Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Online International Journal Available at http://www.cibtech.org/jls.htm
2013 Vol. 3 (3) July-September, pp.521-525/Agarwal et al.
Research Article

AN ANALYSIS OF BASIL (*OCIMUM* SP.) TO STUDY THE MORPHOLOGICAL VARIABILITY

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ABSTRACT
Basil is an incredible herb, a member of the Lamiaceae, used both as a culinary and ornamental herb. The genus *Ocimum* contains between 50 and 150 species of herbs and shrubs. It has strongest medicinal use is as an antimicrobial and it is very high in vitamins and minerals. In this study, 16 accessions of basil were grown and maintained at day/night temperatures of 28-33 ^{0}C and 20-25 ^{0}C for analysis of quantitative characters and qualitative or phenotypic characters were measured before harvesting. The comparative study of *Ocimum* sp. was examined to assess the variability of qualitative and quantitative morphological characters present among the sixteen different genotypes of *Ocimum* species. This analysis of data showed that location had significant effect on all the 6 characters. The interaction between genotype and environment was also pronounced for all the characters.

INTRODUCTION
Basil (*Ocimum basilicum* L.) an annual herb belonging to the mint family has been cultivated for thousands of years and has become an essential ingredient in many cooking traditions. Basil is a member of the Lamiaceae, used both as a culinary and ornamental herb. The genus *Ocimum* contains between 50 and 150 species of herbs and shrubs (Bult and Kiang, 1992). It has strongest medicinal use is as an antimicrobial and it is very high in vitamins and minerals. Native to tropical parts of Asia, Africa, Central and South America, this easily grown tender leafy herb is primarily grown for its aromatic leaves which are used fresh or dried to liven up numerous culinary dishes. It is also known for its purifying and disinfecting properties (Fufa *et al.,* 2005). In India, basil is considered sacred and is cherished in almost every Hindu house. Basil can be used as an ointment for insect bites, and its oil is applied directly to the skin to treat acne among the plants known for medicinal value. The oil extracted from the leaves is reported to possess antibacterial and insecticidal properties, and is effective as a mosquito repellent. The aromatic compounds found in the essential oils of *Ocimum sanctum* are mainly the mono-terpenes, sesquiterpenes and phenols, alcohols, esters, aldehydes, ketones and others. In traditional system of medicine, different parts (leaves, stem, flower, root, seeds and even whole plant) of *Ocimum sanctum* Linn. have been recommended for the treatment of bronchitis, malaria, diarrhea, dysentery, skin disease, arthritis, eye diseases, insect bites and so on. The *O. sanctum* L. has also been suggested to possess anti-fertility, anticancer, antidiabetic, antifungal, antimicrobial, cardioprotective, analgesic, antispasmodic and adaptogenic actions. Eugenol (1-hydroxy-2-methoxy-4-allylbenzene), the active constituents present in *O. sanctum* L. have been found to be largely responsible for the therapeutic potentials (Priyabrata Pattanayak *et al.*, 2010). In ayurveda the *Ocimum sanctum* leaves, flowers and occasionally the whole plant is used medicinally in the treatment of heart and blood diseases, leucoderma, strangury, asthma, bronchitis, lumbago and purulent discharge of the ear. The leaf juice possesses diaphoretic, antiperiodic, stimulant and expectorant properties.

