Assessment of Variability Parameters for Agro-morphological and Phyto-chemical Traits in Basil (*Ocimum basilicum* L.) Germplasm

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(Received: 21 August 2010; Revised: 13 September 2010; Accepted: 11 November 2010)

The variability parameters *viz*., genotypic coefficients of variation (GCV), phenotypic coefficients of variation (PCV), heritability and genetic advance were studied for agro-morphological and phyto-chemical traits in 30 genotypes of basil during *kharif* 2004 and 2005. Tremendous variability was observed for agro-morphological as well as phyto-chemical characters. The high and medium values of GCV and PCV for seed yield/plant and spike length respectively, showed presence of maximum amount of variability in the germplasm. High heritability estimates were observed for seed yield/plant, leaf stem ratio, 1000 seed weight and plant height. These attributes may be improved further by selection. The estimates of high genetic advance were observed for fresh herbage yield per plant, seed yield per plant, plant height and dry yield/plant. The genetic advance as percentage of mean was recorded high for characters like leaf-stem ratio and spike length. The high estimates of genetic advance coupled with high heritability estimates for seed yield/plant, leaf stem ratio and plant height may be helpful in formulating the selection criteria for improvement of this important medicinal plant.

Key Words: Basil, Coefficient of Variation, Genetic Advance, Genotypic Coefficient of Variation, Medicinal plant, Phenotypic Heritability

Introduction

Basil *(Ocimum basilicum* L.*)* is a globally important plant and grown since times immemorial due to its medicinal, culinary and other properties. The genus *Ocimum* belongs to family Lamiaceae having around 160 species widely distributed throughout the country from tropical areas to 1800 m in the Himalayas region (Balyan and Pushpangadan, 1988). At global level, it is distributed and grown in Arabia, Australia, Brazil, Egypt Malaya, Nepal, Iran, Philippines and Western Asia (MGrieve, 1992; Pushpangadan and Bradu, 1995; Bhattacharjee, 1998; Verma *et al.*, 1998; Pandey and Chowdhary, 2002). The role of genetic variability is well documented in crop improvement. The selection of the best genotypes for the desirable traits from the variable populations is important for making rapid improvement of the plant. The selection of the potential parents from the variable populations is also important for their use in crossing for further improvement. Genotypic and phenotypic coefficient of variability helps to access the magnitude of variability in population. Selection would be more effective for the traits which exhibit high variability and heritability along with moderate to high genetic gain. Keeping in view of the above, an attempt was made to analyze the variability parameters for agro-morphological and phyto-chemical parameters of basil germplasm. Realizing the importance of crop, the desired variability for different agronomic traits coupled with quality parameters have been identified for further improvement. The studies will be helpful and of practical significance to the plant breeders to achieve the desired level of improvement in this important medicinal plant.

Materials and Methods

Thirty accessions of basil were augmented from different sources. These comprised of 20 accessions of exotic origin (EC) from five countries (USA-10, USSR-07, Poland-01, Hungary-01 and Germany-01) and rest were indigenous collections (IC) representing the maximum variability by taking into consideration their place of origin (Madhya Pradesh-06, Gujarat-02, Andhra Pradesh-01 and Uttar Pradesh-01). The experimental material was grown in nursery and transplanted in a randomized block design (RBD) with three replications during *kharif* 2004 and 2005 at National Bureau of Plant Genetic Resources (NBPGR) Experimental Farm, Issapur, New Delhi, (latitude 28°36′N, longitude 76°50′E) and at Research Farm, Janta Vedic College Baraut, Baghpat, UP (latitude 29°06′N, longitude 77°15′E). Three rows of each accession/row were transplanted with row to row and plant to plant spacing of 45 and 30 cm, respectively. Observations were recorded

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on five randomly selected plants in each genotype for 16 characters *viz.*, number of primary branches/plant, lamina length (cm), lamina width (cm), leaf-stem ratio, days to flower initiation, number of spikes/plant, spike length (cm), number of flower-whorls/spike, plant height (cm), fresh herbage yield/plant (g), dry herbage yield/plant (g), days to seed maturity, seed yield/plant (g), 1000-seed weight (g), essential oil content (%), and essential oil yield/plant (ml). The Genotypic and phenotypic coefficients of variances were estimated according to Burton and DeVane (1953). Heritability in broad sense was calculated as ratio between genotypic variance to the total phenotypic variance and expected genetic advance was defined as the difference between mean of the progeny of selected individuals and base population as suggested by Johnson *et al*. (1955).

