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Influence of Fresh Chopped Leaves and Dry Leaf Powder of some Horticultural Trees on Controlling Root-knot Nematode, *Meloidogyne javanica* on Broad Bean

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Abstract

Fresh chopped and dry leaf powders of china berry(*Melia azedarachta*), golden chain (*Cassia fistula*), luciana (*Lucaena Leucocephala*), poinciana (*Poinciana regia*) and purple orchid (*Bauhinia Variegata*) was applied as soil amendments at rates of 5, 10, 15 and 20 g / kg soil to control the root-knot nematode, *Meloidogyne javanica* infecting broad bean cv. Maser-1 under greenhouse conditions. Result revealed that all powder or chopped amendments suppressed population of nematode and fewer root galls per plant were formed special at the highest rates of amendments. All treatments significantly ($P \leq 0.05$) decreased nematode criteria when compared to untreated (check). In general, there was a positive correlation between the tested rates and the percentages reduction in nematode parameters higher rates of chopped or dry leaves were caused higher percentage nematode reduction, when compared the whole averages of materials with each other in controlling nematode parameters. Also, almost the treatments of dry leaf powder amendments succeeded in improving the plant growth than unamended soil as evidence in increment of lengths and fresh weights of both shoots and roots. Also, the increase in such parameters of plant growth clear differences according to the type and the amount of materials used.

Keywords: *Meloidogyne javanica, broad bean, fresh copped tree leaf, dry leaf powder, root-knot nematode, soil amendment.*

Introduction

The influenced of fresh chopped leaves and dry leaf powder on controlling root-knot nematodes and consequently improving plant growth, voluminous studies had been done on several economic vegetable crops by many workers (Mojtahedi *et al*., 1991; Montasser *et al*., 1991; Patel *et al*., 1994; Kimenju *et al*., 2008; Ibrahim and Traboulsi, 2009; Montassere *et al*., 2012; Mouse *et al*., 2014 and Sowley *et al*., 2014).

The first report of such a phenomenon by amending soil with chopped pineapple leaves (*Ananas comosus* L.) to control *Meloidogyne* spp. in cowpea recorded by (Leinford *et al*., 1938). Chopped neem leaves when adding to soil infested with *Rotylenchulus reniformis* yielded the greatest reduction in nematode numbers (Lall *et al*., 1977). Dry leave powders of *Tagets patula, Xanthium straumarium, Verbesina enceloides* and *Artomesia scoprariа* produced the greatest reduction in *M. incognita* population and improved plant growth (Sharma *et al*., 1985). The application of fresh *Gliricidia* leaves to soil reduced the total nematode populations of *Meloidogyne incognita*

and *Rotylenchulus reniformis* (Duhaylongsod, 1988). The tested dry leaf powders amendments *Bauhinia variegate*, *Cassia fistula*, *Cassia nodosa*, *Ceratoni siligua*, *Dalbergia sisso*, *Eucalyptus restrate, Ficus nitida, Poinciana regia*, *Populus nigra,* and *Sterculia diversifolia* significantly reduced the numbers of root galls and the rate of nematode penetration on tomato roots when compared with the untreated control Montasser, (1991). Dry leaf powder of *Tagetes erecta* and *Ricinus commanis* Suppressive effect on nematode reproduction as well as improved soybean shoot and root weights Al-Sayed *et al*., (1992). Dry leaf powder of damsis give the conceder able control of root-knot nematode with increase in growth of sunflower as compared to un-treated check followed by parsley, Indian laburnum, fennel, sweet marjoram and coriander especially at two higher rates of application (Montasser *et al*., 1999). *Tithonia diversifolia, Desmoaium uncinatum*, *Tagetes minuta, Leucaena leucocephala*, and *Crotalaria juncea* were among the most effective in root-knot nematode suppression when used in rotation with beans. Such as green manure plants reduced the reproductive potential of *Meloidogyne* spp. (Kimenju *et al*., 2008). Chopped or ground dry leaves of assa-peixe (*Vernonia polyanthes*), lemon-grass (*Cymbopogon citratus*), eucalyptus (*Eucalyptus citriodora*), castor (*Ricinus communis*), mango (*Mangifera indica*) or neem (*Azadirachta indica*) reduced the gall number, when incorporated into the soil as powder, and maximum nematode suppression occurred in soil amended with neem leaves (61%) (Lopes *et al*., 2011). The application of *Azadirachta indica* leaf powder gave the highest reduction in root galls and nematode population followed by *Cassia siamea*, *Eucalyptus gigantea* and *Parkia biglobosa* (Chimobekujwo *et al*., 2013). Minimum gall formation observed in *Aegle marmelos* and *Prosopis cinerarea* treated plants and all the tested dry leave powder improved plant growth characters of *Coleus forskohlii* over control (Soumana and Trivedi, 2015). The aim of this study to control the root-knot nematode of broad been coasted by *Meloidogyne gavanica* by using fresh chopped leaves and dry leaf powder of some horticulture trees.