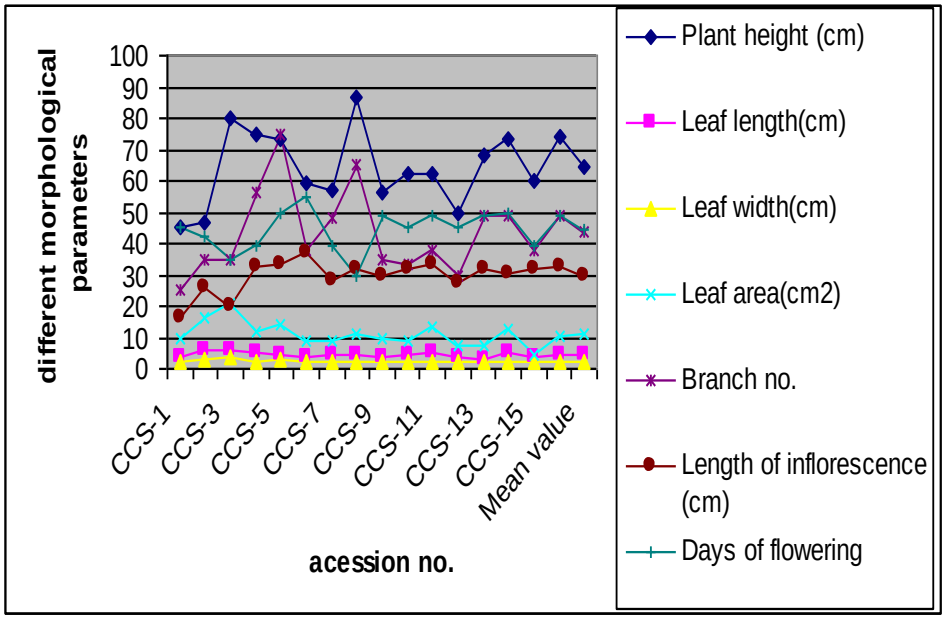
MATERIALS AND METHODS
Plant materials seed of 16 accessions of basil were collected from Department of Seed Science, C.C.S. University Meerut. Seed of all *Ocimum* sp. accessions were grown in a sterilized soil in pots and three seedlings of each accession were transplanted in to 8 litre pots and arranged in randomized complete block design and in three replicates. Green house plants were irrigated to pot capacity daily and

maintained at day/night temperatures of 28-33^{0}C and 20-25 ^{0}C. The quantitative charcters (days to flowering, plant height, branch no., and length of inflorescence) were measured before harvesting. Six qualitative or phenotypic characters (leaf shape, leaf margin, leaf color, leaf surface and flower color) were also recorded. The above ground biomass of each plant was harvested at full bloom, weighed, bulked, placed in a paper bag, and dried.

RESULTS AND DISCUSSION

Different accessions of ocimum was shown similar phenotypic characters like ovate shape, flat surface, entire margin of leaf, Green color of stem, bract and leaf and white color of flower. Some accession was shown lanceolate shape, undulate surface of leaf, purple color of stem, bract and pink color of flower.

Analysis of the data of the plant height varied from 86.5 cm (CCS-8) to 45.00 cm (CCS-1) with mean value 64.21. The number of primary branches per plant contributes for the herbage yield of plant. In overall analysis of the data of the locations, the number of primary branches per plant varied from 75 (CCS-5) to 25 (CCS-1) with mean value 43.62. The days to flower initiation in overall analysis of the data of the locations was varied from 55 (CCS-6) to 30 (CCS-8) with mean value 44.37. The leaf length of the plant was varied from 5.3cm (CCS-11) to 3.3cm (CCS-13) with mean value 4.40 was recorded in overall analysis. The leaf width of the plant was varied from 3.4 (CCS-3) to 2.1 cm(CCS-10) with mean value 2.4cm. The leaf area was varied from 4.4 cm (CCS-15) to 13.25cm^2 (CCS-5) with mean value 10.91cm^2 was recorded in overall analysis (shown by graph Figure).



The comparative study of *Ocimum species* was examined to assess the variability of qualitative and quantitative morphological characters present among the sixteen different genotypes of *Ocimum* species. Morphological characters were compared to estimate the biological diversity among different genotype under same climatic condition and location. It can be deduced from the findings that highly significant variations amongst the various characters existed in different genotypes of *Ocimum* species under present study. The overall analysis of data showed that location had significant effect on all the 6 characters. The interaction between genotype and environment was also pronounced for all the characters. Similar results were observed in some earlier studies involving different *Ocimum* species for different morphological traits such as plant height, fresh herb yield, and oil content, number of branches, leaf length, leaf width, and number of inflorescence reported by (Tepi *et al.*, 1991; Sarvin *et al.*, 1992; Szabo *et al.*, 1996; Verma *et al.*, 1989; Gupta, 1969).

