

Original Research Article

<https://doi.org/10.20546/ijcmas.2022.1102.044>

Assessment of the Potentialities of Three Species of Zalingei (Western Sudan) Natural Flora as Pest control Agents

Fatin Abdalla Osman¹, Eltigni Eltahir Ali² and Taha Mohammed Sharief^{3*}

¹Department of Plant Protection and Environmental Studies, University of Alzaeim, Alazhari, Sudan

²Department of Crop Protection, University of Khartoum, Khartoum, Sudan

³Department of Horticulture, University of Zalingei, Zalingei, Sudan

*Corresponding author

ABSTRACT

The study comprised two parts, laboratory and field study to assess the potentialities of alcoholic crude extracts of the three plants species as control agents. The laboratory works: different concentrations of Alcoholic crude extracts from *Khaya senegalensis* (Mahogany), *Boscia senegalensis* (Mokhait), and *Acacia nubica* (La'ot) barks were prepared. The Field work: The interviews carried out during June 2006 in Zalingei area - Central Darfur State - western Sudan. The results of the interviews showed that farmers use several native plants for the solution of pest problem; these plants are naturally distributed in the area year round and handy to the farmers. This is one of the reasons that encouraged farmers to use these plants. A field experiment was conducted for two successive seasons (2017/ 2018) and (2018/2019) at the experimental farm of the Faculty of Agriculture, University of Khartoum – Shambat. Three different concentrations were compared with the negative control and positive control to study the effect of bark extracts on whitefly in Okra plant. The results justified need for further research on effect of the three plants species extracts against pests with an emphasis on more investigation to identify and determine their modes of action, stability and persistence etc... to develop the most effective components of the extracts to enable their use in Integrated Pests Management program.

Keywords

Alcoholic extract, control, *Boscia senegalensis*, *Acacia nubica*

Article Info

Received:

05 January 2022

Accepted:

30 January 2022

Available Online:

10 February 2022

Introduction

Current research on crop protection is oriented towards exploring new alternative sources of pesticides, less hazardous and inexpensive. Pesticides of plant origins constitute possible avenue in future. Plants in addition to their Capacity to produce carbohydrates, protein etc. they also

produce chemical compounds that are not directly involved in the metabolic process and are considered as secondary metabolites. These natural products play a distinct role in plant-environment interaction. They have different roles in protecting the plants from pest invasion, (Hassan Ali and Lwande, 1989). Some of these substances have been used as botanical poisons such as Pyrethrum, Nicotinem etc.

such chemicals are of widespread in the flora, they have been reported to affect insects by poisoning, inhibiting feeding and disturbing hormonal balance, (Jacobson, 1989). Sudan is one of the richest countries in its natural flora. Plants of this country, both cultivated and wild are not doubtfully, unlimited reservoir for medicinal, pharmaceutical, aromatic and pesticidal chemicals.

The research going in this field showed that *Ocimum basilicum* sweet basil "Rehan" (Gubara, 1983) and (Ahmed, 1993), *Calotropis procera* sadom apple "Ushar" (Fageer, 1999), *Azadirchta indica* "Neem" (Fadl Elmula, 1994) and Gafal trees *Boswellia papyrifera* "Tarak-tarak" and "GafalAzrak" *Commiphora Africana* (Saxena and Co. Workers, 1987), have very promising insecticidal effects.

Chemical pesticides have been shown to cause toxic effects that could be dangerous to human health and environment through their accumulative effect especially in area which has never been subject to the Classical pesticides use, seeking for less hazardous and inexpensive alternative sources is one of the main targets of current research. Furthermore, the chances of pests developing resistance to such substances are less likely (Butler *et al.*, 1986) Jebel Marra Area (Zalingei) has different climatic zones and virgin arable lands which enrich the area with diverse natural plants. The selected pesticidal plants are however, widely spreading in J.M.A. The use of these plants are based on the traditional usages in the area.

These plants are *Acacia nubica*, (Leguminosae), *Boscia senegalensis* and *Khaya senegalensis* (Capparridaceae). The use of these plants for field pest's control has never been subjected to scientific research. The difficulty to obtain chemical pesticides couple with lack of know-how of the correct application procedures and safety precaution as well, confined their use in a very narrow scope. Thus it is necessary and important to explore new source of cheaper, safer and preferable pesticides of plants origin. This is one of the main targets of the current research work. The objectives of this research are:

Identification of plant species used in the study area to control insect pests.

