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Research Article

Comparative Antioxidant and Phytochemical Evaluation of Selected Varieties of *Colocasia esculenta* (L.) Schott Leaves

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ABSTRACT

Sree Kiran, Sree Rashmi, Sree Pallavi, and Muktakeshi are the four commonly cultivated varieties of *Colocasia esculenta* (L.) Schott. The current study aims to perform phytochemical screening and the antioxidant capacity of the leaf extracts of these varieties. Furthermore, LCMS was used to examine the polyphenolic content of Muktakeshi's ethanolic leaf extract. The phytochemical analysis of the cultivars indicated that all extracts contained beneficial phytocompounds like phenols, terpenoids, flavonoids, alkaloids, saponins, and tannins. The ethanolic leaf extract of Muktakeshi was found to have greater levels of total phenol (39.47 ± 0.47 GAE mg/g) and flavonoid (49.672 ± 0.15 QE mg/g) contents. All the leaf extracts exhibited a moderate antioxidant ability, whereas the ethanolic extract of Muktakeshi exhibited comparatively higher antioxidant potential in both DPPH (88.3 ± 0.58%) and nitric oxide (84.6 ± 0.79%) assays with the least IC_{50} value. The LC-MS studies detected eight polyphenolic compounds like quercetin, kaempferol, gallic acid, caffeic acid, luteolin 7-rutinoside, chlorogenic acid, vitexin, and rutin in the ethanolic leaf extract of Muktakeshi. It is a good source of many potentially effective bioactive compounds and helps to prevent human oxidative stress-associated diseases. The present study found considerable variations in the phenol-flavonoid content and antioxidant properties of the *Colocasia* varieties studied.

INTRODUCTION

Colocasia esculenta (L.) Schott, commonly known as taro, has been used in traditional medications for an extended period in tropical and subtropical areas.[1,2] The taro plant is edible and provides significant carbohydrates, protein, and minerals. Consumption of taro can help prevent constipation and reduce the risk of colon cancer. The corm, petiole, and leaves of *C. esculenta* are excellent sources of dietary fiber, minerals, protein, and ascorbic acid and are used in various culinary applications.[3] The high levels of dietary fiber in the leaves regulate intestinal transit and improve dietary bulk and consistency of feces by absorbing water.[4] This particular plant is highly recognized for its healing properties and has been used for treating various illnesses, including internal hemorrhage, diarrhea, asthma, skin conditions, arthritis, and neurological disorders.[5] The phytochemical compounds present in the selected plants provide numerous medicinal benefits such as antifungal, antimicrobial, and antihypertensive effects.[6] The ICAR-CTCRI has released many varieties of *C. esculenta*.[7] Sree Kiran, Sree Rashmi, Sree Pallavi, and Muktakeshi are the most commonly cultivated varieties. The distinctive characteristics of the tubers, leaves, and even the petiole's colors give each variety a distinct individuality.[8] A lot of variabilities exist in the phytochemical composition of *C. esculenta* varieties available in India.[9] The resistance against the *Phytophthora colocasiae* was reported to be varied between the taro varieties. Sree Kiran is highly sensitive, Sree Rashmi is moderately sensitive, Sree Pallavi is moderately resistant, and Muktakeshi is highly resistant to the pathogen.[10] These diverse responses to a single

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pathogen are due to the phytochemical variations (both composition and quantity) of phenol, flavonoids, and other derivatives.[11] A systematic analysis of these varieties has not yet been done, but it is crucial in identifying and quantifying potentially bioactive phytocompounds in them. In light of the above information, the current research was carried out to measure the selected cultivar's antioxidant potential and phenol-flavonoid content of the selected taro leaves. The LC-MS analysis was used to detect polyphenolic compounds in the extract with high antioxidant ability.[12]

