

EFFICACY OF CERTAIN PESTICIDES AND DRIED LEAF POWDERS IN THE MANAGEMENT OF RICE WHITE TIP NEMATODE, *Aphelenchoides besseyi*.

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ABSTRACT

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 of 2002 in plastic bags in outdoor. All materials tested obviously reduced the population density of *A. besseyi* on rice seedlings during the growing season as well as at harvesting time to certain extent as compared to the untreated control. Among the toxicants applied, Dimethiate and Malathion as foliar spray separately achieved the highest percentages of nematode reduction at all rice growth stages tested, whereas *V. rosea* and *D. stramonium* accomplished the least values in this respect. Moreover, spraying Dimethiate or Malathion on rice seedlings showed the best method of applications tested in the management of *A. besseyi* on rice seedlings with value of 11.38 and 13.5 individuals/100 rice grains, respectively followed by the granular chemicals i.e. Furadan (U.S.A) (19.88), Cartan (21.38), Furazed (23.38) and Carbo-El-Nasr (26.25), whereas the dried leaf powders i.e. *V. rosea* (56.50) and *D. stramonium* (62.00) ranked the third in suppressing numbers of *A. besseyi* per 100 rice grains as compared to those of the untreated rice plants (140 individuals).

Keywords: Pesticides, plant leaf powders *A. besseyi*, chemical control, rice plant, application methods.

INTRODUCTION

Rice, *Oryza sativa* L., is the staple food of more than two billion people, predominately in Asia, where, more than 90% of the world's rice grown and consumed (Bridge *et al.*, 1990). In Egypt, rice growing area reached 1.225 million feddan in 2002, 80% of the cultivated rice area is by transplanted 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 4.45 million tons as the productivity average is 3.63 tons per feddan according to report published by Badawi *et al.* (2002).

Worldwide, rice yield losses due to plant parasitic nematodes are estimated at 10% (Sasser and Freckman, 1987). Major nematode pests of rice are *Aphelenchoides besseyi*, *Criconemella onoensis*, *Ditylenchus angustus*, *Heterodera* spp., *Hirschmanniella* spp., *Hoplolaimus indicus*, *Meloidogyne* spp., *Paralongidorus* spp., *Pratylenchus* spp., and *Xiphinema ifacolum* (Bridge *et al.*, 1990). White tip disease of rice plant caused by a seed-borne nematode, *Aphelenchoides besseyi*, Christie, 1942 has been widely distributed in many rice growing countries in Asia, Tropical America, formerly USSR and Africa (Franklin and Siddiqi, 1972; Fortuner and Williams,

1975 and Ou, 1985). Recently, it was recorded by Amin (2002) for the first time in Egypt during a survey of plant parasitic nematodes in the paddies of Dakahlia and Sharkia governorates in the Nile Delta. Moreover, Tahwail village where paddy areas of South Dakahlia governorate were cultivated with Giza 171 and Rehoo cultivars achieved the highest levels of *A. besseyi* infestations in rice grains as well as straw (Khalil and El-Sherif, 2003). *A. besseyi* caused variable yield losses in different countries ranging from 14.5 to 46.7% in Japan (Nishizawa & Yamamoto, 1951), 40 – 50% in U.S.A. (Atkins & Todd, 1959), 29 to 46% in Taiwan (Hung, 1959), 41 to 71% in formerly USSR (Tikhonova, 1966) and about 60% India (Rao *et al.*, 1985).

Management of rice white tip nematode, *A. besseyi* was studied by some workers such as Kumar & Sivakumar, (1998); Tacconi *et al.*, (1999) and Tiwari, (2000). Tacconi *et al.* (1999) stated that when investigations were carried out on the population dynamics of *A. besseyi* in a Bologna rice field and on the effect of seed treatments with either ethoprophos 20% EC at 0.5%/100 litres, or hot water at 53–54°C for 15 min., both treatments were recorded to reduced the infestation of rice seed kept for propagation to almost nematode-free level. The infestation on untreated seeds was firstly observed in spikelets during the swelling phase whereas from treated seeds, nematodes were recovered only after harvesting and from husks. However, in treated seed husk infestation decreased between 82 and 96% with respect to the untreated control.

