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Chemical Composition of Biological Pesticides in Leaf of *Chromolaena odorata*

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ABSTRACT

The increased use of pesticides in the control of vector pests has raised some concern over the adverse effect of these chemicals on humans, domestic animals and their environment. This research was undertaken to harness the beneficial use of the extract of *Chromolaena odorata*, as biopesticide.

This study aims to determine bio-pesticidal chemical composition in ethanolic extract of *Chromolaena odorata* (Siam weed). Fresh and healthy leaves of *Chromolaena odorata*, were harvested. They were air dried for four weeks on the laboratory bench, pulverized and extracted using soxhlet apparatus and ethanol as the solvent. The bioactive of ethanolic extracts from the siam weed were profiled using gas chromatography flame ionization detector (GC-FID). The ethanolic extracts underwent GC-FID analysis, which identified 49 components. According to the bioactive contents of the extracts from the plant, these substances fall within the class of terpenes, esters, sterols, and triterpenoids, which were recognized to have active plant-protective and health-improving effects on economic food crops. Consequently, from the various literatures, the GC-FID analysis of the phytochemical components found in the siam weed extracts showed the potential to serve as biological insecticides, nematicides, bactericides and fungicides.

Keywords: C*hromolaena odorata;* bio-pesticides; bio-active; phytochemical

INTRODUCTION

Chromolaena odorata, (Siam weed), is a scrambling perennial plant that reaches a height of 2-3 cm. Its stems are straight, pithy, brittle, and easily branch. The leaves have an arrowhead shape and measure 6–12 cm in length and 3–7 cm in breadth. They have three veins that resemble a pitchfork (Pandurangan *et al*., 2015).

Native to Central and South America, *C. odorata* is a weedy herb that has spread throughout tropical and subtropical regions (Gautier, 1992; Omokhua *et al*., 2016). As a plantation cover crop, it was initially brought to Southeast Asia in the 1920s and Africa in 1940. Since then, it has proliferated all over the world (Rouw, 1991; Kouame *et al*., 2013). For its several therapeutic benefits, *C. odorata* has been used historically. It is particularly useful externally for conditions including inflammation, skin infections, and wound healing. Research has shown that the leaf extract possesses anti-inflammatory, (Owoyele *et al.,* 2005; Pandith*et al*., 2013), anti-bacterial, (Suksamrarn *et al*., 2004; Stanley*et al*., 2014) anti-cancer (Kouame *et al*., 2013; Adedapo *et al*., 2016), anti-convulsant (Amazu*et al*., 2013) anti-diabetic (Onkaramurthy *et al*., 2013; Uhegbu *et al*., 2016),anti-fungal (Ngono *et al*., 2006; Naidoo *et al*., 2011) antioxidant (Vijayaraghavan *et al.,* 2013; Boudjeko *et al.,* 2015), and anti-parasitic (Thoden et al., 2007; Ezenyi et al., 2014), hemostatic and wound healing (Pandurangan *et al*., 2015; Owoyele *et al*., 2005; Pandith *et al*., 2013; Pandith *et al*., 2013),and hepato-protective activities (Alisi *et al*. 2011; Asomugha *et al*., 2014).

The antioxidant properties of the plant help to preserve the development of keratinocytes and fibroblasts on the wounds, which is why mending wounds is so effective (Owoyele et al., 2005). In Vietnam, *C. odorata* is widely used for traditional wound healing. The aqueous extract from the leaves has also been used to treat skin infections and soft tissue burns (Thang *et al.,* 2001; Phan *et al.,* 2001). Report has it that *Chromolaena odorata* has been used as bio-pesticide against beans weevils

Essential oils from the plant have shown anti-fungal and anti-microbial activities and anti-radical potential (Félicien*et al.,* 2012), mortality of the maize grain weevil, *Sitophilus zeamais* (Bouda *et al.,* 2001), in vitro potential cytotoxic activity on human epidemic cell line (Koba *et al.,* 2011), toxic on *Rhipicephalus lunalatus*, ectoparasite of the dwarf goat (Pamo *et al.,* 2004), exploited as insecticide (Noudogbessi*et al.,* 2008), ovicide and larvicide (Félicien*et al.,* 2012). The chemical constituents of its volatile oils are always dominated by ubiquitous mono-and sesquiterpenes of diverse structural pattern. Some major compounds of its oils so defined include β-caryophyllene, germacrene-D, bicyclogermacrene, geijerene, (Z)-β-farnesene, α-pinene, pregeijerene, camphor and limonene (Owolabi*et al.,* 2010;