Materials And Methods

Collection of the Sample

Four varieties of *Colocasia esculenta* (L.) Schott (Sree Kiran, Sree Rashmi, Sree Pallavi, and Muktakeshi) leaves were collected from the ICAR-CTCRI farm in India. ICAR-CTCRI released all four selected varieties, and the varieties were cross-checked and identified by Dr. Asha Devi, Principal Scientist, CTCRI, Thiruvananthapuram, as per the IPGRI descriptors for taro.[13]

Preparation of Plant Extracts

The collected leaf samples were cleaned with distilled water, dried at room temperature, and powdered. Powdered leaves (10 gm) were successively extracted with 150 mL of acetone and ethanol using a soxhlet extractor for 8 to 10 hours at the boiling point of the solvents. For further study, extracts were concentrated to dryness and stored in sample bottles at 4°C.[14]

Phytochemical Screening

Qualitative analysis

The preliminary phytochemical analysis in the acetone and ethanolic leaf extracts (Sree Kiran, Sree Rashmi, Sree Pallavi and Muktakeshi) of *C. esculenta* was carried out using standard procedures.[15]

Quantitative analysis

Quantitative analysis was performed on acetone and ethanolic leaf extracts using standard procedure to evaluate the phenolic-flavonoid content.[16,17]

Antioxidant Analysis

DPPH assay

The examined leaf extract's capacity to scavenge radicals was evaluated using a conventional DPPH assay.[18] In a 96-well microplate, 0.008% w/v of DPPH (100 µL) was mixed with different sample concentrations (100 µL). The absorbance of the mixture was taken at 517 nm after the incubation period of 30 minutes at 25°C. Methanol (100%) was taken as blank.

$$\%RSA = [(OD517_{Control} - OD517_{Sample})/ OD517_{Control}] \times 100$$

Nitric oxide assay

The potential to scavenge nitric oxide radical was measured using a standard procedure.[19] Sodium nitroprusside (5 mM) was made in phosphate-buffered saline, combined with varying extract quantities made in distilled water, and incubated for 30 minutes at 25°C. In place of the test substance, equal amounts of distilled water were used as a control. Next, 1.5 mL of Griess reagent was added to 1.5 mL of the incubated solution. The absorbance of the mixture was taken at 546 nm, and ascorbic acid was taken as standard.

$$\% \text{ scavenging activity} = [(OD546_{Control} - OD546_{Sample})/ OD546_{Control}] \times 100$$

Identification of Polyphenolic compounds by LC-MS analysis

To detect the polyphenolic components in the ethanolic leaf extract of Muktakeshi, LC-MS analysis was performed. The column used for the analysis was C18 (3.0×100 mm, 2.7 microns), with the mobile phase used was 0.1% formic acid: Methanol with 0.5 mL/min flow rate. The separation was gradient-based, and the compounds were detected with the help of MS/MS QTOF 6545(Agilent USA). The experimental conditions used for the analysis were as follows: the gas temperature was 333°C, the gas flow was 11 L/min, and the nebulizer was 41 psi. During the process, the 5 µL injection needle was washed for 3 seconds. MS condition was set in a negative mode to detect the maximum number of monitored metabolite ions. The chromatogram produced displays each constituent's response regarding the quantity of its molecular ions.[20]

Statistical Analysis

Using IBM SPSS version 25, statistical analysis of the data was performed. Tukey post hoc multiple comparison test and one-way ANOVA were utilized for pairwise comparison of variables between solvents ($p \leq 0.05$). The experiments were repeated three times, and the result's mean value ± standard deviation was given.

Results

Qualitative Phytochemical Analysis

Phytochemical analysis revealed the occurrence of several valuable bioactive compounds such as phenols, terpenoids, glycosides, alkaloids, flavonoids, steroids, and saponins in ethanol and acetone leaf extracts of all selected varieties of *C. esculenta* (Table 1).

