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ABSTRACTS OF PAPERS

THE MORPHOLOGY AND SYSTEMATICS OF OSTERTAGIID NEMATODES OF ANTELOPE

J. BOOMKER, Department of Veterinary Pathology, Medical University of Southern Africa, P.O. Box 176, Medunsa 0204, South Africa

Morphologically speaking, the Ostertagiinae is a complex and difficult subfamily. The reason for this is firstly, the number of species and secondly, the number of teratogenic forms that have been described as separate species. Fortunately, in South Africa only a few genera have been described from game and all are fairly easy to identify.

The Ostertagiinae is one of the six or seven subfamilies of the Trichostrongylidae, a large family that contains most of the helminths that are of economic importance in ruminants, including antelope. All occur in the abomasum of their hosts and all burrow into the mucosa to a greater or lesser degree. They are not notably host-specific and, therefore, the terms definitive, occasional, accidental and host-specific are applied when dealing with these worms.

The following genera of the Ostertagiinae occur in game: *Longistrongylus*, with six species, is the most commonly encountered in a number of antelope, such as impala, blesbok, common duikers and reedbuck; *Teladorsagia*, with one species from springbok and gemsbok and another as an occasional parasite in common duikers, the preferred host being sheep; *Ostertagia* which is an occasional parasite in antelope, and has cattle as the preferred host; *Camelostrongylus* of which two species occur, one in grey rhebuck and one in bushbuck, nyala and red duikers. Another genus, which is seen by some workers as belonging to the Ostertagiinae and by others as belonging to the Graphidiinae, is *Hyostrongylus*, a parasite that has in South Africa been found only in bushpig and red duikers.

The genera are grouped according to the configuration of the bursal rays. Thus, *Longistrongylus*, *Ostertagia*, *Camelostrongylus* and *Tragelagia* have the 2–1–2 or *Graphidium* type, while *Telodorsagia* and *Hyostrongylus* have the 2–2–1 or *Hyostrongylus* type.

Characteristics to further separate the genera and species include the configuration of the synlophe, the size and position of the deirids, the presence or absence of an accessory bursal membrane, the configuration of the genital cone and the configuration of the spicules. Female worms are often difficult to identify as they do not have clear morphological characteristics, except for the synlophe and the position of the deirids.

THE SEINHORST FORMULA ON NEMATODE DENSITY AND YIELD—IN TOMATOES

K. C. DAIBER, Vegetable and Ornamental Plant Institute, Private Bag X293, Pretoria 0001, South Africa

Depending on their density at planting, root-knot nematodes mainly *Meloidogyne incognita* and *Meloidogyne javanica*, may reduce the yield of tomatoes causing either slight losses or complete crop failure. The correlation of tomato yield with root-knot nematode density is demonstrated from experimental data and discussed with special reference to the Seinhorst formula.

CORM COATING AS A NEW TREATMENT OF BANANA RHIZOMES AGAINST NEMATODES

KAREN DE JAGER, MIEKE DANEEL and P. WILLERS, Institute for Tropical and Subtropical Crops, Private Bag X11208, Nelspruit 1200, South Africa

Infested banana planting material is the most important way of distributing nematodes. There is presently no method to disinfect banana rhizomes from plant-parasitic nematodes, therefore it is of utmost importance to find a method to get nematode-free planting material. Highly infested banana rhizomes were planted in March 1992 in a fumigated land in Kiepersol. The rhizomes were dipped in a mixture of bentonite clay and five different nematicides (corm coating) to kill the parasitic nematodes. Seven months after planting, the first samples were taken and roots of all the treated plants were still uninfested, while the control plants were highly infested with burrowing nematode (*Radopholus similis*). No nematodes were found in the soil, including the control plots. After eight months the first nematodes were found in the soil of the control plants. The five other treatments (roots and soil) were still uninfested. Results and a discussion will be given.

THE PLANT-PARASITIC NEMATODES ASSOCIATED WITH GROUNDNUT IN SOUTH AFRICA

DRIEKIE FOURIE and CHERYL VENTER, Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa

Sixteen fields in the groundnut (*Arachis hypogaea*) production areas of OFS and Transvaal were sampled.

