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EFFICACY OF *Ficus congensis* Engl. LEAF POWDER AGAINST PESTS OF STORED *Tamaridus indica* L. FRUITS IN GOMBE STATE, NIGERIA

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ABSTRACT

An investigation was undertaken with the aim of determining the efficacy of *Ficus congensis* Engl. leaf powder against pests on stored *Tamaridus indica* L. fruits in Gombe State, Nigeria The experiment was conducted in the laboratory of the Department of Botany, Gombe State University. The method used was by obtaining the plant powders and thoroughly mixing with 20g of Tamarind fruits in 250ML plastic containers at, 0.2, 0.4 0.6 and 0.8g concentrations according standard procedures. The findings revealed that the LC_{50}, LC_{90} and LC_{99} had been found as 0.62g, 1.1g and 1.2g respectively which varied according to Concentrations of and duration of exposure, The treatments had significant results compared to the controls at $P \leq 0.05$ level of significance using the Student Newman-Keuls (SNK) test for variables.

This study concluded that the high efficacy of organic pesticides *Ficus congensis* in the control of insect pest (*Sitophilus linearis*) was 85% mortality for four weeks. The study therefore recommended that *Ficus congensis* should be used at high Concentrations of 1.2 grams per 20 grams of Tamarind fruits to cause 99% mortality. Also the powder should be applied on fresh dried Tamarind fruits for efficient results as it has no toxic effect. The leaf powder is therefore recommended for Tamarind storage for at least four weeks.

Keywords: *Ficus congensis*; *Tamarindus indica*; Insect pests; *Sitophilus linearis.*

INTRODUCTION

Tamarindus indica L. belongs to the Sub-Family Caesalpinioideae of the family Fabaceae (Leguminosae). It is called " Imli" in Urdu and Hindi and Tsamiya in the Hausa Language. It is a large evergreen tree up to 30m tall (Plate 1). The bole is usually 1-2m, up to 2 m in diameter. The crown is dense, widely spreading, rounded; bark rough, fissured, grayish -brown. Tamarind is one of the most widespread trees of the Indian subcontinent (Abubakar *et al.*, 2010) and it is also grown in Nigeria as a multipurpose plant (*Tamarindus indica*). It grows over a wide range of soil and climatic conditions, occurring in low-altitude woodlands, savannah and bush, often associated with termite mounds. Tamarind fruits begin to ripen during February–March (Abubakar *et al.*, 2010).

Plate 1. *Tamarindus indica* Tree SOURCE. (Field Work ,2019)

PLATE 2: Infested *Tamarindus indica* Fruits.Source:(Field Work,2019)

It is used as a traditional medicine in India,Nigeria,Sudan and Bangladesh to treat various diseases including infectious diseases, infertility, and gastrointestinal disorders(Naeem *et al* 2017).. It is also used as food, Hence Tamarind is said to be simultaneously the most acid and the sweetest fruit. The ripe fruit of the sweet type is usually eaten fresh, whereas the fruits of sour types are made into juice, jam, syrup and candy (Ekpong *et al.,* 2015). Fruit is marketed worldwide in sauces, syrups and processed foods. The seeds can be eaten and are prepared in a variety of dishes. Tamarind seeds are also edible after soaking in water and boiling to remove the seed coat. Flour from the seed may be made into cake and bread. Roasted seeds are claimed to be superior to groundnuts in flavor (Naeem *et al* 2017 . The foliage has a high forage value, though rarely lopped for this purpose because it affects fruit yields. In the southern states of India cooked seeds of Tamarind tree are fed to drought animals regularly. It is also used in apiculture: Flowers are reportedly a good source for honey production. *Tamaridus indica* L. provides good firewood it also produces an excellent charcoal. The pulp may be used as a massage and is used to treat rheumatism, it is also used as an acid refrigerant, a mild laxative and also to treat scurvy. Powdered seeds may be given to cure dysentery and diarrhea (Bhadoriya *et al.,*2011). The pulp of the fruit, sometimes mixed with sea-salt, is used to polish silver, copper and brass in India and elsewhere. The most serious pests of the stored tamarind fruits are scale insects *S. linearis*, Details of the Biology of the Tamarind weevil, *S. linearis*, were reported by Cotton (1920) and Usman (1953). The adult is reddish brown to dark brown, slightly shiny, and measures 4-4.5 mm long. Delobel and Tran (1993) listed *S. linearis* in their monograph on Coleoptera and illustrated it. Brown (2013) reported it as causing significant damage: reducing the pods contents to powder and almost every tree being affected by the weevil. Pupation takes place inside the pod and the adult emerges through an exit hole in the pod. Oja and Omoloye (2015) studied the life history of *S. linearis* under laboratory conditions. Mating takes place a few days after emergence and egg laying commences a week after mating. A female lays an average of 165 eggs (132-180) during a period of 86.8 days (77-98) in a small hole it excavates in seeds. Adult longevity was in the range of 91-126 days. Beetle larvae cause damage to branches in Brazil, while in Florida and Hawaii beetles attack ripe pods. Termites attack the tree in China. The Stored fruit of *Tamarindus indica* L. is commonly infested in India and Nigeria.. The African rock fig. (*Ficus congencis* Engl.) leaf powder was used as an alternative to synthetic insecticide against the (*Sitophilus linearis*) on stored *Tamarindus indica* L. Generally, plants have evolved highly elaborate chemical defenses against the insect pest attack and they have therefore provided a rich source of biologically active chemical compounds which may be used as protectant