Quantitative Analysis

Phenolic content

With the regression formula (Y = 0.0115x + 0.0763; R2 = 0.9978), the four ethanolic and acetone leaf extracts'

Table 1: Preliminary phytochemical screening of selected *Colocasia esculenta* varieties

Phytochemicals	*Sree Kiran*		*Sree Rashmi*		*Sree Pallavi*		*Muktakeshi*	
	Acetone extract	*Ethanol extract*	*Acetone extract*	*Ethanol extract*	*Acetone extract*	*Ethanol extract*	*Acetone extract*	*Ethanol extract*
Phenol	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+
Alkaloids	+	+	+	+	-	+	-	+
Saponin	-	-	-	-	-	-	-	+
Terpenoids	-	+	-	+	-	+	-	+
Glycosides	-	+	-	-	-	-	-	+
Steroids	+	-	+	-	+	-	+	-
Tannins	+	+	+	+	+	+	+	+

+ indicates the presence, and - indicates the absence of phytochemicals.

phenolic content was estimated and represented (Table 2) as gallic acid equivalence in mg per dry weight of leaf extract in gram (GAE mg/g) at 786 nm (Fig. 1). The ethanolic leaf extract of Muktakeshi (39.47 ± 0.47) showed the highest phenolic content than other varieties.

Flavonoid content

The aluminum-chloride method was utilized to assess the quantity of flavonoids in leaf extracts of selected varieties. The ethanolic leaf extract of Muktakeshi (49.672 ± 0.15 QE mg/g) showed the highest flavonoid content. With the regression formula ($Y = 0.0044x + 0.0065$; $R2 = 0.9905$), the flavonoids present in the extracts were estimated and represented as quercetin equivalence in mg per dry weight of leaf extract in gram (QE mg/g) at 450 nm. (Fig. 2).

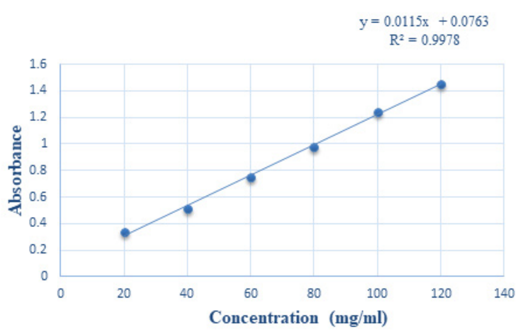

Fig. 1: Calibration curve for gallic acid

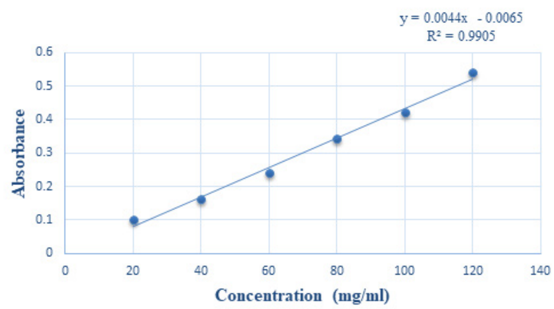

Fig. 2: Calibration curve for quercetin

DPPH assay

The results of the DPPH assay of the samples (leaf extracts and ascorbic acid) (Table 3). The DPPH activity of all four varieties of ethanolic leaf extracts exhibited slightly higher activity than that of the acetone leaf extracts. The scavenging of extracts was found to be increased with the concentration. IC_{50} values of leaf extracts and the standard (Table 4 and Fig. 3). The ascorbic acid had the lowest IC_{50} value of 43.5 ± 2.28 µg/mL. Among the four varieties, the ethanolic extract of Muktakeshi exhibited the highest scavenging (88.3 ± 0.58%) activity with an IC_{50} of 49.8 ± 1.32 µg/mL, followed by the ethanolic extract of Sree Kiran with the scavenging activity of 87.2 ± 0.7% and an IC_{50} of 71.1 ± 1.13 µg/mL.