Preparation of organic extracts of these plants.

Testing of the crude extracts against. White flies, *Bemisia tabaci*

Materials and Methods

Field work

The Interviews

Actual routine interviews were carried out in Zalingei Area during June 2006. The aim of the interviews was to a quaint us of the types of the traditional pests control methods used on field, which plants used to control field pests, which used and how applied it and why the local farmers refrain from using the conventional pesticides.

Collection of potential plants

Three different potential plants species used to control insect pests by the natives were collected from Zalingei Area. Only the pest of the potential plants claimed by the local farmers as to have an effect on insect pests were collected. Bark of (*Khaya senegalensis*, *Acacia nubica*, *Boscia senegalensis* were kept in plastic bags for further treatments and studies.

Field Experiments

A field experiments was conducted for two consecutive seasons during 2007-2008 and 2008-2009 at the Demonstration Farm of the Faculty of Agriculture, University of Khartoum at Shambat.

The experimental area was arrange in split-plot design, four replication, three concentrations and two controls (positive control and negative control) in both seasons, The experimental designed to study the effect of three plants bark extract from Zalingei area. The effect potentials of the plants were

estimated by measuring the reduction of the insect's population.

Spraying

The extracts were sprayed at the rate of 5%, 2.5% and 1.25% on each season. The extracts were applied using hand sprayer, early morning when the wind speed was slow to minimize drift. In the first season the experiment received two sprays at an interval of 21 days (three weeks). The first spray was conducted three weeks from sowing and the second spray three weeks from the first spray (after flowering).

Parameters studied

In each sub-plot two plants were randomly selected to determine the number of insect pest whitefly *Bemisia tabaci* (Genn.).

Method of counting whitefly *Bemisia tabaci*

To count whitefly, two plants were randomly select from each plot on five leaves: two from the top, one from the middle and two from the bottom, were examined for assessing the whitefly population. The total number of adult whiteflies per 10 leaves per plot was related to 100 leaves per plot and recorded for the 20 treatments. This methods mentioned by (Butler, 1986)

Laboratory work

Preparation of bark powders

The harvested plants bark (*K. senegalensis*, *B. senegalensis* and *A. nubica*) were allowed to dry at room temperature for about two weeks. Dried barks were first crushed by hand then ground by an electric blender (type ORCHID) model No. LFO06536), the obtained powder from each plant bark was passed through a sieve (25 mesh) and stored in darkness at room temperature in tightly closed polythene bags until needed for preparation of extracts and bioassay experiments.

Preparation of plant extracts

The three samples of powdered plants bark were placed in conical flask 500 ml. 25g of each plant powder was placed in flask and 250ml of ethanol 80% were added and left for 7 days at room temperature. Flasks were shaken once daily. The crude extracts were filtered through filter paper NO.1. The extracts were left for 7 days at room temperature to evaporate the ethanol, the dried products were collected and kept in glass containers and used later for Preparation of the concentrations used in the bioassay experiments.

Preparation of concentrations

From each dried extract the concentrations 5%, 2.5%, and 1.25% were prepared, weight per volume (w/v) from each plant extract by adding ethanol 80%.

Statistical Analysis

The data collected from the different treatments was subjected to analysis of variance (ANOVA) appropriate for split-plot design (Gomez and Gomez, 1984). The means were separated using the least significant difference (LSD).

Results and Discussion

Field Work

The Interviews

The Interview composed during 2016 covered Zalangei Area located in central Darfur state, Western Sudan. It revealed very interesting facts. The local farmers use many indigenous plants which are used as the sole means to control pests like *K. senegalensis* "Mohogany", *B. senegalensis* "Moyhait" and *A. nubica* "La'ot".

All these plants mentioned above are natural available in the area and thus makes them more handy. Moreover, application methods adopted are

simple, easy safe to man and his animals and natives claim that these plants serve as a good satisfactory source of protection for their field crop. The local farmers grind the barks of these plants in a big traditional blender called "Fundug" after that dipped powder in jars made of mud containing water and then filtered through piece of clothes. After that spraying the extracts on growing plants on field. The difficulty of gaining chemical pesticides, lack of know of correct application procedures, safety precaution confined their use in a very narrow scope, there for the local farmers' use the traditional plants is their area.

Field Experiments

A field experiment was conducted for two consecutive seasons (2017/2018) and (2018/2019) at the Demonstration Farm of the Faculty of Agriculture, University of Khartoum at Shambat.

