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Variability, correlation and path analysis in garden cress (*Lepidium sativum* L.)

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Abstract

Garden cress (*Lepidium sativum* L.) is an important indigenous medicinal plant which is used in various systems of medicines. The presence of genetic variability in the base population is pre-requisite for designing an effective breeding programme for any crop improvement work. Hence, thirty two garden cress genotypes were tested to investigate genetic variability and association among the characters using randomized complete block design at Medicinal and Aromatic Plants Research Station, Anand Agricultural University, Anand during *Rabi* season of the year 2013-14. The analysis of variance revealed significant differences among the genotypes for all the characters, indicating the presence of great deal of genetic variability for different traits. The moderately high estimates of GCV were observed for leaf width and seed yield per plant. The estimates of genetic advance as per cent of mean was moderate to high, coupled with high heritability for plant height, number of secondary branches per plant, leaf length, leaf width, days to 50 per cent flowering and seed yield per plant. Seed yield per plant showed significant and positive association with plant height, plant spread, number of primary branches per plant, number of secondary branches per plant, terminal raceme length, test weight and oil content at genotypic as well as phenotypic levels. The characters *viz.*, test weight, number of secondary branches per plant and terminal raceme length were very high positive direct effects on seed yield per plant. The results showed that the characters which are most important for correlation studies are also proved important by path analysis. Thus, correlation and path analysis study should be considered together for rapid improvement of seed yield in garden cress.

Keywords: Variability, correlation, path analysis, garden cress

Introduction

Garden cress (*Lepidium sativum* L.) is a native of Ethiopia and subsequently introduced in Europe, Asia and USA. It belongs to the family *Brassicaceae* and commonly known as garden cress in English, Chandrasur in Hindi and Asalio in Gujarati. There are diploid (2n=16) and tetraploid (2n=32) forms of garden cress were identified, and it is an allogamous plant with self-compatible and self-incompatible forms and cut the various degrees of tolerance to prolonged autogamy. A degree of variability is noted in the character of the basal leaves (cleft or split to a greater or lesser degree), which is controlled by a single incompletely dominant gene (Wadhwa *et al.*, 2012) [24].

In India, its cultivation is spread in patches across the states of Madhya Pradesh, Uttar Pradesh, Rajasthan, Gujarat and Maharashtra in an area of about 5000 hectares. In Gujarat, it is traditionally cultivated in north Gujarat, Kutch, middle Gujarat and in some part of Bharuch district (Choudhary *et al.*, 2010) [6].

This is a small, herbaceous, glabrous annual plant and cultivated for seed purpose as well as salad supplement in India. The seeds are reddish in colour, oblong, somewhat angular and curved slightly on one side with rough surface. Seeds are pungent, odourless and mucilaginous (Khory, 1999) [10]. The whole seed contains significant amount of iron, calcium, folic acid, vitamin A and vitamin C (Indira kumari, 2013) [8]. Preliminary phytochemical study of garden cress showed the presence of flavonoids, coumarins, sulphur glycosides, triterpenes, sterols and various imidazole alkaloids known as lepidine (Patel *et al.*, 2009) [14].

The vegetable form of garden cress is used as a food and seeds are used to treat a number of ailments in traditional system of medicine throughout India. The leaves are mild stimulant and diuretic, which are useful in scorbutic diseases and in liver complaints (Anonymous, 1962) [3]. The root is used for treating secondary syphilis and tenesmus. The seed are bitter, thermogenic, depurative, rubefacient, galactagogue, emmenagogue, tonic, aphrodisiac and diuretic. The plant is being used for the treatment of Amavata, Sandhivata, and Katishula successfully in Ayurveda (Raval and Pandya, 2011) [15].

Garden cress seeds are good tonic when given daily for feeding to animals after calving to meet the strain and drain of calving for the first two weeks along with bajra grain, wheat bran, methi, ginger, kalijiri, jaggery and oil (Anonymous, 1953) [2]. Paranjape and Mehta (2004) [12] elucidated the usefulness of garden cress in the form of traditional tonic to increase height of children, to increase the milk content in female and a tonic for eyes.

Garden cress seed oil is found to be suitable for edible purpose as the seed has relatively high oil content (26.4%) with a high essential fatty acids i.e. high oleic/linoleic acid with desirable levels of linolenic acid, hence, it can be a promising new oil seed crop in addition to medicinal importance (Patel, 1997) [13]. The protein content of the seed was found to be high (30.6%) with very high proportion of globulin (31.2%) and gluteline (29.3%).

