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ADAMS, J. R., and R. RODRIGUEZ-KABANA. *The effects of 1,2,4,5-tetrachloro-3-nitrobenzene on plant-parasitic and free-living nematodes.*

Attapulgite granules containing the fungicide 1,2,4,5-tetrachloro-3-nitrobenzene (TCNB) in a 10% (w/w) formulation were mixed with 1 kg of naturally infested Norfolk sandy loam in greenhouse pots at the following rates of active ingredient: 0; 56; 112; 224; 448; 896; 1,120; 2,242; and 4,483 kg/ha. The soil was planted to cotton 'M-8' immediately after TCNB was applied. After 30 days, a sample was taken from each pot and living nematodes were counted. Concurrently, the cotton roots were examined for galling density (no. galls/gm fresh root) and the cotton tops and roots were weighed. A significant decrease in the numbers of *Meloidogyne incognita, Pratylenchus* sp., *Tylenchus* sp., and dorylaimoid nematodes was obtained at rates of 56 kg (a.i.)/ha and higher. Numbers of *Helicotylenchus dihystera* and *Hoplolaimus galeatus* decreased significantly at rates of 112 kg (a.i.)/ha and higher. Gall density values were significantly lower in all TCNB treated pots; a 79% decrease in galls was observed in pots receiving the 56 kg (a.i.)/ha rate. No significant differences in the top weights of the cotton plants occurred in any of the treatments. However, TCNB rates of 448; 1,120; and 4,483 kg (a.i.)/ha resulted in a significant increase in the root weights.—*Department of Botany and Microbiology, Auburn University, Auburn, Alabama 36830.*

ANDERSON, R. V. *The use of glass microbeads to simulate the natural environment for ecological experiments with bacteriophagic nematodes.*

Bacteriophagic nematodes were raised in cultures containing glass microbeads 0.1 to 0.2 mm diam. Beads were coated with a film of nutrient broth which supported bacterial growth and thus provided food and moisture for the nematodes. The beads

were packed in vertical glass columns with outlets at each end which allowed CO_2-free air to be pumped through the system. Respired CO_2 was collected when the air flow passed through alkali traps. By measuring changes in respiratory CO_2, it was possible to assess the effects of the nematode grazing and consequent population changes. During the first 4-5 days after addition of nematodes to the system, CO_2 output increased in the tubes containing nematodes. This increase was probably caused by additional nutrient turnover and accompanying increased bacterial growth. Since bacterial populations in systems containing nematodes increased more rapidly, they depleted the carbon source more quickly, and after 5 days, this response was reflected by lower CO_2 outputs compared to bacterial controls. Microbeads are easily sterilized by conventional methods, reusable, and permit efficient extraction of nematodes by the Baermann technique. Although nematodes moved freely among the glass beads, slightly higher nematode densities did occur at the bottom of the tubes after 8 days. The average density of nematodes in the glass beads (120/gm of beads) was lower than in monoxenic soil cultures (320/gm soil). Despite the lower nematode densities, the microbeads are very useful since the specific chemical nature of the system can be controlled and the microbeads simulate the physical environment of the soil.—*Department of Zoology and Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, Colorado 80523.*

APT, WALTER J. *Survival of reniform nematodes in desiccated soils.*

The ability of the reniform nematode, *Rotylenchulus reniformis,* to survive desiccation in pineapple soil (Red Oxisol) of Hawaii was studied under storage conditions. Aliquants of reniform infested soil (700-800/50 cm^3 soil) contained in double polyethylene bags were held at 20-25C at 10 moisture levels for 2 years. Ten, 50-cm^3 samples were taken from each bag monthly, and the numbers of surviving larvae, males, and young females were determined. At 39.2% moisture, 23% of the population survived for 1 month. Rate of decline slowed thereafter, and 3% and 1% of the population survived at 1 and 2 years, respectively. The absence of larvae indicated that all eggs had hatched. At successive lower moisture levels (28.9, 20.8, 18.9, 11.4, 9.7, 7.5, 4.5, and 4.2%), the rate of survival was 21-78% for 3-4 months, after which time the population declined more rapidly and few nematodes survived longer than 15 months. Larvae were present (1-20%) in all the desiccated samples. The ratio of females to males increased from 1:1 at the 39% moisture level to 9:1 in the desiccated soils. These results demonstrate that, while dry fallow over a period of 12-15 months is effective in reducing reniform nematode population in pineapple soil to low levels, the percentage of the population that survives during the period of land preparation and planting (1-4 months) is very high. Data indicate that moist fallow would be more effective in reducing nematode populations during the initial 1-4 months.—*Department of Plant Pathology, University of Hawaii, Honolulu, Hawaii.*

ATILANO, R. A., J. R. RICH, H. FERRIS, and J. A. MENGE. *Effects of Meloidogyne arenaria on endomycorrhizal grape (Vitis vinifera) rootings.*

Mycorrhizae are an important part of most plant-root systems and should be considered when evaluating effects of plant-parasitic nematodes. Three-week-old, one-node, rooted cuttings of 'Thompson Seedless' grape were transplanted into 7.5-cm lengths of 3.5-cm diam PVC tubing containing *Glomus fasciculatus*-infested or noninfested sandy loam soil (75% sand, 24% silt, 1% clay) and placed in a growth chamber (12 h-day, 28 C). Initial fungal inoculum was approx 174 chlamydospores per 100 cm^3 of soil. Forty-eight days later, approximately 1,000 *M. arenaria* eggs were injected into the root zones of six plants each of mycorrhizal and nonmycorrhizal rootings. Six plants each of nematode-free mycorrhizal and nonmycorrhizal plants served as controls. Five days after injection with nematode eggs, all plants were transplanted into 15-cm diam pots randomized on a greenhouse bench and

maintained for 150 days. Mean shoot growth in the nematode treatment was less than, but not significantly different from, that of the nonmycorrhizal controls. Treatment with *G. fasciculatus* alone increased shoot length, dry weight, and root dry weight by 257, 457, and 106%, respectively, over that of the nonmycorrhizal controls. *M. arenaria* negated the significant beneficial effect of *G. fasciculatus* over nonmycorrhizal controls. The numbers of *M. arenaria* juveniles from mycorrhizal roots were greater than those from the nonmycorrhizal roots, but the difference was not significant. Nematode presence did not significantly affect fungal production of chlamydospores.—*Departments of Nematology and Plant Pathology, University of California, Riverside, CA 92502.*

BERNARD, E. C., and R. S. HUSSEY. *Movement and persistence of dibromochloropropane in a layered soil profile.*

The presence of layered soils in middle Georgia and the practice of subsoiling fields to disrupt plow pans complicate the movement of fumigant nematicides. Treatments of 1,2-dibromo-3-chloropropane (DBCP) and subsoiling at 35 cm were applied in a well-drained coastal plain soil consisting of approximately 20-25 cm of a loamy sand topsoil, a 5-8 cm sand textured plow pan layer, and a sandy-clay subsurface. Treatments were: *(i)* 10 kg (a.i.)/ha DBCP injected at a depth of 18 cm, not subsoiled; *(ii)* 10 kg/ha DBCP injected at 18 cm, subsoiled; *(iii)* 10 kg/ha DBCP injected at 35 cm, subsoiled; *(iv)* 13.5 kg (a.i.)/ha DBCP injected at 35 cm, subsoiled. Soil cores (2.5 cm) were taken at 5 depths to 50 cm and at five 7.5-cm increments from the injection line. DBCP was extracted from the soil with hexane and analyzed by gas chromatography. Samples from all treatments were taken on five dates, and concentrations of DBCP were calculated as μg DBCP/gm oven-dried soil. Seventy-two days after DBCP injection, 0, 3, 9, and 48% of the sampled area in treatments *i, ii, iii,* and *iv,* respectively, had a concentration of 0.1 μg DBCP/gm soil or above. An effective dose for control of *Meloidogyne javanica* has been reported to be 0.1 μg/gm oven-dried soil for 7 weeks. Only treatment *iv* showed a level greater than 1.0 μg/gm soil after 72 days (2%). There was considerable downward movement in the sandy-clay subsurface for all treatments, but lateral movement was greatest at 30-cm depth and above in all treatments. The rate of lateral movement varied among the treatments. The greatest area covered by 0.1 μg DBCP/gm soil for treatment *i* was at 8 days; for treatments *ii* and *iii,* 16 days; for treatment *iv,* 29 days. After these times, the areas covered by 0.1 μg/gm soil diminished, but lateral diffusion continued at lower concentrations.—*Department of Plant Pathology and Plant Genetics, University of Georgia, Athens, GA 30602.*

BIRCHFIELD, W., and W. J. MARTIN. *Effects of some organophosphate and carbamate nematicides on reniform nematode and sweetpotato yields.*

The effects of ethoprop, fensulfothion, and carbofuran on reniform nematode *(Rotylenchulus reniformis)* populations and sweetpotato yields and grade were investigated. Ethoprop was used at .55, fensulfothion at .55, .82, 1.10, and 1.36, and carbofuran at .55, and .73 kg (a.i.)/hectare. Granules were placed on a 30-cm band in the open row, covered by disking, and dragged with a 5 cm x 60 cm board. The 9.1-m row plots were planted with 25 cuttings of 'Centennial' sweetpotato variety. Soil temperature at a 15-cm depth was 20 C and soil moisture was 20% (saturated at 25.8%). The field plot design was a randomized block with four replications on 120 cm rows with 1.5 m between plots. Soil samples for nematode assays were obtained from each plot July 7 and September 19. Potatoes were harvested, weighed, and graded on October 7. All treatments and rates significantly reduced the reniform population by July 7. No significant differences in populations among treatments were found September 19. Fensulfothion at 1.10 and 1.36 and carbofuran at .55, and .73 kg (a.i.)/hectare significantly increased US #1 sweetpotato grade by 605, 615, 710, and 905 kg/hectare, respectively. Carbofuran at the .55 and .73 kg rate significantly increased the total marketable grade by 891 and 1,643 kg/hectare, respectively.—*United States Department of Agriculture, Agricul-*

tural Research Service and Department of Plant Pathology, Baton Rouge, LA.

BIRD, G. W., M. SARETTE, C. COLEY, and M. DOVER. *Nematology components of an on-line pest management system.*

Nematology components of the on-line project are accessed through a pest management executive system (PMEX) developed for: collection of relevant data about pests and factors influencing them, integration of these data and interpretation of their significance, and transmission of information to the agricultural community. PMEX provides bi-directional communications (*e.g.*, extension alerts), environmental and biological data flows (*e.g.*, weather input and forecasts, and pest status maps and summaries such as NEMALAB, a package of programs summarizing data generated by the Nematode Diagnostic Service Lab.), modeling applications, and systems functions such as scheduling, maintenance and control. POTATO PEST is a heuristic, on-line simulation of the population dynamics of *Pratylenchus penetrans* and growth and development of *Solanum tuberosum*. The plant model uses air and soil temperatures, and light intensity to determine net assimilation, which is partitioned into roots, stems, leaves, and tubers on a daily basis. The nematode model is driven by soil temperature and initial population density. The models are interactive and evaluate the influence of varying initial population densities of *P. penetrans* on potato yields. Biological and environmental factors are varied on-line, and nematode and plant parameters are graphed automatically. POTATO PEST can be operated with real-time weather data from PMEX, and specific population densities from NEMALAB.—*Department of Entomology, Michigan State University, East Lansing, Michigan 48824.*

BRODIE, B. B. *Managing population densities of Heterodera rostochiensis.*

Population densities of *Heterodera rostochiensis* were monitored for 4 years in field plots that were subjected to crop management systems involving a resistant potato cultivar 'Hudson', a nonhost crop (oats), chemical soil treatment (carbofuran 5.6 kg/ha), and a susceptible potato cultivar 'Katahdin' alone and in various combinations. Nematode densities were determined from soil samples taken after harvest (October) of each year. A 1.8-kg sample was taken at random from the drill rows of each 9 x 15 m plot. Cysts were extracted by flotation, crushed with an electric stirrer, and viable contents (eggs and larvae) counted. Growing a resistant potato cultivar was the most effective means of suppressing populations. Treatment with carbofuran was the least effective, and growing a nonhost crop was intermediate. A density of 0.1 eggs and larvae/gm of soil was maintained in plots with a monoculture of the resistant potato cultivar. Alternate year cropping of resistant and susceptible cultivars maintained the density at 0.6 eggs and larvae/gm of soil. Plots having alternate year cropping of a nonhost crop and susceptible potato had a density of 1.8 eggs and larvae/gm of soil. After an annual application of carbofuran for 4 years the density increased to 23 eggs and larvae/gm of soil. After 4 years of monoculture of the susceptible potato cultivar, the density increased to 43 eggs and larvae/gm of soil. These data indicate that to manage *H. rostochiensis* successfully at low densities, a resistant cultivar or a nonhost crop must be grown at least once in 2 years.—*United States Department of Agriculture, Agriculture Research Service, Department of Plant Pathology, Cornell University, Ithaca, NY 14853.*

BRODIE, B. B., and R. L. PLAISTED. *Resistance to root-knot nematodes in Solanum tuberosum ssp. andigena.*

