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Research Paper

Repellent Effect Of Oil Extracts On *Bemisia tabaci*(Gennadius)

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ABSTRACT
Botanicals have been widely used in the management of insect pests of crops. Bemisia tabaci is a key pest of many plant species world-wide. This is largely due the damage being caused by this insect to crops via sucking of the plant saps, thereby causing economic damage directly or through the pest serving as host to vectors of plant diseases. Behavioural bioassay was performed in a 4-arm olfactometer. The laboratory work was conducted by involving the responses of activeBemisia tabaci, Azadirachta. indica, Jatropha curcas and Lambda-cyhalothrin in a 4-arm olfactometer. The treatment odour source contained 10µl of each of the test compound (A. indica, J. curcas and Lambda-cyhalothrin). The oils were tested at 1, 2 and 100% concentrations while the Lambda-cyhalothrin was tested at 2.5 % EC and 0.05 % solution. The result of the experiments indicated that oil extracts of A. indica, J. curcasand Lambda-cyhalothrin were able to repelled B. tabaci significantly ($p<0.01$) when compared with the control. This activity was demonstrated by Bemisia tabaci spending significantly ($p<0.01$) less time in the test arms consisting of A. indica, J. curcas oil extracts and Lambda-cyhalothrin than the control. Similarly, the number of entries made into the test arms (A. indica, J. curcasand Lambda-cyhalothrin) was significantly ($p<0.01$) more than that of the control. This suggests that both A. indica and J. curcas can be effectively used as repellents againstBemisia tabaci.
KEY WORDS:*Bemisia tabaci, Azadirachta indica, Jatropha curcas, repelled, damage.*

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I. INTRODUCTION

*Bemisiatabaci (*Gennadius) commonly known as whitefly is one of the cosmopolitan economic pest of crops. It is a well-known invasive insect species of plants, adaptive to feeds on over 1000 species of plants (Mohd *et al*., 2011; Abd-Rabou and Simmons, 2012; Tu and Qin, 2017). The insect is a known destructive pest of cowpea, Mung bean, tomatoe, cassava, sweet potatoe, cucumber, cabbage, cotton e.t.c. (Abd-Rabou and Simmons, 2012; Xie *et al*., 2014; Pan *et al*., 2015; Qureshi *et al*., 2016; Zhang *et al*., 2017; Asawalam *et al*., 2018).They are sap-sucking insects that causes serious damage to plants by feeding on plant saps as direct damage and transmit virus as indirect damage to crops (Siti *et al*., 2014). The quality of the products is being reduced as result of the excretion of the honey dew on the surfaces of plant. Among the numerous *B. tabaci* transmitted viruses in crops are; cucumber vein yellowing virus, squash leaf curl virus and tomatoe leaf curl virus (Ardeh *et al*., 2005; Abd-Rabou and Simmons, 2012).Conventional chemicals (synthetic) which have been commonly used in the control of many insect pests though effective in many instances but is prone to resistance by insect pests, pollution of the ecosystem and human toxicity among others.

Hence, these problems posed by these conventional insecticides has discouraged the use of synthetic chemicals in the control of insect pests.

However, the continual quest for insecticides of plant origin may likely proffer solution to the malady posed by synthetic chemicals in the management of this insect pest (Nerio *et al*., 2010; Onoja, 2015; Peixoto *et al*., 2015; You *et al*., 2015; Pavela *et al*., 2016; Benelli *et al*., 2017; Girardi *et al*., 2017; Janaki *et al*., 2018; Lee *et al*., 2019). Both *J. curcas* and *A. indica* have insecticidal properties of antifeedant, anti-oviposition, deterrent, ovicidal and fecundity inhibition to insect pests of crops (FAO, 2006; Devappa *et al*., 2010; Nerio *et al*., 2010; Habou *et al*., 2011; Jide-Ojo *et al.*, 2013; Khelfane-Goucem *et al*., 2014). The extracts of *J. curcas* and *A.*

indica possess antimicrobial potency against fungi and bacteria (Aiyelaagbe *et al*., 2007; Jaglan, 2008; Srivastava *et al*., 2011).

