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IMPACT OF CERTAIN CHEMICAL PESTICIDES AND BIOAGENTS ON SUPPRESSING SOME PARASITIC NEMATODES ASSOCIATED WITH RICE PLANT UNDER FIELD CONDITIONS.

Khalil, A.E.M.[**]; A.G El-Sherif[*] and Samaa M Shawky

[*] **Nematology Division, Plant Pathology Inst., Agric. Res. Centre, Giza**

[**] **Nematology Res. Unit, Agric. Zool. Dept., Fac. of Agric., Mansoura Univ. Egypt**

ABSTRACT

Under field conditions, trials were conducted to evaluate the two chemical pesticides, i.e. Furan-El-Nasr (local) 10%G and Furadan (U.S.D) 10%G as post-planting applications on suppressing population of *Aphelenchoides besseyi*, *Hirschmannilla oryzae*, *Meloidogyne* spp. (J_2) and *Tylenchorhynchus* spp.naturally infested the rhizosphere of rice cv. Sakha 101 at six interval times during the growing rice season 2006, in addition ,the two bioagents i.e. Bio-Zied and Bio-Arc were also tested as foliar spray on rice for controlling *A. besseyi* infecting vegetative parts at the same conditions. Results revealed that all tested compounds reduced the average number of such nematodes either recovered from the rhizosphere or vegetation parts to a certain extent. With respect to soil samples, Furadan(U.S.A) achieved the highest percentage nematode reduction values 40% and 49.6% for *H. oryzae* and *A. besseyi*, respectively ,with their peaks that were recorded to be 315 and 266 individuals /250 g. soil after 60 days from seedlings transplanting , respectively. On the other hand, Furan-El-Nasr showed the highest value of percentage reduction of *A. besseyi* /one gram vegetative parts of rice plant (66.0%) while ranked second to Furadan (U.S.A) in the increment of rice grains weight with values 42.6 and 33.3%, respectively. Moreover, among the two bioagents tested, Bio-Arc, *Bacillus megaterium* ranked third to Furan-El-Nasr in value of percentage *A. besseyi* reduction per one gram of vegetative rice plant (28.8%) and increased weight of 1000 rice grains with value of 11.1%, whereas, Bio-Zied, *Trichoderma album* showed the least values of both criteria.

Keywords : Chemical pesticides i.e Furadan, Furan-El-Nasr, Bioagents ,i.e Bio-Arc, Bio-zied, *Aphelenchoides besseyi Hirschmannilla oryzae, Meloidogyne* (J_2), *Tylenchorhynchus*, Rice cv. Sakha101.

INTRODUCTION

Rice, *Oryza sativa* L., is the main food of more than two billion people, predominately in Asia, where more than 90% of the world's rice growth and consumed (Bridge *et al.*1990). In Egypt, rice growing area reached 1 million feddans in 2005, 80% of the cultivated rice area is by transplanting seedlings, while the rest 20% is by direct seeding. More than 96% of the Egyptian rice area is cultivated in the Nile –Delta. Productivity of rice in Egypt is 3.98 million tons as the productivity average is 4.16 tons per feddan according to report published by Badwi *et al* (2005).

