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INSECTICIDAL PROPERTIES OF CERTAIN INDIGENOUS PLANT OILS AGAINST *SITOPHILUS ZEAMAIS* MOTS.

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ABSTRACT

The toxicity of the essential oils of 4 Nigerian plants, *Monodora tenuifolia* Benth, *Lippia adoensis* Hoschst, *Cymbopogon citratus* L. and *Petiveria alliacea* L. to the maize weevil, *Sitophilus zeamais* Mots. was investigated. Infestation of treated maize prior to storage was carried out at dosage rates of 0.1, 0.5, 0.7 and 1.0ml for each oil. More than 50% mortality of *S. zeamais* adults was recorded at 1. Oml dosage rate in maize seeds treated with *L. adoensis* and *M. tenuifolia,* infested prior to storage and after 2 months of storage. The F_1 progeny and productivity were reduced significantly ($p < 0.05$) at 1. Oml in *L. adoensis* and *M. tenuifolia.* Productivity in treatments of *P. alliacea* and *C. citratus* was not significantly different from controls. Effectiveness of the treatments tested against *S. zeamais* was *L. adoensis* > *M. tenuifolia* > *P. alliacea* > *C. citratus.*

INTRODUCTION

Presently in the tropics, there is a gradual increase in the production of maize. However for increased availability of maize all year round, there is the need for adequate protection against instect attack in order to reduce the losses that occur between harvest and consumption. The use of conventional insecticides to control stored product insects has potential health hazards due mostly to toxic residues. There is an increasing realization that plants manufacture and store various chemical substances which protect them from attack by insects, bacteria, fungi and viruses. Thus there is the need to control food pests through the use of plant materials with a low toxicity to mammals especially man.

In Nigeria, studies on neem plant. *Azadirachta indica* A. Juss (Odeyemi *et al.,* 1981; Ivbijaro, 1983; Sowunmi and Akinnusi, 1983), *Piper guineense* Schum and Thonn (Ivbijaro and Agbaje, 1986; Olaifa and Akingbohungbe, 1986), groundnut oil, (Ivbijaro, 1984; Odeyemi, 1991) have revealed substantital level of insecticidal activity against some stored product insects. In the West African subregion, whole fruits of pepper of the genus *Capsicum* are usually placed among grains as a means of protection against insect damage (Mejule, 1974). Also rice grains and maize seeds are rubbed with vegetable oil to make them more attractive to buyers and prevent insect attack. In the Congo, *Lippia multiflora* Hochst, *Epatorium odoratum* L., *Ocimum canum* L., *Nicotiana tabacum* L. and *Chenopodium ambrosioides* L. are used by farmers to protect beans against *Acanthoscelides obtectus* (say) and *Callosobruchus maculatus* F. as well as groundnuts against *Caryedon serratus* (Delobel and Malonga, 1987).

In the present study, experiment was designed to investigate the toxicity of the essential oils of four plants, *Monodora tenuifolia* Benth, *Lippia adoensis* Hoschst, *Cymbopogon citratus* L. and *Petivera alliacea* L. to the maize weevil *Sitophilus zeamais* Mots., a serious pest of maize in the tropics.

MATERIALS AND METHODS

Cultures of *Sitophilus zeamais* were maintained on maize seeds at 28° C and 70-75% rh. in the laboratory. The plants used for experiments were collected in May and June from farms in Akure, Ondo State, Nigeria. The fruits of *M. tenuifolia,* the roots of *P. alliacea* and leaves of *L. adoensis* and *C. citratus* were dried in a forced air ventilated oven at 40° C, crushed to shreds in a mortar, steam distilled and extracted for oils using the British Pharmacopoiea method (British Pharmacopoiea, 1980). The oil obtained in each case was stored in labelled plasticap bottles at 5° C until required for use.

Clean maize seeds (*Zea mays* L.) were sterilized by freezing at -18° C for two weeks. The sterilized samples were conditioned for 1 week to the ambient temperature of

28±2° C and 70-75% rh in the laboratory to bring the moisture content to 12.06. The dosage rate of 0.1, 0.5, 0.7 and 1. Oml for each oil were incorporated into 50g of the maize samples contained in 25 Oml plasticap jars and mixed for 5 minutes. Experiments were performed in triplicate and maintained at ambient laboratory conditions of 28±2° C, 70-75% rh, 12L: 12D. Each jar containing treated and untreated (Control)maize was infested with 30 unsexed newly emerged (0-24rh old) *S. zeamais* adults. In another experiment, 50g of sterilized maize samples contained in 25Oml kilner jars were treated each oil at dosage rates of 0.1, 0.5, 0.7 and 1.Oml. After 2 months, effeciveness of the oils after storage against *S. zeamais* was tested by introducing 20 newly emerged (0-24hr old) adults into the treatments.

In both experiments, adult mortality was assessed 1, 5 and 21 days after infestation. Adults were considered as dead when no response was obtained after probing the abdomen with forceps and removed from the jats. The jars were kept to observe development from egg to adult stage in each treament. The F_1 progeny were scored every other day until emergence was complete and productivity (progeny/ 21 adult days)was calculated using the method of kazmaier and Fuller (1959).