To address these problems of pest infestation and disease infection occasioned by *Bemisia tabaci* on crops resulting in both qualitative and quantitative losses, there is a need to do more research on *A. indica* and *J. curcas* that seems very promising for the control of *Bemisiatabaci*as biopesticides.

The objectives of this study is to evaluate the efficacy of these plant extracts (*J. curcas* and *A. indica*) as a repellents against*Bemisiatabaci*.

Plant materials collection and extraction

Mature seeds of neem, *Azadirachta indica* were obtained from IBB Road, Calabar. The *Jatropha curcas* seeds were obtained from Ijegu Yala, Cross River State, Nigeria.

The plant materials were air dried on the shade for 3 days and 50g of the dried portion of each plant materials were grounded and used for oil extraction. The essential oil of each plant was extracted by Soxhlet method. Fifty grams (50g) of each plant powder weight into 500ml round bottom flask and 50ml of N – hexane added, the mixture was then heated, pure plant oil was obtained by evaporating the extracting solvent in a water bath at 80^{o}c.

Field establishment for *Bemisiatabaci* infestation.

Top Soil was collected from the University of Calabar Botanical Garden and was air-dried. The air-dried soil was properly sieved to remove all the large particles using a wire mesh of 0.4cm x 0.4cm. Eight perforated plastic buckets were used in the experiment. Three kilogramme (3kg) of the air-dried and sieved soil was weighed into each perforated plastic bucket of $4500cm^2$. All the plastic buckets containing the soil were watered to field capacity and left overnight to drain, before planting the Vita 7 variety of cowpea the following morning. The cowpea plants were allowed to grow for four weeks when there was abundant *Bemisiatabaci* on the cowpea. Mature *Bemisiatabaci* were collected for the laboratory experiment, from four weeks old cowpea plants.

Laboratory Repellence bioassay

Behavioral bioassay were performed in a 4-way olfactometer modified after Pettersson (1970). The olfactometer consisted of three layers of 6mm thick transparent perspex screwed together purchased from Rothamsted research, Harpenda, UK (Ukeh and Umoetok, 2011). Bioassays were conducted and each was run for 10 minutes using a stop watch andit was replicated 6 times using a fresh insect and stimulus source in olfactometer. The first set of bioassays involved a control experiment in which the 4 arms of the olfactometer contained 10µl of solvent (hexane) loaded on clear filter paper discs. This was followed by the repellence bioassay in which the three arms of the olfactometer contained the test compounds (*A. indica, J. curcas* essential oils and Lamda-cyhalothrin served as odour sourceeach) while the remaining one arm served as control and contained the solvent (hexane). Each of the test arm had 10µl of one the insecticides as odour source. The arm containing Lambda-cyhalothrin served as standard check (standard control) and the arm containing hexane served as untreated control. The hexane was used to dilute both oils and Lambda-cyhalothrin to the needed concentrations for the experiment. The Experiment was carried out using various concentrations of the oil extracts and Lambda-cyhalothrin. Each arm of the olfactometer served as treatment source (*A. indica, J. cucas*, Lambda-cyhalothrin and control). The design used for this experiment was a Complete Randomized Design.

