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Identification of Secondary Metabolites from *Tridax procumbens* using Gas Chromatography-Mass Spectrometry (GC-MS) Technique

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ABSTRACT

Background: Secondary metabolites in plants help counteract biotic and abiotic stress and can be utilized in sustainable and eco-friendly farming. This study identifies secondary metabolites in the weed *Tridax procumbens* (coat buttons).

Methods: Extracts (aqueous, methanol, hexane) were prepared from the stem with leaves, root and flower of *Tridax procumbens* and analyzed using Gas Chromatography Mass Spectrometry (GC-MS) technique. Bioactivity was evaluated using Dr. Duke's Phytochemical and Ethnobotanical Databases.

Result: The aqueous extract revealed 8 compounds in the stem with leaves, 14 in the root and 10 in the flower. The methanol extract revealed 40 compounds in the stem with leaves, 31 in the root and 23 in the flower. The hexane extract revealed 20 compounds each in the stem with leaves and flower and 18 in the root. These compounds showed biocidal, bioactive and biodegradable properties with potential applications as pesticides, antimicrobial agents, antioxidants and more. Hence, *Tridax procumbens* shows promising applications in many fields.

Key words: Aqueous extract, Bioactive, Biodegradable, Gas chromatography-mass spectrometry (GC-MS), Hexane extract, Methanol extract, Secondary metabolites, *Tridax procumbens* (Asteraceae).

INTRODUCTION

The misuse of pesticides harms living organisms and causes pollution (Shindez *et al*., 2024). Ecological pesticides which are natural plant secondary metabolites, resist environmental stress and bio stressors, being eco-friendly with low persistence (Kumar *et al*., 2023; Ayilara *et al*., 2023). These compounds have agricultural and medicinal importance (Kikraliya *et al*., 2024; Moond *et al*., 2023; Devi *et al*., 2023; Beniwal *et al*., 2022). Weeds like *Tridax procumbens*, a widespread Asteraceae species, produce valuable secondary metabolites useful in sustainable agriculture (Syed *et al*., 2020; Ingole *et al*., 2022). This 2022 study analyzed aqueous, methanol and hexane extracts of *T. procumbens* to identify their secondary metabolites and bioactivity.

MATERIALS AND METHODS

Tridax procumbens from Kanyakumari were collected, washed, separated into stem with leaves, root and flower, dried for 10 days and powdered. Aqueous extracts were prepared by shaking plant parts in double deionized water for 72 hours, then filtering and centrifuging. Methanol and hexane extracts were obtained using Soxhlet extraction at 65°C and 69°C. All extracts were stored at 4°C. GCMS analysis was conducted at Jawaharlal Nehru University using a Shimadzu GCMS-QP2010 Plus with a Thermal Desorption System TD20. Compounds were identified via the NIST library and bioactivity confirmed using Dr. Duke's database.

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RESULTS AND DISCUSSION

The present study revealed variations in secondary metabolites in different parts of the plant. The aqueous stem with leaf had 8 constituents, the root 14 and the flower 10. Cyclopentasiloxane, decamethyl- was present in higher quantities (43.53%) in the stem with leaf extract. 9,19-cyclolanost-24-en-3-ol, (3.beta.)- is the compound with the highest area percentage (21.61%) in the root extract. Phenol, 2,4-bis(1,1-dimethylethyl), phosphite (3:1), with the highest area percentage (34.39%) in the flower extract. (Fig 1-3).

Methanol extract contained the highest secondary metabolites: stem with leaf (40), root (31) and flower (23). n-Hexadecanoic acid (palmitic acid) was found in all three extracts, with higher concentrations in the stem with leaf extract (39.79%) and flower extract (30.62%). (S,Z)-

Heptadeca-1,9-dien-4,6-diyn-3-ol was present in higher concentration in the root (66.37%) (Fig 4-6).

Hexane extract contained stem with leaf (20), root (18) and flower (20). Squalene (18.22%) which is a triterpene is present in higher concentration in stem with leaf extract. (S,Z)-Heptadeca-1,9-dien-4,6-diyn-3-ol (68.46%) was present in higher concentration in hexane root extract. n-Hexadecanoic acid (17.76%) was

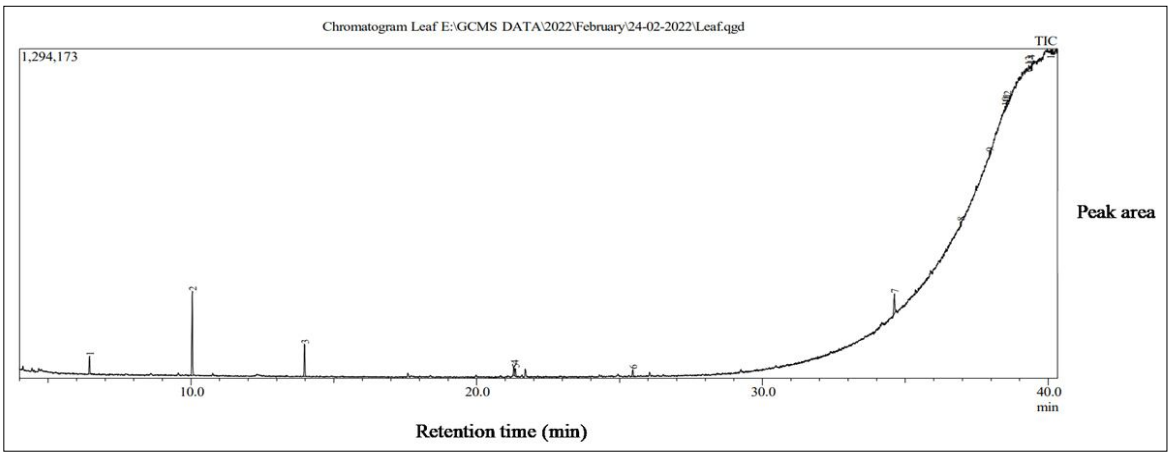


Fig 1: Chromatogram of aqueous extract of stem with leaves.

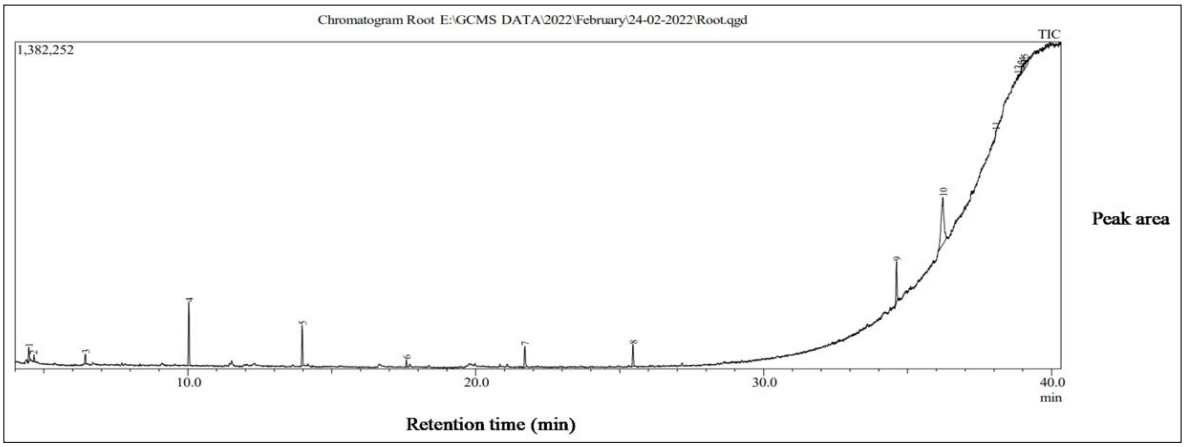


Fig 2: Chromatogram of aqueous extract of root.

