

**HOST RANGE AND DISTRIBUTION OF *MELOIDOGYNE INCOGNITA* AND
M. JAVANICA IN THE SULTANATE OF OMAN**

A. Mani and Muzna Al Hinai

Directorate of Agricultural Research, Ministry of Agriculture and Fisheries, Muscat, Sultanate of Oman.

RESUMEN

Mani, A. y Muzna Al Hinai. 1996. Gama de hospedantes y distribución de *Meloidogyne incognita* y *M. javanica* en el Sultanato de Omán. *Nematrópica* 26:73-79.

Prospecciones fitonematológicas se llevaron a cabo en Batinah, Dhahira, Interior, regiones de Sharqia en el norte de Omán y el gobernadorato de Dhofar en el sur de Omán durante 1991-95, para determinar la gama de hospedantes y distribución de *Meloidogyne incognita* y *M. javanica*. Ambas especies de nematodos se encontraron ampliamente distribuidas en todas las regiones estudiadas. Un total de 78 especies de plantas pertenecientes a 31 familias se reportan como hospedantes de *M. incognita* y *M. javanica*. De estas, cuatro resultaron ser nuevos reportes de hospedantes para *M. incognita* y tres para *M. javanica*.

Palabras clave: distribución, gama de hospedantes, malezas hospedantes, *Meloidogyne incognita*, nematodos agalladores.

The Sultanate of Oman is situated between 16° 40' and 26° 20' north latitudes and 51° 50' and 59° 40' east longitudes, and occupies the southeastern corner of the Arabian Peninsula. It has a coastal line extending about 1700 km from the strait of Hormuz in the north to the borders of the Republic of Yemen in the south, overlooking 3 seas: the Arabian Gulf, Gulf of Oman, and the Arabian Sea. The Sultanate borders with Saudi Arabia and the United Arab Emirates in the West, the Republic of Yemen in the South, strait of Hormuz in the North, and the Arabian Sea in the East (Scholz, 1980). The Sultanate is divided into three Governorates: Muscat, Musandam, and Dhofar (Sallah), and five regions: Al Wusta, Batinah, Dhahira, Interior, and Sharqia.

The climate differs from region to region, being hot and humid during summer in the Batinah, but hot and dry in Dhahira, Interior, and Sharqia regions. However, the higher mountains in the

Interior have a moderate climate throughout the year. The mean monthly maximum and minimum temperatures in northern Oman range between 25.0 to 41.2°C and 14.6 to 29.9°C respectively, with a relative humidity (RH) of 43 to 80%. Rainfall patterns are erratic, but generally rain occurs between December and February, with the annual rainfall ranging from 76 to 106 mm (Anonymous, 1993). Contrastingly, Dhofar has a moderate climate with a mean monthly temperature of 22.8 to 29.0°C and RH of 58 to 90%. The annual rainfall is about 110 mm, and it is the only region in the country which receives rainfall between July and September (Anonymous, 1992). In Dhofar, the southwestern monsoons produce dense mists in July and August on the escarpment mountains and plateau. Condensation or "occult rainfall" is a major source of water for the vegetation. Mean precipitation calculated from mists is 34-35 L/sq. m/day at 4.2 m height (Stanley-Price *et al.*, 1986).

There is an area of about 41 024 ha under cultivation in Oman (Anonymous, 1989), and Batinah is the major agricultural region which occupies 50.6% of the cultivated area. Interior, Dhahira, and Sharqia regions in North Oman and Dhofar governorate in South Oman are the other agricultural areas in the country. Soils are mostly sandy or sandy loam and bore-wells are the major source of irrigation. A number of vegetable, fruit, and field crops are grown either as sole or mixed crops under traditional as well as modern farming systems. Plant-parasitic nematodes have been identified as one of the important constraints in agricultural production (Mani, 1993). Although Waller and Bridge (1978) reported the occurrence of root-knot nematodes, *Meloidogyne incognita* (Kofoid and White) Chitwood and *M. javanica* (Treub) Chitwood, on a few host plants in certain parts of Oman, their host range and distribution have not been studied in detail. Therefore, an attempt was made to study the host range and distribution of *M. incognita* and *M. javanica*, which are the most important phytoparasitic nematodes recorded in Oman (Anonymous, 1993; Mani, 1993; Waller and Bridge, 1978).