Table 1: Study of phenotypic character of different species of *Ocimum*

Accession	Leaf Shape	Leaf Surface	Leaf Color	Leaf Margin	Stem Color	Bract Color	Flower Color	Plant height (cm)	Leaf length (cm)	Leaf width(cm)	Leaf area(cm2)	Branch no.	Length of inflorescence (cm)	Days of flowering
CCS-1	Ovate	Flate	Green	Entire	Green	Green	White	45.0	4.0	2.5	10.00	25	16.5	45
CCS-2	Ovate	Flate	Green	Entire	Green	Green	White	46.5	6.0	2.7	16.20	35	26.0	42
CCS-3	Ovate	Flate	Green	Entire	Green	Green	White	80.0	6.0	3.4	20.40	35	20.0	35
CCS-4	Lanceolate	Flate	Green	Entire	Green	Green	White	75.0	5.0	2.3	11.50	56	32.5	39
CCS-5	Ovate	Undulate	Green	Entire	Green	Green	White	73.0	4.8	2.9	13.90	75	33.0	50
CCS-6	Ovate	Flate	Green	Entire	Green	Green	White	59.0	3.5	2.5	8.75	38	37.0	55
CCS-7	Ovate	Flate	Green	Entire	purple	Puple	Pink	57.0	4.2	2.1	8.82	48	27.8	39
CCS-8	Ovate	Undulate	Green	Entire	purple	purple	Pink	86.5	4.5	2.5	11.25	65	32.0	30
CCS-9	Ovate	Undulate	Green	Entire	Green	Green	White	56.0	3.9	2.5	9.75	35	30.0	49
CCS-10	Ovate	Flate	Green	Entire	Green	Pale puple	Pink	62.0	4.1	2.1	8.61	33	32.0	45
CCS-11	Ovate	Flate	Green	Entire	Green	Green	White	62.0	5.3	2.5	13.25	38	33.5	49
CCS-12	Lanceolate	Flate	Green	Entire	Green	Green	white	50.0	3.8	2.0	7.60	30	27.5	45
CCS-13	Ovate	Flate	Green	Entire	Green	Pale purple	White	68.5	3.3	2.3	7.59	49	32.0	49
CCS-14	Ovate	Flate	Green	Entire	Green	Green	White	73.0	5.0	2.5	12.5	49	30.5	50
CCS-15	Ovate	Flate	Green	Entire	Green	Green	White	60.0	4.0	2.2	4.40	38	32.0	39
CCS-16	Ovate	Flate	Green	Entire	Green	Green	White	74.0	4.5	2.3	10.12	49	32.5	49
Mean								64.21	4.49	2.45	10.91	43.62	29.6	44.3

Conclusion

World plant biodiversity is the largest source of herbal medicine and still about 60 – 80 % world population rely on plant based medicines which are being used since the ancient ages as traditional health care system. It is now clear that, the medicinal value of these plants lies in the bioactive phytochemical constituents that produce definite physiological effects on human body. These natural compounds formed the base modern drugs as we use today. Phytoconstituents are the natural bioactive compounds found in plants (Javanmardi *et al.,* 2002). These phytoconstituents work with nutrients and fibers to form an integrated part of defense system against various diseases and stress conditions. Phytochemicals are basically divided into two groups, i.e. primary and secondary constituents; according to their functions in plant metabolism. Primary constituents comprise common sugars, amino acid, proteins and chlorophyll while secondary constituents consists of alkaloids, terpenoids, saponins, phenolic compounds, flavonoids, tannins and so on.

The morphological diversity within basil has been accentuated by centuries of cultivation with great variation in pigmentation, leaf shape and size (Aninymous, 1980). Using the morphological data in studying genetic diversity and taxonomic relationship of genotypes was previously scored for many plants (Bult *et al.*, 1992).

The unique chemistry of Tulsi is highly complex. Tulsi contains hundreds of beneficial compounds known as phyto-chemicals (Verma *et al.,* 1989). Working together, these compounds possess strong antioxidant, antibacterial, antiviral, adaptogenic, and immune-enhancing properties that promote general health and support the body's natural defense against stress and diseases (Fufa *et al.,* 2005). The essential oils in the leaves of Tulsi that contribute to the fragrance and refreshing flavor of Tulsi Tea, are a particularly rich source of valuable phyto-chemicals.

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