Kossouoh*et al.,* 2011; Suwaibah*et al.,* 2012; Joshi 2013). This research falls within the economic pillars under the good health and well-being of the vision 2030 Sustainable Development Goals. The research provides foundational background information on the production of biological pesticides, safe to eat foods for wellness and healthy life. Thus, the aim of this study is to assess the chemicals composition of biological pesticide in Siam weed leaf (*Chromolaena odorata*).

MATERIALS AND METHODS

Plant Material

Fresh *Chromolanae odorata* were harvested within the premises of Lagos State University of Technology, Ikorodu and were identified by a botanist. The leaves were carefully removed from the stem and washed in running water to remove contaminants. They were air dried at room temperature in an open laboratory space for four weeks and pulverized into powder.

Preparation of Extracts

The extraction was done using soxhlet apparatus and ethanol as the solvent according to the method described by Airaodion *et al.,* (2019). 25 g of pulverized leaves of the three species were packed into the thimble of the soxhlet extractor and 250 mL of ethanol was added to a round bottom flask, which was attached to the Soxhlet extractor and condenser on a heating mantle. The solvent was heated using the heating mantle and began to evaporate moving through the apparatus to the condenser. The condensate dripped into the reservoir housing the thimble containing the sample. Once the level of the solvent reached the siphon, it poured back into the round bottom flask and the cycle began again. The process was allowed to run for a total of 18 hours. Once the process was completed, the ethanol was evaporated in a rotary evaporator at 35°C with a yield of 2.55 g which represents a percentage yield of 10.20%. The extract was preserved in the refrigerator until when needed.

Gas Chromatography (GC) Analyses

Siam weed extract (200 ml) was taken to Central Research laboratory, Federal University of Technology, Akure, Ondo State, Nigeria for bioactive constituents' analysis. The chemical composition of the crude extract was performed using gas chromatography coupled with flame ionization detector (GC/FID). The GC analysis was performed using a chromatography equipped with a flame ionization detector (FID) and two capillary columns of different polarities OV type: 101 (25 m x 0.22 mm x 0.25 mm) and Carbowax 20 M (25 m x 0.22 mm x 0.25 μm). The carrier gas was Helium with a flow rate of 0.8 ml/min and the oven programming temperature was between 50 and 200°C with a gradient of 5°C/min. CPG/MS coupling was performed on a DB1-type fused silica capillary column (25 m x 0.23 mm x 0.25 μm) with Helium as a carrier gas and temperature programming identical to that of the GC (AOAC, 2019).

Identification of the Components

Bioactive compounds extracted from the plant extracts were identified on the basis of GC retention time (RI, determined with reference to homologous series of n-alkanes C8–C25, under identical experimental conditions) on HP-5MS column and matching of the spectra with computer software data of standards (Replib and Mainlab data of GC–MS systems).

RESULTS

GC-FID chromatogram of extracts revealed that forty-nine bioactive compounds are present in *Chromolaenaodorata* (Siam weed). The GC showed the concentrations of the various compounds as a function of retention time while the peak height showed the relative concentrations of the components present in the extract, while the compounds were identified through flame ionization detector attached with the gas chromatography. The identified compounds with their name, % peak area, and retention time were categorized and summarized into five chemical groupsterpenes, triterpenoids, fatty acid, hydrocarbons, esters.

The yield of the extracts obtained from the soxhletethanolic extracts of the leaves of *C. odorata*was 10.20% calculated on a dry weight basis, Table 1 presents the components identified, their percentage compositions and retention indices based on their elution on the HP-5MS column. A total forty-nine compounds were characterized and identified by GC-FID.

