RESEARCH ARTICLE

Phytochemical analysis of different varieties of *Sorghum biocolor* in Telangana state, India

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ABSTRACT

The present study is carried out to detect the phytochemicals of five diverse varieties of sorghum millet from Telangana state. Sorghum or jowar is an enriched source of different phytochemicals, like glycosides, saponins, flavonoids, and alkaloids. Sorghum consumption reduces the risk of the certain types of cancer in humans. India ranks fifth in the production of Sorghum among the countries of the world. Sorghum is packed with calcium, iron, potassium, phosphorous, protein, fiber, and good antioxidants that contain B vitamins like thiamin and riboflavin. Phytochemicals in sorghum and millets have become a critical area of research. Phytochemical analysis was performed and the result revealed the presence of steroids, Glycosides, Volatile oils, saponins, Tannins, and Flavonoids in all five varieties of Sorghum. GC-MS analysis also revealed the presence of six major bioactive compounds in almost all the genotypes studied.

Keywords: *Sorghum, millets, Glycosides, Phytochemicals, GC-MS.*

INTRODUCTION

Millet is a small herb that grows around the world as a grain or plant for human consumption. Almost 50 years ago millet was a popular grain in India. With government policies supporting rice and wheat production and consumption, millet cultivation has declined significantly. Before the Green Revolution, millets represented 40% of cultivated cereal crops. After the Green Revolution, rice replaced most cereals. In addition to changing attitudes, many organizations are supporting the development of cereals [1-2]. Educating farmers on the best techniques for growing millet is an important step. Millet is fibrous, and contains magnesium, niacin (vitamin B_3), and gluten-free proteins [3]. The sorghum is not only a crop, but also a source of biological energy for alcohol, sugar, and ethanol production. In Telangana of India, the Deccan Development Society has noticed a revival of traditional seed banks. The company works with approximately 5,000 small and poor women farmers in Zahirabad, who cultivate not less than 10 crops, mainly millets, per hectare of their farm. Some of them cultivated up to 25 varieties of crops per hectare. The valuable content of fiber and its bioactive compounds help in weight loss [4-5]. Efforts are being made to include unprocessed grains in government lunch programs in public schools in Karnataka and Telangana.

Table 1: Types of Jowar, Crop time, and Yield information

S. No.	Types of Jowar	Crop Time	Yield
1	C.S.V-15	105-110	1315
2	C.S.V -27	110	12-14
3	C.S.V-31	115	11-12
4	C.S.H-36	110	16-18
5	C.S.H-39	110-115	17-18

Material and Methods

The current investigation was carried out at the laboratory in the Department of Botany, and College of Technology, Osmania University, Hyderabad, TS, India. The millet samples were provided by Acharya Jayashankar Agricultural University, Rajendra Nagar, Hyderabad (Table 1). The seeds of all the genotypes were ground to a fine powder using a grinder. The dried millet seed material was stored in paper bags. Approximately 100 grams of dry plant powder soaked in 70% methanol were extracted for 24 hours at room temperature. The next day, the material was refluxed for 3 hours at a temperature not exceeding 30 ° C, cooled, and filtered. The filtrate was then dried to dryness at a reduced temperature. The product was stored in a dryer and used for further research. Phytochemical analysis of ethanol seed extract was carried out following certain prescribed methods [6-8].

Test for Steroids

In a test tube 2ml solution of extract, 2ml chloroform, and 2ml H_2SO_4 were taken and shaken well. The organic layer turns to red and yellowish-green fluorescence to the aqueous layer confirming the steroids.

Test for Volatile oils

Odor test: Characteristic odor of extract indicates the presence of volatile oil. Solubility test: Solubility in 90% alcohol indicates the presence of volatile oil.

Test for Glycosides

In a test tube 2ml solution of extract, 1ml glacial acetic acid, 5% $FeCl_3$ (3 drops), and concentrated H_2SO_4 were mixed and observed. The bluish-green color at the top and red color at the junction is due to the presence of cardiac glycosides.

Test for Saponins

To the extract, water was added and shaken for a few minutes. The formation of foam or froth is due to Saponins in the extract.

Test for Phenolic compounds like tannins

5% Ferric chloride test: To 3 ml of the methanolic seed extract, 3ml of 5% Ferric chloride solution was added and observed for blue-black color, which confirms the availability of phenolic compounds like tannins in the extract.

Test for Flavonoids

To about 0.5 grams of seed extract, ethanol is added to dissolve it. Warm the solution and filter it through filter paper. Add a few pieces of Magnesium turnings and a few drops of concentrated HCl to the filtrate. The appearance of pink or orange color is an indication of the presence of flavonoids.

Test for Alkaloids

To test the presence of alkaloids, a solution of the sample was prepared by adding a few ml of HCl to the extract. Then this solution is used for the following tests for alkaloids

Dragendorff's test

To 2 ml of the test solution, 1 mL of Dragendorff's reagent is added along the side of the test tube. The formation of an orange or orange reddish-brown precipitate is an indication of the presence of alkaloids.

GC-MS Analysis

GC-MS analysis was carried out on a Shimadzu GCMSQ2010 ultra system, The injector temperature was 290°C. The samples were injected in the split mode with a split ratio of 1/23 and the injection volume was 1ul of the capillary column.

RESULT AND DISCUSSION

The phytochemical analysis of the methanol

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Table 2: Phytochemical analysis of sorghum varieties.

S. No	Consituents	C.S.V -15	C.S.V -27	C.S.V -31	C.S.V -36	C.S.V 39
1	Steroids	+	+	+	+	+
2	Glycosides	+	+	+	+	+
3	Volatile oils	+	+	+	+	+
4	Saponins	+	+	+	+	+
5	Tannins	+	+	+	+	+
6	Flavonoids	+	+	+	+	+
7	Alkaloids	-	-	-	-	-

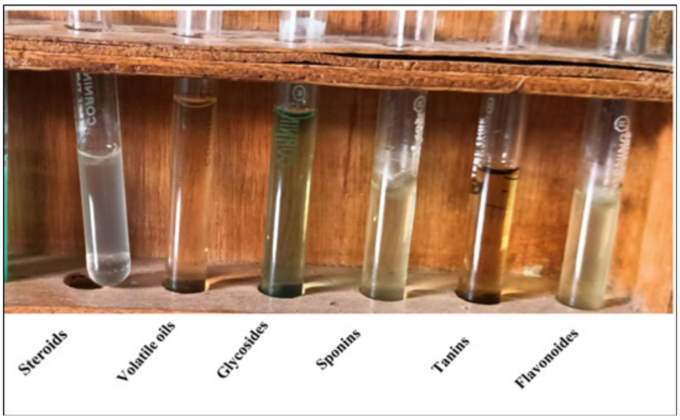

Fig.1: Images of the Phytochemical Analysis of test samples

extract of all four genotypes of the Sorghum millet revealed the presence of steroids, glycosides, volatile oils, saponins, tannins, and flavonoids. However, alkaloids were found to be absent in all the genotypes of Sorghum under study (Table 2& Fig 1). The aromatic GC-MS chromatographic profiles of the millet chloroform extract showed various compounds in each genotype and were classified into different chemical classes. The compound Ethanne1, 1diethoxy was found prominently as the major significant constituents in all the genotypes C.S.V-39 (4.91), C.S.V-31 (3.28), C.S.V-27(1.76), C.S.V36 (1.45), C.S.V-15(0.81) followed by cyclononasiloxane, octamethyl compound. C.S.V39 contains the highest Trichlor ethane (12.97%) among all genotypes followed by the compound 3-Ethoxy1, 1,1,5,5,5, hexamethyl3trimethysiloxy as the lowest of all genotypes (0.12).(Table3).

DISCUSSION AND CONCLUSION

Millet is a highly nutritious cereal and the most widely consumed in the world. In addition, these crops also contain bioactive compounds, including carbohydrates, proteins, flavonoids, and other phytochemicals [9-10]. This crop is

Table 3: Bioactive compounds of Sorghum Millet Genotypes

S. NO	COMPOUND NAME	R. TIME	MOL WEIGHT	FORMALA	CAS NO	CSV15	CSV39	CSV36	CSV31	CSV27
1	Ethane1,1, diethoxy	1.594	118.1742	C6H14O2	105-57-7	0.81	4.91	1.45	3.28	1.76
2	Cyclononasi-loxane, octamethyl	0.92	66.4	C18H54O9SI9	105-57-7	0.78	0.13	0.14	0.61	0.92
3	Dextroam-phetamine	0.021	135.21	C9H13N	300-62-9	-	0.78	0.46	0.21	1.46
4	Trichloro ethylene	1.483	131.38	C2HCl3	79-01-6	2.09	12.97	9.69	-	-
5	3Ethoxy 1,1,1,5,5,5, Hexamethyl 3trimethysi-loxy	37.960	340.71	C17H32O4Si4	1803 0-67-6	0.39	0.12	0.15	0.53	0.39
6	1 penetene, 1,3 Diphenth-yl-(trimethysi-loxy)	31.899	310.5	C20H26OSi	2005-03-27	-	0.23	0.62		0.54

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also a new type of renewable and efficient energy crop. The production of metabolites is a response to genetic and environmental changes [11-26]. The highest protein-carbohydrate concentration found in sorghum millet suggests that cultivation should be promoted as a food crop. Ethane 1, 1, di-ethoxy were found in a remarkable amount in all genotypes followed by cyclononasiloxane, octametyl compound. These tests can be used as a useful tool to analyze sorghum seeds for their phenolic chemical lipid-rich components as a complete nutritional source. Finally, further research has to focus on a comprehensive profile of all the secondary metabolites of this important cereal crop.

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Consent and Ethical Approval

As per university standard guideline, participant consent and ethical approval have been collected and preserved by the authors

Competing interests

Authors have declared that no competing interests exist.

Authors' Contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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