Research Article
Sciences of Phytochemistry

Phytochemical Profiling of Passiflora edulis Vines

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[The author informations are in the declarations section. This article is published by ETFLIN in Sciences of Phytochemistry, Volume 3, Issue 1, 2024, Page 11-19. https://doi.org/10.58920/sciphy0301219]

Received: 14 February 2024
Revised: 28 February 2024
Accepted: 07 March 2024
Published: 12 March 2024

Editor: Samir Chtita

Keywords: Gas Chromatography-Mass Spectrometry, High Pressure Liquid Chromatography, Passiflora edulis vine, Phytochemicals.

Abstract: Over time Passiflora edulis f. flavicarpa (PEFF) have been utilized in traditional medicine for the treatment of different health ailments. This study aims to identify the phytochemical constituents in the vines of PEFF responsible for its traditional usage. Maceration in methanol was used in the extraction of the powdered vines and standard procedures were also used to screen for its phytochemical contents. Two chromatographic techniques such as High Pressure Liquid Chromatography (HPLC) and Gas Chromatography - Mass Spectrometry (GC-MS) were exploited to identify and quantify the phytoconstituents in the methanol extract. Phytochemical screening showed alkaloids, glycosides, flavonoids, tannins, steroids, saponins and terpenoids in the vines of PEFF. Prominent compound revealed by HPLC analysis include pyrogallol (18.64%), ferulic acid (13.71%), ellagic acid (12.88%), salicylic acid (10.83%), ribalinidine (10.50%) and cresol (9.67%). While the GC-MS analysis showed Octadec-9-enoic acid (67.78%); 3-methylindole-2-carboxlic acid,4,5,6,7-tetrahydro-, ethyl ester (16.89%) and 3-aminopyrrolidine (14.52%). Thus, the vines of PEFF contain phytoconstituents responsible for it use in traditional medicine.

Introduction

Passiflora edulis Sims (family-passifloraceae), also known as yellow passion fruit, it vernacular name is ‘mfri vine’ (Oro people of Akwa-Ibom state, Nigeria). It has a shallow root, climbing tendrils, evergreen vine that grows to 25.40-38.10 cm long, 7.62-12.70 cm wide and produce purple-white flower that is showy bowl shape fragrant. It is native of Paraguay, Southern Brazil and Northern Argentina but cultivated and dispersed in warm temperature and tropical climates (1). Three deep lobes are observed in mature leaves, though absent in younger leaves. The leaf lamina is 6-15 cm long, sleekly green, orderly toothed, 2-4 cm long petiolate and 2 raised gland at the end. Stipule is 10 cm long and linear (2).

Synonym of *Passiflora edulis* include *Passiflora ligularis*, *Passiflora lauriflora*, *Passiflora actinia*, *Passiflora amethystina*, *Passiflora capsularis*, *Passiflora cincinnata*, *Passiflora edulis f. edulis*, *Passiflora incarnata*, *Passiflora morifolia*, *Passiflora urnifolia*, *Passiflora coccinea*, *Passiflora setacea*, *Passiflora alata*, *Passiflora quadrangularis*, and *Passiflora ligularis* (3, 4).

The variety *Passiflora edulis f flavicarpa* (PEFF) has been the cornerstone of several herbal preparations for thousands of year, it is use in traditional medicine for treatment and management of convulsion, pain, insomnia, hypertension, migraine, nervousness, symptom of alcoholism, cancer and attention-deficit hyperactivity disorder (5, 6). While pharmacologically, activities such as anti-inflammatory, analgesic, ant-diabetic, antispasmodic, neuroprotective, antidiarrheal, antioxidant, gastroprotective, antihypertensive, antibacterial, and antiproliferative have been documented (1, 7).

Several phytochemicals have been identified from different parts of the *Passiflora edulis*, they include vitexin, isovitexin, isoorientin, luteolin, quercetin and apigenin (8). Phenylethanoid glycosides, cyanogenic glycosides and benzyl alcohol have been isolated and characterized from its stem and leaves (9), its fruits are rich sources of ethyl propanoate, propyl acetate, methyl butanoate, 2-methyl propylacetate, 1-hexanol, cis-3-hexen-1-ol, germacrene D and alpha-terpineol. These compounds contributes to the characteristic fruity, floral and sweety aroma of the fruits (10-12).

