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Evaluation Of The Efficacy Of Some Selected Indigenous Plants Leaf Extracts On Cowpea Beetle (*Callosobruchus Maculatus*)[Coleoptera: Bruchidae] On Cowpea Seeds [(*Vigna Unguiculata)* (L.) (Walp.)]

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Abstract: *Evaluation of toxicidal efficacy of Vernonia amygdalina, Tamarindus indica and Parkia biglobosa leaf extracts against Callosobruchus maculatus were conducted at New Biology Laboratory, School of Technology, Kano State Polytechnics. Plant leaves were collected from Danmaliki in Kumbotso, Kano state and were identified at Plant Biology Department, Bayero University Kano. Callosobruchus maculatus were obtained from Dawanau market in Kano State. These were reared in the laboratory to obtained 1-2 day old adult C. maculatus were identified. Four different doses of the leaf extracts (1.0, 1.5, 2.0 and 2.5g) were taken and separately mixed with twenty gram (20g) of cowpea seeds in separate petri-dishes which correspond to 5.0, 7.5, 10.0 and 12.5%w/w respectively. Positive and negative control treatments were also set along. Each treatment was replicated three times and arranged in completely randomized design. Five (5) adult pairs of newly emerged adult of C. maculatus were introduced into each petri-dish. Mortality of C. maculatus, oviposition, eggs viability, F1 adult emergence, seed weight loss, seed damage, germination and organoleptic properties of seeds were observed. The result indicated that V. amygdalina and T. indica at 2.5g (12.5%w/w) doses were the most effective treatment which recorded significant mortality rate 100±0.00% after 96hrs of treatment. Female fecundity 3.3±0.25 and 3.3±0.10, number of eggs viability 0.67±0.39 and 0.33±0.19, number of C. maculatus adult emergence 0.33±0.19 and 0.00±0.00 respectively.*

Keywords*: cowpea seed, C. Maculates, Leaf extracts, mortality, oviposition and adult emergence*

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I. Introduction

Cowpea (*Vigna unguiculata (L.) walp*) is one of the major food legumes cultivated commercially in most tropics and sub-tropics (Bashir *et al*; 2002). It is truly a multinational crop, providing food for man and livestock and serving as a valuable and dependable revenue-generating commodity for farmers and traders (Singh, 2002; Langyinto *et al*; 2003). It is also a valuable component of farming systems in areas where soil fertility is limiting. This is because cowpea has a high rate of nitrogen fixation (Elawad and Hall 1987) and forms effective symbiosis with mycorrhizae (kwapala and Hall, 1985). It accounts for about 60% of human protein intake in Nigeria (oparaeke *et al*; 1998). The seeds and leaves are very rich in protein (24-33%) and are used in the preparation of various dishes for food and feed (Bressani, 1985). *Callosobruchus maculatus* is responsible for a great deal of damage to the seeds making it unfit for human consumption. Insect pests constitute a major factor militating against food availability and security (Ofuya and Adedire, 2004). Cowpea bruchid(*Callosobruchus maculatus)* (Fab) is a major pest of wide range of stored legume seeds especially of the cowpea *Vigna unguiculata* (Ofuya 2001). Cowpea are rapidly broken down by the cowpea beetle within three to five months in storage (Ajayi and Lale, 2000; Mbailao *et al*, 2006). During storage, the cowpea beetle causes heavy qualitative and quantitative losses. The damaged seeds are unsuitable for human and animal consumption and they cannot be used for planting. There is need to control these insect pests due to their destructive activities so as to maintain the quality of the products. The common control measures has been the use of synthetic insecticides due to their swift action in eradicating the pests, their use is being discouraged due to associated human and environmental problems, such as insect pests resistance to insecticides, environmental pollution, high cost of purchase, non, availability as well as toxic to man and livestock. Akob and Ewete (2007).These drawbacks have necessitated the need for sustainable alternatives measures such as plants with natural insecticidal potency, that are easily biodegradable, environmentally friendly and safe to both producers and consumers (Ewete, *et al*.,1996).Based on this, the present study was conducted to evaluate the efficacy of the leaf extracts of *Vernonia amygdalina, Tamarindus indica and Parkia biglobosa* plants, that are locally available and have been used traditionally by rural farmers in protecting stored products from insect pest infestations. In

