International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor (2018): 7.426

Assessment of Genetic Variability in Coriander (*Coriandrum sativum L.)*

Patel D. G[1], Patel P. R.[2], Patel H. B.[3], Patel A. M. Patel[4]

[1]Agroforestry Research Station, S.D. Agricultural University, Sardarkrushinagar-385 506, Gujarat, India
[2]Pulses Research Station, S.D. Agricultural University, Sardarkrushinagar-385 506, Gujarat, India
[3, 4]Main Spices Research Station, S.D. Agricultural University, Jagudan-382710, Gujarat, India

Abstract: ***Thirty genotypes of coriander were evaluated for estimates of variability, heritability and genetic advance in ten quantitative traits, viz., plant height, number of branches per plant, days to 50% flowering, days to maturity, number of umbels per plant, number of umbellete per umbel, number of seeds per umbellete, thousand seed weight, volatile oil content in seed and seed yield per plant. The analysis of variance indicated that presence of considerable amount of diversity in the material. Phenotypic coefficients in variations were of higher magnitude than that of genotypic coefficient of variations for all the traits. The highest GCV and PCV were observed for seed yield per plant (30.82 and 31.91%) and volatile oil content in seed (22.42 and 25.31%). High estimates of heritability was observed for thousand seed weight, plant height, days to 50% flowering, days to maturity, seed yield per plant, number of seeds per umbellete and number of umbels per plant. Genetic gain varied from 16.74 % for days to maturity to 61.31% for seed yield per plant. Better gains were also recorded for volatile oil content in seed, number of umbels per plant and number of seeds per umbellete. The high estimation of GCV, PCV, heritability and genetic gain for the different traits suggesting probable role of additive gene effects on character expression.***

Keywords: Coefficient of variation, Coriander, Genetic gain, Heritability

1. Introduction

Coriander (*Coriandrum sativum* L.) is an important seed spice crop mainly cultivated in the states of Gujarat and Rajasthan with a sizable acreage in Madhya Pradesh, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh and Bihar. The area of coriander in the country is about 6.04 lakh hectare, while production is about 4.45 lakh tonnes. The area under this crop has gone up from 3.31 lakh hectare (2002-03) to 6.04 lakh hectare (2014-15) but the productivity of the crop is not improved, Information on heritability, genetic advance and variability are important, since these provide basis for improving efficiency of hybridization and handling of segregating populations by selection. Such information on coriander is very limited. Hence, the present investigation was carried out to study the nature and extent of genetic variability, heritability and genetic advance for ten characters in thirty genotypes of coriander.

2. Materials and Methods

The experiment was conducted at Main Seed Spices Research Station, S. D. Agricultural University, Jagudan during rabi 2015-16. Thirty genotypes of coriander collected from different part of the country were grown in a randomized block design with two replications. The seeds of coriander genotypes were sown with a spacing of 30 x 10 cm and recommended cultural practices were followed. The observations were recorded on ten quantitative characters on five randomly selected plants of each genotype in each replication. The data were subjected to statistical analysis as per the method described by Panse and Sukhatme (1961). The variance components and coefficient of variance determined according to Burton (1952). The heritability (broad sense) was calculated using formula proposed by Hanson et al. (1956) and expected genetic advance was worked out by Johnson et al. (1955).

3. Results and Discussion

The results of the analysis of variance indicated that the mean squares due to genotypes were significant for all characters studied (Table 1). The range for seed yield per plant was 4.71–21.21 g with mean value of 14.28 g (Table 3). Genotype COR 95 gave the highest seed yield per plant (21.21 g) followed by genotypes COR 96 (20.83 g), COR 98 (20.81 g) and COR 107 (20.29 g). The lowest seed yield per plant was registered for COR 121 (4.71 g) followed by COR 120 (6.08 g). Bhandari and Gupta (1993) reported lower seed yield per plant range (0.1–5.9 g) in Indian coriander genotypes. Similarly Singh et al. (2006) reported 1.05–14.83 g range for seed yield per plant in 360 Indian coriander genotypes and Geremew Awas et al. (2015) reported 1.5–14.5 g range for seed yield per plant in eight Ethiopian coriander genotypes which agrees with the current findings.

