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Potential of some Nigerian plants as mosquito larvicides

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Abstract
Crude ethanolic extracts of thirteen plants from Nigeria were screened for larvicidal activity against fourth instar *Aedes aegypti* mosquito. Only seven of these were active ($LC_{50} \leq 6.25$ppm). Activity of the solvent partitioned-extracts derived from the more active plants was in the order: EtOAc < BuOH <H_2O (for *Pseudocedrela kotschyi* stem bark); and BuOH < EtOAc < H_2O (for *Pycnanthus angolensis* stem bark). Only the EtOAc extract of *Harungana madagascariensis* was active. This study suggests a potential use of these plants in the control of vector mosquitoes of malaria.

Keywords: *Pseudocedrela kotschyi, Harungana madagascariensis, Pycnanthus angolensis*, Larvicidal activity, *Aedes aegypti* mosquito

Introduction

Malaria is a very rampant and devastating disease in the tropical countries and various efforts have been made in the past to control its morbidity and mortality (Sukumar *et al.*, 1991; Palsson and Jaenson, 1999; Gbolade, 2004). Control at the vector level by treating developmental stages of the vector mosquitoes with insecticides has received wide acceptability. Although synthetic insecticides have proved to be very effective in vector control, they suffer from major disadvantages of resistance and environmental pollution (Zaim and Guillet, 2002). The use of plants as alternative sources of potent chemicals for vector control has been extensively explored and documented (Markouk *et al.*, 2000; Adewunmi *et al.*, 2001; Sosan *et al.*, 2001; Gbolade, 2004; Rajkumar and Jebanesan, 2004). A review was recently published on the insecticidal properties of plants occurring in many parts of the world (Gbolade, 2004). In view of our continued search for potent mosquito larvicides of natural origin, we studied the toxicity of some Nigerian plant extracts against the fourth instar larvae of *Aedes aegypti* mosquito.

Experimental

Preparation of plant materials. Appropriate morphological parts of individual plants were collected from various locations in Osun State and identified at the Department of Pharmacognosy (OAU) herbarium. They were

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then oven-dried (60^0C) and ground into coarse powders. Plant extracts were obtained by macerating 50-100 g of respective plant powders successively with 70% EtOH for 72h., filtered and concentrated *in vacuo* to give residues which were tested for mosquito larvicidal activity against *Aedes aegypti*. Furthermore, 500g of the stem bark of *P. kotschyi, H. madagascariensis,* and *P. angolensis* were similarly extracted and partitioned successively with EtOAc and BuOH.

Bioassay for larvicidal activity. Aedes aegypti L. adult mosquitoes were raised in netted cages (37 x 30 x 28 cm^3) under laboratory conditions (25-30 °C, R.H. 60-70 %) from the larval colony already established in our laboratory. Bioassay was performed as earlier described by Sosan *et al* (2001). Crude residual ethanolic plant extracts (1g) were separately solubilised with dimethyl sulphoxide (DMSO) and made up to 10ml with distilled water to give the stock solutions (10%). Aliquots of the stock solution were introduced into the 75ml bioassay vials and made up to 20ml volumes (bioassay medium) with distilled water to give three different concentrations (1.0mg/ml, 5mg/ml, 10mg/ml). Three replicates were prepared for each concentration and the negative control was 3.0% DMSO. Each test solution comprised ten larvae in 20ml solution of extract (bioassay medium). Toxicity of the extracts was compared with a positive control, endosulphan [(C,C'-(1,4,5,6,7,7-hexachloro-8,9,10-trinorbon-5en-2,3-ylene)(dimethyl sulphite)], a commercial insecticide which was completely larvicidal at 2.5ppm (LC_{50}= 0.89ppm). Mortality at up to 24h. of exposure was recorded and LC_{50} values determined using probit analysis (Finney, 1971).

Results and Discussion

Of the 13 plants investigated, only 7 were observed to be larvicidal at tested doses of 1.0 to 10.0 mg/ml (Table 1). *Harungana madagascariensis* (LC_{50} 2.30) and *Pycnanthus angolensis* (LC_{50} 2.67) were the most active, *Pseudocedrela kotschyi* (LC_{50} 4.46) was of moderate activity, while *Sphenocentrum jollyyanum, Allanblackia floribunda, Hyptis suaveolens* and *Alafia barteri* (LC_{50} 5.60- 6.25) were the least active. Based on these activities, the active crude extracts: *P. kotschyi, H. madagascariensis,* and *P. angolensis* were partitioned successively with EtOAc and BuOH. Bioassays revealed toxicity to mosquito larvae as: EtOAc < BuOH < H_2O for *P. kotschyi,* BuOH < EtOAc < H_2O for *P. angolensis*, and only EtOAc partitioned extract for *H. madagascariensis.* Our investigation indicates the Nigerian flora as a natural source of insecticidal agents suitable for controlling vector mosquitoes of malaria. Similar results had been reported earlier for other Nigerian plants (Adebayo *et al.*, 1999; Adewunmi *et al.*, 2001; Sosan *et al.*, 2001). Plants from other parts of the world have been similarly investigated (Irungu and Mwangi, 1995; Roth *et al.*, 1998; Markouk *et al.*, 2000; Rajkumar and Jebanesan, 2004), and in some instances, bioactive compounds have been isolated (Midiwo *et al.*, 1995; Roth *et al.*, 1998; Gbolade *et al.*, 1999; Rajkumar and Jebanesan, 2004).

