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RESEARCH ARTICLE

EFFECT OF POWDERED LEAVES TAMARINDUS INDICA AND EUCALYPTUS CAMALDULENSIS IN CONTROL OF COWPEA STORAGE PEST

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ABSTRACT

This is a laboratory trial to further test the efficiency of the production of leaves of *Eucalyptus camaldulensis* and *Tamarindus indica* in the control of *Callosobruchus maculatus*, a storage cowpea insect pest. Two cowpea varieties Dan'ila and 207-15 were introduced into glass container containing the test material. The glass container was replicated thrice and arranged in randomized block design for 41 days at temperature between 24^{0c} – 28^{oc} and 41% - 70% humidity. The result obtained at three days post treatment shows that Eucalyptus caused significant adult mortality compared to that of Tamarind and rates of Oviposion between the checks of the individual treatment at p = 5% were no significant. Result obtained at one week post treatment shows adult mortality in both Dan'ila and 207-15 treated with Tamarind sample is more significant then Eucalyptus treated sample. The result Obtained at two weeks post treatment show egg count was significantly suppressed by the Eucalyptus treated sample then followed by Tamarind treated sample. The differences in progeny emergence between the checks and treatment level were found to be significant at 35 days post treatment. Number of infested seed was high in Dan'ila and 207-15 treated with Tamarind then those treated with Eucalyptus. Also the grains damage were highly significant in Dan'ila treated samples and 207-15 treated with Tamarind. At 40 days post treatment, progeny emergence, seeds infestation and loss in weight of grain were significantly suppressed by Eucalyptus treated sample then Tamarind. Eucalyptus shown greater capacity to suppress large build up of this insect in cowpea grains. Thus it can be concluded that the Eucalyptus powder produced a much better protection against the stored cowpea insect *Callosobruchus maculatus* then *Tamarindus indica*.

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INTRODUCTION

Vigna unguiculata L. Walp belongs to the family Leguminosea. It is widely grown in many tropical regions of the world. Cowpea cultivation in West Africa is most common in the dried part of the sub-region. Nigeria is one of the leading cowpea producers in the sub-region. It provide most of the need source of protein for the people. It also accounts for about 60% of the daily dietary poultry intake of most Nigerians. In addition, the cowpea plant enriches the soil through nitrogen fixation process (Operate *et al*., 1998). The major food legume cultivated in Nigeria is cowpea, *Vigna unguiculata L. walp,* (Nielsen *et al*., 1997). The seed beetle *Callosobruchus maculatus* (F) commonly known as bruchid causes considerable loss in *cowpea Vigna unguiculata L. walp* during storage.

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The initial infestation occurs in the field and from there it carried over storage (Prevett, 1986) where the population can rapidly build up. In Nigeria alone the estimated dry weight loss of cowpea due to bruchid infestation is over 29,000 tones each year (A Casewell, 1981) with an estimated value in excess of 30 million U.S dollars in addition to causing direct weight loss of cowpea bruchid also reduce the seed quality affect germination. Cowpeas are one of the most important food legume crops in the semiarid tropics covering Asia, Africa, southern Europe, and Central and South America. A drought-tolerant and warm-weather crop, cowpeas are well-adapted to the drier regions of the tropics, where other food legumes do not perform well. It also has the useful ability to fix atmospheric nitrogen through its root nodules, and it grows well in poor soils with more than 85% sand and with less than 0.2% organic matter and low levels of phosphorus (Singh *et al*., 2003). In addition, it is shade tolerant, so is compatible as an intercrop with maize, millet, sorghum, sugarcane, and cotton.

This makes cowpeas an important component of traditional intercropping systems, especially in the complex and elegant subsistence farming systems of the dry savannas in sub-Saharan Africa (Blade *et al.,* 1997, Blade, 2005). Cowpeas are grown mostly for their edible beans, although the leaves, fresh peas and fresh pea pods can also be consumed, meaning the cowpea can be used as a food source before the dried peas are harvested (Ehlers, and Hall, 1997).Cowpeas thrive in poor dry conditions, growing well in soils up to 85% sand (Obatolu, 2003). This makes them a particularly important crop in arid, semi-desert regions where not many other crops will grow. As well as an important source of food for humans in poor arid regions the crop can also be used as feed for livestock. This predominately occurs in India, where the stock is fed cowpea as forage or fodder (Goossens, 1994). The nitrogen fixing ability means that as well as functioning as a sole-crop, the cowpea can be effectively intercropped with sorghum, millet, maize, cassava or cotton (Blade, 1997).