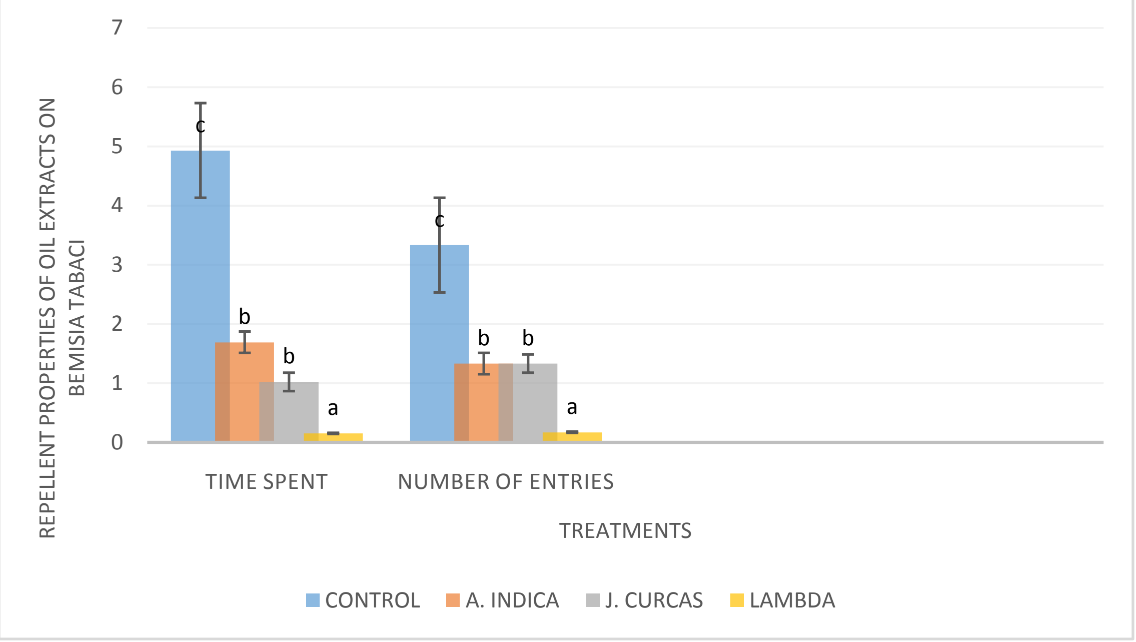
Data collections and analysis

Laboratory work; Computer progrmme was used for collecting and analyzing "Behavior" data with the four-way Olfactometer (OLFA programme) (Ukeh *et al*., 2009; Ukeh and Umoetok, 2011). The data that were recorded included; the time spent by the *Bemisia tabaci*in the different arms of the olfactometer and the number of visit into each arm (Ukeh *et al*., 2009).

The time spent in each Olfactometer arm and the number of visit made by *Bemisia tabaci* in the laboratory bioassay were subjected to the analysis of variance (ANOVA) and treatment means were separated using Turkey's Test at 1 percent level of probability (Genstat , 2005; Alika, 2010).

II. RESULTS

The effects of *Azadirachta indica and Jatropha curcas* oils on the time spent and the number of entries made by *Bemisia tabaci* in the arms of the olfactometer is shown in Figure 1. The results indicated that both plant oils significantly ($p<0.01$) repelled *Bemisiatabaci* as less time was spent in the plant oil treated arms (*A. indica* and *J. curcas* arms) than the untreated arm. *Bemisiatabaci* spent the shortest time in the arm treated with 2.5EC Lambda-cyhalothrin when compared with the arms treated with other compounds. *Bemisiatabaci*. The insect significantly ($p<0.01$) spent the longest time inthe untreated (control) arm when compared with other arms. Similarly, the number of entries made by *Bemisia tabaci* into the control (untreated) arm was significantly ($p<0.01$) higher than other arms with chemicals (*A. indica, J. curcas* and Lambda-cyhalothrin). *Bemisia tabaci*



made the least number of entries into the arm treated with Lambda-cyhalothrin (2.5EC). The number of entries made by *B. tabaci*into the arms treated with *A. indica* and *J. curcas* were significantly ($p<0.01$) less than the untreated arm.

FIG 1: EFFECT OF *Azadirachta indica and Jatropha curcas* OIL EXTRACTS ON REPELLENT ACTIVITY OF *Bemisia tabaci*.

The time spent by *Bemisia tabaci* and the number of entries made into various arms of the olfactometer treated with 1% of *A. indica, J. curcas*and 0.05% Lambda-cyhalothrin solution is shown in Figure 2.The results indicated that *B. tabaci* spent the shortest time in the arm treated with 0.05 % Lambda-cyhalothrin solution when compared with arms treated with 1% of *A. indica, J. curcas* and untreated (control). The insect also spent significantly ($p<0.01$) higher time in the control arm than the arms treated with 1 % of both oils. Furthermore, *Bemisiatabaci* made statistically ($p<0.01$) equal number of entries into the arms treated with 0.05 % Lambda-cyhalothrin, 1% *A. indica* and 1 % *J. curcas* oils which were significantly ($p<0.01$) lower than the entries made into the control arm.

