Evaluation of Leaf Powder and Extract of Datura Stramonium in Controlling Root Knot Nematode [*Meloidogyne Javanica* (Chitwood) 1949] on Sweet Melon in Yola, Adamawa State

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***Abstract*—**Laboratory and field experiments were conducted to evaluate the effect of plant extract of *Datura stramonium* at different concentrations on juvenile mortality of *Meloidogyne javanica.* In the laboratory, 5 ml of crude and diluted extracts were separately dispensed into petri dishes containing 1000 second stage juveniles of *M. javanica* in 10 ml of distilled water. Counts of dead nematodes were made for 72 hrs. There were four treatments and replicated three times. Petri dishes were arranged in a completely Randomised Design in the laboratory. The field experiment consisted of two local cultivars of sweet melon (EX-Jos and EX-Jimeta) and four treatments arranged in a split plot design. Each plant was treated with 5, 10 and 15 g of the powder. Data were collected on vine length, number of leaves, fruit weight, fresh vine weight, fresh root weight, root length, galling index, initial and final nematode population. In the laboratory the result showed that the crude extract gave the highest juvenile mortality (97 %), followed by 5ml dilution (92 %) and the least (0 %) in the control. The field results showed that the plants treated with 15 g of the powder gave longer vine length, higher fruit weights, lowest galling index and fewer nematodes than the control plants. It could be concluded that the plant materials had the potential for use as nematicide which could possibly replace the hazardous synthetic nematicide in the near future. From this study the plant powder and extract used were effective in reducing nematode population in both the laboratory and field trials. It is here by recommended that further research be carried out to determine the phytochemicals content of the plant responsible for reducing the population of nematodes.

Keywords*—Datura stramonium, Meloidogyne javanica,* Extract, Powder, Sweet melon.

I. Introduction

MELON (*Cucumis melon (Linn)*) is a monoecious plant belonging to the family *Cucurbitaceae* (Amar and Lev, 2011). Melon originated in Africa and southwest Asia, (Mohammed *et al.*, 2004; Agricultural guide, 2011). Melons production is concentrated in arid and semi arid regions, but they are grown in many states for local and interstate sales. California accounts for 70 % of total U. S production, followed by Texas and Arizona (Kemble, 2014). Sweet melon grows best on well drained upland, sandy loam soils with p.H levels between 6 to 6.5. Beds should be 6-8 inches high to facilitate drainage, and the optimum temperature range for germination is between 21^{0C} to 35^{oC} (Kemble, 2014). The demand for sweet melons has stimulated the selection and breeding of hundreds of cultivars belonging to numerous market types, some with local and others with regional or international distribution (Sensory *et al*., 2007; Denise *et al*., 2008 and Sebastian *et al.,* 2010). The sweet melon market types that are familiar in Nigeria are classified into; honey dew melon, musk melon, rock melon and water melon (Dalby, 2003; Denise *et al*., 2008; Creight *et al.,* 2010 and Talford, 2011). Nutritionally it is much higher in vitamin A and C. Melon contains up to 94 % water and the remaining 6 % nutrients.100 g serving of melon is a rich source of vitamins C, A, and iron (Burger *et al*., 2002; Powel, 2003 and Salmazl, 2009).

The problems of sweet melon production are pests and diseases which cause considerable yield loss (Akinsanmi *et al*., 2003). Grant (2007) and Esen (2008) reported that one of the major factors limiting profitability of sweet melon production is the damage caused by plant parasitic nematodes especially *Meloidogyne* spp. *Meloidogyne* spp is recognized as one of the plant parasitic nematodes of importance in sweet melon production in Nigeria. Typical symptoms of root knot nematode injury include stunting, unthriftiness, premature wilting, malformed fruit ripens slowly or unevenly chlorosis (yellowing), gall formation, and non-uniform growth and reduced stand establishment (Nasrallah, 2007; Trifonovo, 2011 and Roy *et al*., 2012), and below ground plant parts form a tight mat of short roots and galls on roots of melon (Susan, 2005; Schaefer *et al.,* 2009 and Paris *et al.,* 2011). The damage caused by root knot nematode on sweet melon has not been accurately determined, as infestation levels increases the damage and yield loss also increases (Olowe, 2009 and Szamosi *et al.,* 2010 and Noling, 2012).

