VOLUME 9 ISSUE 1 2023

ISSN 2454 – 3055

INTERNATIONAL JOURNAL OF ZOOLOGICAL INVESTIGATIONS

Forum for Biological and Environmental Sciences

Published by Saran Publications, India

International Journal of Zoological Investigations Vol. 9, No. 1, 392-397 (2023)

International Journal of Zoological Investigations

Contents available at Journals Home Page: www.ijzi.net

Editor-in-Chief: Prof. Ajai Kumar Srivastav

Published by: Saran Publications, Gorakhpur, India

ISSN: 2454-3055

Studies on Pathogenicity of Nematode Infecting Roses

Arya Sunita and Sachan Riya*

Department of Zoology, Dayanand Girls P.G. College, Kanpur (U.P.), India

**Corresponding Author*

Received: 30th December, 2022; **Accepted:** 31st January, 2023; **Published online:** 25th February, 2023

https://doi.org/10.33745/ijzi.2023.v09i01.044

Abstract: Roses are the best-known ornamental plants grown for flowers and landscaping. Rose flowers are symbols of love and beauty. There are different types of nematodes in the soil. They feed on the rose root known as root-knot nematode (genus *Meloidogyne*). The root knot nematode damage results in poor growth, decline flower quality and yield. The infestation of young plants may be lethal while infection in mature plants causes decreased yield.The experiment was performed at D.G. College Kanpur, India in CRD with three replications. 300 soil samples were collected from the rose garden of D.G. College (S1), C.S.A. University of Agriculture and Technology, Kanpur (S2), and farmer field of Salempur, Rooma (S3). It was found that nematode *Meloidogyne incognita* is the most damaging and occurred in 3220, 3201 and 915 in farmer fields, C.S.A. University and D.G. College respectively. The yield was found with a reduced value of 25.75, 40.48 and 36.14% in the root and shoot length, fresh weight of the whole plant as well as the number of leaves in infected plants studied. Gall and egg masses were found on the roots of all tested cultivars. 4 galls and 1 number of egg masses were found in the roots of *Rosa hybrida*. The root gall index and egg-mass index were 3.0 in *Rosa indica* and 2.0 in *Rosa chinensis* and *Rosa hybrida.*

Keywords: Roses, Root-knot nematode, Intensity, Pathogenicity, Rootgall Index, Egg masses index

Citation: Arya Sunita and Sachan Riya: Studies on pathogenicity of nematode infecting roses. Intern. J. Zool. Invest. 9(1): 392-397, 2023.

https://doi.org/10.33745/ijzi.2023.v09i01.044

Introduction

Roses are important ornamental flowers used for commercial perfumery and as a cut flower crop. It is grown for gardens, landscapes, hedging and utilitarian purposes. Rose is called the queen of flowers as well as the king of flowers. This indicates that both kingliness and queenlines are inherent qualities; no other flowers transcend them for their beauty, fragrance, and colour (Ayci *et al.,* 2005; Arya, 2018a). Flowers bloom from late spring until the first frost in the autumn.

Dried rose petals are also used as rose tea as well as applied topically to soothe the skin. It contains polyphenols which have antioxidant properties and protects the body from free radicals and cell damage. It also contains vitamins and minerals, which support the immune system,

and digestion and acts as a mood booster (Bose and Yadav, 1989).Roses are highly susceptible to several diseases, insect pests and nematodes due to which it defoliate and flowering decreased. Several factors can cause these problems, but one is not visible above the ground. Nematodes are microscopic, unsegmented worms that feed on roots of plants (Arya, 2018b; Maleita *et al.,* 2022).There are so many types of nematodes found in earth, some of them are beneficial, but the root-knot nematodes are harmful for the plants (Sasser and Frackman, 1987; Fox, 2001).

