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Variability, Heritability and genetic advance in Tulsi (*Ocimum sanctum* L.)

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ABSTRACT

Heritability analysis was conducted for yield and its component traits in tulsi (*Ocimum sanctum* L.). Both additive and non-additive gene effects were present. Mean square due to lines, testers were also found significant for all the characters. In the investigation, a persual of heritability analysis indicated moderate to high heritability for almost all the characters under study. The characters with high heritability Dry herbage yield, spike length, plant height and Fresh herbage yield. As for as genetic advance is concern, the traits having high heritability coupled with high genetic advance is fresh herbage yield.

Key words : Variability, Heritability, Genetic advance, Tulsi

INTRODUCTION

Biodiversity is an important concept to understand the variation at genome or gene level, species level and Ecosystem level (Krishamurthy, 2003). Genomic variation or the genetic diversity analysis would be much appropriate to understand the genetic distance in particular species or across the species.

Ocimum sanctum distributed in entire Indian subcontinent, the species sanctum of the genus Ocimum grows in wide range rather than other species of this genus (Nadkararni and Nadkarni, 1976). *Ocimum tenuiflorum* L.f. is a synonymous name of *Ocimum sanctum* L. belongs to Lamiaceae family (Satyavati *et al.,* 1976), is a familiar medicinal plant and commonly known as 'Tulsi' in Hindi and "Holy Basil" in English is a herbaceous sacred plant of the Hindus and is worshipped in both homes and temples. *Ocimum sanctum* L. is held sacred by Hindus and is used as medicinal plants in day-to-day practice in Indian homes for various ailments (Pandey and Anita, 1970). *Ocimum sanctum* L. is aromatic herb, distributed throughout; this species is also known as Sri Tulsi and Tulsi plants with purple leaves known as Krishna Tulsi (Sarkar *et al.,* 1994). The plant is distributed in India up to an altitude of 1800m in Himalayas and in Andaman and Nicobar Islands. Different parts of the plant have been claimed to be valuable to cure wide spectrum of diseases. Several medicinal properties have been attributed to *Ocimum sanctum* L. according to Mandal *et al*. (1993).

The genus ocimum is an extremely versatile group consisting 160 species with a geographic distribution spread over the tropical, sub-tropical and temperate regions of both the hemisphere ranging from sea level to 1800 ft. The medicinal value of ocimum was recognised long ago not only in India but also in the ancient civilizations of china and other countries of west Asia, Europe and Africa. It was considered to be of great value as a medicinal and aromatic plants. The economically important part of ocimum is mainly its leaves and the tender parts of the shoots which yield essential oils.

Tulsi, The queen of herbs, the legandry 'Incomparable one' of India, is one of the holiest and most cherished of the many healing and healthy giving herbs of the orient. The sacred tulsi, tulsi is renewed for its religious and spiritual sanctity, as well as for its important role in the traditional Ayurvedic and Unani system of holistic health and herbal medicine of the East. Tulsi extracts are used in Ayurvedic remedies for common cold, headache stomach disorder, inflammation, heart disease, various forms of poisoning and Malaria.

Ocimum sanctum L. is an erect, much branded, tall with simple opposite green on purple leaves, that are strongly and hairy stems. Leaves have petiole and are ovate, up to 6 cm. long. It is cultivated for religious and medicinal purposes and for its essential oil. Tulsi is an important symbol in many Hindu religious traditions, which links the plant with Goddess. Tulsi contain vitamin C and A, Also enhance the efficient digestion, absorption and use of nutrients from food and other herb. The chemical composition of tulsi is highly complex, containing many nutrients and biologically active compounds. The nutritional and pharmacological properties of the whole herb in its natural form, as it has been traditionally used.

MATERIALS AND METHODS

Fourteen ocimum genotype namely Ec-338785, EC-

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388895, EC-368890, EC-387838, EC-388788, EC-312264, EC-388891, EC-174527, IC-112607, IC-210757, IC-3871552, IC-369153, EC-338773 were grown in a Randomized Block Design with three replications at the Research farm of C.C.R. P.G. College MZN, U.P., during *Kharif* season of 2005-2006. Each genotype was assigned in two row plot of 3m length and row to row and plant to plant spacing was kept at 45 and 30 cm., respectively. Observations for ten characters were recorded namely. number of primary branches, days to flower, spike per plant, spike length, number of flower whorls / spike, plant height (cm), fresh herbage yield, dry herbage yield, seed yield per plant, 1000-seed weight.

RESULTS AND DISCUSSION

The mean sum of square due to genotypes were significant for all the characters except no. of primary branches indicating that the variation was genetic. It is indicated that environment variance was less than genotypic and phenotypic variance for each character. Maximum variance (phenotypic and genotypic) was exhibited by spike length, 1000-seed weight and days to flower. However, variability for different characters was reported by Ahmad and Khaliq (2002). The minimum variance was recorded for number of primary branches and fresh herbage yield. Results on these aspects were reported by Szabo *et al*. (1996).

Genotypic co-efficient of variation (GCV) was less as compared to that of phenotypic co-efficient of variation for all the characters and these findings are in close to the observations. The GCV and PCV values were found to be very distant to each other for most of the characters.