Studies have been done on the fruit and leaves of PEFF, due to its medicinal and economic importance. The medicinal relevance of the vines have been meagre and yet to be linked to the different phytochemicals it possess. The need to identify these phytochemical constituents either as a group or individual has become imperative. Thus, this study aims to evaluate the phytochemicals in the vines of PEFF using standard methods and chromatographic techniques, thus providing the basis for its use ethno-medicinally.

Materials and Methods

Collection, Identification, and Extraction

The vines of PEFF were collected in the month of October, 2023 from Akwa-Ibom state, Ibesikpo-Asutan Local Government Area, bounded by latitude 4° 46' 0'' N, longitude 7° 57' 0'' E. It was identified in University of Benin, by Prof H.A. Akinnibosun of the Department of Plant Biology and Biotechnology. Herbarium number was provided UBH 353 and sample specimen was kept in the Departmental herbarium.

PEFF vines were detached, dried for 2 weeks under shade and pulverized using electric milling machine to produce fine particles. Two hundred grams of the powdered vines were macerated with methanol (99.8%) and shaken intermittently every 30 min, for 2 hours, before the mix was kept in a dark compartment for 3 days. The extract was decanted, filtered (size 1 paper) and concentrated in vacuum. Extract obtained was kept in a refrigerator at 4°C until used.

Phytochemical Screening of PEFF Powdered Vines

Powdered vines of PEFF were screened for phytochemicals by methods described by Sofowora (13) and Trease and Evans, (14). Phytochemicals evaluated are alkaloids, flavonoids, glycosides, steroids, saponins, tannins and terpenoids.

Detection of Alkaloids: The powdered vines (0.5 g) was dissolved in dilute hydrochloric acid, filtered and tested for the presence of alkaloids. Mayers test: To the filtrate (1 mL) in a test tube, 4 drops of Mayers reagent was added. A yellow cream precipitate formation indicates the presence of alkaloids.

Wagner's test: Wagner's reagent (4 drops) was added to 1 mL of the filtrate, if a brown-reddish brown formation is observed, and it indicates the presence of alkaloids.

Detection of Flavonoids: The powdered vines (0.5 g) was dissolved in distilled water , boiled for 5 min., filtered and tested for the presence of flavonoids and saponins.

Lead acetate test: A few drops of lead acetate solution was added to the filtrate (1 mL). A yellow-colour precipitate indicates the presence of flavonoids.

Detection of Saponins: Filtrate (1 mL) was mixed vigorously with 1 mL of distilled water. The formation of frothing indicates the presence of saponins.

Detection of Tannins: Powdered vines (0.5 g) are mixed with a few millilitres of distilled water and heated on a water bath, then the mixture was filtered. Ferric chloride was added to the filtrate. The dark green colour indicates the presence of tannins.

Detection of Steroids: A few drops of acetic anhydride are added to the filtrate (methanolic) and the formation of violet to blue to green in some samples indicates the presence of steroids.

Detection of Terpenoids: Powdered vines (10 mg) was mixed with 2 mL chloroform and 3 mL concentrated sulfuric acid added carefully to form a layer. A reddish-brown colour indicates the presence of terpenoids.

Detection of glycosides: About 5 mg of the powdered vines was boiled with 10 % HCl for a few minutes on a water bath, filtered and allowed to cool. An equal volume of chloroform is added to the filtrate. A few drops of 10 % ammonia are added to the mixture and heated. The formation of pink colour indicates the presence of glycosides.

