ISSN 2321-1091

LARVICIDAL ACTIVITIES OF*Tithonia diversifolia*LEAF EXTRACT ONPERI-URBAN MOSQUITO LARVEA INABAKALIKI; ALTERNATIVE TO INSECTICIDE DEVELOPMENT.

***UHUO,CA; OKEREKE,CN., NWELE, ED., OGBONNA S.U.,[2]NWANCHOR, K.C AND OKOH, F.N.**
1.DEPARTMENT OF APPLIED BIOLOGY, EBONYI STATE UNIVERSITY ABAKALIKI EBONYI STATE NIGERIA.
2. DEPARTMENT OF CROP AND LANDSCAPE MANAGEMENT, EBONYI STATE UNIVERSITY ABAKALIKI EBONYI STATE.
3. PARASITOLOGY UNIT, DEPARTMENT OF BIOLOGICAL SCIENCES EVANGEL UNIVERISTY ABAKALIKI, EBONYI STATE.
Correspondence: Cosmas Uhuo, coscusanas@gmail.com +2348032550134

Abstract

The bioassay activitiesof*Tithonia diversifolia* leave extract was conducted on the larvae of Anopheles mosquito collected at peri-urban areas of Abakaliki Ebonyi State, using the concentrations of the extract in dilutions at 50/100ml, 40/100ml, 30/100ml and 20/100ml introduced with 10 Anopheles mosquito larvae each in four replicates and allowed for 3hrs. Mean mortality rate of the larvae were observed after the first hour, thus 30%, 10%, 05% and 0% respectively while in the 2nd hour were 60%, 40%, 20% and 10% and in the 3rd hour were 80%, 60%, 50% & 30% respectively. The result thus revealed that the treatment is dose dependent and that the studied specie has some bioactive compounds that can be exploited for insect pests control hence observed to be sensitive in anopheles mosquito larvae. Therefore *Tithonia diversifolia*leaf extract could be used as a bioassay for the control of mosquito due to its active properties as this has exhibited adverse effects on the larvae thereby reducing the mosquito population and thus reducing the malarious infection associated with the bite of mosquito.

Keywords: Bioassay, Efficacy, *Tithonia diversifolia*, Mosquito.

Council for Innovative Research

Peer Review Research Publishing System

Journal: Journal of Social Sciences Research

Vol. 7, No.1

jssreditor.cir@gmail.com

www.jssronline.com

ISSN 2321-1091

Introduction

The plant *Tithonia diversifolia* belongs to the *Asteraceae* family commonly known as the Mexican sunflower, tree marigold and or Japanese sunflower.This specie (*Tithonia diversifolia)* is a 2-5m tall perennial shrub, which is a native to Mexico and now widely distributed throughout the humid and sub-humid tropics in Central and South America, Asia and Africa (Sonke, 1997). *Tithonia* was introduced into Africa as an ornamental and has been reported in some countries like Kenya (Niang *et al*., 1996), Malawi, Nigeria (Ayeni *et al*., 1997) and in some other African countries like Rwanda, Zimbabwe, Cameroon, Uganda and Zambia. *T. diversifolia* propagates from seeds and are commonly found along roads and waste grounds. The economic importance of*T.diversifolia* includes its use for improvement of soil fertility and crop production.The green biomass of *Tithonia* was previously recognized to be high in nutrients.Recent studies in the highlands of (Nagarajah and Nizar 1982) western Kenya identified green biomass of *tithonia* as an effective source of nutrients for maize (Gachengo 1996, Jama*et al*., 2001), also in Malawi (Ganunga *et al*., 1998) and Zimbabwe (Jiri and Waddington, 1998) have similarly reported *Tithonia* biomass to be an effective source of nutrient for maize. This is due to the high concentrations of N. P. K contained in the green stems and leaves of the *Tithonia*biomass. However, (Gachengo *et al.,* 1999) reported that other than the N. P. K *Tithonia*biomass is also rich in Ca and Mg as soils under *Tithonia*hedges tend to be higher in exchangeable Ca and Mg than soils in adjacent cropped land with no recent use of fertilizer and manure.Extracts from *Tithonia*plants parts reportedly protect crops from termites (Adoyo *et al.*, 1997), contain chemicals that inhibit plant growth (Tongma*et al.,* 1997) and control (Ng'inja *et al*., 1998).

