Research Article

# Relative Susceptibility of Seedlings of Certain Local and Imported Date Palm Cultivars Against Root- Knot Nematode, *Meloidogyne incognita* in Egypt

**Mahmoud M.A. Youssef*, Wafaa M.A. El-Nagdi and Mohamed Fahmy M. Eissa**

*Plant Pathology Department, Nematology Laboratory, National Research Centre, Dokki, Post Code 12622, Cairo, Egypt.*

**Abstract** | Date palm, *Phoenix dactylifera* L., is attacked by numerous pests and diseases of which root -knot nematodes wherever are occurred causing damage to its yield quality and quantity. Due to little work done on date palm and genetic variation in open field in Egypt, therefore, under screen house conditions, 12 local and imported (of Saudi Arabian origin). Date palm cultivars were evaluated for their susceptibility/resistance against root- knot nematode, *Meloidogyne incognita* according to nematode damage index (DI) scale (indicated by host susceptibility/resistance) and the percentage plant vigor scale (indicated by host reaction). The degree of susceptibility/resistance considering DI scale was combined with the percentage host vigor scale of each cultivar (indicated by host category) to give a better evaluation and clear relationship between nematode infection and plant growth criteria. On the latest basis, date palm cultivars were categorized into four cultivars as susceptible (S) (Barhi, Hayani, Sewi Wahat and Sewi Wadi), two cultivars as highly resistant (HR) (Samani and Sokkaria), one cultivar as resistant (R) (Maktomi) and five cultivars as tolerant (T) (Amhat, El-Khalas, Nabtat Ali, Orabi and Zaghlool) against root- knot nematode. In conclusion, the tested cultivars were categorized into four cultivars as susceptible, two as highly resistant, one as resistant and five as tolerant to this nematode. Highly resistant, resistant or tolerant date palm cultivars determined in this study could be utilized for breeding program and could be introduced in integrated pest management for controlling root-knot nematode.

**Received** | February 07, 2026; **Accepted** | April 11, 2026; **Published** | June 28, 2026
***Correspondence** | Mahmoud M.A. Youssef, Plant Pathology Department, Nematology Laboratory, National Research Centre, Dokki, Post Code 12622, Cairo, Egypt; **Email:** myoussef_2003@yahoo.com
**Citation** | Youssef, M.M.A., W.M.A. El-Nagdi and M.F.M. Eissa. 2026. Relative susceptibility of seedlings of certain local and imported date palm cultivars against root- knot nematode, *Meloidogyne incognita* in Egypt. *Pakistan Journal of Nematology*, 44(1): 97-102.
**DOI** | https://dx.doi.org/10.17582/journal.pjn/2026/44.1.97.102
**Keywords** | Date palm, Cultivars, *Meloidogyne incognita*, Damage index, Plant vigor



## Introduction

Date palm, *Phoenix dactylifera* L., is dioecious and artificially pollinated by man and that 90% of all the dates of the world are grown in Iraq, Saudia Arabia and United Arab Emirates. Suitable climatic conditions occur in the dry parts where the palm has been successfully grown on a commercial scale. In Egypt, there are about 13.5 millions date palm trees. Total production is 1.4 million tons with yield

