARTA, JALISCO, MEXICO

SYMPOSIA

METHYL BROMIDE PHASE OUT: AN UPDATE REVIEW [ACTUALIZACION SOBRE EL REMPLAZO DEL BROMURO DE METILO]. **H. J. Banks, Methyl Bromide Technical Options Committee, c/o 10 Beltana Rd. Pialligo, ACT 2609, Australia.—**Methyl bromide, a soil fumigant and nematicide, was listed in the Montreal Protocol on Substances that Deplete the Ozone Layer in 1992. A schedule of reduction steps leading to phase-out of use of methyl bromide as a fumigant was agreed in 1997. Developed countries are to undertake a stepwise reduction in use, with specific exemptions, by 1 January 2005. Developing countries are to reduce consumption to 80% of their baseline by 1 January 2005, with full phase-out by 2015, again with specific exemptions. The exemptions are for feedstock, quarantine and pre-shipment, and "critical" uses. Critical uses are, at present, agreed annually and, for 2005 include several specific uses that involve nematode control. Total methyl bromide use globally has been reduced from about 70,000 tons in the mid-90s, to about 40,000 tons in 2003. Loss of methyl bromide is yet another example in a trend of loss of fumigant nematicides for environmental and toxicological reasons.

BROMURO DE METILO Y USOS CRÍTICOS EN LA UNIÓN EUROPEA [METHYL BROMIDE AND CRITICAL USES IN THE EUROPEAN UNION]. **A. Bello, A. García-Álvarez, M. A. Díez-Rojo, R. Sanz y L. Cuadra, Centro de Ciencias Medioambientales, CSIC, Serrano 115 dpdo, Madrid 28006, Spain.—**Se han concedido a los países de la Unión Europea (UE) 3984 t (25.5 %) de bromuro de metilo (BM) como fumigante de suelos para usos críticos durante el año 2005, que junto a las 9866 t para los EE.UU. (63.3%) representan el 88.8% del BM concedido a los países del Art. 2. Se distribuye la cantidad de BM concedida a la UE por países del modo siguiente: Italia 2047 t, España 1059 t, Francia 450 t, Grecia 219 t, Reino Unido 74 t, Portugal 50 t, Bélgica 45 t y Polonia 40 t, siendo Italia el segundo país en consumo después de EE.UU. Por cultivos corresponden a producción y viveros de fresa 1516 t, tomate 1095 t, pimientos y berenjenas 586 t, flor cortada 471 t, cucurbitáceas 233 t y otros cultivos 81 t. Se señala que Bélgica, Francia, Grecia e Italia solicitan usos críticos para la mayoría de los cultivos, España para fresa, pimiento y flor cortada, Reino Unido y Polonia para fresa y viveros, mientras que Portugal sólo para flor cortada. Se destaca que la UE e Israel son los principales consumidores de BM en flor cortada, mientras que los EE.UU. no utilizan BM para este cultivo. En España se están usando dosis y formulaciones muy bajas de BM, así como aplicaciones en banda y bajo plástico VIF, y en el caso de flor cortada con una frecuencia de dos o tres años. Se han registrado varias alternativas químicas y ensayado en producción de fresas de modo experimental en campo la formulación BM/PIC =33:67. Se ha observado que el cultivo sin suelo puede presentar los mismos problemas fitopatológicos que los cultivos sobre suelo, el uso de variedades resistentes está dando lugar a la selección de poblaciones virulentas, mientras que la solarización, el vapor de agua y las alternativas químicas pueden afectar a los acuerdos internacionales sobre salud y medio ambiente. Se propone el diseño de sistemas de producción integrada que tengan en cuenta el uso de recursos locales.

LINKING NEMATODE DIVERSITY WITH POLLUTION INDUCED STRESS [VINCULANDO LA DIVERSIDAD DE NEMATODOS CON EL ESTRES CAUSADO POR LA CONTAMINACION AMBIENTAL]. **Tom Bongers[1] and Peter Doelman[2], [1]Laboratory of Nematology, Wageningen University, PB 8123, 6700 ES Wageningen, The Netherlands, <tom.bongers@wur.nl> and [2]Doelman Advise, August Faliseweg 10, 6703 AS Wageningen, the Netherlands, p.doelman@chello.nl.—**In industrialized countries soil contamination is rather a rule than an exception. Recent estimations in the Netherlands, calculate that 60 000 sites are still seriously contaminated, with potential risk for human health. The actual risk is subject of debates with consequences for remediation. Remediation of these sites, foreseen in 2030 may cost 22 billion dollars. There also may be ecological risk. How to estimate that ecological risk is a key issue the last decade in the Netherlands. Hitherto, priorities for remediation are based on concentrations (intervention values), adapted for bio-availability, of a restricted set of individual compounds (heavy metals, Persistent Organic Pesticides [POPs], Poly Aromatic Hydrocarbons

[PAH] and others). But what is "bio-availability" in various soils? There is a growing realization that the present method of setting priorities is far from satisfactory as interactions between pollutants are not taken into consideration and sites may be polluted by compounds or reaction products that we do not expect, that we cannot analyze quantitatively or are unknown at all; on the other side "natural attenuation" aspects may play a role. The TRIAD approach, an instrument for integrated ecotoxicological judgement of soil pollutants integrates the physical/chemical approach with toxicological and ecological information. Nematodes offer promising possibilities to monitor the recovery of remediated sites and, as discussed on a recent workshop at the National Institute for Public Health and the Environment (RIVM), to serve as an ecological indicator. In the present contribution we will focus on the development and use of ecological parameters as the Maturity Index, based on the nematode community structure, and applications in environmental studies. This, together with the functional diversity of nematodes in their food-choice behavior, provides a fundamental base for ecological risk assessment.

THE COSTA RICAN METHYL BROMIDE ALTERNATIVES AND PHASE OUT PROGRAM [EL PROGRAMA COSTARRICENSE DE ALTERNATIVAS Y ELIMINACION ACELERADA DEL BROMURO DE METILO]. **F. Chaverri, Universidad Nacional, Instituto Regional de Estudios en Sustancias Tóxicas, Heredia APDO 86-3000, Costa Rica.—**In Costa Rica, since 1999 a program has been established for identification of Methyl Bromide (MB) alternatives and accelerated MB phase-out. Alternatives are being testing on melons, cut flowers, seedbeds and nurseries, which represent the entire MB consumption within the country except for quarantine and pre-shipment applications. The main soil pests of these crops are nematodes (*Meloidogyne* spp., *Pratylenchus* spp., *Helicotylenchus* spp., *Tylenchus* spp. and others), weeds (*Cyperus* spp., *Cleome viscosa, Echinocloa colona* and others), soilborne fungi (*Fusarium* spp., *Rhizoctonia* spp., *Pythium* spp. and others), soil-borne insects and bacteria. The chemical alternatives being evaluated are 1,3-dichloropropene, dazomet, and metham sodium, while the non chemical alternatives under evaluation include solarization, cover crops, steam and biological control. In year 2004, MB consumption was reduced 47% and there is an expected a phase-out in the year 2008, which is 7 years earlier than required by the Montreal Protocol for developing countries. At the present time, the alternatives evaluated show efficacy when they are applied in combination and as part of an integrated pest management program. The Costa Rican growers are experiencing intense competition from other growers in Central America, so their main concern is how to maintain international markets if their competitors avoid MB phase-out acceleration, allowing them to offer a cheaper product. At the moment, environmental certifications seem to be the answer to this dilemma.

DIVERSIDAD DE NEMATODOS EN LA REGIÓN NEOTROPICAL [NEMATODE DIVERSITY IN NEOTROPICAL AREAS]. **A. Esquivel, Laboratorio de Nematología, Escuela de Ciencias Agrarias, Universidad Nacional. Ap. 86-3000, Heredia, Costa Rica, aesquive@una.ac.cr.—**El neotrópico es una de las seis regiones biogeográficas del mundo. Se extiende desde México hasta Sur América, excluyendo la patagonia y parte de Chile andino. A diferencia de otros grupos taxonómicos, la diversidad nematológica ha sido poco estudiada en la región neotropical. Una revisión reciente de literatura por Boag and Yeates (1998), sobre diversidad de nematodos en ecosistemas terrestres, confirma que de 134 sitios analizados sólo 10 corresponden a zonas tropicales y ninguno al neotrópico. Contrariamente a lo esperado, existe la tesis que los nematodos contribuyen relativamente poco a la fauna invertebrada en suelos tropicales, siendo más abundantes y diversos en ecosistemas templados. Los aportes al conocimiento de la nematofauna por taxónomos como Andrássy, Loof, Lordello, Zullini y Siddiqi en varios países del continente americano, sugieren que los bosques neotropicales son tan abundantes y diversos como otros ecosistemas del planeta. Se presenta y discuten los resultados del inventario de la nematofauna en áreas protegidas de Costa Rica, llevado a cabo por el Instituto Nacional de Biodiversidad y la Universidad Nacional. Los resultados son promisorios, quedando aún mucho trabajo taxonómico pendiente. La colección esta resguardada en la Universidad Nacional y la información referente al inventario esta disponible en la página web del INBio, <www.atta.inbio.ac.cr>.

IMPACT OF NON-CHEMICAL ALTERNATIVES TO METHYL BROMIDE ON SUSTAINABLE AGRICULTURAL PRODUCTION [INFLUENCIA DE LA ALTERNATIVAS NO QUIMICAS PARA EL BROMURO DE METILO EN LA AGRICULTURA SUSTENTABLE]. **Saad L. Hafez and P. Sundararaj, University of Idaho, Parma Research and Extension Center, 29603 U of I Ln, Parma, ID 83660, U.S.A.**—Many non-chemical alternatives to methyl bromide [MB] are as cost effective as chemical replacements to methyl bromide. They do not threaten public health and help promote a more sustainable agricultural system. Common non-chemical alternatives to methyl bromide include: solarization, disease suppressive compost [DSC], steam, hot water, hydroponic soil-less substrates, biofumigation, resistant varieties, and crop rotation. Solarization can be a viable alternative to methyl bromide for shallow-rooted, short-season crops against a broad spectrum of soil diseases, fungi, weeds, nematodes, insect pests and most soil borne bacteria. The practice is effective on a wide range of pests and plant pathogens with little labor cost but is climate-dependent and in some cases requires field to be fallow for entire summer. DSC can be applied to fields to suppress disease and enriches soil. It is mainly used in nursery and greenhouse crops. Compost is inexpensive and readily available; it reduces need for fertilizers and peat; it does not normally pose risks to human health during use or handling. However most greenhouse operations do not have the facilities necessary to fully adopt this technology and large-scale field operations may not give consistent results. Quality control is critical in production of effective DSC. For steaming soils, soil temperatures of at least 70°C must be achieved for 30 minutes. Steaming is effective for ornamental bedding plants, potted foliage and flowering houseplants, fresh-cut flowers and greens. Steam is highly efficient and cost-effective, leaves no toxic residue, requires little aeration time, and can disinfest non-soil substances. However, this technique entails: high capital and maintenance cost for boilers; high capital and short life of tarps; problems of application where soils are exposed to rain immediately prior to or during a scheduled treatment; fuel and labor costs. In the hot water treatment top 12 inches of soil (30 cm) is injected with superheated (104°C) water to kill pests and pathogens. It is currently being tested in Florida on tomatoes. U.S. EPA recognizes that potential for use is broad. In this method fields are typically watered prior to planting, so no additional water requirements; no risks to human health. However this method is slow and it is difficult to achieve uniform temperature elevations in soil and requires boilers or other means for heating water. In the hydroponics technique majority of plant nutrient needs are met by mixing water soluble nutrients with water thus eliminating need for soil. This technique is mainly used in greenhouse tomatoes, strawberries, cucumbers, peppers, eggplants, and some flowers. With this method there are no weeds nor soil borne pests, no toxic residues, and there is conservation of water, control over nutrient and oxygen conditions, increased crop quality and yield. Hydroponics involves initial high capital inputs although operating costs are low. Combination of biofumigation and soil solarization has been used very effectively in nematode and disease control for green house vegetable production system.

NEMATICIDES, PEOPLE AND THE ENVIRONMENT—THE UK EXPERIENCE [NEMATICIDAS, GENTE Y EL AMBIENTE—LA EXPERIENCIA DEL REINO UNIDO]. **P. P. J. Haydock, S. R. Woods, I. G. Grove and M. C. Hare, Crop and Environment Research Centre, Harper Adams University College, Newport, Shropshire, U.K.**—Before a nematicide can be marketed in the UK it has to go through rigorous testing to demonstrate that it is effective for the intended purpose, safe in the environment and that it will not cause harm to the workers applying the product and consumers eating treated foodstuffs. This testing is undertaken by the promoting company at its own expense. The resultant data are evaluated by a European Union (EU) member state raporteur, e.g. the Pesticides Safety Directorate in the UK. Due to the harmonization of pesticides registration within the EU data requirements are similar throughout EU member states. Active substances are periodically reviewed within the EU and must obtain Annexe 1 status to continue to be marketed in member states. In March 2003 aldicarb failed to achieve Annexe 1 status and it is probable that this active ingredient will no longer be available as a nematicide in the EU after 2007. Before nematicides can be used the

personnel must have received adequate instruction and guidance on the use of such products and in many cases require a certificate of competence by law to apply the product. This is to ensure that personnel can carry out the application without unnecessary risk to themselves and the environment. Engineering controls such a closed transfer systems and personal protective equipment are used along with properly maintained and calibrated applicators to ensure optimum and safe application. Correct incorporation of granular formulations ensures optimum nematode control and minimises risk to wildlife such as birds. The trend towards returnable containers for granular and fumigant nematicides, encouraged by the EU's Council Directive 94/62 on packaging and packaging waste, has reduced the problem of disposal of waste packaging for users of nematicide.

CHALLENGES TO QUALITY IDENTIFICATION PROCEDURES FOR PHYTOSANITARY ACTION [RETOS PARA LOS PROCEDIMIENTOS DE IDENTIFICACION DE CALIDAD EN LA ACCION FITOSANITARIA]. **Sue Hockland, Pest and Disease Identification Team, Plant Health Group, Central Science Laboratory, Sand Hutton, York YO41 1LZ, UK.—**The development of international phytosanitary standards and increasing requirements for quality accredited procedures are highlighting the challenges facing scientific support services for National Plant Protection Organisations. At a recent joint meeting of the European and Mediterranean Plant Protection Organization and the North American Plant Protection Organization in Mexico (2002), gaps in taxonomic expertise were stated as giving universal cause for concern. Phytosanitary regulations require a sufficiently broad resource base not only to advise on all species involved in international legislation but also to be able to identify non-quarantine species that warrant regulation. A wider taxonomical network is required and the development of the internet offers possibilities of that aim being achieved and for the sharing of scarce resources worldwide. Preserved collections also provide a valuable resource for taxonomists and parataxonomists alike but are often not easily accessible or have insufficient funds for curation and conservation. Modern computer technology and software now available for microscopes also needs to be harnessed to provide tools to facilitate an audit process utilizing digital images, but their development needs to be synchronized across nations to achieve a truly universal system. Other identification tools, such as molecular methods, are becoming more common, but also need to have the appropriate reference material selected and authenticated by specialists to avoid problems later. The development of internationally accepted diagnostic protocols that include all potential identification tools needs to be supported by a program of ring-testing in a range of laboratories so their reliability is assured and a concensus of opinion about their use is achieved.

CURRENT STATUS OF METHYL BROMIDE ALTERNATIVES RESEARCH IN FLORIDA [SITUACION ACTUAL DE LA INVESTIGACION SOBRE ALTERNATIVAS PARA EL BROMURO DE METILO EN LA FLORIDA]. **N. Kokalis-Burelle, USDA, Agricultural Research Service, U.S. Horticultural Research Lab, Ft. Pierce, FL 34945, U.S.A.—**Since 1993, extensive research on alternatives to methyl bromide has been conducted in Florida at USDA, ARS and the University of Florida in cooperation with growers and industry. Although alternative fumigants have proven efficacious for certain pests, no single registered chemical is effective as a nematicide, fungicide, and herbicide. Currently, the best available chemical alternative for most of Florida is Telone C-35 (a combination of 1,3-D and chloropicrin) and an appropriate crop specific herbicide or combination of herbicides. However, use of 1,3-D is problematic in some Florida regions where risk of contamination to surface and groundwater supplies exist. Use of methyl bromide alternatives will require growers to monitor pest populations and employ appropriate combinations of tactics. Progress has been made in developing pest thresholds, population monitoring, and integrated crop management strategies for assessing pest control needs. Fumigant emissions continue to be reduced with VIF films, new formulations, bed size reduction, alternate year applications, and drip application. Cultural, physical, biological, and bio-rational inputs have shown potential as components in integrated crop management strategies. Although research on methyl bromide alternatives has not yet produced a drop-in replacement fumigant, it has resulted in innovative methods and strategies for chemical control of many soil-borne

pests, and significantly contributed to development of more sustainable production practices through a greater understanding of pest biology and soil ecology.

ASSURANCE AND CONTROL QUALITY FOR THE PRODUCTION OF *POCHONIA CHLAMYDOSPORIA* VAR. *CATENULATA* [CONFIABILIDAD Y CONTROL DE CALIDAD PARA LA PRODUCCIÓN DE *POCHONIA CHLAMYDOSPORIA* VAR. *CATENULATA*]. **N. Montes de Oca[1], A. Villoch[1], B. Peteira[1], M. Rodríguez[1], S. Atkins[2], B. Kerry[2] and L. Hidalgo[1], [1]Centro Nacional de Sanidad Agropecuaria (CENSA), San Jose de las Lajas, Apto. 10, La Habana, Cuba and [2]Nematode Interactions Unit, Rothamsted Research[2], Harpenden Herts, AL5 2JQ, UK, lhidalgo@censa.edu.cu.**—*Pochonia chlamydosporia*, a facultative parasitic fungus of nematode eggs, has shown potential as a biological control agent against *Meloidogyne* spp. on vegetable crops. In Cuba, the isolate *P. chlamydosporia* var. *catenulata* (IMI SD187) has significantly reduced nematode infestations in commercial production systems. An essential feature of the production of all microbial control agents is an effective quality control system. Many low technology production systems in use around the world have minimal or no quality control procedures. This is unacceptable and can damage the reputation of microbial control in addition to possible health risks to those that produce or are exposed to the product. The use of a Good Production Practice (GPP) Guide, as a first step to quality assurance must be exploited. The GPP Guide for the mass production of a Bio-nematicide, permitted the evaluation of the quality control system designed for *P. chlamydosporia* var. *catenulata*. The main results included the establishment of an identification system based on cultural, morphological and molecular characteristics and confirmation of the stability of the isolate after 100 serial sub-culturing on agar and more than five year of freeze drying. The production strain has been deposited in a reference cultured collection (UKNCC) and a master and production bank were established. Moreover, the control of the production process and the specification for the initial material and final product were determined. The consistency of the bio-nematicide was demonstrated by the data recorded during the production of 18 batches, in three years, in the Pilot Plant at CENSA. The product obtained had an average viability of 91% chlamydospore germination and 75% eggs of *Meloidogyne* spp. parasitised (biological activity), and a concentration of $2.2 \cdot 10^7$ chlamydospore g^{-1} colonised medium. The Pilot Plant is able to produce 500 kg of inoculum per year with a consistent quality, which is used in field trials to measure efficacy in different conditions, toxicological and eco-toxicological studies and the evaluation of new formulations. The application of the GPP Guide demonstrated that low technology production systems in developing countries can produce high quality products, provided appropriate quality control procedures are robustly implemented. This work has been funded by DFID (UK) and the European Community (Project MiCoSPA, ICA-2001-10185).

MARINE NEMATODE DIVERSITY IN THE NORTHERN SEA OF CORTEZ (GULF OF CALIFORNIA), MEXICO [DIVERSIDAD DE LA FAUNA MARINA DEL NORTE DEL MAR DE CORTEZ (GOLFO DE CALIFORNIA)]. **M. Mundo-Ocampo[1], J. Baldwin[1], P. De Ley[1], W. K. Thomas[2], Axayacatl Rocha-Olivares[3], D. Waumann R.[4] and P. J. D. Lambshead[5], [1]University of California, Riverside, CA 92521, U.S.A., [2]University of New Hampshire, Durham, NH, U.S.A., [3]CICESE, Ensenada, Mexico, [4]Universidad Autónoma Baja California, Mexico and [5]The Natural History Museum, London SW7 5BD, UK.**—Marine nematodes arguably are among the most abundant and diverse invertebrates but they remain underrepresented in global bioinventories including the Gulf of California, Mexico. Through US NSF support and Mexican collaboration, five Gulf localities, selected internationally as urgent biodiversity priorities, are being inventoried for nematode diversity using novel approaches that include linking through-focus video records of individual specimens to DNA sequence data from the same specimen. Presently, more than 200 diverse samples from three divergent Northern Gulf sites, have been collected, population size estimated, and specimens identified to genus level. Collections include more than 60 genera (many new), and a high proportion of new species of Enoplida, Chomodorida and Monhysterida. These have been photographed (in many cases including videos and SEM), deposited and curated in established Mexican and US slide and mass collections including

linked databases designed to provide worldwide access to specimens and data. The project provides a context for training new scientists and establishing synergistic international collaborations while also providing raw material for sophisticated phylogenetic systematics [e.g. the NSF Assembling the Tree-of-Life (ATOL) initiative], and for accurate ecological studies based on reliable identifications.

NEMATODE DIVERSITY AND SOIL HEALTH [DIVERSIDAD DE NEMATODOS Y SALUD DEL SUELO]. **D. Neher, University of Vermont, Burlington, VT 05405, U.S.A.—**Nematodes are part of a complex soil ecosystem, representing multiple trophic positions located centrally within soil food webs. Nematodes possess attributes that make them useful as indicators, linking directly with ecological processes including plant productivity, nutrient cycling and decomposition. Nematodes affect plant productivity negatively by herbivory and parasitism, and positively by increasing nutrient availability through regulation of mineralization and decomposition processes. Positive correlations were observed between successional maturity of nematode communities and decomposition of cellulose in non-cultivated, perennial agricultural systems but not in cultivated soils with annual crops or with decomposition of lignin. Quantitative associations that reveal cause-effect relationships or mechanisms between nematodes and ecosystem function are necessary for complete understanding of indicator performance. Use of nematode communities as bioindicators in terrestrial systems is most studied for application in agricultural ecosystems. Various kinds of perturbations to soils, such as addition of mineral nitrogen fertilizers, cultivation, liming, and accumulation of heavy metals affect the species richness, trophic structure, and successional status of nematode communities. With independent calibration and interpretation, they may also be useful in forest and wetland soils.

ECONOMIC FEASIBILITY OF METHYL BROMIDE ALTERNATIVES AND THE CRITICAL USE EXEMPTION PROCESS [ANALISIS ECONOMICO DE LAS ALTERNATIVAS AL BROMURO DE METILO Y EL PROCESO DE EXENCION PARA USOS CRITICOS]. **J. D. Schaub, United States Department of Agriculture, Washington, DC 20250, U.S.A.—**Appropriate government policies, scientific research, and economically feasible alternatives are keys to eliminating the use of the soil fumigant methyl bromide. Interpreting and applying the economic criteria for exempting critical uses of methyl bromide from phase-out under the Montreal Protocol remains problematic. Fundamental economic concepts are defined and used to evaluate the economic feasibility of a hypothetical alternative. Competing economic frameworks, including partial budgeting, net revenue, and technology adoption models, are used to assess the economic feasibility of methyl bromide alternatives. The economics of alternatives are illustrated through analysis of Critical Use Nominations for methyl bromide from the United States for soil fumigation and post-harvest uses. Conventional economic methods for imputing costs and returns, amortizing capital investments, and accounting for stochastic variables are presented and their importance for drawing conclusion regarding economic feasibility is explained.

ALTERNATIVES TO METHYL BROMIDE—THE CHALLENGES OF FIELD NURSERIES AND PERENNIAL CROPS [ALTERNATIVAS AL BROMURO DE METILO—DESAFIOS DE VIVEROS Y CULTIVOS PERENNES]. **S. Schneider, T. Trout, J. Gerik, G. Browne and H. Ajwa, USDA ARS, Parlier, CA 93648, USDA ARS, Davis, CA 95616 and University of California, Salinas, CA 93905, U.S.A.—**Methyl bromide (MB) has commonly been used to meet the challenge of providing effective nematode control when replanting perennial crops and when producing clean propagative material. In perennial replant situations, effective control is needed for the first several years to produce an orchard or vineyard that will remain productive over the expected life of the crop, which can exceed 50 years. Furthermore, nematodes in roots which remain in the soil after the previous crop is removed, must be killed. In field trials under vineyard replant conditions, after six growing seasons, shank-injected iodomethane and drip-applied 1,3-dichloropropene (Telone EC) provided control of *Meloidogyne* spp. and *Tylenchulus semipenetrans* comparable to MB. In a similar field trial, after three growing seasons, shank and drip-applied iodomethane (IM) and propargyl bromide, and drip-applied 1,3-dichlo-

ropropene + chloropicrin (InLine) provided control comparable to MB. Clean propagative material regulations often require that field nursery crops meet a high standard, such as no detectable plant parasitic nematodes of economic importance. In field trials with natural infestations of *Meloidogyne* spp., tarped applications of 1,3D+chloropicrin (Telone C35), IM+chloropicrin, and chloropicrin alone resulted in 1-year grapevine crops that were free of detectable nematodes. In the two-year tree crops, tarped IM+chloropicrin and Telone C35 produced trees with no detectable nematodes. In a two-year rose nursery trial, Telone C35 (tarped), InLine, Telone EC, IM+chloropicrin (shank and drip-applied), and drip-applied chloropicrin resulted in plants with no detectable plant parasitic nematodes. All of these trials were conducted on sandy loam soils. Trials have been initiated in finer-textured soils to further evaluate these treatments.