The study of extent of association between characters suggests the importance of various component characters affecting the yield. However, this does not provide an exact picture of the relative importance of direct and indirect influence of each of the component character towards yield. In this context, path analysis technique partitioned the correlation coefficient into direct and indirect effects of the independent variable on the dependent variable. Therefore, present investigation has been initiated to study the interrelationship among various yield contributing traits as well as direct and indirect effects of yield attributing traits on the seed yield.

Materials and Methods

Experimental site

The field experiment was conducted at Medicinal and Aromatic Plants Research Station, Anand Agricultural University, Anand during *Rabi* season of the year 2013-14. Geographically, Research Station is located at 22° 35' North latitude, 72° 55' East latitude and an altitude of 45.01 meters above Mean Sea Level. The soil of the experimental site is sandy loam locally known as "*Goradu Soil*" and alluvial in origin, deep, well drained and fairly moisture retentive. The climatic conditions of the area represent the tropical conditions with semi-arid region.

Experimental materials

The experimental materials comprised thirty two genotypes of garden cress were collected from different AICRP Centres of diverse agro-ecological locations of the country varying in altitude, rainfall, temperature and soil types (Table 1).

Experimental details

The experimental materials were evaluated in Randomized Complete Block Design (RCBD) with three replications. The inter-replication distance was 1.5 m. Each genotype was sown in 1.8 m^2 (3.0 m × 0.6 m) plot. Each plot contained two rows with inter-row spacing of 30 cm and seeds were thoroughly and almost thickly sown in the row, but later, 10 days after germination (at true leaf stage) the plants in each row of the plots was thinned out as it should have about 10 cm gap from each other.

Cultural practices

Three weeding activities and two hand-hoeing practices were carried out and fertilizer & chemicals were not applied. All agronomical crop management practices were implemented and the weeding activities were completed before 35 day after germination, because according to Shehzad *et al.* (2011) [18] for obtaining higher yield of the garden cress, weeds should be controlled before 40 days after emergence as it was a critical period of competition.

Characters studied

The phenological characters *viz*., days to 50 per cent flowering and days to maturity were recorded on plot basis. For other traits, the observations were recorded on ten randomly selected competitive plants in each genotype as well as in each replication for various characters. For quality traits, the observations were recorded on randomly selected sample of seeds from each genotype. The details of the observation procedure adopted for the various traits are described as under.

Plant height (cm): It was measured from ground level to the tip of the main branch of randomly selected plants and averaged at the time of maturity.

Plant spread (cm): The maximum spread/width of randomly selected plants was measured and averaged at the time of maturity.

Number of primary branches per plant: It was recorded by counting the number of branches arising from the main central stem of each randomly selected plant and averaged at the time of maturity.

Number of secondary branches per plant: The total number of branches arising from the primary branches were counted and averaged at the time of maturity.

Leaf length (cm): The length of the fully opened five leaves per plant was measured from the tip along with midrib and averaged at the time of flowering.

Leaf Width (cm): The width of the fully opened five leaves per plant was measured at middle of leaf and averaged at the time of flowering.

Days to 50 per cent flowering: It was recorded by counting days from the date of sowing to the date on which 50 per cent plants came to flowering in each plot.

Days to maturity: It was recorded by counting days from the date of sowing to the date when siliqua on main branch reached to the physiological maturity.

Terminal raceme length (cm): The length of the terminal raceme which located on main branch was recorded and averaged at the time of maturity.

Seed yield per plant (g): It was recorded by weighing the clean seed of harvested siliqua from individual plant.

Test weight (g): It is the weight of thousand seeds expressed in grams.

Oil content (%): Oil content was estimated by using Near Infrared Reflectance Spectroscopy (NIRS).

Statistical analysis

The replication wise mean values based on ten randomly selected plants formed the basis for statistical analysis of all the characters. The analysis of variance proposed by Panse and Sukhatme (1978) [11] was followed to test the significance of differences between the genotypes for all the characters.

Estimation of variance components

Genotypic and Phenotypic variances were calculated as suggested by Johnson *et al.* (1955) [9]. Genotypic and Phenotypic Coefficient of Variation were computed using the formula given by Burton (1952) [5], and the values were categorized as low (0-10%), moderate (10-20%) and high (20% and above) as suggested by Shivasubramanian and Menon (1973) [20].