***Feddan=4200m^2**

The estimated rice yield losses due to plant parasitic nematodes were recorded to be 10% all over the world (Sasser and Freckman, 1987). Major nematode pests of rice are *Aphelenchoides besseyi* , *Criconemella ononsis, Ditylenchus angustus , Heterodera* spp. , *Hirschmannilla* spp., *Hoplolaimus indicus*, *Meloidogyne* spp, *Paralongidorus. ,Pratylenchuss* spp*., Tylenchorhynchus* spp*., Trichodorus* spp*., Tylenchus* and *Xiphinema infacolum* (Youssif, 1985, Bridge *et al*., 1990, and El-Sherif *et al*., 2005). In Egypt , the impact of seven pesticides ,i.e. Malathion, Dimethiate, Carbo-El-nasr, Furazed, Furadan, Vydate and Cartan as well as the two dried leaf powders of *Vinca rosea* and *Datura stramonium* in the management of *Aphelenchoides besseyi* on rice seedling cv. Giza 171 was investigated during rice growing season 2002 in plastic bags in outdoor and results indicated that all tested materials obviously reduced the population density of *A. besseyi* on rice seedling during the growing season and at harvesting time to certain extent. Moreover, among the toxicants applied, Dimethiate and Malthion as foliar spray separately achieved the highest percentage of nematode reduction at all rice growth stages tested, whereas *V rosea* and *D. stramonium* accomplished the least values in this respect (El-Sherif and Khalil,2003). However, with respect to *H oryza* management on rice plant cv. Sakha 103 during the rice growing season 2003 with four chemical pesticides ,i.e. Malathion 57%EC. Dimethoate 40% EC, Carbo-El-Nasr 10% G and Cartan 10%G as well as two plant extract i.e. *Vinca rosea* and *Datura stramonium,* that was carried out under field condition , revealed that all tested materials obviously reduced the population of *H. oryza* infesting soil of rice plants. More over ,Cartan 10%G (broadcasting) achieved the highest percentage of nematode reduction with value of 65.4% followed by *V rosea* (foliar spray) with value of 59.4% .where as Carbo-El-Nasr (broadcasting) gave the least value of nematode reduction (39.4%) when compared with the untreated plots ,respectively, (El-Sherif *et al* 2005). The present work deals with the following points (1) to evaluate the efficiency of two chemical pesticides i.e. Furan El-Nasr ,10%G (local), Furdan (U.S.A) 10%G as well as two biocontrol agent i.e. Bio-zied powder (local) , *Trichoderma album* and Bio-Arc powder (local) , *Bacillus megaterium* on controlling four parasitic nematode genera or species i.e. *A. besseyi ,H. oryza , Tylenchorhynchus* and *Meloidogyne* associated with rice rhizosphere plant cv. Sakha 101 and (2) to study the impact of the same toxicants against *A. besseyi* population in vegetative parts of rice plant cv. Sakha101 at various growth stages during the growing season of 2006 as well as rice grains yield under field conditions.

MATERIAL AND METHODS

(A) Management of four plant parasitic nematode genera infecting rice plants under field condition.

To determine the influence of certain pesticides i.e. Furan-El-Nasr 10%G (local) and Furadan 10%G (U.S.A) as well as two biological agent i.e. bio-zied (local, active ingredient 2.5%) *Trichoderma album* and Bio-Arc (local, active ingredient 6%) *Bacillus megaterium* on controlling,

Aphelenchoides besseyi, *Hirschmannilla oryzae*,*Tylenchorhynchus* spp and *Meloidogyne* spp ,2625m^{2}of land was chosen at shubra-sendy, sinbellawian county ,south Dakahlia of northeastern Nile Delta region to carry out this experiment. This chosen area (2625m^2) was divided into five plots with five hundreds and twenty five square meters each. Each plot served as treatment with five replicates at one hundred and five (105m^2) square meters each. After thirty days from sowing rice cv. Sakha 101 seeds, seedlings were transplanted into the previous mentioned plots, which was prepared according to the procedure of rice cultivation under the Egyptian condition. Seven days later, pesticides application as well as biological agent was applied. Treatment were as follows: (1) Furan-El-Nasr 10%G (2) Furadan (U.S.A) 10%G (3) Bio-Zied, 2.5% *Trichoderma album*, (4) Bio-Arc, 6% *Bacillus megaterium* and(5) without any chemical or biological agent (N alone). Furan-El-Nasr (local) or Furadan (U.S.A) was separately added as broadcasting granules at the rate of 108.32 g per replicate (the recommended dose /feddan (4200m^2),13Kg/feddan) ,whereas , each biological agent tested at 750g./150 litter distilled water as spray at the rate of 30 ml/replicate. Each treatment was replicated five times. Two weeks later, N.P.K. fertilizer was applied at the recommended rate /replicate. At the beginning of the experiment, after transplanting rice seedlings, the initial population of the associated nematode species with the rhizosphere of rice roots i.e. *Aphelenchoides besseyi* ,*Hirschmannilla oryzae* ,*Meloidogyne* spp. (J_2), and *Tylenchorhynchus* spp. in three soil samples with 250g. each was extracted by sieving and modified Baermann-pan technique (Goodey, 1957) their identity confirmed microscopically, (Mai&Lyon, 1975; and Lucand Goodey,1987), and the average nematode number / each species was then recorded to be 14.2, 148.0, 14.0, and 28.8 individuals/ 250g. Soil, respectively. After seven days from transplanting rice seedlings into the plots, one soil sample with 250g .each / replicate of each treatment was collected in a plastic bag at interval times i.e. 7, 15,30,45 ,60 and75 days , sent to the Nematology laboratory and kept in refrigerator at 4ºC for nematode extracting. Nematode extraction was carried out by sieving and modified Baermann-pan technique and the average number of each nematode genera or species was determined and recorded.