Surveys were carried out in all the agricultural regions of Oman during the cropping seasons from 1991-95 (Fig. 1). A total of 12 wilayats (districts or divisions) in Batinah, 9 in Interior, 7 in Dhahira, 6 in Sharqia, and 5 in Dhofar governorate were surveyed. Five farms were randomly selected in each wilayat with the help of extension personnel. Root samples of crops, ornamentals, and weed species were collected from each farm and rated for galling on a scale of 0 to 5, where 0 = 0 galls and 5 = >100 galls per root system (Taylor and Sasser, 1978). Adult female nematodes were dissected from infected roots in the laboratory. The nematode spe-

cies were identified based on perineal patterns of adult females as well as characters of the second-stage juveniles (Jepson, 1987). Reference was made to the publications of Goodey *et al.* (1965) and Saka and Carter (1987) for records of hosts for *M. incognita* and *M. javanica* found in this survey. Literature was consulted for proper identification of certain weed specimens (Ghazanfar, 1992).

Observations revealed that a total of 78 plant species belonging to 31 families were found infected by either *M. incognita* or *M. javanica* or both (Table 1). In all, 19 vegetables, 10 fruit crops, 14 field crops, 5 ornamentals, and 30 weed species were found infected by these 2 species of *Meloidogyne*. *Meloidogyne incognita* was recorded on 62 host plants while *M. javanica* was observed on 42 species, which indicated that *M. incognita* was the more frequent nematode species infecting a larger number of host plants. It was generally observed that crops like banana (*Musa acuminata* Colla), eggplant (*Solanum melonaena* L.), fig (*Ficus carica* L.), grape (*Vitis vinifera* L.), okra (*Abelmoschus esculentus* [L.] Moench), papaya (*Carica papaya* L.), pomegranate (*Punica aratanum* L.), and tomato (*Lycopersicon esculentum* Mill.) were severely infected by both *M. incognita* and *M. javanica* in all regions with gall indices ranging from 4.0 to 5.0. They also infected a number of other crops and weed species in many of the regions. *Amaranthus hybridus* L., *Chenopodium murale* L., *Physalis minima* L., *Solanum nigrum* L., and *Vernonia cinerea* (L.) Less. were the most severely and frequently infected weed species in cultivated fields. Four plants were recorded as new hosts of *M. incognita* and 3 weed species were recorded as new hosts of *M. javanica* (Table 1). These results suggest that weed control may be useful in reducing nematode populations during the season and in preventing the carry