Results and Discussion

Greater variability in the base material ensures higher chances of getting the genotypes of desired traits. The estimates of genetic parameters of variability, *viz.*, genotypic coefficients of variation (GCV) and phenotypic coefficients of variation (PCV), heritability in broad sense (h^2) and genetic advance (GA) along with genetic advance as % of mean for different characters is presented in Table 1. The data revealed that there were significant differences among accessions for various agro-morphological and phyto-chemical traits. In overall pooled analysis of the data of both the locations, the high values of GCV for seed yield/plant (50.37) and leaf-stem ratio (29.75); medium values of GCV for spike length (19.73), essential oil yield/plant (12.98), plant height (12.82), fresh herbage yield/plant (11.48), essential oil content (11.46), 1000-seed weight (11.36) and dry herbage yield/plant (11.26) were recorded. The details of the same are presented in Fig. 1.

Similarly, the high values of PCV were observed in seed yield/plant (50.62) and leaf-stem ratio (30.18). Medium values of PCV were observed in spike length (21.80), essential oil yield/plant (19.26), essential oil content (17.98), plant height (14.22), dry herbage yield/plant (13.29), fresh herbage yield/plant (12.93), number of spikes/plant (12.20) and 1000-seed weight (11.60). The details of the same are presented in Fig. 2.

Heritability (bs) is an important selection parameter because it helps in selection of elite genotypes from genetically diverse population. Over all pooled analysis of the data recorded at both the locations revealed that highest heritability estimate was found in seed yield/plant (99.0%) followed by leaf-stem ratio (97.2%), 1000-seed weight (95.8%), spike length (81.9%), plant height