(Adedire *et al*., 2000). Aim of the study was to determine the efficacy of (*Ficus congensis* Engl.) against insect pests on stored *Tamarindus indica* L. fruits in Gombe State, Nigeria.

MATERIALS AND METHODS

Description of Study Area

The experiment was carried out at the Botany laboratory Gombe State University, Gombe. Gombe has two distinct climates, the dry season (November-March) and the rainy season (April- October) with an average rainfall of 865mm (Figure 1).

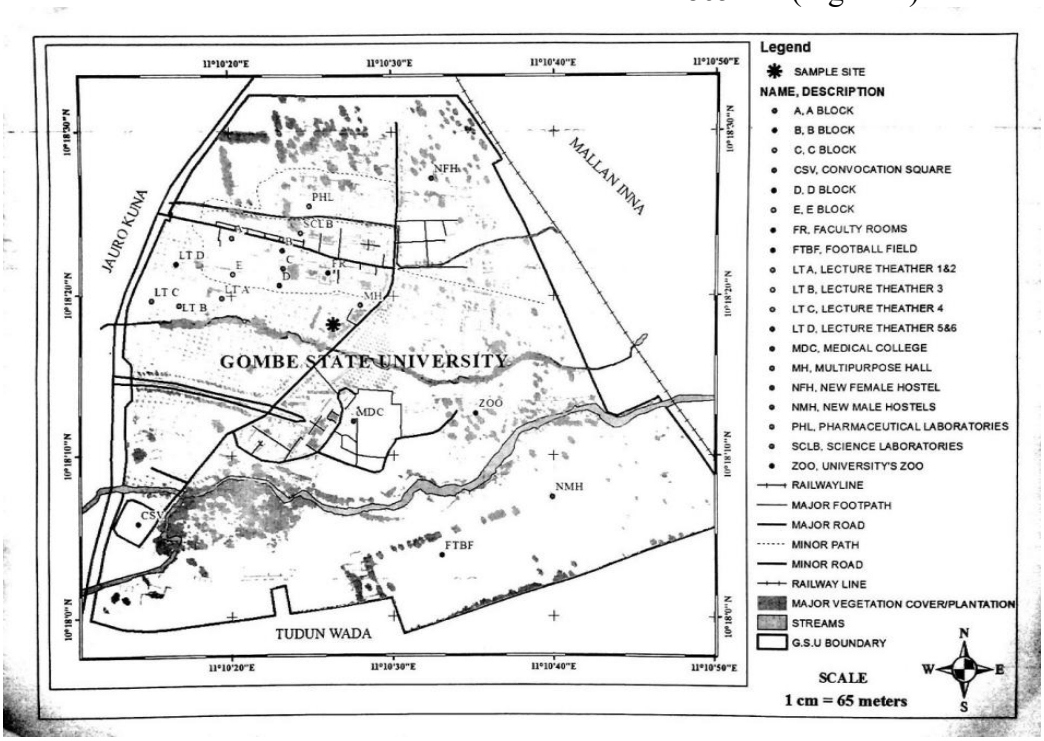

Figure 1: Map of Gombe State University showing Study Site. Source:(Field work, 2019).