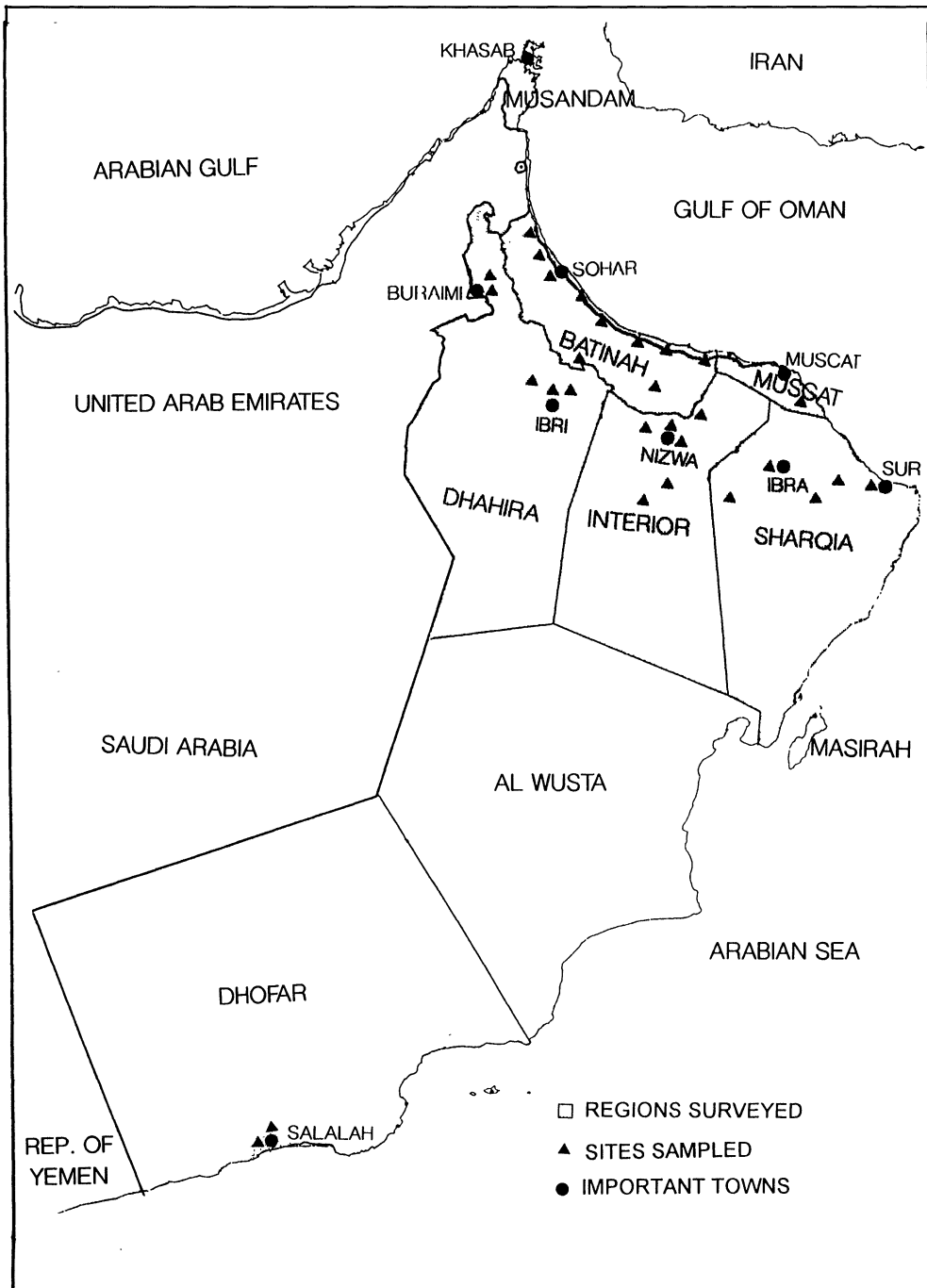


Fig. 1. Map of the Sultanate of Oman showing the regions surveyed and the sites sampled during the survey.

Table 1. Host range and distribution of *Meloidogyne incognita* and *M. javanica* in Oman.