Analysis of Methanol Extract of *Passiflora edulis* Vines by HPLC

Analysis (HPLC) of the methanol extract of Passiflora edulis was done using Shimadzu LC-10AD dual binary pumps, Shimadzu CTO-10AS column oven, and Shimadzu Prominence SPD-20A UV/Vis detector. C-12 normal phase column (Phenomenex, Gemini 5 µ, 200 mm length × 4.8 mm internal diameter) was utilized for the analysis. Mobile phase consisting of solvent A and B, where solvent A was made of acetic acid-acidified deionized water at pH 2.8, while solvent B was acetonitrile at 0.8 mL/min flow rate. Solvent B (5%) was used to equilibrate the column for 20 min post injection of each sample. Temperature of the column was set at 38°C, volume of injection was 20 µL and wavelength set at 280 nm, Compounds were identified and quantified by comparison of the retention times and peak areas with standard (pure) compounds by plotting calibration plot of external standards.

Gradient elution: 0-5 min, 5-9% solvent B; 5-15 min, 9% solvent B; 15-22 min, 9-11% solvent B; 22-38 min, 11-18% solvent B; 38-43 min, 18-23% solvent B; 43-44 min, 23-90% solvent B; 44-45 min, 90-80% solvent B; 45-55 min (15). Standard (AccuStandard, USA) used for this analysis were graciously provided by

Dr. David Ogochukwu of Docchy Laboratory and Environmental Services, Awka. The standard includes ephedrine, ribalinidine, cresol, ellagic acid, naringin, coumaric acid, isoflavone, ferulic acid, pyrogallol, naringenin and salicylic acid. Solutions were prepared at 1 mg/mL for each of the standard used.

Gas Chromatography-Mass Spectrometric Analysis of PEFF Methanol Extract

Gas Chromatography hyphenated to a Mass Spectrometric (Agilent USA 7890A GC system, 5675C Inert MSD) with triple axis detector equipped with an auto injector (10 µl syringe) was used. Helium gas was used as a carrier gas and all chromatographic separation was performed on capillary column (Agilent 19091-433HP-5Ms) having specification: length; 30 m, internal diameter 0.2 µm, thickness; 250 µm, treated with phenyl methyl silox (5 %). Other operating conditions were ion source temperature (EI) at 250°C, interface temperature of 300°C, pressure of 16.2 psia, out time of 1.8 mm, 1 µl injector in split mode with split ratio of 1:50, injection temperature of 280°C. The column temperature started at 50°C for 2 mins and changed to 100°C at the rate of 20°C/min. The temperature was raised to 250°C at the rate of 20°C/min and held for 5 mins. The total elution was 19 minutes. MS Solution software provided by supplier was used to control the system and to acquire the data. Identification of the compounds was carried out by comparing the mass spectra obtained with those of the standard mass spectra from NIST library (NISTII) (16).

Results

Qualitative phytochemical screening of PEFF revealed the presences of secondary metabolite as shown in Table 1.

Table 1. Phytoconstituents of the powdered vines of *Passiflora edulis*.

Phytochemical	Inference
Alkaloid	+
Flavonoid	+
Glycoside	+
Tannin	+
Terpenoid	+
Steroid	+
Saponin	+

Note: (-) means absent and (+) means present.

HPLC analysis of the methanol extract of the vines of PEFF displayed Eleven phyto-compounds as shown in Table 2.

Table 2. Phytoconstituents from HPLC analysis of the methanol vines extract of *Passiflora edulis f. flavicarpa*.

S/N	Compounds	Retention Time	Percentage Area	Concentration (µg/ml)
1	Ephedrine	1.126	0.16	0.0953
2	Ribalinidine	3.376	10.50	2.8080
3	Cresol	7.853	9.67	5.1771
4	Ellagic acid	9.793	12.88	5.1704
5	Naringin	13.016	6.48	3.4699
6	Coumaric acid	19.050	6.58	3.7339
7	Isoflavone	19.606	5.93	2.3822
8	Ferulic acid	22.793	13.71	8.1151
9	pyrogallol	28.696	18.64	11.0394
10	Naringenin	36.016	4.62	2.7354
11	Salicylic acid	42.233	10.83	4.3475

Forty-two compounds were identified in the methanol vines extract of PEFF as shown in Table 3.

Table 3. Phytoconstituents of the GC-MS analysis of the methanol vines extract of *Passiflora edulis f. flavicarpa*.