Datura stramonium also known by its common names 'Jimson weed','devils snare' and 'datura'. It is a foul-smelling, erect, annual, freely branching herb that forms a bush up to 60-150 cm (Stace, 1997). The root is long, thick, fibrous and white. The stem is stout, erect, leafy, smooth and pale yellow green, the stem forks up repeatedly into branches,

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and each fork form a single, leaf and a single flower (Grieve, 1971). The leaves are about 8-10 cm long, smooth, toothed, soft and irregular undulated. The upper surface of leaf is dark green and the bottom light green. The leaves have a bitter and nauseating taste, which is imparted to the extracts even after the leaves are dried (Grieve, 1971). The flowers are trumpet shaped, white to creamy or violet in colour. The egg seed capsule is 3-8 cm in diameter and either covered with spines or bald, at maturity it splits in to four chambers, each with dozens of black seeds. All parts of the plant contain dangerous levels of the tropane alkaloids atropine, hyoscyamine and scopolamine, which are classified as delirients or anticholinergins (Preissel and Preissel, 2002). It is use in the treatment of asthma and as a form of anaesthesia during surgery (Austin, 2005).

Root-knot nematode *(Meloidogyne javanica)* is mostly found in northern Nigeria (Adegbite and Adesiyan, 2005). Nafeseh (2010) reported that it attack melon and cause considerably yield loss. Synthetic nematicides are costly and not affordable by the local farmers, beside its environmental hazards. Research on nematicidal potential of botanicals and their application is on the increase. Different plant parts are being tested to identify the sources of nematicidal substances. Mateeve, *et al.*(1998) evaluated leaf and root extracts of *Ocimum basilicum, Targetes patula, Allium sativa Allium cepa* at 1 % and 0.5 % at pre planting and after planting. They were found to be effective against root knot nematodes. This encouraged the undertaking of the present investigation on nematotoxic evaluation of plant materials which are available, cheap and environmentally friendly and as well as effective in controlling nematodes. The main objective of this work therefore was to evaluate the effect of leaf plant extract and powder of *Dadura stramonium* on *M. javanica* in both laboratory and field on sweet melon

II. Material And Methods

A. Preparation of plant extracts

Water soluble extracts of the plant was prepared using the method described by Agbenin (2005) as follows: 100 g of the leaf of *Datura stramonium* was ground separately with pestle and mortar, and poured into a 500 ml conical flask and 300 ml distilled water added. The set-up was allowed to stand for 24 hrs and centrifuged at 5000 rpm and filtered through What man No. 42 filter paper. The obtained filtrate was designated as crude extract and further diluted with 5, 10, and 15 ml distilled water before using it in the juvenile mortality test.

B. Extraction of Inoculum

The extraction of juveniles was carried out using the modified Baermann method (Whitehead and Hemming, 1965). This involved the use of shallow trays with sieves lined with tissue paper and macerated roots of tomato placed on it, water was poured in from the side of the tray to a level just submerging the materials on the sieves. This set up was left to stand for 24 hours and the nematode juveniles collected were decanted into a beaker. Aliquots of 10ml in syringes were taken and counted under a stereoscopic microscope using a grid counting dish and 1000 juveniles were used for each inoculation of juvenile mortality test and field experiment.

C. Juvenile mortality test

5 ml of crude and diluted extracts of *Datura stramonium* were separately dispensed into petri dishes using 5 ml syringe, except control which contained only distilled water. 1000 juveniles of *M. javanica* suspension were added to each petri dish with a 10 ml syringe. There were five (5) treatments replicated three times. Petri dishes were arranged in a Completely Randomized Design (CRD) in the laboratory. Dead nematodes were counted every 24 hours for three days and recorded as percentage. Identification of dead nematodes was done by touching them with a needle to see if they exhibit mobility. Mean percentage mortality were transform into graph.

D. Phytochemical analysis of plant materials

Phytochemical analysis of the leaf extract was determined in the laboratory using methods described by Sofowora (1993), Trease and Evans (1989) as follows:

E. Tannins

About 0.2 g the extract was mixed with water and heated on water bath. The mixture was filtered and ferric chloride was added to the filtrate. A brownish green solution indicates highly presence of tannins, colour change to dark green indicate moderately presence of tannins, while light green indicate slightly presence of tannins.

F. Saponin

About 0.2 g of the extract was shaken vigorously with 10ml of distilled water and heated to boil. Froting appearance of creamy miss of small bubbles was mixed with two drops of Olive oil and shaken vigorously and observed for the formulation of emulsion. Complete emulsion indicates high presence of saponin, partial emulsion indicates moderate presence of saponin and minimum emulsion indicates slightly presence of saponin.

