



## 2. MATERIALS AND METHODS

### 2.1 Study Location

The study was carried out at Horticulture and Nursery Garden of the Department of Crop production, Federal University of Technology Minna (9° 51 'N, 6° 144 E and 212 m above sea level), Nigeria. Minna falls under the Southern Guinea Savanna ecological zone of Nigeria with average annual rainfall of about 1200mm. The rainfall is distributed between April and early October with peak around September. Temperature ranges from 35 °C to 37.5 °C while the relative humidity is between 40 and 80 %.

### 2.2 Source of Okra Seeds

Clemson spineless, used was sourced from an Agro chemical store in Minna.

### 2.3 Experimental Layout

The treatments; three botanical extracts and a synthetic insecticide were arranged in Completely Randomized Design (CRD) and replicated three times.

### 2.4 Source of Botanicals

The leaf of Moringa, *Moringa oleifera*; Neem, *Azadiracta indica*; Red Jatropha, *Jatropha gossypifolia* were obtained from Landscaping unit of The Federal University of Technology, Gidan kwano Campus Minna, with the aids of cutlass and knife .

### 2.5 Preparation of leaf extracts

The leaves were carefully removed from the branches and 1 kg of the weighed leaves were crushed into paste. Each paste was put into different container and 100 ml of distilled water was added to each paste in the plastic container. The mixture was then stirred using a clean glass rod, covered with aluminum foil to prevent evaporation and left for 24 hours. After 24 hours, the paste was blended in an electric blender and another 100 ml of distilled water was added, stirred with the magnetic stirring rod and covered with aluminum foil, then the blended mixtures were filtered and the liquid content separated. Some drops of streptomycin sulphate were added to prevent bacterial growth in the concentrations.

### 2.6 Treatments

Neem: *Azadiracta indica* leaf extract

Moringa: *Moringa oleifera* leaf extract

Red Jatropha: *Jatropha gossypifolia* leaf extracts

Cypermethrin (as check)

### 2.7 Agronomic Practices

#### 2.7.1 Seed Sowing

Okra seeds were sown at 2 seeds per pot. Application of water was done on daily basis and weeding was done by hand pulling.

#### 2.7.2 Thinning

At 2 week after sowing (WAS) okra seedlings were thinned to one stand per polythene pot.

#### 2.7.3 Fertilizer Application

NPK (15:15:15) fertilizer was applied by side placement and 5 cm away from the plants and covered at 2 weeks after sowing (WAS).

#### 2.7.4 Application of botanical extracts and systemic insecticides

The extracts were applied at 4, 5, 6 and 7 weeks after sowing (WAS).

### 2.8 Data Collection

#### 2.8.1 Plant Height

Okra plants were measured from the base of the plants to the tip of the longest leaves using meter rule at 4,5,6,7 WAS.

#### 2.8.2 Leaf's Number

The number of leaves of each okra stand were counted at 4,5,6,7 WAS.

#### 2.8.3 Number of holes

Holes created by insects on okra leaves were counted at 4, 5, 6 and 7 WAS.

#### 2.8.4 Days to First Flower Opening

The number of days from sowing to the first flower opening was counted

#### 2.8.5 Days to 50% Flowering

This was obtained by counting the number of days from sowing to when 50% of the plant population flowered

#### 2.8.6 Fresh Weight

After harvest, fresh weight of the fruits was taken.

#### 2.8.7 Data Analysis

The data collected from all parameters were subjected to analysis of variance (ANOVA) using statistical Analysis system procedure. The treatment means were separated using Duncan multiple range test (DMRT) at  $p \leq 0.05$ .

