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Agro-morphological diversity in coriander (*Coriandrum sativum* L.) germplasm

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Coriander (*Coriandrum Sativum* L.) is an important seed spice crop of Apiaceae (Umbelliferae) family. It is native to the Mediterranean region having wide spread cultivation across the world for its green leaves, seeds and essential oil. In India, coriander is cultivated both for its seed and leaves, the area under coriander for seed purpose is highly concentrated in the south eastern Rajasthan *i.e.,* Agro-climatic Zone-V of the State covering districts of Kota, Baran, Bundi and Jhalawar. It's also cultivated in other states *viz.,* Madhya Pradesh, Andra Pradesh and Tamil Nadu. In Rajasthan, early type of coriander cultivars with low biomass and medium to bold seed size is commonly grown. Genetic improvement of coriander is very much required for developing better varieties having high yield and essential oil content. Variability and diversity assessment for the agro-morphological traits is of utmost importance for initiating any crop improvement programme (Singh *et. al.*, 4). Germplasm collection and its evaluation are to be conducted over years for precise assessment and validation of the genotypic performance.

At Agricultural Research Station, Kota germplasm set of coriander is being maintained, from the set 162 genotypes including popular varieties were evaluated for a period of four years from 2006-07 to 2009-10 during rabi season at the station in a non-randomized design. Variability parameters were recorded 10 traits *viz.,* day to 50 % flowering, plant height, number of primary branches, number of secondary branches, number of umbel per plant, number of umbellates per plant, days to maturity, test weight, seed yield per plant and essential oil percentage on five randomly selected plant. All recommended package of practices were followed for raising the crop. The data collected for each trait was analysed, average performance of each genotype over four years period was calculated and further based on the average value genetic diversity index was estimated using the NTSYSpc ver 2.01e (Rohlf, 3). Intra and inter cluster distance was calculated based on the distance coefficient and UPGMA dendrogram obtained by using the SHAN sub- programme of the software.

In the set of 162 coriander genotypes ample amount of diversity was observed for all the traits. Based on the data analysed for Euclidean distance, presence of high diversity in the set of the genotypes was reflected. The set of genotypes were distributed in ten clusters (Fig.1). Cluster I was the largest comprising of 118 genotypes, followed by Cluster VI (17 genotypes) and Cluster III (10 genotypes), cluster V, VII, IX and X comprised only of one genotype. Based on the distance coefficient the maximum distance (80.58) was observed between LGC 146 and LGC 2 whereas, minimum distance (1.55) was between LGC 45 and LGC 62. Cluster mean values (Table 1) for each trait were estimated to know the average performance of each cluster. Both intra and inter cluster distance were also calculated (Table 2), the range of variation observed for each trait over across the set of genotypes was recorded maximum for umbellate per plant *i.e.,* 11.20 (LGC 146) to 84 (LGC 2), essential oil percentage i.e., 0.04 (DH 219) and 0.42 (LGC 149) and seed yield per plant i.e., 0.82 (DH 219) to 3.89 (LGC 18). Whereas, minimum range of variation was observed for days to 50 % flowering ie., 63.25 (LGC 30) to 73.25 (UD 796), the set of germplasm is a collected from Rajasthan Agro-climatic Zone- V where mostly farmers grow the early type which was the main reason for lower range of variation for the trait days to 50 % flowering. Mean performance of each cluster was also compared, emphasising on most economic traits, cluster X ranked first for seed yield per plant (3.87 g) and cluster III ranked first for essential oil percentage (0.35). Genotypes of both these clusters (X & III) can be effectively used for developing cultivars with high yield and high essential oil content. In coriander the extent of variability found is high as reported to be high (Singh *et al.,* 4; Dyulgerov and Dyulgerov, 1; Fufa, 2)

Based on the present estimation obtained for the extent of diversity among the set of coriander genotypes it's clearly visible that ample amount of diversity exists for most of traits. The diverse genotypes can be effectively utilized in genetic improvement of coriander following

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Table 1: Cluster Mean performance for the traits studied in coriander germplasm over years