Estimation of heritability

Heritability in broad sense was computed using the formula adopted by Allard (1960) [1], and the percentage was categorized as low (0-30%), moderate (30-60%) and high (60% and above) as demonstrated by Robinson *et al.* (1949) [16].

Estimation of genetic advance

The expected Genetic Advance (GA) was calculated for each character by adopting the procedure as suggested by Allard (1960) [1], and the values of genetic advance as per cent of mean were categorized as low (0-10%), moderate (10-20%) and high (20% and above) as given by Johnson *et al.* (1955) [9].

Correlation coefficient

The estimates of covariances were worked out as per Singh and Choudhary (1985) [21]. The estimates of covariance and variance were utilized in computing genotypic and phenotypic correlation coefficient. The genotypic correlation is chiefly caused by pleiotrophy and linkage action of gene and it was estimated as suggested by Hazel *et al.* (1943) [7].

Path coefficient analysis

The cause and effect, interrelationship between two variables cannot be estimated from simple correlation coefficient analysis. Therefore, the path analysis suggested by Wright (1921) [25] was followed in order to partition genotypic correlation of different variables with seed yield per plant into direct and indirect effects of these variables on seed yield. The path coefficients were obtained by solving simultaneous equations which represent the basic relationship between correlation and path coefficient.

Results and Discussion

The analysis of variance revealed significant differences among the thirty two garden cress genotypes for all the twelve characters (Table 2). The observed highly significant values of the mean squares due to the genotypes for most of the traits indicate a sufficient genetic variability. Thus, ALS 10, SLS 1 and MLS 1001 were identified as elite genotypes based on *per se* performance. However, their superiority should be confirmed over space and time by assessing them over seasons and locations, so as to get more precise estimates of stability and other genetic parameters, which will be useful in future breeding programme.

Variance components and coefficients of variation

The estimates of genotypic and phenotypic variances revealed that the characters like plant height, number of secondary branches per plant, leaf length, leaf width, days to 50 per cent flowering and seed yield per plant showed predominance of genotypic variance in total phenotypic variance (Table 2). On the other hand, plant spread, number of primary branches per plant, days to maturity, terminal raceme length, test weight and oil content have greater influence of environmental factors for their expression.

The genotypic coefficient of variation ranged from 2.45% for days to maturity to 19.70% for leaf width; whereas, the phenotypic coefficient of variation varied from 3.30% for days to maturity to 22.60% for seed yield per plant (Table 2). High degree of variability in the experimental material existed for characters like leaf width and seed yield per plant as revealed by moderately high GCV estimates; while, rest of characters were having low to moderate GCV per cent. Bedassa *et al.* (2013) [4] reported higher estimates of genotypic coefficient of variation for seed yield per plant in garden cress. Low GCV was recorded for characters like plant height, plant spread, number of primary branches per plant, days to 50 per cent flowering, days to maturity, terminal raceme length, test weight and oil content. Low PCV values with low GCV values in these characters indicated less variability for these traits in the genotypes studied and they are poor responsive to selection. Rest of the characters *viz.*, number of secondary branches per plant and leaf length showed moderate GCV values suggested considerable scope for improvement of these traits by selection.

Heritability and genetic advance

Heritability is the proportion of phenotypic variability that is due to genetic reasons. The magnitude of the estimated broad sense heritability ranged from 40.20% for terminal raceme length to 88.70% for leaf width (Table 2). The high heritability coupled with high genetic advance indicated that heritability in genotypes was due to additive gene effects indicating better scope for improvement in the characters by effective selection of genotypes. The characters like leaf length, leaf width and seed yield per plant exhibited high heritability with high genetic advance which could be effectively improved by selection. High heritability for seed yield per plant was also reported by Bedassa *et al.* (2013) [4] in garden cress.

Johnson *et al.* (1955) [9] have suggested that characters with high heritability coupled with high genetic advance would respond better to selection than those with high heritability and low genetic advance. The characters like plant height, plant spread, number of primary branches per plant, number of secondary branches per plant and days to 50 per cent flowering exhibited high to moderate heritability with moderate genetic advance indicating moderate scope of improvement in these traits through selection. The low heritability coupled with low genetic advance indicated poor scope of improvement in oil content through selection.