RESULTS

Fig. 1 shows the adult mortality of *S. zeamais* in maize treated with oils extracted from *M. tenuifolia, L. adoensis, C. citratus* and *P. alliacea.* Mortality increased as dosage of oil increased. In *M. tenuifolia* and *L. adoensis,* high moratality above 50% were recorded at dosage rate of 1.Oml after an exposure period of 21 days. Data on adult emergence and productivity (progeny/21 adult-days) of *S. zeamais* are summaized in Table 1. The F_1 progeny of the insects was reduced in each treatment when compared to that of the control. The insect productivity was significantly different ($P<0.05$) at 1.Oml dosage in *L. adoensis* and *M. tenuifolia.*

Results on the effectiveness of the oils against *S. zeamais* infestation after two months storage showed that *L. adoensis* and *M. tenuifolia* exhibited good activity at 1.Oml dosage only and brought about 57% and 52% mortality respectively after 21 days (Fig. 2). Although mortality was lower at 0.1, 0.5 and 0.7 dosage rates, the F_1 progeny

Table 1. Adult emergence and productivity of *S. zeamais* in treated maize infested prior to storage

Plant	Dosage rates (ml)	No of adults emerged	Progeny/ 21 adult-days	% reduction in progeny
M. tenuifolia	o.1	262	12.5b	29.6a
	0.5	218	10.4b	41.4a
	0.7	196	9.3b	47.3a
	1.0	102	4.9a	72.6b
L. adoensis	0.1	248	11.8b	33.3a
	0.5	206	9.8b	44.6a
	0.7	157	7.5b	57.8a
	1.0	67	3.1a	82.0b
C. citratus	0.1	298	14.4a	19.9a
	0.5	286	13.6a	23.1a
	0.7	264	12.6a	29.0a
	1.0	256	12.9a	31.2a
P. alliacea	0.1	291	13.9a	21.8a
	0.5	280	13.3a	22.0a
	0.7	242	11.5a	34.9a
	1.0	208	9.9a	44.1a
Control	0	372	17.7	-

Means followed by the same letter in the column do not differ significantly at 5% level within each treatment by Duncan,s multiple range test.

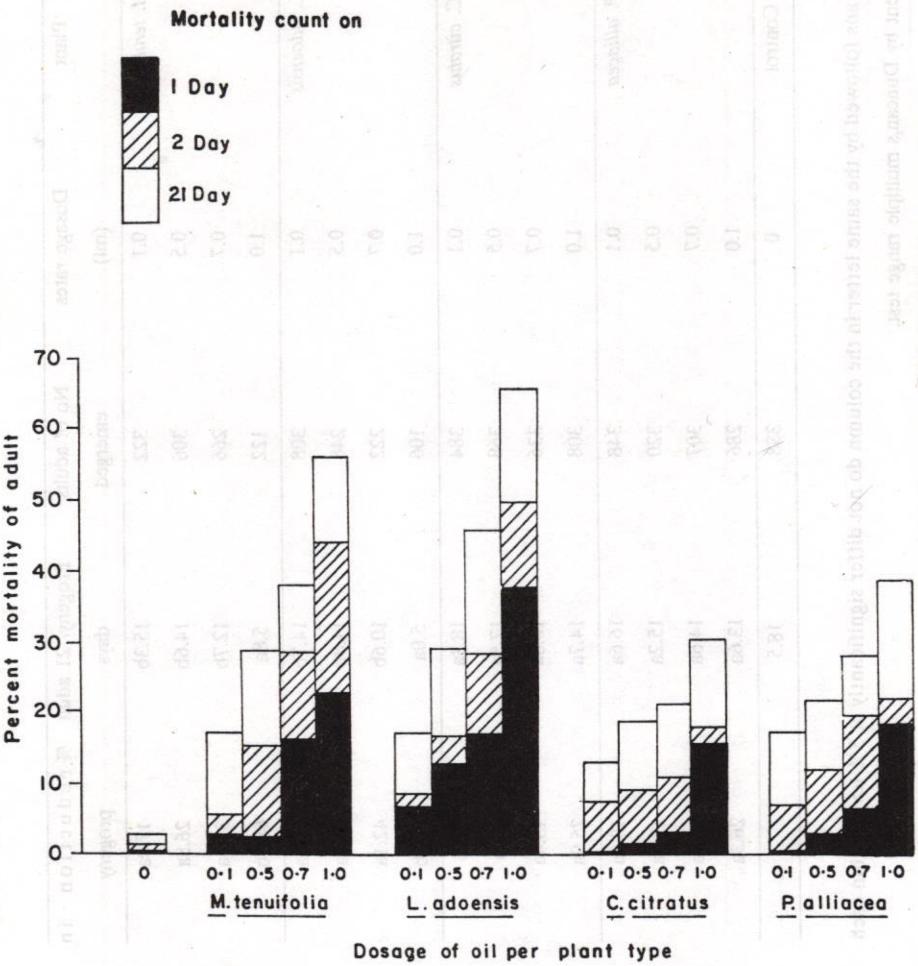

Fig. 1. Adult mortality of *S. zeamais* treated maize prior to storage

Table 2. **Adult** emergence and productivity of *S. zeamais* in treated maize infested after 2 months storage

