Gas Chromatography-Mass Spectroscopy Analysis and Histopathological Effects of Methanol Leaf Extract of *Lasianthera africana* P. Beauv. in the Midgut of Maize Weevil, *Sitophilus zeamais* L.

Diligent Oboho[1*], Edagha, I.[2], Nelson, A.[3], Essien R[4], Akpan A.[1] Aina S.[5], Edeke A.[6], Ita B.[7], Ita S.[8] and Eyo J.[9]

*Corresponding author: diligentoboho@uniuyo.edu.ng X(Twitter): obohodr

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Abstract

Alternative methods for pest control have been widely used to mitigate challenges arising from pesticide applications in agriculture. This study investigated Gas Chromatography-Mass Spectrum (GC-MS) in the identification of bioactive components in methanol leaf extract of *Lasianthera africana* and examined its impact on the midgut histopathology of maize weevil, *Sitophilus zeamais*. The existence of eight (8) phytochemical substances with various therapeutic actions were shown by the GC-MS analysis : Thiirane (2.0); 1,1 dimethylhydrazine (2.8); L-aspartic acid (2.6); N-methyl-3,4-methylene dioxyphenylpropan-3-amine (1.7); 1-hydroxyimino-1-(4-methylphenyl) propan-2-one (2.3); Mercaptoethanol (1.6); 1,3-bis -t- butylperoxy-phthalan (1.3); 2-amino-4-(2-methylpropenyl)-pyrimidin-5-carboxylic acid (2.5) and other minor compounds, as the main constituents. Comparing the plant extract-treated *S. zeamais* specimen to the control, the histological section demonstrated a mild reorganization of the respiratory, secretory, and gastrointestinal layers along with the destruction of the muscular layer. In conclusion, the midgut histology of *S. zeamais* may be affected by the bioactive chemicals present in *L. africana*, which have a variety of biological functions. Thus, farmers are encouraged to use botanicals which are practical, ecologically friendly instead of synthetic insecticides with high residual effects to preserve their stored grains.

Keywords: GC-MS, Histopathology, *Lasianthera africana, Sitophilus zeamais*

Introduction

Fig. 1a: *Lasianthera africana*

Worldwide, stored insect pests are an issue because they lower grain quality and quantity. In the temperate zone, they may cause 5 - 10% damage to stored grains and grain products, while in the tropical zone, 20 - 30% damage[1]. There have been reports of postharvest losses of up to 50% in underdeveloped nations, with significant financial losses.[2]

***Lasianthera africana* (Fig. 1a) is a member of the Lamiaceae family and it is monospecific genus found in South Eastern Nigeria and extends into Cameroon. The aim of this study was to determine the different phytochemicals present and also examine the histopathological effects of the *L. africana* extract on the midgut of the maize weevil, *Sitophilus zeamais*.**

Fig. 1b: *Sitophilus zeamais* (Mason, 2003)

Materials and Methods

Collections of Plant Materials: Fresh leaves of *L. africana* (Herbarium Voucher Specimen No. UUH/3687) were procured from Ikono, Akwa Ibom State.

GC-MS of the Plant: GC-MS of the plant was conducted In the Department of Pharmacognosy and Natural Medicine Laboratory at the University of Uyo in Akwa Ibom State, Nigeria, using standard procedures as outlined by [3,4,5.]

Histopathological Assay of the Insect: For histological investigations, a slightly modified method by Humason (1979) was used.