recent years, attention has been focused on the use of plant materials for insect pest control. Such plant materials include powders from parts of the neem tree, (*Azadirachta indica*), vegetable oils from groundnuts, palm kernel and coconut (Abdullahi, 2011). The plant kingdom contains a huge array of chemical substances; many of these are used by plants for their defense against insect attack. Phytochemicals possess a wide spectrum of biological properties against insects. They may act as antifeedants, repellents, growth inhibitors, attractants, and chemosterilants or as insecticides. The naturally occurring phytochemicals are usually biodegradable and non-toxic to plants, warm-blooded animals and the environment. They offer great potential as safer, more effective and economic pesticides (Radha and Susheela, 2014).

II. Materials And Methods

2.1 Study area

The study was conducted at New Biology Laboratory, School of Technology, Kano State Polytechnics, Nigeria between the period of March to August 2018, under ambient conditions of temperature and relative humidity.

2.2 **Collection and identification of Plant materials**

Fresh leaves of different plants were collected at Dan maliki town, in Kumbotso Local government,of Kano State. These were identified and authenticated at the Herbarium section, Plant Biology Department, Bayero University, Kano, Nigeria.

2.3 Processing of plant materials

Plant materials were air-dried under a room temperature for about 2 weeks following the procedure as described by(Adesina, 2012). The dried leaves were pounded into powder using motar and pestle as described by (Epidi *et al*., 2009). The powdered particles were sieved using 0.01mm mesh size to obtained fine particles. The sieved powdered particles were kept in a glass bottle until required for extraction.

2.4 **COLLECTION OF COWPEA SEEDS**

Clean and healthy cowpea seeds *(Vigna unguiculata)(*IT93K-452-1)was obtained from IITA, Kano State, Nigeria and mechanically damaged seeds were excluded.

2.5 PROCESSING OF COWPEA SEEDS

Checked seeds were placed in plastic bags and kept in the freezer overnight to eliminate any possible beetle infestation coming from field (Marcileyne *et al.,* 2004). The seeds were removed from the freezer and kept at room temperature and relative humidity for some hours to equilibrate and the moisture content of the seeds was measured before the experiment (Jackai and Asante, 2001).

2.6 COLLECTION OF TEST INSECTS AND IDENTIFICATION

A small population of cowpea beetles along with naturally infested cowpea seeds were obtained at Dawanau Market in Dawakin Tofa local Government of Kano state, Nigeria. The insects were identified and authenticated at Crop protection Department, faculty of Agriculture, Bayero University Kano, Nigeria. Prior to rearing

2.7 Bioassay

Bioassay were conducted based on the method described by (Talukder and Howse, 1994) Four different diluted concentration of extract from the leaf of *V.amygdalina* (1.0,1.5,2.0, and 2.5g) which were design after a trial experiment. These were separately mixed with twenty gram(20g) of cowpea in separate Petri dishes which correspond to 5.0,7.5,10.0, and 12.5% W/W respectively. Cowpea seeds which were mixed with different concentrations of the extract were shaken properly to ensure proper coating of the seeds with the extract. The seeds were then air-dried for one hour to evaporate the solvent (Talukder and Howse, 1994). Cypermethrin dust (positive control) was set up as standard chemical insecticides. Control treatment was also set along (which has neither extract nor Cypermethrin dust). Five pairs of the beetle *C. maculatus* which freshly emerged from the culture were released into each treatment. These were covered with a muslin cloth to facilitate proper aeration and prevent entry and exit of insects. Each treatment were replicated three times and arranged in a completely randomized design (CRD) and left on the laboratory bench for daily observation (Oparaeke, 1996). Mortality of the insect was observed after 24hours interval for a period of 96hrs after treatment. The number of eggs laid was counted separately for each treatment on the 14th day after the introduction of beetles to seeds; this was used to calculate the percentage of egg hatching and percentage adult emergence respectively according to Abdullahi *et al.* (2011). All the eggs laid in different Petri dishes were examined and the viable eggs were identified. Viable eggs were recognized by their morphological aspect (Marcileyne *et al*., 2004), since they become opaque as a function of their residue discharged by the larvae during penetration. The % adult emergence was also determined on 35days after the introduction of beetles to seeds.

