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COMPARATIVE EFFECTS OF LEAF EXTRACTS AND POWDER OF *MORINDA LUCIDA* AND SYNTHETIC NEMATICIDE ON THE ROOT-KNOT NEMATODE INFECTION OF *CELOSIA ARGENTEA*

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ABSTRACT: *A potted experiment was carried out to study effects of carbofuran (furadan) a synthetic nematicide and Morinda lucida (Brimstone tree) leaf powder and aqueous extract on root-knot infection, growth and yield of Celosia argentea. The Celosia seeds were sown in sterilized soil filled into pots. The experimental pots were each inoculated two weeks after planting with 5,000 nematode eggs. One week after Inoculation, the celosia plants were subjected to seven treatments which were 1.5kgai/ha, 1kgai/ of carbofuran, 100% and 50%concentration of Morinda lucida leaf extracts and also 2ton/ha and 1ton/ha and 1ton/ha of Morinda lucida leaf powder and the untreated. The result obtained indicated that the treatments had significant effect on number of leaves, plants height, number of branches, wet root weight, dry leaf weight, dry root weight and root gall index. Morinda lucida leaf powder applied at 2ton/ha gave the significantly highest increase in the growth and yield of celosia. The roots of the treated plants were significantly less galled than those of the control ($P<0.05$). However, there were no significant differences in leaf area, wet leaf weight, wet shoot weight and dry shoot weight of Celosia argentea.*

KEYWORDS: Leaf Extract, Morinda Lucida, Synthetic Nematode, Root-Knot Nematode, Celosia Argentea, Nematode

INTRODUCTION

Celosia argentea, a heabeaceus vegetable crop belongs to the family Amaranthacea commonly known as plumed cockscomb, and is a plant of tropical origin. The leaves and flowers are edible and are grown for much use in Africa and south East Asia (Arbonnier, 2004). It can be grown all the year, round provided there is adequate soil moisture. The green leaves are harvested either by up-rooting while plants live about five weeks old or by sequential cutting of shoots.

The main nematode pests of *Celosia argentea*, is Root-knot nematode (Oyedunmade and Olabiyi 2004). Root-knot nematode is an important pest of vegetables. Its approximate distribution in agricultural soils in Nigeria is 75% among *Meloidogyne* species. It attacks almost all the cultivated plants and can cause high crop losses (Ahmad, 2009).The effects of the pests on celosia include; chlorosis of leaves, stunted growth and purple coloration of leaves and stem, lesions and necrosis in the green leaf yield. (Oyedunmade and Olabiyi 2004)

The control of root of root limit nematodes in the fields can be achieved through several approaches, prominent among them is the use of pesticides (Oyedunmade, 2004). In the tropics, synthetic pesticides is common among farmers (Abolusoro *et al.*, 2010) But have been reported to be inappropriate for subsistence farmers (Faheem *et al.*, 2013). It can lead to the destabilization of soil eco-system, resurgent outbreaks and the toxicity of the pesticide

residue to life. Due to the negative impact of synthetic pesticides to the eco-system, and the significance of *Celosia argentea*, to the food of families in Africa, there is need to develop a sustainable and eco-friendly approach towards the combat of root-knot nematode in *Celosia argentea* L., The current study is therefore undertaken to compare the effects of leaf exact and powder of *Morinda lucida* and carbofuran on the root-knot nematode infection of *Celosia argentea.*

MATERIALS AND METHODS

The experiment is a potted experiment and was carried out in the crop pavilion of the department of crop production of the University of Ilorin, Ilorin. Twenty one (21) 10 litre pots were used for the experiment. They were thoroughly washed and dried and arranged on the stands at the crop pavilion.

Soil Sterilization

Soil was collected from a fallow land within the faculty of Agriculture, University of Ilorin. The soil was steam sterilized in a drum, allowed to cool down and later weighed out into 10kg portions which were used to fill each of the twenty one experimental pots.

Seed Collection and Planting

The seeds of local variety of *Celosia argentea* L. were collected from Kabba college of Agriculture, Kogi-State. The seeds were planted in the sterilized soil which was filled into the experimental pots. After establishment, the plants were thinned to one healthy stand per pot.