DITERA—A NEMATICIDE THAT TREATS THE WORLD WITH CLASS [DITERA—UN NEMATICIDA QUE TRATA AL MUNDO CON CLASE]. **P. Warrior, Valent BioSciences Corporation, 6131 RFD Oakwood Road, Long Grove, IL 60047, U.S.A.—**Nematicidal activity of fermentation extracts of the hyphomycete *Myrothecium verrucaria* was discovered in 1987. Laboratory, greenhouse and field experiments over the past decade resulted in the approval for commercial use of DiTera by the United States Environmental Protection Agency in 1997. Commercial development on multiple crops in different location followed. At this time, DiTera has become a significant component in the integrated nematode management programs on grapes and other vegetable crops in California, Mexico and Chile. The key product attributes including its biological features, mode of action and application parameters with special reference to the toxicological and environmental aspects will be discussed in relation to the global regulatory and market needs.

ENTOMOPATHOGENIC NEMATODES IN LATIN AMERICA: TO WHERE RESEARCH SHOULD GO [NEMATODOS ENTOMOPATOGENOS EN AMERICA LATINA:HACIA DONDE VA LA INVESTIGACION]. **S. Patricia Stock, Div. Plant Pathology & Microbiology, Dept. of Plant Sciences, University of Arizona, 1140 E South Campus Dr, Tucson, AZ 85721-0036, U.S.A.** The widely demonstrated capabiliyu of entomopathogenic nematodes (EPN) *Steinernema* and *Heterorhabditis* and their symbiotic bacteria (*Xenorhabdus* and *Photorhabdus* spp., respectively) to control a broad range of agricultural insect pests has made this nematode-bacterium complex the most studied group of insect-parasitic nematodes. Moreover, during the past decade, realization of the practical use of EPN has spurred developments across a far broader scientific front. We are now entering a new era of discovery in which tools of molecular genetics are being increasingly used to address a range of biological questions. The knowledge gained from these efforts will directly benefit the practical application of insect parasitic nematodes as more effective biopesticides. Moreover, these studies will advance these nematodes as unique and intrinsically interesting biological model systems not only for basic research but also in applied fields such as plant health, human medicine, pharmaceutical bioprospecting and genetic engineering. However, in latin America, the situation is slightly different. Several constrains such as reduced funding opportunities, inappropriate infrastructure, reduced number of trained scientists, etc., are some of the factors that restrict progress in EPN research. In this presentation I will summarize the current status of EPN research in Latin America and will emphasize on the needs and future directions for the study of this group of nematodes.

MASS PRODUCTION OF ENTOMOPATHOGENIC NEMATODES IN LIQUID CULTURE [PRODUCCION EN SERIE DE NEMATODOS ENTOMOPATOGENICOS MEDIANTE CULTIVO LIQUIDO]. **[1]Yolanda Reyes, [1]Miriam Adame, [1]Octavio Gómez and [1,2]Mayra de la Torre, [1]Depto. de Biotecnología y Bioingeniería, CINVESTAV-IPN, México City, México and [2]Ciencia de los Alimentos, Centro de Investigación y Desarrollo en Alimentos A.C., Km 0.6 Carretera a la Victoria, 83000 Hermosillo, Sonora, México.—**Nematodes of the generaa *Steinenema* and *Heterorhabditis* are used as agents in insect biocontrol programs. They are associated with specific bacteria which are also involved in the mechanism of pathogenicity and which are consumed by nematodes as living food. Dur-

ing mating, *S. feltiae* males coil themselves around the female. Successful commercialisation of nematode-bacteria biocontrol products depends on the ability to produce sufficient quantities of these products at competitive prices for full scale pest control programs. This could be possible if high cell density submerged cultures are designed and implemented, but major problems related to nematode production in bioreactors still remain. We have studied within bubble columns the kinetics of growth, the distribution of males and females, the size and distribution of bubbles, the instantaneous velocity of nematodes and bubbles under different culture conditions and found that the most important engineering aspects to take into account are oxygen transfer rate, bubble size and hydrodynamics that allow mating.

DESARROLLO Y USO DE *HETERORHABDITIS BACTERIOPHORA* (CEPA HC1) EN EL MANEJO DE PLAGAS EN CUBA [DEVELOPMENT AND USE OF *HETERORHABDITIS BACTERIOPHORA* (CEPA HC1) FOR PEST MANAGEMENT IN CUBA]. **L. Sánchez, M. G. Rodríguez, R. Enrique, L. Gómez, D. Martín, M. A. Martínez, D. M. Soler, B. Peteira, M. Surís y L. Hidalgo, Centro Nacional de Sanidad Agropecuaria (CENSA), Apdo 10 San Jose de las Lajas, La Habana, Cuba.—**Los nematodos entomopatógenos constituyen una alternativa al uso de productos químicos para el combate de plagas. En el presente trabajo se lograron aislar siete cepas nativas del nematodo y se seleccionó a *Heterorhabditis bacteriophora* cepa HC1 como la de mayor potencialidad como agente de control biológico. La caracterización morfológica, fisiológica, molecular y patogénica de esta cepa del nematodo y su bacteria simbionte se realizó, encontrándose que la cepa actúa de forma eficiente en el control de numerosas plagas. Se presentan los resultados en el manejo de *Cylas formicarius* (picudo del camote), palomilla del maíz y chinches harinosas en piña y plantas ornamentales. Los nematodos se aplicaron al área foliar con el empleo de una asperjadora mecánica en un campo de maíz severamente afectado por la palomilla, así como en una plantación de piña con una infestación de grado 4 de chinches harinosas. La dosis de aplicación fue de 200 millones de juveniles (JI)/ha. Dos semanas después de la aplicación se evaluó la densidad de las plagas. El índice de infestación de las chinches harinosas en piña así como de la palomilla del maíz se redujo a cero con una notable recuperación de este último. En el camote se asperjó el material de siembra en una suspensión de 25 millones de JI y 15 días después de plantado se realizó una aplicación al suelo (200 millones de JI/ha) y, en el momento de cosecha, se evaluó el porcentaje de tubérculos sanos e infestados presentándose tan sólo un 2.5% con síntomas del ataque de picudo. Como parte del trabajo, se elaboró la metodología para la reproducción masiva del nematodo en *Galleria mellonella*, adaptada para las condiciones de Centros de Producción de Entomofagos y Entomopatógenos (CREEs) en Cuba, así como su sistema de calidad, que incluye la sintomatología en los cadáveres como un parámetro esencial, lo que ha permitido su introducción en 39 establecimientos del país.

ANTI-NEMATODE EVALUATIONS ON *MELOIDOGYNE INCOGNITA* ASSOCIATED WITH VINEYARDS AT HERMOSILLO, SONORA, MEXICO [EVALUACIONES ANTI-NEMATODO SOBRE *MELOIDOGYNE INCOGNITA* EN VID, HERMOSILLO, SORNORA, MEXICO]. **T. Morales-Perez[1], R. Hernandez-Hernandez[1], J. Avila[2] and N. Marban-Mendoza[1], [1]Departamento de Parasitología Agrícola, Universidad Autónoma Chapingo, Km. 38.5 Carretera México-Texcoco, Chapingo, México, C.P. 56230.—**For about 18 mouths field applications on Superior and Redglobe varieties showed that QL Agri 35 (25 and 30/ha: two applications per year) and Ditera ES (301/ha: two applications per year) were different (? = 0.05) significantly suppressing *M. incognita* populations compared to the control treatment. This effect was most notable 30 days after treatment and individual grape plants showed more root feeders and less galling. Under greenhouse conditions with watermelon (var. Pracock) and potato (var. Alpha) infected with *M. incognita*, QL Agri 35 soil pot drench at 5000 ppm suppressed nematode populations similar to Terfubos and promoted root and plant growth like Hoticplus and Endospore (commercial plant growth promotors). In *in vitro* biossays QL Agri 35, inmobilized *M. incognita* (J2) in less than 24 hours at 3500 ppm and no recovery of nematodes were observed after nematodes were washed to remove chemical solutions and left in aerated distilled water for 24 hours.

DISTRIBUCIÓN ESPACIAL DE LA DIVERSIDAD NEMATOLÓGICA EDÁFICA [SPATIAL DISTRIBUTION OF SOIL NEMATODE DIVERSITY]. **G. Liébanas, Dpto. Biología Animal, Vegetal y Ecología, Universidad de Jaén. Campus "Las Lagunillas" s/n, Edificio B3, 23071-Jaén, España (Spain), gtorres@ujaen.es.—**Uno de los aspectos menos conocidos de la biología de los nematodos del suelo es su distribución a mediana y gran escala geográfica, no habiéndose propuesto hasta el momento una teoría general sobre la misma. No obstante, hay evidencias de que existen gradientes ambientales (latitud y altitud principalmente) de riqueza específica que pueden considerarse patrones de distribución comunes a otros grupos zoológicos, así como distintos factores edáficos que pueden condicionar la distribución de la diversidad nematológica. Por otra parte, son escasas las propuestas de hipótesis explicativas (procesos) de los patrones observados, pero desde una perspectiva histórica ha sido la tectónica de placas el proceso más habitualmente invocado para explicar la distribución de táxones emparentados evolutivamente. En esta contribución se presenta una síntesis de los conocimientos actuales sobre el tema, así como resultados originales obtenidos en dos estudios realizados en áreas naturales de la Península Ibérica.

ASPECTOS CUANTITATIVOS DE LA DIVERSIDAD NEMATOLÓGICA [QUANTITATIVE ASPECTS OF NEMATODE DIVERSITY]. **R. Peña-Santiago, Dpto. Biología Animal, Vegetal y Ecología, Universidad de Jaén, Campus "Las Lagunillas" s/n, Edificio B3, 23071-Jaén, España (Spain), rpena@ujaen.es.—**La diversidad del filo Nematodos (Nematoda) es una de las menos conocidas dentro del reino Animal (Animalia), con estimaciones que varían desde cien mil hasta un millón de especies existentes, si bien sólo están descritas unas veinticinco mil. Un análisis de la evolución temporal de la descripción de nuevos táxones de rango inferior (géneros y especies) a lo largo del pasado siglo nos muestra algunos patrones relevantes y nos proporciona información básica para intentar realizar proyecciones más fiables (con base más sólida) que las disponibles en la actualidad. Así, resulta evidente que la segunda mitad del pasado siglo, muy particularmente las décadas de los sesenta, setenta y ochenta, fue una época de intensa labor taxonómica que se tradujo en un notable avance en el inventario de la fauna nematológica, sobre todo de formas de vida libre, fitoparásitas y entomopatógenas. Pero también es obvio que en los últimos 20 años se ha producido una disminución del ritmo al que progresa nuestro conocimiento de la 'nematodiversidad', debido tal vez a una crisis en la atención que se presta a este asunto, y todo ello a pesar del creciente interés a todos los niveles por los temas relacionados con la biodiversidad en general.

IMPACTO DE LA REDUCCIÓN DEL USO DE NEMATICIDAS EN LA PRODUCCIÓN ACTUAL DE BANANO EN ECUADOR [IMPACT OF REDUCTION OF NEMATICIDES USE ON BANANA PRODUCTION IN ECUADOR]. **C. Triviño[1] y J. Escobar[2], [1]Instituto Nacional Autónomo de Investigaciones Agropecuarias (INIAP), Box 09 01 7069, Guayaquil, Ecuador and [2]Bayer CropScience, Guayaquil, Ecuador.—**En Ecuador el uso de nematicidas para el control de nematodos se inició en la década del 70. Hasta mediados de la década del 90 el número de ciclos de nematicidas fluctúo de 2 a 3 veces por año, realizado especialmente por los Exportadores y Multinacionales, situación que influyó en una mejor protección del sistema radical del banano. Posteriormente, los productores y empresarios bananeros le han dado mayor importancia al Manejo de la Sigatoka negra (costos por caja alrededor del 10%), nutrición (5%) y otras labores del manejo del cultivo, considerando además que de manera intermitente el productor enfrenta precios bajos de la fruta. Durante los últimos cinco años las aplicaciones de nematicidas se han reducido frecuentemente hasta 1 ciclo cada 2 años, a excepción de las Compañías Exportadoras que en sus áreas aún mantienen un adecuado control de nematodos. Actualmente la falta de manejo adecuado a provocado la alta incidencia de nematodos en el 60% de las plantaciones del país, que han reducido significativamente la masa radical de las plantas, incrementándose las densidades poblacionales de *Radopholus similis* y *Helicotylenchus multicinctus* y como consecuencia el volcamiento de las plantas entre el 10 a 25% y la reducción de la producción entre el 10 al 30% cajas/ha/año, razón por la cual, grupos de bananeros han retomado el control de nematodos mediante el uso de nematicidas químicos para mejorar el desarrollo y productividad de las plantas.

DISSECTING HOST RESPONSES TO INVASION BY ROOT KNOT NEMATODE [DISECANDO LAS RESPUESTAS DEL HOSPEDANTE A LA INVASIÓN DE LOS NEMATODOS AGALLADORES]. **J. E. Schaff and D. McK Bird, Center for the Biology of Nematode Parasitism, Box 7253 NCSU, Raleigh NC, 27695.—**Root knot nematodes (RKN) elicit dramatic morphological and biochemical changes in susceptible and resistant plants and we are using a microarray approach to examine the concomitant global changes of host gene expression. We have developed an interwoven loop design to facilitate comparing data representing variables such distinct time-points during infection, and defined plant and nematode genotypes. Data are being analyzed using a mixed model which takes both random and fixed effects into account. One microarray screen uses 50-mer oligonucleotides defining genes with postulated function in giant cell and gall formation (hypothesis testing) and another microarray screen is based on EST clones defining approximately 4,700 unique genes expressed in tomato roots (gene finding for hypothesis generating). Candidates revealed in either screen will be validated by in situ transcript mapping. Sequences of these candidate genes will be compared and genes grouped according to protein motifs ascertained using Hidden Markov Models. We will use these data to query the Gene Ontology database to assess molecular function, cellular location, and biological processes of host genes regulated by RKN.

TRAINING OPPORTUNITIES IN NEMATOLOGY. A POINT OF VIEW BUT A COMMON WORRY [OPORTUNIDADES DE FORMACIÓN EN NEMATOLOGÍA. UN PUNTO DE VISTA PERO UNA PREOCUPACION COMÚN]. **K. G. Davies and R. H. Manzanilla-López, Nematode Interactions Unit, Rothamsted Research, Harpenden, Herts, AL5 2JQ, UK.—**Plant-parasitic nematodes are economically important crop pests that need to be controlled in order to minimize yield loss. There is therefore a need to research these organisms in order to establish new methodologies leading to their control within the context of a sustainable management approach. Trained scientists with specialist knowledge in nematology are required to cover present and future needs, in both developed and developing countries. Recently advances in biotechnology have revolutionised the approaches being undertaken by the nematological research community and the challenge is to integrate this technology with older methods of control. Recent training of scientists has relied on the concept of an expert authority training highly specialized scientists in their focus of concern. However, crop protection is a part of the food production system and is a complex problem requiring the integration of many disciplines. Therefore, the training of nematologists should not rely solely upon isolated and specific knowledge, but must also involve an appreciation of the wider context in which they will operate and his (her) own personal role or vision with in this context. There is no simple solution. The curricula and its administration require careful thought so that the "products" (i.e., graduates) are made aware of the multiplicity of options and possibilities that a career in nematology requires and are able to respond to and deliver the services society needs and expects.

GLOBAL RESEARCH SUMMARY OF TELONE* AS A SOIL, PREPLANT ALTERNATIVE FOR METHYL BROMIDE. **J. D. Busacca[1], L. Gomez[2] and C. Rojas[3], [1]Dow AgroSciences, Indianapolis, IN, USA, [2]Dow AgroSciences, Guatemala City, Guatemala and [3]Dow AgroSciences, Guadalajara, Mexico.—**Dow AgroSciences has conducted an extensive, global research program for more than eight years to establish Telone as viable alternative to methyl bromide. Research has been conducted cooperatively with University researchers, numerous government research agencies and commodity organizations in more than 20 countries. Research has focused on tomato, pepper, strawberry and melon crops but has also included cucurbits, permanent tree and vines, nursery crops, cut flowers and bulbs. Two formulations have been developed and registered as alternatives for methyl bromide. Telone C-35, a formulation of 1, 3-dichloropropene that includes 35 percent chloropicrin, can be applied utilizing standard shank injection equipment. InLine* is an emulsified formulation of Telone C-35 that has been specifically developed for application through drip irrigation tubes. Both formulations have been tested extensively in Latin America on melons, tomatoes, peppers and other crops. They deliver high levels of efficacy against nematode and disease organisms and provide yields as good as or better than methyl bromide in commercial production situations.

DETECCION DE NEMATODOS DE IMPORTANCIA CUARENTENARIA PARA MEXICO EN MATERIAL VEGETAL DE IMPORTACION [DETECTION OF PLANT-PATHOGENIC NEMATODES OF QUARANTINE IMPORTANCE TO MEXICO IN IMPORTED PLANT PRODUCTS]. **D. Colmenares A., A. Ramírez-Suárez, M. R. Hernández H., J. R. Pérez Z. y F. Ramírez R., Centro Nacional de Referencia Fitosanitaria, Dirección General de Sanidad Vegetal, SAGARPA, Guillermo Pérez Valenzuela No. 127 Col. Del Carmen, Coyoacán, D.F. 04100, México.—**La Dirección General de Sanidad Vegetal (DGSV) tiene entre sus objetivos evitar o prevenir la entrada de plagas y enfermedades cuarentenados a territorio mexicano. Para realizar de manera adecuada esta tarea se auxilia de diferentes áreas afines, una de ellas es el Centro Nacional de Referencia Fitosanitaria (CNRF) que tiene como función principal detectar los patógenos y plagas en material vegetal de importación, así como la evaluación, estandarización y validación de nuevas técnicas usadas para el diagnóstico fitosanitario. La detección de nematodos de importancia cuarentenaria está a cargo del Laboratorio de Nematología Agrícola "Dr. Carlos Sosa Moss", el cual también tiene entre sus funciones: detección e identificación de nematodos de importancia cuarentenaria, desarrollo, validación y difusión de nuevas técnicas o procedimientos de diagnóstico. En los últimos 4 años (2000 al 2003) se han recibido un promedio de 1100 muestras para su análisis en el Laboratorio de Nematología, las cuales son procesadas por diferentes metodologías para la extracción de nematodos fitopatógenos como son: macerado-tamizado-centrifugado, elutriador de Oostrenbrink, disección directa de raíces y tubérculos, incubación de tejidos, entre otras. Los nematodos de interés cuarentenarío que se han interceptado en los últimos 4 años son: nematodo agallador de Columbia (*Meloidogyne chitwoodi*) en tubérculos de papa; el nematodo javanés (*M. javanica*) en tubérculos de papa y ornamentales; el nematodo de los bulbos y tallos (*Ditylenchus dipsaci*) en ornamentales y bulbos de ajo; el nematodo de la pudrición seca (*D. destructor*) en ornamentales; el nematodo dorado de la papa (*Globodera rostochiensis*) en tubérculos de papa; nematodos foliares *Aphelenchoides fragariae, A. besseyi* en fresa y ornamentales. La identificación a nivel género y especie de los nematodos detectados se realiza mediante la elaboración de montajes temporales y permanentes de filiformes, elaboración de cortes de los patrones perineales y montaje del cuello de hembras de *Meloidogyne*, cortes fenestrales de nematodos formadores de quistes, uso de claves taxonómicas, morfometría, descripciones originales y comparación con material de la colección de referencia del CNRF; así como el empleo de técnicas moleculares como la reacción en cadena de la polimerasa.

GENOME-BASED APPROACHES TO NEMATODE-BACTERIAL INTERACTIONS [INVESTIGACIONES GENOMICAS SOBRE INTERACCIONES ENTRE NEMATODOS Y BACTERIA]. **C. H. Opperman, Center for the Biology of Nematode Parasitism, Department of Plant Pathology, Box 7253, North Carolina State University, Raleigh, NC 27695, U.S.A.—***Pasteuria penetrans* is an endospore-producing, Gram-positive bacterium that is an obligate parasite of root-knot nematodes (*Meloidogyne* spp.), which are themselves obligate parasites of plants. This bacterium has been associated with nematode suppressive soils and also shown to have tremendous potential for the biological control of root-knot nematodes. However, the fastidious nature of the organism and the lack of ability to perform forward genetic experiments have hindered our ability to make progress on culturing, host-range expansion, and mass production techniques. Therefore, we have begun sequencing the genome of *Pasteuria.* Phylogenetic analysis using both our data and previously reported 16S ribosomal DNA sequence has shown the genus *Pasteuria* is a deeply rooted member of the *Clostridium-Bacillus-Streptococcus* branch of the Gram-positive eubacteria. We have identified over 1000 *Pasteuria* genes in greater than 1 Mb of contiguous sequence. We will present a draft sequence of the *P. penetrans* genome, along with genome comparisons to the closely related *Bacillus* genus. In a separate project, we have begun to sequence the genome of the root-knot nematode, *Meloidogyne hapla.* The *M. hapla* genome is 62.5 Mb in size and consists mainly of unique sequence. We are making physical maps to help with the sequencing strategy. The combination of these two genomic sequences will enable us to ask detailed questions about the *Pasteuria-Meloidogyne* interaction, including the molecular basis of attachment and host specificity.

PRIMARY SIGNALING EVENTS BETWEEN ROOT-KNOT NEMATODE AND HOST [EVENTOS PRIMARIOS INVOLUCRANDO SEÑALES MOLECULARES ENTRE EL NEMATODO AGALLADOR Y LA PLANTA HOSPEDANTE]. **David Bird[1], R. Weerasinghe[1], N. Allen[2] and D. Lohar[1], [1]Center for the Biology of Nematode Parasitism and [2]Department of Botany, North Carolina State University, Raleigh, NC 27696 U.S.A.—**Root-knot nematodes (RKN) are significant agricultural pests worldwide, and induce stereotypic giant cells (GC) in the root vasculature of most plants. The discovery that GC express the KNOX and PHAN transcription factors required for meristem maintenance suggests that GC are a type of induced meristem, perhaps with similarities to rhizobia-induced meristems which also express PHAN and KNOX. This idea was strengthened by the discovery that the nodule-regulation genes *ccs52* and *ENOD40* also are expressed in young GC. Genetic evidence points to a role for KNOX in regulation of hormonal response pathways, and cytokinins have been implicated in the formation of nodules. We used the cytokinin-responsive *ARR5* gene promoter from *Arabidopsis* (driving *GUS*) to obtain a spatio-temporal map the cytokinin response in the legume *Lotus japonicus*. A cytokinin response was not detectible during root penetration and migration by RKN, nor in mature GC. However, down-regulation of cytokinin levels in planta via transgenic expression of cytokinin oxidase genes produces roots with significantly fewer GC, implicating a transient requirement for cytokinin at the onset of GC initiation. Confocal microscopy of *Lotus* composite plants transgenic for GFP-marked actin and microtubules revealed that RKN elicit cytoskeletal responses in root hairs indistinguishable from those induced by rhizobia. RKN also induce root hair deformation and branching. Because they encode primary rhizobial signal receptors, we have begun to dissect the host pathway that responds to the diffusible RKN signal using *Lotus symRK*, *nrf1* and *nrf5* mutants. We found that NFR1 and NFR5 are required for RKN induced root hair branching, but SYMRK is not. Physical characterization of the RKN signalling molecule(s) is in progress.

INMERSIÓN DE RAÍCES DE VID EN QL AGRI 35 (EXTRACTO DE *QUILLAJA SAPONARIA*) PARA EL CONTROL DE *MELOIDOGYNE ETHIOPICA* [IMMERSION OF GRAPE ROOTS IN AL AGRI 35 (*QUILLAJA SAPONARIA* EXTRACT) FOR THE CONTROL OF MELOIDOGYNE EHIOPICA]. **J. C. Magunacelaya, J. Nitshe y H. Pacheco, Universidad de Chile, Santiago, Chile, jmagunac@agricola.net.—**Se evaluó la técnica de inmersión de raíces de vid Pinot Noir altamente infestadas con *Meloidogyne ethiopica*. Plantas libres del nemátodo fueron inoculadas con 2000 huevos de *M. ethiopica*. Después de 30 días se aisló las raíces del suelo para realizar los tratamientos de inmersión, los cuales tuvieron siempre una duración de 3 horas. Se realizó tratamientos con QL Agri 35 a 10.000, 20.000, 40.000 y 80.000 ppm, Nemacur 400 EC 1.500 ppm y Nemacur 240 CS a 1.500 ppm. También se dejó testigos con y sin *M. ethiopica*. Luego de los tratamientos de inmersión las plantas fueron replantadas en macetas con suelo estéril, para permitir el desarrollo de las raíces y de los nemátodos sobrevivientes al tratamiento. Después de 40 días desde la inmersión, las plantas se desmontaron de sus macetas y se midió nivel de agallamiento, peso de raíces y crecimiento de la parte aérea. Además, se realizó recuento de huevos en las raíces y de juveniles de segundo estado en el suelo. Los resultados mostraron que no hubo diferencias en el número de agallas en las raíces, sin embargo todos los tratamientos disminuyeron el número de juveniles en el suelo respecto al testigo, y los tratamientos de QL Agri 35 a 20.000 ppm y Nemacur 400 EC a 1.500 ppm fueron efectivos en cuanto a reducción de la capacidad de reproducción del nemátodo expresado por el número de huevos en las raíces.