Bioassay Experiments

In the 1st season (2017/2018) the statistical analysis of the 1st pre-spraying count of W.F. population showed no significant differences, which indicated even distribution of W.F. in the plots. The 1st post-spraying count after 24 hr, 48 hr, 72 hr, 1 week and 2 weeks showed there was significant differences between treatment (5%, 2.5% and 1.25%) and controls (positive and negative control). Also no significant differences between the treatment fig.(1).

The data analysis of the first spraying count of white fly population after 24 hrs showed significant differences between *A. nubica* extract and (*k. senegalensis*, *B. senegalensis* extracts), and after 48 hrs, 72 hrs, 1 week and 2 weeks there was no significant differences between the plants extracts Fig. (2).

The effect of *K. senegalensis*, *B. senegalensis* and *Acacia nubica* first season spray (2) (2017/2018) on white fly *Bemisia tabaci*. The analysis of the 2nd pre-

spraying count (2017/2018) of (W.F.) population showed no significant differences. The analysis of the 2nd post-spraying count showed there were significant differences between controls and different treatment and after 48 hrs, 72hr, one week and after 2 weeks there was significant differences between treatment 5% and (2.5%, 1.25%) Fig. (3).

The effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* bark extracts on whitefly insect first season (2017/2018). Spray (2). The analysis of the 2nd post-spraying count of white fly population after 24 hrs, 72, 1 week and 2 weeks showed significant differences between *A. nubica* extract and (*K. senegalensis*, *B. senegalensis*) extracts and no significant differences between *K. senegalensis* and *B. senegalensis* extract. After 48 hrs there were significant differences between different plants extracts Fig. (4).

In the 2nd season (2018/2019) the analysis of the 1st pre-spraying count of whiteflies population showed no significant differences which indicated even distribution of whiteflies in the plots. The 1st post-spraying count after 24 hr and 1 week showed significant differences between controls and treatments (5%, 2.5%, and 1.25%) and no significant differences between the three treatments. After 48 hr there were significant differences between controls and the three treatments and there were significant differences between treatment 5% and (2.5% and 1.25%) fig (5)

The analysis of 1st spraying count of whiteflies population after 24 hr, 48 hr, 72 hr and 1 week showed no significant differences between the different plants extracts (*K. senegalensis*, *B. senegalensis* and *A. nubica*), but after 2 weeks there was significant differences between *K. senegalensis* extracts and *A. nubica* extracts and no significant differences between *K. senegalensis* and *B. senegalensis* extracts, also no significant differences between *B. senegalensis* and *A. nubica* extracts Fig. (6).

Fig.1 Effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* concentrations on white fly *B. tabaci* adults first season (2007/2008) spray (1)

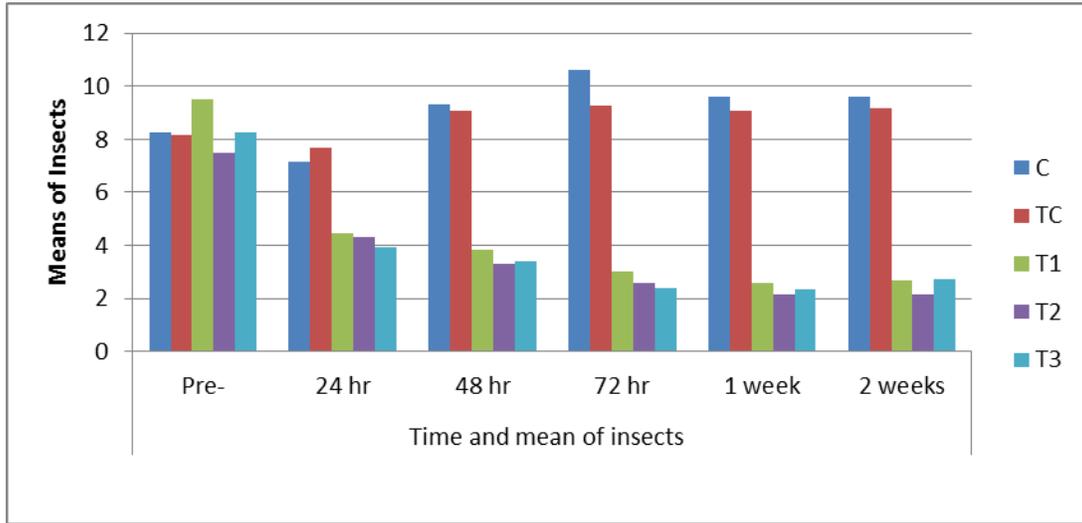


Fig.2 Effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* bark extracts on white fly *B. tabaci* adults 1st spray season (2007/ 2008).