Plant derived insecticides may not be as effective as their synthetic counterparts, but their uses can be augmented with other controls, such as natural enemies and entomopathogens, to provide acceptable level of protection. These plants are grown locally and educating farmers and general public on their protection would lead to an increase in their uses (Jackai *et al.,* 1985). Synthetic insecticides are very expensive and unavailable at critical periods and they sometime constitute a health hazard to consumers. Research for alternative to synthetic insecticides are been intensified worldwide and the use of plant derived products with their array of active components is the focal point (opera *et al.,* 1998). Many farmers in many parts of the tropics use botanicals for grain protection in storage as well as against field pest (schmutterer, 1990).

Plant are a rich source of bioactive organic chemicals, many of which may have evolved to protect the plant from herbivores and some thousand plant species have been reported to possessed pest control properties (Ahmed *et al.,* 1984). The most important compounds, nicotine, rotenone, and the pyrenthrins are very effective (Chimbe and Galley; 1996). Tamarind is mainly grown for the fruit but is also a valuable timber species the fruit pulp has high content of vitamin B and is eaten fresh or made into jam, chutney, sweet or juice. Flower, leaves and seeds are used in variety of dishes. It also used for furniture and provide good firewood and is excellent for making charcoal. It is used for fodder, it is deep root nature make it very resistance to storms and suitable for windbreak, also suitable for fire breaks (sankaranarayanna, 1994). Although a legume, Tamarind is not nitrogen fixing but medicinally plays very important role as a source of medicine, based on human study, tamarind intake may delay progression of fluorosis but enhancing excretion of fluoride (Indica, 2010). Excess consumption has been noted as traditional laxative. In animal studies, tamarind has been found to lower serum cholesterol and blood sugar levels. Due to lack of available clinical trials, there is sufficient evidence to recommend tamarind to cure hypercholesterolemia (high cholesterol) or diabetes (Indica, 2010). Photochemical studies revealed the presence of Tannin, saponins, alkaloids and phlotamins and other extract active against gram positive and gram negative bacteria temperature ($4 – 30^{oc}$) studies shows that lowest MIC and MIB where demonstrated against staphylococcus aureus. Analysis reports indicate the application of tamarind in the control of storage maize weevil stitophilus zaemays (Doughari, 2006). The botany of Eucalyptus camaldulensis consist of the following features; it is evergreen trees with opposite leathery leaves, which are covered with a white wax giving them bluish appearance and mature which are usually longer grayish green in colour. The bark often sheds to reveal a smooth grayish green truck (Borland *et al.,* 1991) Eucalyptus it is indigenous to Australia but also common in the tropics and subtropics (Uphof, 1968) Eucalyptus tree are grown for timber and pulp they are also in medicine and perfumery (Dakshi Namurthy, 1988). Commercial oil 25ml oil in choice chamber experiment A. obetectu; it also showed direct ovicidal and larvicidal effects (Stamopoucus, D.C 1991).

The vapor from 200g oil in 860ml desecrators caused 100% mortality in adult C. Chinensis within 24hours (Ahmad and Eapen, 1986). Exposure to oil vapor caused mortality in adult C. cephalonica (Pathak and Krishna, 1991). Many insecticidal plants are useful for pest control in the field as well as for stored products. There is a tremendous wealth of traditional local knowledge has neglected over the past decade. However, small scale farmers do encounter problem due to the expensive of the synthetic chemical (insecticide) and as a result caused high tremendous economic crisis, economic lost and widespread and famine in much different local area in our country and other neighboring countries around us. As a result there is need to revive the use of our natural insecticidal plant, to wipe away famine and to ensure the restoration of our economic losses. Consequently, the insect bio assay with plant materials is a useful and pragmatic tool for farmers and extension workers to identify storage pest-controlling plants, irrespective of their mode of action (Gabinele stoll, 1986).

Cowpea storage weevil is a major problem during storage the adults make holes in the cowpea grain and lay eggs inside. The whitish larvae (Grubs) inside the grains, and there they develop and complete their life cycle. Damage by this pest is easily recognized by the holes (windows) visible on stored cowpea (Anthony Joudeowei, 2002). The ecology and biology of *Callosobruchus maculatus* has been extensively investigated (creland and Duk, 1987, Giga and Smith, 1987, Ofuya and Agele 1989, Mitchel, 1990). The bruchid is quite easy to culture and manipulate in the laboratory, and has consequently been used as a model for studies in population dynamics physiology, genetics and evolutionary biology (Messina 1989). In Nigeria *C. Maculatus* is a major primary pest of stored seed cowpea, pigeon pea and African yam bean. It also infests soya bean and Bambara groundnuts (Dobie *et al.*, 1984).