The variation with respect to plant height ranged from 54.70–99.30 cm, showing broad variability among the genotypes. Genotype COR 110 gave the highest plant height (99.30 cm) followed by COR 95 (92.50 cm) and COR 98 (92.30 cm), while COR 102 gave the lowest plant height (54.70 cm) followed by COR 101 (57.40 cm). Similar ranges were reported by Diederichesen (1996) and Peter (2004) in coriander. Mengesha (2008) also reported plant height range from 49.65–97.30 cm in 49 coriander genotypes. Geremew Awas et al. (2015) also reported 22.4 -83.8 range for plant height in eighty coriander genotype.

The variation in number of branches per plant ranged from 3.90-6.20. Genotype COR 95 gave the highest number of branches per plant (6.2), followed by COR 98 , COR 96 and COR 105 (6.1,6.0 and 6.0, respectively).Genotype COR 97 and COR 115 gave minimum number of branches per plant (4.4) followed by COR RCr 728 and COR 116(4.5 and 4.7, respectively). The variation in number of umbels per plant ranged from 12.00-26.00 showing wide

variability among the genotypes for this character. Genotype COR 95 gave the highest number of umbels per plant (26.00), followed by COR 98 and COR 96 (25.1 and 23.7, respectively). Similar findings were also reported Rajput and Singh (2003), Vijay Gupta (1993) and Geremew Awas et al. (2015). Days to 50% flowering ranged from 46.5 (COR) to 69.5 days (Hisar Anand) followed by COR 114 and COR 115 (68.5 days). While days to maturity ranged from 96.50 (COR 101) to 128.50 days (COR 114 and COR 115) followed by COR 110 and Hisar Anand (127 days) and COR 109 (126.5 days). Bhandari and Gupta (1993) reported 65–118 ranges for days to 50% flowering and 112–145 ranges for days to maturity in coriander genotypes.

Minimum variability among the genotypes was observed for number of umbellete per umbel as compared to other traits (Table 2). Genotype COR 107 and COR 110 gave the highest number of umbellete per umbel (6.5) followed by COR 95 and COR 117 (6.3). COR 103, COR 104 and COR 112 gave the lowest number of umbelletes per umbel (4.6, 4.7 and 4.7, respectively). Bhandari and Gupta (1993) reported 7.1–17.8 range for number of umbellete per umbel, which is higher as compared to the current findings. Singh et al. (2006) reported 2–7 ranges for number of umbellete per umbel in coriander genotypes.

The variation in number of seeds per umbellete ranged from 6.20-13.80 with mean of 9.54. Genotype COR 118 gave the highest number of seeds per umbellete (13.20) followed by COR 110 and COR 95 (12.2 and 11.7, respectively). COR 108 and COR 103 gave the lowest number of seeds per umbellete (6.2 and 6.4, respectively). Similar findings were also reported Rajput and Singh (2003), Vijay Gupta (1993), Singh et al. (2005) and Geremew Awas et al. (2015).The range for thousand seed weight was 10.16–15.65 g with mean of 13.07 g. Genotype COR 121 gave highest thousand seed weight (15.65 g) followed by genotype COR 103 and COR 95 (14.99 and 14.62 g, respectively) and genotype Hisar Anand gave the lowest thousand seed weight (10.16 g) followed by RCr 728 and COR 120(10.47 and 10.74 g, respectively). Bhandari and Gupta (1993) reported thousand seed weight range of 5–22.1 g in coriander. Mengesha and Alemaw (2010) reported 9.8–12.8 g thousand seed weight range in coriander genotypes. Similar findings were also reported by Parthasarathy et al. (2008), Singh et al. (2005) and Geremew Awas et al. (2015).The range for volatile oil content in seed was 0.19–0.42 per cent with mean of 0.32 per cent. Genotype COR 95 gave highest volatile oil content in seed (0.42 %) followed by genotype COR 98 and COR 110 (0.41 %) and genotype COR 103 gave the lowest volatile oil content in seed (0.19 %) followed by COR 99, COR 102 and COR 121 (20 %). Similar findings were also reported Rajput and Singh (2003), Vijay Gupta (1993) and Geremew Awas et al. (2015).