Details	No of genotypes in cluster	DF50%	PH	DM	PB	SB	UMP	UMPU	EO	TW	SY/P
Cluster-I	118	67.09	80.26	102.52	3.43	5.26	11.08	44.4	0.27	11.26	1.71
Cluster-II	07	67.75	88.03	103.48	3.34	4.71	11.86	52.62	0.27	11.77	1.93
Cluster-III	10	67.80	76.61	103.73	2.93	4.36	8.68	27.98	0.35	11.25	1.66
Cluster-IV	04	70.25	75.68	114.31	3.78	5.58	12.49	43.89	0.25	9.37	1.86
Cluster-V	01	67.75	71.1	100.63	3.73	6.29	20.6	84	0.34	10.83	2.97
Cluster-VI	17	67.13	82.48	101.6	3.67	5.79	15.63	59.87	0.26	11.32	2.07
Cluster-VII	01	65.25	86.7	100.63	2.95	4.13	8.8	55.27	0.3	16.8	2.11
Cluster-VIII	02	72.25	86.8	118.63	3.65	5.11	7.63	53.82	0.29	11.07	1.13
Cluster-IX	01	66.25	90.3	99.63	3.17	5.46	16.6	52.8	0.4	12.52	2.54
Cluster-X	01	67.25	76.3	100.625	2.77	3.496	23	74.8	0.34	13.2	3.87
Overall Mean	-	67.30	80.59	102.98	3.42	5.23	11.59	45.40	0.27	11.29	1.78
Minimum (Genotype)	-	63.25 (LGC-30)	63.50 (RCr436)	94.63 (LGC6)	2.00 (LGC30)	2.82 (LGC46)	5.80 (UD796)	11.20 (LGC146)	0.04 (DH219)	6.07 (CS2)	0.82 (DH219)
Maximum (Genotype)	-	73.25 (UD796)	106.10 (LGC147)	121.13 (UD728)	5.63 (LGC11)	8.22 (LGC11)	26.60 (LGC138)	84.00 (LGC2)	0.42 (LGC149)	17.80 (LGC146)	3.89 (LGC18)

Table 2: Intra and inter cluster distance estimated among the cluster depicting diversity among the coriander germplasm

Clusters	I	II	III	IV	V	VI	VII	VIII	IX	X
I	**46.70**	1.74	4.65	6.53	11.04	11.04	11.04	21.20	69.12	69.12
II	-	**75.23**	4.65	6.53	11.04	11.04	11.04	21.20	69.12	69.12
III	-	-	**21.20**	6.53	11.04	11.04	11.04	21.20	69.12	69.12
IV	-	-	-	**34.85**	11.18	11.18	11.18	21.34	69.26	69.26
V	-	-	-	-	**0.00**	4.94	4.94	21.78	69.70	69.70
VI	-	-	-	-	-	**11.03**	0.58	21.78	69.70	69.70
VII	-	-	-	-	-	-	**0.00**	21.78	72.6	72.6
VIII	-	-	-	-	-	-	-	**9.44**	71.73	71.73
IX	-	-	-	-	-	-	-	-	**0.00**	20.33
X	-	-	-	-	-	-	-	-	-	**0.00**

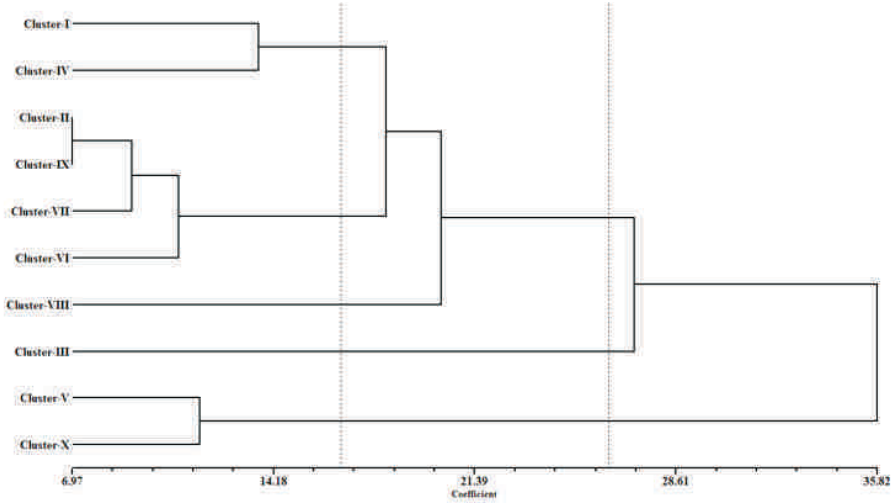

Fig 1: Dendrogram showing the Euclidian distance among the coriander genotypes

mass selection or recurrent selection to develop genotypes with high yield and essential oil.

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