Extraction of Nematode Eggs

Galled roots were collected from *Celosia argentea* on which a pure culture of *Meloidogyne incognita* was raised. The galled root was washed properly under the tap in order to get rid of attached soil. The roots were cut into small pieces and shaken with 5% sodium hypo chloride solution for about four minutes in a kilner's jar (Hussey and Barker, 1973) in order to digest the gelatinous matrix encasing eggs. The content was seized through a 200mesh sieve nested oven. Egg suspension was made with distilled water in a 500ml beaker. The number of eggs in 1ml egg suspension was standardized so that 1ml egg suspension contained approximately 100 freshly extracted *Meloidgyne incognita* eggs.

Inoculation of Nematode Eggs in the soil

The plants were inoculated 2weeks after planting with nematode eggs by placing 5,000 *Meloidogyne incognita* eggs very close to the base of the plant roots.

Preparation of test plant materials

Fresh leaves of the test plant (*Morinda lucida* (Brimstone tree) were collected and air dried for two weeks. The dried leaves were grounded into powder from by using an attrition mill. Phytochemical screening was conducted to test the plant for alkaloids, flavonoids, saponin, and tannins.

Preparation of plants Extract

Fresh leaves of *Morinda lucida* were harvested and chopped into pieces. One Kilogram (1kg) of the test leaves was taken and mixed with 1litre of water and allowed to soak for 24hrs, it was later sieved to obtain 100% test plant extract. Another 500g of the plant material was mixed with 1litre of water and allowed to soak for 24hrs; it was later sieved to obtain 50% plant extract.

Treatments Application

Seven treatments and three replicates in Randomized Complete Block Design were used in the experiment. They include:

Carbofuran 1.5kgai/ha

Carbofuran 1kgai/ha

Morinda lucida extracts 100%

Morinda lucida extracts 50%

Morinda lucida powder 2ton/ha

Morinda lucida powder 1ton/ha

Control

Data collection

Data were collected on the following parameter: plant height, number of leaves, number of branches, fresh and dry leaf weight, fresh and dry root weight, fresh and dry shoot weight, leaf area and root galling index according to Taylor and Sasser (1978),

Data Analysis

The data collected were subjected to analysis of variance and where necessary, the means were separated using Duncan's multiple range test.

RESULTS

Number of leaves

Table 1 depicts the effect different treatment with *Morinda lucida* leaf and carbofuran on the mean number of leafs of *Celosia argentea* plant. The result shows there were significant difference in number of leafs as a result of the difference throughout the period of observation. As from third week after planting till the end of the observation period (11 WAP) the higher dose of *Morinda* leaf powder (2 ton/ha) was significantly superior to the untreated control. While the number of leaf in the 100% leaf, leaf extract was also significantly than what was observed in the control during (8-11 WAP).

Plant height (cm)

The result obtained in respect of plant height as result of different treatment with *Morinda lucida* leaf plant extract and plant powder and carbofuran are shown that different treatment with *Morinda lucida* and carbofuran significantly increased the main height of the *Celosia argentea* as compared with the untreated control.

Number of branches

The different treatment of *Morinda lucida* leaf (plant extract and plant powder) and carbofuran add significant differences on the mean no of branches of the *Celosia argentea* shown in table 3.In most cases, the treated plant produced significantly more branches than the untreated control.

Leaf Area, Wet Leaf Weight, Wet-Root Weight, Wet-Shoot Weight, Dry Leaf Weight,Dry Root Weight and Dry Shoot Weight.

Table 4 shows the result obtained with regard to treatment with *Morinda lucida* leaf (plant extract and plant powder) and carbofuran on the main leaf area, wet leaf weight, wet root weight, wet shoot weight, and dry shoot weight of *Celosia argentea*. *Celosia* plant that were treated with *Morinda lucida* powder of 2 ton/ha adds the significantly highest wet root weight, dry leaf weight and dry root weight than the other treatment. While there were no significant difference in the leaf area. Wet leaf weight, wet shoot weight, and dry shoot weight among the different treatment.