Estimated variance components, Phenotypic Coefficient of Variation (PCV) and Genotypic Coefficient of Variation (GCV) of the 10 studied traits of coriander genotypes are presented in Table 3. The estimated phenotypic coefficient of variation was relatively greater than the genotypic coefficient of variation in magnitude for all characters considered. The highest phenotypic coefficient of variation (31.91 %) was observed for seed yield per plant followed by volatile oil content in seed (25.31 %), number of umbels per plant (20.87 %) and number of seeds per umbellate (19.22 %). While it was lower for days to maturity (8.31 %), thousand seeds weight (10.68 %) and number of umbelletes per umbel (10.70 %). The highest Genotypic Coefficient of Variation (GCV) was obtained for seed yield per plant (30.82 %) followed by volatile oilcontent in seed (22.42 %), number of umbels per plant (19.86 %), number of seeds per umbellete (18.55 %) and plant height at maturity (15.08). Genotypic coefficient of variation is lower for days to maturity(8.21 %), number of umbellete per umbel (9.64 %), number of branches per plant(9.72) and thousand seed weight(10.60 %) (Table 3). Similar findings were reported by Singh et al. (2006), Geremew Awas et al. (2015) and Bhandari and Gupta (1993) for coriander.

Genotypic coefficient of variation together with heritability estimates would give the best picture of the amount of advance to be expected from selection (Burton and DeVane, 1953). Thus, the heritable portion of the variation could be more useful with the help of heritability estimates. The results that are presented in Table 3, showed that the estimates of heritability in broad sense were high for thousand seed weight (98.46 %) followed by plant height (97.95), days to 50% flowering (97.91%), days to maturity(97.82), seed yield per plant (93.27%), number of seeds per umbellete (93.10%), number of umbels per plant (90.54%),number of umbellete per umbel (81.18%), volatile oil content in seed (78.43 %) and number branches per plant (77.41%). This confirms the findings of Bhandari and Gupta (1993) for estimates of broad sense heritability in 200 coriander genotypes in India. These finding were also in agreement with the finding of Mengesha and Alemaw (2010) and Geremew Awas et al. (2015).

Genetic gain that is expected from selecting the top 5% of the genotypes, as a percent of mean varied from 16.74 % for days to maturity to 61.31% for seed yield per plant. This may indicates an increase of the same magnitude can be made by selection based on these traits under similar conditions. Better gains were also recorded for volatile oil content in seed (40.90%), number of umbels per plant (38.92 %), number of seeds per umbellete (36.87 %) and plant height (30.74 %)(Table 3). Intermediate genetic gain values were obtained for days to 50 % flowering (24.60 %), thousand seed weight (21.66 %), number of umbellete per umbel (17.90 %), number of branches per plant (17.62 %) and days to maturity (16.74). Mengesha and Alemaw (2010) and Singh et al. (2006) reported high genetic advance as percent of mean for seeds per umbellete, seed yield per plant and number of umbels per plant which partially agrees with the current findings.

4. Conclusion

Among the genotypes evaluated, the superior ones for different traits are COR 101, COR 106, COR 107 and COR 108 for days to maturity; COR 110, COR 95 and

COR 98 for plant height; COR 95 and COR 98 for branches per plant; COR 95, COR 98 and COR 96 for umbels per plant; COR 107, COR 110 and COR 95 for umbellete per umbel; COR 118, COR 110 and COR 95 for seeds per umbellete; COR 121, COR 103 and COR 95 for thousand seed weight; COR 95, COR 98 and COR 110 for volatile oil content and COR 95, COR 96, COR 98 and COR 107 for seed yield. These superior genotypes could be exploited for inter varietal hybridization (reciprocal recurrent selection method) for evolving a high yielding variety by combining other desirable traits.