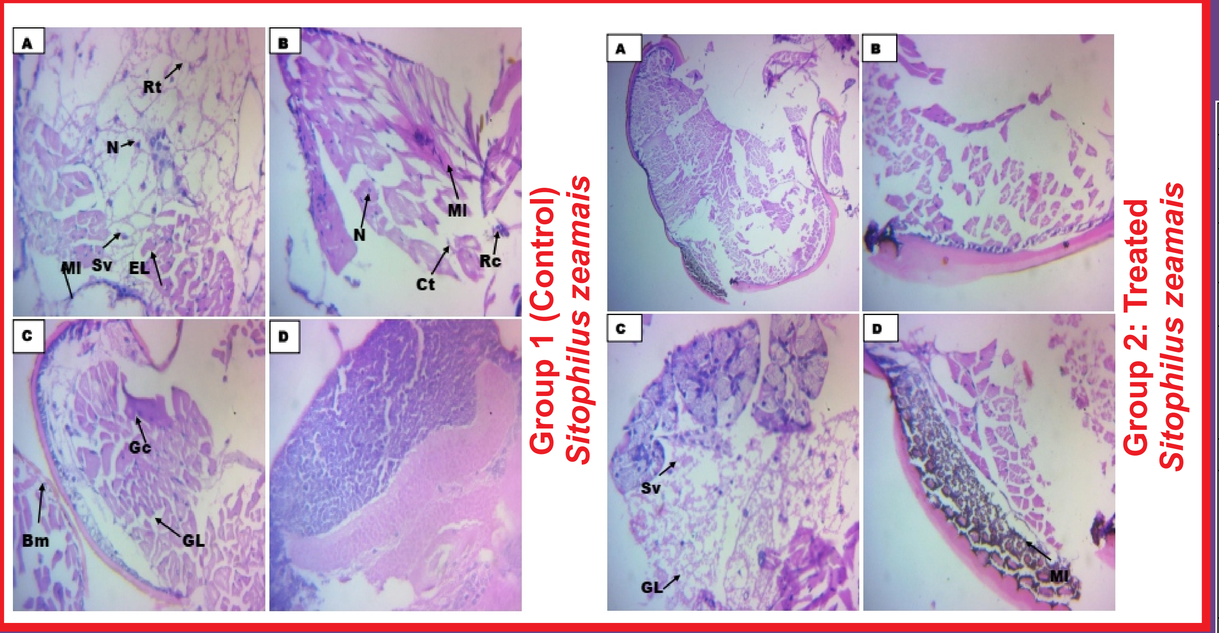


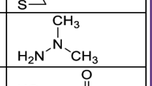
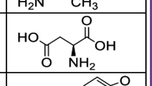
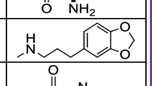
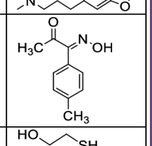
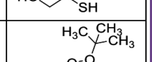
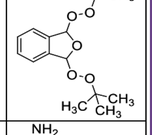
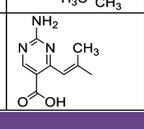
Fig 3: Photomicrographs (Mg = 400x) of untreated stained with H&E.

Legends: A = Respiratory tract, B = Muscle, C = Gastro-intestinal tract, D = Excretory system. Epithelium Lining (EL), Basement membrane (BM), Regenerative Cells (Rc), Gut Lumen (GL), Muscular Layer (ML), Secretory

Fig 4: Photomicrographs (Mg = 400x) of *L. africana* 10 mg/kg treated stained with H&E.

Legends: A= Respiratory tract, B = Muscle, C = Gastro-intestinal tract, D = Excretory system. Epithelium Lining (EL), Basement membrane (BM), Regenerative Cells (Rc), Gut Lumen (GL), Muscular Layer (ML), Secretory Vesicles (SV), Goblet

Table 1: Chemical composition of methanol extract of *L. africana*

S/N	Compound	RT	Area (%)	Chemical Formula	Molecular Weight	Structure
1	Thiirane	43.239	2.016	C_2H_4S	60.12	
2	1,1 dimethyl hydrazine	42.946	2.723	$C_2H_8N_2$	60.10	
3	L - aspartic acid	84.124	2.626	$C_4H_7NO_4$	133.10	
4	N - methyl-3,4-methylene dioxyphenylpropan-3-amine	86.102	1.706	$C_{11}H_{13}NO_2$	193.24	
5	1-hydroxyimino-1-(4-methyl phenyl)propan-2-one	83.941	2.305	$C_{10}H_{11}NO_2$	177.20	
6	Mercaptoethanol	88.593	1.654	C_2H_6OS	78.13	
7	1,3- bis -t- butylperoxy-phthalan	95.920	1.262	$C_{16}H_{24}O_5$	296.36	
8	2-amino-4-(2-methylpropenyl)-pyrimidin-5-carboxylic acid	87.641	2.504	$C_9H_{11}N_3O_2$	193.20	

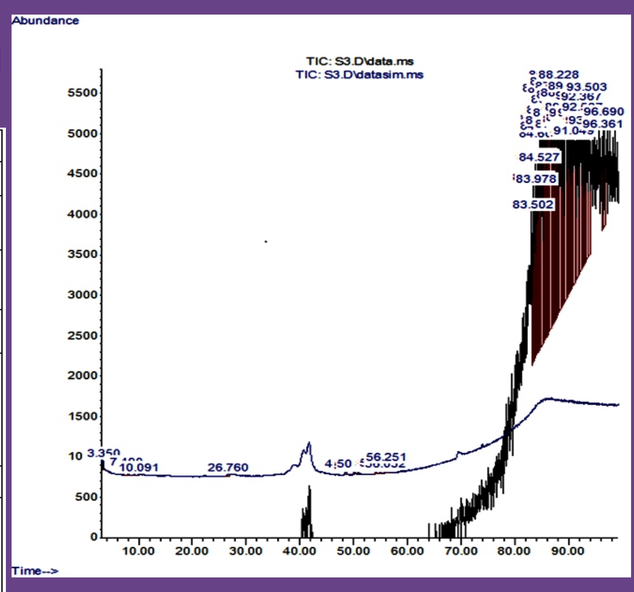


Fig 2: GC-MS Analysis of the Methanol Extract of *L. africana*

Conclusion: The *L. africana* methanol extract demonstrated a strong insecticidal activity and this were able to kill the insect by penetrating their midgut histoarchitecture. This plant botanical formulation can be used in pest management programs since it is easily accessible, safe for the environment, and non-toxic to non-target organisms.

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