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CONTROL OF ROOT-KNOT NEMATODE INFECTING ROSE PLANTS AND MANAGEMENT INFLUENCE ON FLORAL PARAMETERS

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ABSTRACT : *A pot experiment was conducted to determine the effect of bioagents (Bacillus megaterium – Trichoderma album) and to evaluate the efficacy of nematicides (Fosthiazat – Oxamyl- Fenamiphos – Ethoprophos) on the control of Meloidogyne javanica infecting rose plants during 2014. The influence of these treatments on flowers quality, number of developed flowers, length of stem, fresh and dry weights, and total carbohydrates& Nitrogen in leaves were also measured under greenhouse conditions. Results indicated that all treatments greatly suppressed the counts of M. javanica. Fosthiazat and oxamyl nematicides recorded 88.2% and 76.5% reduction of nematode juveniles in soil compared to 80% and 70% reduction in females in root, respectively. Moreover the bioagent, Bacillus megaterium recorded 50% and 70% reduction in gall numbers and females in root , respectively. As for the quality of flowers, results indicated that the treatments of Fosthiazat , Oxamyl and Bacillus megaterium produced a remarkable flower numbers giving 6.34 ,5.76 and 5.48 flower per plant , respectively compared to the control treatment that gave 3.13 flower / plant . The mean fresh and dry weights of leaves, were significantly increased with all treatments compared with check treatment .*

Key words: *Root–knot nematode, Rose, Nematicides, Bioagent, Total Carbohydrates.*

INTRODUCTION

Roses, the queen of cut flowers, are among loveliest object on our earth along with its possible pharmaceutical uses. Rose exports have been developed in Egypt over the past 10 years, due to the high quality of blooms when given proper care. Rose is subject to attack by several diseases, which reduce its performance and net returns. Moist soil conditions provide an excellent environment for nematodes and crown gall nematode damage is described to be a major disease problem in rose gardens (Davis and Jenkins,1960) . *Meloidogyne hapla* is one of the most damaging plant-parasitic nematodes in temperate regions. , causing small galls or swellings on the fine fibrous roots, decreasing plant vigor. Small yellow leaves, early leaf shed, stunting, and reduced bud formation are the foliar symptoms of nematode damage on roses. Plant decline usually occurs gradually over a period of several years until poor flower and foliage quality is being recognized. Discoloration and a reduction in the number of fibrous roots are often associated with nematode damage on roses. This nematode has a wide host range with more than 500 plant taxa including roses (Onkendi and Moleleki, 2013). Disease management is known to be an important practice of a rose maintenance programs.

This study, was conducted to determine the effect of bioagents (*Bacillus megaterium – Trichoderma album*) in nematode control compared to the efficacy of the nematicides: fosthiazat, oxamyl, fenamiphos, ethoprophos) in control of *Meloidogyne javanica* infecting rose plants as well as, the quality of flowers, number and length of stem flower, fresh and dry weight of flower , and total carbohydrates in leaves of rose plants under greenhouse conditions .

MATERIALS AND METHODS

Root-knot nematode :

The nematode inoculum used in this research was obtained from greenhouse culture maintained at the Plant Pathology Research Institute, A. R. C. where *Meloidogyne javanica* (Treub) Chitwood nematode was reared in a greenhouse on tomato plants. Eggs of *M. javanica* were extracted from roots in 0.5 % sodium hypochlorite (Hussey and Barker,1973) and caught on a 250 mesh sieve. Second stage juveniles (J2) were hatched from these eggs on Baermann funnels and only (J2) less than 2 days old were used for experimentation.

Greenhouse experiments:

Twenty four rose seedlings were transplanted in plastic pots (25 cm d) filled with autoclaved loamy sand (1:1) during 2014 year. Twenty one pots after seven days were inoculated with 2000 second stage juveniles of *M. javanica*. Three pots were considered as control. After seven days pots were assigned to eight groups as follow:

1 st group, received 0.4 g /pot of *Bacillus megaterium* .
2nd group, received 0.4g/pot of *Trichoderma album* .
3rd group , received 0.2 g /pot of fosthiazat.
4th group , received 0.1ml /pot oxmayl.
5th group, received 0.1ml/pot of fenamiphos.
6th group, received 0.4 g /pot of ethoprophos.
7th group, received nematode only (Control).
8th group , without nematicide and without inoculum of *M. javanica* (Check).