## 3. RESULT

### 3.1 Effects of Botanical Extracts on Infestation of Insect Pests of Okra Plant

The effect of botanical extracts on okra leaves at 4 WAS showed that there was no significant difference between control and botanical extract treatments (Table 1). Neem extract had the highest (5.33) number of holes; followed by control (3.00), *Jatropha* extract (1.67), systemic insecticide (Cypermethrin) (0.67) and *Moringa* extract (0.33) had the fewer number of holes. No significant difference among the treatments was recorded at 5 WAS, Neem extract had the highest number of holes (5.33), control (4.00), and *Jatropha* extract (3.00) while systemic insecticide (cypermethrin) (1.33) and *Moringa* extract had the least number of holes (0.33). So also, there was no significant difference ( $P < 0.05$ ) between the treatments in 6 WAS, it was observed that neem extract had the highest number of holes (5.33), control (4.00), *Jatropha* extract (3.00), systemic (1.33) and moringa extract (0.33). Lastly in 7 WAS, there was no significant difference between the treatment groups. Control and neem extract had the same highest number of holes (5.33), *Jatropha* extract (3.00), Cypermethrin (1.33) and moringa extract with the lowest number of holes at (0.33).

### 3.2 Effect of Botanical Extracts on Number of Leaves Per Plant

The effect of botanical extracts on number of leaves of okra at 4 – 7 weeks after sowing (WAS) (Table 4.2). There was no significant difference recorded among the various treatments, although Neem leaf extracts had the highest number of leaves at all the weeks followed by Cypermethrin.

### 3.3 Effect of Botanical Extracts on Plant Height Per Stand

This shows the effect of botanical extracts on plant height per stand at 4 – 7 weeks after sowing (WAS). At 4 WAS, there was no significant difference among the botanical extracts, Cypermethrin and Control. At 5WAS, *Moringa* extract recorded the tallest significant different ( $p \leq 0.05$ ) plant. But no significant difference among all treatments used for the research at 6 and 7WAS.

### 3.4 Effect of Botanical Extracts on Day To Flowering of Okra.

Effect of the botanicals on this trait was significant ( $P \leq 0.05$ ) with *Jatropha gossypifolia* extract and Cypermethrin recorded the earliest day to flowering (41 days), followed by *Moringa oleifera* (42 days) to flowering with control and Neem *Azadiracta indica* having 48 days and 49 days respectively .There was significant difference ( $P \leq 0.05$ ) between Neem extract and all others botanical extracts.

### 3.5 Effect of Some Botanical Extracts on The Fruit Yield of Okra Plant.

*Moringa (Moringa oleifera)* extracts was recorded to have the highest fruit yield (46.94 g), followed by Cypermethrin (34.7 g) with *Jatropha gossypifolia* extract and Neem *Azadiracta indica* extracts recorded 6.95 g and 24.37 g respectively. Control had lowest yield which was 21.36 g.

Table 1: Effect of botanical extracts on Infestation of insect pests of okra				
Number of holes				
Treatment	4 WAS	5 WAS	6 WAS	7 WAS
Control	3.00a	4.00a	4.00a	5.33a
Neem Extract	5a	5a	5a	5a
Jatropha Extract	2a	3a	3a	3a
Systemic	1a	1a	1a	1a
Moringa Extract	0.33a	0.33a	0.33a	0.33a
LSD±	5.43	6.51	6.51	6.27

Means followed by similar alphabet(s) in the same column are not significantly different at ( $P \leq 0.05$ ) by Duncan Multiple Range Test (DMRT)

**Table 2: Effect of botanical extracts on number of leaves of okra**

Number of Leaves				
Treatment	4 WAS	5 WAS	6 WAS	7 WAS
Moringa leaf Extract	5	6	7	8
Neem leaf Extract	5	5	8	8
Jatropha leaf Extract	5	5	7	7
Cypermethrin	5	6	8	8
Control	4	5	7	7
LSD±	0.95	1.09	2.53	2.16

Means followed by similar alphabet(s) in the same column are not significantly different at ( $P \leq 0.05$ ) by Duncan Multiple Range Test (DMRT)