(B) Rice white –tip nematode, *Aphelenchoides besseyi* population at various growth stages or rice plant cv. sakha101 as influenced by the same two chemicals and two biological agents under field condition:

Based on chlorotic discoloration of the leaf sheath just below the collar of 2 months-old plant of rice cv. Sakha101, five locations of infested rice plants were selected and marked by bamboo / treatment for collecting samples of plant leaves, steams and panicles of each treatment at such growth stage i.e. flowering ,prematurely and harvest stages , a twenty grams of flag –leaf plus steam and panicles per each location /treatment were collected in paper bags and brought to the Nematology laboratory , kept in a refrigerator at 4ºC. These materials were cut into 0.25 cm pieces and soaked in tap water in a 10-cm-diam. plastic cup. Twenty four hours after incubated into water, suspension was sieving through 100 mesh and the nematodes

were concentrated through sieving 350 mesh (Goodey, 1957), counted, recorded and their identity confirmed microscopically. Nematode extraction was conducted in darkness at 25±2ºC as this temperature is within the suitable range for extraction of *A. besseyi* from the soaked material tested (Tamura and Kegasawa, 1957). Moreover, one thousand rice grains per replicate / treatment at harvest was weighed and recorded, and the average weight was determined. All data of the present investigation were subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984) and means were compared by Duncan's multiple range tested (Duncan, 1955).

RESULT AND DISCUTION

Data in Table (1) documemted the average number of *Aphelenchoides besseyi*, *Hirschmannilla oryzae* , *Meloidogyne* spp($J_{2)}$ and *Tylenchorhynchus* spp. per 250g.soil of the rhizosphere of rice plant cv. Sakha 101 as influenced by the pre-planting applications of the two chemical pesticides i.e. Furan-El-Nasr and Furadan (U.S.A) during the rice growing season 2006 under field condition it was evident that both toxicants significantly reduced the four parasitic nematodes species examined, as compared to the untreated. Furadan (U.S.A) as broadcasting application surpassed Furan El-Nasr (local) in suppressing number of *A. besseyi* , *H. oryzae,* and *Tylenchorhynchus* spp. with value of nematode reduction percentages 49.6, 29.3, 40.0, 23.7, 42.95, 39.4% except that of *Meloidogyne* spp.(J_2) which was par (30.9%), respectively. (Table 1) when compared with the untreated plots. Results also indicated that average number of either *A. besseyi* or *H. orayzae* at intervals times i.e. 7, 15, 30, 45,60 and 75 days after transplanting of seedlings was gradually increased and reached its peak at 60 days, then slightly declined at 75days after transplanting, whereas, *Meloidogyne* spp. (J2), and *Tylenchorhynchus* spp reached the peaks at 30 days, and declined, as compared to the untreated, respectively. Moreover, the efficacy of Furadan (U.S.A), also accomplished the low value of number of folds (10.71) to the rice white-tip nematode, *A. besseyi*, when compared to that of Furan-El-Nasr (15.12). Like wise, similar trend was obtained with respected to *Hirchamanniella oryzae* (1.19 and 1.52), respectively. Moreover, similar results were recorded for *Meloidogyne* spp. (J2), and *Tylenchorhynchus* spp. with respect to number of folds which were reported to be 1.19, 1.74, and1.52, 1.61, respectively.

Data in Table (2) revealed the impact of two chemical pesticides i.e. Furan-El-Nasr local) and Furadan (U.S.A) as well as two bioagents, i.e. Bio-Zied, *Trichoderma album* and Bio-Arc, *Bacillus megaterium* on the rice white-tip nematode, *A. besseyi* population at various growth stage i.e. flowering plus Flag-Leaf, pre-maturing and harvest as well as the weight of 1000 grains of rice cv. Sakha 101 during the rice growing season 2006 under field conditions. Results indicated that all tested materials significantly reduced the average nematode number per one gram of vegetative parts plus leaf and panicle (Table2).

T1

Among the toxicants tested, Furan-El-Nasr 10%G accomplished the highest percentage of nematode reduction with value of 66.0%, followed by Furadan(U.S.A) (64.8%), and then Bio-Arc,*B. megaterium* (28.8%) whereas, treatment received the bioagent, Bio-Zied, *Trichoderma album)* showed the least value of nematode reduction percentage which amounted to 16.4% as compared to the untreated plots, respectively. With respect to rice grains yield, Furadan (U.S.A) as broadcasting application achieved the highest percentage of increase with value of 42.6%, followed Furan-El-Nasr (broadcasting) with value of 33.3% while the two bioagents showed the least values of percentage of increase rice grains yield which were amounted to 11.1% and 5.5% for Bio-Arc and Bio-zied when compared to the untreated plots, respectively,(Table2).