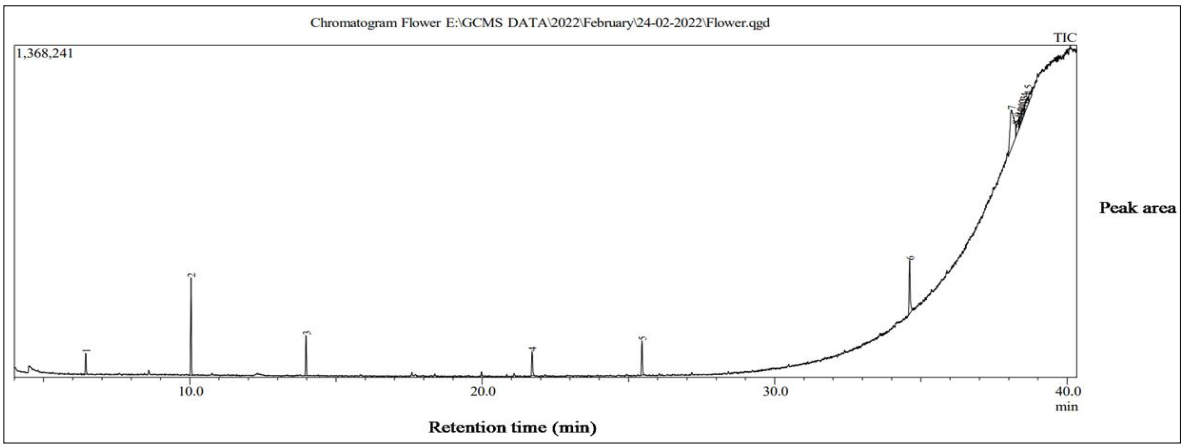


Fig 3: Chromatogram of aqueous extract of flower.

Table 1: Secondary metabolites identified in the aqueous stem with leaf extract of *Tridax procumbens* using gas chromatography-mass spectrometry (GC-MS) technique.

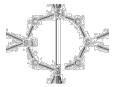
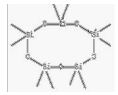
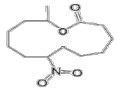
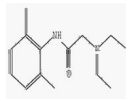
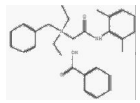
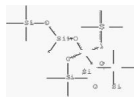
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
6.45	8.86	Cyclotetrasiloxane, octamethyl-	296 $C_8H_{24}O_4Si_4$		Siloxane cyclic compound	Antimicrobial antioxidant used in skin care products (Helal *et al*., 2019)
10.044	43.53	Cyclopentasiloxane, decamethyl-	370 $C_{10}H_{30}O_5Si_5$		Siloxane cyclic compound	Antimicrobial (Helal *et al*., 2019)
13.976	17.79	Cyclohexasiloxane, dodecamethyl-	444 $C_{12}H_{36}O_6Si_6$		Siloxane cyclic compound	Antimicrobial (Erdoğan *et al*., 2020)
21.299	5.66	8-nitro-12-tridecanolide	257 $C_{13}H_{23}NO_4$		Nitrogen compound	No activity reported
21.352	4.50	Bicyclo [4.1.0] hept-2-ene-7-ethanol, alpha.,1,5,5-tetramethyl-, [1.alpha.,6.alpha.,7.alpha.(r*)]-	194 $C_{13}H_{22}O$		Alcoholic compound	Antimicrobial (Dr. Duke's database)
25.465	4.27	Acetamide, 2-(diethylamino) -N-(2,6-dimethylphenyl)-	234 $C_{14}H_{22}N_2O$		Amide compound	Anti-inflammatory antimicrobial (Dr. Duke's database)
34.617	13.51	Benzyldiethyl-(2,6-xylylcarbamoylmethyl) -ammonium benzoate	446 $C_{28}H_{34}N_2O_3$		Quaternary ammonium compound	Antimicrobial compound used as preservative (Dr. Duke's database)
39.32	5.42	1,1,1,5,7,7,7-Heptamethyl -3,3-bis(trimethylsiloxy) Tetrasiloxane	444 $C_{13}H_{40}O_5Si_6$		Organo-sillicon compound	Analytical reagent for organosilicon compounds

Table 2: Secondary metabolites identified in the aqueous root extract of *Tridax procumbens* using gas chromatography-mass spectrometry (GC-MS) technique.

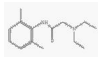
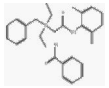
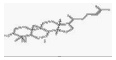
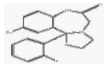
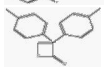
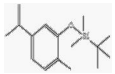
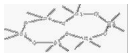
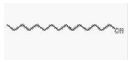
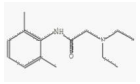
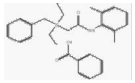
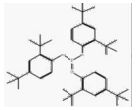
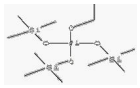
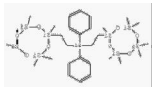
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
4.478	2.03	Silane, (fluoromethyl) dimethyl-	92 C_3H_9FSi		Silica compound	Antimicrobial (Dr. Duke's database)
4.658	0.82	3-Pentanol	88 $C_5H_{12}O$		Saturated alcoholic compound	Antimicrobial flavoring agent (Dr. Duke's database)
6.443	1.29	Cyclotetrasiloxane, octamethyl-	296 $C_8H_{24}O_4Si_4$		Siloxane cyclic compound	Antimicrobial antioxidant used in skin care products (Helal *et al*., 2019)
10.035	8.60	Cyclopentasiloxane, decamethyl-	370 $C_{10}H_{30}O_5Si_5$		Siloxane cyclic compound	Antimicrobial (Helal *et al*., 2019) Antimicrobial (Erdoğan *et al*., 2020)
13.973	5.52	Cyclohexasiloxane, dodecamethyl-	444 $C_{12}H_{36}O_6Si_6$		Siloxane cyclic compound	
17.595	0.93	Cycloheptasiloxane, tetradecamethyl-	518 $C_{14}H_{42}O_7Si_7$		Siloxane cyclic compound	Antimicrobial (Dr. Duke's database)
21.704	3.54	1-Tetradecanol	214 $C_{14}H_{30}O$		Alcoholic compound	Antimicrobial used in cosmetics (Dr. Duke's database)
25.461	3.43	Acetamide, 2-(diethylamino)-N-(2,6-dimethylphenyl)-	234 $C_{14}H_{22}N_2O$		Amide compound	Anti-inflammatory antimicrobial (Dr. Duke's database)
34.614	6.74	Benzyldiethyl-(2,6-xylylcarbamoylmethyl)-ammonium benzoate	446 $C_{28}H_{34}N_2O_3$		Aromatic compound	Antimicrobial used as preservative (Dr. Duke's database)
36.221	21.61	9,19-cyclolanost-24-en-3-ol, (3.beta.)-	426 $C_{30}H_{50}O$		Triterpene compound	Insecticide anti inflammatory (Mazhar *et al*., 2022)
38.055	0.49	Haloxazolam	376 $C_{17}H_{14}BrFN_2O_2$			Drug used for insomnia (Dr. Duke's database)
38.945	0.64	3,3-Di-p-tolyl-thietan-2-one	268 $C_{17}H_{16}OS$		Sulfur containing ketone compound	Insecticide (Dr. Duke's phytochemical and ethnobotanical database)
38.975	1.62	Carvacrol	264 $C_{16}H_{28}Osi$		Monoterpen-oid phenol	Antimicrobial additive preservative flavoring agent (Dr. Duke's database)
39.04	3.19	Pentasiloxane, 1,1,3,3,5,5,7,7,9,9 -decamethyl-	356 $C_{10}H_{32}O_4Si_5$		Silica compound	

Table 3: Secondary metabolites identified in the aqueous flower extract of *Tridax procumbens* using gas chromatography-mass spectrometry (GC-MS) technique.

Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
6.443	3.71	2,2,4,4,6,6,8,8-octamethyl-1,3,5,7,2,4,6,8-tetraoxatetrasilocane	296 $C_8H_{24}O_4Si_4$		Siloxane cyclic compound	Antimicrobial antioxidant used in skin care products (Dr. Duke's database)
10.043	16.74	Cyclopentasiloxane, decamethyl-	370 $C_{10}H_{30}O_5Si_5$		Siloxane cyclic compound	Antimicrobial (Helal *et al.*, 2019)
13.976	7.33	Cyclohexasiloxane, dodecamethyl-	444 $C_{12}H_{36}O_6Si_6$		Siloxane cyclic compound	Antimicrobial (Erdoğan *et al.*, 2020)
21.704	5.36	n-Pentadecanol	228 $C_{15}H_{32}O$		Alcoholic compound	Antimicrobial (Dr. Duke's database)
25.462	7.48	Acetamide,2-(diethylamino)-N-(2,6-dimethylphenyl)-	234 $C_{14}H_{22}N_2O$		Amide compound	Anti-inflammatory antimicrobial (Dr. Duke's database)
34.615	13.10	Benzyldiethyl-(2,6-xylylcarbamoylmethyl)-ammonium benzoate	446 $C_{28}H_{34}N_2O_3$		Aromatic compound	Antimicrobial compound used as preservative (Dr. Duke's database)
38.085	34.39	Phenol, 2,4-bis (1,1-dimethylethyl)-, phosphite (3:1)	646 $C_{42}H_{63}O_3P$		Phenolic compound	Antioxidant antibacterial antiseptic anti-inflammatory antiviral cancer preventive pesticide (Zaho *et al.*, 2020)
38.26	5.12	3-Ethoxy-1,1,1,5,5,5-hexamethyl-3-(trimethylsiloxy) trisiloxane	340 $C_{11}H_{32}O_4Si_4$		Siloxane compound	No activity reported
38.42	2.75	Cyclononasiloxane, octadecamethyl-	666 $C_{18}H_{54}O_9Si_9$		Siloxane compound	Antioxidant activity (Dr. Duke's database)
38.465	2.69	Silane, diphenyl-bis-[2-(1,3,5,5,7,7-heptamethyl-2,4,6,8-tetraoxy-1,3,5,7-tetrasilacyclooctyl) ethyl]	800 $C_{30}H_{60}O_8Si_9$		Silica compound	

present in higher concentration in hexane flower extract (Fig 7-9).

The secondary metabolites identified in this study have many biological uses, as mentioned in Table 1-9, referring to Dr. Duke's Phytochemical and Ethnobotanical Databases.

Tridax procumbens is traditionally used in Asia to treat skin diseases and wounds, but recent studies

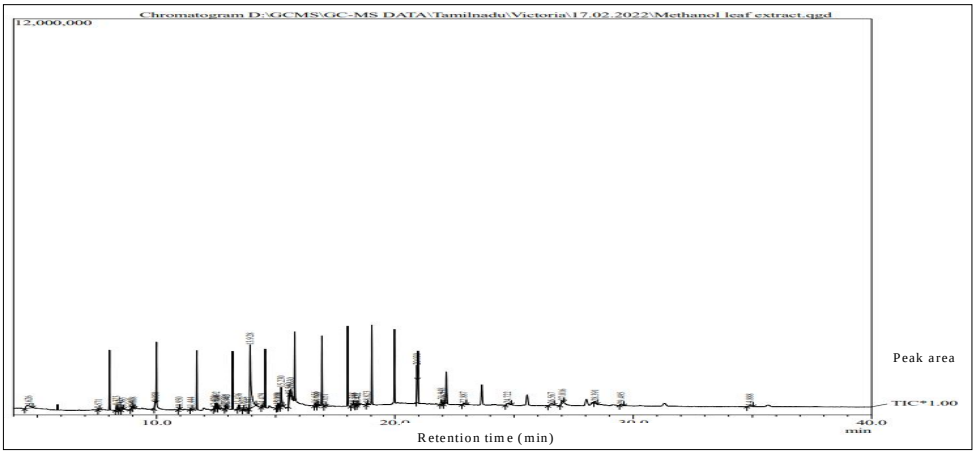


Fig 4: Chromatogram of methanol extract of stem with leaves.

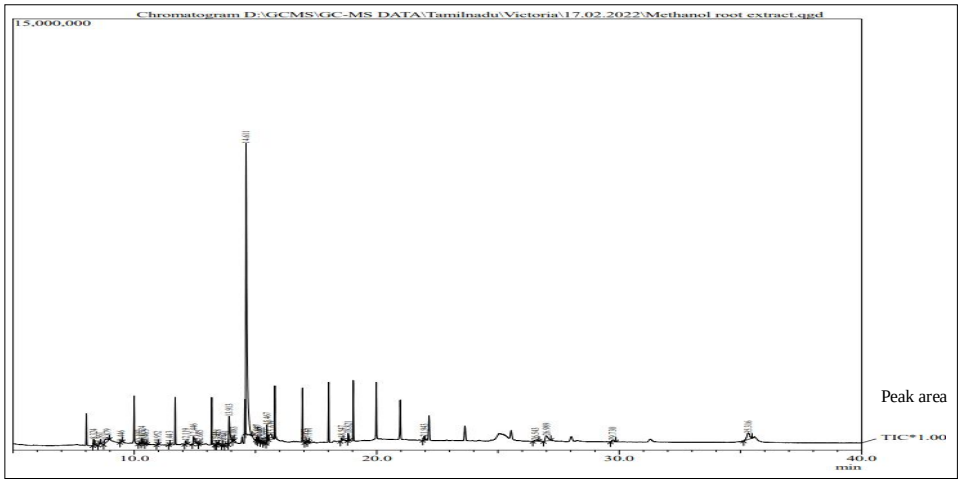


Fig 5: Chromatogram of methanol extract of root.

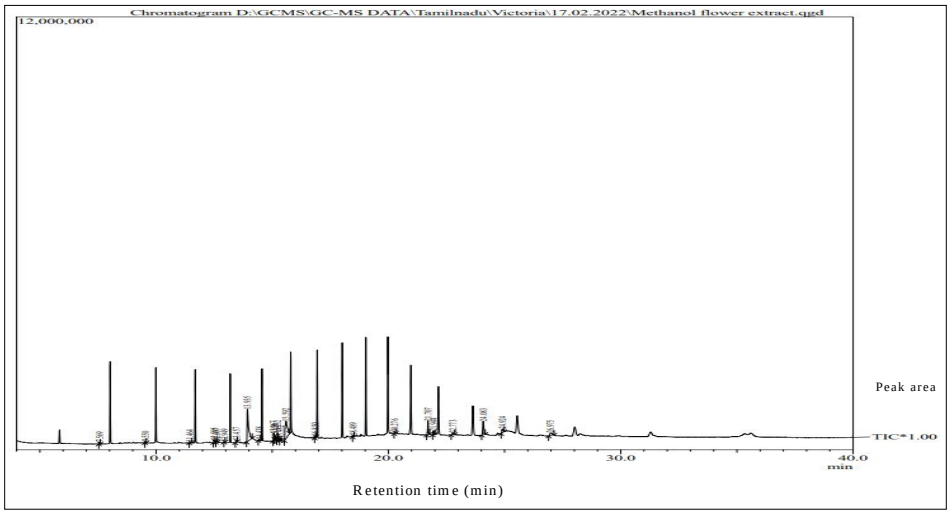


Fig 6: Chromatogram of methanol extract of flower.

Table 4: Secondary metabolites identified in the methanol stem with leaf extract of *Tridax procumbens* using gas chromatography-mass spectrometry (GC-MS) technique.

