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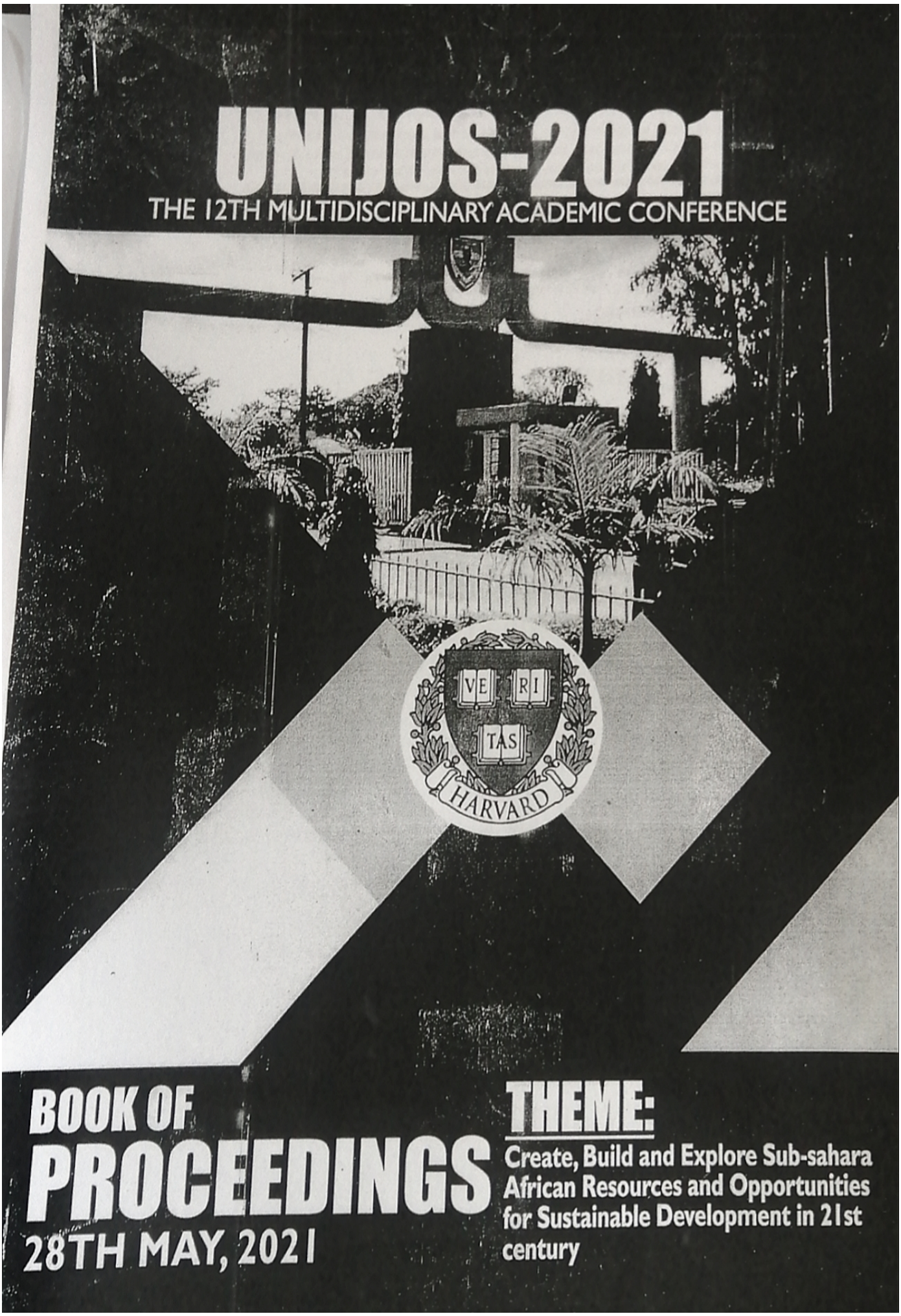

BOOK OF PROCEEDINGS

28TH MAY, 2021

THEME:

Create, Build and Explore Sub-sahara African Resources and Opportunities for Sustainable Development in 21st century

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FOR THE

THEME
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- *Medical and Pharmaceutical Sciences*
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- *Environmental*
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EFFECTS OF SOWING TREATMENTS OF CANDLE BUSH (*SENNA ALATA*) EXTRACT ON JUTE MALLOW (*CORCHORUS OLITORIUS*) INFECTED WITH ROOT KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*)

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Abstract

This present study was conducted to evaluate the effects of sowing treatments of Candle bush (*Senna alata*) extract on Jute mallow (*Corchorus olitorius)* infected with root knot nematode (*Meloidogyne incognita*). Four cultivars of *Corchorus olitorius*, including A (NGB00229), B (NGB00209), C (NGB00277) and D (NGB00215) were evaluated for physiological and morphological parameters. Plant height, leaf number, leaf area, biomass weight and root gall index were used as agronomic indices. Seeds were sourced from the National Center for Genetic Resources and Biotechnology (NACGRAB), Ibadan, Oyo State and seeds were treated using the recommended heat treatment method in order to break seed dormancy. The seeds were sown using the Completely Randomized Block design (CRD), with four replications and the *C. olitorius* cultivars as the treatment. Results showed significant differences in most of the traits evaluated for the four cultivars except for stem girth, number of pods and their relative weights which was not significantly different for all the cultivars. The present study indicated enough variation among the extract concentrations for all the cultivars which can in turn help to broaden the genetic bases of new cultivars to reduce nematode insurgence.

Keywords: cultivars, traits, root knot nematode and physiological parameters.

Introduction

Nematodes or roundworms as described by Hodda and Zhang, (2011; 2013), as a diverse animal phylum inhabiting a broad range of environments. Taxonomically, they are classified along with insects and other moulting animals in the clade Ecdysozoa, and unlike flatworms, have tubular digestive systems with openings at both end.

Nematodes are very small, slender worms: typically about 5 to 100 µm thick, and 0.1 to 2.5 mm long, Weischer and Brown, (2000). Kavlie *et al.*, (2010) , describes the smallest nematodes are microscopic, while free-living species can reach as much as 5 cm (2 in), and some parasitic species are larger still, reaching over 1 m (3 ft) in length. The body is often ornamented with ridges, rings, bristles, or other distinctive structures (Lalosevic *et al.*, 2013).

Chitwood, (2016), reported that global losses associated to root-knot nematodes (RKNs) alone from 75 countries as at 2000 was valued at $121 billion. Phytoparasitic nematodes are considered as hidden enemies, which can cause yield losses up to 80% in vegetables and have been associated with the severely infested fields (Tariq-Khan *et al* .,2017).

Corchorus olitorius L., commonly known as wild okra, belongs to the family Tiliaceae. It is widely consumed as a vegetable among rural communities in most parts of Africa (Velempini *et al.*, 2003). In West Africa it is commonly cultivated and very popular among people of all classes especially in Nigeria (Oyedele *et al.*, 2006). According to Zakaria *et al.* (2006), wild okra is used in folklore medicine in the treatment of gonorrhea, chronic cystisis, pain, fever and tumors. *Corchorus olitorius* is known to contain high levels of iron and folate which are useful for the prevention of anemia (Oyedele *et al.*, 2006).

Senna alata is an important medicinal tree, as well as an ornamental flowering plant in the subfamily Caesalpinioideae, which grows well in forest areas of West Africa (Owoyale *et al.*, 2005). The result of the qualitative analysis of the leaf carried out by Sun *et al.*, (2009), indicated

that alkaloids, quinones, saponins, phenolic compounds, flavonoids, tannins, and anthraquinone were present.

According to Islam, (2013), the most serious pests are nematodes from the genus *Meloidogyne*, leaf-eating beetles and caterpillars. If it is dry, eight to ten weeks after planting, yield losses can occur due to leaf bugs and spider mites attacks resulting in terminal shoot wilt. Damage by nematodes can be minimized by crop rotation. Application of insecticides is also possible, but agent and application time should be chosen carefully since the leaves are harvested for consumption. The mineral composition of the leaves of *C. olitorius* revealed high concentrations of Mg, Fe and Ca.