Moreover, among the efficacy of 11 pesticides that were applied by seed soaking and spray application in the management of white tip disease of rice, vamidothion exhibited maximum percentage mortality of *A. besseyi*, followed by quinalphos and thiometon, whereas, carbendazim, phosphamidon, quinalphos, fenitrothion, dimethoate and phosalone – treated seeds revealed nematode-free seedlings in 32-days-old rice (Tiwari, 2000).

The aim of the present investigation was to determine the efficacy of seven pesticides as well as two dried plant leaves powders on controlling rice white tip nematode *Aphelenchoides besseyi*, naturally infested rice seeds cv. Giza 171 during rice growing season of 2002 in plastic bags under outdoor conditions.

MATERIALS AND METHODS

During rice growing season of 2001, certain locations in fields of Tahwail village at Simbellawian district, south Dakahlia governorate (Nile Delta of A.R. Egypt) of naturally infested rice seedlings cv. Giza 171 exhibiting symptoms of white tip disease caused by *Aphelenchoides besseyi* were selected and marked by bamboo stakes for collecting their panicles at harvest in order to be used in this study during rice growing season of 2002.

To determine the influence of certain pesticides i.e. Malathion 75% EC cheminova, O,O-dimethyl-S-(1,2-dicarbethoxy) ethyl phosphorodithioate, Carb El-Nasr 10% G., 2, 3-dihydro-2, 2-dihydro-2, 2-dimethyl benzofural-7-methyl carbomate; Dimethiate 40%, [O,O-dimethyl-S-(methyl-carbamoyl)] methyl phosphorodithioate; Furazed 10% G (carbofuran) (Local) 2, 3-dihydro-2, 2-dimethyl benzofural-7-yl methyl carbomate; Furadan 10% G (carbofuran)

(USA), 2, 3-dihydro-2, 2-dimethyl benzofural-7-methyl carbamate, Vydate 10% G (Oxamyl) and Cartan 10% G. (Local), Methyl N',N'-dimethyl-N-[(methyl carbamoyl)oxy]-1-thiooxamimidate, as well as two dried leaf powders i.e. Periwinkle, *Vinca rosea* and *Datura stramonium*, on controlling *A. besseyi*, two hundreds of these infested rice seeds cv. Giza 171 were broadcasting sown for each plastic try (60 x 30 x 4 cm). Each plastic try has small pores within its bottom, which covered with newspaper to prevent clay soil and water. Each try was filled with sterilized clay soil which was mixed with five grams of urea plus two grams of zinc sulfate as a fertilizer before sowing rice seeds, then irrigated with enough tap water and covered with plastic sheet for 24 hrs.

Each cultivated plastic try was irrigated with water until seed germination; and through the seedbed and nursery period. The initial population of *A. besseyi* per 100 rice grains was determined by soaking them in a plastic cup 20 cm diam. filled with tapwater for 24 hrs, sieved through 350 mesh (Cobb, 1918), counted and recorded to be 88 individuals. After twenty five days from sowing, rice seedlings were transplanted into plastic bags 40 cm in diam., filled with 20 Kgs sterilized clay soil, previously sterilized with bromide methyl at the rate of 100 gm/m². Each plastic bag has three hills with five seedlings each. Forty plastic bags with 15 rice seedlings each was used in this experiment. Pesticidal applications as well as dried leaf powders tested were added 2 days after transplanting of rice seedlings. Treatments were as follows:-

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|---|--|
| 1- Malathion 57% EC, | 2- Carbo El-Nasr 10% G., |
| 3- Dimethiate 40% EC, | 4- Furazed 10% G., |
| 5- Furadan 10% G. | 6- Cartan 10% G (Local), |
| 7- Vydate (oxamyl) 10% G., | 8- <i>Vinca rosea</i> , |
| 9- <i>Datura stramonium</i> , and
powder (N alone) | 10- Without any chemical or plant leaf |

