Study on character association and path-analysis in turnip (*Brassica rapa* L)

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ABSTRACT

The present study was conducted during rabi season of 2020 at the experimental research farm of the Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh. Twelve genotypes of turnip were evaluated in randomized complete block design to check the extent of character association and path-coefficient analysis for various horticultural traits including average root yield with leaves. The trait, average root yield with leaves had positive and significant character association with the trait average root yield without leaves both at genotypic and phenotypic levels. Path-analysis had positive direct effect on average root yield with leaves observed by the characters leaf length, leaf width, average root yield without leaves, days to first harvest, days to 50 per cent germination, TSS and number of leaves per plant.

Keywords: Turnip; character association; path-analysis; traits, genotypic; phenotypic

INTRODUCTION

Turnip (*Brassica rapa* L) is one of the important hardy cool season root crops which belongs to family Cruciferae with chromosome number 2n= 20. It's grown for its fleshy roots and green leaves and is a rich source of several vitamins (A, B and C), proteins, carbohydrates and minerals like calcium. It is broadly cultivated all over the world and is well adapted to a wide range of climatic conditions. The Mediterranean region is assumed to be the primary centre of European types while eastern Afghanistan is considered to be another primary centre with Asia Minor, Transcaucacus and Iran as secondary centers. The knowledge of genetic correlation among different horticultural traits of a crop can help the breeder in the selection of the desirable combinations of traits in a given genotype and helps in decreasing the retarding effect of negative correlations. Path-coefficient analysis determines the direct and indirect influence of the various independent variables on the dependent variable like yield and separates the correlation coefficient into the components of direct and indirect effects.

MATERIAL and METHODS

The present investigations were conducted during rabi season of 2020 at the experimental research farm of Department of Vegetable Science, College of Horticulture and Forestry, Neri, district Hamirpur, Himachal Pradesh in order to adjudge the character association and path-analysis studies in turnip. The study comprised 12 (7 local and 5 commercial) different genotypes of turnip and seeds of genotypes were directly sown in the field on 27 October 2020 at a spacing of 30 cm x 10 cm in randomized complete block design. Seedlings were thinned after 10-15 days of germination in order to maintain proper spacing between the plants. The observations were recorded on traits viz days to 50 per cent germination, days to first harvest, duration of availability of marketable roots (days), number of leaves per plant, leaf length, leaf width, leaf area, plant height, plant spread, average root yield without leaves, average root yield with leaves, root-shoot ratio, root length, root diameter, TSS and ascorbic acid content. The genotypic and phenotypic correlation was studied as per formula given by Al-Jibouri et al (1958) and path-coefficient as per the procedure suggested by Wright (1921) and elaborated by Dewey and Lu (1959).

Table 1. Genotypic and phenotypic correlation coefficients between average root yield with leaves and its component characters in turnip (*Brassica rapa* L)

