

Incidence of root-knot nematodes on different date-palm (*Phoenix dactylifera* L.) cultivars

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ABSTRACT

A survey was conducted in different randomly selected localities of the date-palm (*Phoenix dactylifera* L.) growing areas of district Kharan for the determination of incidence, prevalence, severity and identification of major species of root-knot nematodes. During the survey, a total of 160 root samples were collected from different localities and cultivars of date-palm. The maximum prevalence was recorded from locality Nouroz Kalat (100%) and the minimum prevalence recorded was (20%) from Totazai and Raskoh. The incidence, as well as severity varied in all the cultivars. The maximum severity and incidence of root-knot nematode was recorded from date-palm cultivar Rabi (90%) followed by Alini (80%) with galling index of 4 and the minimum was recorded in cultivar Kaluth (20%) with a galling index of 1. The root samples collected from date-palm cultivars showed the occurrence of two species of root-knot nematode *Meloidogyne incognita* and *Meloidogyne javanica* which were found to be associated with date-palm in district Kharan. In the present study date-palm (*Phoenix dactylifera* L.) is reported as a new host of *Meloidogyne javanica* in Pakistan.

Keywords: *Meloidogyne*, date-palm, incidence, prevalence, severity.

Date-palm is a member of family Palmaceae and is extensively grown for its delicious fruits and other useful byproducts which include fruit for fodder and food, fuelwood, fiber for ropes, leaves for basketry and covering furniture wood (Lombard & Tengberg, 2001). It is considered as the king of Oasis and tree of life due to its attractive beauty. It is commonly cultivated in numerous tropical and subtropical regions of the world especially in America, Tropical Asia, Africa, Middle East and Arabian Peninsula (Zhai *et al.*, 2013). The fruit of date-palm contains very wide range of reasonable quantities of carbohydrates, fiber contents and salts (including minerals) and traces of vitamins (Al-Shahib & Marshall, 2003). Pakistan ranks fifth among the major date producers with an overall production of 566.494 thousand tonnes from an area of 90.7 thousand hectares and an export of 93.1 thousand tonnes (Anonymous, 2009). Countless insect, pests and fungal diseases

attack date-palm causing considerable losses in yield wherever it is grown. Significant yield losses in date-palm are recorded due to attack of fungus, bacteria, virus and nematodes. Among such limiting factors which cause these losses one of them is nematodes.

Among the plant parasitic nematodes, the *Meloidogyne* sp., is one of the serious date-palm nematode pests. *Meloidogyne* sp. is the most commonly wide-spread nematodes all-over the world (Sasser, 1989). The seedlings of date-palm are severely damaged by the infection of *M. javanica* (Carpenter, 1964). The root-knot nematode is pathogenic to seedlings of some date-palm cultivars (Eissa *et al.*, 1998). About 90% of the date-palm seedlings are killed by root-knot nematodes in heavily infested soil (Griffith & Koshy, 1990). Date-palm cultivars Deglet-Noor and Amhat are tolerant while Braim, Hayany and Honey are susceptible to the

root-knot nematode infection (Carpenter, 1964). Date-palm cultivar Deglet Noor is least susceptible cultivar to *Meloidogyne javanica* in Algeria (Lamberti & Greco, 1977). So far very little has been studied about the yield losses of date-palm due to nematodes. There are numerous unidentified factors which affects the productivity and growth of date-palm. There is a possibility that the unhealthy growth of date-palms, generally attribute to attack of nematodes (Zaid *et al.*, 2002). Date-palm is from very few plants which are popular in arid regions and provides important resources for the populations in addition to nomadic tribes.

Materials and Methods

Survey

A survey was conducted during 2015-2016 in the date-palm growing areas of district Kharan, Balochistan for the determination of incidence, prevalence and severity of root-knot nematodes. For the determination of prevalence, from each locality, five orchards of date-palm were randomly selected and from each date-palm orchard, 4 plants were selected. The localities were Union Council Jamak, Union Council Juda Kalat, Union Council Miskan Kalat, Union Council Sarawan, Union Council Nouroz Kalat, Union Council Tohmulk, Union Council Totazai and Union Council Raskoh. And for the determination of incidence and severity, 20 roots sample were collected from each cultivars of date-palm. The date-palm cultivars were Alini, Rabi, Kaluth, Shakari, Qiyas Kunk, Muzati, Begum Jangi and Ushkich. Root samples were collected from the rhizosphere of date-palm plants by digging a hole near the base of the roots 5-50 cm deep depending on tree size. Approximately 20 g roots sample were collected from each plant. Root samples were placed in plastic bags sealed tightly and labeled with the details of host, locality and date of collection.