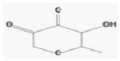
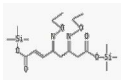
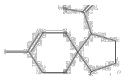
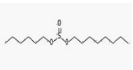
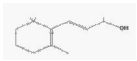
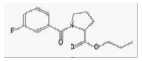
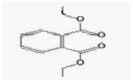
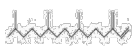
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
4.626	5.68	1,5-anhydro-6-deoxyhexo-2,3-diulose	144 $C_6H_8O_4$		Flavonoid fraction	
7.571	0.38	Fumarylacetoacetate diethoxime, bis(trimethylsilyl) ester	430 $C_{18}H_{34}N_2O_6Si_2$		Silica compound	
8.323	1.87	Acoradiene spiro [4.5]dec-7-ene, 1,8-dimethyl-4-(1-methylethenyl)-, [1S-(1.alpha.,4.beta.,5.alpha.)]-	204 $C_{15}H_{24}$		Sesquiterpene	Analgesic antibacterial antitumor sedative fungicide insecticide (Dr. Duke's database)
8.442	0.33	Sulfurous acid, hexyl octyl ester	278 $C_{14}H_{30}O_3S$			Antimicrobial (Dr. Duke's database)
8.565	1.37	3-buten-2-ol,4- (2,6,6-trimethyl-1-cyclohexen-1-yl) (Beta Ionol)	194 $C_{13}H_{22}O$		Cyclic compound	
8.947	0.17	L-Proline,N-(3-fluorobenzoyl)-, propyl ester	279 $C_{15}H_{18}FNO_3$		Ester compound	
9.008	0.35	Heptadecane	240 $C_{17}H_{36}$		Alkane compound	Anti-inflammatory (Erdoğan *et al.*, 2020)
9.950	1.33	Diethyl phthalate (1,2-Benzenedicarboxylic acid)	222 $C_{12}H_{14}O_4$		Aromatic dicarboxylic acid compound	Antimicrobial antifouling (Dr. Duke's database)
10.950	0.24	Dodecane, 2,6,11-trimethyl-	212 $C_{15}H_{32}$		Alkane compound	
11.444	0.38	Nonane, 5-(2-methylpropyl)-	184 $C_{13}H_{28}$		Alkane compound	
12.420	0.52	Sulfamide, N-[2-(4-methoxyphenoxy) ethyl]-N',N'-dimethyl-	274 $C_{11}H_{18}N_2O_4S$		Sulfur compound	Antimicrobial (Dr. Duke's database)
12.492	1.76	Neophytadiene	278 $C_{20}H_{38}$		Alkene compound	Anti-inflammatory antioxidant cardio protective properties insecticide (Dr. Duke's database)
12.589	0.36	2-Pentadecanone, 6,10,14-trimethyl-	268 $C_{18}H_{36}O$		Ketone compound	

Table 4: Continue....

Table 4: Continue....

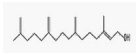
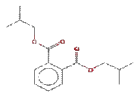
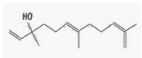
12.891	0.93	7-Tridecanone	198 $C_{13}H_{26}O$		Ketone compound	
12.942	0.30	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	296 $C_{20}H_{40}O$		Diterpene	Insecticide antimicrobial (Dr. Duke's database)
13.436	1.40	Hexadecanoic acid, methyl ester (Palmitic acid ester)	270 $C_{17}H_{34}O_2$		Saturated long chain fatty acid	Antioxidant hypocholester-olemic pesticide nematicide antiandrogenic hemolytic flavor enhancer 5-Alpha reductase inhibitor (Dr. Duke's database)
13.633	0.23	Isophytol	296 $C_{20}H_{40}O$		Diterpene	Insecticide antimicrobial antioxidant diuretic (Dr. Duke's database)
13.847	0.33	1,2-benzenedicarboxylic acid, bis (2-methylpropyl) ester	278 $C_{16}H_{22}O_4$		Ester of phthalic acid	Antimicrobial anti fouling (Dr. Duke's database)
13.928	39.79	n-Hexadecanoic acid (Palmitic acid)	256 $C_{16}H_{32}O_2$		Saturated long chain fatty acid	Antioxidant hypocholesterol-emic Nematicide antiandrogenic pesticide hemolytic flavor enhancer 5-Alpha reductase inhibitor anti-inflammatory (Aparna *et al.*, 2012)
14.429	0.72	1,6,10-Dodecatrien-3-ol, 3,7,11-trimethyl-(Nerolidol)	222 $C_{15}H_{26}O$		Sesquiterpene alcohol	Insecticide anti-inflammatory antimicrobial (Dr. Duke's database)
15.060	0.75	9,12-Octadecadienoic acid (Z,Z), methyl ester (Linoleic acid methyl ester)	294 $C_{17}H_{30}O_2$		Polyunsaturat-ed fatty acid	Hypocholesterolemic nematicide antiarthritic hepatoprotective antiandrogenic hypocholesterol-emic 5-alphareductase inhibitor antihistamine insectifuge anticoronary antiacne antieczemic (Dr. Duke's database)
15.120	0.99	(Z,Z)-6,9-cis-3, 4-epoxy-nonadecadiene	278 $C_{19}H_{34}O$		Alkene compound	

Table 4: Continue....

Table 4: Continue....

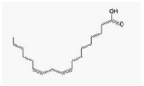
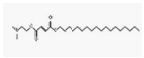
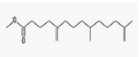
15.230	8.53	Phytol	296 $C_{20}H_{40}O$		Diterpene	Insecticide antimicrobial antioxidant diuretic (Islam *et al.*, 2018)
15.560	2.14	9,12-Octadecadienoic acid (Z,Z)-(Linoleic acid)	280 $C_{18}H_{32}O_2$		Polyunsaturat-ed fatty acid	Hypocholesterolemic nematicide antiarthritic hepatoprotective antiandrogenic hypocholesterole-mic 5-alphareductase inhibitor anticoronary antihistaminic insectifuge antiacne antieczemic (Dr. Duke's database)
16.656	0.99	Hexane, 1,1'-oxybis- (Dihexyl ether)	186 $C_{12}H_{26}O$		Ether compound	
16.760	0.63	Bis [2(Dimethylamino)ethyl] ether	160 $C_8H_{20}N_2O$		Tertiary amine -based organoamine compound	Anti-inflammatory antimicrobial (Dr. Duke's phytochemical and ethnobotanical database)
17.051	0.32	1,7-Dioxaspiro [5.5]undec-2-ene	154 $C_9H_{14}O_2$		Cyclic compound	No activity reported
18.218	1.04	Undecanal, 2-methyl-	184 $C_{12}H_{24}O$		Aldehyde compound	Anti-inflammatory antimicrobial (Dr. Duke's database)
18.350	0.29	2-Octyn-1-ol, 7-[(tetrahydro-2H-pyran-2-yl)oxy]-	226 $C_{13}H_{22}O_3$		Oxy compound	
18.422	0.33	Fumaric acid, 2-dimethylaminoethyl octadecyl ester	439 $C_{26}H_{49}NO_4$		Ester compound	
20.930	5.75	Squalene	410 $C_{30}H_{50}$		Triterpene	Lipoxygenase-inhibitor antioxidant antibacterial antitumor immunostimulant cancer preventive chemo preventive pesticide (Huang *et al.*, 2009)
21.948	2.27	Cholesta-3,5-diene	368 $C_{27}H_{44}$		Steroid	Anticancer antiarthritic hepatoprotective antimicrobial diuretic antiasthma (Dr. Duke's database)
22.067	0.25	Tetradecanoic acid, 5,9, 13-trimethyl-, methyl ester	284 $C_{18}H_{36}O_2$		Fatty acid methyl ester	Antioxidant cancer preventive nematicide lubricant hypocholesterole-mic (Dr. database)

Table 4: Continue....

Table 4: Continue....

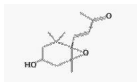
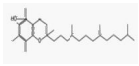
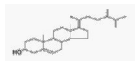
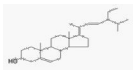
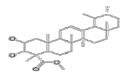
22.887	1.01	3-Buten-2-one, 4-(4-hydroxy-2, 2,6-trimethyl-7-oxabicyclo [4.1.0]hept-1-yl)	224 $^{c}{}_{13}H_{20}O_3$		Ketone compound	
24.722	2.45	Vitamin E	430 $C_{29}H_{50}O_2$		Chromanol ring compound	Analgesic antiageing antidiabetic anti-inflammatory antioxidant antileukemic antidermatitic antitumor hepatoprotective anticancer hypocholesterole-mic vasodilator antiulcerogenic antispasmodic anticoronary antibronchitic (Dr. Duke's database)
26.567	2.18	Ergost-5-en-3-ol	400 $C_{28}H_{48}O$		Steroid	Anticancer antiarthritic antimicrobial hepatoprotective antiasthma diuretic (Dr. Duke's database)
27.016	2.34	Stigmasta-5,22-dien-3-ol, (3.beta.,22E)-	412 $C_{29}H_{48}O$		Steroid	Anticancer diuretic hepatoprotective antimicrobial antiarthritic antiasthma (Dr. Duke's database)
28.391	1.32	Olean-12-en-3-one	424 $C_{30}H_{48}O$		Aromatic compound	
29.495	1.54	Methyl commate D	486 $C_{31}H_{50}O_4$		Tritepene glycoside	Antimicrobial (Dr. Duke's database)
34.888	1.16	2-heptadecyloxirane (1,2-Epoxynonadecane)	282 $C_{19}H_{38}O$		Epoxy compound	

Table 5: Secondary metabolites identified in the methanol root extract of *Tridax procumbens* using gas chromatography-mass spectrometry (GC-MS) technique.