Malathion or dimethiate was separately added as spray at the rate of 5 ml/Lor 2.5 ml/L/replicate, respectively. Each of Carbo-El-Nasr, Cartan, Furazed, Furadan (USA) and Vydate was introduced at the rate of 2.4 gm/replicate, whereas each plant powder tested at the rate of 40 gm/replicate. Each treatment was replicated four times.

One month later, NPK fertilizer was added at the recommended rate/replicate; and then 25 grams of rice plant leaves and stems (tillering stage)/replicate of each treatment at the level of 5 cm height from the plant base was cut and collected in paper bags, brought to the Nematology Laboratory and kept in a refrigerator at 5°C for nematode counting. Similar sample per each replicate/treatment was taken for flag-leaf, stem and at pre-maturity stage of panicles as well as at harvesting time. These samples were separately collected in paper bags and kept as previously mentioned for the same purpose. These materials were separately cut into 0.25 cm pieces, mixed and then one gram of each growth stage of rice seedling was randomly taken and soaked in tap water in a 10-cm-diam. Plastic cup. Suspension was passed through 60 mesh-sieve 24 hrs after incubation, and the nematodes were concentrated through Cobb's sieve 350 mesh (Cobb, 1918), counted, recorded and their identity confirmed microscopically.

At harvest, one hundred rice grains/replicate of each treatment was collected and soaked in a plastic cup 20-cm-diam. provided with enough tap water for 48 hrs and another one hundred was also soaked and incubated in water for 96 hrs. Each set was separately sieved with 60 mesh. The nematodes were then concentrated through Cobb's sieve 350 mesh (Cobb, 1918), examined, counted and recorded.

Nematode extraction in each procedure mentioned above was conducted in darkness at $25 \pm 2^{\circ}\text{C}$ as the temperature is within the suitable range for extraction of *A. besseyi* from the soaked materials (Tamura and Kegasawa, 1957).

Data were subjected for analysis of variance (ANOVA) (Gomez and Gomez, 1984) and means were compared by Duncan's multiple range test (Duncan, 1955).

RESULTS

Data of the present investigation show the influence of seven chemical pesticides i.e. Malathion, Dimethiate, Carb-El-Nasr, Cartan, Furazed, Furadan, Vydate as well as two dried leaf powders i.e. *Vinca rosea* and *Datura stramonium* on controlling the rice white tip nematode *Aphelenchoides besseyi* that naturally infested rice seedlings cv. Giza 171 during the rice growing season of 2002 under outdoor conditions (Tables 1 and 2). Results indicated that all materials tested, obviously reduced the population density of *A. besseyi* infesting rice plants during the growing season and harvesting time to certain extent (Tables 1 & 2). Data presented in Table (1) revealed that the average number of *A. besseyi* in one gram of rice seedling at various growth stages was significantly affected by the materials tested as compared to the untreated rice plants. Moreover the average number of *A. besseyi* per one gram of rice seedling varied according to the growth stages tested with values of 736, 133 and 199 individuals for one month after transplanting, pre-maturity and harvest stages in the untreated rice seedlings, respectively.

Obviously, the use of Dimethiate, Malathion, Furandan, Cartan, Furazed, Carbo-El-Nasr, Vydate, *Vinca rosea* and *Datura stramonium* in controlling, *A. besseyi* during the growing rice period until harvesting time gave good results in percentage of nematode reduction which were recorded to be in descending order; for example at harvest stage, 86.70, 81.03, 76.13, 73.17, 67.13, 61.31, 48.12, 28.27 and 23.12%, respectively (Table 1).