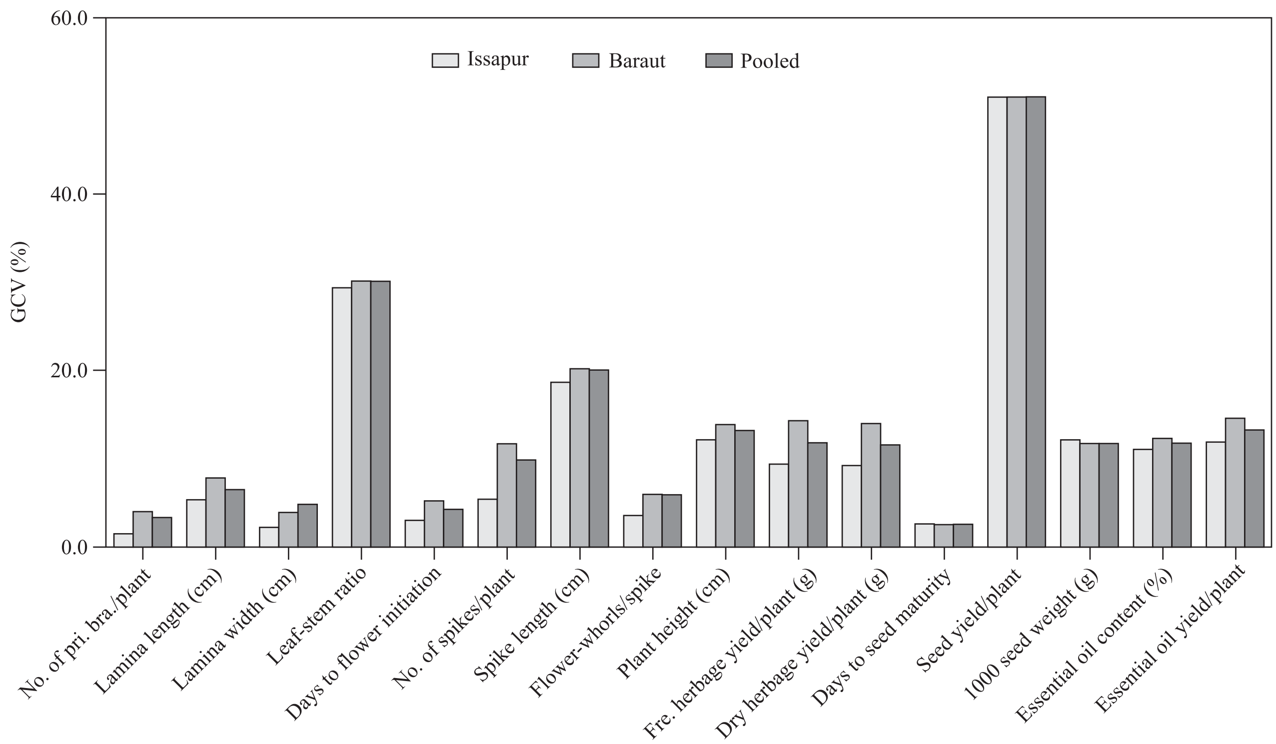

Fig. 1. Genotypic coefficients of variation in 30 accessions of basil

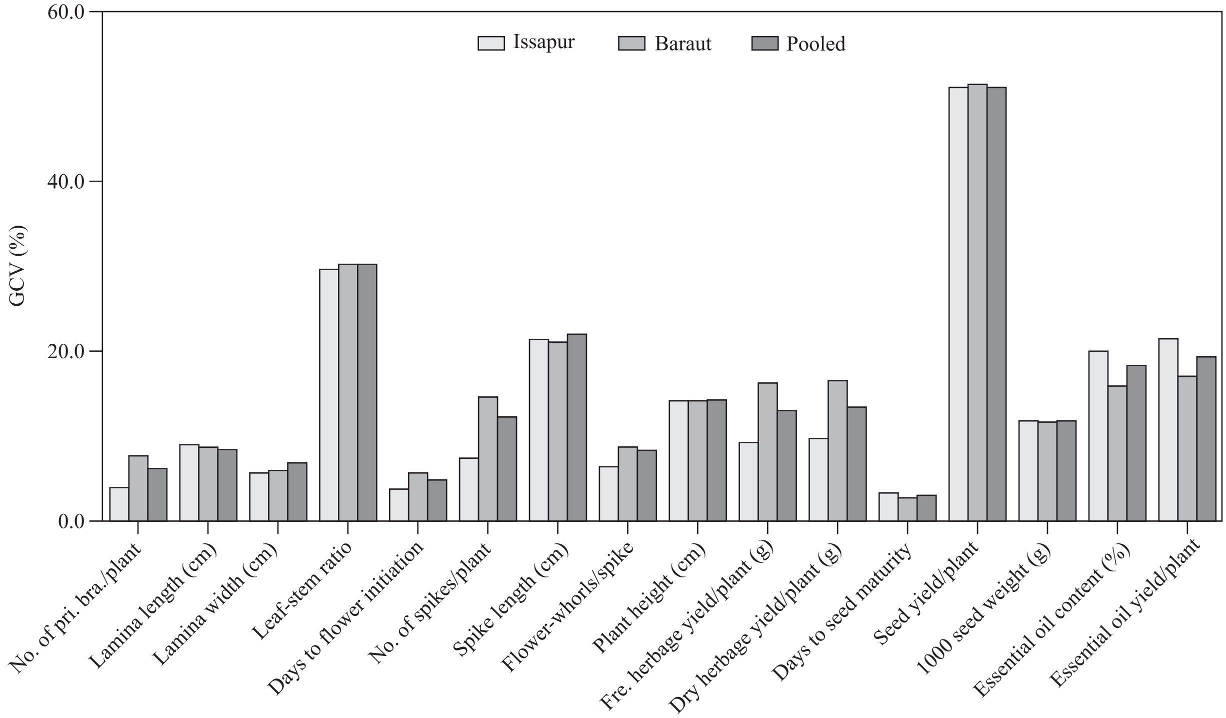

Fig. 2. Phenotypic coefficients of variation in 30 accessions of basil

(81.3%), fresh herbage yield/plant (78.9%), dry herbage yield/plant (71.8%) and days to flower initiation (71.4%). Moderate heritability estimates were observed for number of spikes/plant (62.6%), days to seed maturity (59.8%) and lamina length (53.0%). Low heritability estimates were observed in number of flower-whorls/spike (48.7%), lamina width (46.7%), essential oil yield/plant (45.4%), essential oil content (40.6%) and number of primary branches/plant (27.1%). The details of the same are presented in Fig. 3.