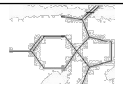
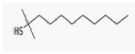
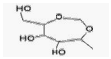
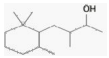
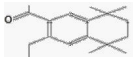
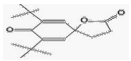
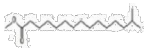
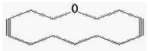
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
8.324	0.98	Spiro [4.5]dec-7-ene, 1,8-dimethyl -4-(1-methylethenyl)-, [1S-(1.alpha., 4.beta.,5.alpha.)]-(Acoradiene)	204 $C_{15}H_{24}$		Sesquiterpene	Analgesic antitumor antibacterial sedative fungicide anti-inflammatory insecticide (Dr. Duke's database)
8.561	0.38	2-Undecanethiol, 2-methyl-	202 $C_{12}H_{26}S$		Sulfur compound	Insecticide (Dr. Duke's database)
8.879	2.11	2,5-Monomethylene-l-rhamnitol	178 $C_7H_{14}O_5$		Alcoholic compound	Antimicrobial (Dr. Duke's database)
9.446	0.24	Ledol	222 $C_{15}H_{26}O$		Sesquiterpene alcohol	Insecticideanti-inflammatory antimicrobial (Dr. Duke's database)
10.197	0.22	9-Octadecenoic acid (Z)- (Oleic acid)	282 $C_{18}H_{34}O_2$		Mono-unsaturated fatty acid	Insecticide anti-inflammatory (Dr. Duke's database)
10.324	1.08	Methyl tetrahydroionol	212 $C_{14}H_{28}O$		Alcoholic compound	Antimicrobial (Dr. Duke's database)
10.465	0.30	2H-2,4a-Methanonaphthalen-8(5H)-one, 1,3,4,6,7,8a-hexahydro-1,1,5,5-tetramethyl-	220 $C_{15}H_{24}O$		Sesquiterpene oxide	Insecticide anti-inflammatory antimicrobial (Dr. Duke's database)
10.952	0.15	Cyclohexanol, dodecyl-	268 $C_{18}H_{36}O$		Aromatic compound	
11.443	0.09	5,5-Diethylheptadecane	296 $C_{21}H_{44}$		Alkane compound	
12.685	0.24	7-Acetyl-6-ethyl-1,1,4, 4-tetramethyltetralin	258 $C_{18}H_{26}O$		Aromatic cyclic compound	
13.344	0.07	7,9-Di-tert-butyl-1-oxaspiro (4,5) deca-6,9-diene-2,8-dione	276 $C_{17}H_{24}O_3$		Unsaturated cyclic compound	
13.428	0.47	Pentadecanoic acid, 14-methyl-, methyl ester	270 $C_{17}H_{34}O_2$		Saturated fatty acid compound	
13.621	0.05	Hexadecane	226 $C_{16}H_{34}$		Alkane compound	
13.761	0.74	Oxacyclotetradeca-4,11-diyne	190 $C_{13}H_{18}O$		Unsaturated cyclic compound	
13.913	6.47	n-Hexadecanoic acid (Palmitic acid)	256 $C_{16}H_{32}O_2$		Saturated long chain fatty acid	Hypocholesterolemic antioxidant pesticide nematicide antiandrogenic 5-Alpha reductase inhibitor flavor hemolytic Anti-inflammatory (Dr. Duke's database)

Table 5: Continue...

Table 5: Continue...

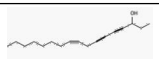
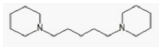
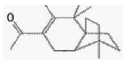
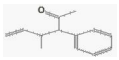
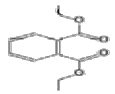
14.083	0.19	Panaxjapyne A	246 $C_{17}H_{26}O$		Unsaturated alcoholic compound	Antidiabetic (Dr. Duke's database)
14.611	66.37	(S,Z)-Heptadeca-1,9-dien -4,6-diyn-3-ol	244 $C_{17}H_{24}O$		Unsaturated alcoholic compound	
15.047	0.36	9,12-Octadecadienoic acid, methyl ester (Linoleic acid methyl ester)	294 $C_{19}H_{34}O_2$		Poly unsaturated fatty acid	Hypocholesterolemic antiarthritic nematicide hepatoprotective hypocholesterolemic antiandrogenic 5-Alpha reductase inhibitor anticoronary antihistaminic insectifuge antiacne antieczemic (Dr. Duke's database)
15.107	0.35	9-Octadecenoic acid (Z)-, methyl ester (Oleic acid methyl ester)	296 $C_{19}H_{36}O_2$		Mono-unsaturated fatty acid	Anti-inflammatory cancer preventive antiandrogenic hypocholesterolemic 5-Alpha reductase inhibitor flavor insectifuge (Dr. Duke's database)
15.222	0.33	Phytol	296 $C_{20}H_{40}O$		Diterpene	Insecticide antimicrobial antioxidant diuretic (Islam *et al.*, 2018)
15.337	0.14	Octadecanoic acid, methyl ester (Stearic acid methyl ester)	298 $C_{19}H_{38}O_2$		Saturated fatty acid	Insecticide antioxidant (Dr. Duke's database)
15.639	3.04	(9e,12e)-9,12-Octadecadienoyl chloride (Linolelaidoyl chloride)	298 $C_{18}H_{31}ClO$		Unsaturated fatty acid compound	Nematicide hypocholesterolemic Antiarthritic hepatoprotective hypocholesterolemic antiandrogenic 5-alpha reductase inhibitor antihistamic insectifuge anticoronary antiacne antieczemic (Dr. Duke's phytochemical database)
17.053	0.11	1,5-Di(1-piperidinyl) pentane	238 $C_{15}H_{30}N_2$		Alkaloid	Anti-inflammatory antimicrobial antioxidant (Dr. Duke's database)
17.161	0.23	Ethanone, 1-(1,2,3,4,7,7a-hexahydro-1, 4,4,5-tetramethyl-1,3a-ethano-3a H-inden-6-yl)	246 $C_{17}H_{26}O$		Ketone compound	
18.547	0.59	5-Hexen-2-one, 4-methyl-3-phenyl-	188 $C_{13}H_{16}O$		Aromatic ketone compound	
18.821	0.89	Diethyl phthalate (1,2-benzenedicarboxylic acid)	390 $C_{24}H_{38}O_4$		Aromatic dicarboxylic acid compound	Antimicrobial anti fouling (Dr. Duke's database)

Table 5: Continue...

Table 5: Continue...

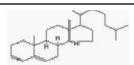
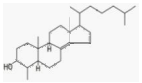
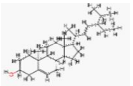
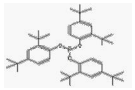
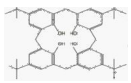
21.943	0.70	Cholesta-3,5-diene	368 $C_{27}H_{44}$		Steroid	Anticancer antiarthritic hepatoprotective antimicrobial diuretic antiasthma (Dr. Duke's phytochemical and ethnobotanical database)
26.543	0.74	Cholest-8(14)-en-3-ol, 4-methyl-, (3.beta.,4.alpha.,5.alpha.)	400 $C_{28}H_{48}O$		Steroid	Anticancer antiarthritic hepatoprotective antimicrobial diuretic antiasthma (Dr. Duke's database)
26.989	2.98	Stigmasta-5,22-dien-3-ol, (3.beta.,22E)-	412 $C_{29}H_{48}O$		Steroid	Anticancer antiarthritic hepatoprotective antimicrobial diuretic antiasthma (Dr. Duke's database)
29.730	0.83	Phenol,2,4-bis (1,1-dimethylethyl)-, phosphite (3:1)	646 $C_{42}H_{63}O_3P$		Phenolic compound	Analgesic antioxidant antibacterial antiseptic anti-inflammatory vasodilator antiviral cancer preventive pesticide (Zaho *et al*., 2020)
35.316	3.88	5,11,17, 23-tetratert-buty lpentacyclo [19.3.1.1~3,7~.1~9,13~.1~15,19~] octacosa-1(25), 3(28), 4,6,9(27), 10,12,15(26), 1 6,18,21,23 -dodecaene-25,26,27,28-tetrol	648 $C_{44}H_{56}O_4$		Cyclic aromatic compound	

Table 6: Secondary metabolites identified in the methanol flower extract of *Tridax procumbens* using GC-MS technique.