A search was made among the Cornell University collection of *Solanum tuberosum* ssp. *andigena* for clones resistant to root-knot nematodes. Evaluations were made in a greenhouse (27-32 C) in 7.5-cm clay pots. Each potato clone was evaluated for resistance to *Meloidogyne incognita acrita, M. incognita, M. arenaria, M. javanica,* and *M. hapla.* In 1973 and 1974, clonal evaluations were made against mixed inoculum consisting of all five species of *Meloidogyne.* Potato seedlings were grown in infested soil for 4-5 weeks; then the roots

were rated for galls. Each clone was rated on a 1-10 scale in which 0 = no galls and 10 = maximum galling. Of the 1,473 clones evaluated, 15 clones received a rating of less than 5. In 1975, these 15 clones were evaluated against each species of *Meloidogyne* separately. Five of the clones which possessed resistance (rating < 5) to two or more species of *Meloidogyne* were selected for bulk crosses in an attempt to increase the level of resistance to *Meloidogyne*. Each clone was bulk pollinated with pollen from the five clones. In 1975, progeny from these crosses were evaluated for resistance to each of the species of *Meloidogyne*. These crosses produced two families with resistance to the five species of *Meloidogyne*. Resistance to *M. incognita acrita* had the highest frequency with up to 100% of the progeny in one family resistant to this species. Resistance to *M. incognita* was found in all families with up to 42% of the progeny in one family resistant to this species. Only three of the families contained progeny with resistance to *M. arenaria, M. javanica,* and *M. hapla.—Agricultural Research Service, United States Department of Agriculture, Department of Plant Pathology, and Department of Plant Breeding and Biometry, respectively, Cornell University, Ithaca, NY 14853.*

BRODY, J. K. *Post-penetration development of Heterodera leuceilyma on St. Augustinegrass.*

St. Augustinegrass was inoculated by transplanting newly rooted sprigs into soil heavily infested with *Heterodera leuceilyma.* Sprigs were removed from the inoculum after 24 h, roots were washed, and the sprigs were transplanted into 10-cm plastic pots containing soil previously fumigated with methyl bromide (0.59 gm /liter). One or two sprigs were removed daily for 50 days and stained with acid fuchsin for observation. Following penetration, the larvae began to swell and their genital primordia lengthened. The second molt occurred 7 days after penetration. The cuticle of the third-stage larvae had longitudinal ridges. By the middle of the third stage, the genital primordium of the female was *V*-shaped, with the bottom of the *V* directed towards the rectum; the genital primordium of the male was *J*-shaped, with the crook directed anteriorly. Third-stage larval males also had two subcuticular, longitudinal rows of "cells." The third molt occurred 15-20 days after penetration. The ovaries of the fourth-stage larval females grew anteriorly with very little coiling. Males of this stage lengthened and became flexed three times within the third-stage cuticle. The fourth and final molt occurred 18-22 days after penetration. Bodies of the females hardened by the 27th day and were packed with eggs by the 34th day. A gelatinous matrix surrounded the vulva by the 40th day. Males did not emerge from the third and fourth stage cuticles until the 27th day. *—Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611.*

CANTO-SAENZ, M., and M. MAYER de SCURRAH. *Races of the potato cyst nematode in the Andean region and a new system of classification.*

Fifty-six populations of the potato cyst nematode collected from northern Bolivia to southern Colombia were inoculated to the European host differentials, as well as to six additional clones derived from *S. vernei* and *S. spegazzinii,* in order to determine their potential as differentials for the Andean nematode populations. *S. tuberosum* subsp. *tuberosum* and *S. tuberosum* subsp. *andigena* were used as control plants. Three to five tubers from each clone were planted in sterilized soil in 500-cm^3 clay pots, which were sunk in humid sand in a screenhouse. Minimum-maximum air temperature was 15-19 C. At planting, inoculum was added as 30 cysts (about 3,000 eggs/plant). To evaluate host reaction, root ball readings as well as final population/initial population ratio were used. Variability, as to the host reaction, of populations from southern Peru and northern Bolivia was higher than other populations. All plants were efficient hosts for the populations from Northern Peru and they supported high reproduction of most of the Andean populations of potato cyst nematode. However, *S. vernei* $(Vt^n)^2$ 62.33.3 was an inefficient host for 83% of th populations from southern and central Peru, Ecuador, and Colombia. Because of

the variability of Andean populations, identification of races was limited to the use of European systems of classification. Therefore, a new classification scheme was developed. Under this scheme, British and Dutch races, as well as Andean populations of the potato cyst nematode, can be identified.—*U.N.A. La Molina, Apartado 456 and the International Potato Center, Apartado 5969, Lima-Perú.*

CHAPMAN, R. A. *Population dynamics of Hoplolaimus galeatus in sod.*

Twelve sites in a 16-m-square plot of weedy bluegrass sod on a silt loam soil were sampled, starting in September 1973, 30 times each during a period of 30 months. Each sample contained 140 cm^3 of soil (3 probes, 15 cm deep x 2-cm diam). Plant-parasitic nematodes in the genera *Criconemoides, Helicotylenchus, Hoplolaimus, Paratylenchus, Pratylenchus, Tylenchorhynchus,* and *Xiphinema* were recovered. *Hoplolaimus galeatus,* the most consistent in occurrence, was found in all but three samples. Populations (ave. no./140-cm^3 sample) of *H. galeatus* in soil were highest in February and lowest in August in 1974 and 1975 (137 and 107 vs. 55 and 46, respectively). In the same order, total numbers in soil and roots in 1975 were 123 and 87. Fluctuation of total population (1.4 x) was less than that of soil population (2.3-2.5 x) because larvae remained in roots during summer and moved into soil during winter. The total number of larvae was relatively constant (32 – 56, $\bar{x}$ = 51) regardless of season. Populations of females and males in soil were proportional to those in roots and soil, and relatively constant regardless of season. Maximum ranges and means of soil populations of females and males were 17 – 46 ($\bar{x}$ = 35) and 10 – 25 ($\bar{x}$ = 18), respectively, and for total populations they were 28 – 52 ($\bar{x}$ = 41) and 11 – 31 ($\bar{x}$ = 21), respectively. The average ratio of females:males was 2:1. Total numbers and composition of this population (46% larvae, 36% females, and 18% males) remained relatively constant at soil temperatures and moistures ranging from 27 C and 17% in summer to 1 C and 36% in winter.—*Department of Plant Pathology, University of Kentucky, Lexington, KY 40506.*

COX, R. J., E. H. MOODY, and C. J. SOUTHARDS. *Effects of neutron irradiation on Meloidogyne incognita.*

Two groups of *Meloidogyne incognita* eggs (*i* = 50% exceed the 4-cell stage of embryological development; *ii* = 50% equal to or less than the 4-cell stage of embryological development) were irradiated with fast neutrons at 0, 1, 2, 3, or 4 Krads at 7, 22, or 32 C. Radiation had an effect on the hatch of both groups of eggs. The hatch of *i* eggs was inversely proportional to the radiation levels and was independent of exposure temperature. However, the hatch of *ii* eggs was not proportional and was associated with exposure temperature. More eggs hatched at the 2 Krad, 7 C treatment than in any of the other treatments at this temperature. The 1 Krad treatment resulted in the lowest hatch. The 3 and 4 Krad, 7 C treatments were intermediate in affecting hatching and differed from the 1 and 2 Krad treatments. At 22 C, all radiation treatments showed significant increases over the controls with peaks at 1 and 3 Krads. There were no differences in the hatch of *ii* eggs at 32 C. Host differential studies showed that larvae from females developing from *ii* eggs irradiated at 1, 2, and 3 Krads at 7 C and from females which developed from both egg groups at all radiation levels at 32 C parasitized and reproduced on a resistant cultivar of cowpea, *Vigna sinensis* (Breeding Line M57-13N). The progeny from *i* eggs from all radiation levels at 7 C did not differ from the controls in the host differential studies. Eggs produced by females developing from *ii* eggs irradiated at 1, 2, and 3 Krads at 32 C remained infective after storage for 4 weeks at 10 C.—*Department of Agricultural Biology, Institute of Agriculture, University of Tennessee, Knoxville, TN 37901.*

CROLL, NEIL A. *Integration and coordination of the behavioural activities of Caenorhabditis elegans.*

Careful analysis, in which a time-lapse video tape recorder and closed circuit

television were employed, has been used to record and quantify the behavioural activities of *Caenorhabditis elegans*. Movement, feeding, defaecation, and spontaneous backward movements have been described and the intervals between each have been measured. When *C. elegans* feeds on cultures of *Escherichia coli,* it becomes less active and this observation, together with others, has led to the hypothesis that an antagonism exists between feeding and somatic muscular contraction. The relationship between the individual behavioural components just listed has been related to current thinking on neurophysiology and the neurotransmitters: acetylcholine esterase and biogenic amines. Finally, a case is made for the generality of this behavioural model and its applicability to the basic pattern of nematode organisation.—*Institute of Parasitology, Macdonald College of McGill University, Macdonald College P. O., P. Quebec, Canada H0A 1C0.*

ENDO, B. Y., and W. P. WERGIN. *Ultrastructure of the labial and cephalic sensory organs of the root-knot nematode, Meloidogyne incognita.*

Second-stage larvae of *Meloidogyne incognita* were examined to determine the ultrastructure of labial, cephalic, and accessory sensory organs. The labial organs can be observed on the external surface of the nematode where they occur as six pores which encircle the stoma. Internally, each pore is surrounded by a cuticular canal containing receptors that consist of two modified cilia. Each cilium is an anterior extension of an axon. These axons collectively form nerve bundles and extend posteriorly to the nerve ring. The extracellular space surounding each ciliary segment is continuous with a narrow space formed by a laminar membrane complex that extends posteriorly and is adjacent to supportive or hypodermal tissue. Cephalic sensory organs, which are peripheral to the labial organs, lie in the two subventral and two subdorsal sectors of the anterior region of the nematode. Their structure resembles that of the labial organs in being *(i)* innervated by modified cilia that are anterior extensions of axons, *(ii)* limited by a canal, *(iii)* surrounded by the supportive hypodermal tissue, and *(iv)* associated with an adjacent membrane complex. However, in contrast to the structure of a labial organ, each cephalic organ is innervated by a single axon whose canal terminates beneath the cuticle of the nematode. A number of accessory axons, which are less clearly defined, occur in the anterior region of the nematode. These receptors are not enclosed by a canal but do terminate beneath the cuticle of the nematode. Observations pertaining to cuticular pores associated with labial organs indicate that these receptors may have a chemoreceptor or secretory function, whereas the lack of cuticular openings associated with the cephalic and accessory receptors suggests that these latter structures may act as tactoreceptors.—*Nematology Laboratory, Plant Protection Institute, Agricultural Research Center, U.S. Department of Agriculture, Beltsville, MD 20705.*

EVANS, D. M., and J. A. FOX. *Influence of metopyrone on development of Heterodera glycines.*

An inhibitor of steroid synthesis, 2-methyl-1,2-di-3-pyridyl-1-propanone (metopyrone), was applied at 4, 20, and 100 μg/ml to second-stage larvae of *Heterodera glycines* and 'Lee' soybean *(Glycine max)* roots as follows: *(i)* simultaneous treatment of soybean roots with larvae and metopyrone, *(ii)* treatment of larvae with metopyrone prior to inoculation, and *(iii)* treatment of soybeans with metopyrone 48 h after inoculation. When compared to nontreated controls, plants that received metropyrone in treatment *(i)* showed both an increase in both the percentage of larvae that survived to adults and the rate at which males emerged from roots, and exerted a feminizing effect on sexual development. The percentage of males decreased from 77% in the nontreated controls to 61% in the 100 μg/ml solution. In treatment *(ii)*, metopyrone increased the percentage of larvae that survived to adults but did not influence sexual development. In treatment *(iii)*, metopyrone exerted a feminizing influence on sexual development. The percentage of males decreased from 66% in the controls to 53% in the 20 μg/ml solution. These results indicate

that the influence of metopyrone on sexual development of *H. glycines* was mediated through the host plant and suggest that host steroids are involved in growth and development of *H. glycines.*—*Supported by CSRS Grant 316-15-69. Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.*

FERRIS, H. *A generalized nematode simulator based on heat-unit summation.*

The relationship of accumulated heat units (degree hours or degree days above a basal threshold) to nematode population development is well documented. A simulator was developed which uses daily max and min soil temperatures to accumulate heat units and predict nematode life cycle length and reproductive output. Temperature, as a regulator of metabolic rate, is the driving force for the simulator. The effects of other environmental inputs on the system, as they become limiting, is to curtail or reduce the accumulation of effective heat units. Advantages of this approach to simulation include ease in determining the relationship between heat unit summation and nematode development and the adaptability of the simulator to other nematode systems. The heat unit relationship also holds for many plants, a factor which is convenient in developing a model of the plant/nematode interaction. However, the lack of biological information required for the model is a disadvantage in that detailed analysis of parts of the system are avoided. —*Department of Nematology, University of California, Riverside, CA 92502.*

FINNEY, J. R. *The in vitro culture of mermithid parasites of blackflies and mosquitoes.*

Sufficient numbers of mermithid eggs must be obtained in order to test mermithid parasites as control agents of aquatic stages of blackflies and mosquitoes in a natural environment. One method of obtaining sufficient eggs and subsequent preparasitic nematodes for release into streams involves culturing these parasites *in vitro.* By using *Reesimermis nielseni,* a parasite of mosquitoes, and *Neomesomermis flumenalis,* a natural parasite of blackflies, techniques were developed (for mass sterilization and transfer of both eggs and preparasitic stages) which facilitated initiation of cultures in commercially available tissue-culture media. Best results were obtained using a combination of Grace's tissue-culture medium and Schneider's Drosophila medium modified by the addition of fetal calf serum. *Reesimermis nielseni* was cultured at 26 C and *N. flumenalis* at 10C; the media were replaced every 3 days. After 22 days preparasites of both nematodes had developed to a stage comparable with that of a 3-4 day nematode *in vivo* with *R. nielseni* having reached a length of 6-7 mm and *N. flumenalis* 8-9 mm.—*Research Unit on Vector Pathology, Memorial University of Newfoundland, St. John's, Newfoundland, Canada.*