G. Alkaloid

About 0.2 g of the plant extract was warmed with 1% H_2SO_4 for 5 minutes. It was filtered and few drops of Dragendolt reagent were added. Appearance of red precipitate indicates the presence of alkaloid. Also the reaction producing deep orange precipitate indicates high presence of alkaloid, orange precipitate indicates moderately presence of alkaloid and light orange precipitate indicate slightly presence of alkaloid.

H. Flavonoid

A quantity of 0.2 g of the plant powder was taken and heated with 10ml of ethyl acetate over a steam bath for 5 minutes. The mixture was then filtered and 5ml of the filtrate was shaken with 2ml of ammonia solution. Appearance of yellow colour indicate highly presence of flavonoid, colour change to cream which indicate moderately presence of

flavonoid and white colouration indicates slightly presence of flavonoid.

I. Field Experiment

The experimental plot measuring 23.5m x 29.5 m was ploughed and harrowed. Plots were then demarcated using split plot design. There were four treatments replicated three times. The two cultivars were the main plots while the different levels of plant powder serves as the subplots. Two seeds of the two cultivars Ex- Jos and Ex-Jimeta were planted at the depth of 2 cm at row spacing of 1.5 x 1.2 m. Seedlings were treated separately with 5, 10 and 15 g of the powder a week after emergence except the control which were not treated. Each plant was inoculated with 1000 juveniles of *M. javanica* at two weeks after emergence. Irrigation of the field was carried out once a week using generator to pump water from the nearby river through the channels into the beds within the field. Weeding was carried out twice at two weeks interval to prevent competition between the crops and the weeds for nutrients, space, water, and light and to keep the experimental plot clean. N.P.K (15: 15: 15) fertilizer was applied twice at the rate of 0.02 g/ plant. The first application was carried out at three weeks after emergence and the second dose was applied at six weeks after emergence. Data were collected on both above and below ground parts of the plant. Galls were rated using the rating scheme described by Sasser *et al*. (1984). Nematodes were extracted from the soil using the methods described by Whitehead and Hemming (1965). All data collected were subjected to Analysis of variance (ANOVA) and the means were separated using Duncan's Multiple Range Tests (DMRT) at 5 % level of probability.

III. Results And Discussion

The result of the phytochemical analysis is presented in table 1. The result indicated that the leaf extract contained slight amounts of alkaloid, moderate amounts of tannin and high amounts of saponins and flavonoids (Table 1). Figure 1 shows the effect of different levels of concentrations of *D. stramonium* on juvenile mortality of *M, javanica*. The result shows that the crude extract recorded the highest juvenile mortality (97 %), followed by 5 ml dilution (92 %) and lowest mortality (0%) was recorded in the control (Figure 1). The effect of the different levels of the extract on juvenile mortality could be due to the presence of tannins, alkaloids and flavonoids which have been reported to killed nematodes (Adegbite and Adesiyan, 2003, Umar, 2012). The results also indicated that the higher the concentration the more juveniles killed and vice versa. The control recorded 0 % mortality because it was only distilled water.

TABLE I
PHYTOCHEMICAL ANALYSIS OF EXTRACT OF *D. STRAMONIUM*

Extract	Phytochemical			
	Saponin	Tannin	Flavonoid	Alkaloid
D. stramonium	+++	++	+++	+

Key: + = slight presence, ++ = moderate presence, +++ = high presence

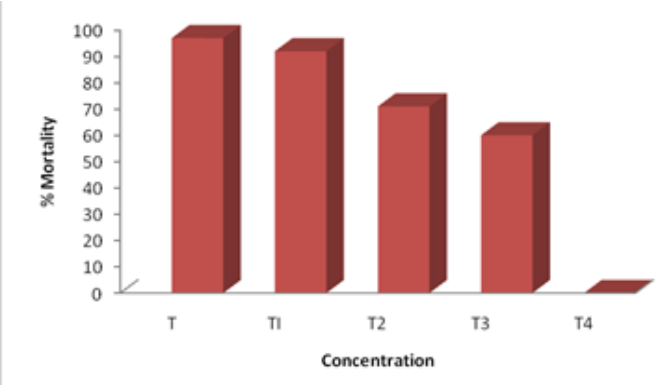

Fig. 1 Effect of different levels of *D. stramonium* on juvenile mortality of *M. javanica* in the laboratory

T= Crude extract, T1= Crude extract + 5 ml distilled water, T2= Crude extract + 10 ml distilled water, T3= Crude extract + 15 ml distilled water, T4=Control (only distilled water)

