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VARIABILITY AND CORRELATION STUDIES IN RADISH ((*RAPHANUS SATIVUS* L.) GENOTYPES UNDER LOW HILLS OF HIMACHAL PRADESH INDIA

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ABSTRACT

An experiment was carried out at Experimental Farm of Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur, HP. Experimental material comprised of 25 genotypes including check variety Japanese White. Estimates of GCV and PCV were high for ascorbic acid content in roots and root length. High heritability coupled with high genetic advance as per cent mean was observed for traits *viz,* plant height, number of leaves per plant, crown diameter, root yield per plot, average root weight with leaves, root length, total soluble solids and ascorbic acid content. The correlation studies revealed that root yield per plot exhibited significant and positive correlation with average root weight with leaves, plant height, root length, days to marketable maturity, leaf length, dry matter content in roots, total soluble solids, leaf width and crown diameter. Path analysis indicated that maximum positive direct effect on root yield per plot was exhibited by Average root weight with leaves followed by leaf length, number of leaves per, ascorbic acid content in roots, plant height and total soluble solids.

***Key words*:** Radish, Heritability, Correlation, Path analysis, Genotypes

Introduction

Radish is an important root vegetable crop grown in tropical and temperate climates. Radish is a short duration crop and belongs to family Cruciferae having chromosome number 2n=2x=18. Its ease of cultivation and available for use within 4 to 8 weeks of seed sowing make it an ideal crop for the kitchen garden. It is a popular vegetable produced for its roots, which can be eaten fresh as a salad or roasted. It has a strong flavour and is regarded as an excellent appetizer. Primary root and the hypocotyl are the edible portion of radish roots. Roots differ widely in shape, size, and length (Singh and Nath, 2012). Different shape of roots are round to oval, conical, cylindrical and spindle with blunt or semi-blunt end. The skin colour can vary from white to pink, crimson and black etc. Radish leaves are nutritious and can be cooked or used as fodder to animals. Roots of radish are good source of vitamin C and can be used to treat piles, liver and gall bladder problems (Dhananjaya, 2007). Anthocyanin pigment is responsible for the red and purple colour of roots and this pigment have anti-oxidant and nutraceutical and properties (Jing *et al.*, 2014). Pungent flavour of radish is due to the presence of highly volatile alkaloid isothiocyanate (Bose *et al.*, 2000). Black radish roots have laxative properties which can indirectly increase the flow of bile and seeds have been determined to have diuretic and carminative properties. Radish roots and leaves are used in homeopathy to cure diarrhoea.

Genetic variability is important for selecting the promising genotypes for improvement for yield contributing characters as well as to select potential parents for further breeding programme (Bazargaliyeva *et al.*, 2023). The success of breeding programme depends upon the amount of variation exists in available germplasm. Most of the traits are highly influenced by environment and it is important to test the variability

Table 1: Mean performance of radish genotypes for days to marketable maturity, plant height (cm), number of leaves per plant, leaf length (cm), leaf width (cm), crown diameter (cm) and average root weight with leaves (g).

Genotype	Days to marketable maturity	Plant height (cm)	Number of leaves per plant	Leaf length (cm)	Leaf width (cm)	Crown diameter (cm)	Average root weight with leaves (g)
Anantnag Red	47.71	43.99	14.53	30.56	11.83	2.57	210.50
Scarlet Globe	33.17	31.44	7.53	27.24	8.59	1.68	128.01
Japanese White Long	48.47	52.14	14.33	29.43	10.93	2.60	238.71
Chinese Pink	45.97	53.93	10.87	33.82	9.80	2.60	210.90
Mino Early	44.47	55.27	12.40	32.35	10.39	2.03	229.32
Kashi Sweta	46.74	54.81	12.07	32.71	10.92	2.10	251.03
Kashi Aardra	48.21	54.92	12.27	35.14	9.44	2.15	235.57
Kashi Hans	47.83	57.22	10.27	33.58	9.68	2.11	209.62
Kashi Mooli-40	45.47	57.44	10.93	35.60	9.98	2.34	249.59
VRRAD-4	47.90	53.54	14.67	28.48	8.98	1.87	219.02
VRRAD-11	47.27	57.11	15.00	31.82	9.75	1.88	218.63
VRRAD-91	45.46	55.71	11.73	32.22	10.70	2.27	245.75
VRRAD-131	44.99	52.36	12.27	34.76	10.72	2.14	208.18
VRRAD-199	46.39	58.38	14.93	30.22	10.68	2.23	254.03
VRRAD-200	46.87	55.29	11.60	30.99	10.70	1.97	211.25
Him Palam Mooli-1	61.69	55.85	11.87	32.57	9.15	1.96	233.59
LC-51	50.70	57.84	16.67	35.53	10.70	1.88	261.99
LC-52	50.41	57.88	11.80	37.57	10.48	2.21	247.40
LC-53	49.41	55.87	15.80	32.97	9.44	1.98	266.20
LC-54	52.10	54.21	15.87	32.85	11.63	2.01	263.77
LC-56	52.93	57.48	14.47	38.60	11.41	2.58	241.21
LC-57	51.80	57.75	14.33	37.70	9.77	2.52	270.31
LC-58	54.80	61.51	13.53	39.12	11.32	2.48	279.84
Pusa Himani	46.83	57.95	11.93	30.42	10.52	1.46	192.53
Japanese White (Check)	48.41	52.83	13.80	28.84	9.33	1.76	225.25
Mean	48.24	54.51	13.02	33.00	10.27	2.14	232.09
$CD_{(0.05)}$	2.29	2.94	1.63	1.67	0.89	0.21	23.16
CV (%)	2.89	3.28	7.60	3.07	5.24	5.90	8.12