Experimental Insects

Sitophilus linearis L. weevil was obtained from established laboratory culture reared on disinfested *Tamarindus indica* L. fruit, variety at ambient temperature of 28+ or -2^{0}C and 75+ or -5% relative humidity. The Tamarind fruit to be used for the bioassay ware obtained from Gombe Main market, Gombe state, Nigeria. First it was cleaned and disinfested by keeping it at the refrigerator for seven(7) days to kill all hidden infestations. All the life stages, particularly the eggs are very sensitive to cold (Koehler, 2003). The disinfested Tamarind fruits were placed inside a GallenKamp Oven (Model 250) at 40^{0}C for 4 hours (Jambere *et al.,*1995) and Later air dried in the laboratory to prevent moldiness (Adedire *et al.,* 2011) before they were stored in plastic containers with tight lid disinfested swabbing with 90% Alcohol.

Plant Material

The plant material used in the present study was *Ficus congensis* leaf. *Ficus congensis* Engl (Moraceae) is a tropical tree of up to 25 m high and of 2m girth in trunk. It is a locally abundant terrestrial plant found in Swamps and Ravines and richly available in the West African Sub-region (Burkill,1997).The genus *Ficus* is found in the tropics with about 755

species world wide (Van Noort *et al.*,2007). There are currently 112 recognized species, 36 of which are indigenous to S.Africa (Berg,1990; 1991;1992; Burrows,2003;Chinwendum *et al.*,2011)..Ficus congensis is used traditionally used to treat various diseases including infectious diseases, infertility and gastrointestinal disorders (Chinwendum *et al*.,2011).

The leaf were shade dried for 7 to 14 days. The cleaned dried leaf was pulverized in to fine powder using a blender (Super master, Model SMB 2977, Japan). The powder was further sieved to pass through 1mm^2 mesh. The powders were packed in plastic containers with a tight lid and stored in a refrigerator at 4^0C prior to use.

Effect of Contact Toxicity of Plant Products on Adult Mortality of *Situphilus linearis*

The methodology of Ileke, 2011, was adopted as follows. The plant powders were thoroughly mixed with 20g of Tamarind fruits in 250ML plastic containers at, 0.2, 0.4 0.6 and 0.8g concentrations. The experimental design ware structured in a Completely Randomized Block Design (CRBD). Each treatment ware duplicated four times (4). The replicated treatments were arranged on the Table at a room temperature of 38-39^o c and relative humidity of 40-45%. Five of adult *Sitophilus linearis* unsexed (2 to 3 days old) were introduced in to the treatment and control (Idoko and Adebayo, 2011; Udo, 2011). *Sitophilus linearis* Engl. mortality was assessed every 24 hours for three weeks, then at week four after treatment (Ashamo, 2007). Dead ones were removed at the end of the experiment and the results were taken.

Statistical Analysis

The data collected were subjected to statistical analysis using Probits Analysis. Where significant differences exists, treatment means were separated using the new Duncan's Multiple Range Test (Zar, 1984). at P≤0.05 /

RESULTS

Effectiveness of Ficus *congensis* as Contact Insecticides

The results obtained shows percentage mortality when the *Sitophilus linearis was* subjected to the following concentrations as follows 0.2g, 0.4g 0.6g and 0.8g of the plant material (*Ficus congensis* Engl.) leaf powder after each week for four weeks as 5,12,15 and 17 was recorded,. This shows that time and concentration had an effect on mortality as could be seen in the Table 1, below.

Table1: Mean Percentage mortality (%) of *Sitophilus linearis* exposed to different concentrations

***Ficus congensis* Engl.**	**Concentrations**	**Time**			
	(*S. linearis*/g)	168Hours	337Hours	572Hours	765Hours
	0.2	3	3	4	5
	0.4	4	5	5	8
	0.6	6	8	12	15
	0.8	6	8	13	17
	Control	0	0	0	1

According to the Table above the percentage mortality of *Sitophilus linesris* in response to different concentrations of *Ficus congoensis* leaves extract and duration of exposure varies according to different concentrations.

Figure 2 below expressed the lethal concentrations of F *congensis* Engl. that caused 50% mortality of adult *S. linearis* at 0.62 concentration of *F congensis* .0.2g of Tamarind, at 90% caused mortality of adult *S. linearis* at rate of 1.1g *F congensis* . 20g of Tamarid fruits caused 99% mortality of adult *S. linearis* on stored *Tamarindus indica* L. fruits at the rate of 1.2g of *F congensis*.