of 126kg/tree (Anonymous, 2016). it is attacked by numerous pests and diseases of which plant -parasitic nematodes as *Helicotylenchus* spp., *Hoplolaimus* spp., *Longidorus* spp., *Meloidogyne* spp., *Pratylenchus* spp., *Tylenchorhynchus* spp. and others (Youssef and Eissa, 1994; Mani *et al*., 2005; Eissa *et al*., 2009). Root-knot nematodes, *Meloidogyne* spp. are causing damage to its yield which has been estimated to be 30–50% (Jain, 1991). El-Nagdi *et al*. (2015a) showed that certain date palm cultivars tested in the current investigation (Samani, Zaghlool, Amhat and Sewi) were in association with some plant-parasitic nematodes (*Helicotylenchus* spp., *Tylenchorhynchus* spp. and *Xiphinema* spp.) with different population densities causing damage to these cultivars. Youssef (2014) reviewed that root-knot nematode is considered the most important pest infecting date palm all over the world. Youssef and Eissa (1994) found that the number of the 2nd stage juveniles of *M. incognita* in soil of date palm fluctuated coinciding with the predominant soil temperature without any sharp peak through the year of study, Griffith and Koshy (1990) reported that seedlings of fifty date palm cultivars were susceptible to the root-knot nematode and most of them (more than 90%) were killed in soil highly infested with this nematode. Eissa *et al*. (1998a) determined susceptibility of seventeenth date palm cultivars to infection by *M .incognita* which exhibited different reactions to nematode. Chedekal (2013) reported that maximum reduction in date palm seedlings infected by *M. incognita* occurred in fresh root weight (44.24%) followed by dry shoot weight (31.76%). El-Nagdi *et al*. (2015b) found that older date palm seedlings supported more population of *M. incognita* than younger ones as indicated by number of galls and egg-masses on roots and juveniles in soil, but older ages were rated as less affected by this nematode depending upon their percentages of plant growth vigor. Due to little work was done on date palm in relation to nematode infestation in Egypt, this research was conducted as rapid screening to evaluate the response of twelve local and imported cultivars of date palm seedlings to infection by root-knot nematode, *M. incognita* under screen house conditions.

## Materials and Methods

Under screen house conditions, seeds of different date palm cultivars (Table 1) were soaked in tap water for 2 weeks and then incubated in wet cloth for other two weeks. Each sprouted seed was planted in 20-cm diam. Plastic bag filled with solarized sandy loam (1:1) soil (2 kg). Heavily infested soil by root-knot nematode, *Meloidogyne incognita* were extracted for second stage nematode juveniles assay by centrifugal floatation technique (Jenkins,1964). Sprouted plants were left for two months for growing large root system. Ten replicates from each cultivar were inoculated with 2,000 newly hatched juveniles of *M. incognita*/ pot in four holes around each plant. All pots were arranged in a completely randomized block design on a bench at 30 ± 5 °C. Twelve months after nematode

**Table 1:** *Final population and rate of build-up of Meloidogyne incognita infecting twelve date-palm cultivars under screenhouse conditions.*

| Cultivars | No. of | | | Total final nematode population | Rate of build-up (pf/pi)** |
|---|---|---|---|---|---|
| | $J_2$s in soil /pot | $J_2$s in roots/plant | Egg-masses/plant | | |
| Amhat | 22560 | 100 | 15 | 22675 | 11.34 |
| Barhi* | 2240 | 408 | 34 | 2662 | 1.34 |
| El-Khalas* | 16984 | 117 | 37 | 17138 | 8.57 |
| Hayani | 560 | 93 | 19 | 672 | 0.34 |
| Samani | 5792 | 243 | 10 | 6045 | 3.02 |
| Sewi(Saidi) Wahat | 2560 | 210 | 20 | 2790 | 1.40 |
| Sewi (Saidi)Wadi | 2136 | 320 | 11 | 2467 | 1.23 |
| Sokkaria* | 2178 | 427 | 10 | 2615 | 1.31 |
| Maktomi* | 960 | 433 | 7 | 1400 | 0.70 |
| Nabtat Ali | 5760 | 127 | 13 | 5900 | 2.95 |
| Orabi | 3544 | 1260 | 15 | 4804 | 1.78 |
| Zaghlool | 7529 | 480 | 39 | 8048 | 4.02 |

*-Values are averages of 10 replicates.*Cultivars of Saudi Arabian origin. -** Rate of build= Pf= Final population/Pi= Initial population.*