Materials and Methods

Preparation of nematode inoculum.

Two-months-old tomato (*Solanum lycopirscon* L.) roots infected with populations of *Meloidogyne javanica* were washed with tap water to remove adhering soil particles, cut into small pieces and the eggs collected according to Hussey and Barker (1973). The extracted eggs were transferred to Baermann trays with soft tissue paper at room temperature to allow egg hatching. After 72 hours, the emerging second stage juveniles were counted under a light microscope and the average number per ml calculated.

Evaluation of some horticultural trees leaves against root-knot nematode, *Meloidogyne javanica* infecting broad bean cv. Maser 1.

Leaves of five trees were tested chinaberry (*Melia azedarachta*), golden chain (*Cassia fistula*), luciana (*Lucaena Leucocephala*), poinciana (*Poinciana regia*) and purple orchid

(*Bauhinia Variegata*). Leaves were collected from trees and dried under shade for 10 days before being pounded with Compactor to make a coarse powder. In the other treatment leaves of trees were collected from trees and finely chopped before add to soil. Tree leaves were applied to the soil at the rate of 5, 10, 15 and 20 gm. per 1 kgm soil. Broad been seeds were planted in 15 cm diam. Clay pots containing autoclaved sandy clay soil 1: 1 (v: v). After two weeks from planting has infection with 1000 newly hatched larvae of root knot nematode per pot.

Un- inoculated pots served as a control. Four replicates of each of them five treatments with different concentrations compared to untreated (control). All pots were arranged in a randomized block design a greenhouse. All plants were grown during the normal growing seasons at greenhouse temperature of 35 ± 5 c, 45 days after inoculation, all plants were harvested and removed gently, washed in water and the root of each plant was stained in lacto phenol acid fuchsine **(**Goodey 1963). Eggs of ten randomly selected egg-masses of each root system were also counted by sodium hypochlorite. The rate of nematode reproduction was calculated**.** The number of juveniles in soil per pot, galls, developmental stages on root, egg-masses per root and number of eggs/ egg mass were counted by Christie & Perry (1951) and Southey (1964) fresh weights of the root and shoot systems as well as their lengths were determined. Data were subject to analysis of variance (ANOVA) (Gomes & Gomez, 1984) and means were compared by Duncan multiple - range test (Duncan1955).

Results and Discussion

A- The effect of dry leaf powders of tree leaves as soil amendment against the root-knot nematode, *Meloidogyne javanica* on broad bean cv. Maser 1.

The effect of amending soil with dry leaf powders of china berry (*Melia azedarachta*), golden chain (*Cassia fistula*), luciana (*Lucaena Leucocephala*), poinciana (*Poinciana regia*) and purple orchid (*Bauhinia Variegata*) to control the root-knot nematode, *Meloidogyne javanica* infecting broad bean cv. Maser 1 was studied ander greenhouse conditions. Data presented in Table (1) revealed that all powder amendments suppressed populations of nematodes and fewer root galls per plant were formed special at the highest rates of amendments. Therefore, all amendments of the tested powder tree leaves as soil application significantly reduced the values of root galls per root and nematode reproduction on roots of broad bean cv. Maser 1 when compared with unamended control. Such nematode values gradually decreased with increasing the amended of any of the tested dry leaf powder, Table (1). However, the highest reductions in number of galls and rate of nematode reproduction in soil tested with 20 g/kg, soil of the highest reduction in the number of galls and rate of nematode reproduction in soil treated with (20 g/kg soil) of china berry, golden chain, luciana, poinciana and only purple orchid 15 and 20 (3 and 0.22), (5 and 0.16) (3 and 0.09), (4 and 0.22) and (7 – 0.22 and

5 – 0.13), respectively. There are significantly differences ($P \geq 0.05$) in the number of galls per root of broad bean grown in soil amended with such materials at the rate of (5 g / kg soil) was found when compared with those of the other treatments, (Table 1). Also, the nematode final population lower than initial population at rates of 15 and 20 g /kg soil amended with china berry, luciana and poinciana with values (0.49 and 0.22), (0.99 and 0.09) and (0.74 and 0.22) respectively.

