Nursery Insect Pests of *Moringa oleifera* Lam in Owerri Area, Imo State, Nigeria.

***Ojiako, F. O[1]., Enwere, E. O[1]., Dialoke, S. A[1]., Ihejirika, G. A[1]., Adikuru, N. C[1]. and O. E Okafor[2]**

1. Department of Crop Science and Technology, Federal University of Technology, P.M.B 1526, Owerri, Imo State.
2. Raw Materials Research and Development Council, No.17 Aguiyi Ironsi Street, Maitama-Abuja
*Corresponding Author: E-mail: frankojiako@yahoo.com; Tel: 2348033586134

ABSTRACT

An experiment to determine the insect pests of Moringa oleifera Lam. at different stages of growth in the nursery and their control with neem extracts was conducted at the Teaching and Research Farm of the Federal University of Technology, Owerri. In the first four weeks, the variegated grasshoppers (Zonocerus variegatus L.), houseflies (Musa domestica L.) and the red wood ants (Formica rufa L.) were the major insects in the nursery. At 5-8 and 9-12 WAP, unsprayed plots had the highest mean number of insect pests (12.94 and 17.33) as against the plots sprayed with neem extracts (8.61 and 10.00), respectively. There were no significant differences in the collated stem heights and number of damaged leaves at various treatment levels (4 – 12 WAP) and (2 - 12WAP) respectively, in the three cultivars (Ilorin, Lafiaji and Mokwa) used.

Key words: *Moringa oleifera,* neem extracts, weeks after planting (WAP), cultivars

INTRODUCTION

Moringa Oleifera belongs to the family Moringaceae, which is the family consisting of only one genus with about 13 species of deciduous trees (Keay, 1989). It is a native of India, but introduced into the tropics and is easily recognized by the compound pinnate leaves (2 or 3 times pinnate) and the long narrow angular fruits containing large, usually winged seeds (Hutchinson and Dalziel, 1966).

The tree is rather slender with a dropping branch that grows approximately 10 metres in height and grows best in hot and semi-arid tropics. Moringa, considered as one of the world's most useful trees, is drought-tolerant and grows with rainfalls of 250-1500mm per year. It is fast growing, prefers well drained fertile sandy or loamy soils but could tolerate clayey but not water-logged soils. Every part of the tree, from the roots to the leaves, has beneficial properties that can serve humanity.

Moringa plays an important role in solving most of the nutrition and general disease control problems of the world. All parts of the Moringa tree are edible and have long been consumed by humans (Fahey, 2005). According to Fugile (2000), the many uses for *Moringa* include: alley cropping (biomass production), animal forage (leaves and treated seed-cake), biogas (from leaves), domestic cleaning agent (crushed leaves), blue dye (wood), fencing (living trees), fertilizer (seed cakes), foliar nutrient (juice expressed from the leaves), green manure (from leaves), gum (from tree trunks), honey and sugar cane juice clarifier (powdered seeds), honey (flower nectar), medicine (all plant parts), ornamental plantings, biopesticide (soil incorporation of leaves to prevent seedling damping off, etc.), pulp (wood), rope (bark), tannin for tanning hides (bark and gum), water purification (powdered seeds). In the past, the paste of the seeds had been used by nomads as a natural coagulant for water purification in the Sudan and other parts of Africa (Eleirt *et al.*, 1980).

Moringa seed oil (yields 30 - 40% by weight), also known as Ben oil, is sweet non-sticky, non-dry oil that resists rancidity. It has been used in salad, for fine machine and lubrication and in the manufacture of perfumes and hair care product (Tsakin *et al.,* 1999). The seeds are also eaten green, roasted, powdered and used for tea or used in curries.

This tree has in recent times been advocated as an outstanding indigenous source of highly digestible protein, calcium, iron, vitamin C and caroteniods suitable for utilization in many of the so-called developing regions of the world where undernourishment is a major concern (Loebel, 2002).

The objective of this study, therefore, was to determine the insect pests of *M. oleifera* at the nursery stage, in Owerri West area of Imo State, Nigeria. This will help intending farmers to be abreast of what insect pests to expect in the nursery. It is also intended to determine whether neem, a biopesticide, could meaningfully control these pests. This is necessary as most parts of Moringa are eaten raw and consumers are constantly apprehensive of the deleterious effects of synthetic insecticides.

MATERIALS AND METHODS

The experiment was conducted at the School of Agriculture and Agricultural Technology Research Farm, Federal University of Technology, Owerri. The site is geographically located between latitudes 05^0 20^0N and longitude 07^0 02^0E; at altitude 91m above sea level. The area has annual rainfall range of 1500 - 3000mm and average maximum temperature of 35^0C and minimum of 17^0C in the tropical rainforest zone of Southeastern Nigeria. The soils are ultisols, generally sandy and acidic with high degree of erodibility. The nursery site measuring about 50 x 100 meters was cleared, cleaned and leveled.

The seeds of *Moringa oleifera* were purchased from Ilorin and Lafiaji in Kwara State and Mokwa in Niger State, Nigeria. Other materials used included black polythene nursery bags, perforators, sweep net, knapsack sprayer, bowls, sample bottles, ethanol and formalin solutions.

The experiment started with collection of top soil which was mixed with little quantity of poultry waste and allowed to cure for 7 days. The mixture of top soil and organic manure was then used to fill the nursery bags (0.5 kg) which had been perforated to allow for water drainage. The filling of the nursery bags was done by the use of a hand trowel and shovel.

The nursery bags where arranged in plots of 50 clusters each. The varieties Lafiaji, Mokwa and Ilorin represents treatments and each of them were replicated 6 times, making a total of 18 clusters and a total of 900 plants

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Fig. 1: Layout of Moringa plants (cv. Lafiaji)

Fig2: Layout of Moringa plants (cv. Ilorin) (2 WAP)

Fig2: Moringa plants (cv. Ilorin) (9WAP)

Moringa plants: Final day at the Nursery (12WAP) (Notice the yellowing of the leaves)

The seeds were initially treated with Apron star WS (20% Thiamethoxam + 20% Metalaxyl-M + 2% Difenoconazol) seed dresser to enhance optimum germination and to protect the seeds from insects' attack and were planted two seeds per bag. Germination was noticed 4 days after planting. Thinning was done in bags with more than one germinated seed.

Insect Sampling

Insect sampling involved the collection of insects at different stages of growth of the plant using a sweep net, cellophane bags and sample bottles. Sampling was carried out from 3 weeks after planting and continued till the 12th week when the seedlings were transplanted. The sampling was done weekly for 10 weeks, that is, for weeks 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12, from 6.30 am - 9.30 am every Tuesday (weekly). The collected insects were stored in sample bottles containing 20% Formalin solution and were bulked for analysis thus: 3-4 weeks, 5-8 weeks, and 9-12 weeks.

Collection and Preparation of Neem Seed Extracts

Neem seeds were collected around the school premises. The seeds were shade dried for 2 days before weighing and grinding. 15 gms of the powdered neem seeds were weighed out and soaked in 1 litre of water for 24 hours. The soaked powdered neem seeds were then filtered using muslin cloth. The filtrate was applied on plots from the third week after germination at weekly intervals. Fresh neem extracts were prepared every week. Before each spray, insect samples were taken from each plot.

Weeding was done at intervals to avoid weed competition for nutrients with the crop. Pest attack was also reduced through weeding because weeds could serve as hosts to insect pests. This was done manually with hoe and hand pulling (rogueing).

Plant Height and Leaf Damage Assessment

The leaves damaged by insects, before and after application of neem extracts, were assessed. This was carried out by visual assessment of 30 leaves randomly selected per stand and counting the number of damaged leaves. The leaf damage assessments were recorded 6 times (at 2, 4, 6, 8, 10 and 12) WAP. A measuring tape was used to determine the plant height. The height of the plant was measured from the base to the last fully open leaf of the plant. The plant height measurements were carried out 5 times (at 4, 6, 8, 10 and 12) WAP.

The experiment was laid out in a Complete Randomized Design (C.R.D.) and analyzed using analysis of variance (ANOVA) and least significant difference (LSD) to separate the means.

RESULTS AND DISCUSSION

The result presented in Table 1 shows the mean number of insects collected and identified from the plots at 3 – 4 weeks after planting (WAP). The insects identified were mainly; *Zonocerus variegatus* Linnaeus (variegated grasshopper), *Musa domestica* Linnaeus (house fly), *Formica rufa* Linnaeus (red wood ant), *Lagria villosa* Fabricus (leaf - eating beetle), *Oedaleus nigeriensis* Uvarov (Nigerian grasshopper) *and Homorocoryphus*

nitidulus vicinus Walker (edible or long- horned grasshopper). At this stage of growth, no spraying was done because the crop had not produced enough leaf foliage. From the results, *Z. variegatus* and *M. domestica* had the highest mean number of insect pests found on the plants. (0.93 and 0.88 respectively). They were, therefore, more prevalent than others during the period under review. This result is in agreement with earlier works of Akanbi *et al.* (2007), who reported *Z. variegatus* as a major pest of most vegetables in Southern Nigeria
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Table 1: Mean Number of Insect Pests Collected from the Plots at Weeks 3 – 4 Before Spraying Neem Extracts.

Treatment	Insect Type						Total No. of Insect Pests
	Zv	Fr	Md	Lv	On	Hn	
Plot before spraying (Week 3)	0.33	0.67	1.43	0.33	0.00	0.00	2.76
Plot before spraying (Week 4)	1.53	0.33	0.33	0.00	0.00	0.00	2.19
Mean value	0.93	0.50	0.88	0.17	0.00	0.00	

Where LSD at 5% = 0.3114
Zv = *Zonocerus variegatus* Linnaeus (variegated grasshopper)
Fr = *Formica rufa* Linnaeus (red wood ant)
Md = *Musa domestica* Linnaeus (house fly)
Lv = *Lagria villosa* Fabricus (leaf-eating beetle)
On = *Oedaleus nigeriensis* Uvarov (Nigerian grasshopper)
Hn = *Homorocoryphus nitidulus vicinus* Walker (edible or long- horned grasshopper)

The result at 5 - 8 WAP is presented in Table 2. The unsprayed plot had the highest mean number of insect pests (12.94) as against the plots sprayed with neem extracts (8.61). In the unsprayed plots, the number of *Z. variegatus* was highest (5.0) followed by *M. domestica, L. vilosa and F. rufa. O. nigeriensis* and *H. nitidulus* tallied. In the sprayed plots, the number of *Z veriegatus* was also highest followed by *M. domestica, F. rufa, L. vilosa*, *H. nitidulus*, *O. nigeriensis,* in that order. The prevalence of *M. domestica* could be due to the proximity of the experimental plots to the farm piggery.

Table 2: Mean Number of Insect Pests Collected from the Plots at Weeks 5 – 8

Treatment	Insect Type						Total No. of Insect Pests
	Zv	**Fr**	**Md**	**Lv**	**On**	**Hn**	
Sprayed plots	3.67	1.01	1.60	1.00	0.33	1.00	8.61
Unsprayed plots	5.00	1.60NS	3.00	2.00	0.67NS	0.67NS	12.94
Mean value	4.33	1.33	2.30	1.50	0.50	0.83	

LSD at 5% = 0.857
NS = No significant difference between the means at LSD 0.05
Zv = *Zonocerus variegatus* Linnaeus (variegated grasshopper)
Fr = *Formica rufa* Linnaeus (red wood ant)
Md = *Musa domestica* Linnaeus (house fly)
Lv = *Lagria villosa* Fabricus (leaf-eating beetle)
On = *Oedaleus nigeriensis* Uvarov (Nigerian grasshopper)
Hn = *Homorocoryphus nitidulus vicinus* Walker (edible or long- horned grasshopper)

The trend was almost replicated in weeks 9 – 12 (Table 3). In summation (weeks 3 – 12), *Z. variegatus* (10.55) was the most abundant insect pest on the plots, followed by *M. domestica* (6.50), *H. nitidulus* ((2.50), *F. rufa* (2.33) *and O. nigeriensis* (2.03) in that order (Table 4).

Table 3: Mean Number of Insect Pests Collected from the Plots at Weeks 9–12

Treatment	Insect Type						Total No. of Insect Pests
	Zv	**Fr**	**Md**	**Lv**	**On**	**Hn**	
Sprayed plots	3.33	0.33	2.67	0.67	1.33	1.67	10.00
Unsprayed plots	6.33	0.67NS	4.33	1.00NS	2.67	2.33	17.33
Mean value	4.83	0.50	3.50	0.83	2.00	2.00	

LSD at 5% = 0.824
NS = No significant difference between the means at the $LSD_{0.05}$
Zv = *Zonocerus variegates* Linnaeus (variegated grasshopper)
Fr = *Formica rufa* Linnaeus (red wood ant)
Md = *Musa domestica* Linnaeus (house fly)
Lv = *Lagria villosa* Fabricus (leaf-eating beetle)
On = *Oedaleus nigeriensis* Uvarov (Nigerian grasshopper)
Hn = *Homorocoryphus nitidulus vicinus* Walker (edible or Long- horned grasshopper)

Since there was noticeable reduction in the number of insect pests on the sprayed plots, it could be inferred that neem extracts exerted insecticidal effect on the insect pests. Amatobi (2004) had observed that neem products had insecticidal action in the control of insects pest of most vegetables. Jonathan *et al*. (2009) later reported that the use of neem extracts and other organic pesticides provided protection to vegetable plants against attack from insect pests.

Table 4: Total Mean Number of Insect Pests Collected for Weeks 3 – 12. (Sprayed and Unsprayed Plots)

WAP	Zv	Fr	Md	On	Hn
3-4	1.39	0.50	0.17	0.00	0.00
5-8	4.33	1.33	2.83	1.20	0.50
9-12	4.83	0.50	3.50	0.83	2.00
Total	10.55	2.33	6.50	2.03	2.50

Zv = *Zonocerus variegates* Linnaeus (variegated grasshopper)
Fr = *Formica rufa* Linnaeus (red wood ant)
Md = *Musa domestica* Linnaeus (house fly)
Lv = *Lagria villosa* Fabricus (leaf-eating beetle)
On = *Oedaleus nigeriensis* Uvarov (Nigerian grasshopper)
Hn = *Homorocoryphus nitidulus vicinus* Walker (edible or long- horned grasshopper)

For the collated mean values of the number of damaged leaves obtained in the three cultivars at the end of the experiment (2 – 12 WAP), cv. Mokwa (6.95) had the highest followed by cv. Ilorin (6.90) and cv. Lafiaji (6.80) in that order (Table 5). The number of damaged leaves were, however, not statistically different from each other.

Table 5: Mean Number of Damaged Leaves (Weeks After Planting, WAP)

Treatment	2 WAP	4 WAP	6 WAP	8 WAP	10 WAP	12 WAP	Mean Value
Cv. Lafiaji	0.50	2.80	4.00	5.70	14.10	13.90	6.80
Cv. Mokwa	0.60	2.90	3.80	6.70	13.60	14.10	6.95
Cv. Ilorin	0.50	2.90	3.70	6.60	13.70	14.00	6.90
Total	1.60	8.60	11.50	19.00	41.40	42.00	
Mean	0.50	2.90	3.80	6.30	13.80	14.00	

NS= No significant difference between the means at LSD 0.05

The collated total mean heights of stems measured from the 3 cultivars were also not statistically different from each other at the end of the experiment (4 – 12 WAP).

Cv. Ilorin (34.70cm) had the highest, followed by cv. Lafiaji (34.2cm) and cv. Mokwa (33.40) (table 6).

Table 6: Mean Height of Stems (cm)

Treatment	4 WAP	6 WAP	8 WAP	10 WAP	12 WAP	Mean Value
Cv. Lafiaji	9.90	23.70	30.50	49.40	57.90	34.20
Cv. Mokwa	9.40	22.30	30.50	48.90	56.10	33.40
Cv. Ilorin	10.10	23.10	30.50	50.70	59.20	34.70
Total	29.40	69.10	91.20	14.90	173.30	
Mean	9.80	23.01	30.40	49.60	57.70	

Significant Difference (@ Fcal 5.34* against 3.11)

$LSD_{0.05} = 7.75$

From the results obtained in the nursery, there were strictly no varietal differences in the parameters measured. Though Palada and Chang (2003) had stated that *M. oleifera* varieties differ in growing habit, leaf, flower, and pod characteristics; Rajangam *et al.* (2001) had earlier reported that India, the world's largest producer of Moringa, with an annual production of 1.1 to 1.3 million tonnes of tender fruits from an area of 38,000 ha, had only a few distinct varieties whose differences were primarily in the length and colour of the pods. Varietal differences in cv. Ilorin, Lafiaji and Mokwa may, therefore, manifest later in the field.

By the 12^{th} week, it was observed that some leaves had started falling off and the roots of the plants in the nursery bags had started piercing through the nursery bags into the soil. We also observed change in colour of the leaves. Apparently, the plants had exhausted the soil nutrients in the polythene bags. These were signs that the plants may have been overdue for transplanting into the field.

CONCLUSION

Moringa oleifera, in the Southeastern zone, could be attacked, in the nursery, by various insect pests of which *Zonocerus variegatus* and *Musa domestica* are most predominant. The damage occasioned by these attacks, however, was not significant and did not affect the height of the plants in the nursery.

The use of neem extracts in the management of insect pests of *M. oleifera,* should be encouraged especially for resource-poor farmers in the rural areas. This is because the product is easy to obtain and process and could be an alternative bio-pesticide for the control of insect pests.

REFERENCES

Akanbi, W. B, Adebayo, T.A, Togum, O.A., Adedeye, A.S and Olaniram, O. A (2007): The use of compost extracts as foliar spray nutrients source and botanical insecticides in *Moringa oleifera.* IDOSI Publications. World J. Agric. Sci. 3(5): 642 - 652.

Amatobi, C.I. (2004): General biology, natural enemies and control. Arthropod pests of crops in Nigeria. Pa NDAHI Printing Press, Sabon-Gari, Zaria.Pp:30-179

Eleirt, U., Walters. H. and Mahrstedt, A (1980): The Antibacterial properties of seeds of *Moringa oleifera*. *Planta Medica*, 42 (1): 55.

Fahey, J. W. (2005): *Moringa oleifera*: A Review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part I. *Trees for Life Journal 2005* (1): 5-11.

Fugile, L.J. (2000): New uses of Moringa studied in Nicaragua. ECHO Development Notes 68: 1-25

Hutchinson, J. and Dalziel, J.M. (1966): Flora of Tropical Africa, Vol. 1 part 1. The White Friars Press Ltd, London.

Jonathan, E., Brenda, S and David, H (2009): Home vegetable garden in pest control. Oklahoma Co-operatives Extension Services U.S.A. Pp. 2 - 10

Keay, R.W.J. (1989): Trees of Nigeria. Oxford University Press.

Loebel, F (2002): Studies of the nutritive value of *Moringa oleifera* (Drumstick tree). Agric. Food Chem. 28: 1163-1166.

Palada, M.C. and Chang. L. C. (2003): Suggested cultural practices for Moringa. International Cooperators' Guide, Asian Vegetable Research & Development Center (AVRDC), Pub. **03-545:** 1-4

Rajangam J., Azahakia Manavalan R. S., Thangaraj T., Vijayakumar A. and Muthukrishan N. (2001). Status of Production and Utilisation of Moringa in Southern India. Horticultural College and Research Institute Tamil Nadu Agricultural University, Tamil Nadu, India.

Tsakins, J.; Lalas, S.; Gergis, V.; Douroglou, V. and Spiliotis, V. (1999): Characterization of *Morimga oleifera* variety Mbolo seed oil of Kenya. J. Agric. and Food Chem. 47: 4495-4499.