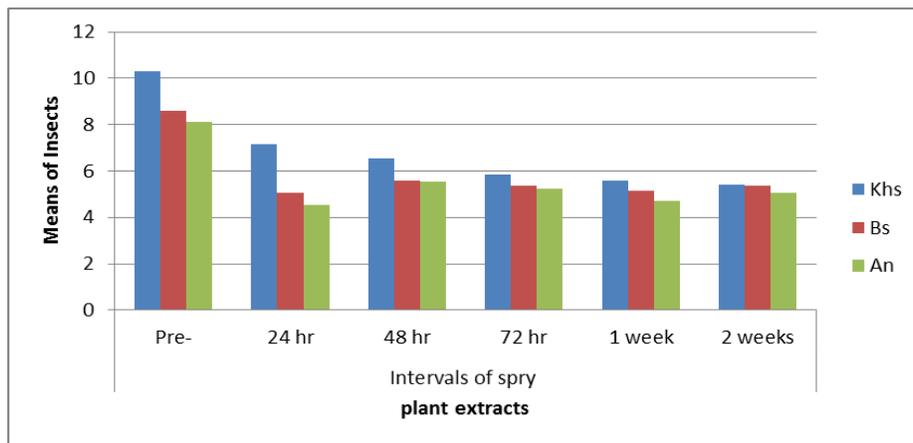


Fig.3 Effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* concentrations on white fly (W.F) (*B. tabaci*) adults 1st season (2007/2008) spray (2)

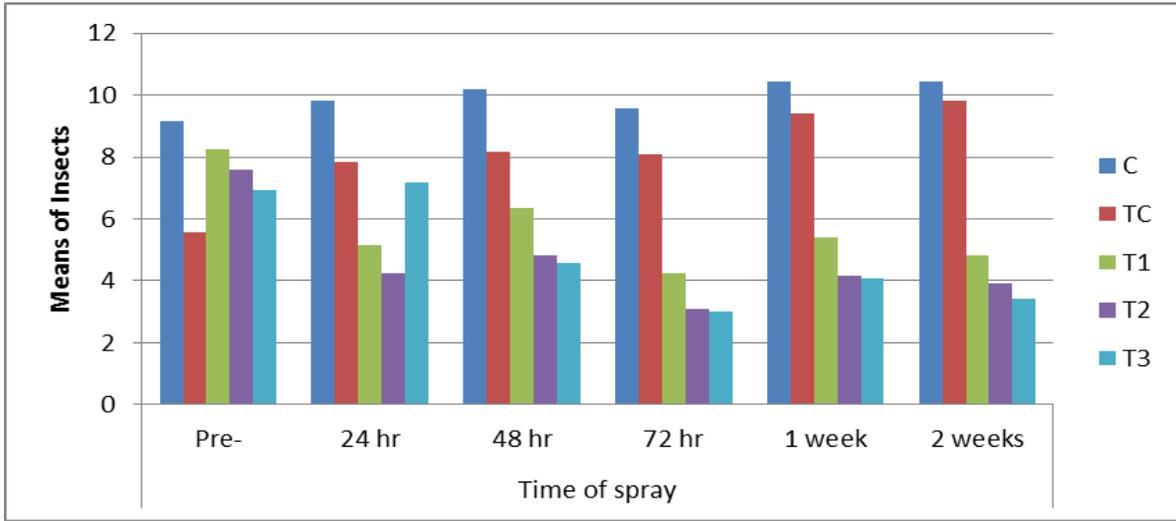


Fig.4 The effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* concentrations on white flies *B. tabaci* 2nd season (2008/2009) spray (1).