Table 1: The Chemical Compositions of *Chromolaenaodorata*

S/N %	RT	% AREA	LIBRARY ID	REF#	CAS#	QUAL
1	4.946	0.47	Catechol	5860	000120-80-9	59
			1H-Benzotriazole	9260	000095-14-7	53
			Catechol	5859	000120-80-9	50
2	5.354	3.68	5-Hydroxymethylfurfural	11339	000067-47-0	72
			5-Hydroxymethylfurfural	11338	000067-47-0	64
			1H-Pyrazole, 4,5-dihydro-3- methyl-1-propyl	11489	026964-49-8	47
3	7.117	1.40	4-Acetoxybenzaldehyde	35587	000878-00-2	42
			2,4,6-Cycloheptatrien-1-one,2-hydroxy-	10091	000533-75-5	30
			4-Acetoxybenzaldehyde	35588	000878-00-2	27
4	7.413	0.77	Copaene	68472	003856-25-5	96
			alfa-Copaene	68522		96
			Copaene	68473	003856-25-5	96

5	7.457	0.91	Copaene	68472	003856-25-5	96
			Copaene	68473	003856-25-5	96
			Copaene	68474	003856-25-5	95
6	8.087	4.18	Benzoic acid, 4-methoxy-	26627	000100-09-4	93
			Benzoic acid, 4-methoxy-	26636	000100-09-4	93
			Benzoic acid, 4-methoxy-	26632	000100-09-4	90
7	11.442	2.10	3-[(Z)-1-Butenyl]-4 vinylcyclopentene	23445	052886-04-1	35
			6-(1'-Oxo-2'-propenyl)-1,3-cis,cis -cyclooctadiene	33411	138146-05-1	35
			Spiro[4.4]nona-1,6-diene, (S)	9618	039746-39-9	35
8	11.672	2.49	Bicyclo[4.1.0]heptane,-3-cyclopropyl,-7-hydroxymethyl, trans	36538	1000223-00-6	45
			Bicyclo[6.1.0]nonane, 9-(1-methyle thylidene)	35103	056666-90-1	43
			2,3-Diazabicyclo[2.2.1]hept-2-ene,5-ethenyl-4,7,7-trimethyl-,(1.al pha.,4.alpha.,5.beta.)-	34882	1000221-84-7	38
9	12.242	1.33	Phenol, 3,4,5-trimethoxy-	51859	000642-71-7	95
			3,4,5-Trimethoxyphenol	51857	030225-76-4	94
			Phenol, 3,4,5-trimethoxy-	51860	000642-71-7	72
10	12.686	2.48	1,2,3-Trimethoxybenzene	38847	000634-36-6	38
			1,2,3-Trimethoxybenzene	38845	000634-36-6	30
			Vanillic acid	38762	000121-34-6	30
11	12.871	2.14	Octacosylpentyl ether	263355	1000406-42-4	27
			Hexacosylpentyl ether	257324	1000406-42-3	27
			Carbonic acid, eicosyl vinyl ester	219345	1000382-54-3	25
12	13.257	1.72	Cyclohexene, 1-nitro-	12014	002562-37-0	38
			2-Heptyne	2867	001119-65-9	38
			2-Heptyne	2864	001119-65-9	38
13	13.516	1.20	Benzenepropanoic acid, 4-methoxy, beta-oxo-, methyl ester	72048	1000338-13-0	93
			4'-Methoxybutyrophenone	45847	004160-51-4	87
			4'-Methoxybutyrophenone	45850	004160-51-4	87
14	14.064	1.12	6-Hydroxy-4,7-dimethoxy-2H-1,3-be zodioxole-5-carbaldehyde	88870	849798-24-9	53
			2,3,4,5-Tetramethoxybenzaldehyde	89005	065884-12-0	46
			Piperonylic acid, 5-nitro-	75528	000716-32-5	30
15	14.101	1.21	6-Tridecene, 7-methyl-	61879	024949-42-6	70
			7-Tetradecene, (Z)-	61868	041446-60-0	51
			6-Tetradecene, (E)-	61859	041446-64-4	51
16	14.219	0.97	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	47528	1000297-95-5	95
			2-Methylthianaphthene-1,1 dioxide	48558	006224-55-1	64
			(E)-4-(3-Hydroxyprop-1-en-1-yl)-2 methoxyphenol	47541	032811-40-8	58
17	14.419	2.31	Tetradecanoic acid	91415	000544-63-8	98
			Tetradecanoic acid	91420	000544-63-8	97
			Tetradecanoic acid	91418	000544-63-8	97
18	14.553	1.54	Pyridine, 4-methyl-, 1-oxide	5680	000544-63-8	43
			Silane, chlorotriethyl-	24908	000544-63-8	38
			1H-3a,7-Methanoazulene, octahydro- 1,4,9,9-tetramethyl-	70783	000544-63-8	35
19	14.686	0.82	2-Cyclopenten-1-one, 4-hydroxy-3-methyl-2-(2-propenyl)-	26892	000551-45-1	53
			Cyclopentaneacetaldehyde, 2-formyl -3-methyl-alpha-methylene-	36381	005951-57-5	50
			Carane, 4,5-epoxy-, trans	25896	006909-20-2	49
20	14.753	0.48	5-Ethyl-2-furaldehyde.	10622	023074-10-4	58
			3-Cyclohexene-1-carboxaldehyde, 1-methyl-	10785	000931-96-4	52
			1.alpha., 4a.beta., 8a.alpha.-Deca hydro-1-naphthalenol	27803	036159-47-4	49
21	14.901	1.57	4-(2,2-Dimethyl-6-methylenecyclohe xyl)butanal	59779	095452-13-4	45
			2(1H)-Naphthalenone, octahydro-1,4 a-dimethyl-(1.alpha.,4a.beta.,8a .alpha.)-	47962	022738-31-4	43
			2-Decanynoic acid	37828	001851-90-7	43