Rose plants were uprooted after eight months with their root system(s) intact as for as possible and washed with tap water .

The number of root galls and females were counted in root juveniles of *M. javanica* were estimated in 250 g soil. Flowering parameters as date of flowering, number of flowers per plants, flower stem length (cm), fresh and dry weights of flowers, fresh and dry weights of leaves. The flowers were cut at the at the early stage of opening, when the outer petals started to unfold. The leaves of flowering stem were dried at 40^{c} for 48 hours for chemical analysis. The total carbohydrate in the dry leaves of stem were determined according to Dubios *et al*. (1956) .The total nitrogen was measured in dry leaves using the method of Ling (1963). Statistical analysis was made and the L.S.D. at 5% level was calculated according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Results showed that all treatments greatly suppressed the nematode juveniles in the soil , reduced the number of root galls and females in roots. Results in Table (1) reveal that the use of nematicide fosthiazat recorded 88.2% and 75.0%reduction in numbers of *M. javanica* juveniles in soil and root galls respectively . Oxamyl caused 76.5% and 75.0% reduction of *M. javanica* juveniles in the soil and root galls, respectively . Fenamiphos caused smaller effect being 58.5% and 50.0% reduction of *M. javanica* in the soil and root galls. The bioagent *Bacillus megaterium* resulted in 52.9% and 50.0% reduction in of *M. javanica* counts in soil and root galls respectively.

Results in Fig. (1) illustrate that using fosthiazate, oxamyl and *Bacillus megaterium* recorded reasonable reduction in numbers of females 80, 70 and 70% in roots respectively , compared to fenamiphos , Ethoprophos and *Trichoderma album* that recorded 50, 50 and 30% reduction females in root respectively . Also using fosthiazat and oxamyl has recorded 88.2 and 76.5 % reduction of juveniles in soil.

Table (1): Effect of biocontrol agents and nematicides on *Meloidogyne javanica* infecting rose plants during 2013-2014.

Treatments	Aver. No. of juvenile /250 g soil	reduction % of *M. javanica* juveniles	Aver. No. of galls /root	reduction %of galls/ root	Aver. No. of females / root	reduction% of females /root
Bacillus megaterium	80.0 b	52.9	6.0 b	50.0	3.0	70.0
Trichoderma album	160.0 a	5.9	12.0 a	00.0	7.0 b	30.0
Fosthiazat	20.0 d	88.2	3.0 c	75.0	2.0 c	80.0
Oxamyl	40.0 cd	76.5	3.0 c	75.0	3.0 c	70.0
Fenamiphos	70.0 bc	58.8	6.0 b	50.0	5.0 c	50.0
Ethoprophos	90.0 b	47.1	7.0 b	41.7	5.0 c	50.0
Nematode only	170.0 a	-	12.0 a	-	10.0 a	-
L.S.D.at 5%	37.15		2.81		1.99	

values followed by the same letter within a row are not significantly at 0.05 level.