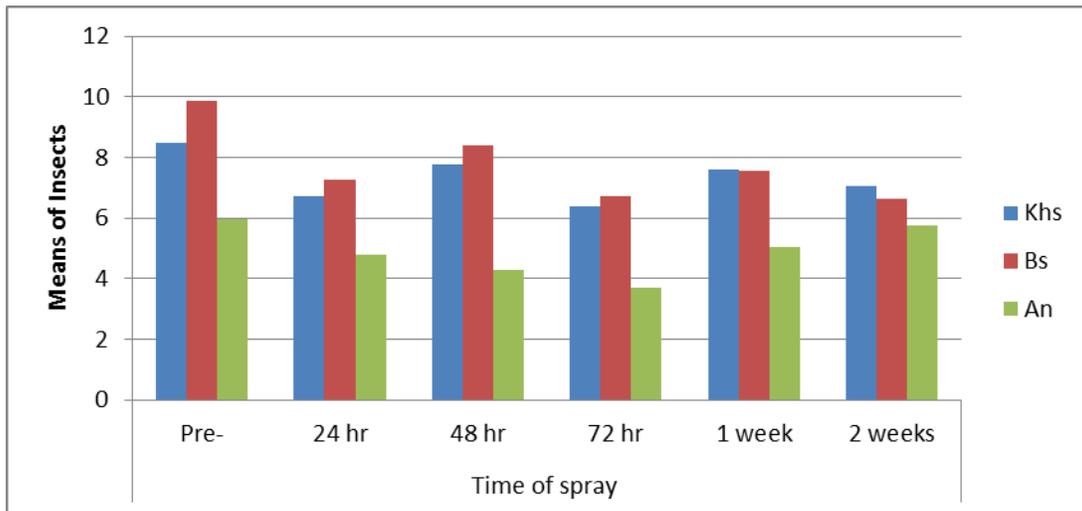


Fig.5 The effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* bark extracts on white flies *B. tabaci* 2nd season (2008/2009) spray (1).

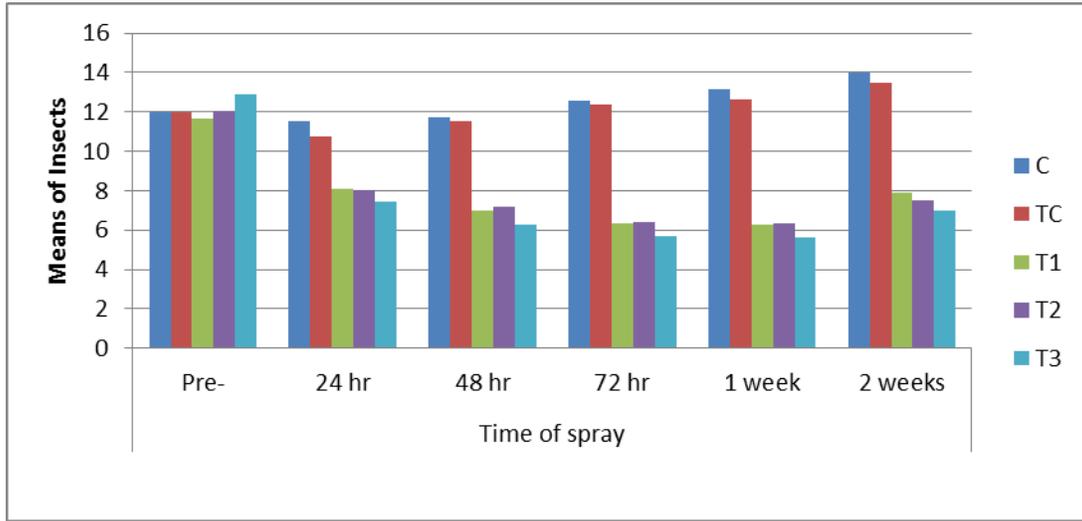


Fig.6 The effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* concentrations on whiteflies *B. tabaci* 2nd season (2008/2009) spray (2).