Materials and Methods

Source of plant accessions

Four cultivars of jute mallow which includes *corchorus* NGB00229; NGB00209; NGB00277 and NGB00215 were obtained from the National Center for Genetic Resources and Biotechnology (NACGRAB), Ibadan, Oyo State, Nigeria. While the leaves of *Senna alata* were collected from a fully grown and mature tree in Gurara, Minna, Niger State. Enough leaves were collected using cutlass, packed in labeled polythene bags and transported to the Crop Production Department for extraction.

Field experiment

Conical flasks of 10 cm in diameter and Polly pots will be used for this research work. The conical flasks will be arranged on the laboratory bench while the Polly pots will be arranged in the screen house in a Completely Randomized Design (CRD). For each of the extract, 200 ml of each of the concentration levels will be poured into the conical flasks after steeping (pre soaking in hot water) using a pipette. At the beginning of the experiment, four hundred (400) seeds of the four cultivars of *Corchorus olitorius* will be transferred into hot water with a temperature of 93 ^{o}C and allowed to soak for 10 seconds to overcome dormancy using four different conical flasks labeled A (NGB00229), B (NGB00209), C (NGB00277) and D

(NGB00215). After 10 seconds, these seeds will be sieved out using a filter paper and transferred into the various solutions labeled S (100 %), S (75 %), S (50 %), S (25 %) and the control (distilled water). This will be done to allow the seeds further absorb each of the extract in order to increase their viability and germination capacity while increasing their anti-nematicidal properties prior to inoculation. The seeds will be allowed to soak further for 10 minutes and later air dried which will take place 24 hours before sowing in the nursery. The treatment will be replicated four times and a control which will be kept at an ambient temperature ranging from 30°C-34°C in the laboratory during the course of the research. The experiment will be a 4×4×5 treatment combination making a total of 80 treatments combinations. The results of the data will be analyzed using the analysis off variance (ANOVA) and the means will be separated by Duncan's Multiple Range Test (DMRT) at 5 % level of probability level.

Pot Experiment

The pot experiment will be conducted under screen house conditions. Poly pots (16 cm by 25 cm) will be filled with 2 Kg sterilized soil in the ratio 3: 1 (sandy loam: farmyard manure). Each pot will be inoculated with 10 egg masses of *M. incognita* containing about an average of 200 larvae by making grooves around the roots at the same distance from the base. The experiment will be carried out in a Completely Randomized Design (CRD) with four replications of each treatment and control. Untreated uninoculated plants will be taken as control.

Results

Data collection will begin two weeks after inoculation and would continue on a weekly basis for a period of eight weeks i.e. 3, 4, 5, 6, 7, 8, 9 and 10 weeks respectively. The data will be analyzed for the growth, physiological parameters such as: number of leaves per plant, leaf area, plant height, stems girth, number of pod per plant, average pod length, pod weight, biomass fresh weight, biomass dry weight and root gall index.

Most of the cultivars were found immune according to the rating scale of Table 1 based on the number of galls on the root system. (Table 2): The resistance rating of the cultivars was: NGB00229 (highly resistant), NGB00209 (highly resistant), NGB00277 (highly resistant), NGB00215 (moderately resistant). The cultivars NGB00229 had a higher plant height compared to the other cultivars at week 2 but was not significantly different from NGB00277 and NGB00215 at week 4. The 100% concentration at 4 weeks showed a higher plant height than those of other concentrations including the control for all the cultivars.

While at 7 weeks after inoculation, the plant height did not differ significantly from each other for the various concentration levels but differ significantly among the cultivars. Significant differences were also recorded among the cultivars across the weeks with regards to the number of leaves. The highest number of leaves was recorded for cultivars NGB00229, followed by NGB00209, NGB00215 and then NGB00277. The least number of leaves was observed in cultivar NGB00215 which behaved similarly for other parameters. Significant differences was not observed in traits such as stem girth, number of pods and their respective weights but there were slight differences in the root gall index with cultivar NGB00215 showing the highest susceptibility to root knot nematode infestation.