At all rice growth stages examined, the pesticides such as Dimethiate and Malathion which were applied as foliar spray achieved the highest percentages of nematode reduction with values of 94.9 and 94.2% for the stage of one month after transplanting, 87.24 and 79.36% for pre-mature stage, and 86.7 and 81.0% for harvest stage, respectively, whereas the application of dried leaf powder such as *V. rosea* and *D. stramonium* accomplished the least percentage of nematode reduction with values of 74.9, 74.0%; 23.3, 21.2%; and 28.3, 23.12% for the same growth stages, respectively (Table 1).

Table (1): Influence of certain pesticides and dried leaf powders on the population density of *A. besseyi* infected rice seedlings cv. Giza 171 during the growing season of 2002 under outdoor conditions.**

Treatments	*Average number of <i>A. besseyi</i> ** in one gram of rice seedling at various growth stages		
	One month after** trans- planting *(%)	At pre-maturity** Stage *(%)	At harvest** *(%)
Malathion 57% EC.	42.8b (94.18)	27.5fe (79.36)	37.75fg (81.03)
Carbo-El-Nasr 10%	82.5b (88.79)	42.75d (67.92)	77.0d (61.31)
Carton 10%	64.5b (91.23)	34.75de (73.92)	53.5fe (73.12)
Dimethiate (EC.) 40%	37.3b (94.93)	17.0f (87.24)	26.5g (86.68)
Furazed 10%	69.8b (90.51)	39.0de (70.73)	64.0de (67.84)
Furadan 10% G (USA)	53.5b (91.37)	33.25de (75.05)	47.5fe (76.13)
Vydate 10% G	108.3b (85.28)	71.75c (46.15)	103.25c (48.12)
<i>Vinca rosea</i>	185.0b (74.86)	102.25b (23.26)	142.75b (28.27)
<i>Datura stramonium</i>	191.3b (74.00)	105.0b (21.20)	153.0b (23.12)
N alone (Control)	736a (-)	133.25a (-)	199.0a (-)

* Each figure is a mean of four replicates.

** Means with the same letter are not significantly different.

+ Figures between parenthesis are percentage of nematode reduction.

++ Initial of nematode population per 100 rice grains = 88 individuals.

Table (2): Influence of certain pesticides and dry dried leaf powders on reducing the population density of *A. besseyi* infected rice grains cv. Giza 171 during the growing season of 2002.

Treatments	**Average number of <i>A. besseyi</i> ** recovered per 100 rice grains separately soaked in tap water at harvest time for				*Average number of nematode/ 100 rice grains
	48 hrs	% Reduction	96 hrs	% Reduction	
Malathion 57% EC.	11.75	90.58	15.25	90.28	13.5 f
Carbo-El-Nasr 10%	20.25	83.76	33.25	78.82	26.75 d
Carton 10%	14.00	88.77	28.75	81.69	21.38 d
Dimethiate (EC.) 40%	10.75	91.38	12.00	92.36	11.38 f
Furazed 10%	17.50	85.97	29.25	81.37	23.38 d
Furadan 10% G (USA)	12.75	89.78	27.00	82.80	19.88 e
Vydate 10% G	27.75	77.75	45.25	71.18	36.50 c
<i>Vinca rosea</i>	52.25	58.12	60.75	61.31	56.50 b
<i>Datura stramonium</i>	55.75	55.31	68.25	56.53	62.00 b
N alone (Control)	124.75	-	167.0	-	140.88 a

* Means with the same letter are not significantly different.

** Each figure is a mean of four replicates.

++ Initial population of *A. besseyi* per 100 rice grains = 88 individuals.

Among the materials tested in reducing population density of *A. besseyi* that was recovered from 100 rice grains either after 48 or 96 hr of soaking in tap water, Dimethiate and Malathion gave the highest percentage of nematode reduction, followed by Furadan (U.S.A) and Cartan, whereas, Furazed, Carbo-El-Nasr and Vydate achieved the moderate values of

nematode reduction percentages, while *V. rosea* and *D. stramonium* showed the least values (Table 2).