Table 1: Mean performance of parental lines for yield contributing traits

Sr. No.	Genotypes	No. of primary branches	Days to flower	Spike per plant	Spike length	No. of flowers whorls per spike	Plant height (cm)	Fresh herbage yield	Dry herbage yield	Seed yield per plant	1000-seed weight
Female parent											
1.	EC-838785	15.67	43.67	18.00	25.70	20.97	52.67	271.33	62.53	24.00	1.93
2.	EC-388895	17.00	45.33	19.00	22.47	29.30	58.67	289.33	65.37	22.33	1.97
3.	EC-388890	14.01	42.33	15.00	25.07	28.53	60.67	292.33	67.30	25.33	1.87
4.	EC-387838	13.33	45.00	13.63	21.60	29.40	59.00	311.33	70.67	27.33	1.63
5.	EC-388788	17.00	46.67	17.17	21.87	20.37	50.33	273.00	63.53	24.67	1.40
6.	EC-312264	18.33	43.67	18.50	22.97	21.63	54.00	317.33	75.60	30.33	2.13
7.	EC-388891	19.33	46.33	19.33	23.83	25.23	56.67	324.33	75.00	25.33	1.90
8.	EC-112548	17.67	49.33	18.37	25.93	26.20	58.33	346.33	84.37	23.33	1.53
9.	EC-174527	17.00	48.67	17.10	27.47	23.27	52.00	324.00	76.10	31.00	1.87
	Mean	16.59	45.67	17.34	24.10	24.99	55.82	305.48	71.16	25.96	1.80
Male parent											
1.	IC-112607	14.78	35.33	17.60	22.97	21.40	45.00	328.00	77.37	31.67	1.83
2.	IC-210757	14.74	37.33	23.00	24.50	25.03	53.67	287.67	67.60	26.67	1.43
3.	IC-381552	15.44	42.00	19.97	17.074	26.60	57.33	249.33	59.37	24.67	1.30
4.	IC-369153	15.15	43.00	22.87	21.10	28.71	57.00	280.33	68.93	26.00	1.20
5.	EC-338773	16.17	45.33	21.00	18.80	26.27	60.33	264.00	64.37	26.00	1.93
	Mean	15.26	40.60	20.89	20.89	25.60	54.67	281.87	67.53	27.00	1.54

Table 2 : Heritability, genetic advance, GCV and PCV in Ocimum

Sr. No.	Characters	Heritability	Genetic advance	Genetic advance as percent of mean	Genotypic co-efficient variation	Phenotypic co-efficient variation
1.	No. of primary branches	54.9	2.32	15.10	9.80	13.22
2.	Days to flower	94.1	6.27	15.03	74.44	7.67
3.	Spike per plant	90.8	6.44	33.16	17.02	17.85
4.	Spike length	97.1	5.93	23.49	11.79	11.96
5.	No. of flowers whorls/spike	88.6	5.91	25.44	12.37	13.14
6.	Plant height (cm)	96.2	14.22	22.88	11.59	1.82
7.	Fresh herbage yield	96.2	67.34	22.17	1.04	11.26
8.	Dry herbage yield	99.1	17.56	24.18	1.91	11.96
9.	Seed yield per plant	80.6	5.96	20.83	11.47	12.78
10.	1000-seed weight	67.4	0.39	22.03	13.29	16.19

Hammer *et al.* (1996) reported wide range of difference for growth characteristics and yield component with in the different species and races. The characters like number of primary branches, fresh herbage yield, dry herbage yield which possess moderate value of GCV and PCV can also be considered for selection. Number of primary branches showed low values of GCV and PCV. However, great variation for Days to flower was reported of Verma *et al.* (1989).

According to Johnson *et al*. (1955), genetic advance as per cent of mean depends upon selection differential, genetic co-efficient of variation and heritability ratio. The heritability values estimated in the present study are expressed in broad sense. Broad sense, heritability, however, gives only a rough estimate. Morever, broad sense heritability and narrow sense heritability are generally negatively co-related (Kempthorne, 1957). If heritability was mainly due to additive effects, it would be associated with high genetic gain and if it is due to non-additive, genetic gain would be low (Panse, 1967) only four characters namely, dry herbage yield, spike length, plant height and fresh herbage yield showed high heritability. The high heritability indicated that the characters were less influenced by the environment. Ahmad and Khaliq (2002) also estimated heritability for important morphological trusts.

Characters such as days to flower, spike per plant number of flowers / spike, and dry herbage yield showed moderate GCV also showed moderate and high heritability. Table 2 reveals that all the 4 characters. showed high heritability but they did not show equally high genetic advance. Johnson *et al.* (1955) suggested that characters with high heritability coupled with high genetic advance would respond to selection better than those with high heritability and low genetic advance.

The characters like fresh herbage yield, dry herbage yield and plant height showed both high heritability as well as high genetic advance could be improved through either pure line selection or simple mass selection Moderate heritability and low genetic advance was observed for 1000-seed weight. It is indicated that these parameters are governed by additive gene action and could be equally improved through selection on the other hand, if the character exhibited high heritability with low genetic advance indicated that these characters were governed by non-additive genes and selection would not be effective for these characters.

Fresh herbage yield and dry herbage yield had high GCV, heritability and genetic advance (as present of mean). This indicated that these characters were governed by additive gene effects and could be improved through selections effectively. On the other hand, 1000-seed weight exhibited low GCV and genetic advance with moderate heritability indicating non-additive gene effects and for improving this character heterosis breeding or recurrent selection should be followed. Genotypes which exhibited both high variability along with high genetic advance for certain characters may be evaluated in multi-location trials and isolated as donors for these characters or used as parents in hybrid development.

Conclusion :

The results obtained from the present study are :

Significant differences were observed among the genotypes for all the characters. Genetic variability was maximum for days to flower and minimum for number of primary branches, as reflected by their genotypic co-efficient of variations.

The heritability estimates in broad sense were high for dry herbage yield, fresh herbage yield and plant height, while moderate heritability were observed for days to flower, spike length and spike per plant. No. of primary branches showed lowest heritability.

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