present in the germplasm, is heritable or due to environment. The character must have high heritability with high genetic advance which indicate the additive gene effects. The phenotypic correlation coefficient considers both genetic and environmental factors whereas, the genotypic correlation coefficient considered hereditary influence and determines the relationship between two characters and may be useful in selection. The correlation analysis aids in understanding how many horticultural traits are mutually interrelated with each other while path coefficient studies help us to understand the effect of a character independently and in conjunction with other characters on the dependent character which is of economic value.

Materials and Methods

The experiment was undertaken during rabi season of 2022 at Experimental Farm of Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur (H.P). Twenty five genotypes including check variety Japanese White were evaluated in Randomized Complete Block Design with three replications. The plot size was of 1.2 m × 1.0 m and spacing was 30 cm ×10 cm. Cultural practices were followed as recommended in Package of Practices for Vegetable Crops published by the Directorate of Extension Education, UHF Nauni, Solan to raise healthy crop stand. Observations were recorded on various horticultural traits viz. days to marketable maturity, plant height (cm), leaf length (cm), leaf width (cm), number of leaves per plant, crown diameter (cm), average root weight with leaves (g), root length (cm), root diameter (cm), root yield per plot (kg), TSS (°Brix), ascorbic acid content in roots (mg/100 g), dry matter content in roots (%), incidence of disease, root shape, external skin colour from five randomly selected plants for each genotype and plot. Analysis of variance was calculated according to (Gomez and Gomez, 1984). The genotypic and

Table 2: Mean performance of radish genotypes for root length (cm), root diameter (cm), root yield per plot (kg), total soluble solids (°Brix), ascorbic acid content in roots (mg/100 g) and dry matter content in roots (%).

Genotype	Root length (cm)	Root diameter (cm)	Root yield per plot (kg)	TSS (°Brix)	Ascorbic acid content in roots (mg/100 g)	Dry matter content in roots (%)
Anantnag Red	10.79	4.48	4.43	4.83	23.25	7.73
Scarlet Globe	4.96	4.31	2.60	3.61	12.78	6.09
Japanese White Long	20.83	3.72	4.68	5.03	17.97	7.39
Chinese Pink	20.96	3.74	4.36	5.22	24.95	6.63
Mino Early	22.59	3.32	4.22	5.60	20.79	7.03
Kashi Sweta	23.72	3.73	5.74	5.32	25.62	7.71
Kashi Aardra	23.97	3.48	5.52	5.19	16.95	6.51
Kashi Hans	21.85	3.61	5.43	6.29	19.32	7.23
Kashi Mooli-40	20.90	3.31	5.44	4.51	24.10	7.60
VRRAD-4	23.71	3.62	5.05	5.90	18.00	6.83
VRRAD-11	24.34	3.48	4.93	6.20	17.61	7.72
VRRAD-91	23.46	3.49	4.95	5.03	14.16	5.45
VRRAD-131	22.24	3.33	4.29	4.74	18.02	7.21
VRRAD-199	23.44	3.17	5.69	5.41	15.30	6.77
VRRAD-200	23.63	3.40	4.55	5.80	28.11	7.72
Him Palam Mooli-1	23.43	3.25	5.07	6.24	12.17	7.35
LC-51	23.75	3.22	6.19	5.37	15.07	8.41
LC-52	20.15	3.82	5.45	4.30	15.39	7.14
LC-53	24.98	3.33	6.28	5.12	17.03	8.40
LC-54	25.90	3.33	6.22	6.04	14.25	6.71
LC-56	21.96	3.36	5.88	5.60	16.66	7.01
LC-57	26.11	3.59	6.48	5.62	14.44	7.12
LC-58	26.76	3.47	6.63	5.21	18.40	7.95
Pusa Himani	26.41	3.00	4.63	4.13	14.00	6.23
Japanese White (Check)	23.79	3.92	4.85	4.72	17.04	6.31
Mean	22.19	3.54	5.18	5.24	18.06	7.13
$CD_{(0.05)}$	1.42	0.23	0.48	0.18	1.09	0.60
CV (%)	3.89	3.98	5.58	2.06	3.65	5.08