S/N	Compounds	RT (min)	% Area	MF	MW
1	3-Aminopyrrolidine	2.369	14.52	C4H10N2	186.25
2	6-Octadecenoic acid, methyl ester,(Z)-	4.454	0.06	C19H36O2	296.49
3	Sarcosine, N-valeryl-, hexadecyl ester	4.961	0.00	C24H47NO3	397.63
4	Adipic acid, pentadecyl 2-propyl ester	5.046	0.00	C24H46O4	398.60
5	1,3-Butadiene, 2-methyl-	5.271	0.00	C5H8	68.12
6	5-Ethyl-dihydro-4,6(1H,5H)pyrimidinedione	5.947	0.00	C6H9N2O2	140.14
7	1-Butanamine, N-nitro-N-propyl-	6.088	0.00	C7H16N2O2	160.21
8	3-Amino-1,2,4-dithiazole-5-thione	6.172	0.00	C2H2N2S3	150.3
9	3-[3-[2-Methyl-1,3-dioxolan-2-yl]propyl]-2-oxazolidinone	6.651	0.00	C9H14NO4	183.20
10	N-(4-Methoxybenzenesulfonyl)azetidin-3-one	7.130	0.02	C10H11NO4S	241.27
11	8,14-Seco-3,19-epoxyandrostane-8,4-dione, 17-acetoxy-3.beta.-methoxy-4,4-dimethyl-	7.384	0.03	C24H36O6	420.5
12	Lochneridine	7.581	0.01	C20H24N2O3	340.4
13	4,5-Dichloro-1,3-dioxolan-2-one	7.806	0.00	C3H2Cl2O3	156.95
14	Methyl tetradecanoate	8.877	0.06	C15H30O2	242.4

15	17-Pentatriacontene	9.074	0.04	C35H70	490.93
16	2-Furanmethanol, .alpha.-(2-nitropropyl)-,	9.215	0.02	C8H11NO4	185.18
17	3,Trans-(1,1-dimethylethyl)-4,cis-methoxycyclohexan-1-ol	9.384	0.02	C11H21O2	195.28
18	Undeca-3,4-diene-2,10-dione, 5,6,6-trimethyl-	9.581	0.03	C14H22O2	222.32
19	Cyclopropanecarboxylic acid, 2-methylphenyl ester	9.750	0.01	C13H24O2	212.33
20	Imidazole-4-carboxamide	10.398	0.07	C4H5N3O	111.10
21	3-(Methylthio)hexyl butanoate	10.623	0.03	C11H22O2S	218.36
22	cis-10-Nonadecenoic acid	10.764	0.01	C19H36O2	296.49
23	Hexadecanoic acid, 2-methyl-	11.018	0.03	C18H36O2	284.48
24	Tricosanoic acid, methyl ester	11.750	0.11	C24H48O2	368.64
25	Octadecanoic acid, 17-oxo-, methylester	12.004	0.05	C19H36O3	312.49
26	Hexadecanoic acid, 14-methyl-, methyl ester	12.370	0.04	C18H36O2	284.48
27	5-Heptenoic acid, methyl ester,	12.511	0.02	C8H14O2	142.20
28	2,5-Di-(4-nitrophenyl)-tetrazol	12.623	0.02	C13H8N6O4	312.24
29	6-Octadecenoic acid, methyl ester,(Z)-	12.849	0.04	C19H36O2	296.49
30	2H-Pyrimido[1,2-a]pyrimidine, 1,3,4,6,7,8-hexahydro-1-methyl-	13.187	0.04	C14H9N3	229.32
31	Eicosane	13.384	0.02	C20H42	282.50
32	Imidazole-4-carboxylic acid, 5-amino-2-methyl-, ethyl ester	13.581	0.02	C6H9N3O2	155.15
33	4a.alpha.,4b.beta.-Gibbane-1.alpha.,10.beta.-dicarboxylic acid, 4a-formyl-7-hydroxy-1-methyl-8-methylene-, dimethyl ester	13.807	0.02	C22H30O6	390.5
34	1,2,3-Triphenyl-3-methyl-cyclopropene	13.919	0.01	C22H18	282.4
35	N-Acetyl-d,l-norleucenine	14.201	0.02	C10H12N2O5	240.21
36	3H-Pyrazol-3-one, 4,4'-azobis[2,4-dihydro-2,5-diphenyl]	14.398	0.01	C30H22N6O2	498.5
37	7-Methoxy-9b-methyl-3-(2-methyl [1,3]dioxolan-2-yl)-1,2,3,4,5,9b hexahydrocyclopenta[a]naphthalene-3a-carbonitrile	14.708	0.00	C20H25NO3	427.4
38	Nonanoic acid	14.905	0.00	C9H18O2	158.24
39	4-phenyl-pyrido[2,3-d]pyrimidine	15.131	0.00	C13H9N3	207.23
40	2-Furancarboxamide, N-(1,4,6-trimethyl-1H-pyrazolo[3,4-b]pyridin-3-yl)-	15.215	0.00	C14H14N4O2	270.29
41	Octadec-9-enoic acid	15.694	67.78	C18H34O2	282.46
42	Ethyl-4,5,6,7-tetrahydro-3-Methylindole-2-carboxylate	17.553	16.89	C12H17NO2	207.27