In using *Tithonia*for treatment it can be administered in several forms: oral decoction of the leaves for treatment of hepatitis, diabetes, malaria, pain chemoprevention and anti-*helicobacter pylori* (Kuroda,*et al*., 2009), external application of dried leaves on wounds and infusion of leaves for treatment of measles (Adebayo, *et al*., 2009). However, previous phytochemical studies of this genus have shown that the major constituents of this plant include three sub types of lactones, flavones and chromenes (Yemele*.,* 2006; Ambrosio, *et al*., 2008).*Anopheles gambiae* is one of the best known, because of its predominant role in the transmission of the most dangerous malaria parasite species*Plasmodium falciparum.* This genus of mosquitoe is not only vectors for canine heartworm *Dirofilaria immitis,* the filaridae,*Wuchereria bancrofti* and *Brugia malayi*, and also viruses such as one that causes O'nyong nyong fever. There is an association of brain tumor incidence and malaria, suggesting that the anopheles might transmit a virus or other agent that could cause brain tumor (Steven, 2010).Anopheles species prefer to feed on humans (anthropophily) or animals such as cattle (Zoophilic).Anthropophilic anopheles are more likely to transmit the malaria parasites from one person to another. Most anopheles mosquitoes' are not exclusively anthropophilic or zoophilic. However, the primary vectors of malaria in Africa *A. gambiae* and *A. funestus*, are strongly anthropophilic and consequently are two of the most efficient malaria vectors in the world (Wang, *et al.,* 2011).

Materials and methods

Test organism

Anopheles mosquitoe larvae were obtained from mosquitoes ovipositing sites found outdoors within peri-urban residence in Abakaliki, Ebonyi State. The colony of the larvae was maintained at room temperature in a plastic bucket half filled with pond water so that the larvae will feed on the microorganisms.

Plant extract preparation

The leaves of *Tithonia diversifolia* were collected from *Ukwu-achi* community in Ebonyi State and were dried for 4-days under room temperature in December 2011. The dried leaves were then grounded using pestle and mortar. Fifty-four grams of the pulverized leaves was introduced into 400ml of ethanol in a plastic bucket/container with cover and allowed to stand for 24hrs. After 24hrs the soaked pulverized leaves were filtered with filter paper into four glass beakers to a measurement of 50ml, 40ml, 30ml and 20ml respectively to get the desired extracts.

Larvicidal bioassay

Larvicidal activities were evaluated by subjecting the Anopheles mosquitoe larvae to different concentrations of leave extract of *Tithonia diversifolia* of 50ml, 40ml, 30ml and 20ml in glass beakers containing 100ml of water each. Newly molted third and fourth instar larvae of 10 were introduced into each glass beaker containing the above stated concentrations of extract and water. The percentage larval mortalities were recorded on an hour interval for three hours. Dead larvae were identified when they failed to move after probing with a needle and couldn't stay afloat. Moreover, a fifth beaker with 100ml water and no extract was also introduced with 10 Anopheles mosquitoe larvae and was used as a control.

Results

The result of the analysis shows the effect of various concentration of the *Tithonia diversifolia* leaf extract on the test organism Table 1. The effect of the leaf extract on the larvae at each hour indicating their mortality against their concentration Table 2. The mean percentage mortality of Anopheles mosquito larvae exposed to various concentration of *Tithonia diversifolia* leaf extract for three hours Table 3. No. of larvae introduced to each concentration is 10.

ISSN 2321-1091

Table 1: The effect of *T.diversifolia* leaf extract on larvae of anopheles mosquito

Time interval	Concentration of extract				
	50/100	40/100	30/100	20/100	Control(100ml)
Ist hour	3	1	-	-	-
2nd hour	6	4	1	1	-
3rd hour	8	6	5	3	-

Table 2: The effect of *T.diversifolia leaf* extract on the larvae in respect to death and live of larvae.