USO DE LAS TECNICAS MOLECULARES PARA LA DETECCION E IDENTIFICACION DE NEMATODOS DE IMPORTANCIA CUARENTENARIA PARA MEXICO [USE OF MOLECULAR TECHNIQUES FOR THE DETECTION AND IDENTIFICATION OF PLANT PATHOGENIC NEMATODES OF QUARANTINE IMPORTANCE TO MEXICO]. **A. Ramírez-Suárez, D. Colmenares A., M.R. Hernández H., J. R. Pérez Z. y F. Ramírez R., Centro Nacional de Referencia Fitosanitaria, Dirección General de Sanidad Vegetal. SAGARPA, Guillermo Pérez Valenzuela No. 127 Col. Del Carmen, Coyoacán, D.F. 04100, México.—**La identificación tradicional de nematodos fitopatógenos se realiza principalmente mediante características morfológicas y morfométricas de juveniles, hembras,

y machos, así como plantas diferenciales, implicando mayor cantidad de tiempo con resultados en algunas ocasiones poco convincentes. El análisis de ADN y particularmente el uso de la reacción en cadena de la polimerasa (PCR), ofrecen la sensibilidad y especificidad genética requerida para fines de diagnóstico. Como una herramienta más en el diagnóstico de nematodos de importancia cuarentenaria, en el Laboratorio de Nematología "Dr. Carlos Sosa-Moss" se utiliza la PCR con la finalidad de corroborar la identificación de los patógenos detectados. Recientemente, se ha estado trabajando con *Meloidogyne chitwoodi* utilizando el par de oligonucleotidos 1839 y C64, específicos para este nematodo. Los productos amplificados muestran una banda de aproximadamente 900 pb, específica para las poblaciones de este organismo. El par de iniciadores utilizado puede evidenciar la presencia o ausencia de *M. chitwoodi* en poblaciones mezcladas. Para el caso del nematodo dorado (*Globodera rostochiensis*), se ha utilizado el par de oligonucleótidos 5SG-SLG haciendo el PCR con ADN extraído y utilizando el sobrante de un solo quiste (huevecillos, juveniles y restos de cutícula). Los productos amplificados de PCR tanto para ADN como para el quiste individual, muestran una banda de 914 pb que corresponde a *G. rostochiensis*, demostrando así la especificidad de estos iniciadores y la rapidez de ésta tecnica ya que al realizar la PCR directamente se evitan la extracción de ácidos nucleicos, lo cual agiliza el proceso del diagnóstico del nematodo dorado a partir de un solo individuo. Por otra parte, con respecto al nematodo agallador del trigo (*Anguina tritici*) se utiliza el par de iniciadores rDNA2 y rDNA1.58S para detectar los Espacios Internos Transcritos (ITS) en el ADN ribosomal. El fragmento obtenido ITS1 para el agallador del trigo es de aproximadamente 550 bp, y al hacer una digestión de este fragmento con la enzima de restricción Alu I se logran obtener dos fragmentos de 277 y 274 que corresponden a *A. tritici*.

INFORMATION COMPUTER SYSTEMS TO SUPPORT THE SEARCH FOR QUARANTINE PLANT-PARASITIC NEMATODES ASSOCIATED WITH DIFFERENT PLANT MATERIALS IMPORTED BY BRAZIL [SISTEMAS INFORMATICOS APOYANDO LA EVALUACION DE LA IMPORTANCIA CUARENTENA DE NEMATODOS ASOCIADOS CON PLANTAS Y PRODUCTOS DE PLANTAS IMPORTADAS POR BRASIL]. **V. R. V. Rissoli[1] and R. C. V. Tenente[2], [1]Universidade Católica de Brasília, QS 07—lote 01 (70.022-900), Taguatinga-DF and [2]Embrapa Recursos Genéticos e Biotecnologia, C.P. 02372 (70770-900), Brasília-DF, Brazil.—**Pest interception is very important in efforts to diminish the risk of introducing new nematode species into Brazil and also in recording the nematode species that occur in the National Territory. To make this information and other services available via the internet, the Nematological Laboratory of Embrapa Genetic Resources and Biotechnology, together with the Catholic University of Brasilia, has developed a website. A database of nematological germplasm analysis, established at Embrapa Genetic Resources and Biotechnology (Brazil), was used to develop a computer system to record details of all plant materials imported into Brazil. The database was fed into a Germplasm Information System (SIG) that record whether the commodity is infected or not by nematodes, the donator and, receptor institutions, and the year of introduction. The system is a powerful tool for providing advice on risk categories to researchers and farmers. This technological resource is available to different users. Therefore, a more extensive project was developed in three main phases: surveys and services, development of a user friendly interface, and the building of computational and programming services necessary for this virtual environment. A bibliographical reference search service, which has helped to improve research and other studies, both international and national, related to nematodes, is now available on this site. This virtual service makes it possible to search Brazilian nematological research results and it is expected that it will help to improve Brazilian Agricultural productivity and quality. The Nematological Laboratory has also developed an intuitive virtual environment that allows even easier interaction in searching the nematological bibliography. A cost-benefit analysis of the computer systems that have been developed reveals a potentially substantial contribution to Brazilian Agriculture. The SIG survey results showed that nematodes detected and identified in plant materials imported from different countries between 1981 to 2003 are of great significance for Brazilian Agriculture. All of these services can be

accessed through this internet site: http://icewall2.cenargen.embrapa.br/. However, the nematological analysis database located at Embrapa Genetic Resources and Biotechnology, Brazil, is not available to outside users.

BIORATIONAL SEEDLING PROTECTION AGAINST PLANT-PARASITIC NEMATODES [PROTECCION BIORACIONAL DE SEMILLAS CONTRA NEMATODOS FITOPARASITOS]. **L. A. Payan[1] and J. O. Becker[2], [1]Syngenta Crop Protection, Visalia, CA 93292, and [2]Department of Nematology, University of California, Riverside, CA 92521.—**Real and perceived concerns about pesticide pollution of air, soil and water, and their potential consequences for the environment has promoted efforts that minimize these factors while maintaining agricultural productivity and profitability. Overall, the US Food Quality Protection Act has been a turning point for all involved parties to focus on reduced risk innovations for pesticide developments. Application rates of many modern fungicides, insecticides and herbicides have dropped to a few grams a.i. per hectare. In contrast, plant protection against parasitic nematodes still relies frequently on fumigants and non-volatile nematicides with high-risk chemistry and a.i. application rates of several kg per hectare. Recent laboratory, greenhouse and field trials have shown that seed coating with abamectin is effective in mitigating root-knot nematode attack of cotton and various vegetable seedlings. Abamectin, derived from the actinomycete Streptomyces avermitilis, is insecticidal, acaricidal and nematicidal. It has an EPA Reduced Risk Status because of a new technology, its low toxicity rating (class IV), low water solubility and rapid degradation. In Meloidogyne incognita infested field trials with cotton and vegetables abamectin seed coating was as effective in reducing galling and increasing yields as carbamate and organophosphate nematicides. Seed coating with abamectin promises to be an ecologically sound and effective plant protection tool that has the potential to minimize the nematicide load in the environment.

ADVANTAGES AND DISADVANTAGES OF THE ELECTRONIC VERSION OF ONTA NEWSLETTER [VENTAJAS Y DESVENTAJAS DE LA VERSION ELECTRONICA DE LA CARTA INFORMATIVA ONTA]. **Renato N. Inserra[1] and José A. Chavarria[2], [1]Florida Department of Agriculture and Consumer Services, DPI, P.O. Box 147100, Gainesville FL, 32614-7100, U.S.A and [2]Department of Crop Protection, Mayagüez Campus, University of Puerto Rico, P.O. BOX 9030, Mayagüez, PR 00681-9030, U.S.A.—**According to article VI, Section 3 of the constitution of the Organization of Nematologists of Tropical America (ONTA), the ONTA Executive Committee appoints an Editor-in-Chief of the ONTA NEWSLETTER. The editor may choose a co-editor. The duties of these editors are to circulate the Organization's Newsletter to inform members of current events in ONTA, in Nematology and related Sciences. The Newsletter had a very important role in the past since it was the major means of communication to convey information about the organization's activities to its members. The two yearly issues of the Newsletter were prepared and distributed in a printed version to the members at a cost of about U.S. $1,200 annually. In 2000, the ONTA Executive Committee recommended Newsletter delivery via the ONTA website. As a result, the ONTA NEWSLETTER is now distributed solely as an electronic version posted on the website. This change reduced the cost for the preparation and distribution of the Newsletter. However, the importance of the role of the Newsletter as major communication tool for ONTA members has diminished, because the website where the Newsletter is posted, has acquired the major role as a source of information for the members. The future role of the Newsletter is unclear and needs to be revitalized. ONTA member input and contributions are needed for the Newsletter to continue as a valuable service.

THE ONTA FOUNDATION, BUILDING THE FUTURE NOW [LA FUNDACION ONTA, CONSTRUYENDO HOY EL FUTURO]. **C. Overstreet, Louisiana State University, Department of Plant Pathology and Crop Physiology, Baton Rouge, LA 70803, U.S.A. and Jimmy R. Rich, University of Florida, North Florida Research and Education Center, Quincy, FL 32351, U.S.A.—**The ONTA Foundation is dedicated to the advancement of our chosen science, Nematology. Foundations serve a valuable role by making funding available for travel, workshops, publication costs, and training. Most

foundations have received their start from large endowments, however, the ONTA Foundation was initiated by individual ONTA members. The ONTA Foundation was first established and chartered in 1994 as a nonprofit corporation in Florida U.S.A. The Foundation is a separate legal entity from the parent Organization of Nematologists of Tropical America. However, all Foundation activities and assets are under the management of the parent ONTA Executive Committee. ONTA Foundation resources have been slowly but steadily increasing over the years through the generous contributions of ONTA members. To date, 56 ONTA members have contributed to the Foundation and these members represent over 15 countries worldwide. Activities of the Foundation to date have been limited, and rather, the focus has been upon asset accumulation. The major Foundation project has been sponsorship of the Student Poster Competition at ONTA Annual meetings, which includes awards of both cash prizes and plaques. The Foundation is a vehicle to help ONTA build the future of Nematology. Foundation goals are to provide students and fellow scientists in Nematology the technologies and tools to impact the future of our science. Funding and support provided by the ONTA Foundation will act as a catalyst to encourage and develop these future generations of Nematologists and promote the science that has contributed so much to each of us and mankind.

ONTA ONLINE: COMMUNICATING TO THE WORLD [ONTA ONLINE: COMUNICANDO AL MUNDO]. **Jimmy R. Rich[1] and Aurelio Ciancio[2], [1]University of Florida, 155 Research Road, Quincy, FL 32351 U.S.A. and CNR, Instituto per la Protezione delle Piante, Sezione di Bari,Via Amendola 165/A, 70126 Bari, Italy.—**The ONTA web site (*www.ontaweb.org*) was created in 1994 in response to the growing opportunities for use of web-based information technologies and the strong need for reliable communication among the Organization's worldwide membership. The site has evolved to well over 100 pages of content including a Spanish language-mirror site created in 1998 (*http://srv.ba.cnr.it/ciancio/ONTA/Ontaweb-S.html*). From the onset, the two web sites were created and are maintained without cost or obligation to ONTA. This has been accomplished with the fine support of our laboratory staffs, internal funding, and the 'free of charge' internet server space provided by our respective institutions. Progress in developing these sites has been steady over the past 10 years. They now serve as a source for most information pertaining to ONTA operations including the constitution, operations manual, annual meeting announcements, officers and award winners, and membership lists. In addition, the ONTA NEWSLETTER is published solely on the ONTA web sites, and free access to both current and back issues of NEMATROPICA is available through these outlets. The WWW has provided almost limitless opportunities for the cataloging and now even interactive information exchange. We propose to expand the ONTA sites to include a virtual Nematological library to archive auto-tutorials, presentations, reference materials and taxonomic keys. In addition, back issues of the Newsletter need archiving and memorabilia from ONTA history should be displayed online. Help from ONTA members is essential for this ambitious 'second phase' of web site development. Please contribute your design ideas, information, web links and other items of interest, and as importantly, volunteer time and effort to make the ONTA web sites truly outstanding.

ONTA ORGANIZATIONAL STRUCTURE AND MEMBER INVOLVEMENT OPPORTUNITIES [ESTRUCTURA ORGANIZATIVA DE ONTA Y OPORTUNIDADES DE INVOLUCRARSE]. **G. R. Noel, USDA, Agricultural Research Service, Urbana, IL 61801, U.S.A.—**The history of Onta began in 1967 when nematologists met in Rio Piedras, Puerto Rico during the first symposium on tropical nematology. Several of those nematologists met on december 2, 1967 in San Juan, Puerto Rico to form "The Organization of Tropical American Nematologists". Those who made the historic decision to form the society were Alejandro Ayala, Jesse Roman, R. Chevres-Roman and L. F. Martorell of Puerto Rico, R. Barriga Olivares of Columbia, G. Blair of Trinidad, J. E. Edmunds of St. Lucia, and J. A. Winchester and A. C. Tarjan of the U.S.A. The first meeting was held in Sarasota, Florida in November, 1968 and was attended by 44 individuals from 10 countries. A. C. Tarjan was the first President. Those visionary nematologists formed the society with the anticipation of advancing the science of nematology in Tropical America. The success of their efforts have been due to the willingness of in-

dividuals to take hold of their vision. In particular, Rodrigo Rodriguez-Kábana during a time that Onta struggled to survive, preserved *Nematropica* as a viable journal. The old guard is stepping aside, and Onta needs younger people to take hold of the vision of those nematologists who first met in 1967. There are many opportunities to serve in Onta and to help keep the society viable. Foremost is for members to publish their research in *Nematropica*. The journal continually struggles to have sufficient numbers of high quality manuscripts. Members of Onta do excellent research, and the rest of the agricultural community needs to know this. Two committees that need much greater involvement are the Honors and Awards Committee and the Nominations Committee. The Home Page Committee and Foundation Committee welcome more member participation. Historically, the Treasurer has been from Puerto Rico where Onta is incorporated. In this time of electronic communication the Secretary does not have to be from the U.S. Perhaps the most critical positions in Onta are the English and Spanish editors of *Nematropica*. Seriously consider volunteering for these two important positions. Onta will remain strong only as long as more members are willing to make some sacrifice for the benefit of the society.

PINC: A GRADUATE EDUCATION OPPORTUNITY IN NEMATOLOGY [PINC: UNA OPORTUNIDAD DE EDUCACION DE GRADO SUPERIOR EN NEMATOLOGIA]. **Maurice Moens, Gent University, Laboratory for Agrozoology, Coupure 555, 9000, Gent, Belgium.—**The Post-Graduate International Nematology Course (PINC) at Ghent University started in 1992 and is financed by VLIR (Flemish Interuniversity Council). Seven students attended the course during the first year. Since then, the number of students fluctuated between 9 and 18; they were always selected out of about 90 applications per year. Over the twelve years, 127 students obtained the degree of 'Master of Science in Nematology'. The majority of the students come from developing countries; unfortunately, only 11.1 % originate from Latin America. The Programme comprises lectures and exercises. These are grouped into two main options: (i) nematology applied to agroecosystems and (ii) nematology applied to natural ecosystems. Students with a main interest in taxonomy can select the taxonomical subjects of both options. The study is finalized with a personal research project. Seminars and study visits abroad bring the students in contact with estabilished nematologists. Alumni have access to additional grants. Details about admission requirements and possible scholarships are given.

ORAL PAPER SESSIONS

EVALUACION DE TRES ALTERNATIVAS AL BROMURO DE METILO EN CONTROL DE NEMATODOS EN TOMATES EN INVERNADEROS [EVALUATION OF THREE ALTERNATIVES TO METHYL BROMIDE IN THE CONTROL OF NEMATODES ON TOMATOES IN GREENHOUSES]. **E. Aballay E. y P. Meza D., Facultad de Ciencias Agronómicas, Universidad de Chile, Casilla 1004, Santiago, Chile, eaballay@uchile.cl.—**Uno de los principales problemas a nivel radical en el cultivo de tomates (*Lycersicon esculentum*) en Chile, lo constituyen los nematodos del género *Meloidogyne*. Tradicionalmente se controla con Bromuro de Metilo. Para el cultivo de verano-otoño en invernaderos se estableció un ensayo con el propósito de comparar alternativas a este fumigante. Se realizaron aplicaciones al suelo de Caduzaphos, (Rugby, 200 CS) 2.8 k i.a./ha y *Myrothecium verrucaria* (Ditera WG) 6.5 k i.a./ha, ambos aplicados en dosis completa en plantación y dosis dividida en dos y tres, cada 15 días. También se usó una mezcla de capsicina mas allyl-isothyocianato, (Dazitol) en dosis de 40, 80 y 120 l/ha de producto comercial 1 semana antes del transplante. Su efectividad se comparó con un tratamiento Standard en la zona, a base de bombonas de bromuro de metilo más cloropicrina (98:2), dosis de 45 g/m^2. La evaluación de juveniles 60 días post plantación, indica un grado de control significativo ($P < 0.05$) con Cadusaphos, Dazitol y bromuro, sobre 85%, en tanto *M. verrucaria* presentó una menor respuesta, cercana al 55%. El rendimiento en frutos señala diferencias significativas en los tratamientos con bromuro y Dazitol (>3.65 kg/planta) sobre el testigo (3.05 kg/planta), en tanto los nematicidas no fumigantes presentan valores inferiores, no significativos.

SUPPRESSION OF *MELOIDOGYNE INCOGNITA* BY SOIL APPLICATION OF *PASTEURIA PENETRANS* ISOLATE FROM Al-QASSIM AREA, SAUDI ARABIA [SUPRESIÓN DE *MELOIDOGYNE INCOGNITA* MEDIANTE APLICACIÓN AL SUELO DE UN AISLAMIENTO DE *PASTEURIA PENETRANS* DEL AREA DE Al-QASSIM]. **S. AL-Rehiayani, College of Agriculture and Veterinary Medicine, Al-Qassim University, Buriedah, Al-Qassim, Saudi Arabia.—**In a greenhouse experiment, the potential of *Pasteuria penetrans* isolate from Al-Qassim area for suppressing *Meloidogyne incognita* was evaluated over 3-year period by following up nematode population (J2s) in 20 kg potted soil. *Pasteuria penetrans* was inoculated in the first year only using infested field soil at rates of 0, 3.75, 7.5, 11.25, and 15 kg soil per pot. Three Eggplant seedlings were planted in each pot and inoculated with 20,000 J2s of *M. incognita*. Results indicated that the number of second-stage-juveniles (J2s) having *Pasteuria* attached increased with increasing inoculum levels. *Pasteuria penetrans* significantly reduced the densities of J2 six months after inoculation and the treatment with the highest rate had the lowest numbers. At the end of third year, treatments with higher rates (11.25 and 15 kg) had the greatest percentage of dead and infected J2s (90% and 100% respectively). This preliminary study has shown that *Pasteuria penetrans* isolate from Al-Qassim area has the potential to suppress *M. incognita* population but further field data is needed to determine the actual number of the bacterium endospores required for nematode suppression.

EVALUATION OF ADVANCED CLONES OF POTATO TO THE CYST NEMATODE *GLOBODERA ROSTOCHIENSIS* [EVALUACION DE CLONES AVANZADOS DE PAPA AL NEMATODO QUISTE *GLOBODERA ROSTOCHIENSIS*]. **G. Anaya[1], N. Jiménez-Perez[1], D. Rodríguez[1], R. Crozzoli[2] and N. Greco[3], [1]Universidad Centroccidental "Lisandro Alvarado", Postgrado de Agronomia, Apdo. 400, Barquisimeto, Venezuela, [2]Universidad Central de Venezuela, Facultad de Agronomía, Instituto de Zoología Agrícola, Apdo. 4579, Maracay, Venezuela and [3]CNR, Istituto per le Protezione delle Piante, Sezione di Bari, 70126 Bari, Italy.—***Globodera rostochiensis*** (Woll.) Behrens is one of the most important pathogens because it causes severe losses in potato yield so that it is necessary to search new resistant sources in inbreeding programs as control alternative. In this research we evaluated the genetic behavior of fifteen advanced clones of potato to *G. rostochiensis* pathotype Ro2 in Agua Negra, Jimenez County, Lara State. Potted plants were inoculated with an initial density (Pi) of 20 eggs/cm^3 soil at planting in a randomized design and clones resistance to cyst nematode was made based upon number of immature females and multiplication rate (Pf/Pi) nematode. Clones 393465-38 and 392634-21 showed to be resistant because of lower multiplication rate, 0.02 and 0.08, respectively, and a low number of immature females. Clones 393558-44, 392636-9 and 393073-15 were moderately resistant with multiplication rate of 5.06, 6.53 and 4.83, respectively. The remaining clones may be considered susceptible. Results suggest that clone 393465-38 should have resistant genes to *G. rostochiensis* (Ro2); however more information about its field performance is required.

EVALUATION OF A RESISTANT CLONE OF *SOLANUM TUBEROSUM* TO *GLOBODERA ROSTOCHIENSIS* [EVALUACION DE UN CLON DE *SOLANUM TUBEROSUM* RESISTENTE AL *GLOBODERA ROSTOCHIENSIS*]. **G. Anaya[1], N. Jiménez-Perez[1], D. Rodríguez[1], R. Crozzoli[2] and N. Greco[3], [1]Universidad Centroccidental "Lisandro Alvarado", Postgrado de Agronomía, Apdo. 400, Barquisimeto, Venezuela, [2]Universidad Central de Venezuela, Facultad de Agronomía, Instituto de Zoología Agrícola. Apdo. 4579, Maracay, Venezuela, and [3]CNR, Istituto per le Protezione delle Piante, Sezione di Bari, 70126 Bari, Italy.—**Resistance of the clone 393465-38 to *G. rostochiensis* Ro2 was evaluated under field conditions in Agua Negra, Jimenez County, Lara State. Microplots were inoculated with increasing population densities (Pi) of nematode (0, 0.125, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128 and 256 eggs/cm^3 soil) and arranged in a field randomized design. Plant height was less affected with lower initial nematode populations (0.125-8 eggs/cm^3 soil), while reduction in plant growth was evident when 32 or more eggs/cm^3 soil were used. The most severe effect was observed with Pi ≥ 128 cm^3 soil, 15 days after planting. Yield was estimated by fitting tuber weight data to Seinhorst's equation and relationship between initial density and tuber weight was expressed by the equation y = 0.34 +

$(0.66)Z^{Pi-T}$. Tolerance limit (T) was 0.5 eggs/cm^3 soil and minimum yield (m) was 0.34 for tuber weight at Pi ≥ 64 eggs/cm^3 soil. The greatest yield loss was 66%. A low reproduction rate of this nematode species was observed with Pi ≤ 8 eggs/cm^3 soil, while maximum reproduction rate was 1.42 at Pi = 64 eggs/cm^3 soil. Results suggest that clone 393465-38 may be considered as resistant to cyst nematode based upon lower reproduction rate and intolerant due to negative effects on yield.

REVISION OF MONONCHIDS (NEMATODA: MONONCHIDA) IN CULTIVATED SOILS FROM SPAIN. [REVISION DE MONONCHIDOS (NEMATODA: MONONCHIDA) EN SUELOS DE CULTIVO EN ESPAÑA]. **S. C. Arcos[1], D. Jimenez-Guirado[2], A. Bello[1] and M. Arias[1]. [1]Centro de Ciencias Medioambientales, CSIC, Serrano 115 dpdo, Madrid 28006, Spain and [2]Departamento de Zoología, Facultad de Ciencias, Universidad de Córdoba, Spain, scobacho@ccma.dsic.es.—**A revision of the nematodes belonging to Orden Mononchida in cultivated soils in Spain is carried out. Sixteen species from eight genera and four families have been found: *Anatonchus ginglymodontus* (4 records), *A. tridentatus* (17), *Clarkus papillatus* (122), *Coomansus parvus* (6), *Iotonchus rotundicaudatus* (14), *Miconchus longicaudatus* (9), *M. studeri* (2), *Mononchus truncatus* (8), *M. tunbridgensis* (1), *Mylonchulus brachyuris* (34), *M. brevicaudatus* (3), *M. cereris* (1), *M. sessus* (1), *M. sigmaturus* (78), *M. subsimilis* (3), *Prionchulus muscorum* (4) and *P. punctatus* (4). For the first time are reported from cultivated soils in Spain the following species: *A. ginglymodontus, M. studeri, M. truncates, M. tunbridgensis, M. brevicaudatus, M. cereris* and *P. punctatus.* Geographical distribution was analyzed, with most of the records belonging to the Central Plateau of Spain, Cataluña, Andalucía and Canary Islands. They appeared in 64 different crops, fruit trees being the best studied with 102 records, followed by vineyards with 87, vegetable crops (39) and less frequently in citrus (21), arable crops (9) and ornamentals (6). These nematodes are of special interest as bioindicators in soil systems conservation.