Nematodes belong to phylum Nematoda, which are multiracial and pseudocoelomate (Verma, 2017; Verma and Prakash, 2020). They can embrace a diverse and extreme stage of cold to hot areas of land. According to feeding behaviour and lifestyles, plant parasitic nematodes are grouped into ecto- and endoparasite (Escobar *et al.,* 2015). Root-knot nematodes are endoparasites (Singh and Chahar, 2021).They form galls and knots in the roots of the infected plants. Adult females lay approximately 1000 eggs in a gelatinous substance on the surface of the root of rose plants. After some time, eggs are inserted in the gall or plant tissue. Beginning first stage juvenile (J1), after the embryogenesis moults within the egg to the second infective juvenile stage (J2). The hatching stage of *Meloidogyne incognita* commonly depends on suitable temperature and moisture conditions because of their wide host nature and no stimulus from the host is needed (Curtis *et al.,*2009). The second juvenile stage (J2) enters the root of the host plant cell wall with the use of a stylet. The stylet is also helpful for secretion from the oesophagus and taking several nutrients. Then the Root-knot nematode passes through the third molts, the third stage of juvenile (J3), the fourth stage (J4) and forms an adult. After some time males are developed and come out of the host roots of the rose plant and females appear as pear-shaped and liberate eggs on the surface of the root (Nour *et al.,* 2015).The infection in mature plants causes a decrease in yield. Infection in the young plants may be lethal (Anamika and Sobita, 2012; Mukhtar *et al.,* 2014). The whole life cycle of Root-knot nematode is completed in 25-27 days. The maximum number of Root-knot nematodes is especially found in the root zoon area from 5 to 25 cm in depth (Kumar *et al*., 2020). In this study we have investigated the phytogenicity of the nematode *Meloidogyne incognita* infecting three species of roses.

Materials and Methods

300 soil samples were randomly collected from the rhizosphere of roses grown in different localities of Kanpur from July to October. Soil samples were collected from D.G. College, Kanpur (site 1-S1); C.S.A. University of Agriculture and Technology, Kanpur (site 2-S2); and farmer's field of Salempur village, Rooma (site 3-S3). Samples of soil were taken by digging of the soil samples of about 500 g each and were kept in plastic bags. Soil samples were thoroughly mixed, and 100g of soil was used to extract nematodes according to sieving and modified Baermann pan technique (Goodey, 1957). After thorough rubbing, each soil sample was soaked in tap water for 25 min, and then the mixture was rubbed by hand. Direct sieving through 60 and 400-mesh sieve was used. The resulting suspension was transferred on a soft tissue paper fitted on a Baermann pan for separating active nematodes from soil particles (Goodey, 1957). After 48 h, the plate containing nematodes was transferred to a glass jar. The identification of nematodes in repeated aliquot parts (1 ml each) in every soil sample was based on the morphological features of the adult and larval farms according to Mai and Lyon (1975). Data were recorded from the slides viewed under 40 × magnification powers for determining the number of nematodes.

Culturing of root-knot nematode:

The root-knot nematode *Meloidogyne incognita* are known for a pure culture from single egg masses that are recognized according to the characteristics of their perineal pattern (Taylor and Sasser,1978; Mukhtar, 2018) and cultivated in the garden of D.G. College. This nematode has been

used to inoculate the next pathogenicity experiment.

Pathogenic study:

During the survey, *M. incognita* was found to be a common and dangerous nematode pest on roses. Three commercial cultivars of roses: 1-*Rosa indica* 2- *Rosa chinensis* 3- *Rosa hybrid* were used for the study. In10 cm diameter plastic bag was filled with 1 kg steamed sterilized clay of loamy soil. Each was separately planted with one rose 45 days old seedlings of rose from each tested cultivar. Twenty-four plastic bags were used in this experiment, eight of each rose cultivar. After seven days seedlings transplanting four bags were inoculated with about 2000 freshly hatched second-stage juvenile nematodes. Other four plastic bags kept free from nematode inoculums and served as control treatment. After fifty days of nematodes inoculation, plants were uprooted, and soil were cleaned from root system. Length and fresh weight of shoot, root, and number of leaves parameters of each replicate were measured. Data of growth parameters were recorded in healthy plants and compared with infected plants. The infected roots were stained with acid fuschin and cleaned in tap water and kept in cold and pure glycerine (Goodey, 1957). From each plastic bag number of root-knot nematodes gall and egg-masses per root system were observed and the number of nematodes were counted under the microscope. Rootgall index (RGI) and egg masses index (EMI) were rated on a scale of 0 to 5 scale where 0= with no galls, or egg masses, 1=1-2 galls or egg masses, 2= 3-10 galls or egg masses and 5= more than 100 galls or egg masses. The index was adopted by the method suggested by (Taylor and Sasser, 1978). Data were subjected to Analysis of variance (ANOVA) (Gomez and Gomez, 1984; Chandel, 2007).

Results and Discussion

The soil sample taken from the rose garden of D.G. College, Horticulture Department of C.S.A. University of Agriculture and Technology, Kanpur, and farmer fields of Salempur, Rooma revealed the presence of so many genera of nematodes. Plant parasitic nematode, *Meloidogyne* seemed to be the most prevailing pest as they were found a maximum of 83 times in farmer fields with an average of about 3201 individuals per 100 g soil sample (Table 1).

The population of the nematode was found (Table 1) thirty times more in *Rosa indica* at S1 and S3. The number of nematodes was found maximum of 1335 in S2 soil sample. The soil sample of S1 represented 155 nematodes and was found twelve times; however in S2 soil sample occurs 45 times with an average of 1685 individuals per 100 g of soil (Table 1). In *Rosa hybrida* variety number of individuals were found 1111 and 23 times at S3 soil sample. The present finding showed close conformity with the finding of Towson and Lear (1982), Ploeg (2007) and Escobar *et al*. (2015). Frequency of Limited Akron was 19.00, 31.33, and 27.66 per cent in S1, S2, and S3, respectively.

Tables 2 and 3 illustrate the impact of *Maleidogyne incognita* infection on the growth of a plant and nematode parameters of three rose - *Rosa indica*, *Rosa chinensis*, and *Rosa hybrida*. It was noticed that whole growths parameters of Rose cultivate were affected by *Meloidogyne incognita* infection to a certain area. It was found that treatment with 2000 second stage juveniles of *Meloidogyne incognita* per pot highly reduced the root and shoot length and fresh weight of the whole plant as well as the number of leaves with the value of 25.75, 40.48 and 36.14 per cent for S1 rose sample (Table 2).

A fresh weight of root was found, a maximum of 17.45 g in an uninfected plant of *Rosa hybrida*. However, root weight was found 12.25 g in infected plants. *Rosa chinensis* root weight of infected plants was found 8.10 g and for uninfected plants 13.33 g. So, the percentage reduction in fresh weight of shoot and root was found 36.86%. The number of leaves revealed a vast range of variation in percentage reduction. It was found 18.44 to 36.14% in *Rosa chinensis* to

Table 1: Frequency of occurrence and intensity of Root-knot nematodes in roses

S. No.	Rose cultivars	Occurrence and intensity of nematodes per 100 g soil in three rose cultivars			Total	Frequency of occurrence %	No. of infested Cultivars
		***Rosa indica* n=100**	***Rosa chinensis* n=100**	***Rosa hybrida* n=100**			
1.	D.G. College (S1)	30 (200)	12 (155)	15 (560)	57 (915)	19.00	3
2.	C.S.A. University Agriculture and Technology, Kanpur (S2)	31 (1335)	45 (1685)	18 (200)	94 (3220)	31.33	3
3.	Farmer Field of Salempur, Rooma (S3)	30 (710)	30 (1380)	23 (1111)	83 (3201)	27.66	3