C		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16
X1	G	1															
	P	1															
X2	G	0.263	1														
	P	0.195	1														
X3	G	0.138	0.367*	1													
	P	0.111	0.349*	1													
X4	G	0.340*	0.190	-0.394*	1												
	P	0.288	0.127	-0.297	1												
X5	G	0.751**	-0.181	-0.156	0.720**	1											
	P	0.469**	-0.142	-0.115	0.384*	1											
X6	G	0.732**	0.420*	0.610**	-0.025	0.418*	1										
	P	0.522**	0.323	0.516**	0.042	0.285	1										
X7	G	0.864**	0.256	0.394*	0.289	0.727**	0.929**	1									
	P	0.630**	0.170	0.314	0.260	0.704**	0.878**	1									
X8	G	0.391*	-0.387*	-0.417*	0.673**	0.836**	-0.101	0.272	1								
	P	0.323	-0.333*	-0.307	0.414*	0.716**	-0.008	0.358*	1								
X9	G	0.136	0.097	0.567**	-0.461**	-0.066	0.238	0.136	-0.262	1							
	P	0.139	0.060	0.508**	-0.316	0.001	0.187	0.120	-0.123	1							
X10	G	0.325	-0.058	0.445**	-0.320	0.213	0.669**	0.580**	-0.391*	0.517**	1						
	P	0.187	-0.059	0.400*	-0.140	0.081	0.586**	0.454**	-0.214	0.401*	1						
X11	G	-0.211	0.136	0.162	0.486**	-0.414*	-0.222	-0.307	-0.124	-0.070	-0.233	1					
	P	-0.223	0.113	0.146	0.336*	-0.223	-0.154	-0.199	-0.116	-0.016	-0.217	1					
X12	G	-0.045	-0.084	0.585**	-0.139	-0.192	0.095	-0.010	-0.034	0.388*	0.043	0.327	1				
	P	0.057	-0.025	0.455**	-0.077	0.117	0.139	0.163	0.143	0.265	0.058	0.235	1				
X13	G	-0.224	-0.125	0.210	-0.696**	-1.131**	-0.277	-0.654**	-0.679**	0.236	-0.012	0.215	0.211	1			
	P	-0.274	-0.123	0.131	-0.369*	-0.364*	-0.066	-0.240	-0.199	0.247	0.023	0.350*	0.107	1			
X14	G	0.098	-0.436**	-0.512**	-0.334*	-0.097	-0.175	-0.185	-0.053	-0.213	0.201	-0.574**	-0.263	0.132	1		
	P	0.137	-0.409*	-0.492**	-0.303	-0.038	-0.140	-0.130	0.006	-0.155	0.104	-0.507**	-0.172	0.064	1		
X15	G	-0.274	-0.130	0.494**	-0.007	0.031	0.344*	0.268	-0.286	0.439**	0.685**	0.333*	0.366*	-0.109	-0.444**	1	
	P	-0.138	-0.132	0.433**	-0.018	0.076	0.231	0.203	-0.197	0.415**	0.519**	0.314	0.320	-0.016	-0.383*	1	
X16	G	-0.457**	-0.386*	-0.143	0.322	0.105	0.013	0.058	0.020	-0.517**	0.207	0.234	-0.046	-0.261	-0.092	0.515**	1
	P	-0.324	-0.349*	-0.132	0.186	0.098	-0.026	0.035	-0.013	-0.486**	0.168	0.203	0.023	-0.191	-0.106	0.551**	1

C= Character; *Significant at 5% LoS, **Significant at 1% LoS; X1= Days to 50% germination, X2= Days to first harvest, X3= Duration of availability of marketable roots, X4= Number of leaves per plant, X5= Leaf length, X6= Leaf width, X7= Leaf area, X8= Plant height, X9= Root-shoot ratio, X10= Plant spread, X11= Root length, X12= Root diameter, X13= TSS, X14= Ascorbic acid content, X15= Average root yield without leaves, X16= Genotypic correlation coefficient with average root yield with leaves; G= Genotypic, P= Phenotypic

Table 2. Genotypic path-coefficient analysis for direct and indirect effects of component characters on yield in turnip (*Brassica rapa* L)