Eighteen plant-parasitic nematode species were found. The predominant ectoparasites were *Criconemella sphaerocephala* and *Paratrichodorus minor*. The predominant endoparasites were *Pratylenchus brachyurus* and *Ditylenchus destructor*. *C. sphaerocephala*, *P. minor* and *P. brachyurus* (except in pods) populations usually decreased over the season, while *D. destructor* populations usually increased, particularly in the pods. Notes are made of the crops which should not be included in a rotation system with groundnut fields infested with each of these nematode species. Terbufos is a general nematicide registered on groundnuts, while phenamiphos and oxamyl are registered specifically against *D. destructor*.

STRATEGIC MODEL FOR INTEGRATED NEMATODE CONTROL RESEARCH ON TOBACCO

MARTIE S. GREEFF, Tobacco & Cotton Research Institute, Private Bag X82075, Rustenburg 0300, South Africa

The economic production of market orientated tobacco with improved quality includes significant nematode control. All aspects of control i.e. biological, chemical, cultural practices as well as resistance breeding need to be considered in an integrated nematode control programme.

A strategic model for nematode research with the objective of eventual integrated control of nematodes on tobacco has been implemented at TCRI. Long and short term research objectives, as applicable to tobacco, for laboratory, greenhouse and field research are discussed.

IN VITRO CULTURING OF LESION AND ROOT-KNOT NEMATODES

A. F. GROENEWALD, Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa

In vitro culturing of lesion and root-knot nematodes is necessary to maintain pure populations of each important species and race. Pure populations are necessary for the many trials involving these nematodes on maize and groundnuts, and include studies employing electron-microscopy. There are however, several problems pertaining to the initiation and maintenance of these aseptic *in vitro* cultures. Various culture techniques and modifications to the agar mediums have been investigated for improved nematode multiplication.

MASS CULTURE OF *DITYLENCHUS DESTRUCTOR*

A. F. GROENEWALD, Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa

Mass culturing of the peanut pod nematode, *Ditylenchus destructor*, is necessary for the supply of sufficient numbers of single-species populations for a variety of trials, including those on pathogenicity, histopathology, and chemical and cultural control. Various modifications to the agar mediums of these cultures have been investigated to facilitate the more rapid production of large quantities of nematodes under sterile conditions. These modifications have been shown to be more time and cost efficient.

TRAINING IN PLANT PATHOLOGY AND PLANT NEMATOLOGY AT THE UNIVERSITY OF PRETORIA —PROBLEMS AND PROGRESS

N. LABUSCHAGNE, Department of Microbiology and Plant Pathology, University of Pretoria, Pretoria 0002, South Africa

A full-fledged semester course in Plant Nematology is presently being offered as part of the Plant Pathology curriculum at the University of Pretoria (U. P.) This course, in its present form, covers aspects of morphology and anatomy, biology, taxonomy, pathology and control of plant parasitic nematodes. At other South African universities, Plant Nematology is catered for either as a subdivision of some Plant Pathology course or a nematology course in another Department such as Entomology or Zoology. Due to the increasing financial pressures on Universities and a lack of interest in nematology at the post graduate level, U. P. is also forced to rationalise its courses. Reasons for the present dilemma, in which Plant Nematology finds itself, are discussed and possible solutions put forward.

CHEMICAL CONTROL OF THE CITRUS NEMATODE *TYLENCHULUS SEMIPENETRANS*

H. F. LE ROUX[1], M. C. PRETORIUS[1] and LAURA HUISMAN[2]

[1] Preharvest Plant Pathology Section, Outspan Citrus Centre

[2] Outspan Diagnostic Centre, P. O. Box 28, Nelspruit 1200, South Africa

Chemical control is but a small part of the total nematode control strategy which includes: exclusion of the pest; minimizing crop losses through cultural practices and a reduction of the levels of the nematode population in the soil. As a result of the lack of control often experienced after the multiple use of the nematicides aldicarb and fenamiphos, a new philosophy on nematode control is being proposed, viz. that the nematode population be eliminated entirely rather than attempting to manage the populations during critical periods of crop production. Data is presented which shows that the nematode populations can be eliminated in the soil and roots for a period of up to four years following three nematicide applications in one season. The future use of trunk applications of nematicides is also discussed.

THE ROLE OF THE CITRUS NEMATODE, *TYLENCHULUS SEMIPENETRANS* IN A REPLANT ORCHARD AT ZEBEDIELA ESTATES —A CASE STUDY

H. F. LE ROUX[1], M. C. PRETORIUS[1] and LAURA HUISMAN[2]

[1] Preharvest Plant Pathology Section, Outspan Citrus Centre

[2] Outspan Diagnostic Centre, P.O. Box 28, Nelspruit 1200, South Africa

The citrus nematode, *Tylenchulus semipenetrans* is a major problem in citrus soils in southern Africa. The Citrus Improvement Programme has succeeded in eliminating this pest completely in all participating nurseries. The citrus nematode is, however, still of major import ance in replant situations as well as most of the older orchards. This paper presents data on the effect of the citrus nematode on yield, canopy and trunk growth in a replant orchard at Zebediela Estate.