**Table 2:** *Relative susceptibility of twelve date-palm cultivars infected by Meloidogyne incognita under screenhouse conditions.*

| Cultivars | No. of galls | Gall index | Gall size | Gall area | Damage index (DI)* | Host susceptibility/resistance |
|---|---|---|---|---|---|---|
| Amhat | 30 | 5 | 7 | 7 | 6.3 | Susceptible (S) |
| Barhi* | 53 | 7 | 7 | 7 | 7.0 | Susceptible(S) |
| El-Khalas* | 55 | 7 | 7 | 7 | 7.0 | Susceptible(S) |
| Hayani | 27 | 5 | 7 | 7 | 6.3 | Susceptible(S) |
| Samani | 17 | 4 | 5 | 5 | 4.7 | Moderately resistant(MR) |
| Sewi Wahat | 37 | 6 | 7 | 7 | 6.7 | Susceptible(S) |
| Sewi Wadi | 20 | 4 | 7 | 5 | 5.3 | Susceptible(S) |
| Sokkaria* | 17 | 4 | 5 | 5 | 4.7 | Moderately resistant(MR) |
| Maktomi* | 12 | 4 | 5 | 5 | 4.7 | Moderately resistant(MR) |
| Nabtat Ali | 33 | 6 | 7 | 7 | 6.7 | Susceptible (S) |
| Orabi | 22 | 5 | 7 | 7 | 6.3 | Susceptible(S) |
| Zaghloul | 51 | 7 | 7 | 7 | 7.0 | Susceptible(S) |

*-Values are averages of 10 replicates (plant roots). * Cultivars of Saudi Arabian origin.*Damage index (DI) scale according to Sharma et al. (1994) which is an average of gall index, gall size and gall area.*

inoculation, plants were uprooted and cleaned by tap water. Data on the plant growth as fresh weights of shoots and roots and length of shoots were measured. The nematode populations in soil and roots as indicated by number of galls and egg-masses on roots and number of juveniles ($J_2$s) in soil were recorded. Nematodes in soil were extracted by the sieving and decanting technique (Barker, 1985). Nematode second stage juveniles ($J_2$s) in egg masses on part of roots of each cultivar were extracted by incubation method as described by Young (1954). Rate of nematode build up for each cultivar was calculated by dividing nematode final population (Pf) in soil and roots on initial nematode population (Pi). Damage index (DI) was calculated as an average of gall index, gall size and gall area. Plant vigor was calculated as an average of the measured plant growth criteria for each cultivar. Plant vigor (%) was calculated for each cultivar for each variety by dividing average plant growth criteria (plant vigor) on the highest value of plant vigor of a given one multiplied by 100.

## Results and Discussion

Table 1 illustrated final population and rate of build up of the root -knot nematode, *M. incognita* on different date palm cultivars. It was noticed that date palm cv. Amhat had the highest nematode rate of build up followed by cvs. El-Khalas, Zaghlool and Samani. The host susceptibility of twelve date palm cultivars to root- knot nematode, *M. incognita* was shown in Table 2. The tested cultivars were classified according to scale suggested by Sharma et al. (1994) based on damage index (DI) scale into nine cultivars as susceptible (S) and three as moderately resistant (MR) to root-knot nematode. Table 3 showed characteristics of the various cultivars in the form of plant vigor which was calculated as an average of the measured plant growth criteria for each cultivar. Based on the percentage plant vigor potentials, date palm cultivars were classified into seven cultivars as less affected (LA) and five cultivars as moderately affected (MA) by root- knot nematode in the form of host reaction. Based on the combination between degree of host susceptibility/resistance and host reaction mentioned before, the tested date palm cultivars were categorized into four cultivars (Barhi, Hayani, Sewi Wahat and Sewi Wadi), as susceptible (S), two cultivars as highly resistant (HR) (Samani and Sokkaria), one cultivar as resistant (R) (Maktomi) and five cultivars as tolerant (T) (Amhat, El-Khalas, Nabtat Ali, Orabi and Zaghloul) to *M. incognita* infection (Table 3).