FOX, J. A., and L. SPASOFF. *Resistance and tolerance of tobacco to Heterodera solanacearum.*

A greenhouse procedure was developed to evaluate tobacco *(Nicotiana tabacum)* breeding lines for resistance and tolerance to *Heterodera solanacearum.* Two months after inoculation with an initial population density (20,000 eggs/5-cm pot) capable of causing a severe suppression of growth of the standard susceptible variety 'NC 95', individual plants were selected for selfing on the basis of number of females/plant and green weight. After using these selection criteria for several generations, it was apparent that the ability of the host to inhibit the development of the nematode (resistance) was genetically independent of the host's ability to grow in the presence of the nematode (tolerance). Four lines were selected (on the basis of greenhouse data) to represent the following phenotypes: resistant and tolerant (RT), resistant and intolerant (RI), susceptible and tolerant (ST), and susceptible and intolerant (SI). The average number of females/plant and average plant dry weight (gm) for each phenotype were: (RT) 22 and 0.8, (RI) 5 and 0.4, (ST) 544 and 0.6, and (SI) 411 and 0.3. The performances of the 4 lines were compared in 24 field plots with different

nematode densities. The average plant heights, measured 95 days after transplanting were 82, 32, 74, and 62 cm for RT, RI, ST, and SI, respectively. Since the RT line was selected from a cross of RI (BVA523, a burley breeding line) and SI (NC 95), the data indicate that a great potential exists for combining the genetically independent factors of tolerance and resistance through selection.—*Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.*

FRIEDMAN, P. A., and E. G. PLATZER. *Identification of Caenorhabditis briggsae and C. elegans.*

Four strains (1-4) of putative *Caenorhabditis briggsae* were obtained from four laboratories. *Caenorhabditis elegans,* strain N2, was obtained from Dr. R. L. Russell (Cal. Tech.). The arrangement of the bursal rays of strains 1, 2, and 3 was that of *C. elegans.* We could not find males in strain 4. Hermaphrodites of strains 1, 2, and 3 mated with males of *C. elegans* and produced progeny. Similar crosses were attempted with strain 4, but mating did not occur. Therefore, additional approaches were required for the differentiation of species in this genus. Electrophoresis of proteins as a chemotaxonomic tool for nematode species differentiation was investigated. The proteins from homogenates were compared by polyacrylamide-gel electrophoresis (vertical slab). Four to six isoenzymes of malate dehydrogenase were found in all strains. Isoenzymes of strains 1, 2, and 3 exhibited identical electrophoretic mobilities (E_f), whereas those of strain 4 exhibited a greater E_f. Electrophoresis of nematode proteins treated with sodium dodecyl sulfate showed identical patterns for strains 1, 2, and 3. Although most protein bands were common, some proteins from strain 4 differed from the other 3 strains qualitatively and quantitatively. On the basis of morphology, genetic compatibility, and biochemical composition, strains 1, 2, and 3 were *C. elegans.* Although the bursal ray pattern could not be examined in strain 4, the mating test and biochemical evidence indicated it was *C. briggsae.*—*Department of Nematology, University of California, Riverside, CA 92502.*

FRIEDMAN, P. A., and R. A. ROHDE. *Phenol levels in leaves of tomato cultivars infected with Pratylenchus penetrans.*

Pratylenchus penetrans injury to tomato roots results in accumulation of phenols in the lesions. We investigated the possibility of phenol accumulation in leaves of tomato cultivars infected with *P. penetrans.* Tomato cultivars were inoculated with *P. penetrans* from callus cultures. Phenols were identified by thin layer chromatography and quantitated by the Folin-Ciocalteu method. The free phenol content of leaf extracts was the same in healthy and in nematode-infected plants for all tomato cultivars. In contrast, total bound phenols in leaf extracts from 'Manalucie' and 'Rutgers' tomatoes inoculated wtih 10,000 *P. penetrans* increased 4 to 18%, respectively, over those in controls 28 days after inoculation. In 'Valiant' tomato inoculated with 4,500 *P. penetrans,* total bound phenols increased 21% over those in controls 28 days after inoculation. Total bound phenols in 'Manalucie' and 'Rutgers' tomatoes inoculated with 2,200 *P. penetrans* increased 13 and 30%, respectively, over those in controls 42 days after inoculation. The observed increases of bound phenols in leaves of tomato cultivars suggest a systemic response to *P. penetrans* infection of tomato roots.—*Department of Plant Pathology, University of Massachusetts, Amherst, MA 01002.*

GARCIA, M. R., and G. C. SMART, JR. *A field study of the influence of soil temperature on survival of larvae and eggs of the peanut root-knot nematode, Meloidogyne arenaria.*

The seasonal trend for populations of *Meloidogyne arenaria* larvae and eggs as influenced by soil temperature was investigated. Random soil samples were collected monthly, starting June 1975, from each of five replicated field plots of peanuts *(Arachis hypogea)* growing in Arredondo fine sand. A 10-cm diam bucket auger was used to take samples at soil depths of 0-15,

15-30, 30-45, 45-60, and 60-75 cm. Centrifugal-flotation and sieving-staining techniques were used to extract larvae and egg masses, respectively, from 50 cm^3 soil. The gelatinous matrices were stained with 2% Phloxine B solution to improve their visibility for counting. An Atkins Indicator with multi-probe automatic Switchbox and Recorder Model # 25108-09/21066-09/21822-09 was used to record the soil temperatures at 0-, 15-, 30-, 45-, 60-, and 75-cm depths. Three months after planting, egg masses were recovered at all depths sampled and nematode numbers were higher than preplant densities. One month after harvest, the egg masses disappeared and were not recovered through March 1976. Two months after harvest, numbers of larvae in the upper two depths decreased more rapidly than those at lower depths. While the temperature at the surface fluctuated drastically during the fall and winter months, the temperature decreased gradually and fluctuated less at 60-75 cm. *—Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611.*

GOLDEN, A. MORGAN. *First occurrence and morphology of a Meloidoderita species in the United States.*

The genus *Meloidoderita* and its nominate family were established to accommodate a single, unnusual species (*M. kirjanovae* Poghossian, 1966) on *Mentha,* which was known only from certain localities in Russia. Specimens resembling this species were found in a mixed infection with *Heterodera wiessi* on roots of *Polygonum pennsylvanicum* in midsummer of 1975 at Beltsville, Maryland. A pure culture of this nematode was later established on this host in a growth chamber with temperatures of 27 C (day) and 21 C (night) and a 14-h day length. *Meloidoderita kirjanovae* was reported to produce small galls on mint and nettle, but no visible swelling on *Polygonum* roots was caused by this form. The females are rather pear-shaped, have protruding terminal vulva, measure about 300 μm x 225 μm, and have a smooth, thick cuticle (5-10 μm). Only the neck and anterior region of the female extend into the root, and the exposed body is enclosed by a rounded egg sac up to 3 times the size of the female. This sac becomes filled with eggs, and as the larvae hatch from these eggs, a brown cystoid globular structure develops and is filled with eggs within the female. It has a thick surface with prominent spines and might become almost as large as the female (which is then no longer detectable). This unique structure is reported by two Russian workers to arise from the large uterus in *M. kirjanovae.* However, further study is needed on the exact nature and origin of this structure and other aspects of the females, eggs, and larvae of this unusual nematode. Males have not been found.*—Nematology Laboratory, Plant Protection Institute, Agricultural Research Center, United States Department of Agriculture, Beltsville, MD 20705.*

GRULLON, L. A., D. W. DICKSON, and R. P. ESSER. *Comparative morphological and host-range studies of three isolates of Meloidogyne arenaria.*

Morphometric and differential host-range studies were made of three single egg-mass isolates of *Meloidogyne arenaria;* two were from peanut fields in Williston and Jay, Florida, and the third was a greenhouse culture from North Carolina State University. A culture started from infested soil from the Williston field was used for comparison. Plant cultivars tested were: 'Allgold' and 'Porto Rico' sweetpotato, 'Deltapine 16' cotton, 'Albritton' strawberry, 'Rutgers' tomato, 'NC-95' tobacco, 'Minnesota A-401' corn, California wonder' pepper, 'Charleston Gray' watermelon, and 'Florunner' peanut. The North Carolina isolate reproduced on all cultivars except strawberry and peanut, whereas the Florida isolates failed to reproduce on the first four cultivars listed previously. Twenty females, males, and larvae from each isolate were studied and measured. The lateral incisures were present in 50% of the females from Florida, but were absent in the North Carolina isolate. Perineum striae were absent in the Jay isolate, but present in 20-35% of the other isolates. The female excretory pore averaged 26 μm from the anterior end in the North Carolina isolate

and 40-57 μm in the Florida isolates. Average larval body lengths and ranges were as follows: Jay, 420 μm (390-457 μm); Williston single egg mass, 489 μm (468-520 μm); Williston field population, 447 μm (415-494 μm); and North Carolina, 379 μm (354-405 μm). Lateral line aerolation was always present in the North Carolina males but only in 60-70% of the Florida males. The Williston egg-mass isolate did not differ from the field population in differential host ranges or morphometric studies. —*Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611.*

HAMLEN, R. A. *Efficacy of nematicides for control of Meloidogyne javanica on Maranta in ground bed and container production.*

The efficacy of nematicide drenches for controlling *Meloidogyne javanica* on *Maranta leuconeura kerchoveana* was tested in ground beds containing a sand-peat mixture. Carbofuran and oxamyl each at 22.4 kg (ai)/ha suppressed levels of *M. javanica* as well as galling of squash *(Cucurbita pepo)* grown in soil 1 month after the application of drenches. On *Maranta* grown in containers on raised benches, drenches of carbofuran at 0.06 kg (a.i.)/100 liters, ethoprop at 0.04 kg (a.i.)/100 liters, or oxamyl at 0.03 kg (a.i.)/100 liters was more effective than granular formulations at 22.4 kg (a.i.)/ha 1 month following application. At 4 months after application, the ethoprop drench was the best overall treatment, whereas four foliar sprays of oxamyl at 0.12 kg (a.i.)/100 liters applied at 3-week intervals were ineffective. Roots of okra *(Hibiscus esculentus),* growing in soil treated with ethoprop, oxamyl, or aldicarb (10G) at 11.2 kg (a.i.)/ha, were only slightly galled. Significant galling occurred in soils treated with carbofuran or in soil obtained from *Maranta* which had received foliar sprays of oxamyl. At 4 months after application, okra roots from the ethoprop drench were free of visible galls and yielded low populations of *M. javanica* larvae. Carbofuran drenches produced necrotic flecking and marginal necrosis of *Maranta* foliage.—*University of Florida, Institute of Food and Agricultural Sciences, Agricultural Research Center, Apopka, FL 32703.*

HEDRICK, MARGARET L., and C. J. SOUTHARDS. *Reaction of soybean cultivars to Meloidogyne incognita, Sclerotium rolfsii, and Cylindrocladium crotalariae.*

In greenhouse tests, three cultivars of soybeans were inoculated either with *Meloidogyne incognita, Sclerotium rolfsii, Cylindrocladium crotalariae,* or a combination of the nematode with each fungus. Combinations were made both at the time of planting and with the fungus added 14 days after inoculation with *M. incognita.* Each treatment and the control consisted of five replications of five plants each. Plants were maintained for 70 days at 21-31 C in the greenhouse. *Sclerotium rolfsii* was highly pathogenic wherever it was used. Plant mortality and fine-root necrosis did not differ significantly in treatments with the fungus alone and in treatments with simultaneous addition of the fungus and *M. incognita* eggs. There was no evidence of predisposition to *S. rolfsii* due to nematodes. Plant mortality was less in treatments involving *C. crotalariae* than in those involving *S. rolfsii,* but there was an increase in mortality when nematodes were combined with the former. Necrosis of fine roots was greater on plants inoculated with nematodes 14 days prior to inoculation with *C. crotalariae.* This response was more apparent on the *M. incognita* resistant cultivar 'Hill' than on 'Lee 68' or 'Mack'. The lowest numbers of root galls and egg masses were present on 'Hill'. Root nodulation by *Rhizobium* was suppressed 20-50% on plants inoculated with both fungi, but was stimulated on plants inoculated only with *M. incognita.—Department of Agricultural Biology, University of Tennessee, Knoxville, TN 37901.*

HÖGGER, C. H., R. H. ESTEY, M. J. KISIEL, and B. M. ZUCKERMAN. *Scanning electron microscopy of young and old Caenorhabditis briggsae females.*