Time interval							
	50/100	40/100	30/100	20/100	100	TD	TA
Ist hour	3	1	-	-	-	4	46
2nd hour	6	4	2	1	-	13	37
3rd hour	8	6	5	3	-	22	28

Table 3: The mean percentage mortality of anopheles mosquito larvae exposed to various concentration of *T.diversifolia* leaf extract for three hours.

Time interval	Concentration of extract				
	50/100	40/100	30/100	20/100	Control (100ml)
Ist hour	30.00	10.00	05.00	00.00	00.00
2nd hour	60.00	40.00	20.00	10.00	00.00
3rd hour	80.00	60.00	50.00	30.00	00.00

Discussion

The larvicidal activities of aqueous leaf extracts of*T. diversifolia* showed that the plant extracts have insecticidal properties on the targeted organisms (Table 1and 2). Mortality of Anopheles mosquito larvae exposed to the plant extracts increased with exposure and concentration of extracts as was also reported for larvae of Anopheles *gambiae* exposed to extracts of *A.occidentales* Nmanani *et al.,*(2011) and larvae of *C. quinquefasciatus* exposed to extracts of *Nerium indicum* (Srivastava *et al.,* 2003). The result also revealed that mortality of anopheles larvae exposed to the plant extract increased with time of exposure and concentration of extracts as highest mortality was recorded for 50ml conc. of the extract with 30% mortality for the first hour, 60% for the second hour and 80% for the third hour (Table 3).Going by the above deductions, it can be rightly put that the effect of the extract is dose dependent as evident by increase in the percentage mortality with increasing concentration and time. This result is in agreement with the works of Srivastava *et al*,(2003) and Choochote *et al*.,(2004) which reported that larvae of *Culex quinquefasciatus* exposed to extracts of *Nerium indicum* and *Euphorbia royleana* showed high mortality with increased time of exposure and concentration of extracts.

In the above result, differences on the mortality of different larval stages of the Anopheles mosquito revealed that the third instar larvae were more susceptible to the extract at or during the first hour than the fourth instars which showed less susceptibility to the extracts in the first hour of exposure. Similar observations were reported by Nnamani *et al.,*(2011) for larvae of *A. gambiae* exposed to aqueous extracts of *A.occidentales,* and Al-Sharook *et al*,(1991) for larvae of *Culex spp* exposed to crude extracts of *Melia volkensis* and *M. azadirachta* respectively.

Conclusion and Recommendation

From this study, it could be concluded that *T. diversifolia* has potential bioactive compounds against larvae of Anopheles mosquito, and that the extract from the plant could be used in stagnant water bodies which are known to be breeding sites for mosquitoes. However, further research on the bioactive compounds found in the leaves and stems of the plant are

highly recommended. I will also recommend that more research work should be done on the phyto-toxicity of *T. diversifolia.*