Table 2: Total phenol and flavonoid content of leaf extracts of selected *Colocasia esculenta* varieties

Phytochemicals	*Sree Kiran*		*Sree Rashmi*		*Sree Pallavi*		*Muktakeshi*	
	Acetone extract	*Ethanol extract*	*Acetone extract*	*Ethanol extract*	*Acetone extract*	*Ethanol extract*	*Acetone extract*	*Ethanol extract*
Phenol (mg/g GAE)	14.943 ± 2.21	32.781 ± 3.35	16.482 ± 1.45	30.14 ± 0.80	9.062 ± 0.41	19.818 ± 2.11	19.089 ± 0.83	39.47 ± 0.47
Flavonoid (mg/g QE)	17.39 ± 1.16	40.032 ± 0.76	12.593 ± 2.14	39.463 ± 0.18	11.862 ± 0.66	28.306 ± 0.26	23.178 ± 0.15	49.672 ± 0.15

All values are expressed as mean ± SD for three determinations.

Table 3: Percentage inhibition of leaf extracts of *C. esculenta* varieties at different concentrations in the DPPH assay

Varieties	*Conc. (µg/mL)*	*Acetone*	*Ethanol*	*Standard*	*F Value*	*p-value*
Sree Kiran	12.5	30.9 ± 0.8^{a}	32.6 ± 0.26^{b}	38.8 ± 0.83^{c}	110.8	<0.001
	25	33.9 ± 0.91^{a}	35.4 ± 0.64^{a}	44.8 ± 0.92^{b}	148.7	<0.001
	50	41.9 ± 0.16^{a}	45.6 ± 1.17^{b}	54.9 ± 0.24^{c}	277.0	<0.001
	100	52.2 ± 0.49^{a}	59.4 ± 0.48^{b}	66.5 ± 0.47^{c}	662.5	<0.001
	200	76.7 ± 0.38^{a}	87.2 ± 0.7^{b}	88.8 ± 0.73^{c}	432.1	<0.001
Sree Rashmi	12.5	28.6 ± 0.59^{a}	31.1 ± 0.29^{b}	38.8 ± 0.83^{c}	224.9	<0.001
	25	31.6 ± 0.45^{a}	35 ± 0.71^{b}	44.8 ± 0.92^{c}	269.5	<0.001
	50	38.9 ± 0.94^{a}	44.7 ± 0.53^{b}	54.9 ± 0.24^{c}	485.3	<0.001
	100	47.7 ± 0.56^{a}	57.5 ± 0.42^{b}	66.5 ± 0.47^{c}	1118.3	<0.001
	200	71.4 ± 0.18^{a}	86.1 ± 0.4^{b}	88.8 ± 0.73^{c}	782.5	<0.001
Sree Pallavi	12.5	21.2 ± 0.48^{a}	24.6 ± 0.58^{b}	38.8 ± 0.83^{c}	621.4	<0.001
	25	24.7 ± 0.55^{a}	29 ± 0.25^{b}	44.8 ± 0.92^{c}	822.4	<0.001
	50	32.3 ± 0.42^{a}	38.4 ± 0.24^{b}	54.9 ± 0.24^{c}	4289.7	<0.001
	100	43.3 ± 0.57^{a}	48.4 ± 0.74^{b}	66.5 ± 0.47^{c}	1223.8	<0.001
	200	74.1 ± 0.17^{a}	76.9 ± 0.7^{b}	88.8 ± 0.73^{c}	516.5	<0.001
Muktakeshi	12.5	31.5 ± 0.87^{a}	36.6 ± 0.49^{b}	38.8 ± 0.83^{c}	75.6	<0.001
	25	36 ± 0.06^{a}	43.5 ± 0.52^{b}	44.8 ± 0.92^{b}	180.8	<0.001
	50	44.5 ± 1.48^{a}	52.2 ± 0.58^{b}	54.9 ± 0.24^{c}	102.5	<0.001
	100	57.9 ± 1.34^{a}	66.3 ± 0.97^{b}	66.5 ± 0.47^{b}	73.8	<0.001
	200	79 ± 1.08^{a}	88.3 ± 0.58^{b}	88.8 ± 0.73^{b}	134.2	<0.001

All values are expressed in Mean ± SD.
Different superscript letters in the same row indicate statistical significance at 5% level.

