

## **EFFECTS OF AQUEOUS EXTRACTS OF *JATROPHA CURCAS* PARTS ON *MELOIDOGYNE INCOGNITA* INFESTING SOYBEAN (*GLYCINE MAX*)**

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### **ABSTRACT**

Effects of the aqueous extracts of different parts of *Jatropha curcas* plant on *Meloidogyne incognita* infesting soybean was analyzed in Federal College of Agriculture Ishiagu in 2017. The soybean seeds were planted in micro-plots laid out on a platform and inoculated with 3000 eggs of *M. incognita*. The inoculated pots were treated with various extracts of leaf, stem and root at 1 Kg/l of *Jatropha curcas* with distilled water as control. The experiment was laid out in completely randomized design with the treatments replicated five times. Data were collected on plant height, number of leaves, number of pods, weight of pods, weight of 1000 seeds, number of galled roots and number of juvenile per 100 g soil and root length at harvest and subjected to analysis of variance. All the extracts significantly ( $P < 0.05$ ) increased all the growth parameters when compared with the control except the number of pods produced by the plants. In all the parameters, the root extract performed better than other treatments. The extracts showed varying potencies of their nematicidal properties against *M. incognita* and could be employed in the field.

Key words: Extracts; *Jatropha* parts; *M. incognita*; Nematicidal; Potencies;

### **INTRODUCTION**

Soybean (*Glycine max*) belongs to the leguminous family and a sub-family (*Fabaceae*). It is a subtropical plant, native to Southeastern Asia. It is one of the finest stable legumes either consumed directly or used in the constitution of high quality animal feeds such as poultry and fishery amongst others in Nigeria.

Root-knot nematode, *Meloidogyne incognita* (Kofoid and white chitwood) (*Tylenchida: Heteroderidae*) is a major plant parasitic nematodes affecting quantity and quality of the crop (soybean) production in many annual and perennial crops. Infected plants shows typical symptoms including root galling, stunting and nutrient deficiency, particularly nitrogen deficiency (Siddique *et al.*, 2001). Davis and May

(2005), reported that the yield loss in soybean production caused *Meloidogyne incognita* in 2002 was estimated to be between 18.0-47.3%. Root-knot nematode (*Meloidogyne*) are among the most destructive nematodes in agriculture, causing an estimated yearly crop loss of \$100 billion worldwide (Oka *et al.*, 2000). Nematodes are difficult to control because of their wide host range and high rate of reproduction, with females capable of producing up to thousand eggs/female (Natarajan *et al.*, 2006). Plant parasitic nematodes are recognized as the causes of serious yield losses on a wide range of crops (Javad *et al.*, 2006). The most destructive species is *Meloidogyne incognita* which cause serious problem in various agricultural crops.

Chemical control is expensive and is economically viable only for high value crops and creates a potential hazard to the environment and human health (Tsay *et al.*, 2004). Because of these inconveniences, scientists identified natural products with nematicidal activity such as, root exudates, plant volatile compounds and entophytic bacteria (Vetrivelkalai *et al.*, 2010, Pavaraj *et al.*, 2010). Hence, the present study has been carried out to evaluate extract of physic nut (*Jatropha curcas*) root, stem and leaves for their nematicidal properties against *Meloidogyne incognita*

## **MATERIALS AND METHODS**

The research was carried out at the Research and Teaching Farm of Federal College of Agriculture Ishiagu, Ebonyi State. Ishiagu lies within the latitude 05° 56' N and longitude 07 ° 41 ' E in the derived savanna zone of South-Eastern Nigeria with mean annual rainfall of 1350 mm and temperature of 30°C..

### **Soil sterilization**

The top soil (0.3m depth) was collected from the experimental site at the Federal College Agriculture Ishiagu, Ebonyi State. The soil collected was sterilized at 50°C for three hours to ensure that no micro-organism was left alive without destroying the soil nutrients.

### **Platform preparation**

A platform was constructed with bamboos measuring 1.2 m x 0.53 m and height of 0.15m. The soil used for potting after sterilization was sandy- loam soil.

### **Potting and sowing**

Black perforated polythene bags of 30 cm x 30 cm x 30 cm were filled with 5 kg of sterilized soil. Soybean seeds were sown at the depth of 2 – 3cm. The seeds were planted one (1) in each pot.

