Volatile Constituents of the Wild Green Leaf (*Amaranthus viridis*) Growing in the Niger Delta Region of Nigeria

[1]Edet O. Odokwo and [2]Martha S. Onifade
[1]Department Of Chemistry, Federal University Otuoke, Bayelsa State, Nigeria
[2]Department Of Science Laboratory, Yaba College Of Technology, Yaba, Lagos State, Nigeria
[1]Email: odokwoee@fuotuoke.edu.ng

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Abstract

The volatile constituents of the leaves of Amarathus viridis collected from the wild have been identified and quantitied. Fresh leaves of the plant material were subjected to extraction via hydrodistillation technique. The volatile extract was analyzed for its phyto-composition with the aid of a gas chromatography-mass spectrometry (GC-MS). Eight (8) major phyto-compounds which include: propanoic acid, 2,3-dihydroxy- (10.22%), 2-furancarboxaldehyde 5-methyl- (5.92%), propanedioic acid, propyl- (5.76%), 2-isopropoxyethylamine (5.36%), 2-propanone, 1-hydroxy- (4.82%), catechol (4.78%), acetic acid (4.60%) and dodecanoic acid (4.12%) were identified and quantified. The present study has established the volatile phytochemical constituents of the leaves of Amarathus viridis collected from the wild.

Keywords: *volatile extract, Amarathus viridis leaves, GC-MS*

Introduction

There are several edible plant materials in the wild with associated local medicinal claims but limited in phytochemistry reports. There is need to explore these categories of edible vegetables towards ensuring the establishment of their phytochemical profiling. This could just be the needed recipes for complimentary medicines.

Amaranthus viridis is a tropical, edible and medicinal green vegetable belonging to the family Amaranthaceaea. It has a green soft stem with a height growth range of 60-80 cm. The leaves are ovate (3-6 cm long) with numerous branches (Paulpati *et al*., 2014; Yoshitaka and Nguyen, 2007).

Sunday *et al*. (2021) had reported the presence of 22 phytochemicals in the non-volatile aqueous extract via gas chromatography- mass spectrometry, GC-MS analysis. Some of the compounds listed were 3-hydroxyl-N-methylphenethylamine, erucic acid, n-hexadecanoic acid, 3-chloro-1,2-propanediol and cystamine. Phytochemicals such as tannins, saponins, flavonoids, alkaloids, steroids, phenolics, proteins and anthraquinones were as well reported. Thanikachalam and Jayaraj (2021) had also reported the presence of 40 phytochemicals with benzoic acid, 2-[(trimethylsilyl)oxy]-, trimethyl ester being the major compound from the GC-MS analysis of the

aqueous extract of the leaves of *Amaranthus viridis*. Thus, the present study is based on the evaluation of the volatile extract of the leaves of *Amaranthus viridis* via GC-MS.

Materials and Methods

Collection of Plant Material

The plant material (plate 1.) for the present study was collected from the wild in Emeyal 1 community in Ogbia Local Governement Area of Bayelsa state, Nigeria. The plant material was identified by a Biologist of the Department of Biology, Federal University Otuoke, Otuoke, Bayelsa State, Nigeria.

Plate 1. *Amaranthus viridis*

Extraction of Volatile Constituents

Fresh samples of the leaves of *Amarathus viridis* were chopped and then subjected to extraction via hydro-distillation. The extraction lasted for 2 hrs, volatile extract dried with anhydrous sodium sulphate and stored below room temperature.

Identification and Quantification of Volatile Constituents

The identification and quantification of the volatile extract of the leaves of *Amaranthus viridis* were carried out via GC-MS (Agilent technologies, GC system 7890A coupled with MSD 5975C) equipment with an injection mode 7683B series and a NIST 14 data library as reported by Odokwo and Uzoekwe, 2022; Hamilton-Amachree and Odokwo, 2022; Odokwo, and Onifade, 2020; Uzoekwe and Odokwo, 2023).

Results and Discussion

A total of twenty two (22) volatile phytocompounds (table 1.) have been isolated and characterized from the leaves of *A. viridis* collected from the wild. Eight major compounds have been identified which include: propanoic acid, 2,3-dihydroxy- (10.22%), 2-furancarboxaldehyde 5-methyl- (5.92%), propanedioic acid, propyl- (5.76%), 2-isopropoxyethylamine (5.36%), 2-propanone, 1-hydroxy- (4.82%), catechol (4.78%), acetic acid (4.60%) and dodecanoic acid (4.12%). None of these compounds had been reported previously.

Table 1. Phytoconstituents of the volatile extract of wild green leaves

S/N.	Phytcompounds	Concentration (%)	Retention time (min)	Molecular formula	Molecular Weight
1.	Acetic acid, hydrazide	1.38	5.135	$C_2H_6N_20$	74.08818
2.	Acetic acid	4.60	5.928	$C_2H_40_2$	60.0520
3.	2-Propanone, 1-hydroxy-	4.82	7.116	$C_3H_6O_2$	74.0785
4.	Propane, 2,2-dimethoxy-	1.42	7.462	$C_5H_{12}O_2$	104.1476
5.	Methyl glyoxal	1.34	8.769	$C_3H_4O_2$	72.0627
6.	3-Amino-2-oxazolidinone	1.54	9.651	$C_3H_6N_2O_2$	102.0900
7.	Pentanal	1.28	14.243	$C_5H_{10}O$	86.1323
8.	Phenol	1.55	14.558	C_6H_6O	94.1112
9.	1,3-Butadien-1-ol, acetate	1.18	15.682	C_6H_8O	112.1265
10.	Phenol, 2-methoxy-	1.68	17.195	C_7H_8O	124.1372
11.	Catechol	4.78	19.013	C_6H_6O	110.1000
12.	5-Hydroxymethylfurfural	1.08	19.324	$C_6H_6O_3$	126.1100
13.	Propanoic acid, 2,3-dihydroxy-	10.22	20.091	$C_3H_6O_4$	106.0800
14.	2-furancarboxaldehyde 5-methyl-	5.92	20.175	$C_6H_6O_2$	110.1106
15.	2-Methoxy-4-vinylphenol	1.24	21.600	$C_9H_{10}O_2$	150.1745
16.	3-Ethoxyamphetamine	0.80	22.035	$C_{11}H_{17}NO$	179.2588
17.	2-Isopropoxyethylamine	5.36	23.110	$C_5H_{13}NO$	103.163
18.	Benzene, 1-(chloromethyl)-3-nitro-	2.70	23.412	$C_7H_6ClNO_2$	171.581

19.	Imidodicarbonicdiamide, N-formyl-	1.62	23.926	$C_3H_5N_3O_3$	131.09
20.	Dodecanoic acid	4.12	25.516	$C_{12}H_{24}O_2$	200.320
21.	Propanedioic acid, propyl-	5.76	25.770	$C_6H_{10}O_4$	146.1412
22.	nor-Mephedrone	0.85	28.199	$C_{10}H_{13}NO$	163.220

Acetic acid commonly referred to as vinegar has numerous applications in the food industries ranging from being used as flavouring agent, acidulant, preservative and antiinfective agent (Deshmukh and Manyar, 2024). Phytochemicals that have been identified have some physiological effect on the biochemical system. Propanoic acid, 2,3-dihydroxy- also known as propionic acid with derivatives such as ibuprofen, flurbiprofen, ketoprofen, naproxen are known pain killers (analgesic), antipyresis, antiinflammation and anticancer. It is also employed as a preservative for baked food items. It also inhibits the growth of mold and also acts as an antibacterial agent (Goldberg and Rokem, 2009). 2-Furancarboxaldehyde 5-methyl- has been reported to be present in the volatile constituents of both the white and brown grains of teff ((*Erogrostis tef* (Zuccagni) Trotter) (Yisak *et al*., 2021). It has also been identified qualitatively to be present in green and red bell peppers (*C. frutescens*) and the orange bell pepper (*C. annum*) (Shmuel, 2004). Catechols a polyhydroxy aromatic established antioxidant compound has been known to form stable complexes with polyvalent metal ions and also bonds to biomolecules such as the nucleic acids and protein resulting in an irreversible condition that dent the functionality of such biomolecules (Schweigert *et al*., 2001). Dodecanoic acid (lauric acid) is a saturated short chained fatty acid found in both coconut and palm kernel oil. It has been implicated as being an anti-infective, anticancer or antioxidant agent. It is also known to prevent skin diseases, lower bad cholesterol level and also aid in body weight loss (Sandhya *et al*., 2016).

Conclusions

The wild green leaf (*A. viridis*) is rich in volatile phytochemicals that are signatures to its local medicinal and non-nutritive values. The volatile phytoconstituents of the wild green leaves of *A. viridis* should be explored for its various bioactivities with the view of establishing its therapeutical potentials.

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