The growth, development and reproduction of *C. Maculatus* in the laboratory have been studied by different workers (Giga and Smith, 1987)The optimum conditions for these processes in these processes in these beetles are 30-35% relatively humidity which closely approximates to what is obtained during major part of the cowpea storage period. Under optimum condition, *C. Maculatus* egg hatch in 3-5 days larval development takes 8-16 days.

There is 2 day pre-pupal and 5-day pupal stage. After the pupal stage, adult emerge through exist (emergence) holes demarcated. During the last larval instar, male and female may mate shortly after emergence and presumably several times during adult life (Fos, 1993 and Ofuya, 1995). It has been reported that female release a pheromone that attracts males (Qi and Burkholder, 1982). Oviposition starts soon after mating and majority of the eggs are laid within three days (Wassermann, 1985, Creland and Wright, 1989). Unmated females do not normally lay eggs. Adults are basically requiring no water or food for reproduction the adult life span is from 8-16 days, but unmated individuals build live much longer.

Cowpea beetle *Callosobruchus maculatus* is one of the principal storage pests of cowpea grains in sub-Sahara Africa (Murdock *et al.,* 1991). It is a major constraint to cowpea yields throughout the year and account for almost 100% damage to unprotected cowpea after 3-5 months storage (Sing, 1997). Infestation caused by these beetles begins in the field and continued in storage. In tropical Africa, about 70-80%of cowpea is produced (Single *et al.*, 1990). The females deposit eggs and oviposit on the surface of dry, mature pods (Messina 1984 and Murdock *et al.,* 1991). The beetle is a small insect with a small mark on its Wings. The females have round bottom while the males have flat bottom. It is a bruchid and the adults have short life span of about 5-8 days (Sing, 1997).

The larval after hatching enters the seeds using their month parts to bore through, tunnel onwards, and penetrate the seed testa and thereafter, spend the rest of its life cycle inside the larval undergoes four instars within the seed (Shade *et al.,* 1990). The development from egg to adult was reported to last about 35 days susceptible sees at 26^{oC} and 50% relative humidity (Murdock *et al.,* 1991). The entire life cycle may also last about 30 days (Sing 1977). Temperatures between 25^{oC}-34^{oC} and 40-72% relative humidity have also been reported suitable for insect's growth (Operacke *et al.,* 1998). Adults emerge from the seeds through holes made by the larval. The damage to cowpea grains is due entirely to the larval feeding behavior within the seed (Sing, 1977).

Other insects pest of cowpea in storage are Bruchidius atrolineatus pie; which also infest cowpea like callosobruchus maculatus through their Population do not increase in storage (Sing *et al.,*1990) Callosobruchus chinensis L. also another insect pest of cowpea in storage is ranked next in importance to callosobruchus maculates (Tylor, 1981). Workers at the international institute of tropical agriculture (IITA) in Nigeria have screened over 12,000 cowpea germplasm line and have identified only three land races, Tvu 2027, Tvu1 1952 and Tvu 11953 which exhibit moderate level of seed resistance to callosobruchus maculates . Using the resistant parent varieties especially Tvu.2027, IITA has developed several improved breeding lines which combine resistance to callosobruchus maculatus with other desirable agronomic traits such as higher yield, early maturity and diseased resistance (Singh and Singh *et al.,* 1992). Technological that does not involve the use of synthetic chemicals has been employed in the control of stored cowpea beetles these include the use of grain storage bags such as metal drums or triple plastic bags which arrest the development of storage insect pests population. Mixing the grain with wood ash from cooking fibers or other fine grained in organic materials such as sand, also stops damaging to grains (Murdock *et al.,* 1991). The use of plant materials for the preservation of cowpea is common on low resources farms in sub-Saharan Africa. This is often as a whole plant or leaves of various mints, aromatic or pungent plant materials The most commonly used control measure of stored cowpea insect pests are the use of chemical insecticides (Singh 1990 and Jackai *et al.,* 1985).

Chemical control of field insect pest of cowpea using synthetic insecticides is widely known and effective form of pest control (National academy of science 1969). Such synthetic insecticides include endosulfan, monocrotophus, pron plus, e.t.c treating the seeds before they are planted which usually prevent damage from beetles leafhoppers, beanfly and birds (Breniere, 1967). The use of foliar sprays can also be employed these involve either emulsifiable concentrates or wetable powder (Jackai *et al.,* 1985). There is also increasing interest in the application of plant based insecticides against field pests (Schmulterer, 1990; Tamo, *et al.,* 1997.

