Indian J. Pl. Genet. Resources 2(1) : 44-48, 1989

Role of Plant Quarantine in Checking Dispersal of Nematodes with True Seed

ARJUN LAL, V. K. MATHUR AND RAJAN

National Bureau of Plant Genetic Resources, New Delhi

Unknowingly man has helped, to a great extent, in the worldwide geographical distribution of several economically important plant parasitic nematodes through the exchange of nematode infested/contaminated plant material. With the growing awareness of the role of nematodes as a limiting factor in agricultural production, testing of seed material for nematode infestation is now being undertaken by many seed health testing and quarantine laboratories. Nematodes could be transported with the true seeds, either as internally seed-borne or as a contaminant with seed in the form of nematode galls, infested plant debris, soil clods, soil entangled between corrugated seed surface etc. Important nematode interceptions made while quarantine processing of true seed material during 1976-1986 period included Aphelenchoids besseyi, Rhadinaphelenchus cocophilus, Ditylenchus dipsaci, D. angustus, Anguina tritiei, Heterodera schachtii, H. humuli. *Some of the nematode species intercepted are still not recorded from India and are known to cause extensive damage to crops in country of origin.*

Exchange of plant genetic resoures among different countries of the world is essential part of agricultural research for upgrading crops for yield, quality and developing resistant varieties against insects, nematodes, diseases and various stress conditions. However, indiscriminate exchange of plants/plant materials may result in introduction of new pests and diseases which may endanger our agri-horticultural and foresrty crops. Dissemination of plant parasitic nematodes through the movement of vegetatively propagated plant material and infested seed or its contaminants have been reported by several workers from time to time (Thorne, 1961; Southey and Aitkenhead, 1972; Bingefors, 1973; Sanwal and Mathur, 1975; Mathur *et al.*, 1981).

During the past 20 years, several nematode species have been reported as internally seed-borne or forming seed galls (Fortuner and Williams, 1975; Bos, 1977; Cuc, 1982; Green and Sime, 1979; Corbett, 1976). These reports further strengthen the necessity of careful examination of all kinds of imported seed material for nematode infestation. In this paper, nematodes intercepted from imported seed material meant for research purpose are reported. Detection techniques, salvaging methods and suggestions for preventing/minimising risks of introductions of exotic nematode species have also been highlighted.

MATERIALS AND METHODS

Nematode detection techniques

Well over 350 thousand samples of plant/plant material were introduced (1976-86) into India through National Bureau of Plant Genetic Resources, New Delhi and were examined for nematode infestation. Approximately 90 per cent of imported germplasm comprised true or botanical seed. Each sample was carefully examined for nematode infestation using the detection procedures of (i) direct visual examination of true seeds for the presence of soil clods, plant debris, seed galls and abnormalities (deformed/discoloured seeds); (ii) mechanical separation of abnormal seeds/soil clods/other contaminants and soaking them separately in water for 24-48 h at 25-30°C; (iii) extraction of nematodes by Cobb's decanting and sieving technique in combination with Baermann's funnel method and (iv) teasing water soaked seeds using forceps and needle under a dissecting microscope. Further recovery of nematodes from infested/infected seeds was made using Baermann's funnel technique. Nematode suspension was concentrated using a 400 mesh sieve. Nematodes were killed by gentle heat, fixed in formalin and processed to dehydrated glycerine for making permanent mounts. Specific identification was not possible in many cases due to lack of sufficient number of intact/adult specimens.

RESULTS AND DISCUSSION

Nematode interceptions

Species belonging to thirteen genera of plant parasitic nematodes were intercepted from imported seed and its contaminants. Important nematode species intercepted were *Aphelenchoides besseyi* from seeds of *Oryza sativa* and *Digitaria smutsii*; *Rhadinaphelenchus cocophilus** from husk of *Cocos nucifera* nuts; *Ditylenchus dipsaci** from seeds of *Medicago sativa*, *Trifolium* spp. and *Stylosanthes* spp., *Aphelenchoides arachidis** from *Arachis hypogaea*, *Heterodera schachtii* from soil clods mixed with seeds of *Beta vulgaris* (species marked with asterik are still not known from India). The details of various nematode interceptions are given in Table 1.