WAS: Week after Sowing

#### Effect of botanical extracts on plant height of Okra at 4 – 7 weeks after sowing (WAS)

Plant Height (cm)				
Treatment	4 WAS	5 WAS	6 WAS	7 WAS
Moringa leaf Extract	17.33a	24.00a	32.67a	44.00a
Neem leaf Extract	16.67a	21.33b	27.67a	36.00a
Jatropha leaf Extract	16.67a	22.67ab	28.67a	35.33a
Cypermethrin	16.33a	23.67a	28.33a	37.00a
Control	16.67a	23.33a	29.33a	40.33a
LSD±	1.52	1.28	4.41	8.50

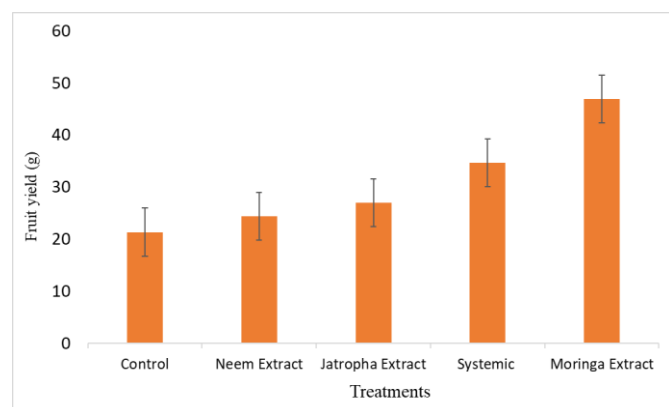
Means followed by similar alphabet(s) in the same column are not significantly different at ( $P \leq 0.05$ ) by Duncan Multiple Range Test (DMRT)

WAS: Weeks after Sowing

#### Effects of Botanical extracts on days to flowering of okra plant

Days to Flowering	
Treatment	
Moringa leaf Extract	42 <sup>a</sup>
Neem leaf Extract	49 <sup>a</sup>
Jatropha leaf Extract	41 <sup>a</sup>
Cypermethrin	41 <sup>a</sup>
Control	42 <sup>a</sup>
LSD±	2.02

Means followed by similar alphabet(s) in the same column are not significantly different at ( $P \leq 0.05$ ) by Duncan Multiple Range Test (DMRT)



**Figure 1:** Effects of some botanical extracts on the fruit yield of okra.

#### 4. DISCUSSION

The Moringa *Moringa oleifera* had tallest okra plant and less infestation of

insect pest, and highest number of leaves, as well as highest yield of okra fruits. *Moringa oleifera* has been reported by Fugile, 2010 to accelerate growth of young plants, strengthen plant, improve resistance to pests and diseases, increases leaf area duration, increase number of roots, produce more and larger fruits and generally increase yield by 20 to 35%. High amount of Zeatin has also been reported in fresh *Moringa oleifera* leaves which is a hormone that increases the growth of plant (Nagar et al., 2006). In some household of Nigeria, the use of Moringa has been reported to have increased seed germination, growth and yield of crops (Muhamman et al., 2010; Phiri and Mbewe, 2010).

*Jatropha gossipifolia* produced high yield followed Moringa, as it has been popularly reported that pests and diseases do not pose a significant threat to Jatropha, due to the insecticidal and toxic characteristics of all part of the plants. All the treatments performed better than Control and competed with high effects with the standard (Cypermethrin).

#### 5. CONCLUSION

From the study, the application of *Moringa oleifera* leaf extract enhanced growth, fruit production and suppressed insect pest attack on the okra assessed. *Moringa oleifera* leaf extract may be a good source of effective insecticide for the control of okra insect pest in this study area with no adverse effect to the environment, human, aquatic resources and natural enemies of the insect pests.

#### RECOMMENDATIONS

Moringa leaf extract is recommended as botanical pesticide to substitute synthetic pesticides for the control of insect pests of okra in Minna. This will help the farmers to obtain the potential optimum growth and fruit production of okra with less adverse effects on human and environment. Further studies should be conducted to find out the active ingredients in the Moringa plants that functions as insecticidal material(s).

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