Correlation coefficient analysis

The genotypic and phenotypic correlation coefficients were estimated among twelve characters to find out the association of seed yield and other yield related characters (Table 3). Seed yield per plant which is an economically important trait, revealed significantly positive association with plant height, plant spread, number of primary branches per plant, number of secondary branches per plant, terminal raceme length, test weight and oil content at genotypic as well as phenotypic levels; while, significant positive correlation contributed by days to maturity at phenotypic level only. Thus, improvement in all above mentioned characters will leads to simultaneous improvement of seed yield and hence they are considered as important yield attributing characters. Whereas, leaf length, leaf width and days to 50 per cent flowering showed non-significant association with seed yield per plant at genotypic as well as phenotypic levels. The results conformed the findings of Bedassa *et al.* (2013) [4] showing positive correlation of seed yield per plant with number of primary branches per plant, number of secondary branches per plant, days to maturity and test weight in garden cress. Srivastava and Singh (2002) [23] and Shekhar *et al.* (2012) [19] reported that oil content was positively and significantly correlated with seed yield per plant in Indian mustard, which partially supports the result of present study.

Terminal raceme length found positively and significantly correlated with plant height. Generally, for garden cress crop the dwarf stature is more desirable; because the tall plant is more prone to lodging. Number of secondary branches per plant was positively and significantly correlated with number of primary branches per plant at genotypic and phenotypic levels. Said (2012) [17] also reported positive association of number of primary branches per plant with number of secondary branches per plant in garden cress. On the other hand, days to maturity showed significant and positive association with seed yield per plant at phenotypic level, indicated that selection for late maturing genotypes is likely to increase seed yield per plant. Besides the seed yield per plant, days to 50 per cent flowering was significantly and positively correlated with days to maturity at genotypic and phenotypic levels.

Four component characters *viz.*, plant spread, number of secondary branches per plant, test weight and oil content showed positive and significant correlation with each other at genotypic as well as phenotypic levels indicating possibility of simultaneous improvement for these traits.

Path coefficient analysis

Generally, seed yield is under the polygenic control, selection for improvement in yield level affects the other correlated traits and vice-versa. Path analysis breaks correlation between traits into their direct and indirect effects on the economic product, permitting a critical examination of specific trait contributing individually and collectively to produce the total effect. It also helps to measure the relative importance of each trait. In this study, path analysis was carried out using the estimates of genotypic correlation coefficients. The estimates of direct and indirect effects of twelve characters on seed yield per plant are presented in Table 4. In this study, test weight and number of secondary branches per plant and terminal raceme length were major characters having very high positive direct effect and significant association with seed yield per plant. Bedassa *et al.* (2013) [4] recorded positive direct effect for test weight with seed yield per plant in garden cress. In addition to that, positive direct effect of number of secondary branches per plant on seed yield per plant was also reported by Srivastava and Singh (2002) [23] in Indian mustard.

The direct effect of plant height was moderate but its association with seed yield per plant was positive because of positive and high indirect effect through terminal raceme length. In a study carried out by Singh and Singh (2010) [22] on Indian mustard, plant height had positive direct effect on seed yield per plant; which also supports the result of the current study. Whereas, the direct effect of number of primary branches per plant was moderate in magnitude and positive in direction, but their indirect effects through number of secondary branches per plant was very high in magnitude and positive in direction. Bedassa *et al.* (2013) [4] also reported positive direct effect for number of primary branches per plant in garden cress.

The direct effect of plant spread was negative but its indirect effect through number of secondary branches per plant was very high; similarly, highest negative direct effect was recorded by oil content but its indirect effect through test weight was very high in magnitude and positive in direction. The results are in contrast to the findings of Bedassa *et al.* (2013) [4] as they reported positive direct effect of oil content on seed yield per plant in garden cress. Negative direct effect of days to 50 per cent flowering contributed positive but non-significant correlation with seed yield per plant. While, days to maturity showed positive and non-significant association with seed yield per plant but its direct effect on seed yield per plant was very low in magnitude and positive in direction. Bedassa *et al.* (2013) [4] reported positive direct effect of days to maturity on seed yield per plant in garden cress.

Hence, selection based on characters *viz*., test weight, number of secondary branches per plant and terminal receme length with very high direct effects and plant height, plant spread, number of primary branches per plant and oil content with high indirect effects may be useful for improving the seed yield of garden cress.