References

[1] Bhandari, M.M. and Gupta, A. (1993).Association analysis in coriander. Indian J. Genet., 53:66-70.
[2] Burton G.W. (1952). Quantitative inheritance in grasses. Proc. 6th Int. *Grassland Cong*. 1: 227-285.
[3] Diederichesen, A. (1996). Coriander: Corianderum Sativum L. Promoting the Conservation and use of Underutilized and Neglicated Crops. Vol. 3. Bioversity International, Rome, Italy, ISBN-13: 9789290432845, Pages: 83.
[4] Geremew Awas, Firew Mekbib and Amsalu Ayana (2015). Variability, Heritability and Genetic Advance for Some Yield and Yield Related Traits and Oil Content in Ethiopian Coriander (Coriandrum sativum L.) Genotypes. International Journal of Plant Breeding and Genetics, 9:116-125.
[5] Hanson C.H., Robinson H.F. and Comstock R.E.(1956). Bimetrical studies of yield in segregating
[6] population of Korean Lespedsa. *Agron. J.* 48: 268-272.
[7] Johnson H.W., Robinson H.F. and Comstock R.E. (1955). Estimates of genetics and environment variability in soybean. *Agron. J.* 47: 314-318.
[8] Mengesha, B. and Alemaw, G. (2010). Variability in Ethiopian coriander accessions for agronomic and quality traits. Afr. Crop Sci. J., 18: 43-49.
[9] Panes V.G. and Sukhatme P.V. (1961). Statistical methods for Agricultural workers, ICAR, New Delhi.
[10] Parthasarathy, V.A., Chempakam, B. and Zachariah, T.J. (2008). Chemistry of Spices. CABI Publishing, USA, Pages:445.
[11] Peter, K.V. (2004). Handbook of Herbs and Spices. Vol. 2, Woodhead Publishing, Cambridge, UK., ISBN-13: 1855737213, Pages: 375.
[12] Rajput, S.S., Singh, D. (2003). Variability in coriander (Coriandrum sativum L.) for yield and yield components. Journal of Spices and Aromatic Crops. Vol. 12 (2) : 162-164
[13] Singh, D., Jain, U.K., Rajput, S.S., Khandelwal, V. and Shiva, K.N. (2006). Genetic variation for seed yield and its components and their association in coriander (Coriandrum sativum L.) germplasm. J. Spices Aromat. Crops, 15: 25-29.
[14] Singh, S.P., Katiyar R.S., Rai, S.K., Triphathi, S.M. and Srivastva, J.P. (2005). Genetic divergence and its implication in breeding of desired plant types in coriander (Coriandrum sativum L.). Genetika, 37: 155-163.
[15] Vijay Kumar Gupta (1993). Yield and yield attributing characters in different varieties of coriander (Coriandrum sativum L.). M.Sc. (Agri.) Thesis, Submitted to Jawaharlal nehru krishi vishwa vidyalaya, jabalpur (M. P.)

Table 1: Analysis of variance for ten characters of Coriander (Mean squares)

Source of variation	d.f.	Plant height (cm)	No. of branches per plant	Days to 50% flowering	Days to maturity	Umbels per plant	Umbellets per umbel	No. of seeds per Umbellet	1000 seeds weight (g)	Volatile oil content (%)	Seed yield/ Plant (g)
Replications	1	1.667	0.240	0.150	3.267	0.417	0.017	0.241	0.069	0.0001	5.517
Genotypes	29	269.092**	0.623**	92.624**	174.515**	29.318**	0.625**	6.499**	3.862**	0.0116**	40.106**
Error	30	2.781	0.079	0.978	1.922	1.455	0.065	0.232	0.030	0.0014	1.398