INTERACTION BETWEEN A SOUTH AFRICAN POPULATION OF *XIPHINEMA INDEX* AND DIFFERENT GRAPEVINE ROOTSTOCKS

Antoinette P. Malan[1] and A. J. Meyer[2]

[1] Plant and Quality Control, Private Bag X5015, Stellenbosch 7599, South Africa

[2] University of Stellenbosch, Stellenbosch 7600, South Africa

Thirty-one grapevine rootstocks were tested for reproduction, root feeding symptoms and transmission of grapevine fanleaf virus by a South African population of *Xiphinema index*. Grapevine fanleaf virus was transmitted within four months to the roots and systematically spread within six months to the leaves of all the rootstocks tested. No root damage and a low reproduction rate of *X. index* were found on the rootstocks Harmony, Freedom and Fairy with Solonis and Othello in their parentage.

THE INFLUENCE OF PLANTING DATE ON NEMATODE CONTROL AND YIELD OF NEMATICIDE TREATED GROUNDNUT UNDER IRRIGATION

A. H. McDONALD, Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa

Groundnut cv. Sellie was planted under irrigation at four different planting dates on the same location. The plants of each planting date received the same nematicide treatments, and were compared to untreated controls. The field was heavily infested with the peanut pod nematode, *Ditylenchus destructor*, and lightly infested with *Pratylenchus brachyurus* and *Meloidogyne* spp. At harvest, significant differences were observed between nematode numbers of each species on plants from each planting date. The efficacy of nematicides, as related to groundnut yield and nematode control, differed between planting dates. It is concluded that environmental conditions play a role in the efficacy and cost effectiveness of nematicides of groundnut.

THE PRESENT STATUS OF NEMATOLOGY IN THE WESTERN CAPE PROVINCE

A. J. MEYER, Department of Entomology and Nematology, University of Stellenbosch, Stellenbosch 7600, South Africa

The study of plant-parasitic nematodes in the Western Cape started thirty years ago. By means of circulating questionnaires and interviews with researchers and other concerned parties in this region, some idea of the research priorities for the future was obtained.

THE INFLUENCE OF *MELOIDOGYNE JAVANICA* ON QUALITY AND YIELD OF POTATOES (*SOLANUM TUBEROSUM* L.)

F. P. OSLER and P. J. STEYN, Vegetable and Ornamental Plant Institute, Private Bag X293, Pretoria 0001, South Africa

Thirty-two potato cultivars/lines were screened for resistance to *Meloidogyne javanica*. The cultivars/lines were planted in a Fernwood (4 % clay) soil that was fumigated with DD before planting to minimize the natural nematode population. Experimental design was a split plot with three replications. The inoculation concentration was 0 and 10 000 eggs per plant in the main plots. There were 32 potato cultivars/lines in the subplots. Plants in 3 m rows were spaced 30 cm in the rows and 85 cm between rows. The yield was divided into five classes ranging from 0 % infected to 100 % infected. The yield percentages of each class was determined and converted to an infection index (100–500). Other traits investigated were the development of hollowheart, discoloration of vascular tissue, specific gravity and the length of the growing season.

THE INVOLVEMENT OF *MELOIDOGYNE INCOGNITA* AND *M. JAVANICA* IN THE OCCURRENCE OF FALSE PANAMA DISORDER OF BANANAS

ELMARÉ C. RABIE*[1], G. C. LOOTS[2] and P. WILLERS[1]

* Stationed at Hluhluwe Research Station, Natal, South Africa

[1] Institute for Tropical and Subtropical Crops, Private Bag X11208, Nelspruit 1200, South Africa

[2] Department of Zoology, PU for CHE, Potchefstroom 2520, South Africa

Since 1981 False Panama Disorder (FPD) has occurred in banana plantations in South Africa. The symptoms of FPD can be confused with those of Panama Disease, a major threat to bananas in South Africa. A correlation between *Meloidogyne* numbers and FPD has been found, though *Meloidogyne* spp. are secondarily involved. Other stress factors such as drought and low temperatures are also involved. One year of chemical control did not give an increase in growth, but did suppress nematode numbers. Foliar symptoms similar to FPD were induced in a simulation of drought conditions in the glasshouse using tissue culture derived banana plants.

