

RESEARCH NOTE/NOTA INVESTIGATIVA

MEDICINAL PLANTS' HOSTING ABILITY FOR NEMATODE *MELOIDOGYNE JAVANICA* AND *M. INCOGNITA*

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ABSTRACT

Baida, F.C., D.C. Santiago, L. H. I. Vidal, L. C. Baida, C. T. Stroze. 2011. Medicinal Plants' Hosting Ability for Nematode Suitability *Meloidogyne incognita* and *M. javanica*. Nematropica 41:150-153.

Medicinal plants can be attacked by pests, diseases and nematodes, which can compromise the quality and quantity of their healing properties and their yield. The aim of this study was to analyse the reaction of 15 medicinal plant species to the nematode *Meloidogyne* spp. The seedlings were produced by seed germination or cuttings under greenhouse conditions. A completely random experimental pattern of 15 treatments and 10 replications was chosen for the study. The seedlings were inoculated with approximately 5000 eggs + J₂/plant 20 days after planting. Plant height and fresh and dry leaf weight, were measured 60 days after planting. The roots were collected, thoroughly washed and stained with Philoxine B and then processed to extract the eggs to determine the reproduction factor. For *M. incognita* the results showed that Chamomile was susceptible with RF = 1,64 making it a good host, and the other plants were resistant (RF < 1), and for *M. javanica* that all the plants showed resistance (RF < 1), Myrrh, Rue and Balsam demonstrating immunity (RF = 0).

Key Words: Parasitism, reaction, galls, reproduction factor.

RESUMEN

Baida, F.C., D.C. Santiago, L. H. I. Vidal, L. C. Baida, C. T. Stroze. 2011. Hospedabilidade de plantas medicinais aos nematóides *Meloidogyne incognita* e *M. javanica*. Nematropica 41:151-153.

Plantas medicinais podem ser atacadas por pragas, doenças e fitonematóides, o que pode comprometer qualitativa e quantitativamente as propriedades curativas e a produção. O objetivo do presente trabalho foi avaliar a reação de 15 espécies de plantas medicinais ao nematóide *Meloidogyne* spp. As mudas foram preparadas em casa-de-vegetação e a reprodução foi realizada por sementes ou estacas. Para o estudo foi adotado o delineamento experimental inteiramente casualizado, com 15 tratamentos e 10 repetições. Realizou-se a inoculação nas mudas após 20 dias do transplante, com aproximadamente 5000 ovos + J₂/planta. Decorridos 60 dias da inoculação, foi mensurado a altura das plantas, além do peso fresco e peso seco das folhas. As raízes foram coletadas, lavadas cuidadosamente, e após, foram coloridas com Floxina B, para posterior contagem de ootecas. Posteriormente as raízes foram processadas para extração dos ovos e determinação do fator de reprodução. Nos resultados para o *M. incognita*, a Camomila foi suscetível, com FR = 1,64, considerada uma boa hospedeira, as demais plantas foram resistentes, com FR < 1. Para *M. javanica*, todas as plantas se comportaram como resistentes, com FR < 1, ocorrendo imunidade para Mirra, Arruda e Balsamo, que apresentaram FR = 0.

Palabras clave: Parasitismo, reação, galha, fator de reprodução

Fuck (2006) described medicinal plants as those containing substances which provoke reactions in the human organism that can range from cure to subsidence of the illness. The concentration of the active substance in the plant as well as the preparation method and

administration is determined by the species' therapeutic or toxic action. According to Correa Junior *et al.* (1991), medicinal plants can be attacked by various pests, diseases and nematodes which affect the quality and quantity of the healing properties and also the

Table 1. Comparison of *M. incognita* and *M. javanica* reproduction averages in different medicinal plant roots.

Treatment	<i>M. incognita</i>			<i>M. javanica</i>		
	Eggs + J ₂ ^x /root	Nr of Galls ^y	RF ^z	Eggs + J ₂ ^x /root	Nr of Galls ^y	RF ^z
Tomato (control)	44.870,00 ^{va}	98,20a	8,97a	17.450,00a	87,80a	3,49a
Chamomile	8.181,25b	96,00ab	1,64b	2.340,00b	58,10ab	0,47b
Hyssop	454,00c	49,10bcd	0,05c	1.335,00bc	39,20bc	0,27bc
P. Basil	105,56c	35,60cde	0,02c	930,00bcd	22,70bcde	0,19bcd
G. Basil	1.445,00c	67,50abc	0,29c	710,00bcde	27,40bc	0,14bcde
Dill	125,00c	65,50abc	0,03c	400,00cde	18,00cde	0,07cde
Thyme	650,00c	43,10cd	0,13c	227,78cde	25,33bcd	0,05cde
Fennel	225,00c	9,38efg	0,05c	231,25cde	19,50cde	0,02cde
Guaco	1.190,00c	24,10def	0,15c	124,00cde	39,70bc	0,02cde
Pennyroyal	45,00c	0,70g	0,01c	59,00cde	0,80e	0,01de
Boldo	70,00c	1,90fg	0,01c	40,00de	0,80e	0,01de
Boldinho	65,00c	2,20fg	0,01c	39,00de	0,40e	0,01de
Marjoram	135,56c	0,00g	0,03c	25,00e	0,00e	0,01de
Myrrh	75,00c	3,30fg	0,01c	12,00e	0,40e	0,00e
Rue	135,00c	0,90fg	0,03c	5,00e	2,50de	0,00e
Balsam	200,00c	8,40efg	0,03c	5,00e	0,80e	0,00e
C.V. %	81	43	64	93	56	65