Table 1: List of genotypes used as experimental materials

S. No.	Source	Genotypes
1	AICRP on M&AP, Solan, H.P	(1) SLS 1
2	AICRP on M&AP, College of Horticulture, Mandsaur, M.P	(2) MLS 1001, (3) MLS 1007, (4) MLS 1016
3	AICRP on M&AP, CCSHAU, Hisar, Haryana	(5) HLS 4, (6) HLS 5
4	AICRP on M&AP, AAU, Anand, Gujarat	(7) ALS 3, (8) ALS 4, (9) ALS 6, (10) ALS 7, (11) ALS 8, (12) ALS 9, (13) ALS 10, (14) ALS 11, (15) ALS 12, (16) ALS 13, (17) ALS 14, (18) ALS 15, (19) ALS 16, (20) ALS 17, (21) ALS 18, (22) ALS 19, (23) ALS 20, (24) ALS 21, (25) ALS 22, (26) ALS 23, (27) ALS 24, (28) ALS 25, (29) ALS 26, (30) ALS 27, (31) ALS 1 and (32) GA 1

Table 2: The estimates of minimum, mean and maximum values; genotype (Mg) and error (Me) mean sum of square; genotypic (σ^2g) and phenotypic (σ^2p) variances; genotypic (GCV %) and phenotypic (PCV %) coefficient of variations; heritability in broad sense (h^2bs %) and genetic advance as per cent of mean (GAM %) for different characters in Garden cress

Traits	Min.	Mean	Max.	Mg		Me	σ^2g	σ^2p	GCV (%)	PCV (%)	h^2bs (%)	GAM (%)
SYP	3.38	5.35	7.87	3.41	**	0.49	0.97	1.46	18.45	22.60	66.7	31.01
PH	79.73	94.20	105.27	140.06	**	11.75	42.77	54.52	6.94	7.84	78.4	12.66
PS	17.47	20.73	25.27	13.39	**	3.90	3.16	7.06	8.58	12.81	44.8	11.81
NPB	8.47	11.62	14.40	5.42	**	1.75	1.22	2.97	9.51	14.82	41.2	12.56
NSB	20.10	28.37	34.60	29.10	**	4.27	8.27	12.54	10.14	12.48	66.0	16.95
LL	12.08	17.33	22.53	22.54	**	1.05	7.16	8.21	15.44	16.54	87.2	29.71

LW	5.02	7.51	11.10	6.86	**	0.28	2.19	2.47	19.70	20.92	88.7	38.19
DF	35.00	41.27	47.67	33.02	**	1.95	10.36	12.31	7.80	8.50	84.1	14.73
DM	88.00	94.27	102.00	20.35	**	4.38	5.32	9.70	2.45	3.30	54.9	3.73
TRL	13.12	16.60	18.80	6.03	**	2.00	1.34	3.34	6.98	11.01	40.2	9.15
TW	1.63	1.79	1.99	0.02	**	0.01	0.006	0.011	4.21	5.95	50.1	6.14
OC	17.25	20.67	23.62	5.03	*	2.59	0.81	3.40	4.36	8.92	23.9	4.40

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.
PH = Plant height, PS = Plant spread, NPB = Number of primary branches per plant, NSB = Number of secondary branches per plant, LL = Leaf length, LW = Leaf width, DF = Days to 50 per cent flowering, DM = Days to maturity, TRL = Terminal raceme length, TW = Test weight, OC = Oil content

Table 3: Genotypic correlation coefficient (bellow the diagonal) and phenotypic correlation coefficient (above the diagonal) of different characters in Garden cress