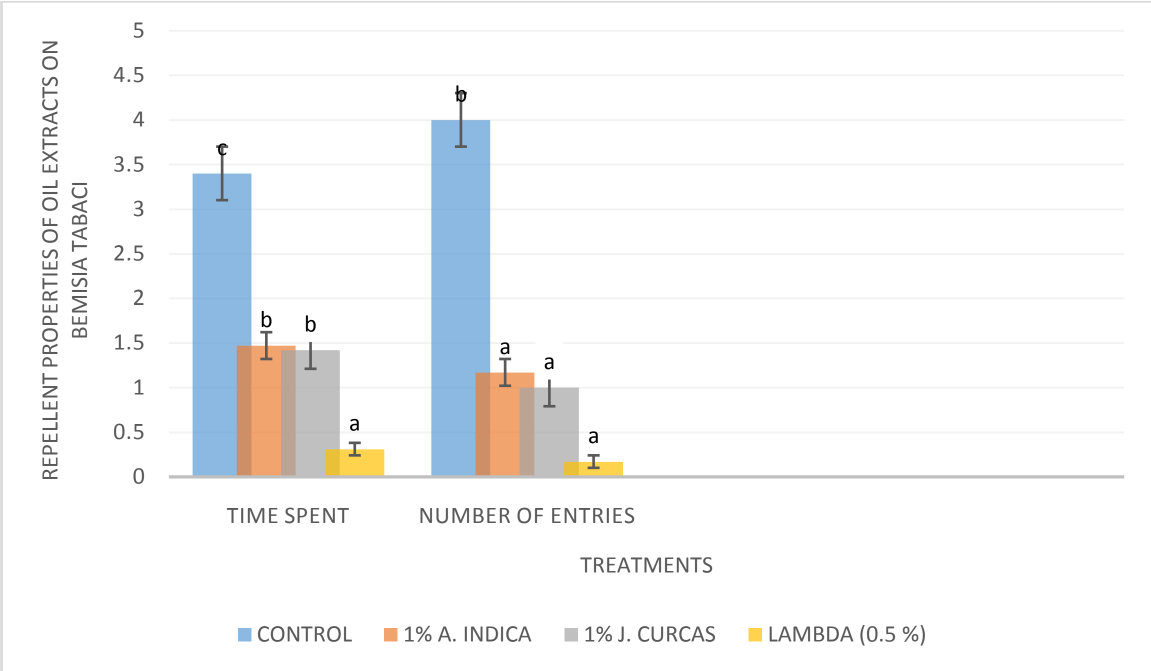


FIG 2: EFFECT OF 1 PERCENT *Azadirachta indica and Jatropha curcas* OIL EXTRACTS ON REPELLENT ACTIVITY OF *Bemisia tabaci*.

The time spent by *Bemisia tabaci* and the number of entries made into the various arms of the olfactometer treated with 2 % *A. indica* , *J. curcas* and 0.05 % Lambda-cyhalothrin solution is presented in Figure 3. The results indicated that 2% of both oils and 0.05 % of Lambda-cyhalothrin significantly ($p<0.01$) repelled *B. tabaci* as the insect spent less time in the arms treated with the oil extracts and Lambda-cyhalothrin than the untreated control. The insect spent significantly ($p<0.01$) equal time in the arms treated with 2 % of both plant oils and 0.05 % Lambda-cyhalothrin. Similarly, the insect made significantly ($p<0.01$) the same number of entries into the arms treated with 2 % of both oils and 0.05 % Lambda-cyhalothrin but the number of entries was significantly ($p<0.01$) less than that of the untreated (control) arm.