*Numbers between parentheses are the population densities of nematode genera from 100 g soil sample

Table 2: Plant growth response of three rose cultivars affected by *Meloidogyne incognita* infection

S. No.	Rose Cultivars	Treatment	Plant Growth Response									
			Length (cm)		Total length (cm)	Reduction %	Fresh Weight		Total F.W. (g)	Reduction %	No. of Leaves	Reduction %
			Shoot	Root			Shoot	Root				
1.	*Rosa Indica*	Infected	30.4	33.3	63.7	25.75	4.26	6.25	10.51	40.48	5.3	36.14
		Uninfected	45.5	40.3	85.8		9.33	8.33	17.66		8.3	
2.	*Rosa chinensis*	Infected	32.5	24.0	56.5	19.13	8.25	8.10	16.35	36.28	8.4	18.44
		Uninfected	38.5	31.3	69.8		12.33	13.33	25.66		10.3	
3.	*Rosa hybrida*	Infected	42.3	35.0	77.3	22.15	12.42	12.25	24.67	26.96	8.4	25.66
		Uninfected	58.0	41.3	99.3		16.33	17.45	33.78		11.3	

*EMI value is the mean of three replicates; F.W. =Fresh weight

Table 3: Host suitability of rose cultivars to the infection of *Meloidogyne incognita* underfield condition

S. No.	Rose Cultivars	No. of galls	RGI	No. of egg masses	EMI
1.	*Rosa indica*	15.3	3.0	4.3	2.0
2.	*Rosa chinensis*	9.5	2.0	2.5	1.0
3.	*Rosa hybrida*	4.0	2.0	1.0	1.0

*Each value is the mean of three replicates; RGI = Root Gall index, EMI = Egg mass index

Rosa indica cultivars, respectively. Similar results were found by Linford (1937).

Host acceptability of the tested rose cultivars wise found that none of these cultivars was immune to *Meloidogyne incognito* infection since galls and galls-masses were found on roots of whole tested cultivars which depend upon their degree of resistance (Table 3). It was found that 4 galls and 1 number of egg -masses were formed on the root system of *Rosa hybrida* with values of RGI and EMI average of 2.0 and 1.0, respectively. In other ways, the highest value of RGI and EMI was obtained in rose cultivars infected with nematodes since RGI and EMI values amount to 2.5 and 1.0,

respectively (Taylor and Sasser, 1978; Perry *et al.,* 2009).

There are no resistant rootstocks, and no variety were resistant (Singh *et al.,* 2019). Is was noticed that rose rootstocks vary in host suitability for several species of pathogenic nematodes as well as rootstocks that are regionally assumed and resistant to a broad spectrum of pathogenic nematodes have not been evaluated at present.

Conclusion

On the basis of above findings, it can be concluded that in soil sample collected from rose farms from three localities, the plant parasitic nematode--root-knot nematode (*Meloidogyne incognita)* appeared to be a very prevailing pest. Soil sample recovered from S1, C.S.A. University Agriculture and Technology, Kanpur, and former fields revealed the presence of the highest number of root-knot nematodes in the surveyed localities of rose farms. Regarding the screening study, it was concluded that none of the three rose cultivars was immune to *Meloidogyne incognita* infection, while three cultivars can be classified as resistant hosts whereas *Rosa indica* rose cultivar was rated as a susceptible host and *Rosa hybrida* cultivar as a tolerant one.

References

Anamika S and Sobita S. (2012) Variation in life cycle of *Meloidogyne incognita* in different months in Indian condition. Int J Sci Res. 3(7): 2286-2288.

Arya S. (2018 a) Biometrical studies of floribunda roses. Int J Biol Sci. 9(1): 162-165.

Arya S. (2018b) Insect pest and diseases of roses: Symptoms and control measures. Acad Social Res. 4(1): 312-319.