22	15.071	1.41	Tridecanedial	76252	063521-76-6	70
			Bicyclo[3.1.1]heptane, 2,6,6-trimethyl-, (1.alpha.,2.beta.,5.alpha.)	17424	006876-13-7	53
			Dodeca-1,6-dien-12-ol, 6,10-dimethyl-	74503	1000156-13-8	42
23	15.123	4.43	2-Pentadecanone, 6,10,14-trimethyl	128827	000502-69-2	91
			2-Pentadecanone, 6,10,14-trimethyl	128823	000502-69-2	90
			2-Pentadecanone, 6,10,14-trimethyl	128826	000502-69-2	90
24	15.234	0.99	Pentadecanoic acid	104278	001002-84-2	83
			Cyclopentadecane	74572	000295-48-7	45
			Pentadecanoic acid	104282	001002-84-2	42
25	15.301	0.39	3,4-Dimethyl-2-prop-2-enyl-2,5 dihydrothiophene 1,1-dioxide	53481	1000305-61-1	70
			Cycloheptane, 4-methylene-1-methyl -2-(2-methyl-1-propen-1-yl)-1-vinyl-	68765	1000159-38-5	66
			trans-Z-.alpha.-Bisabolene epoxide	83578	1000131-71-1	62
26	15.375	0.48	p-Menth-8(10)-en-9-ol, cis-	27588	015714-13-3	55
			1,3,3-Trimethylcyclohex-1-ene-4 -carboxaldehyde, (+,-)-	26117	127128-60-3	50
			13-Tetradece-11-yn-1-o	72625	1000131-00-4	50
27	15.405	0.33	1H-3a,7-Methanoazulene, octahydro-1,4,9,9-tetramethyl-	70783	025491-20-7	50
			3,4-Dimethyl-2-prop-2-enyl-2,5 dihydrothiophene 1,1-dioxide	53481	1000305-61-1	41
			trans-Z-.alpha.-Bisabolene epoxide	83578	1000131-71-1	38
28	15.464	1.08	Caryophyllene oxide	83535	001139-30-6	78
			1H-3a,7-Methanoazulene, octahydro 1,4,9,9-tetramethyl-	70783	025491-20-7	55
			Diazoprogesterone	195535	1000255-30-9	52
29	15.523	0.56	Alloaromadendrene	68577	025246-27-9	81
			(-)-Isolongifolol, methyl ether	98688	1000333-80-8	64
			9-Isopropyl-1-methyl-2-methylene-5oxatricyclo[5.4.0.0(3,8)]undecane	83636	1000185-86-6	52
30	15.627	3.47	Bicyclo[2.2.1]heptane-2,5-dione,1,7,7-trimethyl-	36330	004230-32-4	50
			2,4-Dimethyl-3-nitrobicyclo[3.2.1] octan-8-one	62339	1000192-17-3	47
			2(1H)-Naphthalenone, octahydro-4a, 7,7-trimethyl-, trans-	59812	054699-31-9	47
31	15.679	0.92	2(1H)-Naphthalenone, octahydro 4a, 7,7-trimethyl-, trans-	59812	054699-31-9	81
			Fumaric acid, 2-chloropropyl penta decyl ester	239635	1000348-57-2	64
			Hexacosyl acetate	248621	000120-80-9	60
32	15.760	0.92	Octacosylheptafluorobutyrate	273239	1000351-83-6	87
			cis-11-Hexadecenal	100562	053939-28-9	64
			2-Piperidinone, N-[4-bromo-n-butyl]-	95915	195194-80-0	64
33	15.979	1.93	5,6,6-Trimethyl-5-(3-oxobut-1-enyl)-1-oxaspiro[2.5]octan-4-one	98357	1000192-73-9	70
			17-Pentatriacontene	265112	006971-40-0	55
			2-(2R,4aR,8aS)-4a-Methyl-8-methyl enedecahydronaphthalen-2-yl)acrylaldehyde	81710	003650-40-6	55
34	15.901	14.64	n-Hexadecanoic acid	117418	000057-10-3	99
			n-Hexadecanoic acid	117419	000057-10-3	99
			Octadecanoic acid	144271	000057-11-4	90
35	15.960	2.07	Nonadecane, 1-chloro-	161769	062016-76-6	89
			Hexadecane	89844	000544-76-3	89
			Carbonic acid, eicosyl vinyl ester	219345	1000382-54-3	55
36	15.997	1.42	Nonadecane, 1-chloro-	161769	062016-76-6	93
			1-Bromodocosane	232144	006938-66-5	50
			Carbonic acid, eicosyl vinyl ester	26632	1000382-54-3	46
37	16.049	2.93	Hexadecanoic acid, ethyl ester	144307	000628-97-7	97
			Hexadecanoic acid, ethyl ester	144309	000628-97-7	95
			Undecanoic acid, ethyl ester	78055	000627-90-7	93
38	16.545	0.99	Cholestan-3-ol, 2-methylene-, (3.beta.,5.alpha.)-	239014	022599-96-8	70
			Cyclopentadecane	74572	000295-48-7	56
			tert-Hexadecanethiol	119379	025360-09-2	55
39	16.716	1.53	Methyl pentadecyl ether	104447	007307-52-0	53
			Phytol	155849	000150-86-7	52
			Octacosylpentyl ether	263355	1000406-42-4	49
40	16.841	1.80	9,12-Octadecadienoic acid (Z,Z)-	140138	000060-33-3	98
			Linoelaidic acid	140124	000506-21-8	97
			9,12-Octadecadienoic acid (Z,Z)-	140139	000060-33-3	96
41	16.893	1.60	Cyclohexanol, 3-ethenyl-3-methyl-2-(1-methylethenyl)-6-(1-methylethy),[1R(1.alpha.,2.alpha.,3.bet.,6.alp	85869	035727-45-8	90