One-week-old (young) *C. briggsae* females generally had a smooth cuticle, whereas 5-week-old (old) specimens had a wrinkled cuticle, and the annules were

sunken. In slightly shrunken, old nematodes, the cuticle collapsed over the hypodermal chords and the outline of the basal bulb of the esophagus was seen. In young specimens the mouth was open, and in old ones it was usually closed. The two small circular amphidial openings were located on the second (head) annule. The endings of the outer cephalic and labial sensilla were observed as two small bumps on each subventral and subdorsal lip. The lateral lines were formed by three parallel ridges which often had double crests. Deirids, easily visible in young nematodes but not in old ones, were located on the dorsal lateral line at the level of the excretory pore. The vulva had two large, almost semicircular lips bordered laterally by cuticular flaps. Cryofractures through old nematodes showed holes within the intestinal epithelium which conformed in size and location to sites normally occupied by age-pigment granules. These holes were not observed in corresponding fractures through young nematodes.—*Department of Plant Pathology, Macdonald Campus of McGill University, St. Anne de Bellevue, Que., Canada HOA 1CO; and Laboratory of Experimental Biology, University of Massachusetts, East Wareham, MA 02538.*

HUSSEY, R. S., and R. W. RONCADORI. *Influence of subsoiling on cotton yield and on the vertical distribution of soil-borne microorganisms.*

Experiments were conducted on a Marlboro loamy-sand soil to determine the effects of continued subsoiling on cotton yield and on the vertical distribution of soil-borne microorganisms. Subsoiling 35 cm deep under the planting row for 3 consecutive years increased annual yields of seed cotton by 50 to 140%. However, subsoiling was necessary each year to obtain yield increases. The addition of the nematicide 1,2-dibromo-3-chloropropane significantly reduced the population density of *Hoplolaimus columbus* but did not increase seed-cotton yields over subsoiling alone. Subsoiling significantly reduced *H. columbus* in the top 20 cm of soil. This reduction was correlated with the presence of fewer roots in this top zone because of deeper penetration by much of the root system. Selected plots were sampled (preplant and harvest) at four depths (0-18, 19-38, 39-53, and 54-70 cm) to determine the effects of subsoiling on the vertical distribution of certain soil-borne microorganisms. Subsoiling under the same row for 3 consecutive years had no significant influence on the vertical distribution of the soil-borne microorganisms. Highest population densities of plant-parasitic nematodes, *Pythium* spp., *Fusarium* spp., and *Endogone* spp. occurred at the 0-18 cm depth. Significant differences occurred, however, in samples taken before planting and at harvest. Populations of *Pythium* spp. remained stable, whereas *Fusarium* spp. declined, and *Endogone* spp. increased during the growing season only at the 0 to 18 cm depth. Population densities of *H. columbus, Meloidogyne incognita,* and *Helicotylenchus* sp. increased at all depths during the growing season.—*Department of Plant Pathology and Plant Genetics, University of Georgia, Athens, GA 30602.*

IBRAHIM, I. K. A., and M. A. REZK. *Pathogenesis and development of Meloidogyne javanica on corn.*

Meloidogyne javanica induced pathological symptoms, including galling of roots and depressed growth vigor, on the corn hybrid 'A-17'. Second-stage larvae invaded young roots within 6 h after inoculation. Most of the larvae penetrated root apices, but the zones of elongation and differentiation, and mature tissues also were invaded. Larval penetration and migration through root tissues caused distortion to the nearby cells. Giant cells developed mainly in the meristematic and stelar tissues within 6 days after inoculation. Endodermis and pericycle were interrupted at the site of nematode invasion. Third- and fourth-stage larvae and young females were detected 10, 12, and 16 days after inoculation, respectively. Adult females were observed after 20-24 days; females oviposited 30 days after inoculation; and the life cycle of *M. javanica* was completed in about 34 days.—*Department of Plant Pathology, Faculty of Agriculture, Alexandria University, Alexandria, Egypt.*

IMBRIANI, J. L., and E. G. PLATZER. *Malate dehydrogenase in Reesimermis nielseni (Mermithoidea).*

The specific activity, pH optimum, substrate, and cofactor affinities of malate dehydrogenase (MDH; EC 1.1.1.37) from *Reesimermis nielseni* were determined. Postparasitic stages of *R. nielseni* were homogenized and a high-speed supernatant was prepared for determination of MDH activity by spectrophotometry. Activity was determined for oxaloacetate reduction and malate oxidation. Malate dehydrogenase from *R. nielseni* was more active in 0.1 M Tris-Cl than 0.1 M potassium phosphate. For oxaloacetate reduction, the pH optimum was 8.1, the specific atcivity was 4.80 μmoles min^{-1} mg $protein^{-1}$, and the apparent affinity constants (K_m) for oxaloacetate and reduced nicotinamide adenine dinucleotide were 4.4 x 10^{-5} M and 1.4 x 10^{-5} M, respectively. For malate oxidation, the pH optimum was 8.3, the specific activity was 0.437 μmoles min^{-1} mg $protein^{-1}$, and the K_m for malate was 7.4 x 10^{-4} M. Reduced nicotinamide adenine dinucleotide phosphate did not function as a cofactor for the enzyme. Malate dehydrogenase activity in *R. nielseni* (Adenophorea) is higher than that reported for most nematodes in the Secernentea, but the kinetic properties are similar.—*Department of Nematology, University of California, Riverside, CA 92502.*

INSERRA, R. N., and N. VOVLAS. *Pathogenicity of Pratylenchus vulnus to sour orange seedlings.*

Greenhouse-pathogenicity studies were conducted with *Pratylenchus vulnus* on sour orange (*Citrus aurantium* L.) to determine the role of this nematode in tree decline often seen in citrus nurseries in southern Italy. One-year-old sour orange seedlings were individually transplanted into 18-cm diam clay pots containing pasteurized sandy loam soil. After 1 month, 10 plants each were inoculated with 100, 250, and 500 nematodes/pot, and 10 noninoculated plants served as controls. Seedlings were randomized on a greenhouse bench and grown for 13 months at 24-26 C. Root samples were selected for nematode assay and plant height measurements were taken 6, 11, and 13 months after inoculation. Stem diameter and oven-dry shoot and root weights were taken at final harvest. All *P. vulnus*-inoculated seedlings had significant growth retardation ranging from a suppression (compared to controls) of 25-38% in height, 35-47% in dry top weights, 23-35% in dry root weights, and 11-21% in trunk diam. Final densities were 1,167; 1,185; and 1,313 *P. vulnus*/gm of root, respectively, for each inoculum level. Similar results were obtained in a second experiment using sour orange seedlings growing in a river sand and inoculated with 100 *P. vulnus*/pot. Dry root weights and trunk diam were 58 and 23% less than those of respective controls. Final density was 1,959 *P. vulnus*/gm of root. Histological studies of roots infected with *P. vulnus* showed that the cortex was the tissue most extensively attacked. No evidence of vascular tissue damage was observed.—*Agricultural Nematology Laboratory, National Council Research, 70126 Bari, Italy.*

JATALA, P., L. GUTARRA, E. R. FRENCH, and J. ARANGO. *Interaction of Heterodera pallida and Pseudomonas solanacearum on potatoes.*

Pseudomonas resistant potato cultivar 'BR-73.40' (*Solanum phureja* x *S. tuberosum* subsp. *tuberosum*) and susceptible cultivar 'Renacimiento' (*S. tuberosum* subsp. *andigena*) were grown in 2,000-cm^3 clay pots placed in a screenhouse. When plants were approximately 20-cm tall, they were inoculated with *Heterodera pallida* and *Pseudomonas solanacearum* by using the following treatments: *(i) H. pallida* alone (3,000 freshly hatched larvae in 20 ml water/pot), *(ii) P. solanacearum* Race 3 alone (20-ml water suspension of 6 x 10^7 cells/ml), and *(iii) H. pallida* + *P. solanacearum* simultaneously. Control plants received neither organism. Inocula were introduced through 12 x 1-cm glass tubes placed around the seed piece at planting and protruding 3 cm above the soil line. Screenhouse minimum-maximum temperatures ranged from 14-26 C up to the time of inoculation, 16-29 C the next 14 days, and 20-34 C during the remaining 46 days of the experiment. Bacterial wilt

symptoms were recorded daily. Wilt initiation of 'Renacimlento' inoculated with bacteria alone was 10% 36 days after inoculation and rose to a maximum of 50% after 50 days. When both organisms were inoculated simultaneously, there was 50% wilt in 15 days and 100% after 25. Bacteria alone caused an initial 10% wilt of 'BR-73.40' in 25 days, and wilt reached a maximum of 20% in 47 days. When soil was infested with both organisms, wilt occurred initially after 22 days in 20% of the plants and reached 100% after 52 days. Temperature conditions during the first 3 weeks after inoculation with *H. pallida* did not hinder the establishment of the nematodes within the roots as the majority of the larvae inoculated alone reached maturity. The major impact of the synergism caused by the two combined organisms occurred during the first 2-3 weeks after inoculation when the temperature conditions favored the nematode establishment. Wilt symptoms, however, only occurred when the temperature was high.—*The International Potato Center, Apartado 5969, Lima, Peru.*

JATALA, P., and P. R. ROWE. *Reaction of 62 tuber-bearing Solanum species to the root-knot nematode, Meloidogyne incognita acrita.*

Tubers of 220 accessions, representing 62 tuber-bearing *Solanum* species, were planted in sterilized soil in 10-cm clay pots and grown in a screenhouse. Two weeks later, each plant was inoculated by the addition of comminuted potato roots infected with *Meloidogyne incognita acrita* to the soil. Two months after inoculation, root systems were examined for nematode infection. Relative severity of root galling and nematode reproduction was rated on a scale of "zero" to "four." A score of "zero" was used for no root galling and/or no nematode reproduction and the score of "four" was used for very severe root galling and/or a very high nematode reproduction. Plants with "zero" or "one" were rated as resistant. Twenty-six accessions, representing 19 species segregated for resistance, and the roots of some plants were rated "one" (trace of galling and/or reproduction by the nematode). The highest frequency of resistant plants was found in the following accessions: *S. capsicibaccatum* PI 205560, *S. megistacrolobum* Oka 3931, *S. microdontum* Oka 4820, *S. sparsipilum* PI 310933 and HHC 4399, and *S. spegazzinii* Oka 4902. Roots of some plants of *S. acroscopicum* PI 365315, *S. gourlayi* Oka 4532, *S. megistacrolobum* Oka 4460, and *S. sparsipilum* PI 310933 exhibited no galling and/or nematode reproductions. In studies parallel to these, over 3,000 clones of cultivated potato species from the germ plasm collection of the International Potato Center were tested for resistance to root-knot nematode in the field as well as in the screenhouse. An adequate level of resistance was not detected in the cultivated potatoes. Therefore, breeding for resistance to the root-knot nematodes will be based on the resistant clones of the non-cultivated species.—*The International Potato Center, Apartado 5969, Lima, Peru.*

JOHNSON, A. W., D. R. SUMNER, C. C. DOWLER, and N. C. GLAZE. *Influence of three cropping systems and four levels of pest management on populations of root-knot and lesion nematodes.*

Crops were grown one year in field plots of Tifton loamy sand naturally infested with nematodes, pathogenic fungi, and weeds. Treatments were: (i) methyl bromide (MB); *(ii)* DD-MENCS (D-M) + ethoprop (E); *(iii)* ethoprop (E), if needed because of the nematode levels; and *(iv)* control — no nematicide. Annual cropping systems were: *(i)* turnip-peanut-cucumber (T-P-C), *(ii)* sweet corn-soybean-wheat (SC-SB-W), and *(iii)* turnip-field corn-southern pea (T-FC-SP). In the T-P-C cropping sequence, populations of root-knot nematodes, *Meloidogyne* spp., were suppressed by all management levels on turnip but increased on peanut in control plots. Yield of cucumber was greater when nematode populations were low. Populations of lesion nematodes in the T-P-C sequence were not affected by management levels. In the SC-SB-W sequence, populations of root-knot nematodes were not affected by management levels, but numbers of lesion nematodes were suppressed by all management levels except the control. Yields of sweet corn and

soybean were greater when lesion (*Pratylenchus* spp.) nematodes were controlled. In the T-FC-SP sequence, populations of root-knot nematodes were not affected by management levels on turnip and were suppressed to very low levels by MB and D-M on field corn and by MB on southern pea. Lesion nematodes did not increase on turnip but increased rapidly on field corn. Yield of southern pea was inversely related to the initial population of root-knot and lesion nematodes.—*Agricultural Research Service, United States Department of Agriculture, Georgia Coastal Plain Experiment Station, Tifton, GA 31794.*

JOYE, L. G., and V. G. PERRY. *Incidence of Contortylenchus spp. in southern pine beetle populations from the southeastern United States.*

During 1975-1976, larval, pupal, and adult southern pine beetles, *Dendroctonus frontalis* Zimmerman, from the southeastern United States were examined for internal nematode parasites of the genus *Contortylenchus.* Nineteen of twenty-one beetle populations were examined and all but two populations contained *Contortylenchus* spp. *Contortylenchus* spp. were found in beetles attacking loblolly, longleaf, sand, and shortleaf pine. The rate of parasitism did not appear to vary according to the heights of the trees where the beetles were found. At least two species of *Contortylenchus* appear to be parasitizing the southern pine beetle in the south. The rate of parasitism increased with the maturity of the beetle. Lowest rates were found in beetle larvae, whereas highest rates were found in adult beetles. Apparently, most of the nematodes enter beetles during the late pupal stage. Incidence of *Contortylenchus* spp. varied from 12-24% for populations of beetles available in sufficient numbers for statistical analysis. In samples of populations having few beetles, the presence of *Contortylenchus* spp. was only noted, but no statistical tests were made.—*Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611.*