TABLE II
EFFECT OF DIFFERENT LEVELS OF *D. STRAMONIUM* POWDER ON *M. JAVANICA* ON SWEET MELON

Treatment	Parameter										
	VL (cm)	NL	NF	FW (g)	FVW (g)	DVW (g)	FRW (g)	DRW (g)	RL (cm)	GI	FNP
A. Powder											
5g	62.1c	95c	14c	420c	220c	117c	30b	18.2b	16.5c	3b	320b
10g	70.5b	120b	20b	550b	262b	125b	22c	10.4c	20.1b	2c	150c
15g	82.3a	139a	25a	720a	325a	160a	10d	5.6d	30.2a	1c	60d
CON	20d	50d	10d	150d	90d	25d	45a	24.5a	10.5d	5a	1250a
CV	16.2	17.5	15.3	19.6	20.3	19.0	20.3	20.1	19.6	18.6	19.5
B. Cultivar											
EX-JOS	66	110b	18a	519a	266b	71.1b	25.9a	5.4a	16.3a	2a	329a
EX-JIMETA	68	122a	19a	553a	300a	88.4a	26.7a	4.3a	16.4a	1a	275b
A*B	S	S	NS	NS	NS	NS	NS	NS	NS	NS	NS

VL= Vine length, NL= Number of leaves,NL= number of fruits, FW-Fruit weght,FVW- fresh vine weight, DVW- dry vine weght, FRW- fresh root weght, DRW- dry root weight, RL- Root length, GI- Galling index, FNP- Final nematode population.Means in the same colum followed by the same letter are not Significantly different at 5% according to Duncan's New Multiple Range Test

Table 2 shows the effect of the different levels of the powder on the control of nematodes in sweet melon fields.The result on vine length and number of leaves showed that plants treated with 15 g of the powder recorded the longest plants (82.3 g) and highest number of leaves (139), followed by those treated with 10 g of the powder and least in the control. The longer vines recorded might be due to the effect of plant powder incorporated into the soil to caused nematode mortality as a result of the phytochemical presence in the powder. The plants were probably able to utilize the available water and nutrients present in soil for their maximum growth and developments. Ismail *et a* .(2011) reported that the incorporation of waste residues from jojoba black seed oil extraction suppressed *Meloidogyne incognita* and increased yield of grapevine. The control recorded shorter vines and fewer leaves because the plants were not treated and allowed for more nematode activity which resulted in stunted plants. Barker *et al.* (2004) and Donald (2004) reported that severely nematode infected plants in control plants could become stunted, canopy development impaired and leaves become chlorotic depending on soil condition. The results on the number of fruits and fruit weights indicated that plants

treated with the 15 g of the powder recorded the highest number of fruits (25) and fruit weight (720 g) respectively and least in the control. This could be due to the nematicidal potential of the powder which not killed nematodes but also supply nutrients to the soil from its decomposing compounds which resulted in the increased in fruits and fruits weights.The treated plants recorded more fresh and dry vine weights as compared with the control. The control recorded lower weights because they had fewer leaves and vines as shown in table 2. Yujil *et al.* (2002) reported that incorporation of rock fleabane plant *(Inula viscosa)* powder at a concentration of 0.1 % in soil reduced second stage juveniles of root- knot nematodes (*M. javanica*). The treated plants also recorded longer roots, fewer galls and nematodes recovered from the soil. Amongst the treated plants, the 15 g treatments recorded the longest roots, fewer galls and nematodes. Saifullah (2012) reported that phytochemicals such as alkaloids, saponins, flavonoids, glycocides, tannins, steroids and phenols contained in soil amendments significantly reduced number of galls, egg masses, reproductive factor and increased yield and growth of plants. The control on the other hand recorded the heaviest roots, shorter roots, more galls and higher number of nematodes. This could be because the plants were not treated which resulted in more destruction to roots due to invasion by nematodes and in hypertrophy and hyperplasia of cells set in. Abubakar *et al*. (2004) observed an increased in the population of *Meloidogyne incognita*, higher root galls, poor growth and yield of tomato in the control plants.

IV. Conclusion And Recommendation

The result of the study showed that *D. stramonium* crude extract and 15 g of the powder reduced the population of *Meloidogyne javanica* invivo and invitro and increased the growth and yield of sweet melon. It is recommended that further laboratory study be carried out to determine the chemical isolates responsible for killing the nematodes.

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