2.8 Statistical analysis

Two way analysis of variance (ANOVA) was conducted and where there is significant difference, least significant difference (LSD)was conducted to find out where difference exist.

III. Results And Discussion

Mortality of *C. maculatus* on cowpea seeds treated with different leaf extracts were recorded and presented in Table 1. The results indicated that there were no significant differences on the mortality of *C. maculatus* on cowpea seeds treated with *P. biglobosa* at various doses 1.0g (5.0%w/w), 1.5g (7.5%w/w), 2.0g (10.0% w/w) and 2.5g (12.5%w/w) recorded 0±0.00% similar to that of untreated control in comparisms with synthetic chemical control which recorded 100±0.00% mortality at 24hours after treatment. At 48hours after treatment there were no significant differences on the mortality rate on treated cowpea seeds at doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 10.00±6.00, 6.70±7.00, 3.30±3.00 and 0.00±0.00% in comparisms with untreated control which recorded 0.00±0.00%. At 72hours of treatment there were no significant differences on the mortality of *C. maculatus* on cowpea seeds treated at doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 33.3±3.00, 23.3±2.00, 16.7±1.00 and 10.0±6.00%, in comparisms with untreated control. At 96hours of treatment there were no significant differences on the mortality of *C. maculatus* on treated cowpea seeds at doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 60.0±1.00,46.7±2.00, 36.7±1.00 and 23.3±2.00%, in comparisms with untreated control which recorded 0.00±0.00%.

There were no significant differences on the mortality of *C. maculatus* on cowpea seeds treated with *Tamarindus indica* at doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 10.0±0.00, 6.70±2.00, 0.00±0.00 and 0.00±0.00%, similar to that of untreated control (0.00±0.00%) in comparisms with synthetic chemical control which recorded 100.00±0.00% at 24hours of treatment. At 48hours of treatment there were no significant differences on the mortality of *C. maculatus* on treated cowpea seeds at doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 5g (7.5%w/w) and 1.0g (5.0%w/w)which recorded 26.70±0.00,16.70±1.00, 6.70±3.00 and 6.70±3.00% similar to untreated control recorded 0.00±0.00% . At 72hours of treatment there were no significant differences on the mortality of *C. maculatus* on treated cowpea seeds at doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 53.3±0.00, 36.7±0.00, 23.3±0.00 and 16.7±2.00% in comparisms with untreated control. Highest significant (P<0.05) mortality of *C. maculatus* at 96hours of treatment at high dose 2.5g (12.5%w/w) recorded 100.0±0.00% in comparisms with other doses 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 63.3±0.00, 43.3±1.00 and 30.00±1.00% respectively and these were found to be higher than that of untreated control which recorded 0.00%.

There were no significant differences on the mortality of *C. maculatus* on cowpea seeds treated with *V. amygdalina* among the various doses 2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 20.0±1.00, 16.70±1.00, 6.70±2.00 and 0.00±0.00%, in comparisms with that of untreated control which recorded 0.00±0.00%. However, highly significant (P<0.05) mortality100±0.00% at 24hours of treatment were recorded on seeds treated with synthetic chemical control. There were no significant differences on the mortality of *C. maculatus* among the various doses2.5g (12.5%w/w), 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 46.70±0.00, 36.70±2.00, and 16.70±2.00 and 6.70±3.00% at 48hours, in comparisms with untreated control which recorded 0.00±0.00. At 72hours of treatment highest significant (P<0.05) mortality of *C. maculatus* 86.7±1.00% at high dose 2.5g (12.5%w/w) was recorded in comparisms with other doses 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded 60.0±1.00, 30.0±1.00 and 16.70±2.00% these were found to be higher than that of untreated control which recorded 0.00±0.00% *C. maculatus* mortality. Highest significant (P<0.05) mortality 100.0 ±0.00 and 90.30±0.00 were recorded on seeds treated with *Vernonia amygdalina* at doses 2.5g (12.5%) and 2.0g (10.0%w/w) at 96hours of treatment in comparisms with other doses 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded *C. maculatus* mortality 50.0±1.00 and 26.70±2.00% and these were found to be higher than that of untreated control which recorded 0.00±0.00% *C. maculatus* mortality.