Root Gall Index

Table 5 signifies the effect of different treatment with *Morinda lucida* leaf (plant extract and plant powder) and carbofuran on mean root gall index of *Celosia argentea* plant. All the treated plant are significantly less galled than the untreated control plant. However, the *Morinda lucida* leaf powder resulted in the least of root gall indices.

Discussion

Root-knot nematodes are capable of reducing the total yield of *Celosia* plants as well as predisposing it to secondary attack by pathogens, notable viruses and fungi (Abolusoro, *et al*., 2010).

The inoculation of the soil with root-knot nematodes resulted in the characteristics galls in the untreated Celosia plants while the treatment with Carbofuran and *Morinda lucida* significantly reduced the galling of *Celosia* roots. Galling is known to prevent absorption of water and nutrients from the soil (Oyedunmade, 2004).

The yield obtained from *Celosia argentea* plants that were treated with furadan and *Morinda lucida* was high when compared with the control. The root-knot nematodes *Meloidogyne incognita* was reported to reduce the yield of Celosia plant by 66% (Alam et al., 1989). The world estimate of crop yield losses due to the root-knot nematode range from 31% in rice to 43% in cowpea and 46% in vegetable (Abolusoro, *et al*., 2010).

The number of leaves, plant height and number of branches were significantly increased in all the treated plants as compared with the control. This may be due to fertilizing function of the plant materials used as the treatments with which may enhance the amount of nutrients in the

soil after decomposition and hence increase the amount of nutrients available for the Celosia plant. Also the control of the nematodes in the treated plants could lead to good plant growth and early maturity.

RECOMMENDATION

In the absence of synthetic nematicides, it is recommended that farmers should adopt the use of soil amendment using plant based organic materials such as Rattle weed(*Crotolaria retusa),African marigold(Tegetes erecta),Basil(Ocimum gratissimum),* Brime tree stone(*Morinda lucida)* leaf e.tc. as plant extracts or plant powder to serve as soil amendment as a means of controlling plant parasitic nematodes in the soil. The plant materials are cheap, environmentally friendly, renewability of the soil, biodegradability and readily available to the farmers most especially the local farmers and the plant residue improves soil fertility and has low toxicity to mammals.

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APPENDIX

Table 1: Effects of Carbofuran and *Morinda lucida* extract and powder on the mean number of leaves of *Celosia argentea*

WEEK(S) AFTER PLANTING

TREATMENTS	3	4	5	6	7	8	9	10	11
Carbofuran 1.5kgai/ha	6.67 b	9.67 b	33.67a bc	43.33 ab	69.67 b	125.67 a	141.33 ab	154.00 ab	155.67 ab
Carbofuran 1kgai/ha	7.67 b	11.00b	30.00a bc	40.33 bc	62.67 b	11.00a b	132.00 ab	144.33 ab	146.00 ab
Morinda lucida extracts 100%	7.67 b	9.67 b	24.00b c	34.00 bc	77.00 ab	133.67 a	177.00 a	192.00 a	193.00 a
Morinda lucida extracts 50%	8.67 b	9.00 b	25.33b c	29.67 bc	69.33 b	107.33 b	152.00 ab	168.00 ab	169.00 ab
Morinda lucida powder 2ton/ha	8.33 b	20.00a	49.33a	59.67 a	94.67 a	122.00 ab	177.00 a	189.67 a	190.33 a
Morinda lucida powder 1ton/ha	11.00a	20.67a	43.67a b	48.00 ab	91.00 a	112.67 ab	156.33 ab	171.33 ab	172.00 ab
Control	6.67 b	11.00b	18.00c	23.67 c	56.67 b	93.33b	110.67 ab	119.33 b	121.33 b
S.E	0.71	0.79	6.55	5.67	6.47	9.08	14.97	16.03	15.98

Table 2: effects of Carbofura and *Morinda lucida*_extract powder on the mean plant height (cm) of *Celocia argentea.*