Maximum number or nematode species including viable cysts of some of the cyst forming nematode species have come along with true seeds as contaminant (Table 1), thus highlighting the point that any plant parasitic nematode species can get transported across the continents by this mode of dispersal irrespective of the fact whether the seeds are from a host or non-host crop. It may be mentioned here that on most occasions, soil clods weighing only 200 to 500 mg were found to carry the nematodes in a viable condition. This observation coupled with the fact that sufficient information on seed-borne nematodes is still lacking, strongly suggests the need to subject all the incoming seed material to quarantine examination.

Besides the plant parasitic nematodes, species of several free living and saprophagus genera, viz, *Rhabditis*, *Panagrolaimus*, *Diplogaster*, *Plectus*, *Dorylaimus*, and *Cephalobus* were also intercepted.

TABLE 1. NEMATODES INTERCEPTED FROM IMPORTED SEED MATERIAL DURING 1976-1986

Nematodes intercepted	Seed material	Country of origin
	A. From Seed	
Aphelenchoides besseyi	*Oryza sativa*	Philippines, UK, USA
	Digitaria sp.	Australia
Aphelenchoides spp.	*Cocos nucifera*	Ivory Coast, Guyana
	Artemisia annua	USA
	Guiciclina gosipes	Costa Rica
	Arachis hypogaea	Sri Lanka
	Pentstemon sp.	USA
	Stylosanthes sp.	Australia
	Terminalia chebula	USA
	Macadamia spp.	Australia
Aphelenchoides arachidis	*Arachis hypogaea*	Philippines, Thailand
Bursaphelenchus sp.	Red palm oil nuts	Indonesia
Ditylenchus dipsaci	*Stylosanthes* sp.,	Australia
	Medicago sativa	
	Trifolium sp.	
	B. Seed galls as contaminants of seed	
Anguina tritici	*Triticum aestivum*	Turkey, Italy, UK
Anguina sp.	*Stylosanthes* sp.	Australia
	C. From soil clods mixed with seed	
Aphelenchoides subtenuis	*Lablab purpureus*	Australia
Aphelenchus avenae	*Helianthus annuus*	Egypt
	Eucalyptus sp.	Australia
	Arachis hypogaea	Sri Lanka
	Triticum aestivum	Italy
	Medicago sativa	USA
Aphelenchus spp.	*Trifolium* spp.	Australia
Criconema sp.	*Arachis hypogaea*	Thailand
Criconemella lobata	*Hordeum vulgare*	Syria
	Arachis hypogaea	Thailand
Ditylenchus sp.	*Helianthus annuus*	Egypt
Filenchus filiformis	*Sesamum* spp.	Egypt
Helicotylenchus dihystera	*Triticum aestivum*	Mexico
	Eragrostis spp.	Ethiopia
	Arachis hypogaea	Bulgaria
Helicotylenchus spp.	*Sesamum* sp.	Egypt
	Arachis hypogaea	Sri Lanka
	Mrdicago sativa	USSR
	Medicinal plants	Hungary
	Brassica spp.	Thailand
Hemicriconemoides spp.	*Digitaria* spp.	Australia
Heterodera schachtii (Cysts)	*Beta vulgaris*	UK, Italy, West Germany
Heterodera spp. (Cysts)	*Pinus oocarpa*	Brazil
	Triticum aestivum	Turkey

Contd.

TABLE 1. (*Continued*)

Nematodes intercepted	Seed material	Country of origin
Hoplolaimus galeatus	*Medicinal plants*	USA
Hoplolaimus spp.	*Arachis hypogaea*	Thailand, Sri Lanka
	Eucalyptus spp.	Australia
	Lycopersicon spp.	Hungary
	Beta vulgaris	UK
Paratylenchus projectus	*Triticum aestivum*	Italy
Paratylenchus sp.	*T. aestivum*	UK
Pratylenchus neglectus	*T. aestivum*	Mexico
Pratylenchus sp.	*Arachis hypogaea*	Sri Lanka
Rotylenchulus sp.	*Eragrostis* spp.	Ethiopia
	Sesamum spp.	Egypt
Tylenchorhynchus claytoni	*Triticum aestivum*	Mexico, Italy, Turkey
Tylenchorhynchus spp.	*Eucalyptus* sp.	Australia
	Oryza sativa	USA
	Brassica spp.	Thiland
Tylenchus spp.	*Triticum aestivum*	Italy, Turkey
	Hordeum vulgare	Syria
	D. Plant debris/paking material	
Aphelenchoides myceliophagus	*Acrocomia sclerocarpa* *Euterpe oleracea*	Brazil
Aphelenchoides spp.	*Citrus bergamia*	Italy
Ditylenchus anqustus	*Oryza sativa*	Philippines
Helicotylenchus spp.	*Carambola* spp. *Myrciaria sp.*	USA