		ha ..)]			
		Pentadecafluorooctanoic acid, octa			
		decyl ester	274630	1000406-04-8	49
		Nonadecyltrifluoroacetate	227165	1000351-76-3	49
42	16.997 2.33	Linoleic acid ethyl ester	167367	000544-35-4	89
		Z,Z-4,15-Octadecadien-1-ol acetate	167375	086252-67-7	83
		6-Tridecane	48000	042371-66-4	83
43	17.019 1.16	13-Octadecenal, (Z)-	126830	058594-45-9	60
		Oxirane, tridecyl-	89784	018633-25-5	60
		cis-13-Octadecenoic acid	142083	013126-39-1	53
44	17.627 1.72	11,13-Dimethyl-12-tetradecen-1-ol acetate	142133	1000130-81-0	76
		Docosyl propyl ether		1000406-28-2	
		Hexacosyl propyl ether	219473	1000406-28-4	50
			248661		46
45	17.775 3.42	Methyl tetratriacontyl ether	267425	1000406-30-1	90
		Octacosyl propyl ether	257323	1000406-28-5	70
		Hexacosyl propyl ether	248661	1000406-28-4	70
46	18.338 2.17	4,8,12,16-Tetramethylheptadecan-4-olide	182574	096168-15-9	72
		delta.-Nonalactone			
		trans-3-Methyl-4-octanolide	29928	003301-94-8	46
			29959	039638-67-0	46
47	18.412 5.59	9-Octadecenamide, (Z)-	141029	000301-02-0	98
		9-Octadecenamide, (Z)-	141028	000301-02-0	96
		9-Octadecenamide, (Z)-	141032	000301-02-0	95
48	18.989 2.25	Stigmasterol	244153	000083-48-7	25
		6,9-Octadecadiynoic acid, methyl ester	150118	056847-03-1	14
		Stigmasta-5,22-dien-3-ol, acetate(3.beta)-			
			57963	004651-48-3	12
49	19.071 2.31	Stigmasterol	244153	000083-48-7	40
		6,9-Octadecadiynoic acid, methyl ester	150118	056847-03-1	14
		Stigmasta-5,22-dien-3-ol, acetate(3.beta)-			
			257963	004651-48-3	12