### **Preparation of leaf, stem and root extracts**

One kilogram of fresh leaves, stems, and roots of *Jatropha curcas* was weighed with citizens' electronic weighing balance.

The plant leaves, stems, and roots were chopped (macerated) into pieces with knife to facilitate the extraction (Ogwulumba, 2007). They were soaked separately in different containers that contained one (1) liter of distilled water each and left for 24 hours. After that, the soaked macerated plants parts (stem, leaves and roots) were filtered using cheese cloth. The filtrate became the aqueous extract of the leaves, stem and roots.

#### **Source of nematode inoculum**

This was obtained from infected roots of spinach which were maintained in containers of soil infested with *Meloidogyne incognita*. The roots were thoroughly washed with distilled water and cut into pieces of about 2 mm long and put into a 100 ml measuring cylinder. 200 ml of 0.5% sodium hypochlorite solution was poured into the measuring cylinder, tightly capped and shaken vigorously for 5 minutes to dissolve the gelatinous matrix, thus freezing the eggs from the mass (Hussey and Barker (1973).

#### **Inoculation**

Each of the soybean stand contained in the micro plots was inoculated with root-knot nematode (*Meloidogyne incognita*), eggs with the use of syringe. Each micro plot received 3000 eggs.

#### **Application of the extracts**

Thirty minutes after inoculation of the nematode eggs, the leaf, stem and root

extracts were applied respectively, 100 mls per stand per treatment. Sterilized distilled water was used as control. This was done once.

#### **Estimation of juveniles of *Meloidogyne* population in the soil**

Soil samples for each treatment were collected from each pot, close to the plant roots, at harvest and were taken to the laboratory after harvesting. The soil was wrapped with a tissue paper and placed on a rubber bucket containing distilled water. The water in the bucket had slight contact with mesh containing the tissue wrap of soil and allowed for forty-eight (48) hours for nematodes to crawl out of the soil. After which the wrapped tissue was removed and a binocular microscope was used to count and estimate the number of nematodes in the container under the microscope.

#### **Experimental Design**

The experimental design used in this research was completely randomized design (CRD), with four treatments replicated five times.

#### **Collection of Data**

Data were collected on the plant height (cm) and number of leaves at 10 weeks after inoculation, number and weight(g) of pods and weight (g) of 1000 seeds per treatment at harvest, number of galled roots, number of juvenile per 100g soil and root length/plant at harvest.

#### **Statistical Analysis**

The data collected were subjected to analysis of variance (ANOVA). Significant treatment means were separated using F-LSD = LSD at 5% level of probability as outlined by Obi (2002).

## RESULTS AND DISCUSSION

Table 1, shows the results obtained from the plant height and number of leaves at ten (10) weeks after planting. The extracts

significantly ( $P < 0.05$ ) affected the plant height and number of leaves produced by the plants. All the extracts significantly ( $P < 0.05$ ) differed from the control while the root extracts increased the plant height and number of leaves significantly ( $P < 0.05$ ) more than other two extracts. The highest plant height of 34.58 cm and number of leaves of 59.10 were obtained from the plots treated with root extract.

**Table 1: Plant Height at Ten Weeks after Planting (10 WAP)**

	Plant height (cm)	Number of leaves
Control	15.43	17.15
Leaf	25.13	43.30
Stem	27.18	47.35
Root	34.58	59.10
LSD <sub>0.05</sub>	4.56	6.12

The *Jatropha* extracts did not have any significant ( $P > 0.05$ ) effect on the number of pods produced by the plants but affected significantly ( $P < 0.05$ ) the weight of pods and weight of 1000 seeds at harvest wherein the root extract proved better than other treatments (Table 2).

The highest pod weight (45.50 g) and 1000-seed weight (11.25 g) were all obtained from the plots treated with the root extract whereas the control plots produced the lowest values of 14.35 g and 4.75 g of pod weight and 1000 – seed weight respectively.