In this investigation, the tested date palm cultivars varied in their susceptibility/resistance against root-knot nematode, *M. incognita*. These cultivars were categorized according to damage index (DI) suggested by Sharma *et al.* (1994) and the percentage of plant vigor potentials. It is interesting to note that, date palm cv. Amhat was rated as S to root -knot nematode, depending on the scale of DI, but it was rated as LE according to the percentage plant vigor and finally was categorized as T to this nematode as indicated in host category which agreed with Carpenter (1964) who reported that Amhat was categorized tolerant against

**Table 3:** *Plant growth criteria, host reaction and host category of twelve date-palm cultivars infected with Meloidogyne incognita under screenhouse conditions.*

| Cultivars | Fresh wright | | | Plant vigor* | % plant vigor potential** | Host reaction*** | Host category**** |
|---|---|---|---|---|---|---|---|
| | Plant length (cm) | Shoots (g) | Roots (g) | | | | |
| Amhat | 53.5 | 29.5 | 13.7 | 32.2 | 90.4 | Less affected(LA) | Tolerant(T) |
| Barhi* | 32.7 | 23.3 | 14.5 | 23.5 | 66.0 | Moderately affected(MA) | Susceptible(S) |
| El-Khalas* | 49.5 | 23.3 | 15.5 | 29.4 | 82.6 | Less affected(LA) | Tolerant(T) |
| Hayani | 32.8 | 24.1 | 14.8 | 23.9 | 67.1 | Moderately affected | Susceptible(S) |
| Samani | 41.2 | 27.7 | 19.8 | 29.6 | 83.1 | Less affected(LA) | Highly resistant(HR) |
| Sewi Wahat | 45.2 | 22.9 | 9.6 | 25,9 | 72.8 | Moderately affected(MA) | Susceptible(S) |
| Sewi Wadi | 44.3 | 25.8 | 10.4 | 26.8 | 75.3 | Moderately affected(MA) | Susceptible(S) |
| Sokkaria* | 45.2 | 26.7 | 22.8 | 31.6 | 88.8 | Less affected(LA) | Highly resistant(HR) |
| Maktomi* | 38.3 | 25.4 | 11.5 | 25.1 | 70.5 | Moderately affected(MA) | Resistant(R) |
| Nabtat Ali | 45.0 | 35.8 | 20.5 | 33.8 | 95 | Less affected(LA) | Tolerant(T) |
| Orabi | 33.9 | 31.3 | 15.3 | 29.3 | 82 | Less affected(LA) | Tolerant(T) |
| Zaghlool | 47.0 | 38.8 | 21.1 | 35.6 | 100 | Less affected(LA) | Tolerant(T) |

*-Values are averages of 10 replicates (plant roots). * Cultivars of Saudi Arabian origin. -*Plant vigor was calculated as an average of plant growth criteria for each cultivar. -**Plant vigor potential % was calculated by dividing average of plant growth criteria (plant vigor) of each variety on the highest value of plant vigor of a given one multiplied by 100. -***Host reaction: 0-50% plant vigor = Highly affected (HA), 51-80% = Moderately affected (MA) and 81-100% = Less affected (LA). -****Host category: HS or S+HA=HS; HS or S +MA=S; HS or S+LA=T; HR or MR or R+HA=MR; HR or MR or R+MA=R; HR or MR or R+LA=HR; HS=Highly susceptible, S=Susceptible, HR=Highly resistant, MR=Moderately resistant, R=Resistant, T=Tolerant.*