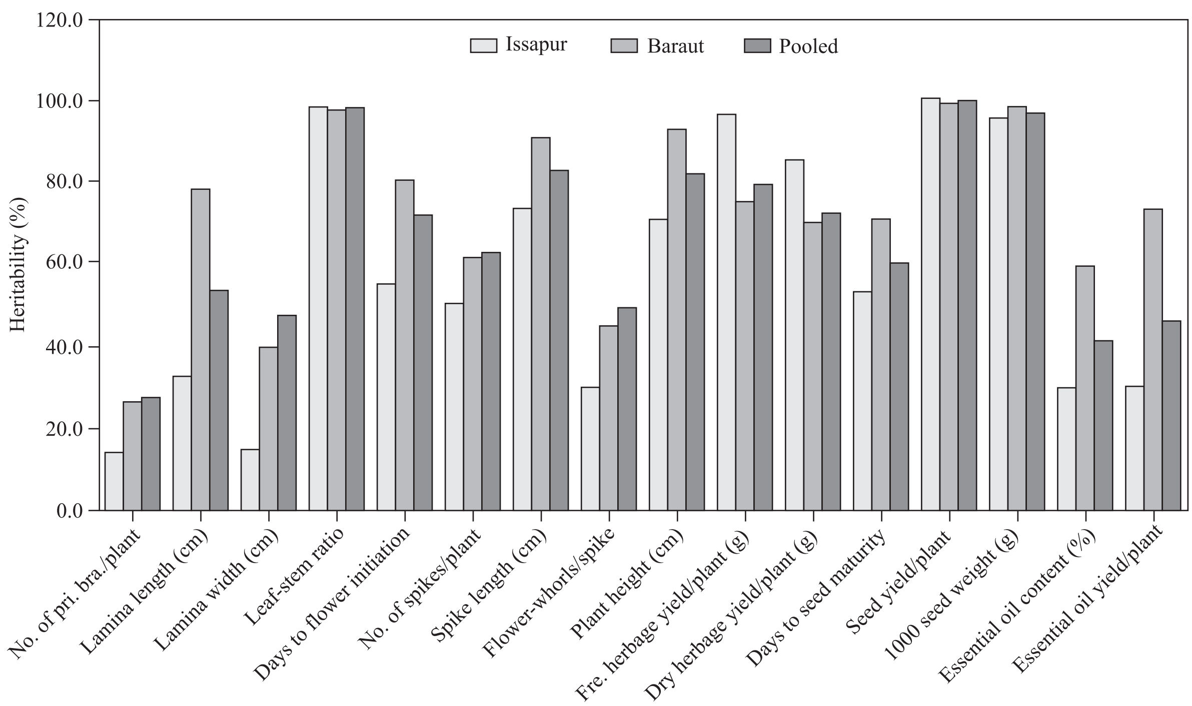

Fig. 3. Heritability (bs) in 30 accessions of basil

Genetic advance is also an important selection parameter. The estimates of genetic advance for various characters studied are presented in Table 1. Overall pooled analysis of the data of both the locations showed that the highest genetic advance was obtained in fresh herbage yield/plant (61.14). Seed yield/plant (21.34), followed by plant height (12.89), dry herbage yield/plant (12.47) and number of spikes/plant (10.97) showed the moderate estimates of genetic advance. For remaining characters the genetic advance was low which ranged from 0.03 to 6.08. The details of the same are presented in Fig. 4.

The results of genetic advance as per cent of mean revealed that overall pooled analysis of the data for both the locations revealed that the highest genetic advance as

Table 1. Variability parameters for 16 characters in 30 basil germplasms

S.No.	Character(s)	Range	SEm ±	GCV	PCV	Heritability (%)	Genetic advance	Genetic advance as % of mean
1.	No. of primary branches/plant	10.63–12.98	0.26	3.31	6.35	27.1	0.42	3.57
2.	Lamina length (cm)	4.42–5.89	0.12	6.44	8.52	53.0	0.48	9.74
3.	Lamina width (cm)	2.60–2.82	0.06	4.79	7.00	46.7	0.18	6.64
4.	Leaf–stem ratio	0.59–1.67	0.02	29.75	30.18	97.2	0.60	60.61
5.	Days to flower initiation	60.28–72.82	0.68	4.11	4.86	71.4	4.58	7.15
6.	No. of spikes/plant	54.55–82.18	2.12	9.65	12.20	62.6	10.97	15.73
7.	Spike length (cm)	10.55–23.91	0.63	19.73	21.80	81.9	6.08	36.76
8.	No. of flower–whorls/spike	10.85–15.28	0.30	5.77	8.27	48.7	1.04	8.29
9.	Plant height (cm)	44.95–81.70	1.36	12.82	14.22	81.3	12.89	23.81
10.	Fresh herbage yield/plant (g)	223.58–346.25	7.05	11.48	12.93	78.9	61.14	21.01
11.	Dry herbage yield/plant (g)	49.16–75.78	1.83	11.26	13.29	71.8	12.47	19.67
12.	Days to seed maturity	153.58–167.33	1.22	2.29	2.96	59.8	5.79	3.65
13.	Seed yield per plant	10.41–44.65	0.43	50.37	50.62	99.0	21.34	103.24
14.	1000 seed weight (g)	1.10–1.69	0.01	11.36	11.60	95.8	0.32	23.02
15.	Essential oil content (%)	0.14–0.23	0.01	11.46	17.98	40.6	0.03	16.67
16.	Essential oil yield/plant	0.39–0.71	0.03	12.98	19.26	45.4	0.10	18.87