Table 4: IC_{50} values of leaf extracts of *C. esculenta* varieties for DPPH assay

Varieties	*Acetone*	*Ethanol*	*Standard*	*F-value*	*p-value*
Sree Kiran	89.4 ± 0.77^{a}	71.1 ± 1.13^{b}	43.5 ± 2.28^{c}	676.7	<0.001
Sree Rashmi	105.8 ± 1.34^{a}	73.8 ± 1.48^{b}	43.5 ± 2.28^{c}	949.3	<0.001
Sree Pallavi	116.4 ± 0.5^{a}	101.5 ± 0.14^{b}	43.5 ± 2.28^{c}	2433.0	<0.001
Muktakeshi	78.5 ± 1.11^{a}	49.8 ± 1.32^{b}	43.5 ± 2.28^{c}	382.2	<0.001

All values are expressed in Mean ± SD.
Different superscript letters in the same row indicate statistical significance at 5% level.

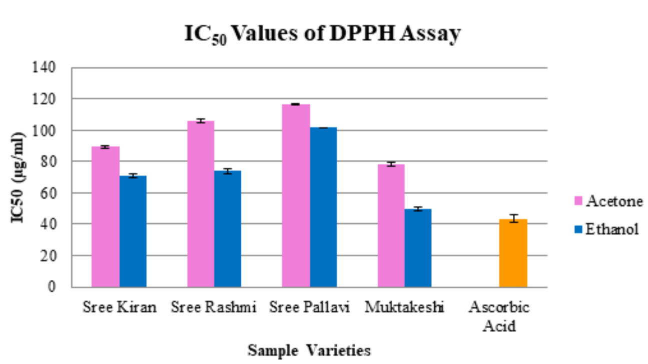

Fig. 3: IC_{50} values of leaf extracts of *C. esculenta* varieties for DPPH assay

Nitric oxide assay

The results of the assay exhibited significant scavenging potential (Table 5). In this assay, leaf ethanolic extract displayed higher activity than acetone leaf extracts. Among the four selected varieties, the ethanolic extract of Muktakeshi showed the highest percentage of inhibition with the lowest IC_{50} value (Table 6 and Fig. 4). All samples showed gradual elevation in the scavenging activity as the concentration increased from 12.5 to 200 µg/mL. The ethanolic extract of Muktakeshi showed 84.6 ± 0.79% inhibition with an IC_{50} value of 76.1 ± 1.71 µg/mL, followed by the ethanolic extract of Sree Kiran with the highest radicle scavenging of 79.7 ± 1.77% with IC_{50} value of 89.6 ± 0.35 µg/mL. At the same time, the radicle scavenging and

Table 5: Percentage inhibition of leaf extracts of selected varieties *C. esculenta* at different concentrations in Nitric oxide assay