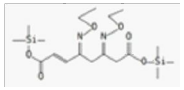
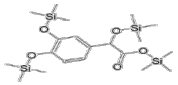
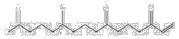
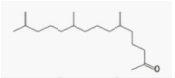
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
7.569	0.70	Fumarylacetoacetate diethoxime, bis (trimethylsilyl) ester	430 $C_{18}H_{34}N_2O_6Si_2$		Silica compound	
9.550	0.40	Benzeneacetic acid,. alpha.,3,4-tris[(trimethylsilyl) oxy]-,trimethylsilyl ester	472 $C_{20}H_{40}O_5Si_4$		Silica compound	
11.464	0.56	Nonane,5-(1-methylpropyl)-	184 $C_{13}H_{28}$		Alkane compound	
12.505	0.85	Neophytadiene	278 $C_{20}H_{38}$		Alkene compound	Anti inflammatory Antioxidant Cardio protective properties Insecticide (Dr. Duke's Database)
12.607	0.54	2-Pentadecanone, 6,10,14-trimethyl-	268 $C_{18}H_{36}O$		Ketone compound	
12.949	0.16	2-Furanmethanol, 5-ethenyltetrahydro-. alpha.,.alpha.,5-trimethyl-, cis-	170 $C_{10}H_{18}O_2$		Alcoholic compound	Antimicrobial (Dr. Duke's Database)
13.457	1.03	Hexadecanoic acid, methyl ester	270 $C_{17}H_{34}O_2$		Saturated long chain fatty acid	Hypocholesterolemic Antioxidant Pesticide Saturated long Nematicide Antiand-rogenic Hemolytic Flavor enhancer 5-Alpha reductase inhibitor (Dr. Duke's Database) Phytochemical and Ethnbotananical Database)
13.935	30.62	n-Hexadecanoic acid	256 $C_{16}H_{32}O_2$		Saturated long chain fatty acid	Hypocholesterolemic Antioxidant Pesticide Nematicide Flavor enhancer Hemolytic 5-Alpha reductaseinhibitor Antiandrogenic Anti-inflammatory , (Dr. Duke's Database)

Table 6: Continue...

Table 6: Continue...

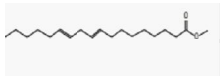
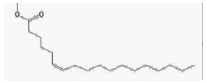
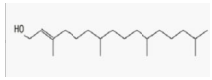
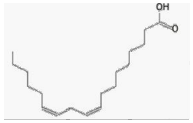
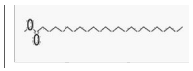
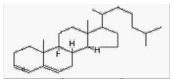
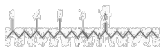
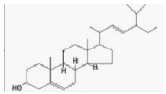
14.438	0.68	Geranyl linalool isomer B	290 $C_{20}H_{34}O$		Fragrance compound	Antimicrobial (Dr. Duke's Phaytochemical and Ethnobotanical Database)
15.067	2.36	9,12-Octadecadienoic acid, methyl ester	294 $C_{19}H_{34}O_2$		Poly unsaturated fatty acid	Nematicide Antiarthritic Hypocholesterolemic Hepatoprotective Antiandrogenic 5-Alpha reductase inhibitor Hypocholesterolemic Antihistaminic Anticoronary Antieczemic AntiacneInsectifuge (Dr. Duke's Database)
15.121	1.18	6-Octadecenoic acid, methyl ester, (Z)- (Oleic acid methyl ester)	296 $C_{19}H_{36}O_2$		Mono fatty acid	Anti- inflammatory Cancer unsaturated preventive Antiandrogenic Hypocholesterolemic 5-Alpha reductase inhibitor Flavor enhancerInsectifuge (Dr. Duke's Database)
15.232	4.17	Phytol	296 $C_{20}H_{40}O$		Diterpene	Insecticide Antimicrobial Antioxidant Diuretic (Islam, M. T *et al.*, 2018)
15.352	0.96	Octadecanoic acid, methyl ester (Stearic acid methyl ester)	298 $C_{19}H_{38}O_2$		Saturated fatty acid	Insecticide Antioxidant (Dr. Duke's Database)
15.592	25.04	9,12-octadecadienoic acid	280 $C_{18}H_{32}O_2$		Polyunsaturated Fatty acid	Nematicide Antiarthritic Hypocholesterolemic Hepatoprotective Hypochole-sterolemic 5-Alpha reductase inhibitor Antiandrogenic Antihistaminic Anticoronary Antieczemic AntiacneInsectifuge (Dr. Duke's Database)
16.850	0.73	Heneicosane	296 $C_{21}H_{44}$		Alkane compound	Antimicrobial Pheromone compound which is used by termites and other insects (Vanitha *et al.*, 2020)

Table 6: Continue...

Table 6: Continue...

18.489	0.73	Eicosane, 1-iodo-	408 $C_{20}H_{41}I$		Alkane iodo compound	Antimicrobial (Dr. Duke's Database)
20.276	0.77	Tetracosanoic acid, methyl ester	382 $C_{25}H_{50}O_2$		Fatty acid methyl ester	
21.707	7.09	Nonacosane	408 $C_{29}H_{60}$		Alkane compound	Diuretic Anticancer Antiarthritic Hepatoprotective
21.944	2.54	Cholesta-3,5-diene	368 $C_{27}H_{44}$		Steroid	Antimicrobial Antiasthma Antiasthma (Dr. Duke's Database)
22.773	1.35	Dodecane, 2-methyl-	184 $C_{13}H_{28}$		Alkane compound	
24.083	10.03	Hexatriacontane	506 $C_{36}H_{74}$		Alkane compound	As Paraffin wax in candle Antioxidant (Dr. Duke's Database)
24.924	3.08	Phytyl decanoate	450 $C_{30}H_{58}O_2$		Fatty acid phytyl ester	Anti-inflammatory Antimicrobial Flavoring agent Sanitizer (Dr. Duke's Database)
26.975	4.41	Stigmasterol	412 $C_{29}H_{48}O$		Steroid	Antiarthritic Hepatoprotective Anticancer Antimicrobial Diuretic

(Ingole *et al*., 2022) suggest these properties lack strong scientific evidence. The present study identified various biologically active compounds that are valuable for further research. Future research should focus on secondary metabolites in weed plants rather than heavily exploited medicinal ones to uncover new bioactive compounds and therapeutic properties.

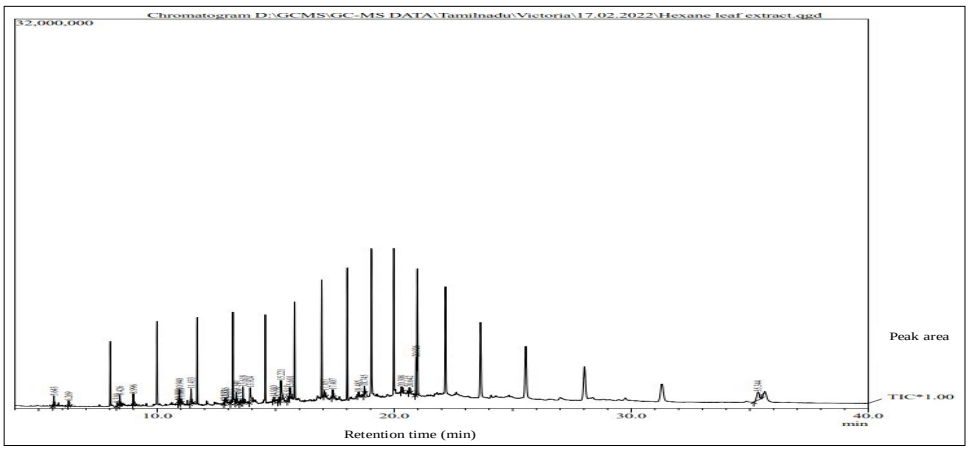


Fig 7: Chromatogram of hexane extract of stem with leaves.