DISTRIBUTION OF *XIPHINEMA PYRENAICUM* DALMASSO, 1969 WITH NOTES ON *X. ACERI* CHIZHOV, TIEV & TURKINA, 1986 (NEMATODA: LONGIDORIDAE) [DISTRIBUCION DE *XIPHINEMA PYRENAICUM* DALMASSO, 1969 CON NOTAS SOBRE *X. ACERI* CHIZHOV, TIEV & TURKINA, 1986 (NEMATODA: LONGIDORIDAE)]. **M. Arias, M. Escuer, S. C. Arcos and A. Bello, Centro de Ciencias Medioambientales, CSIC, Serrano 115 dpdo, Madrid 28006, Spain, maria.arias@ccma.csic.es.—**A study of the distribution and morphometric characteristics of *X. pyrenaicum* and *X. aceri* was carried out as a consequence of their presence and spread in Spain. More than 50 populations of *X. pyrenaicum* have been studied and one of *X. aceri* that includes the four juvenile stages, undescribed until now. The study revealed that both species are typical of Mediterranean environments, with *X. pyrenaicum* being widespread in the circummediterranean basin.

VARIACION DE CARACTERISTICAS FENOLOGICAS EN ARBOLES DE GUAYABO (*PSIDIUM GUAJAVA* L.) INFESTADOS CON *MELOIDOGYNE INCOGNITA* Y TRATADOS CON MATERIA ORGÁNICA EN EL ESTADO ZULIA, VENEZUELA [CHANGES IN PHENOLOGICAL CHARACTERISTICS OF GUAVA TREES (*PSIDIUM GUAJAVA* L.) INFESTED WITH *MELOIDOGYNE INCOGNITA* AND TREATED WITH ORGANIC MATTER IN ZULIA STATE, VENEZUELA]. **Ana M. Casassa-Padrón[1], Merilyn Marín-Larreal[2], Evelyn Pérez-Pérez[3], Casilda González-Palmar[4], Dubia Chirinos-Torres[4], César González[5] y Luis Sandoval[6], [1]Universidad del Zulia (LUZ), Facultad de Agronomía, Instituto de Investigaciones Agronómicas (IIA), Apdo. 15205 Maracaibo, ZU4005, Estado Zulia, Venezuela, [2]LUZ, Facultad de Agronomía, Dpto. Botánica, [3]Centro Frutícola del Zulia-CORPOZULIA, Municipio Mara, Estado Zulia, Venezuela, [4]Proyecto FONACIT S1-2000000795, S1-2808, CONDES-LUZ No. CC-0802-01, No. CC-0194-03, No. 1736-98, [5]Centro Frutícola del Zulia-CORPOZULIA y [6]LUZ, Facultad de Agronomía, IIA. Maracaibo, Venezuela.—**La adición de enmiendas orgánicas al suelo favorece el crecimiento de las plantas y puede aprovecharse para recuperar árboles de guayabo afectados en su sistema radical por *Meloidogyne incognita.* Por ello, la acción biofumigante del estiércol de cabra y la composta de cachaza de caña de azúcar, se evaluó en la recuperación de guayabos de 7 años de edad, en un campo infestado con *M. incognita*, registrandose los cambios fenológicos y la fluc-

tuación poblacional del nematodo. Los tratamientos fueron: un testigo (T1), aplicaciones trimestrales de 30 (T2) y 60 (T3) kg/árbol de estiércol de cabra, 30 (T4) y 60 (T5) kg/árbol de composta de cachaza de caña de azúcar, así como la aplicación combinada de las compostas en dosis de 15 (T6) y 30 (T7) kg de cada una. Estos tratamientos se aplicaron a 21 árboles de guayabo, sembrados en el Centro Frutícola del Zulia-CORPOZULIA (11_00'00''LN 71_30'00''), municipio Mara, estado Zulia. Los registros mensuales de brotación, floración y fructificación, fueron expresados en porcentaje, con relación a los eventos fenológicos mencionados, así como las poblaciones de *M. incognita* (juveniles de segundo estadio/100 g de suelo y en 10 g de raíces). La fase de floración se presentó durante todo el año en los árboles tratados, mientras que en el testigo prevaleció la fase vegetativa. La fructificación también ocurrió todo el año y con mayor intensidad en el mes de julio, excepto en T1 y T3 que estuvieron en reposo al menos 6 meses, efecto probablemente relacionado con las dosis de composta. Las poblaciones del nematodo tendieron a disminuir en los árboles tratados comparados con el testigo. Los resultados indican que la utilización de enmiendas orgánicas favorece el aumento de la fase reproductiva de los árboles y la disminución de las poblaciones de *M. incognita*, representado una alternativa para el manejo integrado de patógenos en sistemas de producción frutícola.

POULTRY LITTER AS SOIL AMENDMENT FOR THE MANAGEMENT OF PLANT-PARASITIC NEMATODES ON PLANTAIN [GALLINAZA COMO ENMIENDA AL SUELO PARA EL MANEJO DE NEMATODOS FITOPARÁSITOS EN PLATANO]. **J. A. Chavarria-Carvajal[1], N. Vicente[1] and J. Ortiz[2], [1]Department of Crop Protection and [2]Department of Agricultural Economic, Mayagüez Campus, University of Puerto Rico, P.O. Box 9030, Mayagüez, PR 00681-9030, U.S.A., jose_chavarria@cca.uprm.edu.—**Annually Puerto Rico produces an average of 71,500 metric tons of poultry litter from the poultry industry. Accumulation of this material is a serious problem that represents an environment hazard and leads to significant pollution of soils and waterways in the Island. If properly used this material could become a valuable soil amendment for nematode control, and will contribute to a proper disposal on agricultural soils. An experiment was carry-out at the Corozal Substation to determine the effectiveness of poultry litter for the management of plant-parasitic nematodes on plantain. The experimental design was a randomized complete block design (RCB) with four treatments and four replicates. Plantain (*Musa acuminata* × *M. balbisiana*, cv 'Maricongo') was used as planting material in a population density of 3086 plants/ha. Poultry litter was incorporated into a nematode-infested soil at rates of 7.3 and 14.5 kg/plant. A chemical treatment (phenamiphos at 1.5 g a. i/plant/application) and an absolute treatment were included to determine the effectiveness of the amendment. Results showed that poultry litter was effective reducing final soil and root populations of *Radopholus similis, Meloidogyne incognita, Rotylenchulus reniformis* and *Helicotylenchus multcinctus* when compared with the chemical and absolute controls. The amendment improved plant development and crop yield and also was effective reducing the damage caused by the corm-weevil (*Cosmopolites sordidus* Germar). These findings indicate that poultry litter represents a suitable ecological alternative for nematode management and waste disposal in Puerto Rico.

IDENTIFICATION OF ROOT-KNOT NEMATODE JUVENILES THROUGH MOLECULAR PROBES [IDENTIFICACION DE JUVENILES DE NEMATODOS AGALLADORES POR SONDAS MOLECULARES]. **A. Ciancio[1], A. Loffredo[2] and M. Finetti-Sialer[3], [1]CNR, Istituto per la Protezione delle Piante, Sezione di Bari, 70126 Bari, Italy, [2]Dipartimento di Entomologia Agraria, Università di Napoli, 80055 Portici, Italy and [3]Dipartimento di Protezione delle Piante dalle Malattie e Microbiologia Applicata, Univeristà degli Studi, 70126 Bari, Italy.—**Molecular beacons (MB) are DNA-based fluorescent probes capable to detect complementary target DNA sequences even at low template concentrations, when coupled with PCR. MB rely on a favoured hybridization thermodynamics and are sensitive to a single nucleotide mismatch, quenching any florescent emission. Using the alignement of four 18S and ITS2 rDNA gene sequences of *Meloidogyne incognita, M. javanica, M. hapla* and *M. arenaria* available in public databases, we designed a set of three different probes specifically targeting two polymorphic regions present only in *M. incognita* and a further region also present in *M. javanica.*

The probes were tested for nematode species identification using 1-5 juveniles as a template. Two populations of *M. incognita* and *M. javanica* were used. Single juveniles of *M. incognita* and *M. javanica* were hand picked from the soil sievate and placed after washings in vials for disruption with glass beads, in 50 ?l sterile distilled water. A Real-time PCR assay was then performed using a 15 ?l aliquot of the template, in presence of the fluorescent probes with the forward and reverse primers corresponding to the three probe regions to be amplified. Controls included 1-5 specimens of *Helicotylenchus* sp. or water. The combined application of the three probes was used to recognize the two species of *Meloidogyne*. Their potentials in nematode diagnostics and quarantine is discussed.

ULTRASTRUCTURE AND PHYLOGENETIC POSITION OF A *PASTEURIA* FORM PARASITIC IN *TYLENCHULUS SEMIPENETRANS*. [ULTRAESTRUCTURA Y POSICIÓN FILOGENETICA DE UNA FORMA DE *PASTEURIA* PARASITA DE *TYLENCHULUS SEMIPENETRANS*.]. **A. Ciancio[1], P. Leonetti[1], M. Cermola[2], M. Bourijate[3] and R. Favre[2], [1]CNR, Istituto per la Protezione delle Piante, 70126 Bari, Italy, [2]CNR, Istituto di Genetica A. Buzzati Traverso, 80125 Napoli, Italy and [3]INRA, Agadir, Morocco.—**The ultrastructure of a *Pasteuria* sp. form parasitizing a population of the citrus nematode *Tylenchulus semipenetrans* proceeding from Taroudant, Morocco, was investigated with Transmission electron microscopy. TEM data showed the general *Pasteuria* organization, based on an endospore with a central core, measuring 2.5 ± 0.2 µm and 1.3 ± 0.1 µm, respectively. Sections of propagules inside parasitized juveniles showed the central nuclear core region was surrounded by an electron dark cortex 180 nm thick. This layer was enclosed by an outer cortical layer 120-150 nm thick and an outer electron dark endospore coat, 80-100 nm thick. The latter was characterized by a progressive basal reduction allowing germ peg outgrowth. The endospore was provided with thin parasporal fibers responsible for host adhesion, a thick exosporium enclosing a coarse fibrillar matrix, and an external electron dark sporangial wall. The 16S rDNA gene region of the bacterium was sequenced. A 1366 bp PCR amplicon showed homology with other *Pasteuria* spp. sequences available in GenBank, including a specific region unique for the genus. A ClustalW alignement showed close relationships with GenBank sequences AF077672 and AF375881, both proceeding from *P. penetrans*. Research partially funded by bilateral research project CNR/CNCPRST.

EVALUACIÓN DEL NEMATICIDA ECOLÓGICO NEMATRON® Y *METARRHIZIUM ANISOPLIAE*, EN EL CONTROL DE *GLOBODERA* spp. [EVALUATION OF THE ECOLOGICAL NEMATICIDE NEMATRON® AND *METARRHIZIUM ANISOPLIAE,* FOR THE CONTROL OF *GLOBODERA* spp.]. **M. Cordero y M. Gandica, Universidad Nacional Experimental Del Táchira, Decanato de Investigación, Apdo 436, Táchira, Venezuela.—**Se evaluó la efectividad del nematicída Nematron® (Hidroxipopenal azadirachtina) y *Metarrhizium anisopliae* (Ma) en el control de *Globodera* spp. Se evaluaron 10 tratamientos con 5 repeticiones, aplicando el nematicída y la solución de esporas del hongo en drench cada 7 y 15 días respectivamente: T1-T2: 1.40 cm^3/l, T3-T4: 1.90 cm^3/l, T5-T6: 2.40 cm^3/l y T7: 5.0 cm^3/l (2,7 gr i.a.) aplicado solo cada 15 días, como la dosis y frecuencia comercial recomendada por el fabricante; T8-T9: (Ma) a $3 \cdot 10^7$esporas/ml (100 cm^3/planta) y T0: Testigo. Como hospedero, se sembró la variedad de papa susceptible al nematodo, Diacol Capiro en bolsas de vivero con suelo previamente desinfestado. Se inoculó con una población inicial (Pi) de 7 h+J2/cm^3 de suelo. Las dosis utilizadas de Nematron® fueron determinadas a partir de una prueba DL50 y la dosis recomendada en la etiqueta del producto. Al finalizar el ensayo se determinaron los valores de las poblaciones finales (Pf), la tasa de multiplicación del nematodo y el porcentaje de materia seca por tratamiento, encontrándose que el mejor control se obtuvo en el tratamiento 2 (1.40 cm^3/l) de Nematron® aplicado cada 15 días, con una población final de 0.16 h+J2/cm^3 de suelo; en Ma el mejor control se presentó en el tratamiento 9, aplicado cada 15 días con una población final de 1 h+J2/cm^3 de suelo, comparados con el testigo con una Pf 9.2 h+J2/cm^3 de suelo. Los resultados obtenidos indican la efectividad del nematicída ecológico Nematron®, y de *M. anisopliae*, en el control de *Globodera* spp.

EFFECT OF *ROTYLENCHULUS RENIFORMIS* ON YIELD OF COWPEA IN POTS [EFECTO DE *ROTYLENCHULUS RENIFORMIS* SOBRE EL RENDIMIENTO DE FRIJOL EN MACETA]. **R. Crozzoli[1], G. Perichi[1] & N. Greco[2]. [1]Universidad Central de Venezuela, Facultad de Agronomía, Instituto de Zoología Agrícola, Laboratorio de Nematología Agrícola, Apdo. 4579, Maracay 2101-A, Venezuela & [2]CNR, Istituto per la Protezione delle Piante, Sezione di Bari, 70126 Bari, Italy.—**The relationship between a geometric series of ten initial densities (*Pi*) of *Rotylenchulus reniformis*, mixtures of eggs, juveniles and immature females from 0 and 64/cm^3 soil, and growth of cowpea (*Vigna unguiculata*) cv Blackeye was investigated in two-liter clay pots. Fitting the Seinhorst model, $y = m+(1-m)z^{Pi-T}$, to average seeds weight (70 days after sowing), tolerance limits (*T*) to the nematode of 0.12 eggs, juveniles and immature females/cm^3 soil, was derived. Minimum relative yields (*m*) for seeds weight was 0.65 at Pi ≥ 16 nematodes/cm^3. The maximum rate of nematode population increase was 32.16-fold and occurred at the lowest initial population density. The highest final population density (*Pf*) of the nematode was 10.27 eggs + juveniles + immature females and eggs/cm^3 soil and occurred at *Pi* = 1 juveniles + young females/cm^3 soil.

BREEDING FOR RESISTANCE TO ROOT-KNOT NEMATODES (*MELOIDOGYNE* SPP.) IN COMMON BEAN [MEJORAMIENTO PARA RESISTENCIA A NEMATODOS NODULADORES (*MELOIDOGYNE* SPP.) EN FRIJOL COMUN]. **M. Di Vito[1], B. Parisi[2], A. Carboni[2] and F. Catalano[1], [1]CNR, Istituto per la Protezione delle Piante, Sezione di Bari, 70126 Bari, Italy and [2]Istituto Sperimentale per le Colture Industriali (ISCI), MiPAF, 40128 Bologna, Italy.—**The root-knot nematodes *Meloidogyne incognita* and *M. javanica* are the most common and damaging nematodes of common bean (*Phaseolus vulgaris*) in several countries. In Italy, the crop is one of the most common food legumes and is severely damaged by these pathogens under both field and greenhouse conditions. Nematicides and other management practices satisfactorily control these nematodes but are expensive and may cause environmental pollution. The use of resistant cultivars, when available, is an effective alternative management method to the use of nematicides. Accessions and lines of common bean Alabama 1, A 445, Blanco Laran, PI 165426, Black Turtle II, and the new Italian inbreed lines ISCI 112/94-27, ISCI 197/151-5, ISCI 213/28-4 and ISCI 481/16-9 were screened for their reaction to Italian populations of *M. incognita* race 1 and 2, *M. javanica*, *M. arenaria* race 2 and *M. hapla*. Alabama 1 and PI 156426 were resistant to all Italian populations of the nematodes; A445 was resistant to *M. incognita* race 1 and 2 and *M. javanica*; and ISCI 197/151-5 was resistant to *M. incognita* race 1 and *M. arenaria*. The remaining genotypes were susceptible to all nematode populations tested. Alabama 1, A 445 and PI 156426 were used in an innovative breeding program to introduce resistance to root-knot nematodes into several Italian types (climbing and dwarf) of common bean. More than 2000 crosses were made and the reaction of F_1 and F_2 progenies to these damaging nematodes was analyzed both under greenhouse and field conditions. The preliminary results suggest that resistance to *Meloidogyne* spp. in common bean appears to be regulated by dominant gene(s), which may facilitate breeding efforts to produce root-knot nematode resistant bean lines.

EVALUATION OF FIVE MEXICAN ISOLATES OF *POCHONIA CHLAMYDOSPORIA* (GODDARD) ZARE, EVANS & GAMS FOR THE CONTROL OF *NACOBBUS ABERRANS* (THORNE) THORNE Y ALLEN [EVALUACIÓN DE CINCO AISLAMIENTOS MEXICANOS DE *POCHONIA CHLAMYDOSPORIA* (GODDARD) ZARE, EVANS & GAMS, PARA EL CONTROL DE *NACOBBUS ABERRANS* (THORNE) THORNE Y ALLEN]. **A. Doroteo-Mendoza[1], F. Franco-Navarro[2] y J. Alfonsina-Hernández[2], [1]FESC-UNAM, Cuautitlan Izcalli, Mexico State, Mexico and [2]IFIT-Colegio de Postgraduados, Montecillo, Mexico State, Mexico 56230.—**Parasitism of five isolates of the nematophagous fungus *Pochonia chlamydosporia* (MPc1-MPc5) on *Nacobbus aberrans* eggs from two populations, (Montecillo, Mexico State and Tecamachalco, Puebla), was determined under controlled conditions. Two different experiments were conducted using different inoculum source of the fungus. In the first experiment, chlamydospores from colonized rice ($5 \cdot 10^3$ chlamydospores per plate) were applied, and in the second experiment, chlamydospores were from plates with the fungus growing on potato-agar

(PA) for 2-3 weeks (application of a mass quantity of chlamydopores). Both experiments consisted of 10 treatments, each one with five replications, and five plates without fungus (negative controls). The parasitism level was assessed in standard bioassays on plates of water-agar with antibiotics 4 days after inoculation with nematode eggs from both populations. There were highly significant differences in percentage parasitism among isolates (Tukey, _ = 0.01). When colonized rice was used, the isolates which parasitised most eggs from the Montecillo and Tecamachalco populations, respectively, were MPc1 (87% and 81%) and MPc5 (77% and 79%). When chlamydospores from plates with PA were used, the isolates which parasitised most eggs from the Montecillo and Tecamachalco populations, respectively, were MPc1 (86% and 78%) and MPc5 (89% and 83%), again. Although there was no great effect of the inoculum type on the parasitism results, the nematode eggs from both populations were significantly more susceptible to MPc1 and MPc5 isolates. Both isolates could be used for the biological control of *N. aberrans* (Project: MiCoSPA. ICA4-CT-2002-10044).

PEST MANAGEMENT IN URBAN AGRICULTURE SYSTEMS: A CASE STUDY WITH PLANT-PARASITIC NEMATODES [MANEJO DE PLAGAS EN SISTEMAS DE AGRICULTURA URBANA: UN ESTUDIO DE CASO CON NEMATODOS PARASITOS DE PLANTAS]. **Emilio Fernandez[1], Antonio Lobaina[1], Ricardo Cuadra[2] and Alejandro de Humboldt[2], [1]Instituto de Investigaciones de Sanidad Vegetal (INISAV), Calle 110 #514, Miramar Playa, Ciudad Habana, Cuba, and [2]Instituto de Investigaciones Fundamentales en Agricultura Tropical (INIFAT), Calle 1, Santiago de las Vegas, Ciudad Habana, Cuba.**—Vegetable production under urban and peri-urban conditions has been developed in Cuba using a minimum of resources and implementing systems without agrochemicals. These cropping systems provide fresh vegetables to urban inhabitants that are a source of employment and avoid transportation costs and delays from the countryside. Urban agriculture has all pest types associated with conventional agriculture although sometimes the behavior of pests is different than in rural conditions. Plant-parasitic nematodes are included in the most damaging group because of the high susceptibility of most vegetable crops. Many studies have been conducted with nematodes such as surveys of species, screening of commercial varieties, and physical, cultural and biological control methods. We have found root-knot nematodes widely distributed in urban agricultural systems, mostly *Meloidogyne incognita*. Other species such as *Rotylenchulus reniformis* have local importance while species of *Helicotylenchus* and *Pratylenchus* are not associated with economical damage. The use of nematode-free transplants is very important, and all soils and organic matter are sampled in order to avoid problems in later production. The use of soil solarization in July-August has shown good results in the management of nematodes, weeds and fungi. Crop rotation with onions, garlic and the intercropping with *Tagetes* are common practices to reduce *M. incognita* populations. The use of trap crops such as lettuce is an economical and practical tool to reduce root-knot nematode populations. Biofumigation with organic matter such as *Brassica* residues and humus have shown promising results in alleviating nematode problems. With respect to biological control, the use of *Trichoderma harzianum* (applied as a preventive to seedlings) suppresses *Meloidogyne* populations. Other biological agents such as *Pochonia chlamydosporia* (= *Verticillium chlamydosporium*) and *Corynebacterium paurometabolum* have shown activity under some conditions while *Pasteuria penetrans* is presently under study. New studies are being conducted to control nematodes and include the use of entomopathogenic nematodes, resistant varieties, new combinations for crop rotation and the impact of different cultural practices.

DIVERSITY OF NEMATODES IN FOUR LAND USE MOSAICS WITH DIFFERENT MANAGEMENT INTENSITY INSIDE THE BIOSPHERE RESERVE "LOS TUXTLAS", VERACRUZ, MEXICO [DIVERSIDAD DE NEMATODOS EN CUATRO MOSAICOS DE USO DE SUELO CON DIFERENTE INTENSIDAD DE MANEJO DENTRO DE LA RESERVA DE LA BIOSFERA "LOS TUXTLAS", VERACRUZ, MÉXICO]. **F. Franco-Navarro[1] and K. Vilchis-Martínez[2], [1]IFIT-Colegio de Postgraduados, Montecillo, Mexico State, Mexico 56230 and [2]FESC-UNAM, Cuautitlan Izcalli, Mexico State, Mexico.**—This study was conducted within the Biosphere reserve "Los Tuxtlas", Veracruz, Mex-

ico, to examine the diversity of nematodes from soils with differing management intensity. Inside three localities, four land use mosaics (pasture, maize field, agroforesty and jungle) were selected and eight sampling points were located inside each one (distance between points: 200 m); from each point, one soil sample (made up of 12 subsamples) was taken (total: 96 soil samples). For nematode extraction, 300 g of soil per sample was processed by sieving and then by the centrifugation-sugar flotation method. The extracted nematodes were killed by a microwave at 60°C, fixed with 4% formalin, and the suspension was adjusted to 10 ml. The nematode population from each sample was counted by randomly removing 1 ml from the solution, and the total number was calculated by the mean of three counts _ 10. The data were then transformed into different ecological parameters: abundance (A), genus' richness (GR), Simpson's diversity index (SDI) and Shannon's diversity index (ShDI). Although there was no significant difference among land use mosaics at two localities, at one of them A, GR, SDI and ShDI were higher in the jungle (819, 15, 0.8184 and 2.1031, respectively) than in the other land use mosaics; at the second one, the highest values were from pasture (577, 15, 0.8574 and 2.2214, respectively). At the third locality there were significant differences among land use mosaics; all ecological parameters were higher in the jungle: A=1469, GR=35, SDI=0.9197 and ShDI=2.9370. Genera of bacterial feeders, fungal feeders, plant parasites, omnivores and predators are being identified and other ecological parameters will be calculated. (Project: BGBD, funded by GEF).