POPULATION DYNAMICS OF SOME ECONOMICALLY IMPORTANT NEMATODES IN MAIZE FIELDS IN THE WESTERN TRANSVAAL

H. F. RIEKERT, Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa

Previous papers on population dynamics of locally economically important nematode species on maize suggest that numbers in the soil are low and in the roots high, shortly after planting. At harvest the numbers in the soil increase and those in the roots decrease. During the present trial carried out at four localities in the Western Transvaal, the above-mentioned pattern of population development did not occur. The trial showed increases in nematode numbers in both the soil and the roots during flowering and ear formation, for *Pratylenchus* spp., *Meloidogyne* spp. and *Paratrichodorus* spp., Hoplolaiminae, Criconematinae and Longidoridae. These populations decreased again at harvest.

COMBINED EFFECT OF NEMATODES AND RATOON STUNTING DISEASE ON SUGAR-CANE

V. W. SPAULL, S. A. Sugar Association Experiment Station, Private Bag X02, Mount Edgecombe 4300, South Africa

A field trial was established to investigate the possible interaction between nematodes and the bacterium *Clavibacter xyli* subsp. *xyli*, the causal agent of ratoon stunting disease (RSD) in sugar-cane. The trial site was a sandy soil infested with species of *Pratylenchus*, *Meloidogyne*, *Paratrichodorus* and *Xiphinema*. The trial was established with RSD-infected and RSD-free sugar-cane variety N12 and the nematodes were controlled with aldicarb. In both the plant and first ratoon crops, the combined effect of a heavy infection with *C. xyli* subsp. *xyli* and large numbers of nematodes, on the yield of cane and sucrose, was additive.

STUDIES TO DETERMINE THE EXTENT OF CROP LOSS IN SUGAR-CANE CAUSED BY NEMATODES

V. W. SPAULL, S. A. Sugar Association Experiment Station, Private Bag X02, Mount Edgecombe 4300, South Africa

It is known that nematodes can affect the yield of sugar-cane on some loamy sand and sandy loam soils. To assess the extent of the problem, trials were established on eleven Cartref form soils and three Kroonstad form soils. Site selection was based on availability and a soil clay content of about 10 %. None of the sites were considered, by the growers, to have a nematode problem. Each trial comprised plots treated with a split application of 14 kg aldicarb/ha and an untreated control. Noteworthy responses occurred in some of the sites and especially in two of the Kroonstad sites. Large numbers of *Paratrichodorus* species occurred in these two sites. It is concluded that unsuspected losses from nematodes may be widespread.

THE EFFECT OF *PARATRICHODORUS MEYERI* ON TOBACCO

ELIZABETH R. VAN BILJON[1] and J. HEYNS[2]

[1] TCRI, Private Bag X82075, Rustenburg 0300, South Africa

[2] RAU, P. O. Box 834, Johannesburg 2000, South Africa

Various inoculation levels of *Paratrichodorus meyeri* were tested on tobacco cultivars K51E and RK. A damage threshold value of 100/1,5 ℓ soil was established for the tobacco cultivar K51E, where as cultivar RK proved to be highly tolerant and showed no adverse effects at any level of inoculation.

THE EFFECT OF DIFFERENT RATES OF CIS-DD (1,3-DICHLOROPROPENE) ON THE CHLORINE CONTENT OF CURED ORIENTAL TOBACCO LEAVES

ELIZABETH R. VAN BILJON and W. VAN DER MERWE, Tobacco & Cotton Research Institute, Private Bag X82075, Rustenburg 0300, South Africa

One of the factors affecting soil fumigant performance is temperature and all nematicides dependent upon gas diffusion are less effective at low temperatures, but some more than others. In the oriental tobacco growing areas in the Western Cape, a problem was encountered with EDB fumigation as temperatures were too low at the time of application. Trials were therefore initiated to evaluate various other nematicides. A significant yield increase was obtained with cis-DD (1,3 dichloropropene) fumigation. DD being a fumigant that only requires a minimum soil temperature of 7 °C. The use of DD, however, can contribute to an increase in the chlorine content of the cured leaf. A high chlorine content in the leaf is detrimental to the development of tobacco, leading to production of thickened and brittle leaves which, when cured, have undesirable colour, moisture relations and combustion properties. A study was therefore initiated to determine the effect of different rates of cis-DD on the chlorine content of cured oriental tobacco leaves, the results of which are discussed in this paper.

