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Reserch Article

PHYTOCHEMICAL ANALYSIS IN OCIMUM ACCESSIONS

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ABSTRACT

Objective: Quantitative estimation of the phytochemicals *viz.,* alkaloids, terpenoids, phenols and flavonoids were carried out in fifteen different accessions of *Ocimum* species and was compared with control *viz., Ocimum sanctum* and *O. basilicum* to find out the best performing accessions.

Methods: The leaf samples were collected from 120 days old plants. The total phenolic content was determined by folin ciocalteau method, total flavonoids content was determined by aluminium chloride method, alkaloid determination using Harborne method and quantification of terpenoids was done according to Morigiwa.

Results: The concentration of phenols, flavonoids, alkaloids and terpenoids were found in the range of 31.16-177.44 mg/g gallic acid equivalent, 3.23-34.78 mg/g quercetin equivalent, 11.67-77.33 mg/g and 216.16-350 mg/g respectively. The maximum concentration of flavonoids and phenolics were found in the accession IC201233. The maximum amount of alkaloid content was found in the accession IC381552 and the maximum amount of terpenoids were found in the accessions EC388890, EC338785, IC436153, IC381552 and IC469904.

Conclusion: The amount of alkaloids and terpenoids were found to be higher in the accessions when compared to the controls and hence can be utilized to meet various pharmaceutical and industrial purposes.

Keywords: Ocimum, Phenols, Flavonoids, Terpenoids, Alkaloids.

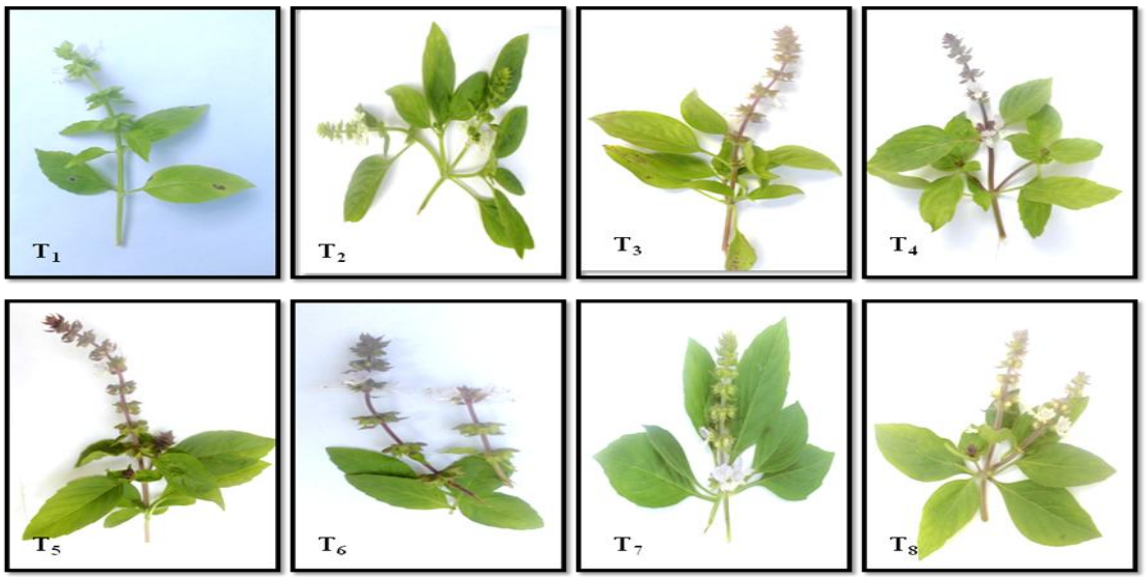
INTRODUCTION

Plants are a valuable source of a wide range of secondary metabolites which are used as pharmaceuticals, agrochemicals, flavors, fragrances, colors, biopesticides and food additives. Over 80% of the approximately 30,000 known natural products are of plant origin [1]. Secondary metabolites perform no direct metabolic function but fulfill specific ecological functions such as maintaining aesthetics of the plant, attracting insects for pollen transfer and animals for consumption of fruits, as defense mechanism in conditions of stress, wounding or pathogen attack and as natural pesticides [2]. Despite advancements in synthetic chemistry, biological sources are usually preferred for a number of secondary metabolites including pharmaceuticals due to lesser side effects and better biodegradability [3].