Varieties	*Conc. (µg/mL)*	*Acetone*	*Ethanol*	*Standard*	*F Value*	*p-value*
Sree Kiran	12.5	28.6 ± 0.45^{a}	30.9 ± 0.5^{b}	35.4 ± 0.57^{c}	141.2	<0.001
	25	31.8 ± 0.34^{a}	33.4 ± 1.14^{a}	38 ± 0.97^{b}	40.0	<0.001
	50	37.7 ± 0.39^{a}	38.6 ± 0.63^{a}	47.6 ± 0.77^{b}	232.7	<0.001
	100	48.7 ± 0.49^{a}	51.6 ± 0.64^{b}	58.9 ± 0.69^{c}	224.2	<0.001
	200	72.9 ± 0.3^{a}	79.7 ± 1.77^{b}	90.5 ± 0.79^{c}	185.9	<0.001
Sree Rashmi	12.5	26.5 ± 0.28^{a}	29.1 ± 0.59^{b}	35.4 ± 0.57^{c}	253.2	<0.001
	25	29.4 ± 0.44^{a}	33 ± 0.33^{b}	38 ± 0.97^{c}	134.6	<0.001
	50	37.2 ± 0.51^{a}	37.3 ± 1.25^{a}	47.6 ± 0.77^{b}	131.8	<0.001
	100	48.5 ± 0.32^{a}	53.3 ± 0.41^{b}	58.9 ± 0.69^{c}	327.1	<0.001
	200	70.9 ± 0.51^{a}	78.8 ± 0.89^{b}	90.5 ± 0.79^{c}	522.6	<0.001
Sree Pallavi	12.5	24 ± 0.58^{a}	26.2 ± 0.49^{b}	35.4 ± 0.57^{c}	374.4	<0.001
	25	26.6 ± 0.49^{a}	28.1 ± 0.28^{a}	38 ± 0.97^{b}	276.9	<0.001
	50	32.1 ± 0.4^{a}	31 ± 0.76^{a}	47.6 ± 0.77^{b}	580.8	<0.001
	100	40.7 ± 0.39^{a}	44 ± 0.34^{b}	58.9 ± 0.69^{c}	1139.0	<0.001
	200	62.2 ± 0.25^{a}	68.3 ± 0.32^{b}	90.5 ± 0.79^{c}	2526.8	<0.001
Muktakeshi	12.5	28.8 ± 0.38^{a}	31.9 ± 0.68^{b}	35.4 ± 0.57^{c}	107.7	<0.001
	25	31.8 ± 0.47^{a}	35.5 ± 0.6^{b}	38 ± 0.97^{c}	58.2	<0.001
	50	39.7 ± 0.64^{a}	44.3 ± 0.8^{b}	47.6 ± 0.77^{c}	86.4	<0.001
	100	51.8 ± 0.16^{a}	55.6 ± 0.89^{b}	58.9 ± 0.69^{c}	88.4	<0.001
	200	73.2 ± 0.38^{a}	84.6 ± 0.79^{b}	90.5 ± 0.79^{c}	498.4	<0.001

All values are expressed in Mean ± SD.
Different superscript letters in the same row indicate statistical significance at 5% level.

Table 6: IC_{50} values of leaf extracts of *C. esculenta* varieties for Nitric oxide assay

Varieties	*Acetone*	*Ethanol*	*Standard*	*F Value*	*p-value*
Sree Kiran	103.5 ± 1.3^{a}	89.6 ± 0.35^{b}	63.6 ± 0.78^{c}	1520.7	<0.001
Sree Rashmi	109.3 ± 1.45^{a}	91.4 ± 0.19^{b}	63.6 ± 0.78^{c}	1744.4	<0.001
Sree Pallavi	141.4 ± 0.92^{a}	123.3 ± 0.69^{b}	63.6 ± 0.78^{c}	7691.9	<0.001
Muktakeshi	98.5 ± 0.72^{a}	76.1 ± 1.71^{b}	63.6 ± 0.78^{c}	689.6	<0.001

All values are expressed in Mean ± SD.
Different superscript letters in the same row indicate statistical significance at 5% level.

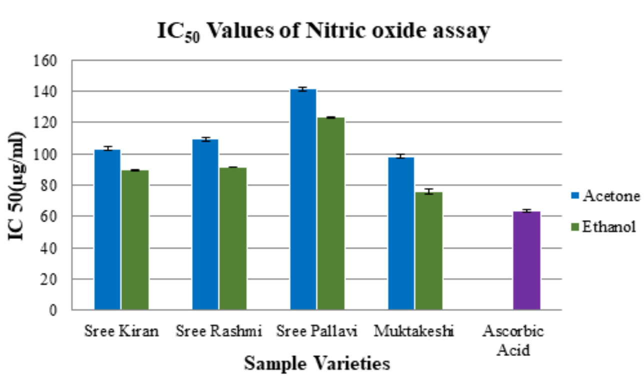

Fig. 4: IC_{50} values of leaf extracts of *C. esculenta* varieties for Nitric oxide assay

IC_{50} values of ascorbic acid were found to be 90.5 ± 0.79% and 63.6 ± 0.78 µg/mL, respectively.