Traits	SYP	PH	PS	NPB	NSB	LL	LW	DF	DM	TRL	TW	OC
SYP	1.000	0.212*	0.468*	0.371*	0.412*	0.169	0.189	0.009	0.218*	0.389*	0.352*	0.535*
PH	0.370*	1.000	0.156	0.094	0.180	0.319*	0.346*	0.596*	0.586*	0.309*	0.162	0.053
PS	0.523**	0.246	1.000	0.178	0.446*	0.179	0.155	0.002	0.220*	0.122	0.307*	0.385*
NPB	0.630**	0.260	0.562**	1.000	0.687**	0.218*	0.107	0.059	0.194	0.045	0.165	0.091
NSB	0.550**	0.259	0.702**	0.798**	1.000	0.370*	0.212*	0.117	0.337*	0.049	0.229*	0.248*
LL	0.240	0.437*	0.274	0.263	0.460**	1.000	0.838**	0.279*	0.207*	0.168	-0.071	0.097
LW	0.217	0.444*	0.218	0.116	0.249	0.884**	1.000	0.284*	0.189	0.277*	-0.159	0.086
DF	0.095	0.715**	0.129	0.051	0.127	0.335	0.332	1.000	0.355*	0.182	-0.017	-0.253*
DM	0.336	0.815**	0.388*	0.603**	0.619**	0.393*	0.253	0.530**	1.000	0.108	0.258*	0.288*
TRL	0.748**	0.694**	0.310	0.116	0.061	0.223	0.443*	0.246	0.232	1.000	-0.075	0.109
TW	0.486**	0.179	0.440*	0.503**	0.443*	-0.081	-0.212	0.059	0.447*	0.046	1.000	0.495*
OC	0.717**	0.254	0.465**	0.640**	0.637**	0.125	0.090	-0.300	0.559**	0.129	0.812**	1.000

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.
PH = Plant height, PS = Plant spread, NPB = Number of primary branches per plant, NSB = Number of secondary branches per plant, LL = Leaf length, LW = Leaf width, DF = Days to 50 per cent flowering, DM = Days to maturity, TRL = Terminal raceme length, TW = Test weight, OC = Oil content

Table 4: Genotypic path coefficient analysis showing direct (bold-diagonal) and indirect (off-diagonal) effects of different characters on seed yield per plant in Garden cress

Traits	PH	PS	NPB	NSB	LL	LW	DF	DM	TRL	TW	OC	ɤg
PH	0.172	-0.113	0.051	0.253	-0.193	0.272	-0.559	0.021	0.553	0.206	-0.292	0.370*
PS	0.042	-0.457	0.111	0.686	-0.121	0.134	-0.101	0.010	0.247	0.506	-0.534	0.523**
NPB	0.045	-0.257	0.198	0.779	-0.116	0.071	-0.040	0.015	0.092	0.579	-0.736	0.630**
NSB	0.044	-0.321	0.158	0.977	-0.203	0.153	-0.099	0.016	0.049	0.510	-0.732	0.550**
LL	0.075	-0.125	0.052	0.449	-0.443	0.542	-0.262	0.010	0.178	-0.093	-0.144	0.240
LW	0.076	-0.100	0.023	0.243	-0.391	0.613	-0.259	0.006	0.353	-0.244	-0.104	0.217
DF	0.123	-0.059	0.010	0.124	-0.148	0.203	-0.781	0.013	0.196	0.068	0.345	0.095
DM	0.140	-0.177	0.119	0.605	-0.174	0.155	-0.414	0.025	0.185	0.515	-0.642	0.336
TRL	0.119	-0.142	0.023	0.060	-0.099	0.272	-0.192	0.006	0.797	0.053	-0.149	0.748**
TW	0.031	-0.201	0.099	0.433	0.036	-0.130	-0.046	0.011	0.037	1.151	-0.933	0.486**
OC	0.044	-0.213	0.126	0.622	-0.055	0.055	0.234	0.014	0.103	0.935	-1.149	0.717**

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.
PH = Plant height, PS = Plant spread, NPB = Number of primary branches per plant, NSB = Number of secondary branches per plant, LL = Leaf length, LW = Leaf width, DF = Days to 50 per cent flowering, DM = Days to maturity, TRL = Terminal raceme length, TW = Test weight, OC = Oil content, ɤg = Genotypic correlation coefficient, Residual effect at genotypic level = 0.2203

Conclusion

The findings of present investigation lead to concluded that the economic character, seed yield per plant showed more contribution of genotypic variance to total phenotypic variance and high estimates of genetic advance as per cent of mean, coupled with high heritability. The correlation study revealed that terminal raceme length, oil content, number of primary branches per plant, number of secondary branches per plant, plant spread and test weight were important characters for increasing seed yield. Genotypic path coefficient analysis indicated that the predominance of direct effects of test weight, number of secondary branches per plant and terminal raceme length as well as indirect effects of plant height, plant spread, number of primary branches per plant and oil content.

On the basis of all the above studies, it can be concluded that, while imposing selection for genetic improvement of seed yield in garden cress, due weightage should be given to test weight and number of secondary branches per plant and terminal raceme length.

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