^vData referring to averages on 10 repetitions, without transformation.

^wAverages followed by the same letter in the column do not vary in the 5% Tukey multiple comparison test. The letters represent the transformed data.

^xNumber of eggs + J₂ per root system.

^yTotal number of galls per root system.

^zReproduction Factor (RF=Pf/Pi) (Oostenbrink, 1966).

productivity of the plant.

Plant nematodes are significant in the field of agriculture because of the damage they cause and because of the lack of knowledge about their presence among those working in agriculture (Ferraz; Santos, 1995). Karl, Souza and Mattos (1997) emphasized that medicinal plant cultivation on a commercial basis is faced with a relative scarcity of data on plant health, especially in nematology.

Quénéhervé *et al.* (1995), aiming to verify some plants' host suitability for nematodes in Martinique, proved that *Ageratum conyzoides* (mentrasto) was an excellent *Meloidogyne* host.

Asmus and Andrade (1997) analysed *M. javanica* reproduction in weeds, some having medicinal properties, and found that the nematode reproduced well in two species. Park *et al.* (2004) tested 22 medicinal species' host suitability for *M. hapla* in a Korean greenhouse. Twelve species were susceptible, three immune, five resistant, one was considered tolerant,

and one hypersensitive. Thus, the aim was to analyse 15 species' reaction to the nematodes *M. javanica* and *M. incognita*.

The experiment was conducted in a greenhouse with 15 treatments and 10 replications in an entirely random pattern. 'Santa Cruz' variety tomato plants (*Lycopersicon esculentum* L.) were used as the control plant for the *Meloidogyne* spp. inoculation. Fifteen species of medicinal plant were evaluated for their reaction to *Meloidogyne incognita* and *M. javanica* from February to October 2009. The medicinal plants were taken out of the greenhouse and taken to a phytopathology laboratory to analyse their reaction to *M. incognita* and *M. javanica*.

The *M. incognita* and *M. javanica* populations were increased in greenhouses. At 45 days of greenhouse cultivation, 'Santa Cruz' cv. tomato plant roots were thoroughly washed and cut into 1.0 cm pieces. They were then put in a blender for 45 seconds and blended with a solution of 0.5% sodium hypochlorite and poured

into 74 micron sieve over a 25 micron sieve. The matter collected from the 25 micron sieve was transferred to a beaker, from which 1.0 ml aliquots were taken to count the eggs and juveniles under a microscope using the method described by Boneti and Ferraz (1981). The inoculum was prepared to contain 1000 eggs ml⁻¹.

The test plant seedlings were prepared at the State University of Londrina in a greenhouse, produced by seeds or cuttings. Seeds of commercially produced *Ruta graveolens* (Rue), *Matricaria recutita* (Chamomile), *Anethum graveolens* (Dill), *Pimpinella anisum* (Fennel), *Hyssopus officinalis* (Hyssop), *Origanum majorana* (Marjoram), *Ocimum basilicum* (Green Basil), *Ocimum basilicum* (Purple Basil) and *Thymes common* (Thyme) were planted for germination in trays of 128 cells containing the commercial substrate Turfafertil. After germination they were moved to 3 L plastic pots containing sand + soil (2:1) substrate previously sterilized with the product Fumisolo. The seedlings were after ten days transplanted, one plant per pot when the fifth definitive leaf was produced.

The *Carpobrotus edulis* (Balsam), *Plectranthus neochilus* (Boldinho), *Plectranthus barbatus* (Brazilian Boldo), *Mikania glomerata* (Guaco), *Commiphora myrrha* (Myrrh) and *Mentha pulegium* (Pennyroyal) seedlings produced from cuttings were packed in black polythene sacks in a greenhouse with pre-sterilized substrate made up of 1:1 manure and carbonised rice hull and were watered periodically to maintain moisture to facilitate root growth. Re-potting into pre-sterilized sand + soil substrate (2:1) with the product Fumisolo, in 3 L plastic pots when cuttings had produced new foliage.

The definitive pot substrate for the experiment was taken to the soil laboratory for a basic nutrient and pH analysis. Both the pH level results, which remained at 6.2 and the nutrients evaluated were found to be satisfactory and within the standard limits for fertility, with a basic maintenance fertilization with the granulated formula 8-28-16 being applied at 1 gram per pot once before re-potting.