Ocimum, an ethnic medicinal plant rich in phytochemicals, comes under the family Lamiaceae. Lamiaceae is a relatively common botanical family and includes approximately 220 genera and about 3,500 to 4,000 species [4]. *Ocimum* is represented by 45 genera and 574 species with 256 endemic species [5]. The medicinal, culinary and aromatic value of *Ocimum* species depends on their bioactive phytochemical constituents that produce definite physiological action in the human body. Some of their most important bioactive phytochemical constituents include alkaloids, flavonoids, phenolics, terpenoids and essential oils [6]. A study was conducted to analyze the secondary metabolites *viz.,* alkaloids, terpenoids, flavonoids and phenolics present in 15 accessions of Ocimum to find out their potential for industrial applications.

MATERIALS AND METHODS

The seeds of 15 Ocimum accessions *viz.,* EC388889(T1), EC388887(T2), EC388788(T3), EC388895(T4), EC112548(T5), EC388891(T6), EC388890(T7), EC338785(T8), IC436153(T9), IC381552(T10), IC326735(T11), IC201233(T12), IC333833(T13), IC469904(T14), IC336833(T15) were received from National Bureau of Plant Genetic Resources, New Delhi, India and the controls *Ocimum sanctum* (Tos) and *Ocimum basilicum* (Tob) were received from University of Agricultural Sciences, Bangalore, India and were maintained at VIT University (Fig.1). The leaves were collected from 120 days old plants, shade dried, powdered and used for preparing a methanolic extract.