Scientific name of host plant	Family	Common name	Nematodes recorded ^x	Gall index ^y	Distribution in Oman ^z
<i>Abelmoschus esculentus</i> (L.) Moench	Malvaceae	Bhendi, okra	Mi, Mj	5.0	B,D,Dg,I,S
<i>Achyranthes aspera</i> L.	Amaranthaceae	Weed	Mi	4.0	B,Dg,I
<i>Aerva javanica</i> (Burm. f.) Juss.	Amaranthaceae	Weed	Mi*	2.0	I
<i>Allium cepa</i> L.	Liliaceae	Onion	Mi, Mj	2.0	B,I,S
<i>Allium sativum</i> L.	Liliaceae	Garlic	Mi	1.0	B,I
<i>Alternanthera sessilis</i> (L.) Dc.	Amaranthaceae	Weed	Mi	2.0	I
<i>Amaranthus graecizans</i> L.	Amaranthaceae	Pigweed	Mi	3.0	B,Dg,I
<i>Amaranthus hybridus</i> L.	Amaranthaceae	Common pigweed, Green amaranth	Mi, Mj	3.0	B,I
<i>Amaranthus</i> cf. <i>viridis</i> L.	Amaranthaceae	Slender amaranth	Mi	2.0	Dg
<i>Amygdalus arabicus</i> Oliv.	Rosaceae	Almond	Mj	1.0	I
<i>Avena sativa</i> L.	Poaceae	Oat	Mi	1.0	D
<i>Beta vulgaris</i> L.	Chenopodiaceae	Sugarbeet	Mj	5.0	I
<i>Boerhaavia diffusa</i> L.	Nyctaginaceae	Red spiderling	Mj	3.0	Dg
<i>Brassica oleracea</i> L. var. <i>capitata</i>	Cruciferae	Cabbage	Mi	3.0	B
<i>Brassica oleracea</i> L. var. <i>botrytis</i>	Cruciferae	Cauliflower	Mi	3.0	B
<i>Capsicum annuum</i> L.	Solanaceae	Peppers	Mi	5.0	B,Dg,I
<i>Carica papaya</i> L.	Caricaceae	Papaya	Mi, Mj	5.0	B,D,Dg,I,S
<i>Chamaesyce hirta</i> (L.) Millsp.	Euphorbiaceae	Weed	Mi	2.0	B
<i>Chenopodium murale</i> L.	Chenopodiaceae	Nettle-leaved- goosefoot	Mi, Mj	3.0	Dg,I
<i>Chloris gayana</i> Kunth	Poaceae	Rhodesgrass	Mi	1.0	B,I
<i>Cicer arietinum</i> L.	Fabaceae	Chickpea	Mi	3.0	I
<i>Convolvulus arvensis</i> L.	Convolvulaceae	Field bindweed	Mj	2.0	Dg,I
<i>Coriandrum sativum</i> L.	Umbelliferae	Coriander	Mi	3.0	B
<i>Cucumis melo</i> L.	Cucurbitaceae	Sweet melon	Mi	3.0	B,D
<i>Cucumis sativus</i> L.	Cucurbitaceae	Cucumber	Mi	5.0	B,D,Dg
<i>Cyperus rotundus</i> L.	Cyperaceae	Nut-grass	Mj	2.0	B
<i>Datura metel</i> L.	Solanaceae	Thorn-apple	Mi	2.0	B
<i>Daucus carota</i> L.	Umbelliferae	Carrot	Mj	4.0	B,I
<i>Eclipta prostrata</i> (L.) L.	Compositae	Weed	Mj	3.0	B

*New host record.

^xNematode species: Mi = *Meloidogyne incognita*; Mj = *Meloidogyne javanica*.^yGall index scored on 0-5 scale.^zDistribution: B = Batinah; D = Dhahira; Dg = Dhofar governorate; I = Interior; S = Sharqia.

Table 1. (Continued) Host range and distribution of *Meloidogyne incognita* and *M. javanica* in Oman.