*M. javanica* and Hayani was susceptible to the same nematode infection which agreed with the present study. Previous study conducted by Eissa *et al.* (1998a) categorized date palm cvs. Zaghlool (HS), Hayani (MS), Amhat (MR), and Orabi, Sewi (Saidi), Samani, and Sokkaria (HR) to infection by *M. incognita*. Eissa *et al.* (1998b) reported that the roots of susceptible cv, Zaghlool infected with *M. incognita* promoted giant cells formation (Figure 1), while the infected roots of resistant date-palm cv. Samani reacted inversely by forming a necrotic spot around nematodes (Figure 2) which was similar with the present results, Yasir *et al.* (2018) found that the highest population density of root-knot nematode was related to certain cultivars of date-palm and sandy soil. It could be concluded that *Meloidogyne* can survive well in sandy or loamy soil rather than clay soil linking to large interspaces, aeration and artificial irrigation help to provide suitable habitat for the activity of such nematode in sandy soil under suitable temperature. as reported by Youssef and Lshein (2013). The roots of resistant cultivars may be linked to releasing phenols, enzymes, inhibitory hormones and/or toxins against nematodes preventing their development and build up which conformed conclusions by Eissa *et al.* (1998a, b).

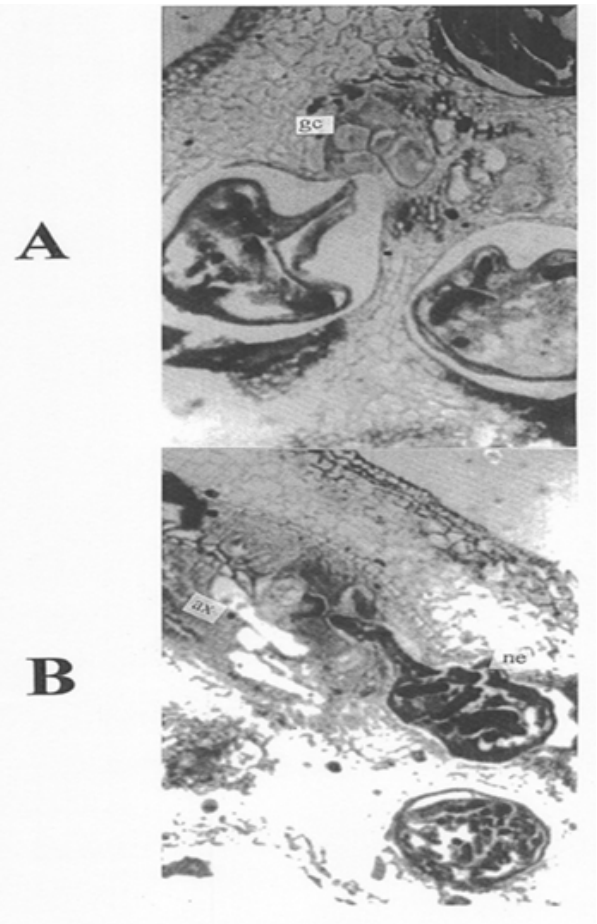


**Figure 1:** *A: Females and giant cells, B: Females and abnormal xylem in susceptible cultivar (After* Eissa *et al.*, 1998a*).*