DISCUSSION

Bio-pesticides are effective and safer means of controlling pests, they have a mild effect on the environment compared to their synthetic counterpart, and they are specific in their target, hence preventing bioaccumulation (Kumar *et al.,* 2021; Saberi *et al.,* 2020). Bio-pesticides are made from natural substances, such as plants, microbes, and nanoparticles of biological origin, thus, making them a sustainable means of pest control (Saberi *et al.,* 2020). The effectiveness of bio-pesticides in pest management comes from various modes of action, which include actions that regulate gut disruption, pest growth, and pest metabolism. Bio-pesticides work by denaturing protein, causing metabolic disorder and paralysis, activating target-poisoning mechanisms, exhibiting multisite inhibitory actions, and releasing neuromuscular toxins and bioactive compounds (Sparks and Nauen, 2015; *Dar et al.,* 2021; Fenibo et al., 2021). These multiple actions offer bio-pesticides the capacity to alter the course of pest resistance as compared to chemical pesticides. Studies have indicated that bio-pesticides are eco-friendly, possess low toxicity properties, are biodegradable, and specific in action with little or no negative impact on non-target organisms (Deravel *et al.,* 2014; Kalpana and Anil, 2021). Unlike bio-pesticides, conventional pesticides are a major source of environmental pollution, which promotes pest resistance with high post-harvest contamination and bioaccumulation in food crops (Fenibo*et al.,* 2021.

In this study, GC-FID analysis of ethanolic extract of *Chromolaena odorata* reveals the presence of phytol. Phytol has been reported to have antimicrobial activity against Mycobacterium tuberculosis (Rajab *et al.,* 1998; Saikia*et al.,* 2010) and Staphylococcus aureus (Inoue *et al.,* 2010). Therefore, siam weed might have bio-pesticidal effect. In medicinal fields, phytol has shown anti-nociceptive and antioxidant activities as well as anti-inflammatory and anti-allergic effects (Ryu*et al.,* 2011). Recent studies have revealed that phytol is an excellent immune stimulant, superior to a number of commercial adjuvants in terms of long-term memory induction and activation of both innate and acquired immunity (Lim *et al.,* 2006). Phytol has been investigated for its potential anxiolytic, metabolism modulating, cytotoxic, antioxidant, autophagy and apoptosis-inducing, anti-nociceptive, anti-inflammatory, immune-modulating, and antimicrobial effects (Islam *et al.,* 2018). It has also been reported that phytol modulate transcription in cells via transcription factors PPAR-alpha and retinoid X receptor (RXR) (Saikia*et al.,* 2010). According to the report of Moraes*et al.,*phytol is gaining more usefulness as a food additive and in medicinal fields, as its manifest promising antischistosomal properties in vitro and in a mouse model of schistosomiasismansoni (Moraes*et al.,* 2014).

