Pak. J. Nematol., 30 (1): 21-26, 2012

PLANT PARASITIC NEMATODES ASSOCIATED WITH DIFFERENT MENTHA SPECIES

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Abstract

Thirteen mint species were evaluated for the presence of nematode fauna associated with their rhizospheres. Six plant parasitic and six saprophytic nematode genera were found associated with mint rhizosphere. *Tylenchorhynchus* spp., was found to be associated with highest number of mint varieties that is seven while *Trichodorus* was found attached with only one mint variety. The highest population recorded was of *Helicotylenchus* from six mint varieties. Maximum numbers of plant parasitic nematodes were found associated with pahari podina. No plant parasitic nematode was found associated with field mint (*Mentha arvensis*) which can further be investigated for its role as nematode repellent and can be used either as mulch or inter cropping.

The taxonomic family Lamiaceae is known as the mint family, which includes many other aromatic herbs including basil, rosemary, sage, oregano and catnip. *Mentha* (mint) is a genus of about 25 species around the globe. However, the species within *Mentha* have a subcosmopolitan distribution across Europe, Africa, Asia, Australia and North America. In many Indo-Pak and Aryan language, it is called Pudina. It is aromatic, almost exclusively perennial, rarely annual herbs, while the species that make up the *Mentha* genus are widely distributed and can be found in many environments. Most *Mentha* grow best in wet environments and moist soils. It is supposed to make good companion plants, repelling pest insects and attracting beneficial ones. It is susceptible to whitefly and aphids (Elisabeth, 1992).

It was originally used as a medicinal herb to treat stomachache and chest pains and it is commonly used in the form of tea as a home remedy to help alleviate stomach pain. During the middle ages, powdered mint leaves were used to whiten teeth. Its decoction / tea is a strong diuretic. However, the menthol from mint essential oil (40-90%) is an ingredient of many cosmetics and some perfumes. The menthol and mint essential oil are also much used in medicine as a component of many drugs and are very popular in aromatherapy. A common use is as an antipruritic, especially in insect bite treatments. The strong, sharp flavor and scent of mint is sometimes used as a mild decongestant for illnesses such as

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the common cold (Rose, 1981). It is also used in some shampoo products, in cigarettes as an additive, because it blocks out the bitter taste of tobacco and soothes the throat. Its leaves are used by many campers to repel mosquitoes while the extract from mint leaves have a particular mosquito-killing capability. Mint plants planted near doorways help drive ants away. Its oil is also used as an environmentally-friendly insecticide for its ability to kill some common pests like wasps, hornets, ants and cockroaches (Davidson, 1999).

Green & Skotland (1993) reported number of fungal, viral and nematodes associated with the mint species responsible for causing confusing infections and poor growth performance. The various fungal diseases caused by different pathogens including Anthracnose (*Sphaceloma menthae* Jenk.), Black stem rot (*Phoma strasseri* Moesz), Leaf blight (*Cephalosporium* sp.), *Phoma* leaf spot (*Phoma exigua* Desmaz.), Powdery mildew (*Erysiphe* spp.), *Ramularia* leaf spot (*Ramularia menthicola* Sacc.), Rust (*Puccinia menthae* Pers.), *Septoria* leaf spot (*Septoria menthae* Oudem.), Stem and stolon canker (*Rhizoctonia solani* Kühn), Stolon decay (*Fusarium solani* (Mart.) Sacc.), *Verticillium* wilt (*Verticillium* sp.) and White mold stem rot *Sclerotinia sclerotiorum* (Lib.) de Bary, while the tomato spotted wilt virus caused spotted wilt in mint plantations.

The one factor responsible for primary infection in roots are phytonematodes present in the rhizosphere of soil and playing the role in soil ecology by their mode of actions. Among the plant parasitic nematodes associated and causing damage to the mint plant are; leaf & bud (*Aphelenchoides parietinus* (Bastian) Steiner) lesion (*Pratylenchus neglectans* (Rensch) Filipjev & Schuurmans-Stekhoven, *P. penetrans* (Cobb) Filipjev & Schuurmans-Stekhoven), needle (*Longidorus elongatus* (de Man) Thorne & Swanger), *L. sylphus* Thorne, pin (*Paratylenchus hamatus* Thorne & Allen, *P. microdorus* Andrassy, *P. macrophallus* (de Man) Goodey and root-knot (*Meloidogyne hapla* Chitwood) (Green & Skotland, 1993). The medicinal plants that had associated with phytoparastic nematodes include: *Tylenchorhynchus* sp., *Helicotylenchus* sp., *Hoplolaimus* sp., *Xiphinema* sp., *Longidorus* sp., *Trichodorus* sp., and saprophytic nematodes as *Alaimid* sp., *Cephalobid* sp., *Diplogastrid* sp., *Plectus* sp., which were classified according to their trophic groups as phytonematodes, bacterial feeders, fungivors, omnivores and predators (Khanzada *et al.*, 2007).

The data revealed in this study are the soil rhizosphere analysis of different trophic groups of phytonematodes, associated with the mint varieties planted at Seed Health Laboratory, Plant Genetic Resource Program (PGRP), Institute of Agricultural Biotechnology and Genetic Resources (IABGR), National Agricultural Research Center, Islamabad, Pakistan.

Materials and Methods

In February, 2010, mint varieties (local & exotic) comprising nana maghrabi, lavender mint (*Mentha piperita*), lemon mint (*Mentha piperita citrata*), china mint (*M. arvensis*), menthol (*Mint camphor*), cool mint (*M. spicata*), pahari podina, nana asavi, white mint, catnip (*Nepeta cataria*), common mint (*M. arvensis*), European pennyroyal (*M. pulegium*) and pepper mint (*Mentha piperita*) showing growth reduction, stunting and other foliar burning symptoms, were collected along with soil rhizosphere and plants from Seed Health Lab PGRI for diseases diagnostic services (collaborations of Crop Diseases Research Program, Institute of Plant and Environmental Protection, National Agriculture Research Center, Islamabad, Pakistan) .