In this study, a potential is predicted for the use of these seven active Nigerian plants in vector control of mosquitoes, thereby curtailing the malaria burden. Further work will unravel the bioactive compounds in their biologically-active fractions.

Table 1: Toxicity of ethanolic plant extracts to mosquito larvae

Plant extract (family)	Plant part	Mortality (%)			LC_{50}
		1.0mg/ml	5.0mg/ml	10.0mg/ml	(mg/ml)
Alafia barteri Oliv. (Apocynaceae)	Leaves	0	46	70	5.90
Allanblackia floribunda Oliv. (Guttiferae)	Stem bark	0	88	100	5.60
Bidens pilosa L. (Compositae)	Whole plant	0	0	30	>10
Hymenocardia acida Tul. (Euphorbiaceae)	Root bark	0	0	60	>10
Colocasia esculentum Schott (Araceae)	Leaves	0	0	53	>10
Detarium senegalensis Gmelin (Caesalpiniaceae)	Leaves	0	0	43	>10
Euphorbia hirta L. (Euphorbiaceae)	Whole plant	0	0	30	>10
Harungana madagascariensis Lam. (Hypericaceae)	Stem bark	30	63	90	2.30
Hyptis suaveolens Poit. (Lamiaceae)	Aerial parts	0	20	93	6.25
Pseudocedrela kotschyi (Schweinf.) Harms (Meliaceae)	Stem bark	0	53	100	4.46
Pycnanthus angolensis (Welw.) Warb. (Myristicaceae)	Stem bark	23	63	90	2.67
Sphenocentrum jollyyanum Pierre (Menispermaceae)	Root	0	50	63	6.20
Spondiathus preussi Engl. (Euphorbiaceae)	Stem bark	60	70	66	>10

References

Adebayo T.A., Gbolade A.A. and Olaifa J.I. (1999); Comparative study of toxicity of essential oils to larvae of three mosquito species. *Nigerian Journal of Natural Products and Medicine* 3, 74-76.

Adewunmi C.O., Aladesanmi A.J., Adewoyin F.B., Ojewole A.O. and Naido N. (2001); Molluscicidal, insecticidal and piscicidal activities of *Barringtonia racemosa*. *Nigerian J. Nat. Prod. Med.* 5, 56-58.

Finney D.J. (1971); Probit analysis. Cambridge University Press, London. pp. 68-72.

Gbolade A.A. (2004); An overview of plants used for malaria vector control, In: Bodeker G. Rosoanaivo P. Willcox M.L (Eds) Traditional Medicinal Plants and Malaria, CRC Press, London pp.375-388.

Gbolade A.A., Onayade O.A. and Ayinde B.A. (1999); Studies on the insecticidal activities of volatile oil of *Ageratum conyzoides*. *Insect Sci. Applic.* 19, 237-240.

Irungu L.W. and Mwangi R.W. (1995); Effects of a biologically active fraction from *Melia volkensii* on *Culex quinquefasciatus*. *Insect Sci. Applic.* 16, 159-162.

Markouk M., Bekkouche K., Larhoini M., Bousaid M., Lazrak H.H. and Jana M. (2000); Evaluation of some Moroccan medicinal plant extracts for larvicidal activity. *J. Ethnopharmacol.* 73, 293-297.

Midiwo J.O.Y., Mwangi R.W. and Ghebremeskel Y. (1995); Insect antifeedant, growth-inhibiting and larvicidal compounds from *Rapanea melanphoes* (Myrsinaceae). *Insect Sci. Applic.* 16, 163-166.

Palsson K. and Jaenson T.G. (1999); Plant products used as mosquito repellents in Guinea Bissau, West Africa. *Acta Trop.* 72, 39-52.

Rajkumar S. and Jebanesan A. (2004); Mosquito activities of octacosane from *Moschosma polystachyum* Linn. *J. Ethnopharmacol.* 90, 87-89.

Roth G.N., Chandra A. and Nair M.G. (1998); Novel bioactivities of *Curcuma longa* constituents. *J. Nat. Prod.* 61, 542-545.

Sosan M.B., Adewoyin F.B. and Adewunmi C.O. (2001); Larvicidal properties of three indigenous plant oils on the mosquito *Aedes aegypti*. *Nigerian J. Nat. Prod. & Med.* 5, 30-32.

Sukumar K., Perich M.J. and Boobar L.R. (1991); Botanical derivatives in mosquito control: a review; *J. Am. Mosq. Control Assoc.* 7, 210-237.

Zaim M. and Guillet P. (2002); Alternative insecticides: an urgent need. *Trends in Parasitol.* 18, 161-163.