MATERIALS AND METHODS

The aim and objective of this work is to further test the bio-efficacy of powdered leaves of *Tamarindus indica* (Tamarind) *and Eucalyptus Camaldulensis* (Eucalyptus) in the control of storage insect pest of cowpea*; Callosobruchus maculatus*.

- To determine the minimum level of treatment that will ensure protection from bruchid.
- To study the effect of different treatment level of powdered leaves on both resistance and susceptible cowpea variety.
- To determine the more effective powdered among the two on bruchid protection.

The leaves of *Tamarindus indica* and *Eucalyptus camaldulensis* were collected from the school surrounding. The leaves were dried under shade for a few days after which they were ground into fine powder. The cowpea varieties used were one old but resistant variety called 207-15 and another susceptible but local variety called Dan'ila. Both were obtained from international institute of tropical Agriculture (IITA) Kano station, Nigeria.

Experimental Design

Cowpea varieties 207-15 and Dan'ila were sterilized at 80% for 1 hour in an ovum. 50g of sterilized grains of each variety was weighted into each of the glass containers to which different treatment level 0g, 2.5g, 5.0g and 10g of Tamarind and Eucalyptus were then added. Each glass container was thoroughly shaken to ensure good admixture. The contents were allowed to settle down before introducing 10 pairs of adult *Callosobruchus maculatus* (the male: female ratio being about 1:1) obtained from a laboratory culture. The glass containers with three replicates each were covered with fine net to prevent escape of the weevils and allow for aeration which was all laid in a randomized block design for 41 days at temperature range between 25^{oC}-37^{oC} and 42%-70% humidity. The contents of each glass container was examined and recorded at the following period: 3 days, 1 week, 2 weeks, 35 days, 40 days respectively. For adult mortality: egg count (oviposition) was taken by counting the number of eggs laid: adult emergence the F1 progeny were recorded at 35 and 40 days post treatments respectively: the percentage of grain damage was calculated using the emergent hole on each seed as described by (Operacke and Dike, 1996). And lastly loss in weight is calculated by comparing the weight of cowpea grain before and after infestation.

Table 1. Adult mortality of *callosobruchus maculatus* treated Tamarind and eucalyptus leaf powder at 3 days post treatment.

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		0.000	0.333
2.5		2.000	1.000
5.0		1.000	1.000
10		2.333	1.667

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		3.333	2.381
2.5		2.000	1.333
5.0		2.333	2.333
10		4.000	1.001

Table 2. Adult mortality of *callosobruchus maculatus* treated Tamarind and eucalyptus leaf powder at 1 week post treatment.

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		4.000	2.547
2.5		9.667	7.666
5.0		7.667	8.333
10		12.33	2.667

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		4.000	3.000
2.5		7.667	6.333
5.0		9.667	7.000
10		8.667	9.667

Table 3. Egg count of *callosobruchus maculatus* on cowpea grains with Tamarind and eucalyptus leaf powder at 3 days post treatment

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		8.000	6.000
2.5		7.000	4.333
5.0		4.667	2.333
10		3.333	2.667

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		6.667	6.333
2.5		6.000	5.333
5.0		5.000	4.000
10		3.667	6.000

Table 4. Egg count *of callosobruchus maculatuss* on cowpea grains with Tamarind and eucalyptus leaf powder at 1 week post treatment

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		21.333	21.667
2.5		14.000	16.667
5.0		9.000	14.333
10		6.667	9.000

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		22.333	21.667
2.5		15.000	16.667
5.0		11.333	14.333
10		9.333	9.000

Table 5. Egg count of *callosobruchus maculatus* on cowpea grains with Tamarind and eucalyptus leaf powder at 2 weeks post treatment

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		36.333	33.667
2.5		25.000	28.333
5.0		21.333	22.000
10		15.000	15.333

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		36.000	14.667
2.5		35.333	26.333
5.0		24.600	13.667
10		18.000	14.667

Table 6. Egg count of *callosobruchus maculatus* on cowpea grains with Tamarind and eucalyptus leaf powder at 35 days post treatment

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		92.66	49.333
2.5		41.66	54.667
5.0		42.00	42.337
10		29.66	27.667

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		45.000	42.000
2.5		41.667	34.333
5.0		30.333	25.667
10		20.667	20.000

Table 7. Egg count of *callosobruchus maculatus* on cowpea grains with Tamarind and eucalyptus leaf powder at 40days post treatment

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		47.667	51.667
2.5		39.000	26.667
5.0		20.333	24.000
10		12.667	21.000

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		11.667	122.00
2.5		44.333	51.333
5.0		26.333	45.333
10		22.333	55.333