C	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16
X1	0.5116	-0.1713	-0.0579	0.0005	0.9689	0.7417	-1.4863	-0.5178	-0.1452	-0.0721	0.0626	-0.0145	0.0012	-0.0633	-0.2153	-0.457
X2	0.1343	-0.6524	-0.1547	0.0003	-0.2333	0.4261	-0.4408	0.5118	-0.1033	0.0128	-0.0404	-0.0271	0.0007	0.2820	-0.1018	-0.386
X3	0.0704	-0.2396	-0.4214	-0.0006	-0.2013	0.6184	-0.6767	0.5523	-0.6043	-0.0988	-0.0483	0.1886	-0.0011	0.3308	0.3884	-0.143
X4	0.1739	-0.1237	0.1659	0.0014	0.9294	-0.0252	-0.4964	-0.8902	0.4907	0.0709	-0.1446	-0.0446	0.0039	0.2160	-0.0054	0.322
X5	0.3841	0.1179	0.0657	0.0012	1.2905	0.4236	-1.2496	-1.1068	0.0704	-0.0473	0.1231	-0.0618	0.0063	0.0629	0.0242	0.105
X6	0.3743	-0.2742	-0.2570	-0.0004	0.5393	1.0137	-1.5976	0.1336	-0.2531	-0.1484	0.0661	0.0306	0.0015	0.1133	0.2705	0.013
X7	0.4422	-0.1672	-0.1658	0.0004	0.9377	0.9418	-1.7197	-0.3603	-0.1444	-0.1287	0.0914	-0.0033	0.0036	0.196	0.2105	0.058
X8	0.2001	0.2523	0.1758	0.0009	1.0793	-0.1023	-0.4682	-1.3235	0.2788	0.0867	0.0368	-0.0108	0.0038	0.0344	-0.2245	0.020
X9	0.0697	-0.0632	-0.2390	-0.0006	-0.0853	0.2408	-0.2331	0.3464	-1.0653	-0.1149	0.0206	0.1252	-0.0013	0.1375	0.3454	-0.517
X10	0.1662	0.0378	-0.1876	-0.0004	0.2753	0.6779	-0.9974	0.5173	-0.5513	-0.2221	0.0694	0.0139	0.0001	-0.1300	0.5381	0.207
X11	0.1077	-0.0887	-0.0684	0.0007	-0.5340	-0.2253	0.5283	0.1640	0.0741	0.0517	-0.2976	0.1055	-0.0012	0.3711	0.2614	0.234
X12	-0.0230	0.0549	-0.2465	-0.0002	-0.2473	0.0964	0.0178	0.0447	-0.4136	-0.0095	-0.0974	0.3224	-0.0011	0.1696	0.2874	-0.046
X13	-0.1147	0.0815	-0.0884	-0.0009	-1.4600	-0.2811	1.1242	0.8990	-0.2509	0.0027	-0.0641	0.0681	-0.0056	-0.0850	-0.0857	-0.261
X14	0.0501	0.2846	0.2156	-0.0005	-0.1256	-0.1778	0.3182	0.0705	0.2267	-0.0446	0.1709	-0.0846	-0.0007	-0.6463	-0.3489	-0.092
X15	-0.1401	0.0845	-0.2082	-0.0001	0.0398	0.3488	-0.4605	0.3781	-0.4681	-0.1519	-0.0989	0.1179	0.0006	0.2868	0.7861	0.515

Residual effect: 0.0125; C= Character; X1= Days to 50% germination, X2= Days to first harvest, X3= Duration of availability of marketable roots, X4= Number of leaves per plant, X5= Leaf length, X6= Leaf width, X7= Leaf area, X8= Plant height, X9= Root-shoot ratio, X10= Plant spread, X11= Root length, X12= Root diameter, X13= TSS, X14= Ascorbic acid content, X15= Average root yield without leaves, X16= Genotypic correlation coefficient with average root yield with leaves

RESULTS and DISCUSSION

Character association: Character association study revealed that generally the genotypic correlations were higher in magnitude as compared to the phenotypic correlations indicating that apparent association was due to genetic reasons (Table 1).

The most important economic character ie average root yield with leaves showed positive and significant correlation with the traits average root yield without leaves (genotypic= 0.515, phenotypic= 0.551) whereas highly significant negative correlation was exhibited by the trait average root yield with leaves and the trait root-shoot ratio (genotypic= −0.517, phenotypic= −0.486) indicating that the average root yield with leaves increased in those genotypes which exhibited lesser root-shoot ratio.

Path-analysis: Path-analysis study revealed that the character, leaf length had maximum direct positive effect on the dependent trait, average root yield with leaves followed by leaf width, average root yield without leaves, days to first harvest, days to 50 per cent germination, TSS and number of leaves per plant (Table 2). Similar findings have been reported by Mapari et al (2010) and Ullah et al (2010) in radish.

Direct negative effect was expressed by days to first harvest, duration of availability of marketable roots, leaf area, plant height, root-shoot ratio, plant spread, root length, TSS and ascorbic acid content on average root yield with leaves. Kaur et al (2017) also reported similar results in radish crop.

CONCLUSION

Correlation study suggested the importance of the trait average root yield without leaves as it highly affected the economic trait average root yield with leaves in the positive direction. Path-analysis study expressed that the character leaf length exhibited the highest direct effect on the economic yield character and hence selection through this trait would help in evolving genotypes with high average root weight with leaves.

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