Phytochemical profile by LC-MS Q-TOF analysis

LC-MS analysis of the ethanolic extract of Muktakeshi exhibited a total of 8 polyphenolic compounds. The chromatogram obtained from the LC-MS analysis (Fig. 5) and the identified polyphenolic compounds with RT, molecular mass, and biological activity are listed in Table 7.

DISCUSSION

Medicinal plants possess a wide range of phytochemicals that can successfully treat chronic diseases. Recently, robust biomolecules have come from a variety of medicinal

Table 7: Polyphenolic compounds identified from ethanolic leaf extract of Muktakeshi by LC-MS

S No.	*RT*	*Compound*	*Mol. mass*	*Biological activity*
1.	0.937	Quercetin	448.102	Antioxidant, anti-inflammatory activity, and induce apoptosis.
2.	1.014	Kaempferol	286.049	Antioxidant and anticancer activity.
3.	22.471	Gallic acid	170.0223	Antioxidant, anti-inflammatory, and anticarcinogenic activity.
4.	24.162	Caffeic acid	180.16	Antioxidant, anti-inflammatory, anticancer, and neuroprotective activity.
5.	28.875	Luteolin 7-rutinoside	594.1611	Antioxidant, anti-inflammatory, and antiproliferative activity.
6.	28.963	Chlorogenic acid	354.311	Antioxidant, antimicrobial, anti-inflammatory, and antitumor activity.
7.	29.423	Vitexin	432.1087	Antitumor, antioxidant, antiviral and hepatoprotective activities.
8.	30.209	Rutin	610.521	Antioxidant and anticancer activity.

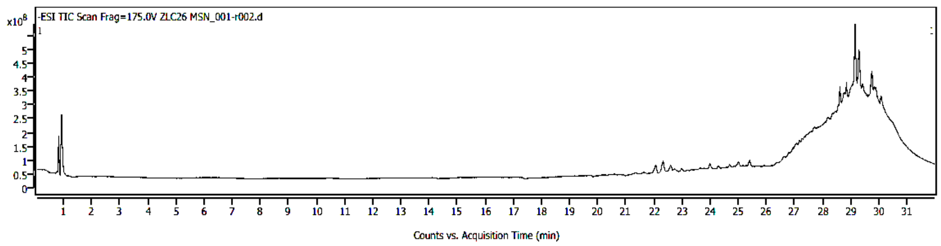

Fig 5: LC-MS chromatogram of ethanolic leaf extract of Muktakeshi

plants. They efficiently treat multiple ailments with little side effects.[21,22] Millions of people worldwide, particularly in the Pacific Island Countries, rely mainly on *C. esculenta* in their diets.[23] Most of the leaves are consumable and rich in vitamins, minerals, fiber contents, etc., but some cause acridity due to excess calcium oxalate.[24,25] There are many varieties of *C. esculenta* cultivated in India. The present study used ethanol and acetone leaf extracts of four commonly grown varieties, Sree Kiran, Sree Rashmi, Sree Pallavi, and Muktakeshi, for phytochemical and antioxidant analysis. The occurrence of several phytocompounds like phenols, terpenoids, alkaloids, flavonoids, glycosides, tannins, saponins, and steroids were identified in the present study. Glycosides are natural cardioactive compounds used to treat cardiac arrhythmia and congestive heart failure. The presence of glycosides in the plant indicates its ability to effectively treat circulatory issues, coughing, and heart insufficiency. Moreover, they may possess antispasmodic and sedative effects.[26] All previous studies revealed that leaves of *C. esculenta* contained numerous bioactive compounds like flavonoids,[27] phenol, tannins, etc., which were in harmony with our findings.