**Table 2: Effect of *Jathropha* extracts on number and weight(g) of pods and weight(g) of 1000 seeds at harvest.**

	Number of pods	Weight(g) of Pods	Weight(g) of 1000 Seeds
Control	10.75	14.35	4.75
Leaf	11.10	43.75	9.50
Stem	12.70	45.35	9.00
Root	12.80	45.50	11.25
LSD <sub>0.05</sub>	NS	7.32	1.28

NS = Not significant

The *Jatropha* extracts significantly ( $P < 0.05$ ) reduced the number of galled roots, number of juvenile and increased significantly ( $P < 0.05$ ) the root lengths of those treated with the extracts (Table 3).

The highest number (23.70) of galled roots was obtained at the control plots which differed significantly ( $P < 0.05$ ) from those obtained from other treatments, while the plots treated with root extract produced the lowest number (4.30) of galled roots at harvest. However, the extracts did not differ significantly ( $P > 0.05$ ) from each other.

The highest number (24.03) of juvenile was obtained from the control plots which differed significantly from those obtained from those plots treated with the extracts, while the plot treated with the root extract produce the lowest number (6.20) of juvenile though did not differ significantly ( $P > 0.05$ ) from the other two treatments at harvest.

The highest number of root length (37.79 cm) was obtained from the plots treated with root extract while the lowest root length (4.96 cm) was obtained at the control plot which differed significantly ( $P < 0.05$ ) from the other treatments.

**Table 3: Effect of *Jathropa* extracts on the Number of galled roots, juvenile and root length at Harvest**

Plant parts extracts (1kg /l)	Number of Galled roots	Number of juvenile / 100g soil	Root length (cm)
Control	23.70	24.03	4.96
Leaf	9.50	7.25	25.46
Stem	4.95	7.25	29.70
Root	4.30	6.20	37.79
LSD <sub>0.05</sub>	7.16	2.61	5.17

## DISCUSSION

Results have shown that there was a general reduction in nematode (*Meloidogyne incognita*) infestation of soybean (*Glycine max*) upon application of various aqueous extracts of *Jatropha curcas*.

The significant increase in the plant height and number of leaves produced by the plant in the plots treated with the various plant part extracts showed the ability of the extracts in suppressing or militating against the attack of the nematode and its effects on the growth parameters of the plant. The application of the extracts which have nematicidal properties created a conducive environment for the thrive of the plants resulting in the enhancement of the growth parameters of the plants in the treated plots.

This was in line with the findings of Natarajan *et al* (2006) who reported that extract of *Tagetes erecta* boosted the height of tomatoes growing on nematode infected soil.

The lower yield in the control plots showed the attacking prowess of *M. incognita* on soybean. The nematode fed freely on the roots of the plants due to absence of any control measures to checkmate the incidence and severity of the nematode attack on the plants, thereby causing enormous damage and yield reduction in the plants. Oka *et al*; (2000) reported that *M. incognita* are among the most destructive nematodes in agriculture, causing an estimated yearly loss of \$100 billion worldwide. Javad *et al*, (2006) also reported that plant parasitic nematodes are

recognized as the cause of serious losses on a wide range of crops. Davis and May (2005) equally reported that the yield loss of soybean production caused by *Meloidogyne incognita* in 2002 was estimated to be between 18.0-47.3%.

The yield parameters increased in the plots treated with the extracts indicating that the plants thrive in an environment with less interference from the nematodes. This also proved that the extracts have the potentials of inhibiting the activities of the nematodes and other potential dangerous microbes thereby allowing the plants to yield better than those in the control plots. Similar results were found by Ugwuoke *et al.*, (2011) where the extracts of *P. biglobosa* on *C. alata* prevented the infection of other microbes and supply the growing plants with carbohydrate (essential macronutrient) for maximum growth and proper respiration in plant.

The aqueous extracts of *J. curcas* reduced significantly the number of *juvenile* on soybean plant when compared with the control. The reduction in the number of *juvenile* in this work was as a result of the nematicidal activity of *J. curcas* which led to the reduction in the number of galled roots and *juvenile* per 100 g soil. This results were in line with the work of Kuete *et al.*, (2007) and Eyong *et al.*, (2006) where the extract of *N. laevis* was reported to have antimicrobial property.

**Conclusion:** In conclusion, the various extracts from the different parts of *Jatropha curcas* proved their nematicidal properties against *Meloidogyne incognita* infesting soybean with the root extract having more nematicidal properties. These extracts could be used in the field to suppress the activities of the nematode thereby increasing the growth and yield parameters of the test crop.

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