Note: RT= Retention time, %Area = Percentage area, MF = Molecular formula, and MW=Molecular weight.

Discussion

Phytochemicals like flavonoids, glycosides, saponins, steroids, tannins and terpenoids have been previously reported in the leaves (17, 18). These may seems to be non-essential, even though they play vital parts in it survival by mediation of environmental interactions with competitors, disease protection, stress, pollution and ultra violet rays. They also contribute toward the colour, aroma and taste of its parts (19).

Phytochemicals can be analyzed by chromatographic methods which provide information about the qualitative and quantitative portions. However, in the absent of this method of analysis, the simple phytochemical screening can be use, with the advantage of being economical, easy to perform and fewer materials or reagents may be required. This study screened the vines of PEFF for phytochemicals and Table 1 provide information of the phytoconstituents present following the analysis.

Previous report of the phytochemical screening of the seeds of *Passiflora edulis* revealed the presence of flavonoids, alkaloids, tannins, glycosides, saponins, and steroids (20), while glycosides, flavonoids, alkaloids, phenolic compounds, tannins and saponins were observed in the leaves. The stem of *Passiflora edulis* showed the presence of glycosides, flavonoids, alkaloids, phenolics compounds and saponins (21). The presence of these chemicals are in agreement with constituents in the vines. However, it should noted that preliminary screening of this kind has the advantage of providing information about the different classes of phytochemicals present in the screened part, thus enabling the determination of the appropriate method for its extraction and isolation of molecules. Its also aid in predicting the likely pharmacological action the plant will exhibit. Flavonoids are known to scavenge for free radicals that are responsible for plethora of diseases in the body. Indicating that flavonoids could be used to prevent or treat such disease conditions. Glycosides regulate growth and involved in allelopathy (22), tannins are used in dressing wounds due to the wound healing potential (23), saponin and steroids induce apoptosis and cell cycle arrest in cancerous cells (24) and tumor induced oedema (25).

Table 4. Compounds and their pharmacological uses.

S/N	Compounds	Class	Uses	References
1	3-Aminopyrrolidine	Heterocyclic amine	Antibacterial	(25)
2	6-Octadecenoic acid, methyl ester,(Z)-	Fatty Acyl	Food, Membrane stabilizer	(26)
3	Sarcosine, N-valeryl-, hexadecyl ester	Amino acid ester	Surfactant	(28)
4	Adipic acid, pentadecyl 2-propyl ester	Ester	New Compound	
5	1,3-Butadiene, 2-methyl-	Alkene	Contribute to flavour and fragrance	
6	5-Ethyl-dihydro-4,6(1H,5H)pyrimidinedione	Heterocyclic compound	New Compound	(29)
7	1-Butanamine, N-nitro-N-propyl-	Nitroalkylamine	New Compound	
8	3-Amino-1,2,4-dithiazole-5-thione	Xanthane anhydride	Anti-aging	
9	3-[3-[2-Methyl-1,3-dioxolan-2-yl]propyl]-2-oxazolidinone	Heteocyclic aklylacetal	New Compound	
10	N-(4-Methoxybenzenesulfonyl)azetidin-3-one	Heterocyclic ketone	New Compound	(30)
11	8,14-Seco-3,19-epoxyandrostane-8,4-dione, 17-acetoxy-3.beta.-methoxy-4,4-dimethyl-	Tetracyclic ketone	New Compound	
12	Lochneridine	Monoterpene indole alkaloid	Anticancer	(31)
13	4,5-Dichloro-1,3-dioxolan-2-one	Carbonate ester	Anticandidal	
14	Methyl tetradecanoate	Fatty Acyl	Membrane stabilizer	(32)
15	17-Pentatriacontene	Hydrocarbon	Antimicrobial	
16	2-Furanmethanol, .alpha.-(2-nitropropyl)-,	Heterocyclic alcohol	New Compound	(33, 34)
17	3,Trans-(1,1-dimethylethyl)-4,cis-methoxycyclohexan-1-ol	Cycloalcohol	Antifungal	
18	Undeca-3,4-diene-2,10-dione, 5,6,6-trimethyl-	Unsaturated ketone	New Compound	(35)
19	Cyclopropanecarboxylic acid, 2-methylphenyl ester	Cycloester	New Compound	
20	Imidazole-4-carboxamide	Aromatic hetero diazole	Anticancer	
21	3-(Methylthio)hexyl butanoate	Thioester	New Compound	
22	cis-10-Nonadecenoic acid	Fatty acid	Membrane stabilizer	
23	Hexadecanoic acid, 2-methyl-	Fatty Acyl	Membrane stabilizer	
24	Tricosanoic acid, methyl ester	Fatty Acyl	Membrane stabilizer	
25	Octadecanoic acid, 17-oxo-, methyl ester	Ester	New Compound	(36)
26	Hexadecanoic acid, 14-methyl-, methyl ester	Fatty Acyl	Membrane stabilizer	
27	5-Heptenoic acid, methyl ester,	Fatty Acyl	Membrane stabilizer	
28	2,5-Di-(4-nitrophenyl)-tetrazol	Tetrazole	New Compound	
29	6-Octadecenoic acid, methyl ester,(Z)-	Fatty Acyl	Membrane stabilizer	
30	2H-Pyrimido[1,2-a]pyrimidine, 1,3,4,6,7,8-hexahydro-1-methyl-	Triazine	New compound	

31	Eicosane	Alkane	Heaing and Lightening	(37)
32	Imidazole-4-carboxylic acid, 5-amino-2-methyl-, ethyl ester	Diazole ester	Anti-Alzheimer	
33	4a.alpha.,4b.beta.-Gibbane-1.alpha.,10.beta.-dicarboxylic acid, 4a-formyl-7-hydroxy-1-methyl-8-methylene-, dimethyl ester	Terpenoid ester	New Compound	(38)
34	1,2,3-Triphenyl-3-methyl-cyclopropene	cycloalkene	New Compound	
35	N-Acetyl-d,l-norleucenine	Monoterpene indole alkaloid	Vertigo	(39)
36	3H-Pyrazol-3-one, 4,4'-azobis[2,4-dihydro-2,5-diphenyl]	Diazole ketone	anti-tubercular, anti-inflammatory, anti-convulsant, anticancer, anti-viral, angiotensin converting enzyme (ACE) inhibitory, and neuroprotective	(40)
37	7-Methoxy-9b-methyl-3-(2-methyl [1,3]dioxolan-2-yl)-1,2,3,4,5,9b hexahydrocyclopenta[a]naphthalene-3a-carbonitrile	Triicyclic aromatic compound	New Compound	
38	Nonanoic acid	Fatty acid	Antitumor	(41)
39	4-phenyl-pyrido[2,3-d]pyrimidine	Heterobicylic	Anticancer	
40	2-Furancarboxamide, N-(1,4,6-trimethyl-1H-pyrazolo[3,4-b]pyridin-3-yl)-	Heterotetrazole	New Compound	(42)
41	Octadec-9-enoic acid	Fatty acid	Surfactant	(43)
42	Ethyl-4,5,6,7-tetrahydro-3-Methylindole-2-carboxylate	Bicyclic ester	New Compound	