KAPLAN, D. T., and R. A. ROHDE. *Effects of lesion-nematode infection on leaf-water vapor loss as determined by diffusive resistance.*

The rate of water vapor loss from leaves of 'Mammoth' sunflowers, *Helianthus annus* L., whose roots were parasitized by *Pratylenchus penetrans,* was determined with a diffusive resistance porometer. Seedlings grown in a growth chamber in 10-cm diam pots were inoculated with 2,000 nematodes. This population level did not produce stunting, foliar symptoms, or visible reductions in root distribution during the experiment. However, the roots (particularly the tap root) exhibited lesion formation and browning. Diffusive resistance of abaxial leaf surfaces was measured at 8 h intervals starting 12 h after saturation of the soil with water and ending upon the first sign of wilting. As soil moisture became limited, the rate of water loss from leaves of infected plants decreased in advance of that of controls. Young nematode-infected plants exhibited reductions in the rate of leaf-water vapor loss at higher soil moisture levels than did diseased plants which were 3 weeks older. Reductions in transpiration may reflect alterations in internal water status of infected plants and in such processes as transport of hormones synthesized in roots. Ultimately, such effects may induce the stunting associated with lesion-nematode infection.—*Department of Plant Pathology, University of Massachusetts, Amherst, MA 01002.*

KAPLAN, D. T., and T. H. TATTAR. *Reduction of electrical resistance in sunflower roots infected with lesion nematodes.*

The effects of *Pratylenchus penetrans* on root tissue of 'Mammoth' sunflowers and 'I O Chief' sweet corn were determined by measurements of electrical resistance. Changes in electrical resistance of lesion nematode-infected, noninfected adjacent tissues and noninoculated root tissue were estimated by measurements with a device which measures electrical resistance to a pulsed current existing between two platinum electrodes inserted 3 mm or 5 mm

apart. Decreases in the electrical resistance of infected sunflower-root tissue indicated that changes in integrity occurred in infected tissues within 3-6 h although lesions were not evident until 16-24 h after inoculation. No lesion formation or changes in electrical resistance were detected in infected corn root tissue. Changes in electrical resistance were not detected in tissues 2 cm from the inoculation site in either of the species tested. The reason for this differential response of corn and sunflower to lesion nematode attack is unknown; perhaps it may be correlated with effects on host tissue resulting from enzyme activity or the number of cells that are killed. *—Department of Plant Pathology, University of Massachusetts, Amherst, MA 01002.*

KLOBE, W. D. *Physiological differences between Tennessee populations of Meloidogyne spp.*

Experiments were conducted: *(i)* to isolate populations of *Meloidogyne* species from various locations in Tennessee, *(ii)* to characterize the populations on the basis of standard differential host response, and *(iii)* to determine the range of physiological variation within *Meloidogyne* species and their effect upon soybean production. Tomato, *Lycopersicon esculentum* Mill. 'Rutgers', was used as the host plant for isolating root-knot nematode populations from soil samples. Single egg masses from original populations were sub-cultured to produce pure-line isolates. Host differential studies with 26 *Meloidogyne* isolates indicated that 13 responded as *M. incognita acrita,* 11 as *M. incognita,* and 2 as *M. javanica.* Partitioned trenches were utilized in field trials to differentiate further nematode isolates on the basis of virulence to soybean. Experimental units (0.6 m deep x 0.9 m wide x 3.0 m long) were filled with a fertilized 3:1 mix of sand (vermiculite previously sterilized with methyl bromide). The growing medium was infested with 600,000 nematode eggs at the time of planting. Soybean selections, having root-knot nematode resistance ranging from poor to good, were planted in a randomized complete block design. Of 21 *Meloidogyne* isolates tested, three gave consistently high pathogenicity ratings and three were consistently low, regardless of soybean germ plasm. The response of 'Forrest', 'Dare', and 'Pickett-71' soybean cultivars was in agreement with the ratings in *Uniform Soybean Tests of Southern States.*—*Department of Agricultural Biology, University of Tennessee, Knoxville, TN 37901* .

KONTAXIS, D. G., I. J. THOMASON, R. HAGEMANN, and H. E. MCKINNEY. *Chemical control of Heterodera schachtii on sugar beets in Imperial Valley, California.*

In August 1975, a nematicide trial was established in a field planted to sugar beets for three consecutive years. In the nontreated plots, the average population density of *Heterodera schachtii* was 2,272 eggs/600 gm of soil at 14 days after the first irrigation. In the 1974-75 crop year the nematode population was also high, and root yields of 15,683 and 62,735 kg/ha were obtained in the nontreated and treated plots, respectively. D-D® (1,3-dichloropropene, 1,2-dichloropropane) at 177 liters or Telone® II (1,3-dichloropropene) at 112 liters/ha, plus 15 kg aldicarb (15G)/ha, were applied on 29 August 1975. An additional 15 kg/ha of aldicarb (15G) were sidedressed on 27 February 1976 at 147 days after the first sprinkle irrigation. Other treatments in the same trial were: *(i)* aldicarb (15G) 30 kg/ha applied at planting time (no soil fumigant); *(ii)* aldicarb (15G) 15 kg/ha at planting; *(iii)* carbofuran (10G) at 44.8 kg/ha plus 177 liters/ha of D-D; *(iv)* carbofuran (10G 44.8 kg/ha plus 84 liters/ha of Telone II; *(v)* carbofuran at 44.8 kg/ha at planting time; *(vi)* Telone II alone at 130.7 liters/ha preplant; *(vii)* Telone II at 84 liters/ha plus 15 kg of aldicarb (15G) at planting and an additional 15 kg/ha of aldicarb at 147 days after the first sprinkle irrigation; and *(viii)* D-D at 149 liters/ha plus 15 kg/ha aldicarb at planting and an additional 15 kg/ha of same on February 27. The soil temperature at fumigation (30.5 cm depth) was 32.8 C. Many seedlings, however, damped-off in the nontreated soil. By mid-January 1976, the plants in all treated plots had developed well. The plants in the nontreated plots were stunted

and about one-third the size of those in the best treatments. The best treatments, on the basis of plant size, were Telone II + aldicarb, D-D + aldicarb, Telone II + carbofuran, and D-D + carbofuran.—*Cooperative Extension, El Centro, CA 92243; Cooperative Extension and Nematology Department, Riverside, CA 92502; Cooperative Extension, El Centro, CA 92243; and Nematology Department, Riverside, CA 92502, respectively, University of California.*

LEWIS, S. A., and T. F. HUFF. *Cuticle anatomy of Hoplolaimus columbus.*

Electron micrographs were taken of transverse and longitudinal sections of adult female *Hoplolaimus columbus.* The cuticle consisted of six distinct layers in four zones: cortical, medial, striated, and granulated. The cuticle was 1.8 μm at midannule and 1.5 μm thick at the annulations, which were 1.5 μm apart at the level of the esophagus. The external cortex (.07 μm) was trilaminate, with each sublayer less electron-dense than the previous sublayer. The internal cortical layer varied from about 0.2 μm under the annulation to 0.4 μm thick at midannule and was more electron-dense at its outer edge. This graduation in density had a layering effect in some of the micrographs. The median layer, about 0.2 μm thick, was composed of electron-dense ovals in a band of material more granular than the inner cortex. These dense bodies, as can be seen in longitudinal sections, were often aggregated below the surface annulations. The striated layer, composed of uniformly spaced rods, was clearly demarcated and about 0.4 μm thick. The rods in this layer were parallel to each other and perpendicular to the nematode surface. Directly under this layer was a homogeneous boundary layer, of about .13 μm in thickness, which joined a thick (.67 μm) electron-lucent basal layer with evident structural features. A layer of densely packed osmiophilic polyhedral granules, measuring .07 μm each, were present at the boundary of this and the previous layer. The hypodemis underlay the basal-granular layer. The structure of the cuticle of *H. columbus,* particularly the unique basal-granular layer, may be important in explaining its resistance to osmotic stress and desiccation.—*Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29631.*

LOPEZ-CHAVES, R., and D. W. DICKSON. *Host response and morphometric variations among three populations of Meloidogyne incognita and one of M. javanica from Florida.*

A morphometric study of three populations of *M. incognita* and one of *M. javanica* from Florida showed significant differences among populations in total length, length of head, dorsal esophageal gland orifice (D.E.G.O.), length of tail, width, anal body diameter, alpha and gamma ratios and second-stage larvae, and stylet length and D.E.G.O. of females. Differences were also noted in the perineal patterns. 'California Wonder' pepper, 'Charleston Gray' watermelon, and 'Allgold' and 'Puerto Rico' sweetpotato cultivars were excellent hosts for the three *M. incognita* populations; corn 'Minn A 401' was a poor host, whereas 'Allbritton' strawberry, 'Delta P.L.16' cotton, 'Florunner' peanut, and 'NC-95' tobacco were nonhosts. The *M. javanica* population readily attacked NC-95 tobacco, Allgold sweetpotato, and Charleston Gray watermelon, but failed to infect Puerto Rico sweetpotato, California Wonder pepper, Allbritton strawberry, Delta P.L.16 cotton, and Florunner peanut. Minn A 401 corn was rated as a poor host for this population. No correlation was found between the morphological characters, except for the differences in the perineal patterns of the two species and the ability of the populations to parasitize the differential hosts. —*Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611.*

MACDONALD, D. H. *Effects of continued application of aldicarb to greenhouse-rose beds infested with Paratylenchus hamatus.*

Aldicarb, reported to be slightly toxic to roses, has been used by commercial rose growers in Minnesota for insect and mite control. The effects of this chemical on roses and associated nematodes was studied in greenhouse rose beds. *Rosa hybrida*

'Forever Yours' bushes on 'Manetti' rootstocks were planted in redwood boxes filled either with pasteurized sandy-loam soil or pasteurized soil infested with an average of 170 *Paratylenchus hamatus*/100 cm³. Applications of aldicarb (10G) to the soil surface were first made 4.5 months after planting and were repeated at 4- to 6-week intervals thereafter. The initial application rates of 0 or 2.84 gm/0.23 m² were changed after 7.5 months to 0.65, 1.30, or 2.6 gm/0.23 m². Soil samples collected just before each of 13 of the 15 aldicarb applications were processed for nematodes by the Baermann pan method. The number of *P. hamatus*/100 cm³ of soil declined from an average of 530 before the first aldicarb application to 29 before the sixth application. *Paratylenchus hamatus* populations in aldicarb-treated soil (2.6 gm/0.23 m³) remained small for 4 months before a rapid and continued increase began. Six and one-half months after the nematode population began to increase (16.5 months after the first aldicarb application), aldicarb-tolerant populations of *P. hamatus* averaged 2,964 per 100 cm³. Lower application rates of aldicarb were also associated with reductions in nematode population size, but these were neither as pronounced or as long-lasting as those achieved with the highest application rate of aldicarb. No evidence of phytotoxicity of aldicarb to this rose-rootstock combination was observed.—*Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.*

MACDONALD, D. H. *Effects of Paratylenchus hamatus on productivity of greenhouse roses.*

Paratylenchus spp. are commonly found associated with the roots of both garden and greenhouse roses in Minnesota. More than 1,000 of these nematodes/100 cm³ of soil have been extracted from numerous samples collected from commercial rose beds. Flower production by *Rosa hybrida* 'Forever Yours' on *Rosa noisettiana* Thory 'Manetti' rootstocks grown under "near commercial" conditions in a sandy-loam soil infested primarily with *P. hamatus* was determined over a 9.5-month period. Bushes growing in soil infested, for most of that period, with low to moderate (647/100 cm³) populations of *P. hamatus* produced 95% more flowers with stems 50.8 cm or longer and 34.9% more with stems 38.1 to 50.2 cm long than did plants growing in heavily infested soil (2,071/100 cm³). These same bushes produced 25.8% more flowers with stems equal to or longer than 50.8 cm and 9.4% more total flowers than did plants growing in soils which contained very few (124/100 cm³) nematodes for most of that period. Thus, low population densities of *P. hamatus* may stimulate rose flower production and improve quality, as measured by the length of the harvestable stems, but greater populations may reduce both total flower production and flower quality.—*Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.*

MANKAU, R., and M. V. MC KENRY. *Spatial distribution of nematophagous fungi associated with Meloidogyne incognita on peach.*

A 20-year-old peach orchard on Lovell rootstock at Parlier, CA was examined for the spatial association of nematophagous fungi and soil-inhabiting nematodes. *Meloidogyne incognita* was variably distributed among individual tree sites which exhibited little apparent nematode damage. Random trees were sampled at 56-day intervals over a 14-month period. Nematode suspensions, taken at 15-cm-depth intervals to 120-cm below the soil surface, were extracted and pooled from five sampling positions around each tree, collected on 2.1-cm filter paper discs, and then plated on 25% corn meal agar. Thirteen species of nematode-trapping fungi and four species of endozoic fungi were observed on the plates. *Arthrobotrys* spp. were most abundant with *A. conoides* and *A. dactyloides* occurring in over 60% of all samples at the 30- and 45-cm depths. The latter also occurred on all peach root fragments plated. *Arthrobotrys musiformis* occurred in 50% of all samples at 15 cm and declined markedly with depth. With the exception of *A. conoides*, all of the fungi, including species of *Monacrosporium* and *Dactylaria*, occurred less frequently below 60 cm. Distribution of the fungi by depth was closely correlated with nematode distribution, particularly with *M. incognita*. Efficiency of

the predacious fungi in trapping root-knot nematode larvae present on water agar was somewhat variable, but most fungi eliminated all larvae. Only *A. musiformis* and an undescribed species of *Monacrosporium* did not trap nematodes on the agar. Nematophagous fungi appeared to account for considerable natural control of the root-knot nematode population.—*Department of Nematology, University of California, Riverside, CA 92502.*