Ayci F, Aydinli M, Bozdimir OA and Tutas M. (2005) Gas cromatographic investigation of rose concrete absolute and solid residue. Flavour Fragrance J. 20: 481-486.

Bose TK and Yadav LP. (1989) Commercial flowers. Naya Prakash Publication, Calcutta, pp. 872.

Chandel SRS. (2007) A book of agricultural statistics. Achal Publication.

Curtis RH, Robinson AF and Perry RN. (2009) Hatch and host location. In: Root-knot nematodes, (eds.) Perry R. N., Moens M. and Starr J.L., CABI, UK, pp. 139-162.

Escobar C, Barcala M, Cabrera J and Fenoll C. (2015) Overview of root-knot nematodes and giant cells. Adv Botanical Res. 73: 1-32.

Gomez KA and Gomez AA. (1984) Statistical procedures for agricultural research. 2nd ed., John and Sons. Inc. New York, pp. 680.

Goodey JB. (1957) Laboratory methods for work with plant and soil nematodes. Tech Bull No. 2 Min Agric Fish Ed London, pp. 47.

Kumar V, Khan MR and Walla RK. (2020) Crop loss estimation due to plant-parasitic nematodes in major crops in India. Nat Acad Sci Letts. 43: 409-412.

Linford MB. (1937) The feeding of root-knot nematode in root tissue and nutrient solution. Phytopathol. 27: 824-835.

Mai WF and Lyon HH. (1975) Pictorial key to genera of plant-parasitic nematodes. Ithaca, NY: Cornell University Press.

Maleita C, Correia A, Abrantes I and Estevas I. (2022) Susceptibility of crop plants to the root knot nematode *Meloidogyne luci,* a threat to agricultural productivity. Phytopathol Mediterranea 61(1): 169-179.

Mukhtar T. (2018) Management of root knot nematode *Meloidogyne incognita* in tomato with two *Trichoderma* species. Pakistan J Zool. 50(4): 1589-1592.

Mukhtar T, Hussain MA, Kayani MZ and Aslam MN. (2014) Evaluation of resistance to root-knot nematode (*Meloidogyne incognita*) in okra cultivars. Crop Protect. 56: 25-30.

Nour El-Deen AH, Darwesh HY, El-Ghamdi AA and Samra B. (2015) Evaluating the pathogenicity of nematodes infecting Roses at taif governorate, KSA. Res J Pharmaceut Biol Chem Sci. 6(2): 1562-1567.

Perry RN, Moens M and Starr JL. (2009) Root-knot nematodes. Wallingford, UK, CABI.

Ploeg A. (2007) Research Updates: UC Riverside Nematodes in Roses Grown in Rockwool. CORF News 11(1): 15.

Sasser JN and Freckman DW. (1987) Vistas on Nematology, (eds.) Veech J.A. and Dickson D.W., Hyattsville, M.D.

Singh N and Chahar S. (2021) Isolation and morphological identification of root knot nematode from cucumber roots. Int J Botany Stud. 6(5): 547-550.

Singh T, Prajapati A, Muru AK, Chaudhry R and Patel DJ. (2019) Root knot nematode (*Meloidogyne* spp.*)* infecting Pomegranate: A Review. Agricult Rev. 40 (4): 309-312.

Taylor AL and Sasser JN. (1978) Biology, identification, and control of root-knot nematodes (*Meloidogyne* sp). Coop. Publ., Dep Plant Pathol., North Carolina State Univ., and U.S. Agency Int. Dev., Raleigh, NC, pp. 111.

Towson AJ and Lear B. (1982) Control of nematodes in rose plants by hot-water treatment produced by heat-hardening. Nematology 28: 339-353.

Verma AK. (2017) A Handbook of Zoology. Shri Balaji Publications, Muzaffarnagar. 5th edn., p. 648.

Verma AK and Prakash S. (2020) Status of animal phyla in different kingdom systems of biological classification. Int J Biol Innov. 2 (2): 149-154.