Apparently, Furadan (U.S.A) significantly achieved the highest percentage of nematode reduction ,followed by Furan-El-Nasr with values of 40.0 and 23.7% for the rice- root nematode , *H. orayzae* in the rhizoshere of rice, respectively, On the other hand, Furan-El-Nasr gave better results in suppressing *A. besseyi* number in vegetative parts of the rice plant than Furadan (U.S.A) with values of 66.0% and 64.8%, respectively, whereas , Bio-Zied application (spray) showed the least value (16.4), while Bio-Arc treatment gave a considerable value (28.8%) of percentage nematode reduction per gram of vegetative rice plant and panicle.

Table (2). Impact of two pesticides in comparison with two biocontrol agent on *Aphelenchoides besseyi* population in vegetative parts of rice plant cv. Sakha101 at various growth stages during the growing season of 2006 and rice grains yield under field condition.

Treatment	Average number of *A. besseyi* per one gram of vegetative parts of rice plant cv. Sakha 101 at various growth stages and weight of 1000 grains.							
	Flowering stage (Flage- leaf)	Premature stage	Harvesting stage	Cumulative number	Average no. /g.	% Reduction	Wt. of 1000 grains (g.)	% Increase
Furan El-Nasr+ N 10%G	3.26 c	8.67 c	3.35 c	15.28 c	3.9 c	66.0	21.60 a	33.3
Furadan(U.S.A)+ N 10%G	2.20 c	7.50 c	2.50 c	12.20 c	4.04 c	64.8	23.10 a	42.6
Biozied powder+N (spray)	6.24 a	16.50 b	6.09 b	28.83 b	9.61 b	16.4	17.10 b	5.5
Bio-Arc powder+N (spray)	5.49 b	14.16 b	4.88 b	24.53 b	8.18b	28.8	17.99 b	11.1
N alone	6.34 a	18.85 a	9.28 a	34.47 b	11.49 a	-	16.20 c	-

***Each figure represented the average of five replicates**

****Means with the same letter are not significantly different at p< 0.05.**

In general, the present findings are in accordance with those reported by El-Sherif *et al* (2005) who found that Cartan 10%G as broadcasting application achieved the highest percentage of *H. orayzae* reduction with value of 65.4%, followed by *Vinca rosea* (foliar spray) with value of 59.6% . Moreover, these finding also are in agreement with those reported by El-Sherif *et al* (2006), with respect to the magnificent results given *by V. rosea* or Dimathoate as foliar spray for suppressing *A. besseyi* in shoot and increment grains weight of rice cv. Sakha103 during the rice growing season 2003 under field conditions, and those of Kumar and Sivakumar (1998) with respect to spraying Monocrtophose at 100 /ha at the boot leaf stage of rice that reduced the white-tip incidence and increased rice yield in the field experiments.

It is worthy to note that the low values of both percentage of increase in rice grains weight or nematode reduction that resulted from the tested bioagents treatments need more research to be done to clearly this phenomenon.

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تـاثير بعض المبيـدات الكيماويـة والحيويـة علـي خفـض انـواع النيمـاتودا المتطفلـة والمصاحبة لنبات الأرز تحت ظروف الحقل .

اشرف السعيد خليل ,احمد جمال الشريف و سماء محمود شوقي.

١ قسم النيماتودا معهد بحوث امراض النبات مركز البحوث الزراعية –الجيزة .

٢ وحدة بحوث النيماتولوجي –قسم الحيوان الزراعي –كلية الزراعة –جامعة المنصورة.

تم اجراء تجربـة تحت ظروف الحقل لتقيم مبيدين كيمـائيين همـا فيوران النصر (محلي) (١٠% محبب) وفيورادن (امريكـي) (١٠% محبب) بعد نقل شـتلات الارز نثـرا لخفض اعداد نيمـاتودا القمـة البيضـاء فـي الارز*Aphelenchoides besseyi* ونيمـاتودا جـذور الارز *Hirschmannilla oryzae* ونيمـاتودا تعقد الجذور*Meloidogyne* spp ونيمـاتودا التقزم *Tylenchorynchus* spp الموجودة طبيعيا فـي تربـة جـذور الارز صـنف سـخا ١٠١ عنـد ٦ مواعيد مختلفة هي ٧و١٥و٣٠و٤٥و٦٠و٧٥ يوما من نقل شتلات الارز خلال موسم نمو الارز عام ٢٠٠٦ بالاضـافة الي اختبار مبيدين حيويين هما بيوزيد (محلي) (فطري) وبيوارك(محلي) (بكتيري) رشا علي النباتات عند الجرعة الموصي بها لنفس ظروف الحقل .