McELROY, F. D. *Effects of Pratylenchus penetrans and Xiphinema bakeri on establishment, growth and yield of raspberry.*

The effects of *Pratylenchus penetrans* (Pp) and *Xiphinema bakeri* (Xb) on raspberry growth and yield were studied in artificially inoculated field plots previously treated with Telone® (1,3-dichloropropene). Pure and mixed populations of Pp and Xb were reared on raspberry in the greenhouse for reinoculation. 'Willamette' raspberry root cuttings were rendered nematode-free with a hot-water treatment and grown in the greenhouse until being transplanted to the field. In May the nematode inoculum was mixed into the field soil just prior to the planting of the rooted cuttings. Four treatments were established: Pp alone (5/cm^3 of soil); Pp (5/cm^3)/Xb (0.5/cm^3; Xb alone (0.5/cm^3); and no nematodes. Pp alone had the greatest effect on plant establishment. Plant growth during the first season was determined by weighing pruned material. Growth of plants treated with Xb, Xb/Pp, and Pp was suppressed by 43%, 53%, and 66%, respectively, compared to the growth of nematode-free plants. Cane numbers were used as a growth estimate the second season. In all nematode-infested plants there were 23-30% fewer canes than in the nematode-free plants, but differences between nematode treatments were not significant. Yields in the Xb, Xb/Pp, and Pp treatments were suppressed by 26%, 35%, and 47%, respectively, below yields of the nematode-free plots. By controlling Pp alone, a potential loss of $1,730/ha could be avoided on the first year crop. Preplant fumigation would avoid not only economic losses in yield, but loss of time and money required to replant establishment failures.—*Research Station, Agriculture Canada, 6660 N.W. Marine Drive, Vancouver, B.C., Canada V6T 1X2.*

McELROY, F. D., D. J. F. BROWN, and B. BOAG. *The virus-vector potential of Paralongidorus maximus.*

Paralongidorus maximus was tested as a vector of 20 viruses. Nematodes were allowed 4 weeks access each to acquisition and bait plants. In one series, nematodes were removed from the acquisition plants and added to new pots with bait plants. In another series, the acquisition plants were replaced with bait plants in the same pot. Sixteen of the 20 viruses used in the tests were not transmitted by *P. maximus.* Gall counts from both acquisition and bait plants demonstrated that in all tests the nematodes had fed sufficiently to produce galls, a fact indicating that the nematodes could have acquired or deposited virus from or to the roots. Grapevine chrome mosaic, arabis mosaic, carnation ringspot, cherry leaf roll (cherry, elderberry and rhubarb strains), raspberry ringspot (English and Scottish strains), and tomato black ring viruses were recovered directly from *P. maximus,* an indication that they had ingested the viruses. Known vectors successfully transmitted their associated viruses and demonstrated that transmission was possible under the experimental conditions. Raspberry ringspot (English and Scottish strains), arabis mosaic, and strawberry latent ringspot viruses were recovered from the roots of bait plants grown in pots together with virus infected plants and *P. maximus.* The fact that several types of nematode-free controls were negative strongly suggests that *P. maximus* was instrumental in a low percent transmission of virus but the mode of transmission is unknown. It is concluded, however, that *P. maximus* is not an important vector of presently known nematode-transmitted viruses.—*Research Station, Agriculture Canada, 6660 N. W. Marine Drive, Vancouver, B. C., Canada, V6T 1X2; Scottish Horticultural Research Institute, Invergowrie, Dundee, Scotland, DD2 5DA.*

MCGAWLEY, E. C., and R. A. CHAPMAN. *Development of concomitant populations of Helicotylenchus pseudorobustus, Paratylenchus projectus, and Criconemoides simile on soybean.*

Single 10-day-old 'Custer' and 'Hood' soybean *(Glycine max)* seedlings were inoculated with *Helicotylenchus pseudorobustus, Paratylenchus projectus,* and *Criconemoides simile* alone and in various combinations. Inoculum for each species was 100 females. Population density and composition, and rates of increase [R (R = P_f/P_i where P_f is the final population and P_i is the initial population)] were determined 13, 20, 27, 34, 41, and 50 days after inoculation. At 50 days, R values for *H. pseudorobustus, P. projectus,* and *C. simile* (when alone) were 5.2, 3.9, and 25.5, respectively, on Custer and 2.7, 2.1, and 11.2, respectively, on Hood. On both hosts, *H. pseudorobustus* and *C. simile* reproduced as well in combination as when alone. Addition of *P. projectus* to these combinations did not alter the results. As reported previously for *C. simile* on these hosts, the difference between final populations of *H. pseudorobustus,* inoculated alone, was due to slower maturation of larvae on Hood. Development of *P. projectus* was suppressed on both hosts when it was in combination with *C. simile* and *H. pseudorobustus.* Values of R for *P. projectus* in these combinations were 1.5 on Custer and 1.0 on Hood. Differences in the rate of egg-laying and/or rate of egg-hatching appeared to account for the difference between final populations of *P. projectus* on the two hosts. Root weights of inoculated plants were not significantly different from those of control plants.—*Department of Plant Pathology, University of Kentucky, Lexington, KY 40506.*

MCKENRY, MICHAEL V. *Selecting application rates for methyl bromide, ethylene dibromide and 1,3-dichloropropene nematicides.*

Several factors require consideration prior to the selection of quantity and type of preplant fumigant for specific field or soil pest problems. Cash value of the crop, susceptibility of target pests, longevity of subsequent crop, period of time until planting, soil profile conditions, movement capability of toxicant, and safety in handling are factors of major consideration. The impact of each of these dependent variables has not been adequately quantified. By monitoring the movement of methyl bromide (MB) ethylene dibromide (EDB) and 1,3-dichloropropene (1,3-D) within soils, the influence of soil profile conditions and the movement capabilities of each toxicant have become apparent. The spectrum of bioactivity for these toxicants becomes more restrictive in the following order: MB < 1,3-D < EDB. This long-observed, field response is only partially a result of toxicant persistence, relative application rates, and inherent toxicities. For example, the $LD_{99.99}$ value for root-knot nematode (*Meloidogyne* spp.) infective juveniles when exposed to water concentrations of either MB, EDB, or cis-1,3-D is approximately similar, being 0.21 mM for a 24-h exposure period. Data suggest that observed field responses are due to the relative concentration levels as each toxicant moves through soil. The factor which influences the concentration and extent to which each toxicant moves is its sorptive capacity. Doubling and tripling the application rates can have a minor influence on the concentration and extent of toxicant movement. —*Department of Nematology, University of California, Riverside, CA 92502.*

MILLER, L. I. *Interspecific crosses of certain lemon-shaped amphimictic species of Heterodera.*

Experiments were undertaken at the Rothamsted Experimental Station in England to determine whether *Heterodera cruciferae* would cross with *H. schachtii,* and *H. goettingiana* with *H. glycines.* In all attempted crosses, a single larva of one species and single larva of another species were placed at the bottom of a hole (0.25 cm in diam, 1.5 cm deep) adjacent (ca 0.5 cm) to a single seedling (host to both nematode species) planted in a 5.0-cm pot containing loamy fine-sand soil. Roots were examined after 10 weeks for the presence of gravid females with F_1 larvae. Single larva combinations of the Stone isolate (I) of *H. cruciferae* made with the Shepherd I

of *H. schachtii* were repeated 30 times with 'Greyhound' cabbage as a host and 30 times with 'Klein Mono' sugar beet as host. Two gravid females with F_1 larvae were obtained with cabbage as a host and three with sugar beet as a host. Single larva combinations of the Callewaert I of *H. goettingiana* made with the N.C.l I and the Miss.l I of *H. glycines* were repeated 30 times (host—'Lee' soybean). Four gravid females with F_1 larvae were obtained in the matings of *H. goettingiana* with the N.C.l I, but none were obtained from matings of *H. goettingiana* with the Miss.l I. It is not known whether the hybrids formed are fertile.—*Supported by NATO Research Grant 686. Department of Plant Pathology and Physiology, Virginia Polytechnic Intitute and State University, Blacksburg, VA 24061.*

MILLER, L. I., and MARY MCBRYDE MILLER. *Interspecific crosses of Heterodera glycines and H. schachtii with certain amphimictic round-ended species of Heterodera.*

Experiments were initiated at the Rothamsted Experimental Station to determine whether the N.C.l isolate (l) or Miss.l I of *Heterodera glycines* and the Piemoor I of *H. schachtii* (SCH) would cross with the round-ended species: Rostock I of *H. rostochiensis* (ROS), Colyten I of *H. pallida* (PAL), El Sauce I of *H. "mexicana"* (MEX), type locality (TL) I of *H. virginiae* (VIR), TL I of *H. solanacearum* (SOL), and TL I of *H. tabacum* (TAB). In all attempted crosses, a larva of one species and larva of another species were placed at the bottom of a hole (0.25 cm in diam, 1.5 cm deep) adjacent (ca 0.5 cm) to a single 'Pearson A-1' tomato seedling (host to both nematode species) planted in a 5.0-cm pot containing loamy fine-sand soil. Roots were examined after 10 weeks for gravid females with F_1 larvae. Each of the matings of the N.C.l or Miss.l with ROS, PAL, MEX, VIR, SOL, and TAB were repeated 10 times. SCH matings with each of the round-ended species were repeated 20 times. Two [2 round (R)] females were obtained in the matings of N.C.l with ROS and three [2 R, 1 lemon (L)] females of N.C.l with SOL. Two (2 R) females were obtained in matings of Miss.l with PAL and two (1 R, 1 L) of Miss.l with MEX. One (1 R) female was obtained of SCH with PAL, four (3 R, 1 L) of SCH with MEX, two (2 R) of SCH with VIR and one (1 L) of SCH with TAB. Females were not observed in matings of N.C.l, Miss.l, or SCH with the other round-ended species. It is not known whether the hybrids formed are fertile.—*Supported by NATO Research Grant 686. Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.*

MILLER, P. M., and JOHN L. MCINTYRE. *Activated charcoal inhibits the entry of Pratylenchus penetrans and Heterodera tabacum into tomato and tobacco roots.*

Root dips, of various concentrations, of dry, pulverized, activated charcoal (particle size $\leq 44\mu$m; 3 to 100% a.i., talc as diluent) inhibited by 80-90% the entry of lesion nematodes *(Pratylenchus penetrans)* and tobacco cyst nematode *(Heterodera tabacum)* into roots of tomato and tobacco seedlings. This protection lasted for at least 6 weeks. At the end of this period, the roots of these charcoal-treated plants showed slight or no discoloration, whereas roots of nontreated plants were obviously discolored. The fresh root-weight of the charcoal-dipped tomato seedlings grown in nematode-infested soil was about 50% that of comparable charcoal-dipped plants grown in soil free of nematodes. However, the root growth of tomato seedlings that had not been dipped in the charcoal was suppressed 60-80% when the seedlings were grown in soil infested with either nematode. Seedlings dipped in various concentrations (12-100% a.i.) of dry, powdered papain or gelatin received protection equal to that from the root dip with activated charcoal. Root entry of either nematode was not inhibited by root dips of talc, agar, or collagen. Incorporating the ≤ 44 μm activated charcoal with nematode-infested soil before planting the seedlings was not as effective as the root dips and required at least 200 mg of charcoal/kg of soil to minimize the number of nematodes in the roots after 6 weeks. Incorporation of 45-2,000 μm activated charcoal or $\leq$ 44-

2,000-μm nonactivated charcoal did not inhibit entry by these nematodes.—*Department of Plant Pathology & Botany, Connecticut Agricultural Experiment Station, New Haven, CT 06504.*

NICKLE, W. R. *Toward the commercialization of the mermithid, Reesimermis nielseni.*

New technological advances in the area of insect-parasitic nematodes and the need for alternative methods of insect control have enabled us to consider the use of nematodes in certain insect-suppression practices. The removal from the market of environmentally-unsafe chemical pesticides has also contributed to the realization that new methods are in order. Several new products and techniques, including safer chemical insecticides, pheromones, parasites and predators, sterile male techniques, and others, are being developed for insect control. These are currently competing for consumer acceptance and being evaluated by means of risk-benefit analysis, cost analysis, and Environmental Protection Agency regulations. The economical mass rearing of the mosquito mermithid, *(Reesimermis nielseni),* its potential for economically controlling 60 species of mosquitoes, and its 1-year shelf life have prompted a company to go forward with a commercial product. Following application of the nematode in Maryland, 90% of the following mosquitoes were found to be parasitized: *Anopheles punctipennis, A. cruciens, Culex pipiens, Culex salinarius,* and *Aedes vexans.*—*Nematology Laboratory, Plant Protection Institute, United States Department of Agriculture, Agricultural Research Service, Beltsville, Maryland 20705.*

NOEL, G. R., and B. F. LOWNSBERY. *Pathogenicity of Criconemoides curvatus and Meloidogyne hapla to nondormant alfalfa.*

Meloidogyne hapla occurs commonly and *Criconemoides curvatus* infrequently in California alfalfa stands. The pathogenicity of these nematode species on 'Moapa 69', a common California alfalfa variety, was studied in the greenhouse. Experimental units were 15-cm clay pots in which four alfalfa plants were grown in 1,200 cm^3 of a sandy loam soil. Six units infested with 4,500 *C. curvatus* and six noninfested units were placed at either 22 C or 27 C. Inoculation with *C. curvatus* caused a highly significant suppression in top growth at 22 C, a significant inhibition in top growth at 27 C, and a significant suppression in root growth at both temperatures. During the 17-week experimental period, populations of *C. curvatus* increased 40-fold at 22 C and 63-fold at 27 C. Ten experimental units were infested with 1,500 larvae of *M. hapla,* 10 were infested with 15,000 and 10 were left noninfested. A highly significant suppression in top and root growth resulted from either level of *M. hapla.* In 30% of the pots to which 1,500 larvae were added, one or more plants died, whereas 90% of the pots infested with 15,000 larvae contained one or more dead plants. No noninoculated plants died during the 16-week experimental period.—*Department of Nematology, University of California, Davis, CA 95616.*

NOEL, G. R., and M. A. McCLURE. *Enzyme localization and histochemistry of resistant and susceptible cotton infected by Meloidogyne incognita.*

Acid phosphatase, peroxidase, shikimic dehydrogenase, 6-phosphogluconate dehydrogenase, and proteinase were histochemically localized in resistant 'Clevewilt 6-3-5' and susceptible 'M8' cotton (infected by *Meloidogyne incognita* or noninfected plants). All enzymes except proteinase exhibited greater activity at infection sites than in adjacent or noninfected tissues. During the proteinase localization (12 days after inoculation), nematodes undergoing lyses were found in Clevewilt roots. No differences in enzyme activity in the resistant and susceptible cultivars were detected. Fresh longitudinal sections for enzyme localization were obtained by using a sliding microtome to section root tissue held between two pieces of carrot. Sodium α-naphthyl acid phosphate and Fast Red TR salt were used to demonstrate acid phosphatase activity. Benzidine, hydrogen peroxide, and nickelous ammonium sulfate were used to localize peroxidase activity.