Table 2: Mean performance of various parameters of Coriander

Genotypes	Plant height (cm)	No. of branches per plant	Days to 50% flowering	Days to maturity	Umbels per plant	Umbellets per umbel	No. of seeds per Umbellet	1000 seeds weight (g)	Volatile oil content (%)	Seed yield/ Plant (g)
COR-95	92.5	6.2	58.5	114.5	26.0	6.3	11.7	14.619	0.42	21.208
COR-96	81.6	6.0	55.5	113.5	23.7	6.0	11.0	13.983	0.40	20.833
COR-97	82.6	4.4	55.0	113.0	22.4	6.0	10.3	13.449	0.40	18.986
COR-98	92.3	6.1	56.0	113.5	25.1	6.0	11.6	14.338	0.41	20.806
COR-99	66.2	5.7	48.5	103.5	20.8	5.4	7.5	13.478	0.20	16.958
COR-100	65.4	5.6	49.0	104.0	12.7	5.3	9.2	13.210	0.21	16.639
COR-101	57.4	5.8	46.5	96.5	12.0	5.8	7.6	11.997	0.21	12.542
COR-102	54.7	5.8	53.0	106.0	14.0	5.6	8.4	14.149	0.20	7.889
COR-103	71.9	5.7	54.0	109.5	17.7	4.6	6.4	14.994	0.19	11.194
COR-104	71.0	4.8	53.0	109.0	17.3	4.7	7.2	13.526	0.31	8.056
COR-105	72.6	6.0	49.5	107.5	20.2	4.8	7.1	12.125	0.39	12.486
COR-106	63.3	5.1	48.5	98.5	16.9	5.0	7.7	13.224	0.21	15.278
COR-107	63.4	5.3	48.0	98.5	20.4	6.5	11.3	12.713	0.31	20.292
COR-108	61.8	5.4	48.0	98.5	15.4	5.6	6.2	12.170	0.33	10.194
COR-109	91.0	5.5	66.5	126.5	22.6	5.2	10.2	14.000	0.30	14.736
COR-110	99.3	5.7	66.5	127.0	23.6	6.5	12.2	12.937	0.41	18.319
COR-111	81.2	5.0	60.5	120.0	18.3	5.4	10.3	13.501	0.30	13.722
COR-112	81.0	5.2	57.5	117.5	20.8	4.7	9.1	12.562	0.30	16.458
HisarAnand	82.3	3.9	69.5	127.0	12.6	4.7	9.4	10.157	0.33	9.042
COR-114	89.9	5.3	68.5	128.5	20.1	5.4	8.4	11.618	0.30	12.389
COR-115	73.0	4.4	68.5	128.5	17.7	5.1	9.0	11.208	0.40	13.597
COR-116	86.9	4.7	54.0	111.0	15.6	5.0	11.3	13.218	0.30	16.847
COR-117	77.7	5.8	55.5	113.5	23.0	6.3	13.8	14.480	0.30	19.208
COR-118	84.4	5.5	53.0	110.0	18.7	5.6	10.7	15.333	0.30	14.653
COR-119	72.7	5.4	56.5	116.0	15.2	5.4	9.6	12.884	0.40	12.750
COR-120	66.0	5.5	52.5	112.0	15.0	5.3	9.9	10.743	0.35	6.083
COR-121	70.4	5.8	54.0	110.5	14.8	5.5	9.8	15.646	0.20	4.708
RCr-728	70.1	4.5	67.0	126.5	19.8	5.0	9.9	10.471	0.40	11.653
GCr-1	81.2	5.3	55.0	115.5	20.7	6.2	8.9	11.917	0.40	13.194
GCr-2	92.0	5.5	54.5	115.0	20.8	5.8	10.6	13.322	0.40	17.542
SEm±	1.18	0.20	0.70	0.98	0.85	0.18	0.34	0.12	0.03	0.84
C.D. at 5% level	3.41	0.58	2.02	2.84	2.47	0.52	0.99	0.35	0.08	2.42

Table 3: Genetic parameters in coriander

S. No.	Characters	Grand mean	Range		Coefficient of variation		Heritability (%) (Broad sense)	Genetic advance as % of mean
			Min.	Max.	Genotypic	Phenotypic		
1.	**Plant height (cm)**	76.53	54.70	99.30	15.08	15.24	97.95	30.74
2.	**No. of branches per plant**	5.37	3.90	6.20	9.72	11.047	77.41	17.62
3.	**Days to 50% flowering**	56.08	46.50	69.50	12.07	12.20	97.91	24.60
4.	**Days to maturity**	113.03	96.50	128.50	8.21	8.31	97.82	16.74
5.	**No. of umbels per plant**	18.80	12.00	26.00	19.86	20.87	90.54	38.92
6.	**No. of Umbellets per umbel**	5.49	4.60	6.50	9.64	10.70	81.18	17.90
7.	**No. of seeds per umbellet**	9.54	6.20	13.80	18.55	19.22	93.10	36.87
8.	**1000 seeds weight (g)**	13.07	10.16	15.65	10.60	10.68	98.46	21.66
9.	**Volatile oil content(%)**	0.32	0.20	0.40	22.42	25.31	78.43	40.90
10.	**Seed yield/plant (g)**	14.28	4.71	21.21	30.82	31.91	93.27	61.31