Plant	Dosage rates (ml)	No of adults emerged	Progeny/ 21 adult days	% reduction in progeny
M. tenuifolia	0.1	322	15.3b	17.0a
	0.5	306	14.6b	26.8a
	0.7	266	12.7b	31.4a
	1.0	122	5.8a	68.6b
L. adoensis	0.1	308	14.7b	20.6a
	0.5	248	11.8b	36.1a
	0.7	222	10.6b	42.1a
	1.0	106	5.0a	72.5b
C. citratus	0.1	384	18.3a	1.0a
	0.5	368	17.5a	5.2a
	0.7	336	16.0a	13.4a
	1.0	308	14.7a	25.9a
P. alliacea	0.1	348	16.6a	10.3a
	0.5	320	15.2a	17.5a
	0.7	307	14.6a	20.9a
	1.0	286	13.6a	26.3a
Control	0	388	18.5	

Means followed by the same letter in the column do not differ significantly at 5% level within each treatment by Duncan,s multiple range test.

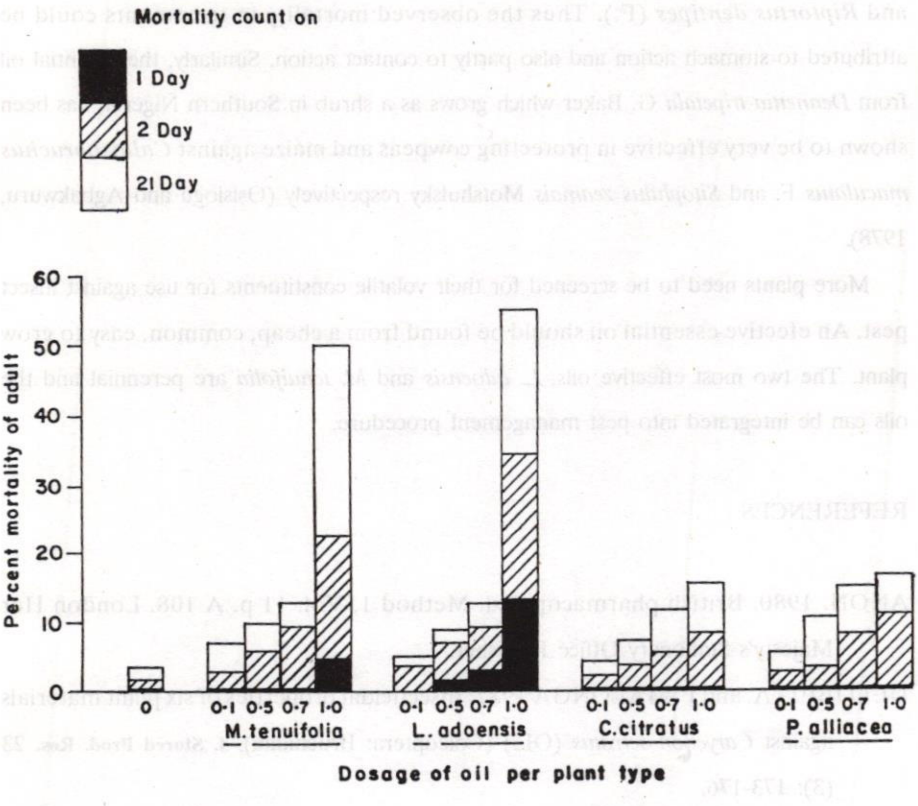

Fig. 2. Adult mortality of *S. zeamais* in treated maize stored for 2 months

and productivity of *S. zeamais* were significantly different ($P<0.05$)(Table 2).

DISCUSSION

The adult mortality observed on the 1st and 2nd day of infestation was low to that of 21 days. Olaifa *et al.* (1987) reported that topical application of essential oils of *M. tenuifolia, L. adoensis, P. alliacea* and *C. citratus* showed acute toxicity against field pests, *Acrae epomina* Cramer, *Dysdercus superstitiosus* (F.). *Ootheca mutabillis* Sahlberg and *Riptortus dentipes* (F.). Thus the observed mortality in treatments could be attributed to stomach action and also partly to contact action. Similarly, the essential oil from *Dennettia tripetala* G. Baker which grows as a shrub in Southern Nigeria, has been shown to be very effective in protecting cowpeas and maize against *Callosobruchus maculatus* F. and *Sitophilus zeamais* Motshulsky respectively (Osisiogu and Agbakwuru, 1978).

More plants need to be screened for their volatile constituents for use against insect pest. An efective essential oil should be found from a cheap, common, easy to grow plant. The two most effective oils, *L. adoensis* and *M. tenuifolia* are perennial and the oils can be integrated into pest management procedure.

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