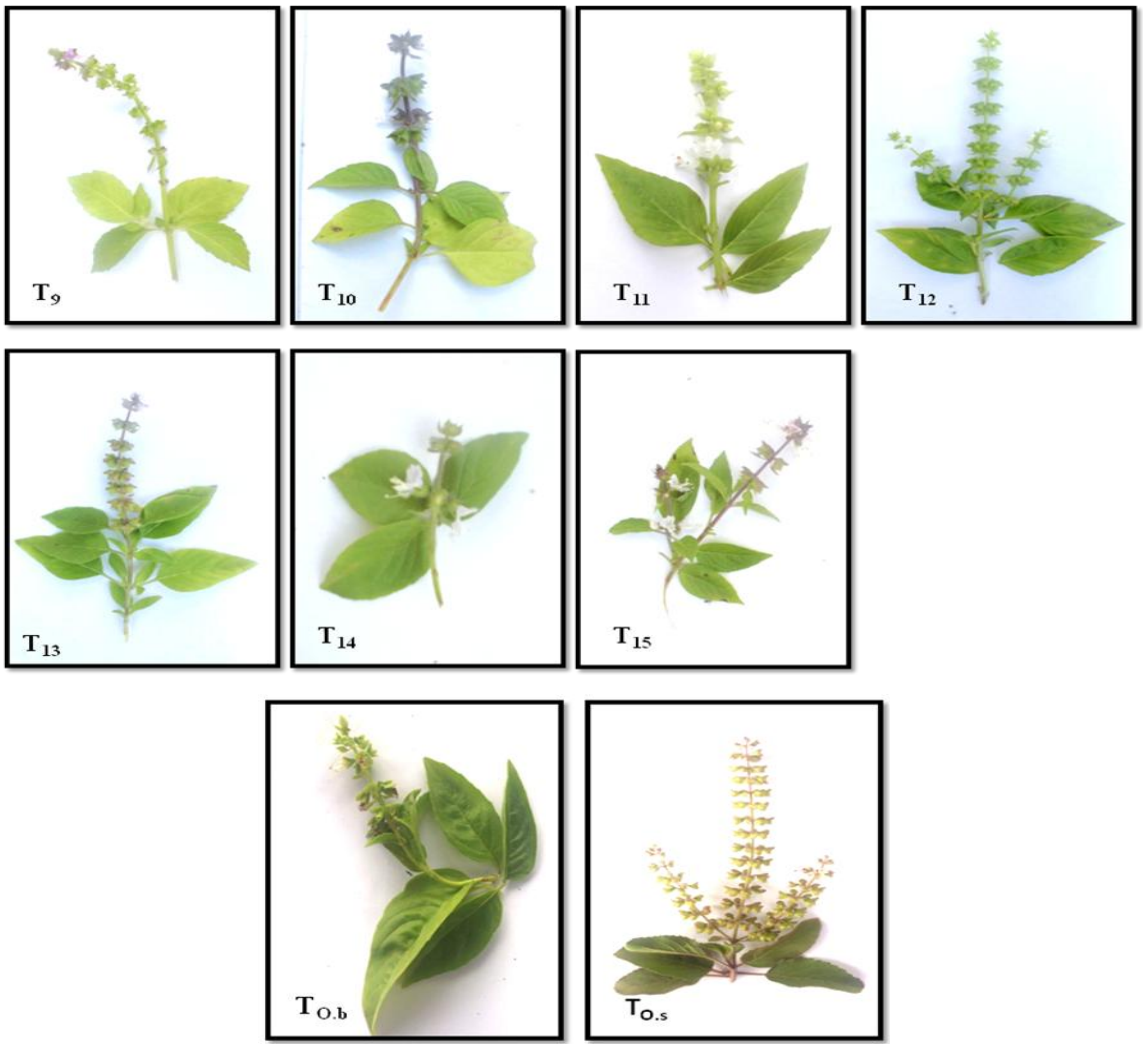


Fig. 1: Photographic depiction of accessions and controls

The total phenolic content was determined by folin ciocalteau method [7], total flavonoids content was determined by aluminium chloride method [8], alkaloid determination using Harborne [9] method and quantification of terpenoids was done according to Morigiwa [10]. The experiments were replicated thrice and results are expressed as mean ± standard deviation. Statistical analysis was performed by one way ANOVA method using SPSS software.

Table 1: Estimated mean concentration of phenolics, flavonoids, alkaloids and terpenoids

S. No.	Accession	Phenolics (mg/g gallic acid equivalent)	Flavonoids (mg/g quercetin equivalent)	Alkaloids (mg/g)	Terpenoids (mg/g)
1	EC388889	31.16 ± 0.12	3.24 ± 0.45	37.67 ± 0.58	233.33 ± 28.87
2	EC388887	72.70 ± 0.87	12.03 ± 0.44	19.33 ± 1.16	250.00 ± 0.00
3	EC388788	74.18 ± 0.64	14.81 ± 0.48	26.67 ± 3.06	216.67 ± 28.87
4	EC388895	59.12 ± 0.85	10.73 ± 0.52	29.333 ± 2.52	233.33 ± 28.87
5	EC112548	63.79 ± 0.71	6.05 ± 0.49	18.00 ± 2.65	300.00 ± 0.00
6	EC388891	88.23 ± 0.61	16.63 ± 0.20	15.33 ± 0.58	333.33 ± 28.87
7	EC388890	111.25 ± 1.55	20.80 ± 0.13	12.00 ± 2.65	350.00 ± 0.00
8	EC338785	82.83 ± 0.31	20.33 ± 0.52	39.667 ± 1.16	350.00 ± 0.00
9	IC436153	88.26 ± 0.46	13.82 ± 0.56	57.00 ± 2.65	350.00 ± 0.00
10	IC381552	98.43 ± 2.29	19.51 ± 0.44	77.33 ± 4.62	350.00 ± 0.00
11	IC326735	149.77 ± 1.75	23.42 ± 0.52	30.00 ± 2.00	273.33 ± 25.17
12	IC201233	177.45 ± 0.69	34.78 ± 0.41	11.67 ± 1.16	300.00 ± 0.00
13	IC333833	114.09 ± 1.09	18.41 ± 0.04	30.33 ± 1.53	250.00 ± 0.00
14	IC469904	104.94 ± 1.95	18.08 ± 0.33	46.67 ± 4.73	350.00 ± 0.00
15	IC336833	158.06 ± 1.15	29.11 ± 0.45	33.00 ± 2.00	273.33 ± 25.17
16	*O. sanctum*	250.23 ± 1.56	78.44 ± 0.75	50.00 ± 4.00	300.00 ± 0.00
17	*O. basilicum*	141.94 ± 1.48	36.46 ± 0.46	50.67 ± 2.89	333.33 ± 28.87