The seedlings were inoculated 20 days after re-potting. Each plant was given a 5 ml suspension of the inoculum containing 1000 eggs ml⁻¹, which were added to three holes around the seedlings, each approximately 2 cm in depth.

The root systems were collected 60 days after inoculation and separated from the above ground part, washed thoroughly then stained with Philoxine B to count the number of galls in each root system, as per Taylor and Sasser (1978). The roots were then processed following the Boneti and Ferraz (1981) extraction technique for egg counting, then the reproduction factor was calculated (RF = end Nr of eggs/starting Nr of eggs) as per (Oostenbrink, 1966). The plants with RF averages less than 1 were considered resistant and plants with an RF greater than, or equal to 1 are susceptible.

The averages collected from the experiment were

compared using the 5% Tukey multiple comparison test, after rejecting their equality in a variance analysis. According to the homoscedasticity test the data was transformed to $(x+k)^{1/2}$ and was used in the variable $k = 1$ for RF and, $k = 0,01$ for Eggs+J₂/root and Nr of galls. In the presentation of results the averages are untransformed and the mean separation letters indicate the comparison results on the transformed data.

Table 1 shows the results of the Tukey multiple comparison test for the different medicinal plant averages with *M. incognita* and *M. javanica*. Data presented in this table are the total number of eggs+J₂/root. Tomato, as expected, showed a much greater average than the medicinal plants. Chamomile had a greater susceptibility to *M. incognita* reproduction than other plants, eliminating the possibility of using this species in areas where this nematode is present. Myers *et al.* (2004) in a study carried out in northern Florida (USA), demonstrating the significance of some plants as nematode hosts and furthermore, the resistance *Lepidium virginicum* (Wild Peppergrass) shown to the nematode *M. incognita* in greenhouse conditions.

Chamomile had a high level of galls indicating that this plant is susceptible to nematode attack and gall formation. The average number of eggs and galls were statistically similar to the tomato. This attack can cause low productivity, changes in its active agents (characteristics that have not been studied much yet) and can even lead to death. The Green Basil and Dill plants also presented greater susceptibility when compared to the other plants. Incidence of gall-forming nematodes was also found by Haseeb and Pandey (1987) in medicinal and aromatic herbs in India, which identified 22 new hosts for *M. incognita* and 21 for *M. javanica*.

As was stated, the RF was the main parameter in evaluating if a plant is susceptible to the nematode or not. The tomato presented an RF much higher than one. We can see that Chamomile presented RF = 1.64, differing from the others which presented RF < 1, indicating that this plant is susceptible to attack from the nematode and should not be used in areas where this plant parasite is present. Plants with a low RF did not present susceptibility to *M. incognita* attack and can be considered for use in areas with nematode management.

In the state of Paraná, the relationship between nematodes and medicinal plants has been examined in some studies. One example of this is the Prodócimo and Lozano (1998) study, in which they detected root knot nematode occurrence in medicinal plants in the Curitiba City region. Of the 61 samples collected, around 50% were infested with one or more species of *Meloidogyne* nematode. Four species were found: *M. hapla*, *M. incognita*, *M. javanica* and *M. arenaria* and some unknown specimens.

For *M. javanica*, in relation to the total eggs + J₂/root variable, we observed that the control was more susceptible, differing statistically from the other treatments. We can also look at the differences in the

medicinal plants and note that Chamomile had the highest average. Costa Manso *et al.* (1985), analysed the susceptibility of 23 medicinal plants to *M. javanica* infestation under greenhouse conditions based on the Taylor and Sasser (1978) infestation index and they considered in this study that three of these plants, among them *Matricaria chamomilla* L. (Chamomile), showed high susceptibility, while six were immune to the infestation and the rest were resistant.

For the number of galls variable, the control showed statistically different averages to the other treatments, except for the Chamomile which was not significantly different than tomato, again showing its greater susceptibility.

With regard to the RF variable, the control is seen as very susceptible. The RF is the most important parameter to indicate a plant's susceptibility to the root knot nematodes and it is worth highlighting that, in this study, all the treatments analysed showed values of less than one and as such can be considered resistant to *M. javanica* attacks. Studying *M. javanica* reproduction in weeds, some with medicinal properties, Asmus and Andrade (1997) used the same parameter and found that the nematode reproduces well in *Bidens pilosa* (Spanish Needle) and *Solanum americanum* (American Black Nightshade) while in *Sida rhombifolia* (Paddy's Lucerne) the reproduction factor was less than 1.0. In the study by Maciel and Ferraz (1996) similar results were reported for Balsam and contradictory ones for Boldo in the variables Number of galls and RF.

All plants were resistant to *M. incognita*, except Chamomile, which showed susceptibility. All plants showed resistance to *M. javanica*, except Myrrh, Rue and Balsam which were immune.

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