phenotypic coefficients of variation were computed using the formulae provided by Burton and De-Vane in 1953. Heritability in a broad sense (h^2_{bs}) and genetic advance as a percent of the mean was calculated by the formula suggested by (Allard, 1960). Traits which were significantly different were further used for the estimation of the genetic parameters.

Results and Discussion

Mean performance of genotypes

The presence of adequate amount of variability in the germplasm because of considerable amount of variation was observed among genotypes for all horticultural parameters. On the mean performance of genotypes (Table 1) genotype Scarlet Globe (33.17 days) mature earlier, while six genotypes exhibit maturity earlier than standard check Japanese White (48.41 days). Genotype Him Palam Mooli-1 (61.69 days) took maximum days to marketable maturity. The minimum plant height was founded in the genotype Scarlet Globe (31.44 cm) followed by Anantnag Red (43.99 cm) and Japanese White Long (52.14 cm). The yield per plot was found to be higher for 12 genotypes than the check variety (4.85 kg). Among all the genotypes, LC-58 exhibited maximum yield (6.63 kg), followed by LC-57 (6.48 kg) and LC-53 (6.28 kg) on per plot. Maximum crown diameter was recorded by genotype Japanese White Long (2.60 cm) and Chinese Pink (2.60 cm) which were found to be statistically at par with the genotypes *viz.*, LC-56 (2.58 cm), Anantnag Red (2.57 cm), LC-57 (2.52 cm) and LC-58 (2.48 cm). The maximum average root weight and root length was recorded by the genotype LC-58 i.e. 279.84 g and 26.76 cm, respectively. In contrast, genotype Anantnag Red demonstrated root diameter of 4.48 cm. Highest value for TSS was found in the genotype Kashi Hans (6.29 °B). Maximum concentration of ascorbic acid

Table 3: Estimation of phenotypic and genotypic coefficients of variation, heritability and genetic advance for various characters in radish.

Characters	Range	Mean ± S.E	COV (%)		H	GAM
			Genotypic	Phenotypic	(%)	(%)
Days to marketable maturity	33.17 – 61.69	48.24 ± 1.14	9.96	10.37	92.26	19.70
Plant height (cm)	31.44 – 61.51	54.51 ± 1.46	10.45	10.95	91.05	20.54
No. of leaves per plant	7.53 – 16.67	13.02 ± 0.81	15.45	17.22	80.51	28.55
Leaf length (cm)	27.24 – 39.12	33.00 ± 0.83	9.51	9.99	90.58	18.64
Leaf width (cm)	8.59 – 11.83	10.27 ± 0.44	7.82	9.41	68.96	13.37
Crown diameter (cm)	1.46 – 2.60	2.14 ± 0.10	13.98	15.17	84.88	26.53
Average root weight with leaves (g)	128.01 – 279.84	232.09 ± 11.48	13.09	14.43	82.35	24.48
Root length (cm)	4.96 – 26.76	22.19 ± 0.71	21.19	21.54	96.74	42.93
Root diameter (cm)	3.00 – 4.48	3.54 ± 0.12	9.24	10.06	84.33	17.47
Root yield per plot (kg)	2.60 – 6.63	5.18 ± 0.24	17.00	17.89	90.26	33.27
TSS (°Brix)	3.61 – 6.29	5.24 ± 0.09	12.85	13.02	97.50	26.14
Ascorbic acid content in roots (mg/100g)	12.17 – 28.11	18.06 ± 0.54	23.33	23.62	97.62	47.49
Dry matter content in roots (%)	5.45 – 8.41	7.13 ± 0.30	9.53	10.80	77.85	17.31

COV: Coefficients of variability (%); **H:** Heritability (%); **GAM:** Genetic advance as % of mean

(28.11 mg/100 g) was recorded in genotype VRRAD-200. Whereas Eight genotypes were found to be significantly superior over check variety Japanese White (17.04 mg/100 g).