Scientific name of host plant	Family	Common name	Nematodes recorded ^x	Gall index ^y	Distribution in Oman ^z
<i>Euphorbia granulata</i> Fossk.	Euphorbiaceae	Weed	Mi*, Mj*	3.0	B,Dg
<i>Euphorbia hypericifolia</i> L.	Euphorbiaceae	Weed	Mj	3.0	B
<i>Euphorbia peplus</i> L.	Euphorbiaceae	Petty spurge	Mi	3.0	I
<i>Ficus carica</i> L.	Moraceae	Fig	Mi, Mj	4.0	B,D,Dg,I,S
<i>Flaveria trinervia</i> (Spreng.) Mohr.	Compositae	Texas flaveria	Mi*	2.0	I
<i>Helianthus annuus</i> L.	Compositae	Sunflower	Mj	1.0	I
<i>Heliotropium bacciferum</i> Forskal	Boraginaceae	Weed	Mj*	2.0	B
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	China-rose	Mj	5.0	B
<i>Ipomoea botatas</i> (L.) Lam.	Convolvulaceae	Sweet potato	Mi	3.0	B,Dg
<i>Jasminum sambac</i> (L.) Ait.	Oleaceae	Arabian jasmine	Mi	2.0	B
<i>Lactuca sativa</i> L.	Compositae	Lettuce	Mi	4.0	B
<i>Lagenaria siceraria</i> (Mol.) Standley	Cucurbitaceae	Bottle gourd	Mi, Mj	4.0	B
<i>Launaea procumbens</i> (R.) Dan. Ram & Raj.	Compositae	Weed	Mi	2.0	B
<i>Lycopersicon esculentum</i> Mill.	Solanaceae	Tomato	Mi, Mj	5.0	B,D,Dg,I,S
<i>Malus pumila</i> Mill.	Rosaceae	Apple	Mi, Mj	1.0	I
<i>Manihot esculenta</i> Crantz	Euphorbiaceae	Cassava	Mi, Mj	2.0	B,S
<i>Manilkara zapota</i> (L.) Royen	Sapotaceae	Sapodilla	Mi*	2.0	D
<i>Medicago sativa</i> L.	Fabaceae	Alfalfa	Mi, Mj	1.0	B,I,S
<i>Momordica charantia</i> L.	Cucurbitaceae	Balsam-pear, bitter gourd	Mi, Mj	5.0	B,Dg
<i>Musa acuminata</i> Colla	Musaceae	Banana	Mi, Mj	5.0	B,D,Dg,I,S
<i>Nicotiana tabacum</i> L.	Solanaceae	Tobacco	Mj	2.0	B
<i>Pennisetum purpureum</i> K. Schum.	Poaceae	Elephant grass, napier grass	Mi	1.0	I
<i>Phoenix dactylifera</i> L.	Araceae	Date palm	Mi, Mj	1.0	B,I
<i>Phyllanthus nodiflora</i> (L.) E. Greene	Verbanaceae	Frog-fruit	Mj	4.0	B,Dg
<i>Phyllanthus maderaspatensis</i> L.	Euphorbiaceae	Weed	Mi	3.0	Dg
<i>Physalis minima</i> L.	Solanaceae	Wild gooseberry	Mi, Mj	5.0	B,I
<i>Piper betle</i> L.	Piperaceae	Betel	Mi	5.0	Dg
<i>Pisum sativum</i> L.	Fabaceae	Pea	Mi, Mj	2.0	S

*New host record.

^xNematode species: Mi = *Meloidogyne incognita*; Mj = *Meloidogyne javanica*.^yGall index scored on 0-5 scale.^zDistribution: B = Batinah; D = Dhahira; Dg = Dhofar governorate; I = Interior; S = Sharqia.

Table 1. (Continued) Host range and distribution of *Meloidogyne incognita* and *M. javanica* in Oman.

Scientific name of host plant	Family	Common name	Nematodes recorded ^x	Gall index ^y	Distribution in Oman ^z
<i>Portulaca grandiflora</i> Hook.	Portulacaceae	Showy purslane	Mi	3.0	B
<i>Portulaca oleracea</i> L.	Portulacaceae	Common purslane	Mi	4.0	Dg,I
<i>Psidium guajava</i> L.	Myrtaceae	Guava	Mi	2.0	B
<i>Punica granatum</i> L.	Punicaceae	Pomegranate	Mi, Mj	5.0	B,D,Dg,I,S
<i>Saccharum officinarum</i> L.	Poaceae	Sugarcane	Mi	2.0	S
<i>Setaria verticillata</i> (L.) P. Beauv.	Poaceae	Hooked bristle grass	Mj	1.0	B
<i>Solanum melongena</i> L.	Solanaceae	Egg plant	Mi, Mj	5.0	B,D,Dg,I,S
<i>Solanum nigrum</i> L.	Solanaceae	Black nightshade	Mi, Mj	5.0	B,I
<i>Solanum nigrum</i> L. var. <i>villosum</i> L.	Solanaceae	Weed	Mi, Mj	3.0	B,I
<i>Solanum tuberosum</i> L.	Solanaceae	Potato	Mi	2.0	B
<i>Spinacia oleracea</i> L.	Chenopodiaceae	Spinach	Mj	4.0	B,Dg
<i>Sporobolus spicatus</i> (Vahl) Kunth	Poaceae	Spicate dropseed	Mj*	1.0	B
<i>Tecoma stans</i> (L.) Kunth	Bignoniaceae	Yellow-bells	Mi	3.0	B
<i>Tradescantia spathacea</i> Sw.	Commelinaceae	Boat-lily	Mi	3.0	B
<i>Triticum aestivum</i> L.	Poaceae	Wheat	Mi	1.0	D,I
<i>Vernonia cinerea</i> (L.) Less.	Compositae	Weedy vernonia	Mi, Mj	5.0	B,Dg,I
<i>Vicia faba</i> L.	Fabaceae	Broad bean, field bean	Mi, Mj	5.0	B,I
<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	Cowpea	Mi, Mj	5.0	B
<i>Vitis vinifera</i> L.	Vitaceae	Grape, wine grape	Mi, Mj	5.0	B,D,Dg,I,S
<i>Withania somnifera</i> (L.) Dun.	Solanaceae	Weed	Mi, Mj	4.0	B
<i>Zea mays</i> L.	Poaceae	Corn	Mi	2.0	B