THE NEMATOLOGICAL SITUATION IN MOZAMBIQUE

RINIE VAN DER OEVER, Departemento de Sanidade Vegetal—Sector Nematologia (INIA) CP 3658 Maputo Mozambique

Relatively little attention has been paid to nematodes in Mozambique. First records date from 1969, when research started as a result of the discovery in the region of *Radopholus similis* on banana. An inventory was made of the host plants of *R. similis* (banana, cotton, groundnut, maize) and a nematode survey was carried out in sugar-cane and citrus. In the latter, the citrus nematode *Tylenchulus penetrans* was found in 2,6 % of the samples.

After a break in nematode research from 1976–1984 another survey was carried out over a period of two years. This work revealed the occurrence of root-knot nematodes (*Meloidogyne incognita, M. javanica* and *M. arenaria*); lesion nematodes (*Pratylenchus zeae, P. brachyurus, P. coffeae* and *P. sefaensis*); reniform nematodes (*Rotylenchulus reniformis* and *R. parvus*) and several other nematode species in different crops, mainly in the southern part of the country. In January 1992, this survey was resumed and now includes some areas in the North of the country. Root-knot nematodes and lesion nematodes constitute the genera most frequently found to date.

HISTOLOGICAL STUDIES OF *DITYLENCHUS DESTRUCTOR* IN GROUNDNUT PODS

CHERYL VENTER[1], H. FOURIE[1], G. VAN ASWEGEN[2], A. J. MEYER[3] and D. DE WAELE[4]

[1] Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa

[2] Department of Zoology, PU for CHE, Potchefstroom 2520, South Africa

[3] Department of Nematology, University of Stellenbosch, Stellenbosch 7600, South Africa

[4] Laboratorium Genetika, Ledeganckstraat 35, Gent, Belgium

Ditylenchus destructor was observed in the endocarp, parenchymous region of the mesocarp, and in the exocarp of the hull of groundnut pods (*Arachis hypogaea*) cv Sellie. The nematode was also found in the parenchyma region of the seed. It was not found in the fibrous region of the mesocarp in the hull, or the vascular bundles of either hull or testa. Adults and eggs were observed in the hull tissues from 19 weeks after planting, but only from 25 weeks in the testa. Anhydrobiotic nematodes were observed in the hull tissues, but not in the testa. In hull stubble, both anhydrobiotic nematodes and eggs will probably play a role in the over-wintering survival of the nematode. In the seeds, eggs will probably be an important source of reinfestation if harvest is delayed to 25 weeks after planting.

MELOIDOGYNE JAVANICA EGG PRODUCTION IN TOBACCO CULTIVARS

JENNIFER I. WAY, Tobacco Research Board, P.O. Box 1909, Harare, Zimbabwe

The number of egg masses per plant and eggs per egg mass of *M. javanica* females infecting roots of root-knot susceptible and resistant tobacco cultivars were compared. At eight weeks after inoculation, the susceptible Kutsaga E1 had the highest number of egg masses per plant followed by Speight G28 and K326. The resistant cultivars RK8, RK1, RK3 and RK14 were intermediate and a resistant parent, SINCB 2-28, had the least egg masses per plant. Differences between the cultivars were shown more clearly by egg masses per plant than by eggs per egg mass and therefore the former was a better indicator of susceptibility of a tobacco cultivar to *M. javanica*.

NOTES ON THE PRESENCE OF PLANT-PARASITIC NEMATODES ON GUAVA, *PSIDIUM GUAJAVA* L. IN SOUTH AFRICA

P. WILLERS, Institute for Tropical and Subtropical Crops, Private Bag X11208, Nelspruit 1200, South Africa

Reports of damage by plant parasitic nematodes to guava outside central American countries are rare. A survey in South Africa indicated that *Helicotylenchus dihystera* occurred in all orchards in the Western Cape, whereas 95,1 % of orchards in Transvaal were infested. Inoculation trials in the glasshouse indicated that *H. dihystera* could suppress growth of seedlings by 40 % at population levels of 12 000/container.

An undescribed *Meloidogyne* spp. was found on guavas in the Lowveld (25°72′S, 30°58′E) recently. This species may cause extensive root damage culminating in tree mortality. Symptoms are similar to that caused by the guava wilt disease pathogen (*Acremonium diospyri*) and may be easily confused.