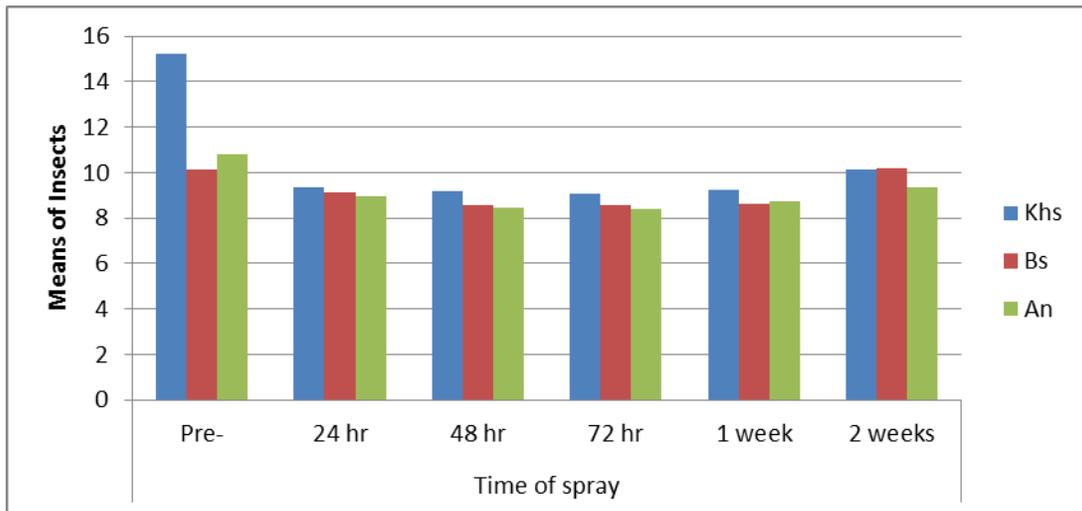


Fig.7 The effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* bark concentrations on white flies *B. tabaci* 2nd season (2008/2009) spray (2).

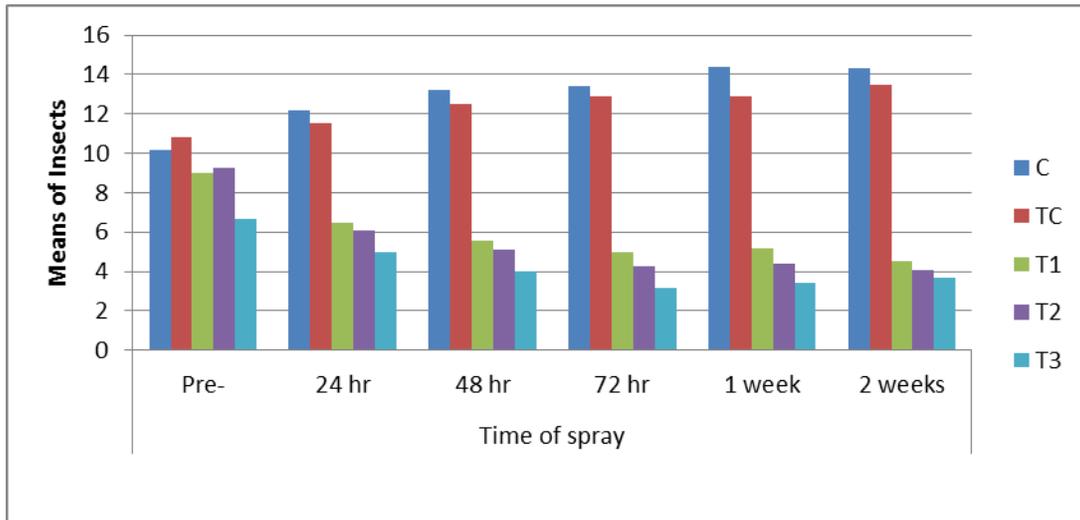
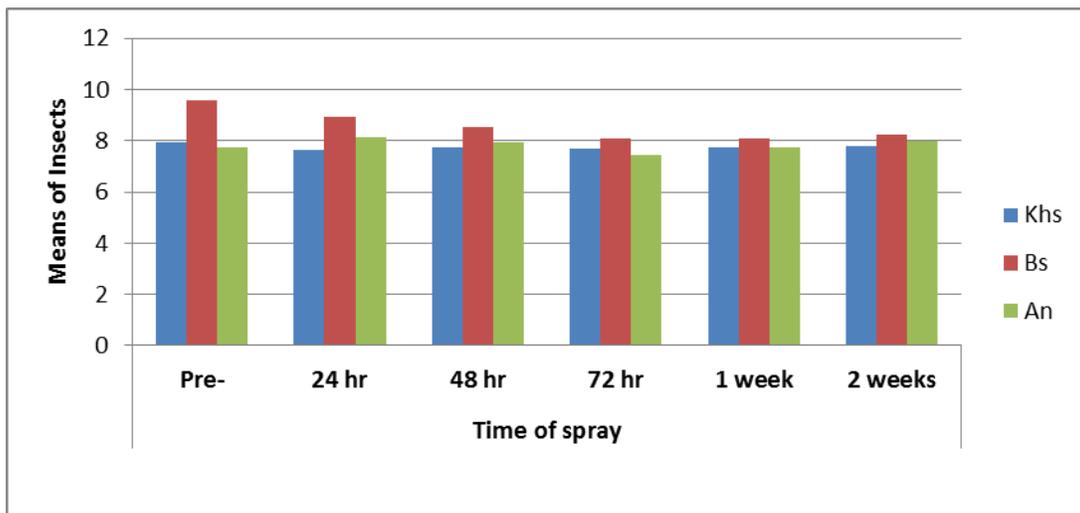


Fig.8 Effect of *K. senegalensis*, *B. senegalensis* and *A. nubica* bark extracts on whiteflies *B. tabaci* 2nd season (2008/2009) spray (2).