*New host record.

^xNematode species: Mi = *Meloidogyne incognita*; Mj = *Meloidogyne javanica*.

^yGall index scored on 0-5 scale.

^zDistribution: B = Batinah; D = Dhahira; Dg = Dhofar governorate; I = Interior; S = Sharqia.

over of the nematode inoculum from one season to another.

ACKNOWLEDGMENTS

The authors are grateful to the Director General of Agricultural Research, Rumais, for providing necessary facilities

and Dr. S. A. Ghazanfar, Department of Biology, and Mrs. Mani Santhi, Small Animal House, Sultan Qaboos University, Muscat, for their assistance in the identification of certain weed specimens collected during the survey and preparation of the map of Oman, respectively.

LITERATURE CITED

- ANONYMOUS. 1989. Statistical yearbook. Development Council, Technical Secretariat, Directorate General of National Statistics, Sultanate of Oman, 481 pp.
- ANONYMOUS. 1992. Report of Salalah integrated study. Soil survey and land classification project. OMA/87/011, Volume 3. Ministry of Agriculture and Fisheries, Muscat, Sultanate of Oman, 174 pp.
- ANONYMOUS. 1993. Agricultural research annual report. Ministry of Agriculture and Fisheries, Muscat, Sultanate of Oman.
- GHAZANFAR, S. A. 1992. An annotated catalogue of the vascular plants of Oman and their vernacular names. National Botanic Garden of Belgium, Meise, Belgium, 153 pp.
- GOODEY, J. B., M. T. FRANKLIN, and D. J. HOOPER. 1965. The nematode parasites of plants catalogued under their hosts. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England, 214 pp.
- JEPSON, S. B. 1987. Identification of root-knot nematodes (*Meloidogyne* species). CAB International, Wallingford, U.K., 265 pp.
- MANI, A. 1993. Nematode diseases. P. 75-98 in Tariq Al Zidgali, ed. Status of pests and diseases in Oman. Series. 1. Plant diseases in the Batinah. Document no. 6/93/22, Agricultural Research Center, Rumais, Sultanate of Oman, 150 pp.
- SAKA, V. W., and C. C. CARTER. 1987. Hosts and nonhosts of the root-knot nematode *Meloidogyne incognita*. North Carolina State University Graphics, Raleigh, North Carolina, U.S.A., 62 pp.
- SCHOLZ, F. 1980. Sultanate of Oman. A geographical introduction, Part I and II. Publ. Geog. Inst., Gottingen University, West Germany, 304 pp.
- STANLEY-PRICE, M. R., A. H. HARTHY, and R. P. WHITCOMBE. 1986. Fog moisture and its ecological effects in Oman. Office of the Advisor for Conservation of the Environment, Diwan of Royal Court, Sultanate of Oman.
- TAYLOR, A. L., and J. N. SASSER. 1978. Biology, identification and control of root-knot nematodes (*Meloidogyne* species). North Carolina State University Graphics, Raleigh, North Carolina, U.S.A., 111 pp.
- WALLER, J. M., and J. BRIDGE. 1978. Plant diseases and nematodes in the Sultanate of Oman. PANS 24:313-326.

Received:

29.XI.1995

Accepted for publication:

7.III.1996

Recibido:

Aceptado para publicación: