ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 4, Issue 2, pp: (8-12), Month: April - June 2016, Available at: www.researchpublish.com

The Adopted Use of *Jatropha Curcas* in the Control of Termites (*Microcerotermes Beesoni*)

Olotuah, O.F.

Department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria

Abstract: **The efficacy of various parts of *Jatropha curcas* in the control of termites was considered in the laboratory. These parts which included the leaves, seeds, bark and the roots were pulverized and diluted in non-toxic polar (ethanol) and non-polar (n-hexane) solvents to extract the active ingredient. In the laboratory experiment, the extracts obtained from the different parts were tested for mortality on termite castes. 5ml of various extracts obtained from pulverized parts of the plant were applied on 10 termites containing five soldiers and five workers which were earlier obtained from a termitarium. The in vitro tests conducted in a petri dish in the laboratory consisted of three replicates for each extract. Mortality rates of termites was observed and recorded at 15, 30, 45, and 60 seconds interval while data obtained were analyzed and means of values separated using Tukey's Honestly Significant Test. Data obtained showed that all the extracts were effective in the control of termites while n-hexane bark was significantly different showing the highest mortality rate compared to other treatments.**

Keywords: **Pest control, *Jatropha curcas*, Plant extract, *termite*, Akungba-Akoko.**

I. INTRODUCTION

Jatropha (*Jatropha curcas L.)* or Physic nut is a drought resistant monoecious large shrub or small tree (5–8) m tall. It belongs to the genus *Jatropha* which consists of over 175 species, and a member of the Euphorbiaceae family. It is a drought-resistant perennial, growing well in poor soil. *Jatropha curcas* plant produces seeds with an oil content of 37%. It has been recorded that *J. curcas* has been useful medicinally. A good crop can be obtained with little effort. Depending on soil quality and rainfall, oil can be extracted from *Jatropha* nuts after two to five years. The annual nut yield ranges from 0.5 to 12 tons. The kernels consist of oil to about 60 percent; this can be transformed into biodiesel fuel through esterification. Insect pests such as termites are one of the major limiting factors in increasing productivity of many crops. *Microcerotermes spp*. is economically the most important termite because of the damage it causes on agricultural and domestic products. Thus, there is a need to control the pest with affordable and locally available indigenous plant materials [1], [2], [3], all shared the similar view on the expedient control of termites sequel to its devastating propensities and concomitant reduction in revenue. Termites, m*icrocerotermes spp.*, are economically the most important termite pests which create considerable damage on agricultural crops and domestic materials. They generally feed on dead plant materials, wood, leaf litter and soil and as such pose a lot of problem to man and the environment which has informed instituting a reliable means of control. Sequel to increasing problems associated with the use of toxic synthetic insecticides; there is a need for the development of safe alternative crop protectants. Among various options available under the concept of Integrated Pest Management (IPM), bio-pesticides play a key role. Records show that parts of Jatropha *curcas* had been used in traditional medicine and as raw material for pharmaceutical and cosmetic industries and consequently it has also been documented by [4] that when adopted as a component of IPM programme, it could considerably reduce pest infestation. This adoption could as well decrease the use of conventional pesticides, besides maintaining high crop yields. Often, application of chemicals had been the most commonly used control measure with harmful effect on the environment and non-target organisms. For the control of termites, synthetic termiticides have been used for a long time. At the advent of termite control, persistency of the chemical was regarded to be a boon, as it

provided protection for longer periods. But soon it was realized that, chlorinated, persistent type of insecticides posed a great hazard to environment, due to their residual effects. Botanical pesticides had also been adopted on the other hand and had also played a key role in the control of termites as they were perceived to be biodegradable, safer and environmental friendly. They could replace expensive chemicals that are currently in use. Consequently, based on the attributes and documentations on *Jatropha curcas*, the experiment was focused on the adoptive use of its extract as a result-driven approach to termite control and as a reliable, friendly and biodegradable botanical.

II. MATERIALS AND METHOD

1. Study area:

This research project was conducted in the laboratory of the Department of Plant Science and Biotechnology and the Department of Chemical Sciences Laboratory, Adekunle Ajasin Akungba Akoko, Ondo State, Nigeria.

2. Plant collection and preparation:

Matured fresh parts of Jatropha curcas were collected at Epinmi Akoko, Ondo State, Nigeria and washed immediately after collection. Soxhlets method was used for the plant extraction. In the preparation of leaf extracts, fresh leaves of J. curcas were obtained and chopped into match stick sizes. 221.1g of the fresh leaf was measured into 600ml of n-hexane and ethanol with a sensitive weighing balance. The plant material was soaked in the solvent for 21days. Then the supernatant was filtered with what-man filter paper in Buchner funnel using extraction pump for the filtration. The extract was stored into a reagent bottle. In the same vein, to obtain extracts from the roots, Jatropha curcas was uprooted and the root cut into match stick sizes, washed and drained. 235.8g of the fresh root was weighed with sensitive weighing balance and samples soaked in 600ml n-hexane and Ethanol respectively for 21 days. The supernatant was then filtered through a concentrated rotatory evaporator at 35- 40° C under reduced pressure to obtain a liquid material. The extract was stored into a reagent bottle. Similarly, seeds of the J. curcas were collected from the same location. The seeds were washed with borehole water and chopped into match stick sizes and crushed roughly. The sample was then weighed. 113.5g of the sample was soaked inside closed lid container with 300ml n-hexane and Ethanol for 21days. The supernatant was filtered using Buchner funnel connected directly to rotatory evaporation at 35-40°C. The extract was stored into a reagent bottle. The bark of the plant was also obtained using the same method but 194.5g of the fresh bark was soaked in 600ml n-hexane and ethanol respectively for 21days. The supernatant was then filtered with Buchner funnel connected directly to rotatory evaporation at 35-40°C

3. Collection of Termites:

Collection of termites' workers and soldiers were done early in the morning from the termite hill or termitarium on the field. The termite samples were collected in petri dishes and the injured ones were removed. The culture which consisted of selected castes and samples of the caste were kept secured at ambient temperature in a jar in the laboratory throughout the experiment.

4. Bioassay of Extracts:

5ml of each of the extracts obtained from all the pulverized parts were applied to five workers and five soldiers in a petri dishes. This set up was monitored for 60 seconds in order to determine the efficacy of the extracts in termite control. Mortality was monitored and values taken at 15, 30, 45 and 60 seconds. The experiment consisted of three replicates.

5. Data Analysis:

The rate of mortality was recorded at intervals 15, 30**,** 45, and 60 seconds and means were separated using Tukey's Honestly Significant Test.

III. RESULTS AND DISCUSSIONS

1. Mortality with Botanical Extracts:

The efficacy of extracts of morphological parts of *J. curcas* in termite control was determined through rate of mortality of the castes. Data obtained showed that the various parts were effective as represented in table 1.

ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 4, Issue 2, pp: (8-12), Month: April - June 2016, Available at: www.researchpublish.com

TABLE 1: CUMMULATIVE MEAN OF MORTALITY RATE OF TERMITES AT DIFFERENT TREATMENT REGIMES

Type of Extracts	Time of Application			
	15 Seconds	30 Seconds	45 Seconds	60 Seconds
n-hexane seed extract	4.33± 0.33^{c}	6.00±0.00^{c}	6.33±0.33^{c}	7.00±0.00^{bc}
n-hexane bark extract	8.67±0.66^{a}	9.00±0.58^{a}	9.67±0.33^{a}	10.00±0.00^{a}
n-hexane leaf extract	4.67±0.33^{c}	6.67±0.33^{b}	7.67±0.33^{b}	8.00±0.00^{b}
n-hexane root extract	6.00±0.00^{bc}	6.33±0.33^{bc}	7.67±0.66^{b}	9.00±0.58^{ab}
Ethanol seed extract	6.00±0.58^{ab}	7.33±0.33^{b}	8.00±0.00^{b}	9.67±0.33^{a}
Ethanol leaf extract	0.33±0.33^{e}	1.33±0.66^{e}	2.00±0.58^{e}	2.67±0.33^{e}
Ethanol bark extract	1.00±0.58^{d}	2.00±0.68^{d}	3.00±0.58^{d}	4.33±0.33^{d}
Ethanol root extract	1.00±0.00^{de}	1.67±0.33^{de}	2.33±0.33^{e}	4.00±0.58^{d}

Mean with the same superscripts along column are not significantly different, $p<0.05$, Tukey's Honestly Significant Test.

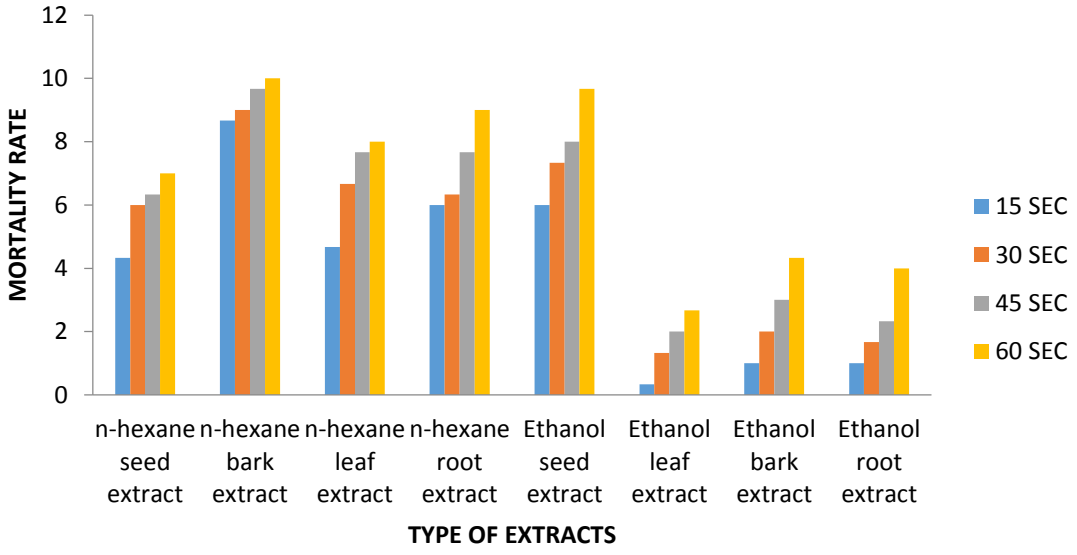

Figure 1: Showing the mortality rate of *Microcerotermes beesoni* at 5ml concentration of all the extracts within 60seconds

The invitro tests of the morphological parts of *Jatropha curcas* on termites, *Microcerotermes beesoni* at time intervals, 15, 30, 45, and 60 seconds revealed that potency of the extracts increases with time. Although all the extracts were effective but there are significant differences among treatment applications. Similarly, fig 1 explicitly present the graphic representation of the varied potentials of the extracts. N-hexane extracts show higher vigour compared to ethanol extract while the extract from the bark showed a significant difference compared to other extracts. Consequently, there were improvement in the efficacy of the extracts over time as all the termites well eliminated within 60 seconds. These observations are in accordance with previous documentations most especially in the adoptive of N-hexane as a solvent in the extraction of active ingredients. The efficacy of N-hexane extract may be attributed to the potency of the solvent to extract almost the entire active ingredient present in all the parts of *J.curcas* than using ethanol as the solvent, which

could also be attributed to the solubility potential of n-hexane. The toxicity of *J. curcas* could as well be attributed to the toxic ingredient "jatrophine" which is the dominant compound found in the seeds of this well-known botanical insecticide with contact and stomach poisoning mode of action as reported by [5] and [6].

Proximate analysis of extract of *J. curcas* confirmed the presence of fatty acids and terpenes which had been reported as effective insecticides in most botanicals while [7], [8] reported that the insecticidal activity of seed oil of *Jatropha curcas* against subterranean termites was due to the presence of several sterols and terpene alcohols. This assertions corroborate the efficacy of various parts of the plant used in termite control.

This research work is in accordance with the work of [5] which reported that water extract of *J.curcas* and *Milletia Ferruginea* are effective as termicides and cause higher toxicity to all the castes of *alates* of termites, *Macrotermes* in which 93-100% mortality was recorded at different concentration level. This report convincingly corroborates the choice of solvent used in the extraction of the active ingredients. This supports the use of the two solvents in the analysis and suggests that extracts of *J. curcas* could be obtained without much effort and confirms its biodegradability. These qualities are in accordance with the use of botanicals in pest control. Consequently, [9] also proved that the great biochemical and genetic similarity of the non-Mexican accessions is certainly due to the few introductions in other countries of *J. curcas* originating from Mexico, possibly perpetuated by vegetative propagation, which is the habit of living fence construction. According to [10] strong similarities between Indian accessions and those from Cape Verde in molecular profiles have been found. Botanical plants insecticidal properties and application have drawn attention for extensive research, which are now highly encouraged in order to meet the demands of Integrated Pest Management and environmental safety. Recently, in developing countries, there is an increasing interest and experience in the use of different types of plant products for the management of insect pests because of drawbacks of conventional pest management options [11] and a view also shared by [12]. Generally, botanical extracts have safe insecticidal properties with broad spectrum of insecticidal activity, relatively specific mode of action, low mammalian toxicity and non-persistence. Besides, there preparation and application methods for farmers are more convenient. The repellency of leaves, seed, and bark powders of *Azadiratcha indica* and *Nerium Oleander* against *Rhizopertha dominica* in wheat grains was reported by [13] while [14] also stated that oil from seeds of *J.curcas* was effective against insect pest associated with cow peas under laboratory and field conditions [5].

The evaluated oil of the physic nut, *J. curcas* under laboratory for its barrier and repellent activity against the Philippine milk termite *Coptotermes vastator* was done by [6] and reported that *J. curcas* oil had anti-feeding effect with reduced tunneling activity and increased mortality on *C. vastator*. The assertion confirms the efficacy of J. curcas as a reliable termicide and consequently affirms the adoptive use of all the morphological parts.