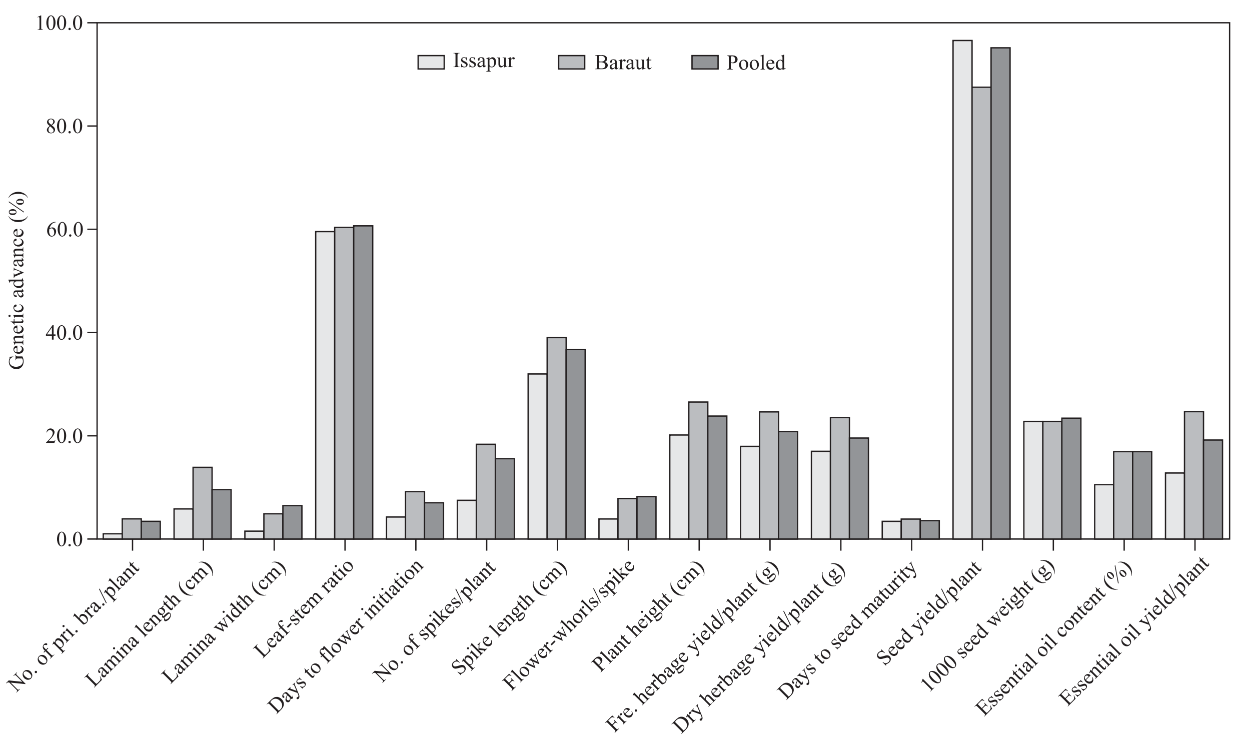

Fig. 4. Genetic advance (%) in 30 accessions of basil

per cent of mean was observed in seed yield/plant (103.29) followed by leaf-stem ratio (60.61). Moderate genetic advance as per cent of means were observed in spike length (36.76), plant height (23.81), 1000-seed weight (23.02), fresh herbage yield/plant (21.01), dry herbage yield/plant (19.67), essential oil yield/plant (18.87), essential oil content (16.67) and number of spikes/plant (15.73). Whereas low values of genetic advance as per cent of means were recorded for number of primary branches/plant (3.57), days to seed maturity (3.65), days to flower initiation (7.15), number of spikes/plant (8.29) and lamina length (9.74).

Thus, information regarding the variability, genotypic and phenotypic coefficient of variation, heritability and genetic advance would be useful in developing reliable selection indices. The desired variability for different agro-morphological traits along with phyto-chemical parameters have been identified for further improvement. As plant height, fresh herbage yield/plant and seed yield/plant recorded higher estimates for genetic heritability and genetic advance, selection for there traits would be more effective. These studies will be helpful and practical use to the plant breeders and to achieve the desired level of improvement in this important but neglected medicinal plant.

Acknowledgements

The authors are grateful to the Director, NBPGR; Head, Division og Plant Exploration & Germplasm Collection and Head, Germplasm Evaluation Division of, National Bureau of Plant Genetic Resources, New Delhi. Thanks are also due to the Principal, JV College Baraut, District Baghpat, Uttar Pradesh, for providing facilities and suggestions from time to time.

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