Genetic variability parameters

The degree of variability present in the germplasm was measured in terms of phenotypic and genotypic coefficients of variation (PCV and GCV), heritability in a broad sense (h^2_{bs}) and genetic advance as a percentage of the mean. For all the traits examined, the magnitude of the phenotypic coefficients of variability was higher than that of the genotypic coefficients of variability. The value of PCV and GCV were high (Table 3) for ascorbic acid content in roots (23.62 % and 23.33 %) and root length (21.54 % and 21.19 %). Mallikarjunarao *et al.*, (2015) also reported high value of phenotypic and genotypic coefficients of variation for ascorbic acid content and root length. Moderate phenotypic and genotypic coefficients of variation were observed for the traits *viz.*, root yield per plot (17.89 % and 17.00 %), number of leaves per plant (17.22 % and 15.45 %) and crown diameter (15.17 % and 13.98 %), average root weight with leaves (14.43 % and 13.09 %), total soluble solids (13.02 % and 12.85 %) and plant height (10.95 % and 10.45 %). Low estimates of this were observed by the traits *viz.*, leaf length (9.99 % and 9.51 %) and leaf width (9.41 % and 7.82 %). Traits showing high to moderate genetic coefficient of variation (GCV) exhibited significant variability, suggesting they hold good potential for improvement in radish through various breeding techniques.

Heritability estimates measure the proportion of genetic variation that can be passed on relative to the total variability. High heritability (>60%) suggests that the trait can be effectively improved through selection, while low heritability implies that the trait is largely influenced by environmental factors, require a larger population to identify desirable genotypes. In Table 3, highest heritability was in ascorbic acid content in roots of 97.62 % followed by total soluble solids (97.50 %), root length (96.74 %), days to marketable maturity (92.26 %), plant height (91.05 %), leaf length (90.58 %), root yield per plot (90.26 %), crown diameter (84.88 %), root diameter (84.33 %), average root weight with leaves (82.35 %), number of leaves per plant (80.51 %), dry matter content in roots (77.85 %) and leaf width (68.96 %). The genetic gain was high for ascorbic acid content in roots (47.49 %), root length (42.93 %), root yield per plot (33.27 %), number of leaves per plant (28.55 %), crown diameter (26.53 %), total soluble solids (26.14 %), average root weight with leaves (24.48 %) and plant height (20.54 %).

Heritability alone does not completely reveal the level of genetic progress. Therefore, a combination of high heritability and high genetic gain is a more dependable basis for making selection decisions. Traits with a high genetic advance suggest they are controlled primarily by additive genes. In contrast, traits with moderate genetic advance indicate the influence of both additive and non-additive genes. Traits with low genetic advance highlight the importance of non-additive gene effects. High heritability coupled with high genetic gain were recorded in horticultural traits *viz.*, ascorbic acid content in roots, total soluble solids, root length, plant height, root yield per plot, crown diameter, average root weight with leaves and number of leaves per plant. These findings are

Table 4: Genotypic and Phenotypic coefficients of correlation among different horticultural traits in radish.