The major polyphenolic compounds like flavonoids, phenol, and tannins in plants help in detoxification.[28] These naturally occurring antioxidants have fewer side effects and are preferred in nutraceuticals for promoting health.[29] The phenolic-flavonoid content of ethanol and acetone extracts of selected varieties was evaluated using standard protocols. The highest phenol-flavonoid content was detected in the ethanolic extract of Muktakeshi. The DPPH and nitric oxide assays revealed that Muktakeshi's ethanolic extract showed the best scavenging potential than the other selected varieties. In the previous study[30], the radicle scavenging ability of *Colocasia* leaf was found to be 86.5%. In another study, [31] the taro methanolic leaf extract (81.77%) showed more radicle scavenging activity than the tuber extract (78.73%). Similar studies conducted on the taro leaves stated that the high scavenging activity of this plant with a low IC_{50} value is due to its high phenol-flavonoid content.[32] Plants that are rich in phenolic compounds contain good antioxidant action.[33] Our conclusions are supported by the results of antioxidant assays and phenolic-flavonoid content, which showed that antioxidant ability would rise as phenolic-flavonoid content increased.[34]

Recent studies on the *Colocasia* leaves found vicenin-2, iso-vitexin, iso-orientin, and luteolin. Anthocyanins like cyanidin and pelargonidin 3-O-beta-D-glucoside are also detected.[35-37] Similar studies conducted on the phenolic composition of *C. esculenta* tubers detected the presence of catechin, kaempferol, caffeic acid, rutin, quercitrin, ellagic acid, quercetin, and chlorogenic acid.[38] LC-MS analysis of ethanol leaf extract of Muktakeshi detected eight polyphenols with retention time 0.937, 1.014, 22.471, 23.029, 24.162, 28.875, 28.963, 29.423, and 30.209 minutes. The polyphenols detected were quercetin, kaempferol, gallic acid, caffeic acid, luteolin 7-rutinoside, chlorogenic acid, vitexin, and rutin, respectively. Quercetin, a bioflavonoid belonging to the flavonol group, was the most important phytoconstituent identified. It has numerous pharmacological activities, like antioxidant, anti-inflammatory, anticancer, atherosclerosis, and hypertension.[39-41] Natural flavonols like kaempferol and its derivatives may halt organ and cell degeneration, lower lipid oxidation, and preserve the functional integrity of these entities. They possess hepatoprotective, neuroprotective, anticancer, antibacterial, and antioxidant properties.[42,43] Gallic acid has antioxidant and anti-inflammatory potency with various roles in signaling pathways and regulates biological functions. It has beneficial effects in preventing and managing disorders and can be introduced as a dietary supplement.[44,45] It has been stated that caffeine has antiviral, anti-inflammatory, and anticancer effects.[46,47] Luteolin-7-rutinoside is an antioxidant that controls oxidative stress, inhibits TLR4 phosphorylation, and modulates the innate immune system.[48] In numerous aspects of health, including antioxidative, neuroprotective, antitumor, anti-inflammatory, and biological activity, chlorogenic acid is essential.[49] Numerous biological properties like antioxidative, anticancer, neuron- and cardio-protective effects are possessed by vitexin and rutin.[50] All eight polyphenolic compounds are excellent antioxidant molecules. The therapeutic and nutritional benefits of *C. esculenta* leaves may be attributed to these bioactive phytoconstituents.

In conclusion, significant differences were observed in the phenol-flavonoid content and antioxidant potential. The ethanol leaf extract of Muktakeshi had the highest phenol and flavonoid content. All four ethanol leaf extracts exhibited moderate antioxidant activity in both assays, and the ethanol leaf extract of Muktakeshi showed the highest scavenging of DPPH and nitric oxide radicles. LC-MS analysis of Muktakeshi's ethanolic extract revealed the presence of eight polyphenols. The compounds identified in this study are responsible for the nutritional and pharmaceutical value of *C. esculenta*. For future therapeutic applications, it is necessary to have a more precise and accurate quantification of the identified polyphenols to isolate and purify these bioactive compounds.

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