WEEK(S) AFTER PLANTING

TREATMENTS	3	4	5	6	7	8	9	10	11
Carbofuran 1.5kg ai/ha	2.60a b	2.63b	7.03b	22.16 b	38.33 b	67.93 b	87.10a b	104.10 b	107.26 ab
Carbofuran 1kg ai/ha	3.10a b	3.03b	8.73b	20.73 b	33.53 b	63.50 b	78.03 b	97.900 b	101.26 b
Morinda lucida extracts 100%	2.16b	3.20b	7.23b	24.03 b	35.30 b	61.90 bc	92.10a b	111.10 ab	115.10 ab
Morinda lucida extracts 50%	3.80a b	3.03b	7.131 b	16.00 c	39.00 b	48.50 d	90.67a b	113.23 ab	115.73 ab

Morinda lucida powder 2ton/ha	3.06ab	3.93ab	10.30ab	33.20a	53.37a	74.33a	100.53a	122.53a	125.33a
Morinda lucida powder 1ton/ha	4.60a	5.20a	15.33a	25.13b	42.40a	67.33b	99.67a	116.46ab	118.90ab
Control	2.06b	2.93b	8.40b	15.46c	27.77c	57.13c	72.80c	84.93c	80.56c
S.E	0.61	0.51	1.66	1.74	3.62	1.89	4.42	5.89	5.53

Table 3: Effects of Carbofuran and *Morinda lucida* extract and powder on the mean number of branches of Celosia argentea.

WEEK(S) AFTER PLANTING

TREATMENTS	5	**6**	**7**	**8**	**9**	**10**	**11**
Carbofuran 1.5kg ai/ha	5.67ab	11.67ab	16.33b	19.33ab	31.67a	36.33a	39.67a
Carbofuran 1kg ai/ha	3.67b	10.00bc	15.00bc	18.33ab	26.67bc	32.67ab	36.00ab
Morinda lucida extracts 100%	2.67b	8.00c	19.67a	20.67ab	30.00ab	35.33ab	37.67ab
Morinda lucida extracts 50%	5.33ab	7.67c	14.67b	19.33ab	25.33c	31.00bc	34.33bc
Morinda lucida powder 2ton/ha	8.00a	13.33a	16.67b	22.67a	30.33ab	34.67a	37.00ab
Morinda lucida powder 1ton/ha	7.33a	11.67ab	15.33b	19.67ab	25.00c	29.67c	30.67cd
Control	5.00ab	9.00b	12.00bc	16.33b	18.00d	24.00d	27.00d
S.E	0.89	0.80	0.91	1.29	1.36	1.33	1.24

Table 4: Effects of Carbofuran and *Morinda lucida* extract and powder on means leaves area, Wet leaves, Wet root wt, wet shoot wt, dry leaves wt, dry root wt, dry shoot wt of *Celosia argentea*

TREATMENTS	Leaf area	wet leaf wt (g)	Wet root wt (g)	wet shoot wt (g)	dry leaf wt (g)	dry root wt (g)	dry shoot wt (g)
Carbofuran 1.5kg ai/ha	1047.00	48.23	30.40b	76.33	5.66ab	8.86b	12.73
Carbofuran 1kg ai/ha	1077.00	47.07	24.43b	80.67	6.00ab	8.00b	13.80
Morinda lucida extracts 100%	993.oo	54.07	34.33ab	83.43	6.03ab	7.63b	12.13a
Morinda lucida extracts 50%	998.00	50.77	29.07b	82.63	5.33b	6.93b	12.83
Morinda lucida powder 2ton/ha	1250.67	63.23	45.37a	106.67	8.23a	14.00a	17.46
Morinda lucida powder 1ton/ha	980.67	41.90	30.70b	88.10	6.00ab	9.10b	16.36

Control	1279.00	53.33	29.60b	89.23	6.26ab	7.70b	14.16
S.E	108.26	6.24	4.31	9.00	0.82	1.11	1.78
	NS	NS		NS			NS

Table 5: Effects of Carbofuran and *Morinda lucida* extract and powder on mean root gall index of *Celosia argentea*

TREATMENTS	ROOT GALL INDEX
Carbofuran 1.5kg ai/ha	2.17b
Carbofuran 1kg ai/ha	2.50b
Morinda lucida extracts 100%	2.17b
Morinda lucida extracts 50%	1.67ab
Morinda lucida powder 2ton/ha	0.83a
Morinda lucida powder 1ton/ha	1.00a
Control	3.33c
S.E	0.26