The analysis of 2nd pre-spraying count of whiteflies population showed no significant differences between plots. The data analysis of the 2nd post-spraying count after 24 hr, 48, 72 hr and 1 week showed significant differences between controls and the three concentrations and there were significant differences between treatment 5% and 1.25%.

After 2 weeks there were significant differences between controls and the different treatments and no

significant differences between the different treatments (5%, 2.5%, 1.25%) fig. (7).

The analysis of the 2nd spraying count W.F. population after 24 hr showed significant differences between *K. senegalensis* extract and *B. senegalensis* extract and there were no significant differences between *K. senegalensis* and *A. nubica* extracts and no significant differences between *B. senegalensis* extract and *A. nubica* extract. After 48 hr, 72 hr, 1

week and 2 weeks there was no significant differences between the different plants extracts Fig. (8).

The use of natural product as insecticides to protect field crops and stored grains against pest attack has long history all over the world. In Sudan, the use of natural material as protectant is still in the experimental and developmental stage, this agree with (Isman, 2006) who mentioned that several factors appear to limit the success of botanicals, most not ably regulatory barriers and the availability of competing products (newer synthetics, fermentation products, microbial) that are cost-effective and relatively safe compared with their predecessors. Some of the plant species that have been examined and included in this study are frequently those used locally by Sudanese people in traditional medicine and protect their crops against pests.

The Interviews conducted during June 2006 covered Zalingei area, it revealed that the local farmers use many indigenous plants to control pests like: *K. senegalensis* "Mohogany", *B. senegalensis* "Moyhait" and *A.nubica* "La'ot". The farmers used these plant species as repellents or as typical insecticides to protect their stored grains this reported by Osman (2001). All these plants mentioned above are naturally available in the area. Moreover application methods adopted are simple, easy and safe to man and his animals. The native claim that these plants serve as a good and satisfactory source of protection for their grains and growing plants (Dichter, 1978), (Hayna, 1982) and (Osman, 2001) came to similar conclusion. These finding agree with reports made by Von Maydell (1986) and Schmutterer (1995) using different plants extracts and different insect species.

This investigation conducted for two seasons (2017/2008) and (2018/2009). Generally showed that all plants bark extracts obtained from *K. senegalensis* "Mohogany", *B. senegalensis* "Moyhait" and *A. nubica* were able to protect the okra plants against white flies. At the first seasons

(2007/2008) the results showed that the plants bark extracts reduced the white flies populations compared with controls and there was significant difference between treatments (5%,2.5% and 1.25%) and controls, but there was no significant difference between the three concentrations (5%,2.5% and 1.25%). The results showed that the extracts reduced the population of white flies insects the least number of insects were observed with *A. nubica* extracts at 5% that means the *A. nubica* extracts gives better results compared with the other plants extracts, also the population of white flies decreased with increase in concentrations. The efficacy of the extracts seem to decrease with time reflected in the increased increments of white flies population, also the results showed that the *A. nubica* came as the best result. This probably due to the differences in its chemical composition. The *A. nubica* extracts containing sterols and the Other plants were not this finding reported by (Wessner *et al.*, 1992) similar pattern was also observed by (Martin and Gopalakrishnan, 2006). On the other hand (Guren *et al.*, 1999) reported that the sterols were shown to give significant feeding deterrent and repellents effects on the plant hopper *Nilaparvata lugens*. The observed reduction on population of white flies' insects was probably due to poisoning, anti-feeding, starvation, repellency and growth regulating or combination of all above mentioned factors to white flies' population. This finding also reported by many authors Hassan (1988); Ahmed (1993) and Osman (2001).