The result indicated that, the highest significant percentage mortality of adult *C. maculatus* 100±0.00% were recorded on seeds treated with *V. amygdalina* and *T. indica* at high treatment level 2.5g (12.5%w/w) respectively, at 96 hours of treatment and the result was similar to that recorded in the positive synthetic chemical control treatment (100±0.00%) while *P. biglobosa* was the least effective which recorded 23.3±2.00% *C. maculatus* mortality at the lowest treatment level 1.0g (5.0%w/w) which was higher than that recorded in the untreated control 0.0±0.00%. The result therefore indicated that insect mortality were found to be higher on seed treated with higher doses 2.0 and 2.5g and lower on seed treated with lower doses 1.0 and 1.5g of all the extracts. Mortality of adult *C. maculatus* progressively increases with increased in concentrations and decreased with decreased in concentration. This was found to be similar with the studies conducted by (Ileke, 2015) who tested the efficacy of *V. amygdalina* leaf powder at the rate of 2g/20g of cowpea seeds and

obtained 100±0.00% mortality of cowpea bruchid within the period of 96 hours after treatment, this was also in line with the finding of (Benoît *et al.,* 2014) that worked on the efficacy of *Occimum gratissimum* leaf extract and recorded 100% mortality of adult *C. maculatus* at 72 hours after treatment. The finding in this study was also in conformity with the studies conducted by (Simon *et al*., 2015) who obtained 100% mortality of *C. maculatus* within 7 days with LC_{50} of 0.39g/kg using *Plectranthus glandulosus* hexane leaf extracts.

Furthermore the finding from this study was also in agreement with that study carried out by (Adediri *et al.,* 2011) who discovered that cowpea seeds treated with hexane extract of cashew kernels caused 100% mortality of adult *C. maculatus* after 96hrs of exposure this was also collaborated with the research carried out by (Magaji *et al*., 2012) that studied the bioassay of *Mundulea sericea* plant against *C. maculatus* (F.) on Stored Cowpea and the result of the study shows that extract recorded 90% mortality of adult *C. maculatus* within the shortest period of time. The finding from the present study shows that mortality of adult *C. maculatus* increases with increase in concentration, and this was similar with the study conducted by (Ahmed *et al.,* 1999) that worked with plant oils against *C. chinensis* and result from the study shows that 100% mortality of adult *C. chinensis* was recorded on neem oil-treated beans after 72 hours. Al- Lawati *et al*. (2002) studied the effect of Jatropha and neem plant extracts on *C. chinensis* and the result from the study indicated high mortality of *C. chinensis* and the finding was similar to that recorded in this present study. The similarities could be possibbly attributed to the toxic component of the extracts excited on the cowpea beetle (*C. maculatus*). It could also be attributed by strong pungent smell of the extracts possibly as a result of active secondary metabolites which may interfere with their normal respiratory process. However, the extracts could be contact bio-insecticide which could possibly block the spiracles leading to suffocation and consequently causes high mortality of the cowpea beetle (*C. maculatus*).