The soil samples were processed by using the sieving and decanting techniques (Barker, 1985) while the roots were gently washed and 5g from each sample was incubated in Baermann funnel at room temperature of 25 ± 5^{o} C for 7 days (Southey, 1970). The nematode population recovered from series of sieves (60-300 mesh) and counted in counting dish. Further, for identification the nematodes were fixed according to De Grissee (1969) and the slides were prepared by ring method according to Hooper (1986). Based on morphological characteristics of adult and juvenile forms, the phytonematodes were identified up to generic level (Mai & Lyon, 1975).

Results and Discussion

Phytonematodes population dynamics frequency was calculated quantitatively in different mint varieties (Table 1). The maximum population observed and calculated was in mint varieties comprising pahari podina, followed by pepper mint (*Mentha piperita*), nana maghrabi, lavender mint (*Mentha piperita*), china mint (*Mentha arvensis*) and lemon mint (*M. peprita citrate*), while the minimum population was recorded in mint varieties including cool mint (*Mentha spicata*) alongwith nana asavi, menthol (*Mint camphor*), European pennipyrol (*Mentha pulegium*), catnip (*Nepeta cataria*), common mint (*Mentha arvensis*) and pepper mint (*Mentha piperita*) (Table 1).

The saprophytic nematodes were observed as different trophic groups and presented as such in the results. This information is also providing the soil ecological picture of mint varieties rhizosphere at NARC. The plant parasitic nematodes, *Helicotylenchus* sp., *Hoplolaimus* sp., *Longidorus* sp., and *Tylenchorhynchus* sp., were found in varying numbers. Highest nematode population was recorded in the pepper mint (*Mentha peperita*) species, which followed by pahari podina having nematode species comprising *Helicotylenchus* sp., *Longidorus* sp., *Tylenchorhynchus* sp., and lavender mint (*Mentha piperita*)

Table 1. Population of nematode genera isolated from rhizoshpere of mint varieties.

Nematode trophic group	Mint varieties*												
	a	b	c	d	e	f	g	h	i	j	k	l	m
Phytoparasitic													
Helicotylenchus sp.	-	358	206	-	246	-	807	-	-	264	-	-	783
Hoplolaimus sp.	-	-	-	-	-	231	-	-	-	66	-	-	392
Longidorous sp.	-	-	138	650	-	-	269	112	83	-	-	-	392
Tylenchorhynchus sp.	-	90	-	163	176	231	269	-	83	-	-	-	235
Trichodorous sp.	-	-	-	-	-	-	-	-	164	-	-	-	-
Xiphinema sp.	330	180	-	-	-	77	-	-	-	-	-	280	-
Bacterial													
Araeolamid sp.	-	180	618	-	35	-	-	-	-	-	-	-	-
Cephalobid sp.	1160	718	-	-	281	462	135	225	330	66	93	-	392
Diplogastrid sp.	-	-	-	163	-	-	-	-	-	-	-	-	-
Rhabditid sp.	-	539	138	-	353	231	269	-	413	132	-	116	470
Monohysterid sp.	-	539	275	813	-	154	807	-	495	-	139	56	-
Predators													
Mononchid sp.	1650	90	344	488	-	-	1076	337	83	-	231	693	705
Total population	3135	2871	1716	2112	1089	1386	3630	561	1650	594	462	1155	3366

*Mint varieties: a: Nana maghrabi; b: Lavender mint (*Mentha piperita*); c: Lemon mint (*M. piperita citrata*); d: China mint (*Mentha arvensis*); e: Menthol (*Mint camphor*); f: Cool mint (*Mentha spicata*); g: Pahari podina; h: Nana asavi; i: White mint; j: Catnip (*Nepeta cataria*); k: Common mint (*Mentha arvensis*); l: European pennyroyal (*Mentha pulegium*); m: Pepper mint (*Mentha piperita*). Population is from 100 g soil samples.

with *Helicotylenchus* sp., *Tylenchorhynchus* sp., and *Xiphinema* sp. No parasitic nematodes were found in common mint (*Mentha arvensis*) and this needs further investigation if this is resistant to plant parasitic nematodes (Table 1). Among parasitic nematodes although *Helicotylenchus* sp., occurs in highest numbers, *Tylenchorhynchus* was found attacked by seven mint species to become most frequently occurring nematode species.

Among the trophic groups the bacteriophagous (bacterial feeder) observed and recovered as highest in number were *Cephalobid* sp., followed by *Rhabditid* sp., *Monohysterid* sp., in majority of the mint varieties. Other relevant populations recovered were *Araeolamid* sp., and *Diplogastrid* sp., in some mint varieties. *Mononchid* sp., was also recovered in high numbers in many mint varieties (Table 1).

Some of the mint varieties were resistant to pathogenic nematode i.e., common mint (*Mentha arvensis*), which might be due to their biochemical behavior. The repellent effect of root biochemical enzymatic activities needs to be investigated and this variety can be used as intercropping with other crops to minimize the nematode population in the field crops. Other related effect of repellency was found in menthol (*Menthol camphor*), catnip (*Capta cataria*), European pennyroyal (*Mentha pulegium*) (Table 1).

The presence of *Cephalobid* sp., and *Rhabditid* sp., in abundance showed that the bacterial activity in the soil and mint root association enhances this trophic group population.

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(Received for publication on 21st July, 2011)