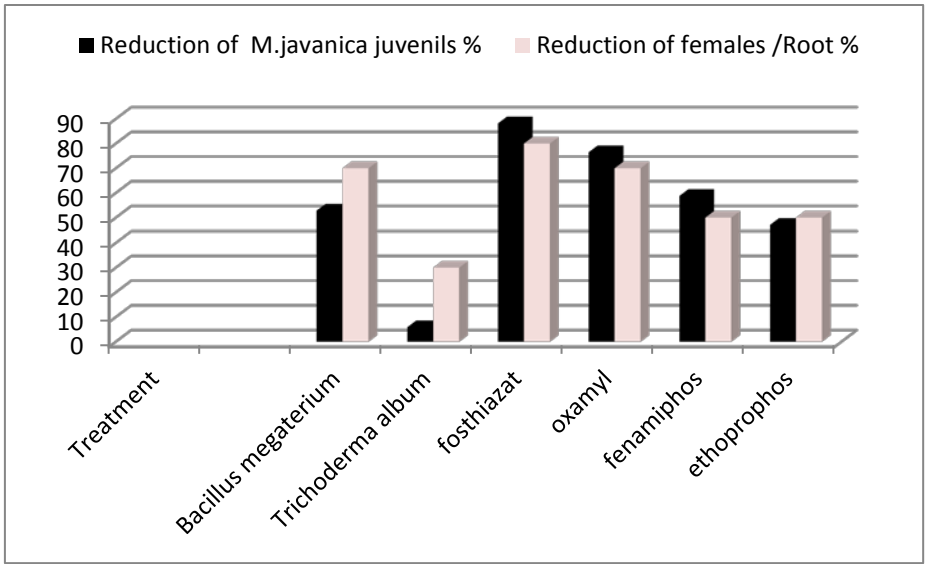

Fig. (1): Effect of biocontrol agents and nematicides on percentage reduction of females in root and juveniles in soil of *M. javanica* .

Data in Table (2) show that different treatments shortened the time from flower bud development until flower opening composed to the control and nematode only. The treatment of fosthiazat resulted in the shortening the duration from flower bud appearance to flower opening 25.70 . The longest period in this respect was in the case of nematode only treatment that recorded 32.33 day.

It is evident from the data that the number of flower per plant was consistently increased in different treatments. Fosthiazat resulted in significant higher number of flowers recorded (6.34) than all other treatment. Whereas, the other treatments produced significantly higher number of flowers compared to the treatment with nematode alone 3.13. No significant changes in the length of stem flower was recognized in treatments with fosthiazat, oxamyl and *Bacillus megaterium* . The fresh weight of flowers increased with all treatments than the treatment nematode only . Also the dry weight of flowers increased in all treatments compared nematode alone treatment .

Data in Table (3) show that the means of fresh and dry weights of leaves on the flowering stems were increased significantly in all treatments than compared to the control treatment nematode alone. Moreover, Table (3) show clearly that the mean percentage of total carbohydrate or nitrogen percentage in rose leaves increased with all treatments than the treatment nematode only .

Table (2): Effect of biocontrol agents and nematicides on flowering duration and flower parameters during 2013-2014.

Treatments	flower bud appearance to flower opening (day)	number flower/ plant	length of stem flower (cm)	flower fresh weight (g)	flower dry weight (g)
Bacillus megaterium	27.24 c	5.48 c	8.50	4.983	1.660 a
Trichoderma album	28.11 c	4.32 d	6.66	4.893	1.150 b
fosthiazat	25.70 d	6.34 b	9.85	4.916	0.913 c
oxamyl	27.13 c	5.76 c	8.55	4.700	1.016 b
fenamiphos	27.60 c	5.65 c	7.27	5.093	1.183 b
Ethoprophos	29.31 b	4.84 d	7.96	4.606	1.000 b
Control Nematode only	32.33 a	3.13 e	6.76	3.700	0.566 d
Check	29.31 b	7.10 a	12.20	5.283	1.130 b
L.S.D.at 5%	1.098	0.954	N.S.	N.S.	0.261

values followed by the same letter within a row are not significantly at 0.05 level.

Table (3): Effect of biocontrol agents and nematicides on fresh and dry weight ,total carbohydrate and nitrogen percentages in the leaves of rose plants during 2013-2014.

Treatments	Fresh weight of leaves on flower (g)	Dry weight of leaves on flower stem (g)	Total carbohydrates in leaves	N % in leaves
Bacillus megaterium	17.813 a	1.846 c	17.300 a	1.373 c
Trichoderma album	17.750 a	3.016 a	18.333 a	1.670 b
fosthiazat	17.133 a	2.223 b	17.023 a	1.473 c
oxamyl	13.266 c	2.510 b	17.220 a	1.700 b
fenamiphos	17.063 a	2.296 b	15.530 b	1.446 c
ethoprophos	16.276 b	2.286 b	15.266 b	1.343 c
nematode only Control	12.866 c	1.673 c	12.500 c	1.183 d
Check	15.966 b	2.533 b	18.913 a	1.860 a
L.S.D.at 5%	0.90	0.47	1.38	0.16

The obtained results show that application of nematicides for control of root-knot nematode affecting rose plants significantly increased the growth parameters and increased the yield of rose. These results are in agreement with those obtained by (Kella *et al*., 2011) and (Kella and Elmansoub 2014).