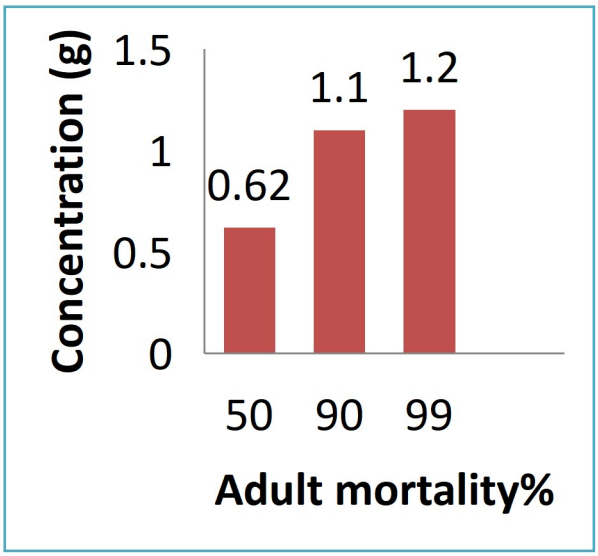

Figure 2: Shows lethal concentrations of *Ficus congoensis* ENGL.

The lethal concentration causing 50% mortality at LC_{50}, LC_{90} and LC_{99} also varied according to concentrations of *Ficus congoensis* and duration of exposure.

The results shows that, the *Ficus congoensis* Engl. leaf extract gave the best result, as it had the less damage to the fruits, high mean percentage of undamaged fruits and high mean percentage mortality. The treatments had significant results compared to the controls at $P \leq 0.05$ level of significance using the Student Newman-Keuls (SNK) test for variables.

DISCUSSION

Ficus congensis Engl. Leaf Powder when used as contact insecticides caused 85% mortality of adult *Sitophilus linearis* in 0.8grams within 28 days of treatment,. An effect that has earlier been reported is that the four levels of the plant material leaf powder (0.2g, 0.4g, 0.6g, and 0.8g) significantly reduces the egg- laying ability and suppressed adult emergence. This agrees with the findings of Ofuya *et al.*, (2001), that plant material powder with toxic constituentss was effective in suppressing egg- laying ability. The observed results could be a direct consequence of reduction in egg production or inhibition of egg laying or both. This means that, the plant material *Ficus congoensis* Engl. has insecticidal properties and effects that inhibit egg- laying and hatching which agrees with Zizka (2008), who stated that, the repellant and the pungent odour produced by the plant material powder inactivates the *Sitophilus linearis.* As a result, their ability to bore into the seed was highly minimized. There was also less weight loss recorded in plant material leaf powder treated seeds. This is in line with the works of Lale (2003), who stated that the presence of the protective powder around the stored product reduces the weight loss by 14%.

Unlike the chemical control, it is still the most effective means of insect pest control but Chemicals are toxic to the target at some stages of its life cycle. The result is in agreement with that of (Zetter *et al*., 1997). They are compound with repellant effects and may not necessarily be actively poisonous but render the fruits unattractive to the pest by virtue of their ordour, taste or physical properties. The dosage level or the quantity of the plant material leaf powder used also significantly affected the results obtained. 20gams of Tamarind fruits treated with 0.8g, 0.6g, 0.4g, and 0.2g of the *Ficus congoensis* Engl. leaf powder caused 85% mortality, 75% damage, 40% damage and only 25% of the insects lost. This trend continues in a descending order as the quantity of the plant material leaf powder quality is reduced from 8.0g, 6.0g, 4.0g and up to 2.0g respectively.

This clearly means that, the higher the quantity of the leaf powder the more effective the plant material was. This is in consistent with (Oaya, *et al.,* 2013; Otitodun *et al.,*2001), who reported that, the dosage level of the protectant is directly proportional to the impact made on both the test insect and the stored product.

CONCLUSION

This study concluded that common pests of stored *Tamarindus indica* L. fruits were *Sitophilus linearis.* The efficacy of organic pesticides *Ficus congensis* in the control of insect pest (*Sitophilus linearis*) was 85% mortality for four weeks (28 days). The lethal concentrations of organic pesticides *Ficus congensis* in the control of insect pests at low concentrations causes 50% mortality of *Sitophilus linearis*, while at high concentrations causes 99% mortality of *Sitophilus linearis.* This study recommended that *Ficus congensis* should be used at high concentration of 1.2 grams per 20 grams of Tamarind fruits to cause 99% mortality and the powder be applied on fresh dried fruit for efficient results as it has no toxic effects. Further research should be carried out to measure the toxicity of leaf powder.

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