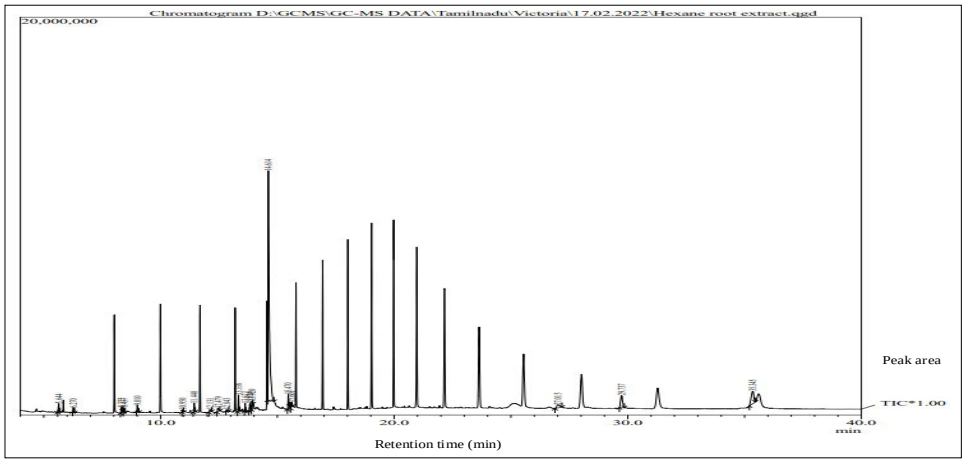


Fig 8: Chromatogram of hexane extract of root.

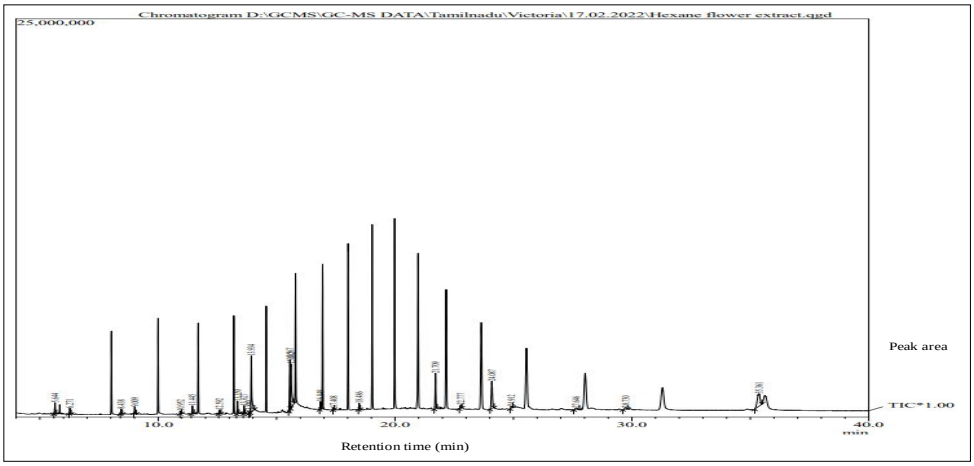


Fig 9: Chromatogram of hexane extract of flower.

Table 7: Secondary metabolites identified in the hexane stem with leaf extract of *Tridax procumbens* using GC-MS technique.

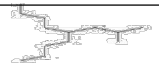
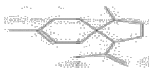
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
5.643	5.10	5-Isobutylnonane	184 $C_{13}H_{28}$		Alkane compound	
6.269	2.02	5-Butylnonane	184 C13H28		Alkane compound	
8.310	1.91	Acoradiene	204 $C_{15}H_{24}$		Sesquiterpene	Analgesic Antitumor Antibacterial Sedative Fungicide Insecticide (Dr. Duke's Database)
8.427	4.04	Hexadecane	226 $C_{16}H_{34}$		Alkane compound	
8.996	4.17	Heptadecane	240 $C_{17}H_{36}$		Alkane compound	Anti-inflammatory (Erdoğan *et al.*, 2020)
10.900	0.56	Propanenitrile, 3-(octylamino)-	182 $C_{11}H_{22}N_2$		Amino compound	Anti-inflammatory Antimicrobial (Dr. Duke's Database)
10.940	5.92	Eicosane	282 $C_{20}H_{42}$		Alkane compound	
11.001	1.30	Octadecane	254 $C_{18}H_{38}$		Alkane compound	Enzymatic activity (Dr. Duke's Database)
11.433	7.18	Heneicosane	296 $C_{21}H_{44}$		Alkane compound	Antimicrobial Pheromone compound which is used by termites and other insects (Vanitha *et al.*, 2020)
12.833	0.56	(Endo)-6-methylbicyclo [3.2.0] heptan-2-one	124 $C_8H_{12}O$		Ketone compound	
12.876	0.84	Phytane(Hexadecane, 2,6,10,14-tetramethyl)	282 $C_{20}H_{42}$		Alkane compound	
13.117	1.28	Nonacosane	408 $C_{29}H_{60}$		Alkane compound	
13.340	5.63	7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6, 9-diene-2,8-dione	276 $C_{17}H_{24}O_3$		Unsaturated ketone compound	
13.503	1.51	Docosane	310 $C_{22}H_{46}$		Alkane compound	

Table 7: Continue...

Table 7: Continue...

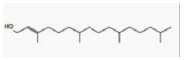
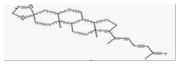
13.924	12.27	n-Hexadecanoic acid	256 $C_{16}H_{32}O_2$		Saturated long chain fatty acid	Hypocholesterolemic Nematicide Antiandrogenic Antioxidant Flavor enhancer Hemolytic 5-Alpha reductase inhibitor Anti-inflammatory Pesticide (Dr. Duke's Database)
15.221	15.37	Phytol	296 $C_{20}H_{40}O$		Diterpene	Antioxidant Antimicrobial Anti-inflammatory Insecticide (Islam *et al.*, 2018)
15.601	5.32	Nonacosane	408 $C_{29}H_{60}$		Alcoholic compound	Antimicrobial (Dr. Duke's Database)
17.057	3.77	Tetracosane	338 $C_{24}H_{50}$		Alkane compound formulation	Antimicrobial Anti-inflammatory Cytotoxic Used in drug (Dr. Duke's Database)
20.642	3.03	Cholestan-3-one, cyclic 1,2-ethanediyl acetal, (5.alpha.)-	430 $C_{29}H_{50}O$		Steroid	Anticancer Antiarthritic Hepatoprotective Antimicrobial Diuretic Antiasthma (Dr. Duke's Database)
20.926	18.22	Squalene	410 $C_{30}H_{50}$		Triterpene	Pesticide Antioxidant Cancer preventive Antitumor Immunostimulant Chemo preventive Antibacterial Lipoxygenase inhibitor (Huang *et al.*, 2009)

Table 8: Secondary metabolites identified in the hexane root extract of *Tridax procumbens* using GC-MS technique.

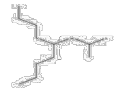
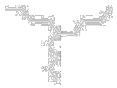
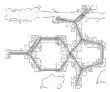
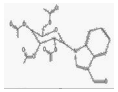
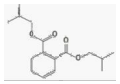
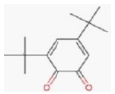
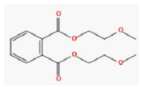
Retention time	Peak area %	Name of the compound	Molecular weight and formula	Molecular structure	Nature of compound	Activity
5.644	1.79	5-Isobutylnonane	184 $^{c}{}_{13}H_{28}$		Alkane compound	
6.270	0.73	5-Butylnonane	184 $C_{13}H_{28}$		Alkane compound	
8.322	0.87	Acoradiene	204 $C_{15}H_{24}$		Sesquiterpene	Analgesic Antitumor Sedative Antibacterial Fungicide Insecticide (Dr. Duke's Database)
8.437	0.78	Indole-3-carboxaldehyde, 1-(3,4,5,6-tetracetoxy-2-oxanyl)-	475 $C_{23}H_{25}NO_{10}$		Aldehyde compound	Antiviral Cytotoxic (Dr. Duke's Database)
9.010	1.05	Hexadecane	226 $C_{16}H_{34}$		Alkane compound	
10.950	0.33	Eicosane	282 $C_{20}H_{42}$		Alkane compound	
11.440	1.34	Heptadecane	240 $C_{17}H_{36}$		Alkane compound	Anti-inflammatory (Erdoğan *et al*., 2020)
12.479	1.12	5,8,11-Eicosatriynoic acid, methyl ester	314 $C_{21}H_{30}O_{2}$		Unsaturated fatty acid ester	
12.843	0.17	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	278 $C_{16}H_{22}O_{4}$		Ester of phthalic acid	Antifouling Antimicrobial (Dr. Duke's Database)
13.338	2.63	o-Benzoquinone, 3, 5-di-tert-butyl-	220 $C_{14}H_{20}O_{2}$		Aromatic ketone compound	Antimicrobial Fungicide (Dr. Duke's Database)
13.621	1.01	Octadecane	254 $C_{18}H_{38}$		Alkane compound	Enzymatic activity (Dr. Duke's Database)
13.824	1.61	1,2-Benzenedicarboxylic acid, bis(2-methoxyethyl) ester	282 $C_{14}H_{18}O_{6}$		Plasticizer compound	Antimicrobial Antifouling (Dr. Duke's Database)

Table 8: Continue....