Moreover, spraying Dimethiate and Malathion on rice seedling achieved the best method of application in the management of *A. besseyi* on rice with values of 11.38 and 13.50 individuals/100 rice grains, respectively, followed by the applications of granular chemicals i.e. Furadan (U.S.A), (19.88), Cartan (21.38), Furazed (23.38) and Carbo-El-Nasr (26.75) whereas, the dried leaf powders i.e. *V. rosea* (56.5) and *D. stramonium* (62.0) ranked the third in reducing number of *A. besseyi* per 100 rice grains when compared to those of the untreated rice plants (Table 2).

DISCUSSION

The present work revealed that among the materials tested for controlling population density of *A. besseyi* infecting rice plant cv. Giza 171, spraying of Dimethiate or Malathion achieved the highest percentages of nematode reduction during all rice growth stages examined. These results are in accordance with the results of Kumar and Sivakumar (1998) who reported that spraying monocrotophos at 1000 ml/ha at the boot leaf stage of rice reduced the white tip incidence; and grain chaffiness and increased rice yield in the field experiments. Moreover, spraying Dimethiate or Malathion at the rate of 2.5 ml/L or 5 ml/ accomplished the best results in the management of *A. besseyi* on rice plants with values of 11.38 and 13.50 individuals per 100 rice grains cv. Giza 171, respectively. These findings agree with that of Tiwari (2000) who found that spraying fenitrothion resulted in less sterile tillers, whereas carbendazim gave nematode free seeds, while the use of phosphamidon showed increased grain weight, yield, nematode free seeds and a lesser % of chaffed seeds.

In conclusion, the best method for suppressing *A. besseyi* infestation in rice seeds of Giza 171 cultivar was the application of such chemical pesticides i.e. Dimethiate or Malathion as foliar spray on rice plants at the beginning of rice growing season.

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تأثير بعض المبيدات ومساحيق أوراق النبات الجافة في مكافحة نيماتودا القمّة
البيضاء في الأرز *Aphelenchoides besseyi*
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تم دراسة تأثير سبعة مبيدات هم الملاثيون، دايمثويت، كاربوالنصر، فيورازيد، فيوردان، فايديت، كارتان وكذلك مساحيق أوراق النبات الجافة لكل من الونكا والداتورا في مكافحة نيماتودا القمّة البيضاء في الأرز *Aphelenchoides besseyi* لصنف جيزة ١٧١ خلال موسم ٢٠٠٢ في أكياس بلاستيك.

أوضحت النتائج أن كل المواد المختبرة قللت أعداد النيماتودا على نباتات الأرز خلال موسم النمو، وكذلك عند وقت الحصاد بدرجة ملحوظة مقارنة بالمعاملة الضابطة. حيث أدت معاملات رش كل من الدايمثويت والملاثيون منفصلا على نباتات الأرز إلى أعلى نقص في تعداد النيماتودا في كل مراحل نمو النباتات المختبرة، بينما حصلت معاملات مساحيق أوراق النباتات الجافة لكل من الونكا والداتورا على أقل القيم في نقص أعداد النيماتودا. وعلاوة على ذلك يعتبر إضافة الدايمثويت أو الملاثيون كمعاملات رش على نباتات الأرز من أفضل الطرق للإقلال من أعداد نيماتودا القمّة البيضاء في الأرز بقيم تصل إلى ١١٣٨ و ١٣٥ فرد/١٠٠ حبة أرز، يليها معاملات المبيدات المحببة وهي فيوردان (١٩٨) وكارتان (٢١٣٨) وفيورازيد (٢٣٨٨) و كاربوالنصر (٢٦٢٥)، بينما كان ترتيب كل من الونكا (٥٦٥) والداتورا (٦٢٠) الثالث في خفض أعداد نيماتودا القمّة البيضاء في الأرز لكل ١٠٠ حبة أرز عندما قورنت بمثيلاتها الناتجة من نباتات غير معاملة.