Characters		PH	NLPP	LL	LW	CD	ARWL	RL	RD	TSS	ACCR	DMCR	RYPP
DMM	G	0.662**	0.529**	0.496**	0.263*	0.251*	0.705**	0.604**	-0.399**	0.567**	-0.195	0.390**	0.709**
	P	0.608**	0.440**	0.486**	0.175	0.223	0.603**	0.576**	-0.346**	0.536**	-0.187	0.324**	0.641**
PH	G		0.428**	0.601**	0.293**	0.173	0.787**	0.916**	-0.760**	0.484**	0.050	0.301**	0.768**
	P		0.395**	0.537**	0.200	0.159	0.692**	0.857**	-0.677**	0.457**	0.038	0.244*	0.711**
NLPP	G			0.143	0.411**	0.122	0.685**	0.502**	-0.302**	0.426**	-0.177	0.469**	0.668**
	P			0.120	0.338**	0.132	0.587**	0.435**	-0.232*	0.377**	-0.149	0.366**	0.555**
LL	G				0.346**	0.529**	0.625**	0.382**	-0.302**	0.141	0.000	0.352**	0.667**
	P				0.276*	0.457**	0.554**	0.355**	-0.269*	0.133	0.001	0.305**	0.613**
LW	G					0.500**	0.460**	0.144	-0.103	0.054	0.246*	0.230*	0.333**
	P					0.373**	0.309**	0.127	-0.099	0.035	0.203	0.204	0.266*
CD	G						0.457**	-0.049	0.222	0.124	0.316**	0.174	0.294**
	P						0.356**	-0.048	0.197	0.108	0.290*	0.165	0.261*
ARWL	G							0.722**	-0.467**	0.405**	-0.027	0.437**	0.948**
	P							0.632**	-0.368**	0.353**	-0.019	0.373**	0.836**
RL	G								-0.783**	0.521**	-0.052	0.164	0.715**
	P								-0.740**	0.501**	-0.045	0.135	0.654**
RD	G									-0.360**	0.188	-0.119	-0.476**
	P									-0.329**	0.181	-0.119	-0.390**
TSS	G										0.102	0.308**	0.439**
	P										0.092	0.271*	0.413**
AACR	G											0.381**	-0.114
	P											0.335**	-0.109
DMCR	G												0.466**
	P												0.377**

DMM: Days to marketable maturity; PH: Plant height (cm); NLPP: Number of leaves per plant; LL: Leaf length (cm); LW: Leaf width (cm); CD: Crown diameter (cm); ARWL: Average root weight with leaves (g); RL: Root length (cm); RD: Root diameter (cm); TSS: Total soluble solids (°Brix); AACR: Ascorbic acid content in roots (mg/100g); DMCR: Dry matter content in roots (%); RYPP: Root yield per plot (kg)
*Significance at 5% level; **Significance at 1% level

supported by Ullah *et al.*, (2010), Sivathanu *et al.*, (2014), Datta *et al.*, (2015), Mallikarjunarao *et al.*, (2015), Roopa *et al.*, (2018) and Mashkey *et al.*, (2021). The genetic advance as a percentage of the mean ranged from 13.37-47.49 % in Table 3. The genetic gain (genetic advance expressed as per cent of population mean) was high for various characters *viz.*, ascorbic acid content in roots (47.49 %), root length (42.93 %), root yield per plot (33.27 %), number of leaves per plant (28.55 %), crown diameter (26.53 %), total soluble solids (26.14 %), average root weight with leaves (24.48 %) and plant height (20.54 %). These results were also supported by the findings of Mashkey *et al.*, (2021) for root length and root yield per plot.

Correlation coefficient analysis

The genotypic correlations were greater in magnitude than the phenotypic correlations, suggesting that heritable factors play a more dominant role. In Table 4, positive and highly significant correlation at both genotypic and phenotypic level with the traits *viz.*, average root weight with leaves (0.948 and 0.836) followed by plant height (0.768 and 0.711), root length (0.715 and 0.654), days to marketable maturity (0.709 and 0.641), number of leaves per plant (0.668 and 0.555), leaf length (0.667 and 0.613), dry matter content in roots (0.466 and 0.377), total soluble solids (0.439 and 0.413), leaf width (0.333 and 0.266) and crown diameter (0.294 and 0.261). Similar findings were observed by Ullah *et al.*, (2010), Mallikarjunarao *et al.*, (2015), Kaur *et al.*, (2017) and Thakur *et al.*, (2023). Whereas, root diameter (-0.476 and -0.390) exhibited negative and significant correlation with root yield per plot. Positive and significant correlation was reported for days to marketable maturity with the traits *viz.*, average root weight with leaves (0.705 and 0.603) followed by plant height (0.662 and 0.608), root length (0.604 and 0.576), total soluble solids (0.567 and 0.536), number of leaves per plant (0.529 and 0.440), leaf length (0.496 and 0.486) and dry matter content in roots (0.390 and 0.324) at both genotypic and phenotypic level. Whereas, the traits leaf width (0.263) and crown diameter (0.251) showed positive and significant association at genotypic level. Days to marketable maturity manifested

Table 5: Estimates of direct and indirect effects of different traits on yield in radish.