IV. CONCLUSION

This experiment demonstrated that n-hexane bark extract of *Jatropha curcas* tested against termites *Microcerotermes beesoni* possesses high and reliable termicidal properties that could be used in the pest management. The results showed that the mortality of termite is time dependent and has the tendency of exhibiting total termite mortality within 60 seconds. Similarly, observations on the repellent and toxic effects of *Jatropha curcas* on termites has proven that this plant could be adopted in termite control as well as the control of other evasive insect pest. In the same vein, every part of the plant had be confirmed to be suitable for pest control while the extractions could be done by using any non-toxic and readily available solvent including water. The propagation of the crop is however without stress as the plant could germinate under minimal agricultural practice. Therefore, J. curcas is a reliable plant that could be employed in the control of termites in order to eradicate the destructive tendencies of the insect and as such alleviate the attendant challenges as often experienced at homes and on the field. This plant should therefore be encouraged to be propagated as edges at home and on the field.

REFERENCES

[1] M., Doolittle, A. Raina, A. Lax and R. Boopathy, "Effect of natural products on gut microbes in Formosan subterranean termites, *Coptotermes formosanus", Int. Biodeterior. Biodegrad. (59)*, 2007, *pp. 69-71.*

[2] N.K Dubey, B. Srivastava and A. Kumar, "Current status of plant products as botanical pesticides in storage pest management. *J. Biopesticides", (1)* 2008, pp. *182-186.*

[3] E. O. Owusu, K.S. Akitse and K. Afreh-Nuamah, "Effect of some traditional plant components on the control of termites, *Macrotermes spp. (Isoptea: Termitidae)", Afr. J. Sci. Technol. (AJST) Sci. Eng. Ser., (9)* 2008, pp. *82-89.*

[4] A., Muhammad, "Antixenotic and antibiotic impact of botanicals for organic management of stored wheat pest insects". *Ph.D. Thesis, University of Agriculture, Faisalabad Paskista.* 2009.

[5] B. Jembere, D. Getahun, M. Negash and E. Sevoum, "Toxicity of *Birbira* (*Milletia ferruginea*) seed crude extract of some insect pests as compared to other botanical and synthetic insecticides". *Proceedings of the 11th NAPRECA Symposium on Natural products and Drug Delivery, August 9-12, 2005, Astanarivo, Madagaskar, (9)* 2005, pp. *88-96.*

[6] M.N., Acda, "Toxicity, tunneling and feeding behavior of the termites, *Coptotermes vastator*, in sand treated with oil of the physic nut, *Jatropha curcas". J. insect Sci.*, (9) 2009), pp. 1-8.

[7] K. O. Adebowale, and C.O Adedire , "Chemical Composition and Insecticidal Properties of the Underutilized *Jatropha curcas* Seed Oil" *African Journal of Biotechnology*, (10) 2006, pp. 901 - 906.

[8] S Nisa, M., S. Ahmed, M. Ashfaq and S.T. Sahi, "Effect of leaf and seed extracts of *Jatropha cucas* Linn. On mortality and tunneling of subterranean termites, *Odontotermes obesus* (Ramb.) (*Termitidae: Isoptera)".Pak. J. Life Soc. Sci., (10)* 2012, pp. *33-38.*

[9] S Basha, D. Franis G, Makkar HPS, Becker K, "A comparative study of biochemical traits and molecular markers for assessment of genetic relationships between *Jatropha curcas* L. germplasm from different countries", *Plant Sci., (*176), 2009, pp. 812-823.

[10] S., Basha, .D. and Sujatha, M. "Inter and intra-population variability of *Jatropha curcas* (L.) characterized by RAPD and ISSR markers and development of population-specific SCAR markers", *Euphytica, (*156) 2007, pp. 375-386.

[11] D. K., Zewde, and B. Jembere, "Evaluation of orange peel *Citrus sinensis* (L) as a source of repellent, toxicant and protectant against Zabrotes subfasciatus (*Coleoptera: Bruchidae*). *Mornona" Ethiop. J. Sci., (2),* 2010, pp. *61-75.*

[12] E. Shaaya and M. Kostyukovysky, "Essential oils: Potency against stored product insects and mode of action" *J. Entomol. Acarol. Res., (43)* 2006, pp. *245-257.*

[13] S.M. Khan and A.A. Marwat, "Effect of bakain (Melia azadirach) and Ask (*Calatrops procera*) against lesser grain borer, *Rhyzopertha domonica", F.J. Res. Sci. Pak., (15)* 2006, pp. *319-324.*

[14] Z.A Habou,, A. Haougui, G. Mergeai, E. Haubruge, A. Toudou and F. Verheggen, "Insecticidal effect of *Jatropha curcas* oil on the aphid Aphis *fabae* (*Hemiptera: Aphididae*) and on the main insect pest associated with cowpeas (*Vigna unguiculata*) in Niger. Tropicultura, (29) 2011, pp. 225-229.