Processing of nematodes

Root samples were transported to Nematology laboratory of Plant Pathology Department, University of Agriculture, Faisalabad and were observed for root-knot nematode infection (presence or absence of galls). The incidence of

infestation of individual date-palm cultivar was recorded by:

Incidence % =

$$\frac{\text{Number of samples with RKN}}{\text{Total number of samples}} \times 100$$

The prevalence of root-knot nematodes in each locality was calculated as followed.

Prevalence % =

$$\frac{\text{Number of fields with RKN}}{\text{Total number of fields surveyed}} \times 100$$

For the determination of severity of root-knot nematodes, the roots of individual plants were rated for galling and egg-mass on 0-5 scale; where 0 = no galls or egg-masses, 1 = 1-2 galls or egg-masses; 2 = 3-10 galls or egg-masses; 3 = 11-30 galls or egg-masses; 4 = 31-100 galls or egg-masses, and 5 = > 100 galls or egg-masses (Quesenberry *et al.*, 1989; Anwar *et al.*, 2007).

Identification of *Meloidogyne* species through perineal patterns

Perineal patterns of mature females were prepared for identification of different root-knot species (Jepson, 1987). The females were detached from the root tissue by teasing the root tissue apart. The extracted females were placed in a drop of 45% lactic acid. The head region of nematode was excised with a sharp needle. All the body tissue was gently removed from the posterior section with a dissecting needle. Then, the cuticle was trimmed into a square with the perineal pattern in the center and transferred to a glass slide in a small drop of glycerin and covered with a coverslip. At least 10 perineal patterns were prepared for the identification of nematode.

Results

Prevalence of root-knot nematodes in different localities of district Kharan

The prevalence of root-knot nematode was recorded from eight union councils of district

Kharan, Balochistan. The maximum prevalence was recorded from union council Nouroz Kalat (100%) followed by Tohmulk (80%) and Jamak (60%) and (40%) from union council Juda Kalat, Miskan Kalat and Sarawan, while the minimum prevalence recorded was (20%) from union council Totazai and Raskoh. The prevalence of root-knot nematode in different localities is given in Table 1.

Incidence of root-knot nematode on different date-palm cultivar

The incidence of root-knot nematodes was recorded from eight cultivars of date-palm. The incidence varied in all the cultivars and ranged from 90% to 20%. The maximum incidence root-knot nematode was found in date-palm cultivar Rabi (90%) followed by Alini (80%), Begum Jangi (65%), Shakari (45%), Ushkich (40%) and Muzati (35%). The lowest incidence was recorded in cultivar Kaluth (20%) followed by Qiyas Kunk (25%). The individual incidences for each cultivar are given in Table 2.

Severity and occurrence of root-knot nematode on different date-palm cultivars

The maximum severity measured in terms of galling index was found (4) on date-palm cultivar Alini and Rabi while the minimum severity was observed in cultivar Kaluth and Qiyas Kunk (1). The individual galling index (Severity) recorded different date-palm cultivars are given in Table 3.

The root samples collected from date-palm cultivars showed the occurrence of two species of root-knot nematode *Meloidogyne incognita* and *Meloidogyne javanica* which were found to be associated with date-palm in district Kharan. *Meloidogyne javanica* was found in all the date-palm cultivars while *Meloidogyne incognita* was found only in three cultivars. The percentage of *Meloidogyne javanica* was highest in date-palm plants (72.72%) followed by *Meloidogyne incognita* (27.27%). The occurrence of different species associated with date-palm cultivars are given in Table 3.

Table 1. Prevalence of root-knot nematodes in different localities of district Kharan.