RESULTS AND DISCUSSION

One way ANOVA results showed that the treatments were significantly different from each other for all the estimations made *viz.,* alkaloids, terpenoids, phenols and flavonoids. The range of secondary metabolites in the *Ocimum* accessions were found to be 31.16-177.44 mg/g gallic acid equivalent for phenols, 3.23-34.78 mg/g quercetin equivalent for flavonoids, 11.67-77.33 mg/g for alkaloids and 216.67-350.00 mg/g for terpenoids as expressed in Table 1.

Accession EC388889(T1), expressed the least amount of phenolics (31.16 mg/g gallic acid equivalent) and accession IC201233(T12), showed the maximum amount of phenolics (177.44 mg/g gallic acid equivalent). None of the accessions had shown to contain higher phenolic content than the control *O. sanctum.* IC326735(T11), IC201233(T12), IC336833(T15) had more phenolic content than the control *Ocimum basilicum*. Accession EC388889(T1), contained the minimum flavonoids content of 3.23 mg/g quercetin equivalent, and accession IC201233(T12) contained the maximum flavonoids content of 34.78 mg/g quercetin equivalent among the test samples. None of the accessions contained higher flavonoids content than the control *O.sanctum*. Accession IC201233(T12) was on par with *Ocimum basilicum* for flavonoids.

Accession IC201233(T12) contained the least amount of alkaloids of 11.67 mg/g content while accession IC381552(T10) showed the highest concentration of 77.33 mg/g followed by the accession IC436153(T9) which had a concentration of 57 mg/g and were found to be higher than the controls. Accession EC388788(T3), contained the least amount of terpenoids (216.667 mg/g) while accession EC388890(T7), EC338785(T8), IC436153(T9), IC381552(T10) and IC469904(T14) contained the maximum terpenoids content (350 mg/g)and were found to be higher than the controls.

The 15 accessions under study exhibited good concentrations of the secondary metabolites estimated *viz.,* phenols, flavonoids, alkaloids and terpenoids. IC326735, IC201233 and IC336833 were found to be rich in phenolics and flavonoids. The total phenolic content in these accessions on an average was found to be 98.28 mg/g which is almost similar to the results obtained from a study on eight *Ocimum* species by Lukmanul Hakim *et .al.* [11]. Lamiacea family is found to be rich in phenolic acids which act as potent antioxidants and protects our system from the harmful effects of free radicals. The plants of genus *Ocimum* are rich in phenolic compounds and are very useful for their therapeutic potentials. They are widely used in traditional systems of medicine [12].

The concentration of flavonoids observed in this study was higher than that of the surface flavones observed in *Ocimum* cultivars by Rene´e Grayer *et al*. [13]. Accessions IC381552 and IC436153 showed higher concentrations of alkaloids. Accessions EC388890, EC338785, IC436153, IC381552 and IC469904 were found to be rich sources of terpenoids. The concentration of alkaloids, phenols and terpenoids in the accessions were found to be much higher than that reported in *Ocimum canum* Sims by Aluko *et al*., [14].

CONCLUSIONS

The economically important parts of *Ocimum* are their leaves and tender shoots [15] and they are used as pharmaceutical agents because of their antimicrobial, antiemetic, antidiabetic, antifertility, antiasthmatic, antistress, insecticidal, diuretic, expectorant, analgesic, hepatoprotective properties [12,16], as flavoring agents in soups, salads, confectionaries, cheese, meat, dental and oral products and as fragrances in perfumery [17; 18], herbal toiletries and aromatherapy treatment [19,20]. The reported accessions can hence be exploited for their medicinal and industrial properties. Purification of the metabolites can pave way for development of products.

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