Generally it could be concluded that the addition of fosthiazat and oxamyl were more effective on growth and flowering quality or quantity parameters of rose plants than the other treatments . Inoculation with *Bacillus megaterium* stimulated all growth parameters of rose plants Desouky (2006).

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مكافحة نيماتودا تعقد الجذور المتطفلة علي نباتات الورد وعلاقة ذلك بجودة الازهار

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الملخص العربى

نباتات الورد لها اهميه اقتصاديه كبيرة و تزرع بمساحات واسعة بهدف التصدير والاستهلاك المحلي حيث انها تدخل في معظم الصناعات مثل العطور ومستحضرات التجميل وايضا تستخدم ازهارها للزينه في المناسبات . وقد وجد ان نيماتودا تعقد الجذور تتطفل علي نباتات الورد مما يؤثر علي انتاجيه النباتات للازهار وايضا علي جوده الازهار ولذلك تم إجراء هذه الدراسه بهدف التعرف علي العلاقه بين إستخدام بعض المركبات في مكافحه نيماتودا تعقد الجذور واثر ذلك علي الازهار فقد تم استخدام اثنين من المركبات الحيويه *Trichoderma album* , واربعه من المبيدات النيماتودية *Bacillus megaterium* Fenamiphos, Oxamyl, Fosthiazat, Ethoprophos وتم تسجيل ميعاد تفتح الازهار وطول الساق الزهري وعدد الازهار وتم تقدير الوزن الرطب للازهار والاوراق وكذلك الوزن الجاف وتم تقدير كمية الكربوهيدرات والنيتروجين في الاوراق ، كما تم ايضا تقدير النسبه المئوية لخفض اعداد اليرقات في التربه وعدد العقد الجذريه وعدد اناث النيماتودا علي الجذور وذلك خلال موسم ٢٠١٣-٢٠١٤.

اظهرت النتائج ان المبيدين Oxamyl, Fosthiazat حققا أعلي نسبه خفض في أعداد يرقات نيماتودا تعقد الجذور الموجوده في التربه حيث سجلا نسبه ٨٨.٢٪ , ٧٦.٥٪ علي الترتيب وايضا حدث نسبه خفض في عدد العقد الجذريه للنيماتودا الموجوده علي المجموع الجذري للنباتات بنسبه ٧٥٪ لكل من المركبين .

أظهرت النتائج أن افضل المركبات في خفض اعداد اناث نيماتودا تعقد الجذور علي المجموع الجذري كان مبيد Fosthiazat حيث سجل ٨٠٪ خفضا فى التعداد.

أظهرت النتائج ايضا ان المبيد النيماتودي Oxamyl والمستحضر *Bacillus megaterium* كان لهم نفس التأثير علي نسبه خفض اعداد اناث النيماتودا علي الجذور حيث سجلا نسبه خفض بلغت ٧٠٪ لكلا المركبين .

أشارت النتائج المتحصل عليها الي ان مكافحه نيماتودا تعقد الجذور المتطفله علي نباتات الورد ادي الي تحسن في صفات النمو مقارنه بالكنترول كما ادت المعاملات الي زياده النمو الخضري والزهري وزياده الوزن الطازج والجاف للاجزاء الخضريه وأزهار القطف بالاضافه الي محتوي الاوراق من الازوت والكربوهيدرات . وفي النهايه تؤدي كل هذه العوامل الي جوده الازهار التي تنتجها النباتات سواء من حيث ارتفاع طول الساق الزهري او حجم الزهره وحيويتها مما يحسن من تحمل ازهار القطف للتداول والتصدير.

أسماء المحكمون:

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