Data showed in Table (2) that almost the treatments of dry leaf powder amendments succeeded in improving the plant growth than unamended soil as evidence in increment of lengths and fresh weights of both shoots and roots. Also, the increase in such parameters of plant growth varied greatly according to the type and the amount of materials. Treatments had significant effect on plant growth parameters when compared with treated plants with nematode alone (check) except in luciana at rates of 15 and 20 g/kg soil which recorded decrease in shoot and root of lengths and fresh weights. Shoot and root lengths and fresh weights significant increase with china berry (40.65 – 68.96 – 56.73 and 70.04 %), golden chain (39.54 – 46.71 – 63.47 and 55.53), luciana (28.49 – 40.49 – 55.47 and 70.33 %) and poinciana (42.42 – 69.98 – 60.13 and 58.32 %) at rate of 5 g. Also, leaf powder of purple orchid had also significant effect at highly rate of application on shoot and root lengths and fresh weights of broad bean cv. Maser 1(36.96 – 63.37 – 50.40 and 51.68 %) compared to plants treated with nematode alone.

B- The effect of some fresh chopped tree leaves as soil amendment against the root-knot nematode, *Meloidogyne javanica* infecting broad bean cv. Maser 1.

Chopped same tree leaves used in this study were promising in controlling *M. javanica* infecting (broad bean cv. Maser 1) and enhancing plant growth criteria (Table 3). The numbers of galls per root, nematode juveniles in soil per pot, nematode developmental stages per root, egg-masses per root, eggs per egg-mass, nematode final population and rate of nematode reproduction differed according to treatment and material used (Table 3). Population of nematode significantly ($P \leq 0.05$) increased in untreated pots,all treatments significantly ($P \leq 0.05$) decreased nematode criteria when compared to untreated (check). In general, there was a positive correlation between the tested rates and the percentages reduction in nematode parameters. Higher rates of chopped were caused higher percentage nematode reduction. Its lower rates caused lower percentages nematode reduction. When compared the whole averages of materials with each other in controlling nematode parameters, it is evident that, the highest degree of reduction in the nematode infection being recorded in plants treated with 20 g. /kg. Soil) of chopped leaves of golden chain, poinciana and purple orchid, they recorded in number of galls and rate of nematode reproduction (3 and 0.16), (3 and 0.13) and (4 and 0.19) respectively. Those treated with a lower rates (5 g. /kg. soil) of golden chain, luciana and poinciana chopped leaves recorded the least effect in number of galls and rate of nematode reproduction (28 and 3.48), (24 and 4.86) and (25 and 3.35) respectively as compared to untreated control (36 and 10.34). Whereas the reduction in the root-knot nematode, *M. javanica* parameters at rates (10 and 15 g /kg soil) recorded moderate values in nematode criteria.

Data also in Table (4) revealed that, almost of used treatments recorded significant increase of plant growth when compared with untreated (check) while, at rates of 10 and 15 g of chinaberry chopped leaves decreased plant growth. The effect of chopped leaves on plant shoot and roots length and fresh weight were classified to three groups: No significant difference between different rates of china berry as applied soil in shoot length, fresh weight and Root weight, luciana in shoots and root lengths, poinciana in shoot lengths and fresh weights and purple orchid in root fresh weight. A significant difference between different chopped trees leaves rates as applied to the soil and the heights increase with the high rate 20 g recorded (china berry in root lengths, golden chain in shoot and root lengths and fresh weights, luciana and poinciana in root fresh weight, and purple orchid in shoot lengths and fresh weights, Table (4).A significant difference between different chopped trees leaves rates as applied to the soil and the heights increase with the less at rate of 5 g. (luciana in shoot lengths, poinciana and purple orchid in root length.