Table 8. Final weight of cowpea grains following treatments and infestation by *callosobruchus maculatus* at day 41 post treatment

Trm seed/g	Var Dan'ila	Tamarind mean	Eucalyptus mean
0.0		43.08	43.06
2.5		45.99	47.63
5.0		49.93	47.36
10		45.27	43.92

Trm seed/g	Var 207-15	Tamarind mean	Eucalyptus mean
0.0		43.20	40.03
2.5		37.38	39.09
5.0		41.35	43.17
10		43.15	42.80

DISCUSSION

The parameters recorded during the trial were as follows: Adult mortality-number of insect death, oviposition - number of eggs layed, adult emergence-number of emerging adult progeny of the first filial generation, seed infestation and loss in weight of grain after infestation. The result of adult mortality of the insect after three days are in table 1 and shows significance mortalities at p = 5% relative to the checks and the individual treatment in 207-15 treated with tamarind sample and Dan'ila treated with both samples.

Tables 2 show the result of adult mortality of callosobruchus maculatus taken as one week post treatment. There are significant differences at p=5% between treatment and control and between the individual treatment in Dan'ila and 207-15 treated both with Eucalyptus. No significant difference was found in Dan'ila and 207-15 treated with both tamarinds. Although the rates of ovipostision between the checks and the individual treatment at three days post treatment were not significant p = 5%. Table 3 the result of an egg count at a one week and two weeks post treatment. Table 4 and 5 shows that eggs count was no more suppressed in 207-15 Treated with tamarind sample then in Eucalyptus treated sample. The result of oviposition in table 5 at p=5% significant difference between the checks and the individual treatment yield positive result. Eucalyptus suppressed rates of oviposition more than the tamarind.

Result of adult emergence at 35 days post treatment is shown in table 6 progeny emergence between the check and individual treatment were found to be significant. High number of infested seeds was found in Dan'ila and 207-15 treated with Tamarind sample then those with Eucalyptus sample. At 40 days post treatment progeny emergence was significantly reduced in 207-15 treated with eucalyptus and tamarind, then with Dan'ila treated with eucalyptus and tamarind. Table 7 fig. 5-6 shows significant reduction at p=5% of seed infestation in Dan'ila and 207-15 treated with both treated samples in various levels related to the checks. High number of seeds are infested in Dan'ila treated with tamarind (2.5g and 5.0g) at 40 days post treatment, seed infestation was significantly reduced related with checks also. Comparisms between 207-15 treated with both tamarinds at table 6-7 shows that Eucalyptus prevents enormous infestation of cowpea grains.

Table 8-9 shows loss in weigh of cowpea grains. The obtained found from the above table shows high loss in weight in 2.5g between the treatment and those of 5.0g and 10g post treatment checks. Result shows high loss in weight in Dan'ila treated with tamarind then Eucalyptus consequently. Eucalyptus provides more protection to the cowpea insect pest then tamarind. This is almost similar to the finding by operacke *et al.* (1998) and Ajai *et al.* (1987). That 5g-10g of neem leaf product protected 100g of cowpea grains from callosobruchus maculatus attack. As such it can be assumed that the toxicity of eucalyptus and tamarind to callosobruchus maculatus could be due there larvicidal, ovidal or insecticidal property. Some histological studies have revealed that the decrees of oviposition are as a result of block in ovarian actives caused by eucalyptus. It also induces sterility in females and disrupts insect growth and metamorphosis. Eucalyptus has also been reported that to have very feeding inhibitors which qualified them as anticidal and function just like neem (wikken *et al.,* 1980). Mode of action of this plant product could also be attributed to stomach poison since the weevil is known to feed directly on bean. Disruption of normal respiratory activities of the weevil which can result in suffocations and subsequent death can also be noted.

Conclusion

Eucalyptus (Eucalyptus camaldulensis) and Tamarind (Tamarindus indica) leaf powders have shown from the result obtained in these trials to be effective against the storage insect pest; callosobruchus maculatus. Eucalyptus powder showed the ability to suppress the large build up these insect at 10g/50g of cowpea grains then tamarind powder. Eucalyptus powder significantly suppressed oviposition p=5%, adult emergence and seed infestation at 10g/50g of cowpea grains. As a result, it's concluded to give a better protection then tamarind evaluation of chemical components present in eucalyptus and tamarind may be fruitful and suitable formulations that render the compound very effective synthetic products.

Recommendation

1. Eucalyptus and Tamarind products are recommended for household to small scale storage of cowpea because the materials are readily available and affordable.
2. The plant materials are also important because they are used as food and local medicinal preparation.

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