Linoleic acid ethyl ester is an esterified form of linoleic acid. It is active against the bacteria *S. mutans, A. actinomycetemcomitans, P. gingivalis, S. gordonii*, and *S. sanguis* and the fungus *C. albicans* when used at a concentration of 25 µg/ml. Linoleic acid ethyl ester (3 mg/kg) prevents arteriosclerosis in rabbits fed with a high-cholesterol diet (Huang *et al.,* 2010). Linoleic acid ethyl ester has also been reported to have hypocholesterolemic, nematicide, anti-arthritic, hepato-protective, anti-androgenic, hypocholesterolemic, 5-Alpha reductaseinhibitor,anti-histaminic, anti-coronary, insecticidal, anti-eczemic, anti-acne activity (Sudha*et al.,* 2013).The mechanism of conjugated linoleic acid as insecticide is due to anti-feedant effects, increased larval mortality, decreased larval development and egg viability (Clement *et al.,* 2019). In Saccharomyces cerevisiae, linoleic acid performs cell toxicity by inducing apoptosis and repressing metabolic enzyme activities (Ferreira et al., 2011). The very long-chain fatty acids elongases play important roles in yeast resistance to cytotoxicity induced by oleic acid through balancing the fatty acid composition in bio-membranes (Wang *et al.,* 2018)

Another active ingredient of interest revealed is stigmasterol, an important plant sterol otherwise regarded as unsaturated phytosterol occurring in plant with potential to inhibit the development of various cancerous cells by inhibiting the promotion and growth of cancer cell lines including but not limited to stomach, lung, ovary, and estrogen-dependent human breast cancers (Bradford and Awad, 2007). It is of great interest finding this extract as one of the sources of stigmasterols that is regarded as the anti-cancer therapy of the future due to its ability to scavenge cancer-causing substances (Lim *et al.,* 2006).

Copaene (COP) is a tricyclic sesquiterpenes derived from different plants; leaves (Afoulous*et al.,* 2013) strongly attractive to an agricultural pest. As a sesquiterpenes it has biological activities such as antimicrobial (Wu *et al.,* 2012), antibacterial(Stojanović-Radić*et al.,* 2012), antioxidant, anti-fungi (Al-maskri*et al.,* 2013).Hexadecanoic acid, ethyl ester is a palmitic acid ethyl ester, it has been reported to have antioxidant, hypocholesterolemic, nematicide, pesticide, anti-androgenic flavor, hemolytic, alphareductase inhibitor activity (Sudha*et al.,* 2013).1H-Pyrazole, 4,5-dihydro-3-methyl-1-propyl- with ratio (14.833%) as anti-bacterial properties (Gottenbos et al., 2002).Caryophyllene oxide is an oxygenated sesquiterpenoid, well-recognized as a protective compound in nutrition, medications and cosmetics. Caryophyllene oxide has some pharmacological potentials like anticholinesterase, analgesic, anti-inflammatory, antifungal activities (Park *et al.,* 2011).Caryophyllene oxide (CPO) is a sesquiterpene isolated from essential oils of medicinal plants such as clove (Eugenia caryophyllata), black pepper (Piper nigrum L.), oregano (Origanumvulgare L.), guava (*Psidiumguajava*) and cinnamon Cinnamomum spp.), and act as a strong anticancer agent also can stop the proliferation of a wide variety of tumor cells, consisting of breast, lung, liver, and prostate adenocarcinoma as reported in several studies (Park *et al.,* 2011).

Vanillic acid (VA) (4-hydroxy-3-methoxybenzoic acid) is a dietetic phenolic composite present in plants and fruits. VA is a metabolic formation of caffeic acid that leads to the development of urine in an inhabitant. Consequent to intake of coffee, chocolate or green tea, and it can demonstrate antioxidant, antimicrobial, anti-genotoxic, and antitumor activities. VA can suppress hepatic fibrosis in chronic liver injury,and it also exhibits chemo-preventive effects in experimentally induced carcinogenesis in rats.1,2,3-Trimethoxybenzene (TMB) is an organic compound containing three methoxy groups in benzene ring having a molecular formula $C_9H_{12}O_3$ and molecular weight of 168.19. These compounds can be used in pharmaceuticals (analgesics, antiseptics), biocides, formulating insect attractants, flavoring agents. They are also useful in the preparation of antioxidants, stabilizers, UV absorbers for plastics and rubbers.

CONCLUSION

In conclusion, analysis of *Chromolaena odorata* has shown it bio-pesticide composition. The chemical composition of bio-pesticides is diverse, comprising various natural ingredients. They offer environmentally friendly pest control options with reduced risks to non-target organisms. While bio-pesticides have specific target pest control and are biodegradable, they may require frequent application and face limitations in persistence and efficacy. Overall, bio-pesticides play a valuable role in integrated pest management strategies, promoting sustainable agricultural practices and reducing reliance on synthetic pesticides.

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