Shikimic dehydrogenase activity was demonstrated by using a reaction medium which contained shikimic acid, nicotinamide adenine dinucleotide phosphate (NADP), nitroblue tetrazolium (NBT), and phenazine methosulfate. The reaction medium used to demonstrate 6-phosphogluconate dehydrogenase activity contained NBT, NADP, magnesium chloride, and 6-phosphogluconate. Proteinase activity was localized with α-N-benzoyl-DL-arginine-β-naphthylamide hydrochloride (BANA) and Fast Garnet GBC salt. Syncytial walls in Clevewilt and M8 cotton roots were studied histochemically and found to contain pectin, but no lipid or lignin. Excised roots were placed in FAA, evacuated for 24 h, and 30 μm cross sections were cut with a sliding microtome. Sudan Black B was used to stain for total lipids. Phoroglucinol and Ruthenium Red were utilized for staining lignin and pectin respectively.—*Department of Nematology, University of California, Davis, CA 95616, and Department of Plant Pathology, University of Arizona, Tucson, AZ 85721.*

NYCZEPIR, A. P., and S. A. LEWIS. *Population response of Hoplolaimus columbus to different soybean genotypes.*

Twelve soybean genotypes possessing genes for resistance to one or more plant-parasitic nematodes were tested for host suitability to *Hoplolaimus columbus*. The genotypes included 'Bragg', 'Pickett-71', 'Forrest', 'Hardee', 'D71-9257', 'Coker-4504', 'W-4', 'Dyer', 'ED-371', P.I.90,763, P.I.89,772; and P.I.88,788 of maturity classes III-VIII. Soybeans were planted in the field with fumigation [DBCP at 7.0 liters (a.i.)/ha] as whole plots (split-plot design). An initial population density of 137 ± 43 nematodes/250 cm^3 of soil was present when 144 samples were analyzed and averaged. Soil and root populations were determined three and four times, respectively, at 6-week intervals throughout the growing season. All 12 soybean genotypes were infected by *H. columbus*. Root populations were significantly greater in the nonfumigated plots. Root infection varied among genotypes in nonfumigated plots. Hardee, W-4, and Coker-4504, of maturity class VIII, appeared tolerant throughout the growing season. Dyer and Forrest, of maturity class V, seemed most tolerant, however, when yield/plant and total yield comparisons of fumigated and nonfumigated plots were made. These genotypes or their maternal parents may provide a source of resistance or tolerance to *H. columbus*. —*Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29631.*

ORR, C. C. *Response of Solanum elaeagnifolium to Nothanguina phyllobia.*

Solanum elaeagnifolium, silverleaf nightshade, has become an important weed in cultivated land which has undergone extensive chemical weed control. *Nothanguina phyllobia,* a host specific parasite of silverleaf nightshade, has recently been observed on the High Plains of Texas and Oklahoma. *N. phyllobia* attack the leaves of silverleaf nightshade and cause extensive galling. The galled leaves abscise after a few weeks, and the partially defoliated plants are stunted or killed. Host range studies were conducted in growth chambers, in a greenhouse, and in the field. Sixteen plant species, which included common crops and various solonaceous crops and weeds, were tested. Plants were inoculated by spraying a water suspension of nematodes on the leaves or by crushing infected leaves and adding them to the soil surface. Ninety-five percent of silverleaf nightshade plants were infected when crushed, infected leaves were placed on the soil surface. None of the other plant species became infected. Larvae of *N. phyllobia* were found to be motile in soil. When placed on the soil surface in a 5-cm diam cylinder, larvae moved downward 30 cm in 6 days. However, the highest populations were found from the soil surface to 10-cm deep. Similar distribution of nematode larvae were found when samples were collected from infested field soil. Samples were collected from the soil surface to 30 cm deep in 2.5-cm increments. In this test, 90% of the larvae were in the top 10 cm of soil. Tests for pathogenicity to plants by the nematode show that 50% of the silverleaf nightshade plants were killed in heavily infested soil.—*Texas Agricultural Experiment Station, Route 3, Lubbock, TX 79401.*

PINOCHET, J., and D. J. RASKI. *Host-parasite relationship of Pratylenchus vulnus in roots of grape variety 'Thompson seedless'.*

Two-bud cuttings of grape cultivar 'Thompson seedless' grown in 20-cm clay pots containing autoclaved sandy loam soil were inoculated with 1,000 surface sterilized *Pratylenchus vulnus*. After 362 days, lesions of all sizes showing areas of discolored necrotic tissue were present on the roots. No other cytoplasmatic or nuclear changes resulting from nematode feeding were observed; however, mechanical damage to cell walls resulted from nematode movement. Nematode densities were greatest inside the lesions where nematodes were randomly oriented. Large lesions contained 40-50 nematodes of which very few were found near the edge of the lesion and none 3 mm beyond the edge. Burrows, probably resulting from the destruction of parenchyma cells, were observed. There was no penetration into meristematic or vascular tissue.—*Department of Nematology, University of California, Davis, CA 95616.*

PINOCHET, J., D. J. RASKI, and A. C. GOHEEN. *Effects of Pratylenchus vulnus and Xiphinema index singly and in combination on growth of Vitis vinifera 'Thompson seedless'.*

Inoculation of sample populations consisting of 500 *Xiphinema index* or 1,000 *Pratylenchus vulnus* (alone or in combination) to greenhouse-grown 'Thompson seedless' vines retarded vine, root, and leaf (area) growth in comparison with healthy control plants. *Pratylenchus vulnus* populations, in comparison with *X. index*, caused a greater suppression of root growth by inhibiting the development of secondary and adventitious roots. Both species retarded top and leaf (size) growth about equally. With combined inoculations, the stunting of tops, roots, or leaves (size) was greater than that from either nematode species alone. Differences in growth between inoculated and control plants increased with exposure time. The *P. vulnus* population was able to compete with and gradually replace an established population of *X. index*. *Pratylenchus vulnus* did not compete for the same feeding site with *X. index*, but the destruction of root system by the lesion-nematode reduced the number of available feeding sites for *X. index*. Densities of both species increased on Thompson seedless roots, but that of *P. vulnus* increased to a much higher level than that of *X. index*. Densities fluctuated widely throughout the three experiments. Saprophytic fungi isolated from canes and soil are believed to be contaminants of no importance.—*Department of Nematology, University of California, Davis, CA 95616.*

RODRIGUEZ-KABANA, R., and PEGGY S. KING. *Activity of the insecticide phorate against root-knot nematodes.*

The effect of the systemic insecticide phorate on *Meloidogyne incognita* and *M. arenaria* was studied, by using naturally infested potted soil planted with cotton (M-8) or tomato (Rutgers), in the greenhouse. The toxicant was applied as the Thimet® (15G) formulation at rates of 0, 6.7, 13.4, 20.2, and 26.9 kg (a.i.)/ha. Gall density (no. galls/gm fresh root) on tomatoes in soil with *M. incognita* was suppressed 42% at the 6.7 kg rate and 86% at the 13.4 kg rate; these suppressions were accompanied by proportionate decreases in the number of larvae in the soil. Rates higher than 13.4 kg were phytotoxic to the plants. Cotton tolerated rates of phorate up to 20.2 kg/ha without significant phytotoxicity. Gall density on cotton roots was suppressed 82.6% at the 6.7 kg rate and 96.7% at the 13.4 kg rate; additional significant decreases were not observed at higher rates. As with tomato, the number of larvae of *M. incognita* in soil planted to cotton paralleled gall density values. In soil with comparable numbers of larvae of *M. arenaria*, no significant suppression in gall density on tomato was observed at the 6.7 kg rate; however, the 13.4 kg rate resulted in a 42% suppression in gall development. Results of these studies suggest that phorate is a good nematicidal deterrent for *M. incognita* but is only moderately effective against *M. arenaria*. —*Department of Botany and Microbiology, Auburn University, Auburn, Alabama 36830.*

RUSSELL, C. C., and L. S. MORRISON. *Nematode antagonistic activity of selected weed species.*

Introduction of weed species to fields has been avoided in the past because of the difficulty and expense of controlling them. The advent of modern herbicides has provided an opportunity to exploit any beneficial aspects of these plants. Seventy-six indigenous plants and plant introductions were tested against *Meloidogyne hapla* to determine their host suitability and/or their potential as nematode-control agents. It was determined that *Gutierrezia sarothrae, Helenium amarum,* and *Oenothera* sp. eradicated *M. hapla* soil populations under greenhouse conditions. All three were found to be highly attractive to *M. hapla* larvae in laboratory root-diffusate attraction studies. *In vitro* observation and root staining have established the mechanism of antagonism to be a localized, hypersensitive reaction to larval invasion in both *G. sarothrae* and *H. amarum.* The mode of action of *Oenothera* sp. has not been determined. *—Department of Plant Pathology, Life Science East, Room 104, Oklahoma State University, Stillwater, OK 74074.*

RUSSELL, C. C., and H. A. SPIEGEL. *A greenhouse soil-temperature control apparatus.*

Control of soil temperatures is desirable in nearly all research on plant-parasitic nematodes in the greenhouse. It is prerequisite to studies on nematodes of winter grown, small grains if such research is to be conducted during summer months. An apparatus consisting of a preformed 49-pot capacity "Perlite" (concrete temperature block with copper cooling coils imbedded in it), was developed. An aluminum foil reflector shield was fitted to the block, which was maintained in a moistened condition. Chilled water was pumped through the cooling coils. Soil temperatures within ± 2 C of the desired 20 C were maintained while greenhouse bench soil temperatures ranged from 25.5 to 36 C. No significant differences in wheat plant weight or reproduction of *Hoplolaimus* sp. were observed in a 42-day test of the system during the summer of 1975.*—Department of Plant Pathology, Life Science East, Room 104, Oklahoma State University, Stillwater, OK 74074.*

SAND, P. F. *The golden nematode program.*

The United States Department of Agriculture (USDA) has been in the cooperative federal-state golden nematode program since 1946. Since that time, there has been a cooperative survey, regulatory, and control program on this pest. The USDA became involved in the golden-nematode program because it is a very serious pest of potatoes, it was limited to a small area on Long Island, and containment and control were desirable until eradication procedures could be developed. Development of new control methods have provided the basis for an eradication program on golden nematode. The use of potato cultivars resistant to golden nematode, systemic nematicides integrated with survey and regulatory program, and soil fumigation now provide farmers with a feasible eradication scheme. Stringent regulatory procedures have prevented spread to other major potato-producing areas in the United States. The goal of the golden nematode program is eradication of the pest from host cropland in the United States by the end of calendar year 1980. *—United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine Programs, Hyattsville, MD 20782.*

SANTO, G. S., and W. J. BOLANDER. *Effects of soil temperature and soil type on the reproduction of Heterodera schachtii and Meloidogyne hapla on sugarbeets.*