The number of female fecundity and viability of the eggs on seed treated with different plants leaf extracts is presented in Table 2. Results indicated that there were significant ($P<0.05$) reduction in the number of fecundity, as well as the viability of eggs among the treatment in comparison with the untreated control. *P. biglobosa* at higher dose 2.5g(12.5%w/w) significantly($P<0.05$) reduced the fecundity 23.3±1.03 and viability of eggs 13.3±3.98 compared to the doses 2.0g (10.0%w/w), 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded fecundity (35.0±0.13) (35.0±0.10) and viability of eggs (28.3±0.18) (28.3±0.05) while at dose 1.0g (5.0%w/w) recorded the highest number of fecundity and viability of eggs 60.0±0.24 and 50.0±0.29 respectively, however, there were no significance differences of fecundity and viability of eggs observed at doses 1.5g (7.5%w/w) and 2.0g (10.0%w/w) which recorded 35.0±0.10 and 28.3±0.05, and 35.0±0.13 and 28.3±0.18 respectively, these were found to be significantly($P<0.05$) lower than that recorded in the untreated control which recorded 124±0.28 fecundity and 108±0.54 viability of eggs respectively. The *T. indica* at high dose 2.5g (12.5%w/w) and 2.0g (10.0%w/w) recorded significant ($P<0.05$) reduction of fecundity3.3±0.25 and 9.7±0.03 respectively compared with treated seeds at doses 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded the highest number of fecundity 10.0±0.00 and 34.0±1.04 respectively and this was significantly lower than that of untreated control which recorded 124±0.28, however there was no significance differences in the number of fecundity on treated seeds at dose 2.0g (%w/w) (9.7±0.03)and 1.5g (7.5%w/w)(10.0±0.00) respectively. Significant reduction of viability of eggs at high doses 2.5g (%w/w), 2.0g (10.0%w/w) and 1.5g (7.5%w/w) recorded 0.67±0.39, 2.0±0.58 and 4.0±0.90 respectively when compared with the lowest dose 1.0g (5.0%w/w) which recorded the highest number of eggs viability 23.7±1.10 and this was significantly lower than that of untreated control which recorded 108±0.54. The *V. amygdalina* at highest doses 2.5g (12.5%w/w) and 2.0g (10.0%w/w) recorded significant ($P<0.05$) reduction of fecundity 3.3±0.10 and 9.0±0.05 compared to dose 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded the highest number of fecundity 40.0±0.37 and 46.7±1.11 and these were significantly ($P<0.05$) lower than that of untreated control which recorded 124±0.28. Significant ($P<0.05$) reduction in the number of eggs viability at dose 2.5g (12.5%w/w) and 2.0g (10.0%w/w) recorded 0.33±0.19 and 3.7±0.05 respectively, when compared with doses 1.5g (7.5%w/w) and 1.0g (5.0%w/w) which recorded the highest number of eggs viability 18.3±0.10 and 25.0±0.14 respectively and these were significantly ($P<0.05$) lower in comparisms with untreated control which recorded 108±0.54.

The highly significantly ($P<0.05$) reduced fecundity was recorded at high dose (12.5%w/w) in *V. amygdalina* and *T. indica* 3.3±0.10 and 0.33±0.25 respectively, while egg viability recorded 0.33±0.19 and 0.67±0.39 respectively. However, *P. biglobosa* at lower treatment level (5.0%w/w) recorded the highest mean number of fecundity 60.0±0.24 and eggs viability 50.0±0.29 which was lower than the untreated control treatment 124±0.280 and 108±0.54 Table 2. This finding was found to be similar to the finding of (Gajmer *et al*., 2002) who discovered that eggs laid on extract-treated oviposition substrate, exhibited reduced hatching and further stated that adults, fed on an extracts containing sucrose diet, laid significantly fewer eggs with poor hatching, this was also in agreement with the finding of (Elhag, 2000) who tested the extracts from nine plant materials as oviposition deterrent against *C. maculatus* and discovered that pulse treated with *Rhazya stricta* leaves, neem seeds, *Heliotropium bacciferum* aerial parts and citrus peels acted as highest ovipositional deterrents. The finding in this study was also in conformity with the finding of (Abdullahi, 2011) who reported that seeds treated with *Balanite aegyptiaca* leaf extract have strong oviposition deterrent and ovicidal effect