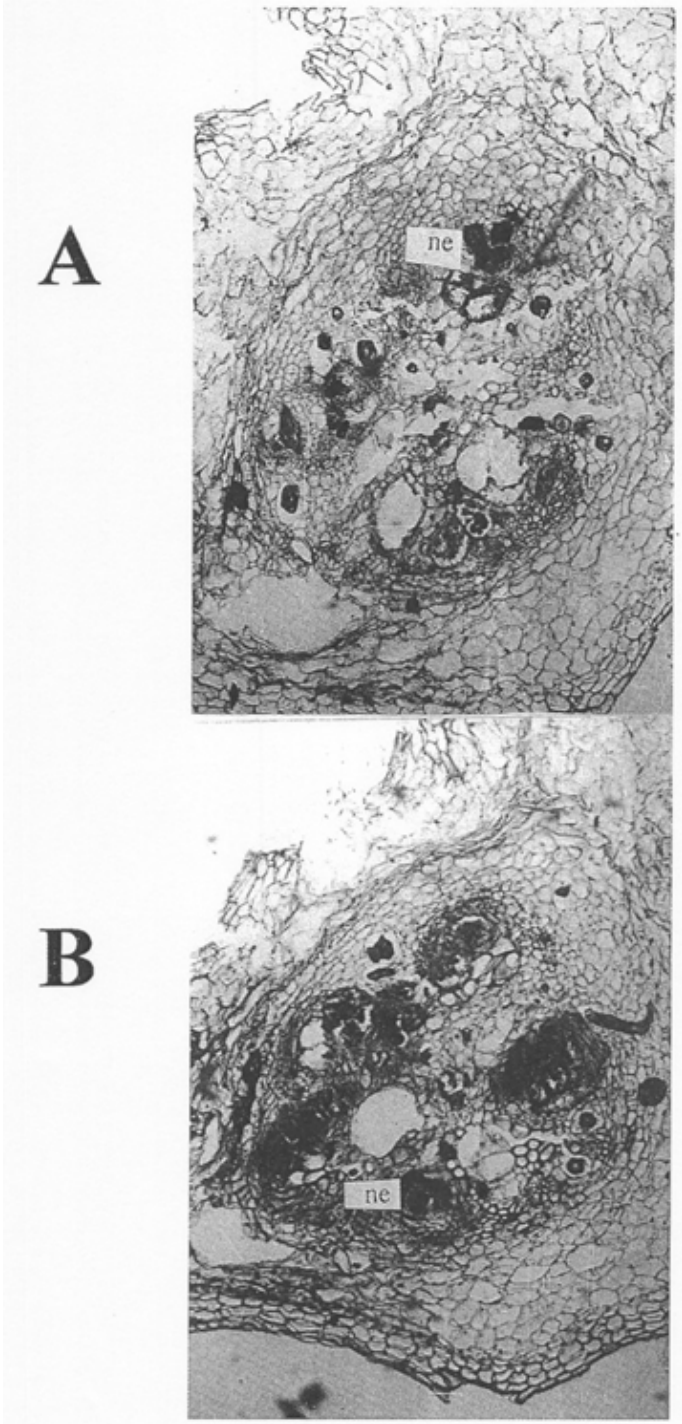


**Figure 2:** *A, B: Necrotic tissues around nematode body in resistant cultivar (After* Eissa *et al*., 1998a*).*

## Conclusions

The present research indicated that, the tested date palm cultivars varied in their susceptibility/resistance against root-knot nematode, *M. incognita*. The tested cultivars were categorized into four cultivars as susceptible, two as highly resistant, one as resistant and five as tolerant to this nematode.

## Acknowledgement

Not applicable.

## Novelty Statement

Some date palm cultivars were found to be highly resistant or resistant cultivars against root- knot nematode, *M. incognita* determined in this study. These cultivars can be utilized in breeding program, so as to introduce them in Integrated Pest Management (IPM) Programme.

## Author's Contribution

MMAY and WMAEN were equal in the design and execution of this experiment. MMAY suggested the idea, worked out and wrote the manuscript**.** MFME collected the literature necessary for study and reviewed the manuscript. All authors read and approved the final manuscript.

*Generative AI and AI assisted technology statement*
The authors declare that no generative AI and no AI assisted technology was used in the creation of this manuscript.

*Conflict of interest*
The authors have declared no conflict of interest.

## References

Anonymous, 2016. Study of the indicators agricultural statistics. Ministry of agriculture and land reclamation. Vol. 2. Egypt: Economic Affairs Sector, Central Administration for Agricultural Economic.

Barker, T.R., 1985. Nematode extraction and bioassays. Pp. 19-35. In: An Advanced Treatise on *Meloidogyne* Vol. II. Barker, T.R., Carter, C.C. and Sasser, J.N. (Eds.). North Carolina State University.

Carpenter, J.B. 1964. Root-knot nematode damage to date-palm in relation to germination and stage of development. Ann. Reptr, 44: 10-14.