Table 8: Continue....

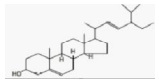
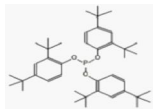
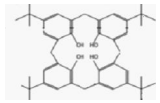
13.920	1.00	n-Hexadecanoic acid	256 $C_{16}H_{32}O_2$		Saturated long chain fatty acid	Anti-inflammatory Hypo-cholesterolemic Antioxidant Nematicide Pesticide Flavor enhancer Anti androgenic Hemolytic 5-Alpha reductase inhibitor (Dr. Duke's Database)
14.614	68.46	(S,Z)-Heptadeca-1, 9-dien-4,6-diyn-3-ol	244 $C_{17}H_{24}O$		Unsaturated alcoholic compound	
15.601	0.69	Tetracosane	338 $C_{24}H_{50}$		Alkane compound	Antimicrobial Anti-inflammatory CytotoxicUsed in drug formulation (Dr. Duke's Database)
27.015	2.23	Stigmasta-5,23-dien-3-ol, (3.beta.)-	412 $C_{29}H_{48}O$		Steroid	Antiarthritic Hepatoprotective Anticancer Diuretic Antimicrobial Antiasthma (Dr. Duke's Database)
29.737	5.98	Phenol, 2,4-bis (1,1-dimethylethyl)-, phosphite (3:1)	646 $C_{42}H_{63}O_3P$		Phenolic compound	Cancer preventive Antioxidant Antibacterial Anti-inflammatory Antiseptic Pesticide Antiviral (Zaho *et al*., 2020)
35.345	8.20	5,11,17,23-tetratert-butylpentacyclo[19.3.1. 1~3,7~.1~9,13~.1~15,19~] Octacosa-1(25),3(28),4,6,9(27), 10,12,15(26),1 6,18,21,23-dodecaene-25,26,27,28-tetrol	648 $C_{44}H_{56}O_4$		Cyclic aromatic compound	

Table 9: Secondary metabolites identified in the hexane flower extract of *Tridax procumbens* using GC-MS technique.

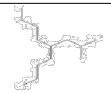
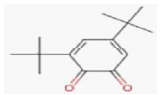
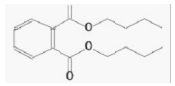
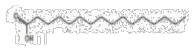
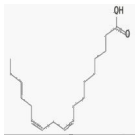
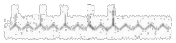
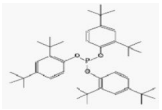
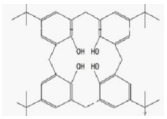
Retention time	Peak area %	Name of the compound	Molecular weight	Molecular structure	Nature of compound	Activity
5.644	3.25	5-Isobutylnonane	184 $C_{13}H_{28}$		Alkane compound	
6.271	1.40	5-Butylnonane	184 $C_{13}H_{28}$		Alkane compound	
8.438	1.31	Indole-3-carboxaldehyde, 1-(3,4,5,6-tetracetoxy-2-oxanyl)-	475 $C_{23}H_{25}NO_{10}$		Aldehyde compound	Antiviral Cytotoxic (Dr. Duke's Database)
9.009	1.69	Hexadecane	226 $C_{16}H_{34}$		Alkane compound	
10.952	0.59	Eicosane	282 $C_{20}H_{42}$		Alkane compound	
11.445	2.31	Heptadecane	240 $C_{17}H_{36}$		Alkane compound	Anti-inflammatory (Erdoğan, M.K *et al.*, 2020)
12.592	1.17	2-Pentadecanone, 6,10, 14-trimethyl-	268 $C_{18}H_{36}O$		Ketone compound	
13.350	3.17	o-Benzoquinone, 3,5 -di-tert-butyl-	220 $C_{14}H_{20}O_2$		Aromatic ketone compound	Antimicrobial Fungicide (Dr. Duke's Database)
13.627	1.61	Nonacosane (Celidoniol, deoxy)	408 $C_{29}H_{60}$		Alkane compound	
13.840	0.33	Dibutyl phthalate(1,2-Benzenedicarboxylic acid, dibutyl ester)	278 $C_{16}H_{22}O_4$		Plasticizer compound	Antifouling Antimicrobial (Dr. Duke's Database)
13.934	17.76	n-hexadecanoic acid	256 $C_{16}H_{32}O_2$		Saturated long chain fatty acid	Hypocholesterolemic Antioxidant Nematicide Anti androgenic Pesticide Flavor enhancer5-Alpha reductase inhibitor Hemolytic Anti-inflammatory (Dr. Duke's Database)

Table 9: Continue...

Table 9: Continue...

15.567	16.64	9,12-Octadecadienoic acid (Z,Z)-	280 $C_{18}H_{32}O_2$		Polyunsaturat-ed fatty acid	Hypocholesterolemic Antiarthritic Antiacne Nematicide Hepatoprotective Anti androgenic Hypocholesterolemic Antihistaminic Anticoronary Insectifuge5-Alpha reductase inhibitor Antieczemic (Dr. Duke's Database)
15.602	16.92	9-Octadecenal, (Z)-	266 $C_{18}H_{34}O$		Aldehyde compound	Flavoring agent Antimicrobial (Dr. Duke's Database)
16.849	1.54	Heneicosane	296 $C_{21}H_{44}$		Alkane compound	Antimicrobial Pheromone compound which is used by termites and other insects (Vanitha *et al.*, 2020)
17.408	0.52	Tetrapentacontane	758 $C_{54}H_{110}$		Alkane compound	
21.709	12.27	Tetratetracontane	618 $C_{44}H_{90}$		Alkane compound	
24.912	1.02	Phytyl decanoate	450 $C_{30}H_{58}O_2$		Ester compound	Antimicrobial Anti-inflammatory Flavoring agent Sanitizer (Dr. Duke's Database)
27.646	1.31	Hexatriacontane	506 $C_{36}H_{74}$		Alkane compound	As Paraffin wax in candle Antioxidant (Dr. Duke's Database)
29.730	1.34	Phenol, 2,4-bis(1,1-dimethylethyl)-, phosphite (3:1)	646 $C_{42}H_{63}O_3P$		[ic compound	Antioxidant Antibacterial Cancer preventive Anti-inflammatory Antiseptic Pesticide Antiviral (Zaho *et al.*, 2020)
35.361	13.85	5,11,17,23-tetratert-butylpentacyclo[19.3.1.1~3, 7~.1~9,13~.1~15,19~]octacosa-1(25),3(28),4,6,9(27), 10,12,15(26),1 6,18,21,23-dodecaene-25,26,27, 28-tetrol	648 $C_{44}H_{56}O_4$		Cyclic aromatic compound	

CONCLUSION

GCMS analysis of *Tridax procumbens* revealed secondary metabolites with pesticidal, antimicrobial, antioxidant and anti-inflammatory properties. These biodegradable compounds offer sustainable alternatives for drug discovery and agriculture. Future research should focus on isolating and analyzing specific metabolites for novel bioactive applications.

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Ethical approval

Ethical clearance was not required for this study, as the research focused on plant-based materials and did not involve human subjects, cell lines or animals.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article. The study did not receive funding from any organization.

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