against *C. maculatus*. Jacobs and Thomas (2015) studied the ovicidal effect of *Secamone afzelii* leaf extract against *C. maculatus*, and the result from the study shows maximum reduction in egg hatching (8.05±1.2) on seeds treated with high doses (10.0%) and the finding was similar to that recorded in this present study. The reasons for the similarities could be probably attributed to the oviposition deterrent and ovicidal effect of the extracts, the eggs mortality and failure to hatch on the seed treated with the extract could be probably attributed to the toxic component of the extracts and also to the physical properties, which cause changes in surface tension and oxygen tension within the eggs. However, in this present study *P. biglobosa* leaf extract at lower treatment level (5.0%w/w) does not caused significant reduction in eggs count (60.0±0.24) and eggs viability (50.0±0.29), this was in contrast with the finding of (Jacob and Thomas, 2015) who discovered that *Jatropha curcas* seed oil significantly reduced the number of eggs laid by adult *C. maculatus* and prevented eggs hatched 33 days after the treatment. The reason for the differences could be possibly attributed due to the absent of some active secondary metabolite in the *P. biglobosa* leaf extracts.

The number of F1 adult emergence from cowpea seeds treated with varying level of plants leaf extracts is presented in Table 3. Result indicated that cowpea seeds treated with *P. biglobosa* at dose 2.5g (12.5%), 2.0g (10.0%) , 1.5g (7.5%w/w) and 1.0g (5.0%w/w) significantly($P.<0.05$) reduced the number of adult emergence 10.7±3.31, 23.0±0.19, 26.3±0.19 and 45.7±0.12 respectively, in comparisms with untreated control which recorded 106.7±0.48, however, no significant difference was recorded between cowpea seeds treated with dose 1.5g (5.0%w/w) and 2.0g (10.0%w/w) recorded 23.0±0.19 and 26.3±0.19 number of adult emerged. There were no significant differences on cowpea seeds treated with *Tamarindus indica* at doses 1.5g (7.5%w/w), 2.0g (10.0%w/w) and 2.5g (12.5%w/w) which recorded the lowest number of adult emergence 2.7±0.77, 1.00±0.00 and 0.33±0.19 but highly significant difference was observed in comparisms with seeds treated at dose 1.0g (5.0%w/w) which recorded the highest number of adult emergence 20.0±1.40 and this was found to be significantly lower when compared with untreated control which recorded 106.7±0.48.The*Vernonia. amygdalina* at doses 2.0g (10.0%w/w) and 2.5g (12.5%w/w) significantly ($P<0.05$) reduced the number of adult emergence 1.00±0.31 and 0.00±0.00 respectively, when compared with that of the doses 1.0g (5.0%w/w) and 1.5g (7.5%w/w) which recorded 15.7±0.13 and 13.0±0.50 and these significantly ($P<0.05$) lowered when compared with that of untreated control which recorded 106.7±0.48.

The significant ($P<0.05$) reduction of adults emergence were recorded on seed treated with high treatment level (12.5%w/w) of *V. amygdalina* (0.00±0.00), followed by *T. indica* (0.33±0.19) and this was similar to that recorded in the (+ve) control treament (0.00±0.00). However, *P. biglobosa* at lower dose1.0g (5.0%w/w) recorded (45.7±0.12), which was lower than that recoeded in the (-ve) control (106.7±0.48) (Table 3). The reductions were found to be higher on seed treated with high dose 2.0g (10.0%w/w) and 2.5g (12.5%w/w) and lower on seed treated with lower dose 1.5g (7.5%w/w) and 1.0g (5.0%w/w). This was found to be similar with the finding of (Jayakumar *et al.*, 2003) who discovered that plant extracts have obvious effects on post-embryonic survival of the insect and resulting reduction in adult emergence in all the concentrations of different plants, this was also in line with the study carried out by (Yang *et al*., 2006) that worked with oils and powders of *Moringa oleifera* and greatly reduced the emergence of the insects and achieved greater inhibition rate when compared to the controls. The finding in this study was also in conformity with that of (Ibrahim and Aliyu, 2014) who discovered that there was no progeny emergence of *C. maculatus* two months after storage using bitter leaf powder at the rate of 3.0g, this was also collaborated with the studies conducted by (Adebowale and Adedire, 2006) who discovered that the cowpea seeds treated with *Jatropha curcas* seed oil reduced the number of eggs laid by *C. maculatus* and prevented the adult emergence. Furthermore, the finding from this study was also in conformity with that of Raja, *et al*. (2001) that studied the effect of plant volatile oils in protecting stored cowpea *vigna unguiculata* (L) against *C. maculates* (F.) infestation and discovered that mint extract inhibited adult emergence in *C. maculatus* in cowpea seeds. The reasons for the similarities probably could be attributed due to the toxicity of the extracts which causes eggs mortality or larval mortality or even reduction in hatching of the eggs leading to inhibition of adult emergence. It may also possibly that chemical compositions of the plants utilized could be responsible for the inability of the adult insects to emerge as they were found to disrupt growth, and reduced larval survival as well as disruption of life cycle in insects in general.