References

- Ahmed, G. A. (1993).Preliminary investigation in insecticidal potentiality of Ushar plant *Calotropis procera* Ait (.M.Sc. thesis Fac. Of Agric., Univ. of Khartoum, Sudan
- Butler, G. D.- Henneberry, J. J. Hutchism, W.D. (1986).(*Bebisiatabaci*).Homoptera: Aleyrodidae) on cotton. Adult activity and cultivar oviposition preference. J. of Econ. Ent., 79: 350-354.
- Butler, G. D.- Henneberry, J. J. Hutchism, W.D. (1986).(Biology, sampling and population dynamics of*Bebisiatabaci* .Agricultural

- Zoology reviews, I: 167-195.
- Dichter, D .(1978).Manual and improved Farm and Village level Grain Storage Methods. GTZ. Series of Training Manual. Geneva, Switzerland.
- FadlElmula, A. M. (1994).(Study on the insecticidal potentialities of Tark-Tark (*Boswelliapapyrifera*) Dil) and GafalAzrak (*Commiphora Africana*)Rich) Fam: Burseraceae (on selected crop pests. M.Sc. thesis fac. Of Agric. Univ. Of Khartoum – Sudan.
- Fageer, T. M. M. (1999). Evaluation of uincarsage of various plant products on the control of broad bean beetle) *Bruchidiusincarnotus*Boh, Family, Bruchidae, Order Coleoptera). M.Sc. thesis Fac.of Agric. Univ. of Khartoum – Sudan.
- Gomez, K. A. and Gomez, A. A. (1984). (Split –plot design analysis, In: statistical procedures for Agricultural research. John Willy and Sons, New York.
- Gubara, A. F. A. (1983). A comparative study on the insecticidal potentialities of Neem (*Azadirachta indica* A. Juss) and Rehan (*Ocimum* spp. M.Sc. thesis Univ. of Khartoum, Sudan
- Guren, Z., Wenqing, Z. Bin, L. Lianquan, G.; Qiang, Z. and Tong-Xian, L.(1999).Insecticidal effects of extracts from two Rice varieties to brown plant hopper *Nilaparvata lugens* J. of chemical ecology vol. 25.No.8. Plenum Publishing Corporation.
- Hassan Ali, A. and Lwande, W. (1989). Anti-pest secondary metabolites from African plants. Insecticides of plant origin ACS symposium series 387, pp. 78 - 94. Washington DC, USA .
- Hassan, M. S. (1988). (Screening of the potentially active chemical control against extracted from *Ocimum basilicum* L”.Rehan “on seleted crop pests. M.Sc. thesis Univ. of Khartoum, Sudan.
- Hayna J.(1982). The storage of the Tropical Agricultural Products Agrodok 31. Agromisa Wageningen,The Netherland.
- Isman, M .B., (2006). Botanical insecticides, deterrent and repellent in modern agriculture and increasing Regulated world.Annu. Rev. Entomol.51: 45- 66
- Jacobson, M. (1989). Botanical Pesticides: past, present and future. Insecticides of plant origin. ACS symposium series, 387, pp. 1-10.
- Martin, J .and Ggopalakrishnan, S. (2006). Insecticidal activity of Aerial parts of *Synedrella nodiflora* . Gaertn (Compositae) on Sopdoptera Litura. Fab. Dep. Of chemistry, J. Central European Agricultural. Vol. 7(2):289-296. Manmonmaniam Sundaranar University- India.
- Osman, F. A. (2001 .(Investigations in the potentialities of JabalMarra Natural Flora as pest control agents. M.Sc. thesis, faculty of Agriculture, U. of K., Sudan.
- Saxena, R. C. and Co. Workers (1987).(Neem seed ”Bitter “for management of plant hopper pests. Neem News letter. 4(4): 49.
- Schmutterer, H. (1995).(The neem tree *Azadirachta indica* A. juss and other Meliaceous for integrated pest management, Medicine, Industry and other purposes. 200-357
- Von Maydell, H. J. (1986).(Trees and shrubs of Sahel, their characteristics and uses, GTZ, VerlagJosfMargrafWeikersheim, Germany.
- Wessner,M;Chpion B.; Girault,J. P.;Kaouadji, N.; Saidi,B. and Lafont,R. (1992). Ecdysteroids From Ajugatva, Phytochemistry. 31,3785-3788.

How to cite this article:

Fatin Abdalla Osman, Eltigni Eltahir Ali and Taha Mohammed Sharief. 2022. Assessment of the Potentialities of Three Species of Zalingei (Western Sudan) Natural Flora as Pest control Agents. *Int.J.Curr.Microbiol.App.Sci*. 11(02): 387-396. doi: <https://doi.org/10.20546/ijcmas.2022.1102.044>