EFECTIVIDAD BIOLOGICA DEL NEMATICIDA ORGANICO QL AGRI 35 PARA EL CONTROL DE *MELOIDOGYNE* SPP. SOBRE PEPINO Y TOMATE EN SINALOA, MEXICO [BIOLOGICAL EFFICACY OF THE ORGANIC NEMATICIDE QL AGRI 35 FOR THE CONTROL OF *MELOIDOGYNE* SPP. ON CUCUMBER AND TOMATO IN SINOLOA, MEXICO]. **V. García-Bernabé[1], N. Marban-Mendoza[1] y R. Trinidad-Correa[2], [1]Depto de Parasitología Agrícola, Universidad Autónoma Chapingo, Edo. de México, km 38.5 carretera México-Texcoco, CP 56230 and [2]Agrobo S. A de C.V., Juarez 461, Pte. Los Mochis, Sin. México.—**En el estado de Sinaloa, en los últimos tres lustros el sistema de cultivo para tomate y pepino se cambió drásticamente lo cual indujo, en parte, a diseminar nematodos particularmente los agalladores (*Meloidogyne* spp.). Casi todas las zonas hortícolas del estado muestran bajas de rendimiento asociados a nematodos agalladores y urge encontrar soluciones amigables ambientalmente que satisfagan también las normas locales de inocuidad. El propósito de este ensayo fue evaluar a los productos QL Agri 35 a diferentes dosis y aplicaciones de Ditera y Vydate. Los parámetros fueron altura de plantas, rendimiento e índice de agallamiento radical. En pepino la mayor altura se obtuvo con Vydate (5 L.ha), seguido por QL 35 (10 L.ha) y testigo con promedios de 75.3, 67.5 y 60.1 cm respectivamente. En tomate el tratamiento QL 35 (5 L.ha), Ditera y el testigo provocarón crecimiento de 82, 80 y 70 cm, respectivamente, sin que hubiese diferencias significativas (P = 0.05). En rendimiento de pepino (# frutos.ha) todos los tratamientos superaron al testigo (P = 0.05) el cual tuvo 7,900, Vydate (16,600) y QL 35 (5 L.ha) con 15,700 frutos. En tomate el QL 35 (5 L.ha) indujo mayor rendimiento (120,000 frutos.ha) comparado con el testigo (53,000 frutos.ha). Con respecto al índice de agallamiento (IA) en pepino, los tres tratamientos de QL 35 indujerón un porcentaje (35-40%) similar a Vydate (40%) pero muy diferente a Ditera (80%) y el testigo (100%). Resultados similares se obtuvierón en tomate. El producto QL Agri 35 muestra resultados alentadores cuando es aplicado en dos subdosis (5 L.ha) o semanalmente a (10 L.ha) en condiciones de alta presión de inoculo.

ENZYMATIC ACTIVITY OF PAL IN CHILLI CM-334 AND ITS POSSIBLE RELATION WITH RESISTANCE BREAKING TO *PHYTOPHTHORA CAPSICI* BY *NACOBBUS ABERRANS* [ACTIVIDAD ENZIMÁTICA DE PAL EN CHILE CM-334 Y SU POSIBLE RELACIÓN CON EL ROMPIMIENTO DE RESISTENCIA A *PHYTOPHTHORA CAPSICI* POR *NACOBBUS ABERRANS*]. **D. Godinez-Vidal[1], E. Zavaleta-Mejía[1], J. Lara-Reyna[1], R. I. Rojas-Martínez[1] and M. Rocha-Sosa[2], [1]Programa de Fitopatología, Colegio de Postgraduados, Montecillo, Edo. de México, 56230 México and [2]Instituto de Biotecnología, UNAM, Cuernavaca, Morelos, Méx. 62210, zavaleta@colpos.mx.—**It has been proposed that in chilli CM-334 the expression of the genes and the enzymatic activity of phenylalanine ammo-

nia-lyase (PAL), could be related with resistance breaking to *Phytophthora capsici* by *Nacobbus aberrans*. The breakdown of resistance is clearly evident when the inoculation with the oomycete is made 21 days after the inoculation with the nematode. The objective of this research was to compare the activity of PAL in CM-334 plants inoculated and noninoculated with these pathogens. The activity of the enzyme was low in plants inoculated only with the nematode, in comparison to noninoculated control; a higher reduction (48%, as compared to the control) in the activity was observed 21 days after the inoculation with the nematode. When the activity of PAL was estimated at different times after the inoculation with *P. capsici*, the activity was significantly higher (Tukey, _ = 0.01) in plants inoculated only with the oomycete, in comparison to the enzymatic activity of plants inoculated only with the nematode, with both pathogens and the noninoculated control. The results obtained suggest that the breakdown of resistance to *P. capsici* by *N. aberrans* in chilli CM-334, might in part be explained by a reduction in the activity of PAL, probably preceded by a down regulation of the gene expression induced by *N. aberrans*. (Project: CONACYT 28594-b).

EVALUACIÓN DE ALTERNATIVAS AL BROMURO DE METILO PARA EL MANEJO DE *MELOIDOGYNE* SPP. EN CASA DE CULTIVO EN CUBA [EVALUATION OF ALTERNATIVES TO METHYL BROMIDE FOR THE MANAGEMENT OF *MELOIDOGYNE* SPP. IN SHELTERED CULTIVATION SYSTEMS]. **L. Gómez[1], M. G. Rodríguez[1], L. Sánchez[1], E. Fernández[2], L. Diaz-Viruliche[3], A. Casanova[4], F. María González[4], R. Cuadra[5] y L. Hidalgo[1], [1]Centro Nacional de Sanidad Agropecuaria (CENSA), Apdo 10, San José de las Lajas, Habana, Cuba, [2]Instituto de Investigaciones de Sanidad Vegetal, [3]Facultad de Agronomía, Universidad Agraria de La Habana, [4]Instituto de Investigaciones Hortícolas "Liliana Dimitrova" and [5]Instituto de Investigaciones Fundamentales de Agricultura Tropical, Cuba.—**La construcción e instalación en Cuba de casas de cultivo tapado (túneles) comenzó en los años 90, con la finalidad de producir vegetales para abastecer la red de hoteles y la población del país. Los nematodos agalladores (*Meloidogyne* spp.) habitan en todos los suelos destinados a cultivo en Cuba, por lo cual para el establecimiento de estructuras o instalaciones de túneles se exige el examen nematológico y medidas de saneamiento. Para determinar las afectaciones de *Meloidogyne* spp. en las hortalizas mantenidas en túnel (tomate, melón, sandia y pimiento) y evaluar las diferentes alternativas para el manejo de especies y razas de *Meloidogyne*, se ejecutó el presente trabajo. Se hizo una encuesta que se aplicó en 12 sitios del país mediante investigación participativa en las regiones Occidente, Centro y Oriente. Los resultados evidenciaron que *Meloidogyne* spp., constituye la principal plaga del tomate en estos sistemas y que afecta a los otros tres en diferente proporción, de acuerdo al sitio, especie presente, etc. De igual forma se elaboró y se puso a disposición de los productores un material educativo para su valoración y algunas medidas para el manejo de poblaciones de nematodos. Como alternativa para sustituir el bromuro de metilo se evaluó la biofumigación con *Brassica* sp. (4 a 8 kg/m^2) para el control de *M. arenaria* y *M. incognita* en túneles. Después de 21 días de introducidos los restos de cosecha, se obtuvieron reducciones del grado de infestación de 5 a 3 (según una escala cualitativa), mostrándose las potencialidades de esa práctica en túneles. También se evaluaron patrones de *Lycopersicon esculentum, Solanum torvum* y *Capsicum annuum* frente a *M. incognita*, como portainjertos de híbridos de tomate y pimiento. Los patrones de *L. esculentum* resultaron muy susceptibles al nematodo, pues la población creció mas de 10 veces con relación al inoculo inicial. Resultados preliminares indican que los materiales de *S. torvum* y *C. annuum* presentan diferentes grados de resistencia al nematodo.

ALTERACIONES HISTOLÓGICAS EN NUEVE MATERIALES DE PASIFLORAS INDUCIDAS POR *ROTYLENCHULUS RENIFORMIS* [HISTOLOGICAL RESPONSES IN NINE GENOTYPES OF PASSION FLOWER INDUCED BY *ROTYLENCHULUS RENIFORMIS*]. **María Alejandra Gómez, Zoraida Suárez H. y Ligia Carolina Rosales, Instituto Nacional de Investigaciones Agropecuarias-CENIAP, Protección Vegetal, Zona Universitaria El Limón, Maracay 2101, Aragua, Venezuela, zsuarez@inia.gov.ve.—**Para determinar las alteraciones histológicas inducidas por *Rotylenchulus reniformis* en *Passiflora* spp., se evaluaron del germoplasma del CENIAP ocho accesiones de *Passiflora edulis*

f. *flavicarpa* identificadas como 214-1, 219-1, 219 -2, 221, 232-1, 236-2, 247-2 y 241 y una de *P. quadrangularis*, la 231. Segmentos de 0,5-1 cm de largo de raíces jóvenes de plantas inoculadas con 5000 nematodos/kg de suelo fueron fijadas en formalina-acido acético-alcohol (FAA), deshidratadas en una cadena ascendente de terbutanol (TBA), embebidas en parafina, cortadas en secciones de 15 ?m de grosor, coloreadas con la tinción Cuádruple de Triarch (modificada por Suárez) y montadas en bálsamo de Canadá. Las accesiones 219-2, 232-2 y 247-2 presentaron una necrosis limitada a las células adyacentes al cuerpo del nematodo. En la 241 se evidenció una necrosis entre los tejidos del cilindro vascular; mientras que en la 221, se observó una necrosis entre el floema y la endodermis. En la 231 se observó un sincitio vacío y la presencia de tílides en los vasos xilemáticos, además de nematodos filiformes confinados en el parénquima cortical. Estas respuestas expresan un reacción de resistencia del hospedero hacia *R. reniformis* que limitaron el desarrollo óptimo del nematodo, con un Factor de Reproducción que fue menor o igual a uno. En la 214-1 y 236-2 se observaron reacciones parecidas a las de las plantas susceptibles como es la presencia de formación de clavija y en el sincitio y no de reacciones típicas de resistencia, por lo que estarían involucrados otros mecanismos que el estudio no reflejó. En la 219-1 se observaron las reacciones típicas de una planta susceptible.

CHEMICAL CONTROL OF *MELOIDOGYNE CHITWOODI* ON POTATO IN IDAHO [CONTROL QUIMICO DE *MELOIDOGYNE CHITWOODI* EN PAPA EN IDAHO]. **Saad L. Hafez, P. Sundararaj and R. Portenier, University of Idaho, Parma Research and Extension Center, 29603 U of I Ln, Parma, ID 83660, U.S.A.—**Two field experiments were conducted at the University of Idaho, Idaho, U.S.A. to study the efficacy of chemical nematicides for control of Columbia root-knot nematode in potato. Both experiments were laid out in a randomized complete block design with 13 and seven treatments each with seven replications in a sandy loam field. In the first experiment Vapam HL and Telone II were applied in combination with Temik 15G or Mocap EC or Vydate L (fall or spring) or Fosthiazate. In the second experiment efficacy of Mocap EC and Vapam (tank mix) were compared to Admire, Telone II, and Mocap alone for their efficacy on Columbia root knot nematode. Russet Burbank seed pieces were planted in rows 3 feet apart and 5 months after planting, the tubers were hand-harvested and weighed, graded and evaluated for nematode infection. Yield of tubers from different treatments of both studies indicated that there was a significant reduction in the percent nematode infection followed by an increase in marketable yield and total yield in different combinations of all treatments as compared to control plots. In the first experiment percent of tubers with nematode infection in treated plots ranged from 11 to 99.6. In the second experiment lowest level of nematode infection was recorded in the fall or spring application of Mocap + Vapam (tank mix) than other treatments. Percent of tubers with nematode infection in treated plots ranged from 8.6 to 91.9.

EFFICACY OF USING AT PLANT AND POST PLANT APPLICATION OF ALDICARB FOR CONTROL OF *HETERODERA SCHACHTII* ON SUGAR BEET [EFICACIA DEL USO DE APLICACIONES DE ALDICARB EN LA SIEMBRA Y POST-SIEMBRA PARA EL CONTROL DE *HETERODERA SCHACHTII* EN LA REMOLACHA]. **Saad L. Hafez, P. Sundararaj and R. Portenier. University of Idaho, Parma Research and Extension Center, 29603 U of I Ln, Parma, ID 83660, U.S.A.—**Two field experiments were conducted at the Parma Research and Extension Center, Parma, Idaho to evaluate the efficacy of aldicarb applied at planting or split application compared to Counter on sugar beet cyst nematode management. The experiments were laid out in a randomized complete block design with seven treatments for the first experiment and 10 treatments for the second experiment each with five replications. In the first experiment there was a significant difference in the sugar beet parameters due to the application of aldicarb treatment. Maximum beet yield and the highest beet vigor were recoded in the treatment with aldicarb applied at the rate of 33 lbs at planting followed by aldicarb applied as planting/post (20+13). Minimum beet yield and the lowest vigor were recorded in the plot treated with Counter. In the second experiment application of aldicarb at planting or split application 8 weeks after planting significantly increased the beet yield as compared to the untreated control. Percent yield increase (25.9%) was maximum in the treatment

with aldicarb applied at planting and post application. Lowest level of yield increase was observed in the plots treated with Counter alone while aldicarb applied along with Counter as post application significantly increased the yield. Aldicarb performed better than Counter in terms of beet yield and percent sugar.

VARIATION IN POPULATIONS OF *ROTYLENCHULUS RENIFORMIS* IN THE SOUTHERN U.S.A. [VARIABILIDAD ENTRE POBLACIONES DE *ROTYLENCHULUS RENIFOMIS* DEL SUR DE LOS U.S.A.]. **Yuhong Li and E. C. McGawley, LSU Ag Center, Dept. of Plant Pathology and Crop Physiology, Baton Rouge, LA 70803, U.S.A.—**Reproductive and genomic differences in populations of the reniform nematode, *Rotylenchulus reniformis*, are being studied among seven populations collected from Alabama, Arkansas, Florida, Hawaii, Louisiana, Mississippi, and Texas. Eight soybean lines (Lee 74, Peking, Plant Introductions (PIs) 88788, 90763, 209332, 437654, 89772, and Cloud) were each inoculated with 1,000 vermiform nematodes. After 30 days, the number of eggs per egg mass and egg masses per plant were determined. Across the eight lines, the number of eggs per egg mass ranged from 0 to 66, while the number of egg masses ranged from 0 to 64. The Alabama population did not reproduce on Peking, PI 90763, PI 437654 and PI 89772, while the Arkansas population reproduced on every line. Analysis of genomic differences among populations is based on examination of the two intergenic spacer regions (ITS1 an ITS2) by polymerase chain reactions (PCR) and restriction fragment length polymorphism (RFLP). Nematode genomic DNA is extracted from 10 swollen females dissected from tomato roots. A fragment with the size of approximately 1100 bp has been produced from every population. Digestion of the amplification product with a number of restriction enzymes will be followed to detect differences in RFLP banding patterns among populations.

EFFECT OF THE TEMPERATURE IN BIOFUMIGATION WITH CROP RESIDUES [EFECTO DE LA TEMPERATURA EN LA BIOFUMIGACIÓN CON RESIDUOS VEGETALES]**. J. A. López-Pérez[1], A. Ploeg[1], S. Edwards[1], T. Roubtsova[1] and A. Bello[2], [1]Department of Nematology, UC Riverside, 1303 Webber Hall, Riverside, CA 92521, U.S.A. and [2]Departamento de Agroecología, Centro de Ciencias Medioambientales (CSIC), Serrano 115, dpto 28006 Madrid, España.—**Most of the studies on biofumigation have focused on the type of biofumigant material. Only in a few cases has the effect of soil temperature been studied. Biofumigation is generally done in warm seasons, but the aim of this experiment was to find out if it is possible to use biofumigation in seasons or places where the temperature is not that high. We used residues of different crops, including broccoli as a standard and two different soils: the first experiment was done with an artificial soil mix (9 parts sand and one part potting mix) infested with *M. incognita* (2,000 eggs/100 g soil), and the second experiment was done with a sandy field soil naturally infested with the same species of root knot nematode (600 J2/100 g soil). Both types of soil were adjusted to 13% of moisture. The biofumigants chosen were: broccoli as a standard, and melon, and tomato plant residues. Chopped shoot material was mixed with the soil at a rate of 2% (w/w). Half of the treatments also received (non-sterilized) dried chicken manure (0.5%). The soil mixtures were then placed into 500 cm^3 jars closed mason jars. Jars were placed in waterbaths at temperatures of 20, 25 or °C with five replicates for each treatment and temperature. After 21 days, the soil was transferred to pots, and the next day a 2-week-old tomato plant var. UC82 was placed in each pot. Two months later, the experiment was terminated and plant growth and nematode infestation levels were determined and analyzed. The results show that in the sterile soil mix, biofumigation worked better than control except at 20°C, and that at lower temperature, adding chicken manure improved nematode control. On the other hand, in the natural soil, biofumigation was effective only at higher temperatures. The reason for these different results will be studied in further experiments.

ESTUDIO DE QUITOSANO (BIOREND) COMO COMPLEMENTO A LA ACCIÓN DE PRODUCTOS NEMATICIDAS, EN VID DE MESA Y VINÍFERA EN CHILE [STUDY OF QUITOSANO (BIOREND) AS A COMPLEMENT TO THE ACTIVITY OF NEMATICIDAL PRODUCTS IN TABLE AND WINE GRAPE IN CHILE]. **J. C. Magunacelaya, P. Abogabir y H. Pacheco, Universidad de Chile,**

Santiago, Chile, jmagunac@agricola.net.—El quitosano, poly-D-glucosamina, es un polímero natural que se obtiene del procesamiento del exoesqueleto de *Lithodes antartica* (Centolla), como producto de desecho de la industria de exportación de este crustáceo en la XII Región de Chile, Punta Arenas. El producto se comercializa como BioRend concentrado soluble (SL). Se realizaron ensayos para evaluar el efecto de la aplicación de BioRend sobre plantas y nemátodos fitoparásitos. El BioRend se aplicó en una dosis de 20 L/Ha y en dosis parcializadas de 10+10 L/ha, 10+5+5 L/ha y 5+5+5+5 L/ha, con intervalos de 10 días entre aplicaciones de las subdosis. Cuando BioRend se usó como complemento a la acción de un nematicida se aplicó 10 L/ha y 5+5 L/ha. Los nematicidas usados en los ensayos fueron etoprofos (Mocap) y fenamifos (nemacur). En Red Globe el mayor control de Criconemella sp. se tuvo cuando se aplicó BioRend después del nematicida, y en los tratamientos en que se aplicó Biorend sólo no hubo reducción de poblaciones del nemátodo, aún cuando se mejoró la calidad de las raíces de las plantas tratadas. En Chardonnay hubo control de *Meloidogyne ethiopica* en tratamientos con nematicida y nematicida más BioRend 5+5 L/ha. La reducción de población se mantuvo en el largo plazo. La calidad de raíces mejoró con los tratamientos de nematicida más Biorend y con el tratamiento de BioRend aplicado en 2 dosis. También en Chardonnay se logró un buen control de *M. ethiopica* con Nemacur más BioRend y los mejores efectos en el rendimiento se obtuvieron con BioRend destacándose la dosis parcializada 5+5+5+5 L/ha. En Red Globe y Chardonnay la población de nemátodos no fitoparásitos no se afectó por acción de los tratamientos con BioRend, y cuando hubo reducción de ésta, pronto se produjo una buena recuperación. Los resultados indican que el quitosano es una buena herramienta cuando se usa como complemento en el manejo de los nemátodos fitoparásitos porque por algún mecanismo se potencia la acción del nematicida, además de que se ayuda a la planta, que se vigoriza y defiende mejor de los nemátodos.

ACCIÓN NEMATICIDA Y BENEFICIOS PARA LA PLANTA (VAR. CHARDONNAY), DEL USO DE 1,3 DICLOROPROPENO (TRIFORM) EN SUELOS ALTAMENTE INFESTADOS CON *MELOIDOGYNE ETHIOPICA*, ENTRE LAS TEMPORADAS 2001 Y 2004 EN LA ZONA CENTRAL DE CHILE
[NEMATICIDAL ACTION AND BENEFITS TO THE PLANT (VAR. CHARDONNAY) FROM THE USE OF 1,3-DICHLOROPROPENE IN SOILS HIGHLY INFESTED WITH *MELOIDOGYNE ETHIOPICA* DURING THE SEASONS BETWEEN 2001 AND 2004 IN THE CENTRAL ZONE OF CHILE].
J. C. Magunacelaya[1], J. Pierce[2] y M. T. Ahumada[2], [1]Universidad de Chile, Santiago, Chile and [2]P. Universidad Católica de Valparaíso, Chile, jmagunac@agricola.net.—Se evalúa anualmente la acción nematicida de 1,3 dicloropropeno en viñedos Chardonnay de Viña Undurraga, Melipilla, Chile, aplicado en enero de 2002. Se mide los efectos benéficos para la planta mediante peso de poda, rendimiento y calidad de raíces. Se aplicó 3 dosis de 1,3D, 280, 370 y 467 litros/Ha. Luego de dos años, en cada sector fumigado se agregó tratamientos de Etoprofos. Se dispone de testigos en plantas en producción, que permitirán comparar en la planta las ventajas de la fumigación en el largo plazo, con plantas que nunca fueron fumigadas. Con este diseño, esta última temporada se tuvo 10 tratamientos, y las mayores reducciones de población de *Meloidogyne ethiopica* se encontraron con 1,3D + Etoprofos. La mayor frecuencia de machos se presentó en los tratamientos testigo absoluto. La presencia de machos se incrementó en la medida que se acerca el fin de la última temporada agrícola. Los tratamientos que presentaron menor presencia de machos de *M. ethiopica* fueron 1,3D en dosis baja, media y alta, con y sin Mocap en la tercera temporada. La mayor frecuencia de machos la presentaron los tratamientos de Nemacur y Mocap. Se obtuvo excelentes resultados de control de juveniles al aplicar Etoprofos en sectores fumigados con Triform. Los mejores resultados de control de *M. ethiopica* los tuvo Triform 467 L. Los Nemátodos no fitoparásitos tuvieron una rápida recuperación de sus poblaciones que se ha mantenido y mejorado a lo largo del tiempo, siendo las especies de nemátodos menos afectadas por los fumigantes. Aunque las plantas del sector fumigado no han llegado a producir, las plantas en producción del ensayo tratadas con Nemacur y Mocap muestran mayor calidad y cantidad de uva. El vigor de las plantas del sector fumigado con Triform a dosis máxima muestra mayor uniformidad, y todos los tratamientos fumigantes presentan mejor calidad de raíces que los

sectores no fumigados. La próxima temporada se podrá comparar rendimiento del sector replantado e iniciar el estudio financiero que permita determinar las ventajas o desventajas de los tratamiento.

CHEMICAL MANAGEMENT OF NEMATODES IN LOUISIANA: 2000-2003 FIELD AND MICROPLOT TRIALS WITH COTTON, SOYBEAN, SUGARCANE, RICE AND ASSORTED VEGETABLES [MANEJO QUIMICO DE NEMATODOS EN LOUISIANA: 2000-2003 INVESTIGACIONES DE CAMPO Y EN MICROPARCELAS CON ALGODON, SOYA, CAÑA DE AZUCAR, ARROZ Y HORTALIZAS]. **E. C. McGawley and M. J. Pontif, Department of Plant Pathology & Crop Physiology, Louisiana State University AgCenter, Baton Rouge, LA 70803, U.S.A., emcgawley@agctr.lsu.edu.**—Agri-Terra, a colloidal suspension containing 1% monobasic sodium phosphate as the active ingredient, has proven to be a safe and efficacious material for the management of many economically important plant parasitic nematode species in Louisiana. Popular cultivars of all major row crops plus a wide variety of vegetable species were evaluated in microplot and field trials during the period 2000-2003. In every trial, significant reductions in nematode populations were observed following application of this material. Harvest data from microplot trials, averaged over years, showed increases in plant dry weights over those of controls which averaged 51% for cotton, 114% for sugarcane, 79% for rice, and 129% for soybean. In field trials in which Agri-Terra was employed as an at-planting, in-furrow spray treatment (10 GPA of a 100:1 dilution), significant yield responses, when compared with those of non-treated controls, were observed in four consecutive years with cotton and in 2 of 3 years with soybean. In a multi-year field trial with sugarcane, the pounds of sugar per ton of cane harvested from the plant crop were numerically, but not significantly, greater than that of the non-treated control. At harvest of the first ratoon crop, however, there was a significant increase in the sugar content per ton of sugarcane. For each of these three crops, Agri-Terra was equal to or better than either Telone II or Methyl Bromide (applied 2 weeks prior to planting at rates of 80.8 and 115.3 lbs/AI per acre, respectively).

PRELIMINARY DESCRIPTION OF A BACTERIAL ENDOSYMBIONT OF SOYBEAN CYST NEMATODE, *HETERODERA GLYCINES* [DESCRIPCION PRELIMINAR DE UN ORGANISMO endoSIMBIOTICO BACTERIAL DEL NEMATODO QUISTE DE LA SOYA, *HETERODERA GLYCINES*]. **G. R. Noel[1,2] and N. Atibalentja[2], [1]USDA, Agricultural Research Service, Urbana, IL 61801, U.S.A. and [2]Department of Crop Sciences, University of Illinois, Urbana, IL 61801, U.S.A.**—Almost 25 years ago, transmission electron microscopy (TEM) revealed the occurrence of an intracellular "bacterium-like organism" in second-stage juveniles of *Heterodera glycines*. Additional TEM studies also found the bacterium in males and females. Since the bacterium cannot be cultured, we extracted DNA from surface-sterilized infected nematodes and used universal bacterial primers and to PCR amplify, clone, and sequence the near full length of the 16S rRNA gene of the bacterium. A BLAST search of DNA databases revealed a 93% similarity index to the '*Bacteriodetes*' symbiont, '*Canditatus Cardinium hertigii*'. This endosymbiont, which parastizes wasps of the genus *Encarsia*, was described in 2004. The endosymbiont of *H. glycines* has brush-like arrays of microfilament-like structures characteristic of the genus *Cardinium*. However, a dissimilarity index of 7% with *C. hertigii* indicates that the endosymbiont of *H. glycines* is a new species.