These pharmacological activities ascribed to a particular plant extract implies that interference may likely be experienced. Thus, to reduce or prevent interference, separation of the components into the various parts will be necessary. HPLC is a separation technique, use to set-apart non-volatile components of the plant extract and has the advantage of being robust and rugged. The nature of the HPLC allows it to identify the compounds in the crude extract of PEFF by comparing the retention time and peak area with standards. The standard utilized in this study are listed in Table 2 and comparing it with peaks and retention time avail the compound in the Table 2. The prominent compounds include pyrrogallol (18.64%), ferulic acid (13.71%), ellagic acid (12.88%), salicylic acid (10.83%), rabilinidine (10.50%), cresol (9.67%), coumarin (6.58%), naringin (6.48%) and isoflavone (5.93%).

Some of the reported activities of the PEFF could be due to the phytochemicals identified. Salicylic acid-Analgesic; ephedrine-antihypertensive, cresol-anti-proliferative, ellagic acid-antiproliferative, antioxidant and anti-inflammatory, narigin-anti-inflammatory and antiproliferative, coumaric acid-anti-inflammatory, isoflavone-antiproliferative, ferulic acid-antioxidant, antimicrobial and anti-inflammatory, pyrrogallol-antioxidant and antibacterial and naringenin-antioxidant, anti-proliferative and anti-inflammatory.

GC-MS analysis was used in the identification of volatile compounds in the extract of PEFF. 3-aminopyrrolidine (14.52%), octadec-9-enoic acid (67.78%) and 3-methylindole-2-carboxylic acid-4,5,6,7-tetrahydroethylester (16.89%) were prominent among the identified compounds.

Studies carried out by He and co-workers have reported high level of fatty acids in both the fruits and leaves (19). Most of the compounds identified are grouped into fatty acids, esters, alkaloids and terpenes, N-acetyl d,l-norleucenine enantiomer is use in the treatment of vertigo in part of Europe (44). Lochneridine belongs to the group of monoterpene indole alkaoids that have been identified in Catharanthus roseus and Tabernaemontana davaricata, they are known to have antimalarial, antiarrhythmic and anticancer properties (45), The presence of these compounds in the vines of PEFF with documented similar or different pharmacological activities, implies that the effect observed could be due to synergistic, additive or antagonistic interaction. Bringing to the fore the need for further studies to isolate and characterize the individual compounds in the vines. These will further aid the identification of activities that were antagonized.

Conclusion

The vines of PEFF have been shown from this study to contain different classes of phytochemicals, which

were further confirmed in the HPLC analysis, sub-divided into ephedrine, ribalinidine, cresol, ellagic acid, naringin, coumaric acid, isoflavone, ferulic acid, pyrogallol, naringenin and salicylic acid and subsequently quantified. The GC-MS analysis provided the avenue for the individual phytochemicals to be identified and linked to some of the ethnomedicinal uses.

Declarations

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Acknowledgment

The authors wish to thank Head of Department of Chemical Engineering, University of Ilorin and Dr. David Ogochukwu of Docchy Laboratory and Environmental Service for running the GC-MS and HPLC analysis for the methanol extract of PEFF.

Conflict of Interest

The authors declare no conflicting interest.

Data Availability

The unpublished data is available upon request to the corresponding author.

Ethics Statement

Not applicable.

Funding Information

Not applicable.

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How to cite: Odion, E.E., Nwigwe, G.N., Ambe, D.A., Nnamani, M.N., Osigwe, C.C., Odiete, E.C., Iyanyi, L.U.. Phytochemical Profiling of Passiflora edulis Vines. Sciences of Phytochemistry. 2024; 3(1):11-19