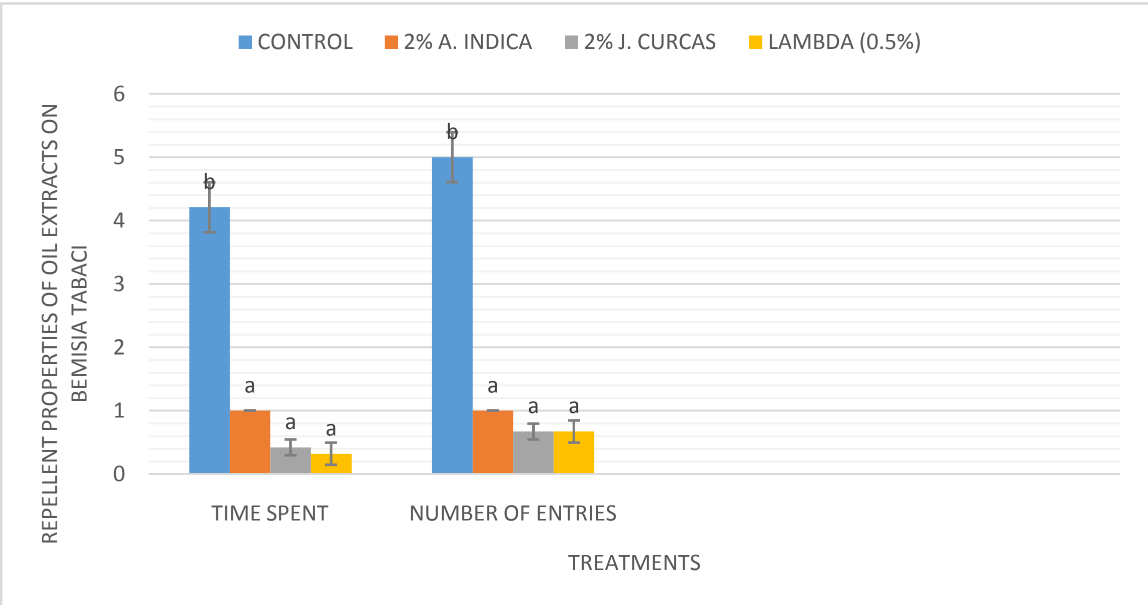


FIG 3: EFFECT OF 2 PERCENT *Azadirachta indica and Jatropha curcas* OIL EXTRACTS ON REPELLENT ACTIVITY OF *Bemisia tabaci*.

III. DISCUSSION

The results obtained from the olfactometer bioassays indicated that *A. indica, J. curcas* repelled *Bemisia tabaci* from the odour source of plant oils. In all the bioassays conducted, the results indicated significantly shorter time spent by *Bemisia tabaci* in the arms of the olfactometer treated with oil extracts than the control. Similarly, *Bemisia tabaci* made significantly less number of entries into the arms treated with the oil extracts than the control arm. This repellent effects was even comparable with Lambda-cyhalothrin in many instances. Many researchers attributed the efficacy of the oil extracts of *A. indica* and *J. curcas* to the presence of Azadirachtin and Phorbol esters, respectively (FAO, 2006; Makker *et al*., 2007; Jide-Ojo, 2013).That is an indication that essential oils with strong odour enhance olfactory sensation which can be used as a tool in insect pest management (Wekesa, 2011; Tu and Qin, 2017). The study simply showed that the concentration of chemical is also a key determinant of its potency as a repellent.This is in agreement with Habou *et al*. (2011) who observed that , the higher the concentration of *J. curcas*, the greater the greater the effect on insects. This observation is in support of the result of the findings of Tu and Qin (2017) that states that, the repellent effects of organic compound depends on the concentrations of the organic compound. The higher the concentration of the chemicals, the higher was their repellent properties. This result is also in support of the findings of Luo *et al*., 2007; Nesseim *et al*., 2012 that states that phorbol esters interfere with the normal message transfer system in the midgut cells, thereby preventing normal signal transduction that regulates the physiological/biochemical reactions stopping cell growth and differentiation.

IV. CONCLUSION

This research showed that the oil extracts of *A. indica* and *J. curcas* possess repellent property which was able to deterred *Bemisia tabaci* from their odour source, as such, the insect spent less time in such treated arms. The application of 2 % concentration of both oils had commensurate repellency capacity with that of 0.05 % solution of Lambda-cyhalothrin.This demonstrates the efficacy of both oil extracts for their repellent activity.

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