LIMITATIONS OF SOIL BULK ELECTRICAL CONDUCTIVITY AND NEMATODE MANAGEMENT ZONES [LIMITACIONES DEL USO DE LA CONDUCTIVIDAD ELÉCTRICA DEL SUELO PARA ESTABLECER ZONAS DE MANEJO DE NEMATODOS]. **C. Overstreet[1], M. Wolcott[1], E.C. McGawley[1], B. Padgett[2], G. Burris[3] and D. Sullivan[3], [1]Louisiana State University, Baton Rouge, LA 70803, [2]LSU AgCenter Northeast Research Station-Macon Ridge, Winnsboro, LA 71295 and [3]LSU AgCenter Northeast Research Station, St. Joseph, LA 71366, U.S.A.**—A study was conducted to evaluate the use of bulk soil electrical conductivity (SEC) and Southern root-knot nematode (*Meloidogyne incognita*) populations to create nematode management zones. SEC often correlates well to soil texture (sand or clay content) and can be particularly useful in defining soil types across a field. Root-knot nematode prefers sandy soils that correspond to low SEC readings. Two adjacent fields were investi-

gated in this study with soil derived from the Mississippi River alluvium. Each field was mapped first with a Veris® 3100 Soil EC Mapping System and sampled for nematodes using a 0.4 ha grid system based on the predominant SEC reading in that grid. The field closest to the river had the least variability, and the majority of the field (27.4 ha) had SEC readings of less than 30 mS/m. This field was divided into seven zones based on SEC levels, and root-knot nematode was found above threshold levels (250 nematodes per 500cm^3 of soil) across the majority of samples in all zones. Nematode management zones could not be delineated in this field. In the field farthest away from the river (32.2 ha), 10 zones based on SEC reading (3.4-104.6 mS/m) were established. Only four of these zones (SEC readings <33.8 mS/m) had root-knot nematodes that were primarily above the threshold level. This field could be divided into nematode management zones where a high percentage of the field would not have to be treated with a nematicide. SEC may be more useful in defining nematode management zones in soils which are highly variable rather than soils with a similar soil texture.

BIOLOGICAL EFFICACY OF *POCHONIA CHLAMYDOSPORIA* (GODDARD) ZARE, EVANS & GAMS FOR THE CONTROL OF *NACOBBUS ABERRANS* IN TOMATO [EFECTIVIDAD BIOLÓGICA DE *POCHONIA CHLAMYDOSPORIA* (GODDARD) ZARE, EVANS & GAMS PARA EL CONTROL DE *NACOBBUS ABERRANS* EN TOMATE]. **I. Pérez-Rodríguez[1], F. Franco-Navarro[2], I. Cid del Prado-Vera[2], V. Santiago-Santiago[1] and A. Montero-Pineda[1], [1]Instituto Tecnológico agropecuario No. 29, Xocoyucan, Tlaxcala, Mexico and [2]IFIT-Colegio de Postgraduados, Montecillo, Mexico State, Mexico 56230.—**Five isolates of *Pochonia chlamydosporia* (MPc1-MPc5), which were isolated from fields infested with *Nacobbus aberrans*, were tested as control agent of the false root-knot nematode in tomato cv. Río Grande under greenhouse conditions. This experiment was made up of 12 treatments, each one with four replications or plots (each plot with two tomato plants). There were positive and negative controls, and the rest of the treatments consisted of two doses (7,500 and 15,000 chlamydospores · g^{-1} of soil) of the different *P. chlamydosporia* isolates. These isolates, cultured on sterilised rice grains, were applied according each dose in a mixture with vermicompost. Soil used for the experiment was collected from a field naturally infested in Tecamachalco, Puebla, Mexico by *N. aberrans*. Fifty days after planting, different variables for plant, nematode and fungus were evaluated. According to results, plants treated with isolate MPc-5 high dose, showed the highest biomass, the lowest damage on roots and the lowest quantity of nematodes in soil and roots (Tukey, _ = 0.05). Isolate MPc-5 and isolate McP-1 could be reisolated from soil and roots after experiments; both isolates were present in eggs masses on petri dishes with water-agar. Results with isolate MPc-5 allow it to be considered as a potential agent for the biological control of the false root-knot nematode. (Project: MiCoSPA. ICA4-CT-2002-10044).

REACTION OF BANANA CLONES (*MUSA* SPP.) TO *MELOIDOGYNE INCOGNITA* RACE 4 [REACCION DE CLONES DE BANANO (*MUSA* SPP.) CONTRA *MELOIDOGYNE INCOGNITA* RACE 4]. **A. C. B. V. Pinto[1], M. B. da Fonsêca Júnior,[2] R. C. V. Tenente[3], O. A. Carrijo[4] and S. P. da Silva Neto[5], [1]CNPq Fellowship for under graduation student, UNICEUB, SEPN 707/909 Campus, Brasília, DF, Brazil, [2]CNPq Fellowship for under graduation student, Universidade Católica de Brasília, QS 07-Lote 01 (70.022-900), Taguatinga, DF, Brasil, [3]EMBRAPA/CENARGEN, CP 2372 Brasilia/DF Brazil, [4]CNPH/EMBRAPA, CP 0218 Brasilia/DF Brazil and [5]CAMPO, SEPN Q. 516, Conj. A nº 49, Brasilia DF/Brazil.—***Meloidogyne* spp. are among of the most important nematode pathogens of banana in different areas in Brazil, but have received insufficient attention by researchers there. The damage caused by these root-knot nematodes (RKN) is dependent on population size, fertility and soil type. Heavily infected banana plants suffer height reduction, weight loss, delayed maturation and even death. Our aim in this study was to describe the reactions of seven different banana clones to *Meloidogyne incognita* race 4, under glasshouse conditions. The tested clones were developed by a Breeding Program of Embrapa Cassava and Tropical Fruits Center and Agriculture Promotion Company. Ten days after micropropagated offspring were transplant to containers of sterilised soil + sand + manure, they were inoculated with 15,000 nematode eggs. The experimental design was completely ran-

domised with four replicates. Nematode reproduction was evaluated 120 days after inoculation by quantifying numbers of nematodes and eggs in roots and soil. The three clones Caipira, Grande Naine, and FHIA-18 (the susceptible standard) were highly susceptible to the nematode, allowing greater multiplication of *M. incognita* race 4 than the susceptible clones, Nanicão and Prata Zulu 57. Two clones, Maçã and Prata Anã, were slightly resistant, but none of the seven clones appeared moderately or completely resistant. Root and shoot weights of these clones were not significantly affected by RKN in this study.

IMPACT OF THREE WEED SPECIES ON REPRODUCTION OF *ROTYLENCHULUS RENIFORMIS* ON COTTON AND SOYBEAN [IMPACTO DE TRES ESPECIES DE MALEZA EN LA REPRODUCCION DE *ROTYLENCHULUS RENIFORMIS* EN ALGODON Y SOYA]. **M. J. Pontif and E. C. McGawley, LSU AgCenter, Dept. of Plant Pathology and Crop Physiology, Baton Rouge, LA 70803, U.S.A.—** From 1999-2002, microplot studies were conducted to determine the effects of cotton (LA. 887), soybean (Pioneer 96B21), and three endemic weed species, [morning glory-MG (*Ipomoea purpurea*), hemp sesbania-HS (*Sesbania exaltata*) and Johnson grass-JG (*Sorghum halepense*)], on reproduction of the reniform nematode, *Rotylenchulus reniformis*. Treatments were arranged as a RCB design with seven replications of seven treatments: 1) cotton or soybean alone; 2) MG alone; 3) JG alone; 4) HS alone; 5) cotton or soybean co-cultured with MG; 6) cotton or soybean co-cultured with JG; and 7) cotton or soybean co-cultured with HS. All seed were sown in the greenhouse in flats of fumigated soil and seedlings were transplanted after 2 weeks into microplots containing 15 kg of fumigated soil. Microplots were established in May-June and infested 2 weeks later with a suspension containing reniform nematode juveniles (cotton 1300-2000/microplot, soybean 1300-3000/microplot). All tests were harvested 60 days after inoculation. At harvest, plant material was dried and weighed, and a soil sample was collected from each microplot. Nematodes were than extracted from a 150 g subsample of soil using a sugar flotation/centrifugation procedure. Numbers of juveniles per microplot and reproductive values (R where R = Pf/Pi and Pf and Pi are final and initial inoculum levels, respectively) were calculated and data were analyzed using ANOVA and Tukey's HSD test. Over three trials (1998, 1999, 2000) the co-culture of cotton with any of the three weed species suppressed reproduction of reniform nematode significantly. Reniform nematode reproductive values for cotton alone averaged 63.2 at harvest, while those for MG, HS, and JG when alone averaged 50.6, 25.4 and 18.0, respectively at harvest. Reproductive values for the cotton-MG combination averaged 44.2 at harvest. Those for the cotton-HS combination averaged 30.1, and the cotton-JG combination averaged 25.0. Reniform reproduction data for soybean over 2001 and 2002 followed a trend similar to that observed for cotton. Reproductive values for soybean alone averaged 76.9 at harvest, while those for MG, HS, and JG when alone averaged 54.9, 35.7, and 20.8, respectively at harvest. Reproductive values for the soybean-MG combination averaged 103.2 at harvest. Those for the soybean-HS combination averaged 59.5, and the soybean-JG combination averaged 36.8. Suppression of reniform nematode could have resulted either from crowding due to the increased amount of biomass present in microplots containing two plant species or from the secretion of allelopathic compounds by weed roots. Studies are currently in progress to test the allelopathy hypothesis.

RESPONSES OF DIFFERENT *MUSA* AAA ACCESSIONS FROM THE CAVENDISH SUBGROUP TO NEMATODES [SUCEPTIBILIDAD DE VARIOS GENOTYPOS DE *MUSA* AAA DEL SUB-GRUPO CAVENDISH A NEMATODOS]. **P. Quénéhervé[1], Ph. Marie[2], M. Folliot[2] and S. Marie-Luce[1], [1]Pôle de Recherche Agronomique de la Martinique, IRD/CIRAD, B.P. 8006, 97259, Fort-de-France Cedex, Martinique and [2]CIRAD, TA 50/PS4, Avenue Agropolis, 34398, Montpellier Cedex 5, France.—**Bananas cultivated for export in the Caribbean are Cavendish cultivars which are all well known as very susceptible to burrowing nematodes (*Radopholus similis*), lesion nematodes (*Pratylenchus coffeae*) and root-knot nematodes (*Meloidogyne* spp.). As a result of a selection program from the agronomists and the geneticists from CIRAD, 12 different accessions of Musa AAA Grande Naine, issued from mass field selection, cloned and propagated in tissue culture were compared to five known local commer-

cial banana cultivars of Grande Naine (Americani, Petite Naine, Poyo, Williams, Zechalv) in two repeated experiments. The experiments were conducted in a growth chamber under controlled conditions. All banana cultivars were susceptible to nematode species, although different degrees of susceptibility were detected. Compared to the control (cv Williams) the reproductive factors of *R. similis* were significantly lowered from 0.7% (cv L52) to 60.1% (cv MA13). The reproductive factors of *P. coffeae* were significantly lowered from 9.7% (cv Jobo) to 48.4% and 64% (cv MA13, experiment 1 and 2). No significant differences were observed with *Meloidogyne incognita*. These unexpected findings have now to be confirmed in a field experiment but are of importance for the choice and commercialization of tissue culture propagated Cavendish plants for planting.

UPDATE OF PLANT PARASITIC NEMATODES AND THEIR CONTROL IN CUBA [ACTUALIZACION SOBRE NEMATODES PARASITOS DE PLANTAS EN CUBA Y SU CONTROL]**. M. G. Rodriguez[1], E. Fernandez[2] and H. Gandarilla[3], [1]National Center of Plant and Animal Health (CENSA), [2]Plant Health Research Institute (INISAV), [3]National Quarantine Laboratory (LCC), Cuba, mrguez@censa.edu.cu.—**Plant-parasitic nematodes are one of the most important pests in Cuba in food and ornamental plants in fields and soils under plastic tunnels. During each year, surveys are made by technicians of the Cuban National System of Plant Protection National System and in research several teams study the nematodes and their impact in crops. *Meloidogyne* spp. (*M. incognita*, *M. arenaria*, *M. javanica* and *M. mayaguensis*), *Radopholus similis*, *Pratylenchus coffeae*, *P. brachyurus*, *P. zeae* and *Xiphinema* spp. are the most important nematodes with wide distribution and several hosts. *Scutellonema bradys* causes losses in yam and *Rotylenchulus reniformis* in lettuce in specific areas. Among cyst nematodes, only one species is present in Cuba, *Cactodera cacti*, and it is important in some ornamental *Cactaceae*. Several management alternatives are recommended to farmers, but the most common are: the use of crop rotation, healthy seedlings and material for planting, bait plants (lettuces) and solarization. Several biological control agents are being developed and used in different agricultural systems (HeberNem®; KlamiC, a product that has as active ingredients the fungi *Pochonia chlamydosporia* and *Trichoderma* spp., among others). In the presentation, some examples of crops and their Integrated Nematode Management programs will be presented.

INTERNAL QUARANTINE FOR *MELOIDOGYNE MAYAGUENSIS* IN CUBA [*MELOIDOGYNE MAYAGUENSIS*, CUARENTENA INTERNAL EN CUBA]. **M. G. Rodriguez[1], I. Garcia[2] and H. Gandarilla[3], [1]National Center of Plant and Animal Health (CENSA), [2]Santiago de Cuba Province Laboratory, National Center of Plant Health (CNSV) and [3]National Quarantine Laboratory (LCC), Cuba, mrguez@censa.edu.cu.—***Meloidogyne mayaguensis* is a very dangerous and polyphagous nematode in the tropics. In Cuba, it is under internal quarantine measurements. This nematode was found in 1981 on coffee in Granma Province and was identified as *Meloidogyne* sp. Morphological and molecular studies were done and the presence of *M. mayaguensis* was confirmed in Cuba in the Easter region. Early in the 1990s, quarantine measurements were taken for this species. Today, more than 20 years after it was found, populations are present only in this region in Cuba (Provinces: Granma, Santiago de Cuba, Holguin and Guantanamo) where they have a very extensive host range. Coffee and guava under field conditions in the mountains have been an historical host in our conditions, but recently, tomatoes, pepper and melon that grow under plastic tunnels have been parasitized by *M. mayaguensis*. Each year, hundreds of samples of soils and roots are taken and examined by nematologists in Plant Health Provincial Laboratories and Quarantine Laboratory and an update of data on distribution and hosts (crops, shadow plants and weeds) in these areas will be presented.

SODIUM AZIDE [SEP 100[R]] FOR CONTROL OF ROOT-KNOT NEMATODE, WEEDS, AND SOIL BORNE DISEASE IN CANTALOUPE PRODUCTION [LA AZIDA DE SODIO PARA CONTROLAR EL NEMATODO AGALLADOR, MALEZAS Y ENFERMEDADES DE ORIGEN EDAFICO EN LA PRODUCCION DEL MELON CANTALUPE]. **R. Rodriguez-Kabana, Department of Entomology & Plant Pathology, Auburn University, Auburn, AL 36849, U.S.A., rrodrigu@acesag.auburn.edu.—**The

efficacy of sodium azide (NaN_3) for control of root-knot nematode (*Meloidogyne incognita*), weeds, and soil-borne diseases in cantaloupe (*Cucumis melo* var. *cantalupensis*) was studied with three field experiments, two in 2003 and one in 2004. NaN_3 was delivered pre-plant into soil by drip irrigation using the SEP 100^R (American Pacific Corporation, Las Vegas, NV, U.S.A.). The compound was applied at rates within the range of 0-224 [kg a.i./ha] and methyl bromide [MB] was injected at 336 kg/ha to serve as positive control. The experiments were sited in fields naturally infested with the nematode, and with severe nutsedge (*Cyperus rotundus*, *C. strigosus*) and other weed problems. Application of NaN_3 at rates ≥56 kg/ha eliminated root-knot and controlled damping-off and root rot caused by species of *Rhizoctonia* and *Fusarium*. Effective weed control was obtained with rates ≥84 kg. Total and marketable yield increased significantly in response to rates of 56 and 86 kg; however, there was no yield benefit obtained with the use of higher rates. Applications of NaN_3 at rates ≥112 kg resulted in gradual decline in yields with severe phytotoxicity observed for the two highest rates (196 and 224 kg). Control of root-knot, seedling and root diseases, and weeds with NaN_3 at rates of 56 and 86 kg was equal or better than was obtained with MB. Results suggest that NaN_3 may be a good substitute for soil fumigation with MB in cantaloupe production.

CONTROL OF PHYTOPATHOGENIC NEMATODES AND WEEDS WITH PROPYLENE OXIDE [CONTROL DE NEMATODES FITOPATOGENICOS Y DE MALEZAS CON EL OXIDO DE PROPILENO]. **R. Rodriguez-Kabana and L. Simmons, Department of Entomology & Plant Pathology, Auburn University, Auburn, AL 36849, U.S.A., rodrigu@acesag.auburn.edu.—**The nematicidal and herbicidal properties of propylene oxide (PO) were studied in greenhouse experiments with sandy loam soil from cotton fields naturally infested with: *Meloidogyne incognita*, *Rotylenchulus reniformis*, *Paratrichodorus minor* and *Hoplolaimus galeatus*. PO delivered in water as a drench at rates (R) 5<R<60 mg/kg soil eliminated all nematodes but *P. minor* when applied at rates >20 mg; *P. minor* was unaffected by the chemical. Planting of 'Hutcheson' soybean in PO-treated soil resulted in increased plant height and in fresh weights of shoots and roots; the "root health index values" of the root systems were markedly improved by PO rates >20 mg. In other experiments, applications of PO at rates ≥25 mg significantly reduced or eliminated sickle pod (*Cassia tora*), morninglories (*Ipomea* spp.), pigweed (*Amaranthus* spp.), and crabgrass (*Digitaria sanguinalis*) and other gramineous species; control of purple (*Cyperus rotundus*) and yellow nutsedge (*C. esculentus*) required doses >30 mg. Results indicate that PO, a compound already registered for treatment of dry goods, is a good candidate for replacement of methyl bromide in soil fumigation.

COMBINATIONS OF METHYL DISULFIDE [$(CH_3)_2S_2$] AND METAM SODIUM FOR CONTROL OF NEMATODES AND WEEDS [CONTROL DE NEMATODOS Y MALEZAS CON COMBINACIONES DE DISULFURO DE METILO ($(CH_3)_2S_2$) Y METAM SODIO]. **R. Rodriguez-Kabana and Lee Simmons, Department of Entomology & Plant Pathology, Auburn University, Auburn, AL 36830, U.S.A., rrodrigu@acesag.auburn.edu.—**Methyl disulfide [$(CH_3)_2S_2$; MDS, dimethyl disulfide, DMDS] is a powerful fungicidal compound with significant nematicidal properties when applied to soil at rates >300 kg/ha. The compound is a poor herbicide but is amenable to combinations with metam Na, a registered, broad-spectrum soil fumigant. A greenhouse study was initiated to determine the potential of combinations of methyl disulfide and metam Na as substitutes for fumigation of soils with methyl bromide (MB). Metam Na was applied to soil at rates of 6.5, 13, 26, and 30 mg a.i./kg soil alone and in combination with 750 mg MDS/kg soil. The treated soil was covered with transparent polyethylene mulch (1 mil) for 10 days when the cover was removed, and degree of control of nematodes and weeds were determined. Metam Na controlled plant pathogenic nematodes (*Meloidogyne incognita* (*Rotylenchulus reniformis*), equally well with and without MDS. Control of yellow nutsedge (*Cyperus esculentus*), crabgrass (*Digitaria sanguinalis*), pigweed (*Amaranthus* spp.) and other common weeds was significantly improved with the combination of MDS and metam Na. Weed control with all combination treatments was superior to that obtained with metam Na or with MDS applied alone. The data indicate that a degree of synergy for weed control exists when metam Na and MDS are com-

bined for soil disinfestation. The study suggests that potential alternatives to MB can be developed based on combinations of the two compounds.

OBSERVATIONS OF SOME *MELOIDOGYNE* POPULATIONS USING SCANNING ELECTRON MICROSCOPY [OBSERVACIONES SOBRE ALGUNAS POBLACIONES DE *MELOIDOGYNE* UTILIZANDO EL MICROSCOPIO ELECTRONICO DE RASTREO]. **M. G. Rodriguez[1], J. Rowe[2] and P. Grax[2], [1]National Center of Plant and Animal Health (CENSA), P.O. Box 10, San Jose de las Lajas, Habana, Cuba and [2]PPI Division, Rothamsted Research, Harpenden, Hertfordshire, England AL5 2JQ U.K.**—Some of the most important pests in tropical countries are *Meloidogyne* spp., which have negative impacts on the yields and shorten the lifetimes of plantations of vegetables, tobacco, coffee, ornamental and other plants. Morphological studies are important in diagnosis of *Meloidogyne* species and, for this reason, the objective of this study was to observe females and males of different populations to complement the light microscope studies that have been previously undertaken. The populations were collected (or sent) from Cuba, Puerto Rico, Hawaii, Nicaragua and Brazil. These native populations were inoculated onto tomato and aubergine plants in quarantine greenhouse conditions at Rothamsted Research to establish cultures. Observations of specimens of *Meloidogyne mayaguensis*, *M. konaensis*, *M. exigua* and *M. paranaensis* were made with Scanning Electron Microscope Hitachi S-450 (10 and 15 kv) and using Cryo-Scanning on a Phillips XL40. All populations showed the most variable character to be the perineal pattern, particularly in *M. mayaguensis*, which showed marked differences between the Cuban, Puerto Rican and Ivory Coast populations. Cryo-scanning techniques meant that morphological features were artifact free and morphological structures, such as lateral lines and the position of the excretory pore, and, in some cases, secretions were easier to define.

SUSTAINABLE AGRICULTURAL PRACTICES FOR NEMATODE MANAGEMENT ON PUMPKIN [PRACTICAS DE AGRICULTURA SOSTENIBLE PARA EL MANEJO DE NEMATODOS EN CALABAZA]. **S. Y. Rosado-Arroyo[1], J. A. Chavarría-Carvajal[1] and C. Flores[2], [1]Departament of Crop Protection and [2]Department of Horticulture, Mayagüez Campus, University of Puerto Rico, P.O. Box 9030, Mayagüez, PR 00681-9030, U.S.A., jose_chavarria@cca.uprm.edu.**—The use of broad-spectrum synthetic pesticides with high toxicity and persistence has traditionally played a major role in the commercial production of pumpkin worldwide. However, the continuous and indiscriminate use of pesticides may have several limitations such as groundwater contamination and deleterious effects on non-target organisms. It is important to search for more environment friendly nematode control measures that not only protect the environment and water resources, but also provide the consumer with healthy products with low levels of pesticides. An experiment was carry-out at Isabela Substation during two cropping cycles to establish the effectiveness of different sustainable agricultural practices for nematode management in pumpkin (*Cucurbita moschata* Duch). The experimental design was a randomized complete block design (RCB) with six treatments and four replicates. Treatments studied were: 1. Rotation of corn (Zea mays cv'Mayorbela') + pumpkin; 2. Rotation of velvetbean (*Mucuna deeringiana*) + pumpkin; 3. Soil incorporation of poultry litter (7.3 kg/plant) + pumpkin; 4. Soil solarization (120 days) + pumpkin; 5. Chemical control (phenamiphos 1.5 g a. i/plant) and 6. Absolute control. At the end of the first cropping cycle, the rotations with corn and velvetbean and the soil incorporation of poultry litter significantly reduced soil and root populations of phytonematodes. At the end of the second cropping cycles nematode control was not different among treatments. However, the results indicated that some agricultural practices were effective improving yield, representing a suitable ecological alternative to reduce the use of pesticides during the commercial production of pumpkin.

EVALUACION DE MATERIALES DE PAPAYAS RESPECTO AL ATAQUE DE *MELOIDOGYNE INCOGNITA* RAZA 1 Y *ROTYLENCHULUS RENIFORMIS* [EVALUATION OF PAPAYA GENOTYPES IN RELATION TO ATTACK BY *MELOIDOGYNE INCOGNITA* RACE 1 AND *ROTYLENCHULUS RENIFORMIS*]. **L. C. Rosales, Z. Suárez H. y M. A. Gómez, Instituto Nacional de Investigaciones Agrícolas-CENIAP, Apdo. 4653 Maracay 2101, Aragua, Venezuela, crosales@inia.gov.ve.**—*Meloidogyne incognita*

raza 1 y *Rotylenchulus reniformis* son las especies más frecuentes en Caricáceas en Venezuela, encontrándose en muchos casos simultáneamente. Como parte de un proyecto Regional de FONTAGRO y con la finalidad de estudiar la acción de estos nematodos en Caricáceas, se evaluaron inicialmente cinco materiales de *Carica papaya, Vasconcellea goudotiana* tipo A y tipo B. Posteriormente, con respecto a *M. incognita* se evaluaron otros nueve materiales de *C. papaya*; *V. cauliflora, V. cundinamarcencis, V. microcarpa microcarpa, V. microcarpa pilifera*. De cada material se usaron cinco plantas no inoculadas como testigo y cinco inoculadas con 2 000 huevos y juveniles de *M. incognita* y *R. reniformis* por planta y 2 500 huevos y juveniles por planta para *M. incognita* sola. Después de 12 semanas se evaluó el peso aéreo y peso radical fresco y seco y el Factor de Reproducción de los nematodos (FR = Pf/Pi). Para la histología, segmentos de raíces fueron fijados en Craff III, deshidratados en terbutanol, embebidos en parafina, cortados en secciones de 15 µm y coloreados con la tinción cuádruple de Triarch (modificada por Suárez). Las plantas inoculadas con *M. incognita* presentaron formación de agallas. El peso aéreo y radical fresco fue significativamente inferior (Tukey, 5%) en las plantas inoculadas respecto a las testigo, con excepción de *C. papaya* 'Red Lady'y 'Maradol'—Aragua que no presentaron diferencias en los pesos mencionados. Los materiales de *Carica* inoculados mostraron células gigantes típicas de *Meloidogyne*. El FR fluctuó entre 2.0 y 7.60. Las plantas inoculadas simultáneamente con *M. incognita* y *R. reniformis*, mostraron células del parénquima vascular formando sincitio y en la misma raíz la formación de células gigantes. Algunos de los materiales pertenecientes al género *Vasconcellea* pueden ser considerados como resistentes con un FR de 0.43 y se propone incluirlos en los programas de mejoramiento de la papaya comercial que actualmente se realizan en la Región Andina.