TABLE 1: Effects of *V. amygdalina, P. biglobosa and T. indica* plant Leaf Extracts on the mortality of adult *C. maculatus* fed on treated cowpea seeds

Treatments	Concentration (w/w %)	Weight of cowpea (g)	No. of insects used(five pairs)	Mortality in Hours (percent)			
				24	48	72	96
P. biglobosa	1.0 (5.0)	20	10	0.00±0.00[a]	0.00±0.00[a]	10.00±6.00[a]	23.30±2.00[a]
	1.5 (7.5)	20	10	0.00±0.00[a]	3.30±3.00[a]	16.70±1.00[a]	36.70±1.00[ab]
	2.0 (10.0)	20	10	0.00±0.00[a]	6.70±7.00[a]	23.30±2.00[a]	46.70±2.00[ab]

	2.5 (12.5)	20	10	0.00±0.00[a]	10.00±6.00[a]	33.30±3.00[ab]	60.00±1.00[ab]
T. Indica	1.0 (5.0)	20	10	0.00±0.00[a]	6.70±3.00[a]	16.70±2.00[a]	30.00±1.00[ab]
	1.5 (7.5)	20	10	0.00±0.00[a]	6.70±3.00[a]	23.30±0.00[a]	43.30±1.00[ab]
	2.0 (10.0)	20	10	6.70±2.00[a]	16.70±1.00[a]	36.70±7.00[ab]	63.30±0.00[ab]
	2.5 (12.5)	20	10	10.00±0.00[a]	26.70±0.00[a]	53.30±6.00[ab]	100.0±0.00[b]
V. amygdalina	1.0 (5.0)	20	10	0.00±0.00[a]	6.70±3.00[a]	16.70±2.00[a]	26.70±2.00[a]
	1.5 (7.5)	20	10	6.70±2.00[a]	16.70±2.00[a]	30.00±0.00[ab]	50.30±1.00[ab]
	2.0 (10.0)	20	10	16.70±1.00[a]	36.70±0.00[a]	60.00±0.00[ab]	90.30±0.00[ab]
	2.5 (12.5)	20	10	20.00±1.00[a]	46.70±0.00[a]	86.70±6.00[b]	100.0±0.00[b]
Control (-ve)		20	10	0.00±0.00[a]	0.00±0.00[a]	0.00±0.00[a]	0.00±0.00[a]
Control (+ve) cypermethrin)	0.12 (0.6)	20	10	100.00+0.00[b]	-	-	-
L.S.D (0.05)				**43**	**NS**	**58**	**67**

Mean ± SE with the same letter are not significantly different from each other by LSD (P< 0.05)

Table 2: Effects of Differerent Leaf Extracts on the Female Fecundity and Viability of Egg of *C. maculatus* reared on Treated Cowpea Seed.