References

1. Adoyo, F.; Mukalama J.B., and Enyola M.(1997). Using *Tithonia*concoctions for termite control in Busia District, Kenya. *ILEIA Newsletter***13**:24-25.
2. Adebayo, J.O.; Balogun, E.A. and Oyeleke, S.A.(2009). Toxicity studies of aqueous extract of *Tithonia diversifolia* leaves using selected biochemical parameters in rats. *Phycog Res*. **1**:143-147.
3. Ambrosio, S.R.; Oki, Y., Heleno, V.C., Chares, Y., Nascimento, P.G., Lishton, J.E., Constantino, M.G., Varanda, E.M., and Da Costa, F.B(2008). Constituents of glandular trichomes of *Tithonia diversifolia*: Relationships to herbivory and antifeedant activity. *Phytochemistry*. **69**:2052-2060.
4. Ayeni, A.O.; Lordbanjou, D.T., and Majek, B.A.(1997). *Tithonia diversifolia*(Mexican sunflower) in South-Western Nigeria: Occurrence and growth habit. *Weed Research*(Oxford) **37**:443-449.
5. Al-Sharook, Z., Balan, K., Jian, Y and Rembold, H. (1991). Effect of crude seed extract on mosquito larvae. *Journal of Applied Entomology*,**111**(5):425-430.
6. Choochote, W., Tueton, B., Chaithong, U. and Chainong, P.(2004). Potential of crude seed extract of celery,Apium graveolus L. against mosquito, Aedes agypti (L). *Journal of Vector Ecology, **29**(2):340-346.*
7. Gachengo, C.N.(1996). Phosphorus release and availability on addition of organic materials to phosphorus fixing soils. MSc thesis. Moi University, Eldoret, Kenya.
8. Gachengo, C.N.; Palm, C.A., Jama, B. and Othieno, C.(1999). *Tithonia* and senna green manures and inorganic fertilizers as phosphorus sources for maize in Western Kenya. *Agroforestry systems.***44**:21-36.
9. Jiri, O. and Waddington, S.R.(1998). Leaf prunings from two species of *tithonia* raise maize grain yield in Zimbabwe, but take a lot of labor! Newsletter of Soil Fert. Net. Harare, Zimbabwe. Target **16**:4-5.
10. Kuroda, M.; Yokosuka, A., Kobayashi, R., Jitsumo, M., Kando, H., Nosaka, K., Ishii, H., Yamori, T. and Mimaka, Y.(2007). Sesquiterpene and Flavonoids from the aerial parts of *Tithonia diversifolia* and their cytotoxic activity. *Chem. Pharm. Bull*. **55**:1240-1244.
11. Nagarajah, S. and Nizar, B.M(1982). Wild sunflower as a green manure for rice in the mid-country west zone. Tropical Agriculturalist **138**:69-78.
12. Ng'inja, J.O.; Palm, C., Niang, A. and Lauriks, P.(1998). Traditional hedges in western Kenya: typology, composition, distribution, uses, productivity and tenure. Pilot Project Report No.8. Regional Agroforestry Research Centre. Maseno, Kenya.
13. Niang, A.; Amadalo, B., Gathumbi, S. and Obonyo, C.O(1996). Maize yield response to green manure application from selected shrubs and trees in western Kenya: a prelimnary assessment. In: Mugah, J.O(ed) Proceedings from the First Kenya Agroforestry Conference on People and Institutional Participation in Agroforestry for Sustainable Development. pp 350-358.
14. Nnamani, C.V..; Osayi, E.E., Atama, C.I., and Nwachukwu, C.(2011). Larvicidal effects of Leaf, Bark and Nutshell of *Anacardium occidentale* on the Larvae of *Anopheles gambiae* in Ebonyi State. *Animal Research International* 8(1):xxx-xxx.
15. Steven Lehrer(2010). "*Anopheles* mosquito transmission of brain tumor". *Medical Hypotheses***74**(1):167-168.
16. Sonke, D.(1997). *Tithonia* weed a potential green manure crop. Echo Development Notes **57**:5-6.
17. Srivastava, V.K.; S.K. Singh, and M. Rai(2003). Toxicity of *Nerium indicum* and *Euphorbia royleana* lattices against *Culex quinquefasciatus* mosquito larvae. *Nigerian Journal of Natural Products and Medicine*, **7**:61-64.
18. Tongma, S.; Kobayashi, K. and Usui, K.(1997). Effects of water extracts from Mexican sunflower (*Tithonia diversifolia* (Hemsl.) A.Gray) on germination and growth of tested plants. *Journal of Weed Science and Technology* **42**:373-378.
19. Wang Y, Gilbreath T.M, Kukutla P, Yan G, Xu .J(2011) Dynamic gut microbiome across life history of the malaria mosquito Anopheles gambiae in Kenya. PLoS One **6**(9):e24767.
20. Yemele, B.M.; Krohn, K., Hussain, H., Dongo, E., Schulz, B. and Hu, Q.(2006). Tithoniamarin and tithoniamide: a structurally unique isocoumarine dimer and a new ceramide from *Tithonia diversifolia*. *Nat. Prod. Res.***20**:842-849.