INTEGRATED NEMATODE MANAGEMENT ON PLANTAIN [MANEJO INTEGRADO DE NEMATODOS EN PLÁTANO]. **J. C. Santiago-Gonzalez[1], J. A. Chavarría-Carvajal[1], R. A. Franqui[2], C. Flores[2] and N. Vicente[1], [1]Departament of Crop Protection and [2]Department of Horticulture, Mayagüez Campus, University of Puerto Rico, P.O. Box 9030, Mayagüez, PR 00681-9030, U.S.A., jose_chavarria @cca.uprm.edu.—**Phytonematodos are the most limiting factor for the commercial production of plantain in Puerto Rico. The use of broad-spectrum synthetic pesticides with high toxicity and persistence has traditionally played a major role in the production of plantain generating concerns about its impact on human health and the environment. An experiment was carry-out at the Isabela Substation to determine the effect of integrated nematode management practices in plantain. The experimental design was a randomized complete block design (RCB) with five treatments and four replicates. Plantain (*Musa acuminata* x *M. balbisiana*, cv 'Maricongo') was used as planting material in a population density of 3,086 plants/ha. Treatments evaluated were: 1. Rotation of velvetbean (*Mucuna deeringiana*) + plantain; 2. Soil incorporation of poultry litter (7.3 kg/plant) + plantain; 3. Rotation of velvetbean + soil incorporation of poultry litter + plantain; 4. Chemical control (phenamiphos 1.5 g a. i/plant/application) and 5. Absolute control. Results showed that root populations of phytonematodes were lower in treatments 1 through 4 at 4 and 8 months after planting, when compared with the absolute control. At harvesting nematode populations were not different among the treatments studied. However, the use of integrated nematode management practices promoted an increase in bunch weight (treatments 1, 3 and 2) when compared with the chemical and absolute treatments.

ASSESSMENT OF NATIVE WOODY SHRUBS FOR RESISTANCE TO THREE *MEDLOIDOGYNE* SPECIES [EVALUACION DE ARBUSTOS AUTOCTONOS PARA RESISTENCIA CONTRA TRES ESPECIES DE *MELOIDOGYNE*]**.** **Jyotsna Sharma and J. R. Rich, University of Florida IFAS North Florida Research and Education Center, 155 Research Road, Quincy, FL 32351, U.S.A., jsharma@ifas.ufl.edu.—***Meloidogyne* spp. damage ornamental landscape plants in the southeastern U.S.A. Plants infected with *Meloidogyne* spp. lose aesthetic value due to chlorosis, wilting, leaf margin necrosis and generally unthrifty appearances. The use of native plants in landscapes is of interest because of low maintenance requirements, including possible resistance to pests. However, few studies have verified resistance of native ornamental plants to *Meloidogyne* species. The objectives of this study were to assess reproduction of *M. arenaria*, *M. incognita*, and *M. javanica* on five native plant taxa: *Hydrangea*

quercifolia 'Oakleaf,' *Viburnum obovatum* 'Densa,' *Itea virginica* 'Little Henry,' *Illicium parviflorum*, *Clethra alnifolia* 'Ruby Spice'. In addition, three commonly grown non-native shrubs, *Ligustrum japonicum* 'Texanum,' *Ilex crenata* 'Compacta,' and *Buxus microphylla* 'Wintergem', were included in the study and served as susceptible, positive controls. Plants were grown in pots in the greenhouse, inoculated separately with 10,000 eggs of one of the three *Meloidogyne* spp., and were allowed to grow for 10 weeks. Root galling then was rated on a scale of 0 to 10 and eggs were extracted from whole root systems and were counted. Galling was not observed on roots of the five native plant species and nematode eggs were recovered only from roots of *Itea virginica* 'Little Henry' inoculated with *M. arenaria* and *M. javanica* (13 and 20 eggs/g roots, respectively). Gall formation and nematode eggs were prevalent on roots of the three non-native taxa, and interactions among species of plants and *Meloidogyne* spp. were observed. Highest root gall ratings (10) were found on roots of *I. crenata* 'Compacta' infested with *M. incognita*, but the highest number of eggs/g root (6397) was observed in plants inoculated with *M. javanica*. Weight of shoots or roots among all plants was not affected by nematode inoculation. Due to lack of root gall development and little or no reproduction on the native taxa, we conclude that they are highly resistant or immune to the three species of *Meloidogyne*. Landscape plantings of the native plants tested herein, therefore, might be suitable as an alternative to overuse of commonly grown shrubs that are susceptible to these *Meloidogyne* species.

POTENTIAL OF ACROLEIN [2-PROPENAL] FOR SUBSTITUTION OF METHYL BROMIDE AS A SOIL FUMIGANT [POTENCIAL DE LA ACROLEINA (2-PROPENAL) PARA REMPLAZAR AL BROMURO DE METILO EN LA FUMIGACION DE SUELOS]. **Lee Simmons and R. Rodriguez-Kabana, Department of Entomology & Plant Pathology, Auburn University, Auburn, AL 36849, U.S.A., rrodrigu@acesag.augburn.edu.—**Acrolein (2-propenal) is a common naturally occurring liquid with high vapor pressure, soluble in water and registered by US-EPA for control of aquatic weeds. The nematicidal and herbicidal properties of the compound were studied in greenhouse and microplot experiments for a 2-year period. Drench applications of acrolein at rates ≥50 mgs/kg soil effectively controlled plant pathogenic nematodes (*Meloidogyne* spp., *Rotylenchulus reniformis*); however, when injected directly into soil, rates ≥100 mg/kg soil were required to obtain equivalent nematode control. Acrolein was effective in controlling yellow nutsedge (*Cyperus esculentus*), crabgrass (*Digitaria sanguinalis*), pigweed (*Amaranthus* spp.), sicklepod (*Cassia tora*), morninglories (*Ipomea* spp., and *Jacquemontia tamnifolia*), and other common weeds of the southeastern U.S.A. Yellow nutsedge was controlled by drench applications at rates ≥160 mg/kg soil and all other weed species were eliminated by rates of 80-100 mg.

INFLUENCE OF EGG BIOLOGY ON REPRODUCTION OF *ROTYLENCHULUS RENIFORMIS* ISOLATES FROM THE SOUTHERN U.S.A. [INFLUENCIA DE LA BIOLOGIA DEL HUEVO EN LA REPRODUCCION DE AISLAMIENTOS DE *ROTYLENCHULUS RENIFORMIS* DEL SURESTE DE LOS E.U.A]**.** **J. B. Sumner and E. C. McGawley, LSU Ag Center, Dept. of Plant Pathology and Crop Physiology, Baton Rouge, LA 70803, U.S.A.—**Reniform nematode, *Rotylenchulus reniformis* (Rr), is a serious nematode pathogen of cotton in the United States, which is currently endemic in the South. Differences in reproduction and cultivar response to and host preference of the nematode, have led to the hypothesis that distinct pathotypes of Rr exist in nature. Populations of Rr from Louisiana (LA), Mississippi (MS), Arkansas (AR), Texas (TX) and Hawaii (HI) were used in these studies to evaluate the relative influence of egg production and viability on the rate of population growth. A microplot trial with Stoneville LA887 cotton was conducted using Rr populations from la, ms, tx, hi, and ar. At harvest, 122 days after planting, there were marked differences in the numbers of juveniles in soil, Rr eggs per gram of root, as well as dry weights of tops and roots. Among the five Rr populations, the numbers of juveniles per 250 cm^3 of soil ranged from 2134 for the ar pop to 4532 for the la population; eggs per gram of root ranged from 47 for the hi population to 464 for the ar population. Weights of tops and roots were reduced significantly below those of controls by populations from aR, la, ms, and tx. Subsequent studies were conducted under lab conditions to evaluate the role of egg

biology in population development of these geographic isolates of Rr. Over the course of two preliminary trials, hatch of eggs of Rr isolates from 10 major cotton-producing parishes of LA were determined in soil and in water. In the first trial, the percent egg hatch in water and soil, respectively, averaged 90% and 93% for the Catahoula parish isolate and 58% and 45% for the Avoyelles isolate. In trial two, the Opelousas isolate had the highest percent egg hatch, which was 91% in water and 94% in soil. The Evangeline isolate had the lowest percent egg hatch in water, which averaged 58%. The Avoyelles isolate had the lowest percent egg hatch in soil, which averaged 57%. Additional egg hatch trials with isolates of Rr from Louisiana and other southern states were conducted using an incubator and a temperature range from 23-32°C.

CAMBIOS HISTOLOGICOS INDUCIDOS POR *CACTODERA GALINSOGAE* EN CEBADA (*HORDEUM VULGARE*) [HISTOLOGICAL CHANGES INDUCED BY *CACTODERA GALINSOGAE* IN BARLEY (*HORDEUM VULGARE*)]. **A. Tovar-Soto[1], I. Cid del Prado-Vera[2], J. M. Nicol[3], K. Evans[4], J. S. Sandoval-Islas[2], A. Martínez-Garza[2] y E. Cárdenas-Soriano[2], [1]Depto. de Parasitología, Escuela Nacional Ciencias Biológicas-IPN. Apdo. postal 256, México, D.F., [2]Colegio de Postgraduados, Montecillo, Edo. de México, Apdo. postal 81, México, [3]International Wheat and Maize Improvement Centre (CIMMYT), P.O. Box 39, Emek, 06571, Ankara, Turkey y [4]Nematode Interactions Unit, Rothamsted Research, Harpenden, Herts, AL52JQ, U.K.—**Se observaron los cambios anatómicos en raíces de cebada cv. Esmeralda infectadas por *Cactodera galinsogae*. Las raíces fueron colectadas a los 10, 20 y 40 días posteriores a la emergencia de un campo naturalmente infestado en la localidad "La Raya", Singuilucan, Hidalgo, México. A los 10 y 20 días en raíces teñidas con fucsina-lactoglicerol, se observaron juveniles (J_2, J_3 y J_4) alojados en el tejido cortical de manera paralela al cilindro vascular. A los 40 días hubieron hembras y machos. A los 10 días en cortes longitudinales al microtomo teñidos con safranina-verde rápido, se observaron juveniles (J_2) embebidos en la raíz en posición paralela al cilindro vascular. A los 20 días aparecieron juveniles (J_3 y J_4) embebidos en el tejido cortical, en donde se observaron espacios debido a la ruptura de las células cercanas al nematodo; además se observaron sitios de alimentación (sincitios) alargados con 4 a 8 células, ligeramente más ensanchados en la parte central, en donde hubo ruptura de paredes celulares, el citoplasma mostró una apariencia densa y granulosa. En cortes trasversales hubo sitios de alimentación con forma irregular, ensanchados y redondeados en uno de los extremos y alargado en el otro, ubicados principalmente en el cilindro vascular. A los 40 días, hubo hembras maduras en el tejido cortical próximas al cilindro vascular alrededor de las cuales se observaron paredes celulares engrosadas. Además se observaron sincitios abarcando 50-60 % del cilindro vascular, en donde el xilema y floema se observaron desorganizados. El citoplasma presentó gran cantidad de gránulos de almidón.

DESARROLLO POSTEMBRIONARIO DE *CACTODERA GALINSOGAE* EN CEBADA (*HORDEUM VULGARE*) [POSTEMBRYONIC DEVELOPMENT OF *CACTODERA GALINSOGAE* ON BARLEY (*HORDEUM VULGARE*)]. **A. Tovar-Soto[1], I. Cid del Prado-Vera[2], J. M. Nicol[3], K. Evans[4], J. S. Sandoval-Islas[2] y A. Martínez-Garza[2], [1]Depto. de Parasitología, Escuela Nacional de Ciencias Biológicas-IPN. Apdo. postal 256, México, D.F., [2]Colegio de Postgraduados, Montecillo, Edo. de México, Apdo. postal 81, México, [3]International Wheat and Maize Improvement Centre (CIMMYT), P.O. Box 39, Emek, 06571, Ankara, Turkey y [4]Nematode Interactions Unit, Rothamsted Research, Harpenden, Herts, AL52JQ, U.K.—**Durante el ciclo agrícola primavera-verano del 2001, se llevó a cabo un ensayo en una parcela naturalmente infestada con *Cactodera galinsogae* (Tovar *et al.*, 2003) en "La Raya", Singuilucan, Hidalgo, México, con la finalidad de conocer el desarrollo postembrionario de este nematodo. Se sembraron al boleo 500 g de cebada cv. Esmeralda en una parcela de 25 m^2. Cada 7 días a partir de la emergencia de las plantas, se realizaron muestreos de suelo y de plantas de manera aleatoria. A los 7 días posteriores a la emergencia, se observó en el suelo la presencia de juveniles del segundo estadio (J_2) los cuales aparecieron durante todos los muestreo realizados. A los 21 días se encontraron (J_2) avanzados dentro de la raíz. Los (J_3) y (J_4) aparecieron a los 35 y 42 días respectivamente; por su parte, las hembras blancas adheridas a las raíces y machos en el suelo aparecieron a los 49 días. A los 56 días

se detectaron hembras con huevos y la formación de los primeros quistes. A los 63 días se recuperó una mayor cantidad de quistes de la raíz, lo que corroboró que *Cactodera galinsogae* completa su ciclo de vida aproximadamente a los 60 días posteriores a la emergencia de cebada. La temperatura del suelo osciló entre 16.3 y 19.8°C y un promedio de 18.5°C durante el experimento.

MALEZAS HOSPEDANTES DE *CACTODERA GALINSOGAE* EN LOS VALLES ALTOS DE HIDALGO, MÉXICO. [WEEDS AS HOSTS OF *CACTODERA GALINSOGAE* IN THE HIGH VALLEYS OF HIDALGO, MEXICO]. **A. Tovar-Soto[1], I. Cid del Prado-Vera[2], J. M. Nicol[3], K. Evans[4], J. S. Sandoval-Islas[2] y A. Martínez-Garza[2], [1]Depto. de Parasitología, Escuela Nacional de Ciencias Biológicas-IPN, Apdo. postal 256, México, D.F., [2]Colegio de Postgraduados, Montecillo, Edo. de México, Apdo. postal 81, México, [3]International Wheat and Maize Improvement Centre (CIMMYT), P.O. Box 39, Emek, 06571, Ankara, Turkey y [4]Nematode Interactions Unit, Rothamsted Research, Harpenden, Herts, AL52JQ, U.K.—**Durante el ciclo agrícola primavera-verano de 2001, en un campo naturalmente infestado con *Cactodera galinsogae* (Tovar *et al.*, 2003) y sembrado con cebada (*Hordeum vulgare* L.) en la localidad "La Raya", Singuilucan, Hidalgo, México, se colectaron cada 7 días a partir de la emergencia de las plantas, ejemplares de todas las malezas crecidas durante el ciclo del cultivo, con la finalidad de conocer cuáles de las malezas crecidas en los campos de cebada son hospedantes de este nematodo. En total se identificaron 20 especies de malezas, correspondientes a 13 familias botánicas. *Galinsoga parviflora* (estrellita) y *Bidens odorata* (rosilla) fueron las malezas en donde mejor se reprodujo *Cactodera galinsogae*, seguidas de *B. ballsii* y *B. serrulata*, todas miembros de Asteraceae, las cuales parecen ser los hospedantes naturales de este nematodo. También *Hordeum vulgare* L. cv. Esmeralda (cebada) y *Avena fatua* L. (avena silvestre) miembros de Poaceae resultaron ser hospedantes de esta especie. En el resto de las malezas revisadas no hubo penetración del nematodo.

NEW ISOLATES OF *POCHONIA CHLAMYDOSPORIA* AND THEIR PARASITISM ON THE FALSE ROOT-KNOT NEMATODE, *NACOBBUS ABERRANS* [NUEVOS AISLAMIENTOS DE *POCHONIA CHLAMYDOSPORIA* Y SU POTENCIAL PARASÍTICO SOBRE EL NEMATODO FALSO NODULADOR, *NACOBBUS ABERRANS*]. **K. Vilchis-Martínez[1], F. Franco-Navarro[2] and J. Alfonsina-Hernández[2], [1]FESC-UNAM, Cuautitlan Izcalli, Mexico State, Mexico and [2]IFIT-Colegio de Postgraduados, Montecillo, Mexico State, Mexico 56230.—**One hundred soil samples from three localities inside the Biosphere reserve "Los Tuxtlas", Ver., Mexico, were examined for the presence of native isolates of *Pochonia chlamydosporia*, a nematophagous fungus with potential for controlling root-knot nematodes. The samples were collected from sites with different land uses (pasture, maize field, agroforesty and jungle) and they were processed using semi-selective medium to isolate the fungus. Thirty-four soil samples were positive for *P. chlamydosporia*; 26 of them belonged to *P. chlamydosporia* var. *chlamydosporia* and eight to *P. chlamydosporia* var. *catenulata*. Four isolates were from pasture, five from maize fields, 13 from agroforesty and 15 from jungle soil samples. Isolates have been preserved through Ultrafreezing at ?80°C and parasitism tests against eggs of *Nacobbus aberrans* have been made for 29 isolates (five replications on plates of water-agar per isolate and five plates as negative controls). There were highly significant differences in percentage parasitism among isolates (Tukey, _ = 0.01). Five isolates had parasitism higher than 80% (81.0-85.6), 14 had parasitism between 70% and 80% (70.6-80.0), and 10 had parasitism lower than 70% (50.2-69.4). Isolates with high parasitism will be assessed against more populations of *N. aberrans*; others tests will be done in laboratory and greenhouse to determine the best isolate for biological control of the false root-knot nematode. This is the first evidence of *P. chlamydosporia* var. *catenulata* being present in Mexican soils. (Project: MiCoSPA. ICA4-CT-2002-10044).

EFECTO DE LA VERMICOMPOSTA EN EL IMPACTO DE *NACOBBUS ABERRANS* EN TOMATE [EFFECT OF VERMICOMPOST ON THE IMPACT OF *NACOBBUS ABERRANS* ON TOMATO]. **A. Villa-Briones[1], E. Zavaleta-Mejía[2], M. Vargas-Hernández[1], S. Ramírez-Alarcón[1] y O. Gómez-Rodríguez[2], [1]Depto. de Parasitología, Universidad Autónoma Chapingo, Km 38.5 Carretera México**

Texcoco, Edo. de México, México, CP 56230 y [2]Programa en Fitopatología, Colegio de Postgraduados, Km. 36.5 Carretera México-Texcoco, Montecillo Edo. de México, México, CP 56230, zavaleta@colpos.mx.—En el marco de una agricultura sustentable, debemos enfocarnos al manejo del hospedante y de su microambiente más que en la eliminación del patógeno. Es factible que si se le provee al primero de condiciones apropiadas para que exprese el máximo de su potencial metabólico y fisiológico pueda entonces tolerar o resistir el ataque del patógeno. Al incorporar vermicomposta en un suelo con un alto grado de infestación por *Nacobbus aberrans,* en invernadero y campo, no siempre se observó una reducción significativa en el grado de agallamiento de las raíces de las plantas de tomate. No obstante las raíces presentaron una reducción significativa en el grado de pudrición y mejor crecimiento de la planta. El mismo efecto se reflejó en un incremento significativo en el peso fresco y seco del follaje. Los filtrados de la vermicomposta redujeron significativamente *in vitro* el porcentaje de J2 activos.

APPLICATION OF KNOWLEDGE REGARDING NEMATODE SENSORY FUNCTION IN CANCER RESEARCH [APLICACION DEL CONOCIMIENTO DE LA FUNCION DE LOS ESTRUCTORES SENSORIALES DE NEMATODOS EN LA INVESTIGACION DE CANCER]. **Bert M. Zuckerman, Dept. of Microbiology, University of Massachusetts, Amherst, MA 1002, U.S.A.—**In previous studies, enzymes targeting specific carbohydrates located on free-living nematode cephalic receptors caused blocking of food-finding behavior. Currently the same methods were applied to MCF-7 breast cancer cells in culture to determine if the cancer-like characters of these cells could be altered. Treatment with the enzyme galactosidase completely inhibited the formation of multicellular nodules in the MCF-7 cell cultures. The results indicate successful application of basic approaches to two widely divergent biological systems.

POSTERS

IDENTIFICATION AND CHARACTERIZATION OF *MELOIDOGYNE* SPP. ON *MUSA* IN MARTINIQUE, GUADELOUPE AND FRENCH GUIANA [IDENTIFICACION Y CARACTERIZACION DE *MELOIDOGYNE* SPP. ON *MUSA* EN MARTINIQUE, GUADELOUPE Y FRENCH GUIANA]. **E. T. Cofcewicz[1], R. M. D. G. Carneiro[2], O. Randig[2], C. Chabrier[3] and P. Quénéhervé[3], [1]Universidade Federal de Pelotas, C.P.354, CEP 96001-970, Pelotas, RS, Brazil, [2]EMBRAPA/CENARGEN, C.P.08223, CEP 70849-970, Brasilia, DF, Brazil and [3]Pôle de Recherche Agronomique de la Martinique, IRD/CIRAD, B.P. 8006, 97259, Fort-de-France Cedex, Martinique.—**Ninety-six populations of *Meloidogyne* species collected on banana fields originated from Martinique, Guadeloupe and French Guiana, were examined using two enzymes: esterase (Est) and malate dehydrogenase (Mdh). Adult females identified as *M. arenaria, M. incognita, M. javanica, M. cruciani, M. hispanica, M. brasiliensis* and *Meloidogyne* sp. showed species-specific phenotypes only for the esterase enzymes. Intraspecific variability among populations was detected using Est and Mdh in *M. arenaria, M. incognita* and *M. javanica.* Perineal patterns were used as a complementary tool together with enzyme characterization and were essential for checking the morphological consistency of the identification. The major species, *M. arenaria* and *M. incognita*, were detected at percentages of 61.9 and 34.3, respectively, and the other minor species at 3.8 %. The *Meloidogyne* populations represented mixed species in 45.1% of the samples. Genetic analysis was conducted using RAPD markers which alone or in combination, provided reliable polymorphisms both between and within species. Based on the presence or absence of bands, RAPD analysis of the data resulted in clustering of species and isolates congruent with esterase phenotype characterization. The intraspecific variability in *M. incognita* and in the group *M. arenaria* represented 14.9 and 61.6% of the polymorphic amplified fragments, respectively. This high variation in *M. arenaria* isolates may indicate multiple origins for populations classified as *M. arenaria* or more than one species inside the same group, but more detailed morphological and DNA studies will be necessary to prove this hypothesis.

IDENTIFICACIÓN DE NEMATODOS ENQUISTADOS ASOCIADOS AL XOCONOSTLE (*OPUNTIA JOCONOSTLE* Weber), EN EL MUNICIPIO DE CHAPANTONGO, ESTADO DE HIDALGO, MÉXICO [IDENTIFICATION OF CYST NEMATODES ASSOCIATED WITH XOCONOSTLE (*OPUNTIA JOCONOSTLE* Weber) IN CHAPANTONGO, HIDALGO, MEXICO]. **Medina Gómez Edgar, A. Ramírez-Suárez, D. Colmenares A., M. R. Hernández H., J. R. Pérez Z. y F. Ramírez R. Centro Nacional de Referencia Fitosanitaria, Dirección General de Sanidad Vegetal, SAGARPA, Guillermo Pérez Valenzuela No. 127 Col Del Carmén, Coyoacán, D.F. 04100, MÉXICO.—**En las zonas áridas y semiáridas del estado de Hidalgo, México el cultivo de Xoconostle (*Opuntia joconostle*), constituye un recurso vegetal con un gran potencial económico. Los estudios enfocados a determinar los patógenos que atacan a este cultivo son muy pocos y más aún sobre los nematodos formadores de quistes, por tal motivo se realizó un estudio de identificación de los nematodos enquistados asociados, mediante análisis morfológico y morfométrico. En el presente trabajo se realizó el muestreo en una plantación de Xoconostle con las variedades: blanco, burro y rosa. Se tomaron un total de 18 muestras de suelo de aproximadamente 1 kg. Los quistes se extrajeron por el aparato de Fenwick y los juveniles de segundo estadío por tamizado de Cobb-centrifugación. Se realizaron montajes permanentes de conos vulvares, huevecillos y juveniles para identificarlos. La población encontrada correspondió a quistes de forma citriforme, color café oscuro en hembras maduras y color amarillo en hembras inmaduras, que presentan el cono vulvar corto. Con base en el análisis morfológico de los patrones de la región fenestral, se observó que éstos no presentaron bullae, ni subpuente, pero el corion de los huevecillos mostró gran número de puntuaciones. Los datos del análisis morfométrico realizado a los quistes fueron: largo con cuello 551µm, ancho 366 µm, largo ÷ ancho 1.7, fenestra (diámetro) 21.94 µm. El análisis morfométrico del segundo estado juvenil mostró los siguientes datos: largo de cuerpo 417.32 µm, largo de estilete 22.52 µm, longitud de la cola 39.45 µm, longitud de región hialina de la cola 18.4 µm, altura de labio 4.8 µm, ancho de labio 9.4 µm, radio caudal A* 2.42, índice A 17.63, índice C 10.42. Estos datos nos indican que el género y especie formador de quistes que se encuentra asociado al cultivo de Xoconostle es *Cactodera cacti*.