Chedekal, A.N., 2013. The effect of *Meloidogyne incognita* on growth of date palm seedlings. Int. J. Res. St. Biosci., 1(2): 11-13.

Eissa, M.F., El-Sherief, M.A., Abdel Gawad, M.M., Ismail, A.E. and El-Nagdi, Wafaa M.A., 1998a. Histological response of susceptible and

resistant date palm cultivars to *Meloidogyne incognita* infection. Pak. J. Nematol., 16: 103-109.

Eissa, M.F., El-Sherief, M.A., Abd- Elgawad, M.M., Youssef, M.M.A., Ismail, A.E. and El-Nagdi, Wafaa, M.A., 1998b. Susceptibility of some date-palm cultivars to the root knot nematode, *Meloidogyne incognita*. In: pp. 282–290. Proc. First Intern. Conf. Date Palm, Fac. of Agric. Sci., United Arab Emirates Univ., Al-Ain, March 8-10.

El-Nagdi, Wafaa M.A., Hafez, O.M. and Saleh, M.A., 2015a. Impact of a biocide abamectin for controlling of plant parasitic nematodes, productivity and fruit quality of some date palm cultivars. Sci. Agric., 11(1): 20-25. https://doi.org/10.15192/PSCP.SA.2015.11.1.2025

El-Nagdi, Wafaa M.A., Youssef, M.M.A. and Eissa, M.F.M., 2015b. Host suitability of date palm seedlings to root knot nematode, *Meloidogyne incognita* as influenced by stress of plant age. Pak. J. Nematol., 33(2): 191-193.

Griffith, R. and Koshy, P.K., 1990. Nematode parasites of coconut and other palms. pp. 363-382. In: Plant parasitic nematodes in subtropical and tropical agriculture (eds. Luc, M., Sikora, R.A. and Bridge, J.), CAB International. Institute of Parasitology, Wallingford, Oxon, OX10 SDE, UK, 629pp.

Jain, P.K., 1991. Nematode pests of vegetable crops, nematode pests of crops (Edited by Bhatti, D.S. and Walia, R.K.), Cosmo Publishers and Distributors, New Delhi, India, pp. 77-97.

Jenkins,W.R., 1964. A rapid centrifugal floatation technique for separating nematodes fro-soil. Plant Dis. Reptr., 18: 692.

Mani, A., Handoo, Z.A. and Livingston, S., 2005. Plant-parasitic nematodes associated with date palm trees (*Phoenix dactylifera*) in Sultanate of Oman. Nematropica, 35: 135-144.

Sharma, S.B., Mohiuddin, M., Jain, K.C. and Remanandan, P., 1994. Reaction of pigeonpea cultivars and germplasm accessions to the root knot nematode, *Meloidogyne javanica*. J. Nematol., 26(4): 644-652.

Yasir, M.S., Sajid, A.K., Javid, N. and Ghani, M., 2018. Incidence of root-knot nematodes on different date-palm (*Phoenix dactylifera* L.) cultivars. Pak. J. Nematol., 36(1): 27-32. https://doi.org/10.18681/pjn.v36.i01.p27-32

Young, T.W., 1954. An incubation method for collecting migratory endoparasitic nematodes. Plant Dis. Reptr., 38(11): 794-795.

Youssef, M.M.A., 2014. Nematodes associated with date palm and their control measures. Arch. Phytopathol. Plant Prot., 47(4): 425-428. https://doi.org/10.1080/03235408.2013.811031

Youssef, M.M.A. and Eissa, M.F.M. 1994. Population dynamics of certain nematodes associated with date palm in Egypt. Afro-Asian J. Nematol., 4(1): 68–72.

Youssef, M.M.A. and Lashein, A.M.S., 2013. Nematodes associated with some date palm cultivars in relation to soil type. Arch. Phytopathol. Plant Prot., 46: 273-277. https://doi.org/10.1080/03235408.2012.739018