In central Washington, *Heterodera schachtii* is generally associated with sugarbeets grown in fine-textured soils and *Meloidogyne hapla* with sugarbeets grown in coarse-textured soils. Soil temperatures during the growing season seldom exceed 21 C. Despite these relatively low soil temperatures, *H. schachtii* and *M. hapla* are important pathogens on sugarbeets. A test was conducted in a growth room to

measure the effect of soil temperature and soil type on the reproduction of *H. schachtii* and *M. hapla* on sugarbeets Temperature-controlled water tanks were used to maintain four temperatures (15.6, 18.3, 21.1, and 23.9 C). Two soil types (silt loam and sandy loam) were fumigated with methyl bromide and potted in 1-liter plastic containers. Five-week-old sugarbeet seedlings were inoculated with 1,000 2nd-stage larvae of *H. schachtii* and *M. hapla*. Each treatment was replicated eight times. *H. schachtii* reproduced best in the silt loam soil and *M. hapla* reproduced best in the sandy-loam soil. Eight weeks after inoculation, 2,500 *H. schachtii* females and cysts/pot were recovered from the silt-loam soil treatments and 370 from the sandy-loam soil treatments. Second-stage larvae of *M. hapla* recovered from the sandy and silt-loam soil treatments were 43,300 and 940/pot, respectively. Reproduction of both species was greatest at the higher (21.1C and 23.9 C) temperatures than at the lower (15.6 C and 18.3 C) temperatures. The higher temperatures yielded 2,600 *H. schachtii* females and cysts and 43,500 *M. hapla* 2nd-stage larvae/pot and the lower temperatures 230 *H. schachtii* and 710 *M. hapla*. There was an interaction between temperature and soil type on the rate of reproduction for both nematode species. The rate of *H. schachtii* population increase with silt loam soil was greater than that with sandy loam soil and vice versa for *M. hapla*.—*Department of Plant Pathology, Washington State University, Irrigated Agriculture Research and Extension Center, Prosser, WA 99350.*

SCHMITT, D. P. *Relative suitability of soybean cultivars to Pratylenchus brachyurus.*

Twenty-five soybean (*Glycine max* L.) cultivars were evaluated for host efficiency to *Pratylenchus brachyurus* (Pb) in greenhouse tests. Half a lot of naturally infested soil was fumigated with methyl bromide and the other half was not treated. The fumigated and nonfumigated soils were placed into 15-cm diam clay pots which were planted to soybeans with three replicates/treatment. The initial population density of Pb was 213 larvae and adults/pot. Numbers of Pb/gm oven-dry (OD) root weight varied among cultivars and also varied in relation to plant damage 65 days after planting. Numbers of Pb/gm OD root ranged from 994 to 20,557 among the 25 cultivars. On the basis of comparisons between plants grown in fumigated soil with those grown in non-fumigated soil, 'Shore' and 'Coker 74-478' were the only cultivars which were stunted by fewer than 6,000 Pb/gm of root (OD). There were fewer than 6,000 Pb/gm of OD root on 'Coker 72-260', 'Coker 338', 'Dare', 'Davis', 'McNair 600', 'Ransom', 'SRF 450', 'Tracy', and 'York'. Cultivars that tolerated population densities greater than 6,000/gm root (OD) without apparent damage were 'Bragg', 'Coker 73-375', 'FFR 555', 'FFR 6024', 'Hutton', and 'Lee 68'. Root growth of 'Shore', 'Essex', and 'Semmes' was suppressed more than shoot growth by Pb; roots were 46, 43, and 33% and shoots were 25, 32, and 24% less than those of the fumigated controls, respectively. Shoot weights of 'Coker 73-473', 'Pickett 71', and 'Coker 136' were 25, 31, and 42% less than the fumigated controls, and root weights were 4, 12, and 23% lower than the controls. Roots of 'Lee 74', 'Forrest', and 'Coker 74-478' weighed 33, 26, and 23% less than the fumigated controls but there were no differences in shoot weight. If similar relationships exist under field conditions, cultivars that supported minimal Pb reproduction or tolerated high numbers of Pb could be incorporated into nematode management programs.—*Department of Plant Pathology, North Carolina State University, Raleigh, NC 27607.*

SINGH, N. D. *Effects of nematicides on nematode populations and yield of corn.*

Six nematicides were evaluated for the control of plant-parasitic nematodes and their effects on growth and yield of corn. The nematicides and rates used were: DD-MENCS (20% methyl isothiocyanate + 80% chlorinated C_3 hydrocarbons) at 100 litres (a.i.)/ha; Bunema® (40% potassium N - hydroxymethyl - N - methyldithiocarbamate) at 90 litres a.i./ha; DD mixture at 100 litres (a.i.)/ha; phenamiphos at 11.5 (a.i.)/ha; oxamyl at 1.7 kg a.i./ha; and ethoprop at 6.7 kg (a.i.)/ha. Nematodes

were counted in 200-cm³ soil samples taken from each plot before planting, and at 4 and 13 weeks after planting. Yield increases of 40%, 39%, 35%, 9%, 12%, and 18% were obtained with DD-MENCS, DD, phenamiphos, oxamyl, Bunema and ethoprop, respectively. Growth on treated plots was significantly greater than on control plots. DD-MENCS and DD were the most effective chemicals in controlling *Pratylenchus zeae, Helicotylenchus dihystera, Criconemoides* sp., and *Meloidogyne incognita*. At 13 weeks after planting, the numbers of *P. zeae, H. dihystera, Criconemoides* sp., and *M. incognita* recovered from control plots were 70, 95, 180, and 170, respectively; those recovered from DD-MENCS were 0, 12, 10 and 82; and those from DD were 0, 9, 10, and 96, respectively. Phenamiphos and ethoprop also significantly reduced all nematode populations. Oxamyl and Bunema did not control *M. incognita* effectively at the 13-week sampling. Correlation coefficient showed an inverse relationship ($r = -0.26$) between yield and total nematode population.—*Caribbean Agricultural Research and Development Institute, The University of the West Indies, St. Augustine, Trinidad, W.I.*

STEELE, A. E. *Effects of selected carbamate and organophosphate nematicides on hatching of Heterodera schachtii.*

Aqueous solutions of ethoprop, oxamyl, phenamiphos, carbofuran, Bunema® (potassium N-hydroxymethyl-N-methyldithiocarbamate), and AC 64,475 [2-diethoxyphosphinylimino)-1,3-dithietane] were tested for their effects on hatching of *Heterodera schachtii*. Concentrations, tested ranged from 0.1 μg/ml to 1,000 μg/ml, depending on the material. Four or five replicates of 20 cysts each were treated for 1 week with the chemical solutions, then for 4 days in tap water, and then placed in sugarbeet root diffusate for 4 weeks to evaluate the residual effects on hatching. All treatments with chemical solutions inhibited hatching. However, permanent suppression of hatching was only obtained with 100 μg/ml phenamiphos or 50 μg/ml AC 64,475. All other materials only temporarily suppressed hatching. Treatments of 50 μg/ml or greater of carbofuran completely suppressed hatching (but the effect was only temporary), whereas concentrations of 0.1 μg/ml carbofuran stimulated hatching.—*Agricultural Research Service, United States Department of Agriculture, Salinas, CA 93901.*

TARJAN, A. C. *Application of systemic nematicides to trunks of trees.*

One ml of oxamyl, phenamiphos, or CGA-12223 aqueous emulsion containing 20 mg (a.i.) was painted on the stems of 9 replicate 2-year-old sour orange seedlings (*Citrus aurantium* L.) infected with *Radopholus similis* Cobb. The seedlings were growing in 15-cm clay pots. Seven weeks after treatment, there were significantly fewer two-spotted spider mites (*Tetranychus urticae* Koch) on leaves of treated plants than on leaves of controls. Twenty-one weeks after treatment, data on plant height, aerial part and root weight, and number of nematodes/gm root indicated superior growth and fewer nematodes in treated plants than in nontreated plants. Phenamiphos was applied at 6 kg/ha to the trunks of 10 replicate 20-year-old Valencia orange/rough lemon trees infected with *Tylenchulus semipenetrans*. Three months later, there were significantly fewer nematodes in roots of treated trees than in roots of controls (216 vs. 396). A second field test was made on 25-year-old Valencia orange/sour orange trees infected with *T. semipenetrans*. Phenamiphos and oxamyl were applied to 6 replicate trees at 4 kg/ha. After 6 months, there were 95 nematodes per gm root from the phenamiphos treatment, 323 nematodes/gm root from the oxamyl treatment, and 360 nematodes/gm root from the controls. Application of certain systemic nematicides to the stems and trunks of woody plants can be an effective method of control. Its advantages are ease and speed of application, simplicity of equipment used, and confinement of the pesticide to a relatively small area of the tree.—*University of Florida, P. O. Box 1088, Lake Alfred, FL 33850.*

VEECH, J. A., and M. A. McCLURE. *Terpenoid aldehydes in root-knot nematode susceptible and resistant cotton seedlings.*

Terpenoid aldehydes have been implicated in the resistance of cotton to certain pathogens. We investigated their role in the resistance of cotton (*Gossypium hirsutum* L.) to the root-knot nematode *Meloidogyne incognita*. Three-day-old, root-knot resistant (Auburn 623) and susceptible (Deltapine 16) seedlings were inoculated with *M. incognita*. Comparable portions of inoculated and noninoculated roots were harvested 2, 4, 7, and 10 days later. Terpenoid aldehydes were extracted, separated by thin-layer chromatography, and measured colormetrically. In noninoculated seedlings of each age, the susceptible cultivar contained more total and more of each of five specific terpenoid aldehydes than did the resistant cultivar. In both cultivars, the concentration of terpenoid aldehydes increased as seedlings aged. Ten days after inoculation, the concentration of terpenoid aldehydes in the infected susceptible cultivar was less than in comparable controls. In infected, resistant seedlings, the terpenoid aldehyde concentration was slightly higher than in controls, but it was still lower than the concentration in comparable aged, noninoculated, susceptible seedlings. Our *in vitro* data alone cannot exclude the possibility that terpenoid aldehydes are involved in resistance to root-knot nematodes. An *in vivo* histochemical study is needed to determine if nematodes induce strategically localized accumlations of terpenoid aldehydes necessary for a role in resistance. Data are also needed on the toxicity of terpenoid aldehydes to nematodes.—*National Cotton Pathology Research Laboratory, P. O. Drawer JF, College Station, TX 77840; and Department of Plant Pathology, University of Arizona, Tucson, AZ 85721.*

VRAIN, T. C., and K. R. BARKER. *Interaction of soil moisture and temperature on survival of Meloidogyne incognita and M. hapla.*

The ability of eggs and larvae of *Meloidogyne incognita* or *M. hapla* to survive in soil at cold temperatures and three moisture regimes was studied. Either 10 egg masses (approximately 2,000 eggs) or 2,000 freshly hatched larvae were placed in 100 cm^3 of fumigated soil (sandy loam and fine sand with particle maximum diam mean of 245 μm:1/1). The infested soil was placed in plastic cups and the moisture adjusted to 12% of dry weight (pF 1.7) or to 25% (pF 0). The cups were randomized in boxes and placed in temperature-controlled chambers at 16 C for 2 days. Ambient temperature was lowered 4 C every 2 days from 16 C to −8 C. When the temperature reached 0 C, soil moisture in half of the cups at pF 1.7 was adjusted to pF 0. Following different treatment periods at 0 C, − 4 C, or −8 C, the temperature was increased 4 C every 2 days until 16 C was reached. The soil from all cups was bioassayed in a greenhouse with 'Manapal' tomato seedlings. Survival of both species was lower at pF 0 at all temperatures than at pF 1.7. At 0 C, 9% of *M. incognita* eggs survived in soil at pF 0 in comparison with 68% at pF 1.7, whereas survival of *M. hapla* eggs was 23% and 100% at the respective moisture levels. *Meloidogyne incognita* larvae survived better than eggs at 0 C at both moisture levels. *Meloidogyne hapla* eggs were killed at −4 C or −8 C at pF 0, but at pF 1.7, 76% of eggs survived at −4 C and 27% survived at −8 C. Survival of *M. hapla* eggs in soil at pF 0 at −8 C was increased when the moisture was changed from pF 1.7 to pF 0 after the temperature had reached 0 C.—*Department of Plant Pathology, North Carolina State University, Raleigh, NC 27607.*

WEHUNT, E. J., D. J. WEAVER, and S. L. DOUD. *Effects of peach rootstock and lime on Criconemoides xenoplax.*

Seven peach rootstocks were tested for effect on soil populations of *Criconemoides xenoplax* at two pH levels in the greenhouse. Soil was collected from the top 16 cm in a peach tree short-life site and passed through a soil shredder. The soil had a pH of 4.9 and contained 90 *C. xenoplax*/50 cm^3. Half the soil was mixed in a cement mixer for 10 min and the other half was amended with 1.5 gm hydrated lime/liter and mixed. The soil was placed in 20-cm clay pots, and a seedling of each rootstock

was planted in each of 10 pots of each soil. The plants were maintained for 3 months at 26.5 C in a greenhouse and then moved outdoors to a slat house and allowed to go dormant naturally. Soil samples were tested for pH and assayed for nematodes periodically. Limed and nonlimed soils had pH values of 6.2 and 5.2, respectively, 2 months after planting. Numbers of *C. xenoplax* were significantly lower in the limed than in the nonlimed soil, but no differences occurred in subsequent samplings. Three months after planting, fewer *C. xenoplax* were found in soil around 'Halford' and 'Siberian C' than around 'NA-8' and 'Nemaguard' seedlings. Ten months after planting, there were fewer *C. xenoplax* in soil around 'Halford' than around 'HW-208' seedlings. These results indicate that the population density of *C. xenoplax* can be influenced by peach rootstocks and that liming the soil can at least temporarily influence the populations. —*Agricultural Research Service, United States Department of Agriculture, Southeastern Fruit and Tree Nut Research Station, Byron, GA 31008; and Division of Agriculture, Fort Valley State College, Fort Valley, GA 31030, respectively.*