EFFECT ON *MELOIDOGYNE INCOGNITA* AND *M. JAVANICA* OF ABOVE-GROUND VELVETBEAN (*MUCUNA PRURIENS* VAR. *UTILIS*) PLANT PARTS INCORPORATED INTO SOIL [EFECTO DE LA INCORPORACION DE PARTES AERIALES DE *MUCUNA PRURIENS* VAR. *UTILIS* CON EL SUELO CONTRA *MELOIDOGYNE INCOGNITA* Y *M. JAVANICA*]. **E. A. Lopes, S. Ferraz, L. G. Freitas, P. A. Ferreira and D. X. Amora, Departamento de Fitopatologia, Universidade Federal de Viçosa, Viçosa, MG 36570-000, Brasil, silamar@ufv.br.—**Possible effects of mixing into soil above-ground parts of velvetbean (*Mucuna pruriens* var. *utilis*) or tomato (*Lycopersicon esculentum*) plants on *Meloidogyne incognita* and *M. javanica* populations were evaluated in greenhouse experiments. The rates used were O, 2, 4, 6 and 8 g of naturally dried leaves and petioles per pot (2L capacity). Height and weight of tomato plants and number of galls and eggs per plant were estimated sixty days after soil infestation. Regardless of the adopted rate, the incorporation into soil of above-ground velvetbean or tomato plant parts had no effect on height and weight of the tops of tomato plants inoculated with *M. incognita* or *M. javanica*. Soil amendments using velvetbean reduced gall numbers for both nematode species, and in pots infested with *M. incognita*, the best effects were obtained with the two largest amendment rates. At 6 and 8 g/pot, reproduction of both nematode species was negatively affected. No significant effect was observed in the reduction of *M. incognita* and *M. javanica* gall and egg numbers in pots where tomato plant parts were used as soil amendment. Financial support: CNPq.

SELECCIÓN DE CEPAS DE *BACILLUS THURINGIENSIS* PARA EL CONTROL DE *MELOIDOGYNE INCOGNITA* EN CUBA, Y ALGUNOS CRITERIOS DE SU CARACTERIZACIÓN [SELECTION OF STRAINS OF *BACILLUS THURINGIENSIS* TO CONTROL *MELOIDOGYNE INCOGNITA* IN CUBA AND SOME CRITERIA TO CHARACTERIZE THEM]. **M. E. Márquez[1], E. Fernández[1], J. E. Ibarra[2] y Y. R. Basurto[2], [1]Instituto de Investigaciones de Sanidad Vegetal (INISAV), CUBA, mmarquez@INISAV.CU y [2]Instituto de Investigación de Estudios Avanzados del IPN (CINVESTAV), Mexico.—**El

control biológico de nematodos parásitos de plantas utilizando *Bacillus thuringiensis* (Berliner) no ha sido suficientemente estudiado en Cuba, a pesar de existir en el país una vasta experiencia sobre su efecto y aplicación en numerosas especies de insectos. El presente trabajo se desarrolló para seleccionar y determinar el efecto nematicida de diferentes cepas de *B. thuringiensis* (Bt), a partir de las cuales podrán desarrollarse nuevos biopreparados a incluir en los sistemas de manejo integrado. Se evaluó la toxicidad de 37 aislados de Bt, sobre *Meloidogyne incognita* bajo condiciones *in vitro*. Las cepas LBT1, LBT3, LBT4, LBT24, LBT25 y LBT47 fueron seleccionadas teniendo en cuenta que en las ootecas del nematodo tratadas se observaron huevos y juveniles deformados, este efecto fue irreversible. La mayor actividad tóxica se alcanzó con el sobrenadante de todas las cepas, excepto la cepa LBT4, donde las mezclas de esporas y cristales provocaron la mayor inhibición en la eclosión y la cepa LBT25, en la cual, todas las fracciones tuvieron la misma actividad tóxica. Las pruebas realizadas en suelos inoculados con tres niveles de infestación de *M. incognita*, demostraron reducción de la infectividad de los nematodos y un retardo en el momento de la infestación de los juveniles a las raíces. La forma bipiramidal con inclusión cúbica fue predominante en los cristales de las cepas nematicidas; sin embargo, la cepa LBT25 presentó una morfología atípica. La composición de proteínas Cry por SDS PAGE, permitió reconocer que las cepas LBT1, LBT3, LBT24 y LBT47 presentaron proteínas tipo Cry 1 (~130 Kda) y Cry 2 (~65 Kda), en la cepa LBT4 no se detectó esta última, la cepa LBT25 tuvo el mismo perfil proteico que *Bt var. israelensis*. Fueron detectados perfiles plasmídicos diferentes, aunque fue común el plásmido de 110Mda excepto en la cepa LBT25, cuyo valor fue de 75Mda. Pudo apreciarse una mayor relación genética entre las cepas LBT1, LBT3, LBT24 y LBT47 con la cepa HD1, a diferencia de las cepas LBT4 y LBT25 que quedaron separadas en grupos diferentes en el dendrograma de similitud.

ORGANOS SENSORIALES CUTICULARES DE ALGUNOS NEMATODOS MARINOS [CUTICULAR SENSORY ORGANS OF SOME MARINE NEMATODES]. **Manuel Mundo-Ocampo, UCR-Nematode Collection, University of California Riverside, Riverside, CA 92521, U.S.A.—**Los órganos sensoriales de los nematodos son tan diversos como los ambientes donde éstos habitan. Los órganos sensoriales cuticulares son aquéllos que detectan estímulos mecánicos, químicos y temperatura, siendo en los nematodos marinos donde éstos se manifiestan de forma más compleja. La cutícula exhibe una serie de órganos sensoriales denominados *sensilas* (*sedas* si son en forma de cabello y *papilas* si tienen forma de botón). Por otra parte, los *anfidios* se caracterizan por tener formas diversas que van desde simples ranuras hasta elaboradas espirales, con componentes cuticulares internos diversos. La forma, posición o patrón básico de ordenación que presentan los órganos sensoriales cuticulares en la parte anterior del cuerpo son considerados como un carácter morfológico de utilidad en la taxonomía del grupo. En algunos casos, pueden incluso variar de acuerdo con el sexo. Este trabajo muestra imágenes microscópicas de diferentes órganos sensoriales incluyendo anfidios, papilas y sedas cuticulares de diversos generos de nematodos marinos de la región norte del Golfo de California, México.

DEVELOPMENT OF DRIP-IRRIGATION TECHNOLOGY AS A DELIVERY SYSTEM FOR THE IMPROVED TARGETING AND CONTROL OF NEMATODE PESTS IN POTATOES [DESARROLLO DE UNA TECNOLOGIA DE RIEGO POR GOTEO COMO UN SISTEMA PARA MEJORAR EL CONTROL DE NEMATODOS EN PAPA]. **Andy Barker[1], Tudor Dawkins[2], Ken Evans[1], Darran Grieveson[3], Helen Kalisz[1], Helen Jacobs[1], Mike Russell[1] and Caroline Cochrane[1], [1]Rothamsted Research, Harpenden, Herts, AL5 2JQ, U.K., [2]Du Pont (U.K.) Ltd., Wedgwood Way, Stevenage, Herts, SG1 4QN, U.K. and [3]Field (G.B.) Ltd., Unit 1, Counter Buildings, Brook Street, Woodchurch, Kent, TN26 3SP, U.K.—**Potato cyst nematodes (PCN) are serious pests of potatoes that threaten the sustainability of U.K. potato production. Control strategies are based on rotation and variety selection but also depend heavily on granular nematicides applied at planting or fumigants applied in advance of planting. The extended hatching pattern of the now dominant species, *Globodera pallida*, reduces the efficacy of a granular nematicides applied in a single dose. The efficacy of applying pulsed doses of liquid Vydate to potato plants growing in PCN-infested soil was examined in a glasshouse experi-

ment. Application of the equivalent of 3.5kg/ha of active ingredient in a single dose provided much poorer control than three pulsed dose rates of the same total amount. This delivery system is currently under test in field trials. Plots were sampled 4 weeks after planting and this revealed significant differences in the total numbers of nematodes (all life stages) per gram of root between the nematicide-treated plots and the untreated group ($P = 0.002$). However, there were no significant differences between potato varieties or, at this stage, between Nemathorin and liquid Vydate treatments. However, it is expected that, as the trials progress, differences will become apparent. Additional benefit may come from the wider adoption of drip-irrigation for the potato crop in allowing better targeting of other inputs (water, nutrients and other crop protection products) and reductions in the total amounts required.

NACOBBUS ABERRANS*: ITS MOLECULAR DIAGNOSIS IN SOIL AND POTATO TUBERS.** [*NACOBBUS ABERRANS*: SU DIAGNOSIS MOLECULAR EN SUELO Y TUBERCULOS DE PAPA]. **S. Atkins[1], R. H. Manzanilla-Lopez[1], J. Franco[2], B. Peteira[1,3] and B. Kerry[1]. [1]Nematode Interactions Unit, Rothamsted Research, Harpenden, Herts, AL5 2JQ, UK, [2]Fundación PROINPA, Av. Blanco Galindo Km 12.5, Casilla 4285, Cochabamba, Bolivia and [3]Centro Nacional de Sanidad Agropecuaria (CENSA), Apdo 10, San José de las Lajas, Habana. Cuba.—Nacobbus aberrans sensu lato*, the 'false root-knot nematode', is known to have more than 80 cultivated and non-cultivated plant hosts. Although this sedentary plant-endoparasitic nematode has the potential to reduce crop yields of major food crops such as potato, sugar beet and tomato in many parts of the world, this 'species' is currently restricted mainly to the Americas. It has, however, been recorded on several occasions in European countries, warranting a particular quarantine effort from the European Union and other related countries in order to avoid its introduction. A primer set was designed from a local pile up of *Nacobbus* ITS sequences submitted to the GenBank/EMBL database. Primers were compared to other sequences in the database through BLAST and FASTA searches to confirm specificity. DNA to be used in PCR reactions, was extracted from nematodes kept in glasshouse cultures, but also from soil and potato tubers collected from naturally infested South American soils. Optimised PCR conditions were established and the PCR products were separated on 2% agarose gels, showing that specific ITS primers for the detection of *N. aberrans sl* generated a single PCR product although band size varied slightly within populations. The product was generated from DNA extracted from all the *Nacobbus* samples tested but not from other nematodes (*Pratylenchus*, *Radopholus*, *Meloidogyne*, *Globodera*, *Heterodera*). The BLAST and FASTA searches only returned hits for *Nacobbus* species. No bands were generated from the control soil and tuber DNA samples, thus demonstrating the specificity of the primers in DNA taken from a field sample. The discrimination by molecular tools of the *N. aberrans sl* complex still requires further studies aimed at understanding the apparently different host ranges of the various putative species. However, the resolution of *N. aberrans sl* into several putative discrete species by molecular techniques has opened the door to a new method for routine quarantine diagnostics that will be faster and more reliable than previous methods, and for the first time capable of detecting *N. aberrans sl* in soil and tuber samples. This would have important applications not only in practical advisory samples but also in the screening of material for quarantine purposes.

ELECTROPHORESIS AND BIOTEST STUDIES OF SOME CEREAL CYST NEMATODE (*HETERODERA* SPP.) POPULATIONS [ESTUDIOS DE ELECTROFORESIS Y BIOPRUEBAS DE ALGUNAS POBLACIONES DEL NEMATODO QUISTE DEL CEREAL (*HETERODERA* SPP.)]. **R. Holgado[1], J. Rowe[2], S. Andersson[3] and C. Magnusson[1], [1]The Norwegian Crop Research Institute, Plant Protection Centre, Department of Entomology & Nematology, Høgskoleveien 7, 1432 Aas, Norway, [2]Rothamsted Research, Plant-Pathogen Interactions Division, Nematode Interactions Unit, Harpenden, Hertfordshire, AL5 2JQ, UK and [3]Swedish University of Agricultural Sciences, Department of Plant Crop Science, P.O. Box 44, S-230 53 Alnarp, Sweden.—**Twenty-seven populations of cyst nematodes belonging to the *Heterodera avenae* complex were studied using isoelectric focusing (IEF). Sixteen Norwegian populations were compared with five Swedish, two Danish, two Israeli, and

two English populations. Forty-two major bands were detected. Some bands were common to most populations, while others were population-specific. Eight population clusters were identified. A group belonging to *H. avenae sensu stricto* consisted of fourteen populations (nine of which were Norwegian). Two Norwegian and one Swedish population were confirmed as belonging to *H. filipjevi*. Three Swedish populations, preliminarily classified as H. avenae and recognised as pathotypes Knislinge, Ringsåsen and Våxtorp, differed from the *H. avenae* and *H. filipjevi* populations. Several Norwegian populations had a similar protein pattern to theVåxtorp population; their species status is still uncertain. One Norwegian population (Brekstad) differed from all Swedish, Danish and Israeli populations but showed some similarity to the English *H. mani* population. Biotests with the sixteen Norwegian populations grouped them according to their virulence on barley differentials. This revealed the occurrence of two pathotypes, Ha 11 and the closely related Ha 12. The two *H. filipjevi* populations were close to the Swedish "western" pathotype. The Brekstad population differed from all others in not reproducing on oats. This, in combination with its protein profile, may indicate that it belongs to a so far undescribed species in the cereal cyst nematode complex.

EXPLORACIÓN DE FITONEMATODOS EN TERRENOS DE LOMAS DE SAN JUAN DE LA UNIVERSIDAD AUTÓNOMA CHAPINGO [A PLANT NEMATODE SURVEY AT THE EXPERIMENTAL STATION "LOMAS DE SAN JUAN" OF THE UNIVERSITY AUTONOMOUS CHAPINGO]. **M. Palomares-Pérez y C. Carrillo-Fonseca, Coordinación de Campo Agrícola Experimental y Depto. de Parasitología Agrícola, Universidad Autónoma Chapingo, Chapingo Edo. De México, km 38.5 carretera México-Texcoco, CP 56230, Mexico.—**El propósito del presente trabajo es conocer los nematodos existentes en los terrenos productivos del Campo Agrícola Experimental de la Universidad Autónoma Chapingo. Se llevó a cabo un muestreo preliminar, completamente al azar en agosto de 2003, y se tomó la décima parte de 135 lotes. La muestra se extrajo a una profundidad de entre 10 y 20 cm, recolectando aproximadamente 1 kg. Cada lote presentó características particulares de suelo. La extracción, conteo e identificación de nematodos a nivel de género se hicieron mediante la utilización de técnicas tradicionales. A los datos se les aplicó una estadística básica para obtener el número de muestras y la dispersión presente en las tablas. Los géneros encontrados fueron; Saprófitos, *Tylenchorhyachus*, *Heterodera*, *Aphelenchus*, *Nacobbus*, *Trichodorus*, *Helicotylenchus*, *Boleodorus*, *Tylenchus*, *Paratylenchus, Dorylaimus*, *Criconemella*, *Ditylenchus* y *Pratylenchus*. Se identificaron 13 géneros de fitonematodos, de los cuales Tylenchorhynchus sp fue el que se presentó en número mayor de individuos y se localizó en mayor número de lotes. La dispersión mostrada en los géneros fue de agregada, regular y al azar.

THE EXTENT OF NEMATODE INFECTION OF GERMPLASM IMPORTED FROM CANADA IN THE QUARANTINE LABORATORY OF EMBRAPA [EL GRADO DE INFECCIÓN POR NEMATODOS EN LA GERMOPLASMA IMPORTADA DE CANADA EN EL LABORATORIO DE CUARENTENA DE EMBRAPA]. **Vandor R. V. Rissoli[1], Renata C. V. Tenente[2] and Henrique I. do Nascimento[3]. [1]Universidade Católica de Brasilia, QS 07-Lote 01 (70.022-900), Taguatinga, DF, Brasil, [2]Embrapa Recursos Geneticos e Biotecnologia, C.P. 02372 (70770-900), Brasília, DF, Brasil and [3]Undergraduate System Analysis, União Pioneira Integração Social, Brasília, SGAS Quadra 913 Conj. B, Brasília, DF, Brasil.—**Stem and bulb nematode *Ditylenchus dipsaci*, is the major plant-parasitic nematode that infests potato material imported from Canada. Potato races (I and II) occur in potato only in a few areas around the world. A computer system for the recording and registration of plant material imported from any country, including Canada, has been developed using a database of nematological germplasm analysis based at Embrapa Genetic Resources and Biotechnology, Brazil. This database is fed into a Germplasm Information System (SIG) that takes into account whether the commodity is infected by nematodes or not, donor and receptor institutions, and the year of accession introduction. The System is a strong tool in the provision of advice on risk categories to researchers and farmers. The results of the SIG survey showed that, from 24 different plant materials, only two were infected by imported plant-parasitic nematodes. Potatoes have been found infested with an important quarantine nematode (*D. dipsaci*, four accessions) and *Datura* with *Aphelenchoides besseyi* (one accession). The oth-

er 22 different botanic materials considered were free from nematodes. These materials included barley, lentil, oat, triticale, wheat, various pasture species and vegetables, *Pinus* and turf. Although there are several species of nematodes of quarantine importance in Canada, the donor institutions have been taking precautions against the possibilities of spreading these parasites into new areas in different countries. The SIG has been giving reliable and accurate information on nematological analyses and thereby lending strong support to Brazilian Agriculture.

RECORDS OF NEMATODES FOUND IN BRAZIL IN PLANT EXPORTS FROM THE U.S.A., AS RECOVERED USING THE GERMPLASM INFORMATION SYSTEM FROM EMBRAPA GENETIC RESOURCES AND BIOTECHNOLOGY [NEMATODOS ENCONTRADOS EN BRAZIL ENTRE PLANTAS EXPORTADAS DE LOS U.S.A. RECOBRADOS POR MEDIO DEL SISTEMA DE INFORMACION DE EMBRAPA, RECURSOS GENETICOS Y BIOTECNOLOGIA]. **Renata C. V. Tenente[1], Vandor R. V. Rissoli[2], Juvenil E. Cares[3] and Henrique I. do Nascimento[4], [1]Embrapa Recursos Geneticos e Biotecnologia, C.P. 02372 (70770-900), Brasília, DF, Brasil, [2]Universidade Católica de Brasilia, QS 07-Lote 01 (70.022-900), Taguatinga, DF, Brasil, [3]Universidade de Brasília, Fitopatologia, Caixa Postal 4457, Campus Darcy Ribeiro, Brasília, DF, Brasil, 70910-900 and [4]Undergraduate System Analysis, União Pioneira Integração Social, Brasília, SGAS Quadra 913 Conj. B, Brasília, DF, Brasil.—**Plant material interchange is important in the development of Brazilian Agriculture. It allows new plant varieties to be introduced into areas of the country that they would otherwise be slow to reach, resulting in good production and many other improvements but also increasing the risks of introducing new pests. In this context, Embrapa Genetic Resources and Biotechnology has developed, through its Quarantine Laboratory, faster procedures for phytosanitary analyses and a database system that permits the tracking of any introduced plant material that has been registered for nematode analysis. Using this system, it was possible to survey and recover all available data related to plant material infected with nematodes that came into Brazil from the USA during 1998 to 2003. The major economic nematodes species and hosts registered were: *Anguina* sp. (*Hordeum vulgaris*), *Aphelenchoides besseyi* (*Sorghum* sp.), *A. spinosus* (*Lactuca sativa*), *Ditylenchus obesus* (*Vigna unguiculata*), *Ditylenchus dipsaci* (*Guizotia abyssinica, Hordeum vulgare, Sorghum* sp.), *D. parvus* (*Oryza sativa*), *D. terricolus* (*O. sativa*), *Meloidogyne* sp. (*Solanum* spp.), *Paurodontus gracilis* (*Pinus* spp., *Sorghum* sp.), *Pratylenchus* sp. (*Annona* sp., *Averrhoa carambola, Manilkara zapota*), *Tylaphelenchus* sp. (*Pinus taeda*), and *Xiphinema* sp. (*Vitis vinifera*). The first report of seed-borne nematodes was made for *Ditylenchus obesus, D. parvus* and *D. terricolus.* This computer system has been shown to be very useful in the recovery of such data in an organized and safe manner, representing a great improvement in the organization and regulation of Brazilian Agriculture. The use of this system has also demonstrated that the benefit:cost ratio of such analyses was positive and of significance for agriculture in general.

SENSIBILIDAD *IN VITRO* DE EXTRACTOS VEGETALES PARA EL CONTROL DE *MELOIDOGYNE INCOGNITA* [*IN VITRO* SENSIVITY OF VEGETAL EXTRACT FOR CONTROL *MELOIDOGYNE INCOGNITA*] **Cristóbal-Alejo J.[1], N. Marbán-Mendoza[3], M. Gamboa-Ángulo[2], J. M. Tun-Suárez[1] y W. Mena Sierra[1], [1]Instituto Tecnológico Agropecuario No. 2. Conkal, Yucatán, [2]Centro de Investigación Científica de Yucatán y [3]Universidad Autónoma Chapingo, Mexico.—**Se evaluó *in vitro* el efecto de extractos de raíces, tallos y hojas de 14 especies vegetales nativas de Yucatán México, un testigo sin extracto y un testigo químico con Furadán L contra juveniles de segundo estadio (J_2) de *Meloidogyne incognita.* Se colocaron por siracusa 20 J_2 en cuatro replicas; 0.250 µg más 0.750 µl de agua destilada estéril, obteniéndose una mezcla de 250 ppm de bionematicida; la misma dosis se empleo para el nematicida químico. Se evaluó el porcentaje de mortalidad y recuperación de viabilidad de los nematodos a las 24, 48 y 72 hrs. posteriores a la exposición de los extractos y final del conteo de mortalidad, respectivamente. Después de 24 hrs de exposición no se detectaron diferencias estadísticas de mortalidad entre tratamientos, sin embargo, a las 48 hrs extracto que mayor porcentaje de mortalidad presentó correspondió a *Calea urticifolia* Mill proveniente de hoja con una mortalidad del 76.67% y el testigo químico con 100%, le siguieron extractos de hoja de *Eugenia winzerlingii* Stand con

50% y extracto de tallo de *Tefrosia cinerea* L. con un 43% de mortalidad, respectivamente. Después de 72 hrs *C. urticifolia* alcanzó porcentaje promedios de mortalidad de 96.66% estadísticamente iguales al testigo químico (Tukey P = 0.05), mientras que *E. winzerlingii* y *T. cinerea*, incrementaron la mortalidad, solo al 60 y 56.67% respectivamente. No existió recuperación de viabilidad de los nematodos después de 24, 48 y 72 hrs, de exposición a los extractos ni al testigo químico.

USO DE VELOCIMETRIA POR SEGUIMIENTO DE PARTICULAS E IMAGENES PARA EL ESTUDIO DEL NEMATODO ENTOMOPATOGENO *STEINERNEMA FELTIAE* [USE OF VELOCIMETRY TO STUDY AND OPTIMIZE CONDITIONS INFLUENCING MASS CULTURE OF THE ENTOMOPATHOGENIC NEMATODE *STEINERNEMA FELTIAE*]. **Reyes Vidal Y.[1] y M. de la Torre Martinez[2], [1]Departamento de Biotechnología y Bioingeniería, CINVESTAV-IPN, Mexico, DF y [2]Departamento de Ciencias de los Alimentos, CIAD, Carretera a la Victoria km 0.5, Hermosillo, Sonora, Mexico.—***Steinernema feltiae* es ampliamente usado para controlar plageas en el suelo, especialmente en ambientes protegidos como invernderos en cultivos de alto valor agregado. Sin embargo, hay pocos estudios acerca de su producción masiva en medios líquidos y de los factores que afecten dicho proceso, debido a que el sistema biológico es muy complejo y la maximización de sus rendimientos depende del ciclo de vida del nemátodo y de su biología reproductiva. En este trabajo se usaron velocimetría por seguimiento de partículas y análisis de imágenes para estudia el comportamiento de los nemátodos en una columna burbujeante. Cuando se utilizó como dispersor una piedra porosa,las hembras se acumularon en el fondo del reactor y cuando se usó una placa perforada tanto hembras como machos se distribuyeron de manera uniforme, independientemente de la velocidad superficial del aire. La velocidad de la fase gaseosa fue siempr más alta que la de la fase líquida. Los datos obtenidos permiten conocer por primera vezel comportamiento dinámico y la interacción de las fases involucradas en un sistema de producción de nemátodos entomopatógenos, información que podría correlacionarse con le reproducción de *Steinernema feltiae*, una vez que se cuente con la informacción del proceso de fermentación.