Table 1: Rating scale for the assessment of level of resistance of plant cultivars against root knot nematodes, based on number of galls (Sasser and Taylor, 1978).

Root knot index	No. of galls/root system	Resistance rating
1	1-2	Highly resistant
2	3-10	Moderately resistant
3	11-30	Moderately susceptible
4	31-100	Susceptible
5	>100	Highly susceptible

Table 2: Reproduction of Root knot nematode on the five cultivars and resistance rating of the nematode

Cultivars	Root Gall Index	Reaction
NGB 00229	0.900^{b}	highly resistant
NGB 00209	1.700^{b}	highly resistant
NGB 00277	1.850^{b}	highly resistant
NGB 00215	4.450^{a}	moderately resistant
SE	±0.399	

Values in each column followed by the same letters are not significantly different according to Duncan's Multiple Range Test ($P \leq 0.05$).

Table 3: Result of the plant height for the concentration levels of the extract and the on four cultivars of *Corchorus olitorius*.

Cultivars	Concentrations	Week 2	Week 4	Week 7
NGB 00229		45.68^{a}	58.79^{a}	59.14^{b}
	100%	46.06^{a}±2.08	63.32^{a}±3.08	63.54^{ab}±3.22
NGB 00209		38.23^{b}	44.27^{b}	46.38^{c}
	75%	35.72^{b}	52.06^{b}	55.38^{b}
NGB 00277		40.90^{ab}	57.90^{a}	64.97^{b}
	50%	43.22^{a}	60.60^{ab}	67.84^{a}
NGB 00215		41.89^{ab}	65.28^{a}	73.13^{a}
	25%	42.78^{a}	53.41^{b}	58.98^{ab}
	Control	40.58^{ab}	53.40^{b}	58.78^{ab}
SE (cultivars)		±1.86	±2.76	±2.88

Values in each column followed by the same letters are not significantly different according to Duncan's Multiple Range Test ($P \leq 0.05$).

Table 4: Result of the number of leaves on four cultivars of *Corchorus olitorius* infected with *Meloidogyne incognita*.

Cultivars	Week 1	Week 3	Week 5	Week 7
NGB 00229	31.65[a]	81.70[a]	119.65[a]	126.55[a]
NGB 00209	32.95[a]	73.35[ab]	105.45[ab]	101.70[a]
NGB 00277	16.70[b]	47.35[c]	92.05[b]	86.00[b]
NGB 00215	27.75[a]	62.00[b]	98.00[b]	83.95[b]
SE	±1.90	±4.29	±6.76	±7.73

Values in each column followed by the same letters are not significantly different according to Duncan's Multiple Range Test ($P \leq 0.05$).

Discussion

Most of the plant growth characters of the jute mallow cultivars were significantly negative correlated with the number of galls of *M. incognita*. Moreover it can be suggested that egg masses also had an indirect effect on the reduction of plant growth. *Meloidogyne* spp. induces galling in the roots and giant cells formation in the stellar region, which destroys the xylem tissues and ultimately reduces the absorption and movement of water and nutrients (Abad *et al.*, 2003). This limitation of nutrient elements in the plant is probably the initial effect that the nematode infestation has on the physiology and metabolism of its host (Lu *et al.*, 2014). These effects increase with the duration of infestation (Melakeberhan *et al.*, 1987). Reduction in chlorophyll content has also been reported to lead to the disturbance of nodule function (Chahal *et al.*, 1983). In conclusion, the current study demonstrated that the four cultivated jute mallow cultivars are highly resistant to *M. incognita* with the exception of the cultivar NGB00215, which was found moderately resistant after pre-sowing the seeds with *Senna alata* extract. Also the highest concentration (100%) of

Senna alata performed the best when compared to other concentration levels in reducing the effect of root-knot nematode infestation.

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