اوضحت النتائج ان كل المركبات المختبرة ادت الي نقص متوسط اعداد النيمـاتودا المسـجلة سواء من التربـة او العينـات الخضـرية للنبات.

بخصـوص عينـات التربـة ادي مبيد الفيـوردان اعلـي معدل نقص فـي اعداد النيمـاتودا بقيم ٤٠% و ٤٩,٦% لكل من نيمـاتودا جذور الارز ونيمـاتودا القمـة البيضـاء فـي الارز علـي التـوالي مسجلا اعلي عدد لهما ٣١٥و ٢٦٦ فردا لكل ٢٥٠ جرام تربة بعد ٦٠ يوم من نقل الشتلات .

واما مبيد فوران النصر قد اعطـي اعلـي معدل نقص فـي تعداد نيمـاتودا القمـة البيضـاء فـي الارز لكل جرام مجموع خضري للارز (٦٦%) وكان ترتيبه الثاني لمبيد فيوردان في معدل زيـادة وزن الالف حبة ارز بمعدل ٤٢,٦%و ٣٣,٣% علي التوالي.

وبخصـوص المبيدين الحيوين كان ترتيب المبيد الحيوي البكتيري الثالـث بعد مبيد الفيـوردان فـي معدل نقص اعداد نيمـاتودا القمـة البيضـاء فـي الارز لكل جرام مجمـوع خضـري لنبـات الارز (٢٨,٨%) وادي الي زيادة وزن الالف حبة بمعدل ١١,٠% بينما كان المبيد الحيـوي الفطـري اقل المبيدات المستعملة حيث اعطي اقل القيم لنفس الصفات المختبرة.

Table (1): Population density of four parasitic nematodes within soil of rice roots cv. Sakha 101 at intervals time as influenced by post-planting application of two chemical pesticides after seedling transplanting during the growing season of 2006.

Chemical pesticides	Parasitic nematode species	Average number of nematode population density per 250g. soil at intervals in days.						Cumulative number (PF)	Average No./250g	% Reduc-tion	No. of folds
		7DA	15DA	30DA	45DA	60DA	75DA				
Furan-El-Nasr 10%G	A. besseyi	0.0d	96.6c	221.66b	306.8a	382.6a	272.0b	1279.6	213.3.	29.3	15.12
	,*H.oryzae*	112.0c	164.8bc	198.4b	221.6b	348.6a	300.4a	1345.8	224.30	23.7	1.52
	Meloidogyne spp	44.8b	42.8a	52.8a	16.0b	10.0c	0.0d	166.4	27.70	30.9	1.74
	Tylenchorhynchus spp	38.4c	42.0b	61.2a	58.8a	44.4b	34.0c	278.3	46.4	39.4	1.62
Furadan (U.S.A) N 10%G	A. besseyi	0.0d	79.6c	134.41b	221a	266.0a	203.3a	912.3	152.10	49.6	10.71
	,*H.oryzae*	106b	121.8b	137.6bc	169.2b	315.0a	207.6a	1057.2	176.20	40.0	1.19
	Meloidogyne spp	43.8a	45.2a	46.8a	16.4b	12.0c	2.0d	166.2	27.70	30.9	1.97
	Tylenchorynchus spp	32.0b	48.0a	56.2a	55.4a	37.2b	24.4c	262.2	43.70	42.95	1.52
Control (untreated)	A. besseyi	14.2d	179.2c	295.8b	406.2a	460.0a	452.0a	1810.2	301.70	-	-
	,*H.oryzae*	148.0c	185.6b	200.8b	322.4b	462.8a	443.8a	1763.4	293.90	-	-
	Meloidogyne spp	14.0c	64.0b	111.6a	24.8c	19.2c	7.0d	240.6	40.10	-	-
	Tylenchorynchus spp	28.8c	69.2.b	141.0a	70.2b	90.8b	59.6b	459.6	76.60	-	-

AD= days after transplanting of rice seedlings, respectively.*

**** Number of folds=Final nematode population density**

Initial nematode population density

1) Rice-white tip nematode, *Aphelenchoides besseyi* 2)Rice-root nematode, *Hirschmannilla oryzae.*

*****Means with the same letter are not significantly different atP<0.05**