Salvaging of infested/contaminated seed samples

Wherever possible, standardised denematisation procedures such as hot water treatment, nematicidal dip, mechanical cleaning and thorough washing with water (to remove soil sticking to seeds with rough surface) were used. Before release of the seed samples, effectiveness of the denematisation method used to achieve 100 per cent kill was checked. Packing material was always replaced by fresh material.

SOME SUGGESTIONS FOR INDENTORS AND SUPPLIERS

Success of plant quarantine in any country largely depends upon crop growers' awareness and their cooperation with quarantine officials in effective implementation of quarantine rules and regulations. 'Prevention is better than cure' holds true with regard to quarantine measures against exotic nematode pests. Therefore, some suggestions are given hereunder which would greatly help in preventing introduction of exotic nematode pests.

— Quantity of seed material being imported is positively correlated with the degree of nematode risk. Therefore, only minimum possible seed quantity

required should be indented. This would not only minimise nematode risk but would also reduce time for inspection, denematisation, if required, and release.

- Custom/Quarantine inspectors must chek passengers' baggage for seed/plant material and send it for plant quarantine inspection.
- Direct planting of any crop in open fields without quarantine clearance must be avoided.
- Request for import of seed material must be sent well in advance to allow sufficient time for quarantine examination and clearance.
- It is important that exporting country sends all seed material free from insects, nematodes, pathogens, weeds and all kinds of contaminants, and also information along with seed material on important pests/pathogens of the concerned crop in the country. This would help the quarantine officials of importing country to take special care against such hazards.

ACKNOWLEDGEMENT

The authors are grateful to Dr. R. S. Paroda, Former Director, National Bureau of Plant Genetic Resources, New Delhi for providing necessary facilities.

REFERENCES

Bingefors, S. 1973. International dispersal of nematodes. Netherland J. Plant Path. 73: 44-60.

Bos, W. S. 1977. *Aphelenchoides arachidis* n. sp. (Nematoda: Aphelenchoidea), an endoparasite of the testa of groundnuts in Nigeria. Zeit. fur Pflanzenki Pflanzensch., 84: 95-99.

Corbett, D. C. M. 1976. *Pratylenchus brachyurus*. C. I. H. Descriptions of Plant Parasitic Nematodes, Set-6, No. 89, 4 pp.

Cuc, N. T. T. 1982. New weed hosts of rice stem nematode identified in Vietnam. Internat. Rice Res. Newsletter., 7 : 15.

Furtuner, R. and K. J. R. Williams. 1975. Review of the literature on *Aphelenchoides besseyi* Christie (1942), the nematode causing 'white tip' disease in rice. Helminth. Abstr., 44: 1-40.

Green, C. D. and S. Sime. 1979. The dispersal of *Ditylenchus dipsaci* with vegetable seeds. Annals Appl. Biol., 92 : 263-270.

Mathur, V. K., K. C. Sanwal, R. V. Singh and Arjun Lal. 1981. Role of soil clods and plant debris mixed with true seed in dissemination of plant parasitic nematodes. Indian J. Nematol., 11 : 92-94.

Sanwal, K. C. and V. K. Mathur. 1975. Soil as contaminant of wheat seed. Indian J. Nematol., 5 : 118-119.

Southey, J. F. and P. Aitkenhead. 1972. Soil-borne pests and pathogens associated with imported plants with special reference to nematodes. EPPO Bull., 7 : 49-59.

Thorne, G. 1961. Principles of Nematology. McGraw Hill Book Co. Inc., New York, XIV, 533 pp.