Our Results in the study are in keeping of those of (Van Dar Laan, 1956 and Alam *et al*., 1977 and 1980) who reported that soil amendments with dry leave powders and chopped leaf plants improved the growth of plants and hence increase the tolerance and resistance against plant parasitic nematodes. Some materials release compounds toxic to nematodes preformed like phenol, tannin azdirachtin, salannin, nimbin, nimbidin, thionemone, meliantol and ricinin (Mian *et al*., 1983; Rich *et al*., 1989; Herrera, 1997 and Akhtar and Malik, 2000) or derived from the decomposition process in soil like ammonia, nitrites, hydrogen sulphid and thiophenes (Rodringuez-Kabana *et al*., 1981; Rodringuez-Kabana, 1986 and Ekatorini and Prosser, 2003). Soil amendments may also provide afavourable substrate for the sustenance of soil microfauna and microflora (Sayre *et al*., 1964) which can include direct predators (micro-arthropods) or parasites (fungi, bacteria) of nematodes or which suppress soil nematode population indirectly through the production of enzymes, emelys, chitinase, collagenase, kerasstase and elastase which disintegrate nematode cuticle (Rodriguez-kabana *et al*, 1983 and Galper *et al*., 1990) or toxic metabolites, such as antibiotic of bacteria origin (Mahdy, 2002 and Schosser *et al*., 2006). Bio-fumigationwas defending as a process of liberation of secondary volatile or not-volatile phytochemicals with nematicidal properties were released during decomposing of materials or animal products. A number of toxic gas products (e.g. thiocyanate and isothiocyanate) are known to be released from these compounds during decomposition (Brown *et al*., 1991; Angus *et al*., 1994; Morra and Kirkegaard, 2002; Lopez-Perez *et al*., 2005; and Roubtsov *et al*., 2007).

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دراسة تأثير أوراق بعض الأشجار البستانية الجافة والطازجة علي نيماتودا تعقد الجذورميلودوجين جافينكا علي نبات الفول البلدي صنف مصر ١

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الملخص

استهدفت الدراسة تقييم فاعلية خمسة أنواع من الأوراق الخضراء المفرومة أو الجافة علي هيئة مسحوق بأربع معدلات مختلفة (٥ ، ١٠ ، ١٥ ، ٢٠ جم/ كجم تربة) للأشجار البستانية الزنزلخت، والخيار شمبر، واللوسينا، والبونسيانا، وخف الجمل المزروعة بكثرة في محافظة أسيوط ودور استخدامها كمخلفات عضوية زراعية في مكافحة نيماتودا تعقد الجذور ميلودوجين جافانيكا التي تصيب جذور الفول البلدي صنف مصر ١، وكذلك تأثيرها علي معدلات تحسين نمو النباتات المصابة.

ولقد أظهرت النتائج أن جميع الأوراق المختبرة سواء خضراء مفرومة أو مسحوق جاف قد أدت الي حدوث نقص معنوي في عدد العقد النيماتودية ومعدل تكاثر النيماتودا علي جذور الفول المعامل بها مقارنةً بالغير معامل. كذلك أوضحت النتائج وجود علاقة سلبية بين عدد العقد النيماتودية ومعدل تكاثر النيماتودا وبين الزيادة في معدلات إضافة الأوراق للتربة سواءاً كانت خضراء مفرومة أو مسحوق جاف. كما أن إضافة مسحوق الأوراق الجافة لأشجار الخيار شمبر، وخف الجمل عند كل معدلات الإضافة المختلفة كانت أعلي تأثير في نقص معدل تكاثر النيماتودا مقارنة بمثيلاتها من الأوراق الخضراء المفرومة علي عكس اضافة الأوراق الخضراء مفرومة لأشجار الزنزلخت عند كل معدلات الإضافة المختلفة مقارنة بمثيلاتها من مسحوق الأوراق الجافة، كما أشارت النتائج الي أن كل المعاملات المختبرة قد أدت الي تحسين معدلات النمو عند اضافة مسحوق الأوراق الجافة لكل المواد المختبرة بمعدلات الإضافة المختلفة أفضل بكثير عند مقارنتها بمثيلاتها من إضافة الأوراق الخضراء المفرومة.