Treatments	Concentration (w/w %)	Weight of cowpea (g)	No. of insect used(five pairs)	Mean no. of fecundity ± S.E	Mean no. of egg viability ± S.E	Eggs viability (%)
P. biglobosa	1.0 (5.0)	20	10	60.0±0.24[g]	50.0±0.29[f]	83.33
	1.5 (7.5)	20	10	35.0±0.10[d]	28.3±0.05[e]	80.85
	2.0 (10.0)	20	10	35.0±0.13[d]	28.3±0.18[e]	80.85
	2.5 (12.5)	20	10	23.3±1.03[c]	13.3±3.98[b]	57.08
T. indica	1.0 (5.0)	20	10	34.0±1.04[d]	23.7±1.10[d]	69.70
	1.5 (7.5)	20	10	10.0±0.00[b]	4.0±0.90[a]	40.0
	2.0 (10.0)	20	10	9.7±0.03[b]	2.0±0.58[a]	20.61
	2.5 (12.5)	20	10	3.3±0.25[a]	0.67±0.39[a]	20.30
V. amygdalina	1.0 (5.0)	20	10	46.7±1.11[f]	25.0±0.14[ed]	53.53
	1.5 (7.5)	20	10	40.0±0.37[e]	18.3±0.10[c]	45.75
	2.0 (10.0)	20	10	9.0±0.05[b]	3.7±0.05[a]	41.11
	2.5 (12.5)	20	10	3.3±0.10[a]	0.33±0.19[a]	10.00
Control (-ve)		20	10	124±0.28[i]	108±0.54[h]	87.09
Control (+ve) (cypermethrin)	0.12 (0.6)	20	10	0.00±0.00[a]	0.00±0.00[a]	0.00
L.S.D (0.05)				**4.69**	**5.13**	

Mean + SE with the same letter are not significantly different from each other by LSD (P< 0.05)

Table 3: Effect of Different Leaf Extracts on Emergence of Adults *C. maculatus* from Treated Cowpea Seeds

Treatments	Concentration (w/w %)	Weight of cowpea (g)	No. of insect used(five pairs)	Mean no. of eggs laid (± S.E)	Mean no. of F1 adult emerged ± S.E	Emergence of adult F1 progeny (percent)
P. biglobosa	1.0 (5.0)	20	10	60.0±0.24[g]	45.7±0.12[g]	76.16
	1.5 (7.5)	20	10	35.0±0.10[d]	26.3±0.08[ef]	75.14
	2.0 (10.0)	20	10	35.0±0.13[d]	23.0±0.19[e]	65.71
	2.5 (12.5)	20	10	23.3±1.03[c]	10.7±3.31[b]	45.92
T. indica	1.0 (5.0)	20	10	34.0±1.04[d]	20.0±1.40[ed]	58.82
	1.5 (7.5)	20	10	10.0±0.00[b]	2.7±0.77[a]	27.0
	2.0 (10.0)	20	10	9.7±0.03[b]	1.00±0.00[a]	10.30
	2.5 (12.5)	20	10	3.3±-0.25[a]	0.33±0.19[a]	10.00
V. amygdalina	1.0 (5.0)	20	10	46.7±0.11[f]	15.7±0.13[cd]	33.61
	1.5 (7.5)	20	10	40.0±0.37[e]	13.0±0.50[c]	32.5
	2.0 (10.0)	20	10	9.0±0.05[b]	1.00±0.31[a]	11.11
	2.5 (12.5)	20	10	3.3±0.10[a]	0.00±0.00[a]	0.00
Control (-ve)		20	10	124±0.28i	106.7 ±0.48[h]	86.04
Control (+ve) (cypermethrin)	0.12 (0.6)	20	10	0.00±0.00a	0.00 ±0.00[a]	0.00
L.S.D (0.05)				**4.69**	**5.19**	

Mean ± SE with the same letter are not significantly different from each other by (LSD P< 0.05)

IV. Conclusion

The *Vernonia amygdalina* and *Tamarindus indica* were the most effective extracts at high dose (12.5%w/w) recorded significant (P<0.05) mortality rate of *C. maculatus* 100±0.00% at 96hours after treatment with LC_{50} value of 1.03µg/l and 0.91µg/l respectively, at 72hrs of toxicity. The highest significant (P<0.05) reduction in fecundity at highest doses was recorded in *V. amygdalina* and *T. indica* 3.3±0.10 and 0.33±0.19 respectively. The highest significant (P<0.05) reduction in eggs viability was also recorded at high dose (12.5%w/w) in *V. amygdalina* and *T. indica* 0.33±0.19 and 0.67±0.39 respectively. Adult emergences were significantly (P<0.05) reduced at high dose (12.5%w/w) of *V. amygdalina* (0.00±0.00) and *T. indica* (0.33±0.19) respectively.

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