Sr.No	Localities	No. of Fields Visited	No. of Fields infested with RKN	Prevalence % of RKN
1	Union Council Jamak	05	03	60%
2	Union Council Juda Kalat	05	02	40%
3	Union Council Miskan Kalat	05	02	40%
4	Union Council Sarawan	05	02	40%
5	Union Council Nouroz Kalat	05	05	100%
6	Union Council Tohmulk	05	04	80%
7	Union Council Totazai	05	01	20%
8	Union Council Raskoh	05	01	20%

Discussion

The findings of this study have clearly demonstrated that *Meloidogyne* spp. is widely distributed in date-palm growing areas of district Kharan, Balochistan. But the incidence and prevalence were variable among the date-palm cultivars and localities. This difference might be related to soil type (Youssef *et al.*, 2013). The sandy soils generally enhance penetration,

development, and reproduction of RKN (Kinloch & Sprenkel, 1994). The differences in the root-knot incidence from locality to locality and field to field also might be related to soil types as soil variation exists among fields (Starr *et al.*, 1993; Anwar *et al.*, 2007). Typically, crop production area with soil containing a higher percentage of sand has a higher population of *Meloidogyne* spp. as compared to those fields with low sand contents (Lawrence *et al.*, 1997; Robbins

et al., 1989). The minimum prevalence of the pathogen was recorded from union council Totazai and Raskoh which might be due to the clayey soil type (Table 1). The maximum prevalence was recorded from the locality Nouroz Kalat and Tohmulk which was due to sandy loam soil. Same results were observed from the survey of incidence of root-knot nematodes from eight cultivars of date-palm (Table 2). The incidence and severity varied in all the cultivars. The maximum severity and incidence were found in date-palm cultivar Rabi and Alini and the lowest incidence was recorded in cultivar Kaluth which confirms the results of (Youssef & Lashein, 2015; Al-Yahya *et al.*, 2001) they concluded that the population densities of RKN is related to certain cultivars of date-palm and sandy soil.

The variation in the incidence among the different date-palm cultivars might be due to the

susceptibility or resistance characteristics of these cultivars to root-knot infection. Lamberti & Greco (1977) reported that date-palm cultivar Deglet Noor is least susceptible cultivar to *Meloidogyne javanica* in Algeria.

Date-palm cultivars Deglet-Noor and Amhat are tolerant while Braim, Hayany and Honey are susceptible to the root-knot nematode infection and the seedlings of date-palm are severely damaged by the infection of *M. javanica* (Carpenter, 1964). Eissa *et al.*, (1998) reported that the roots of susceptible *Phoenix dactylifera* cultivar Zaghoor infected with *Meloidogyne incognita* favored giant cells formation, while the infected root of resistant date-palm cultivars, Samani and Deglet Noor, reacted inversely by creating a necrotic spot. Date-palm possibly acts as a reservoir host for *Meloidogyne* species (Netscher & Luc, 1974).

Table 2. Incidence of root-knot nematodes on different date-palm cultivars.

S. No.	Date-palm cultivars	Total no. of root samples	No. of samples infected with RKN	Incidence % of RKN
1	Alini	20	16	80%
2	Rabi	20	18	90%
3	Kaluth	20	04	20%
4	Shakari	20	09	45%
5	Qiyas Kunk	20	05	25%
6	Muzati	20	07	35%
7	Begum Jangi	20	13	65%
8	Ushkich	20	08	40%

Table 3. Severity and occurrence of root-knot nematodes on different date palm cultivars.

S. No.	Date-palm cultivar	<i>Meloidogyne incognita</i>	<i>Meloidogyne javanica</i>	Gall index
1.	Alini	+	+	4
2.	Rabi	+	+	4
3.	Kaluth	-	+	1
4.	Shakari	+	+	3
5.	Qiyas Kunk	-	+	1
6.	Muzati	-	+	2
7.	Begum Jangi	-	+	2
8.	Ushkich	-	+	2

(RKN species, + = present; - = absent)

The root samples collected from date-palm cultivars showed the occurrence of two species of root-knot nematode *Meloidogyne incognita* and *Meloidogyne javanica* which were found to be associated with date-palm in district Kharan (Table 3). *Meloidogyne javanica* was found in all the date-palm cultivars while *Meloidogyne incognita* was found only in three cultivars.

Conclusion

In conclusion of the survey of root-knot nematodes in 8 localities of district Kharan revealed that nematodes are widespread on date-palm in this district. The maximum incidence and severity of root-knot nematodes were recorded from date-palm cultivars Alini and Rabi and *M. incognita* and *M. javanica* were found in association with date-palm in district Kharan. In this study date-palm (*Phoenix dactylifera* L.) is reported as a new host of *Meloidogyne javanica* in Pakistan.

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