DTMM	**0.070**	0.138	0.168	0.242	-0.051	-0.161	0.902	-0.466	-0.014	0.096	-0.061	-0.151	0.709**
PH	0.046	**0.209**	0.136	0.293	-0.057	-0.111	1.007	-0.707	-0.027	0.082	0.016	-0.116	0.768**
NLPP	0.037	0.089	**0.317**	0.070	-0.080	-0.079	0.876	-0.387	-0.011	0.072	-0.056	-0.182	0.668**
LL	0.034	0.125	0.045	**0.488**	-0.067	-0.340	0.800	-0.295	-0.012	0.024	0.000	-0.136	0.667**
LW	0.018	0.061	0.130	0.169	**-0.195**	-0.321	0.588	-0.111	-0.004	0.009	0.077	-0.089	0.333**
CD	0.017	0.036	0.039	0.258	-0.097	**-0.643**	0.585	0.038	0.008	0.021	0.099	-0.067	0.294**
ARWWL	0.049	0.164	0.217	0.305	-0.089	-0.294	**1.279**	-0.557	-0.017	0.068	-0.009	-0.169	0.948**
RL	0.042	0.191	0.159	0.187	-0.028	0.032	0.924	**-0.772**	-0.028	0.088	-0.016	-0.064	0.715**
RD	-0.028	-0.159	-0.096	-0.158	0.020	-0.143	-0.598	0.604	**0.036**	-0.061	0.059	0.046	-0.476**
TSS	0.039	0.101	0.135	0.069	-0.011	-0.080	0.518	-0.402	-0.013	**0.169**	0.032	-0.119	0.439**
AACR	-0.014	0.010	-0.056	0.000	-0.048	-0.203	-0.035	0.040	0.007	0.017	**0.315**	-0.147	-0.114
DMCR	0.027	0.063	0.149	0.172	-0.045	-0.112	0.559	-0.127	-0.004	0.052	0.120	**-0.388**	0.466**

DTMM= Days to marketable maturity, PH= Plant height, NLPP= Number of leaves per plant, LL= Leaf length, LW= Leaf width, CD= Crown diameter, ARWWL= Average root weight with leaves, RL= Root length, RD= Root diameter, TSS= Total soluble solids, AACR= Ascorbic acid content in roots, DMCR= Dry matter content in roots, GCCRYPP= Genotypic correlation coefficient of root yield per plot; **Residual effect:** 0.0047

negative and highly significant correlation with root diameter (-0.399 and -0.346) at both genotypic and phenotypic level. Average root weight with leaves recorded positive and highly significant correlation with the traits *viz*., root length (0.722 and 0.632), dry matter content in roots (0.437 and 0.373) and total soluble solids (0.405 and 0.353) at both genotypic and phenotypic level. While it exhibited negative and significant association with root diameter (-0.467 and -0.368). Similar results were given by Madaik (2020). Root length expressed positive and highly significant correlation with the trait total soluble solids (0.521 and 0.501) while negative and significant correlation with root diameter (-0.783 and -0.740). Root diameter exhibited negative and highly significant correlation with total soluble solids (-0.360 and -0.329) at both genotypic and phenotypic level. Total soluble solids showed positive and highly significant correlation with dry matter content in roots (0.308 and 0.271). Ascorbic acid content in roots showed positive and highly significant correlation with dry matter content in roots (0.381 and 0.335). Similar observations were recorded by Mallikarjunarao *et al*., (2015) and Kaur *et al*., (2017).

Path analysis

In Table 5, Path analysis elucidates the direct and indirect relationships among variables. Fruit yield was treated as the dependent variable, while the other variables were considered independent. High positive direct effect towards root yield was exhibited by average root weight with leaves (1.279) followed by leaf length (0.488), number of leaves per plant (0.317), ascorbic acid content in roots (0.315), plant height (0.209), total soluble solids (0.169), days to marketable maturity (0.070) and root diameter (0.036) whereas negative direct effect on root yield was exhibited by the traits *viz*., root length (-0.772), crown diameter (-0.643), dry matter content in roots (-0.388) and leaf width (-0.195). Similar results were obtained by Sivathanu *et al*., (2014) and Datta *et al*., (2015).

Conclusion

The genotypes LC-58, LC-57 and LC-53 were found best for yield and other important horticultural traits and can be utilised in other breeding schemes. Selection for traits *viz.*, average root weight with leaves, plant height and root length would be effective for improvement of root yield in radish.

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