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GENOTYPIC ASSOCIATION AND PATH COEFFICIENT ANALYSIS IN ASHWAGANDHA (*WITHANIA SOMNIFERA*)

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ABSTRACT

Genotypic and phenotypic correlations and path coefficient for seven characters were studied in 36 early generation selections in F_2 population of wide crosses (WS 20 x Wild and WS 22 x Wild) and seven genotypes of ashwagandha. Results indicated that root yield was significantly and positively correlated with plant height, stem branches, root length, root diameter, root branches, and seed yield. All the component characters studied were significantly and positively associated among themselves, except root branches with seed yield. Path coefficient analysis showed highest positive direct and indirect effect of plant height and stem branches on root yield. Indirect effects of other component characters were high through plant height and stem branches on root yield. Selection for high plant-height and stem branches appeared to be useful for improving root yield.

Key words: Correlation coefficient, path coefficient, *Withania somnifera*.

Ashwagandha is grown in about 4000 ha for its root in north western Malwa plateau of Madhya Pradesh [1]. Root yield in ashwagandha, as in any other crop plant, is a complex component character. Yield components play an important role in deciding the productivity of the crop. Though in an earlier study both additive and nonadditive components of gene action were reported to be important for root yield and its components [2], a clear understanding and knowledge of genotypic association and contribution of various yield components is essential for any selection programme aimed at yield improvement. Path coefficient analysis is useful for evaluating the relative contribution of each component traits, both direct and indirect, to the yield. No such studies have been carried out so far in this medicinal crop. The present study throws light on the nature of association of root yield with other characters by utilizing early selections in F_2 and other genotypes of ashwagandha.

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MATERIALS AND METHODS

The experimental material comprised 36 early generation selections in F_2 populations of two wide crosses (WS 20 x Wild and WS 22 x Wild) along with seven promising genotypes including parents. The trial was laid out in randomized block design with two replications with plot of size 1.2 x 2 m. Rows were spaced 30 cm apart with plant-to-plant distance of 4–6 cm.

Data were recorded for seven characters on 20 random plants in early selections of F_2 populations and on five plants from promising genotypes. Phenotypic and genotypic correlation coefficients were studied [3] along with path coefficient analysis [4].

RESULTS AND DISCUSSION

The genotypic and phenotypic correlation coefficients are presented in Table 1. These analyses revealed that the genotypic correlation coefficients (r_g) were generally higher than the corresponding phenotypic correlation coefficients (r_p). Root yield was significantly and

Table 1. Genotypic (r_g) and phenotypic (r_p) correlation coefficients for seven characters in ashwagandha

Characters	Stem branches	Root length	Root diameter	Root branches	Seed yield	Root yield
Plant height						
r_g	0.81	0.71	0.74	0.25	0.44	1.02
r_p	0.76**	0.60**	0.80**	0.41**	0.50**	0.71**
Stem branches						
r_g		0.60	0.76	0.55	0.66	0.73
r_p		0.52**	0.71**	0.45**	0.63**	0.70**
Root length						
r_g			0.51	-0.34	0.52	0.55
r_p			0.57**	0.73**	0.49**	0.52**
Root diameter						
r_g				0.35	0.55	0.90
r_p				0.49**	0.49**	0.78**
Root branches						
r_g					0.03	0.44
r_p					0.35	0.34
Seed yield						
r_g						0.52
r_p						0.48**

**Significant at 1% level.

positively associated with all the component traits, except root branches at the phenotypic level. Significant positive associations were observed among all the component characters, except between root branches and seed yield.

Plant height showed highly significant positive association with root yield and all other components except root branches. This significant correlation could be explained by the direct effect of plant height and indirect effect through stem branches (Table 2). Indirect effects via other component characters were mostly negative. Stem branches showed highly significant and positive association with root yield and other characters, which would again

Table 2. Direct (in bold) and indirect effects of plant characters on root yield of ashwagandha

Characters	Plant height	Stem branches	Root length	Root diameter	Root branches	Seed yield	Genotypic correlation with root yield
Plant height	**1.42**	1.37	- 1.49	0.28	- 0.43	- 0.13	1.02
Stem branches	1.15	**1.70**	- 1.27	0.29	- 0.94	- 0.20	0.73
Root length	1.01	1.03	**- 2.10**	0.20	0.58	- 0.16	0.56
Root diameter	1.05	1.30	- 1.07	**0.38**	- 0.60	- 0.17	0.89
Root branches	0.36	0.94	0.72	0.13	**- 1.70**	- 0.01	0.44
Seed yield	0.63	1.12	- 1.09	0.21	- 0.05	**- 0.30**	0.52

Residual effect = 0.23.

be explained by its positive direct effects and indirect effects through plant height on root yield. Although root diameter was significantly and positively associated with root yield and other components, except root branches, it had smaller positive direct effect and more positive indirect effect through plant height and stem branches. It had highest negative indirect effect on root yield via root length.

The root length and seed yield showed significant positive correlation with root yield and its component traits except root branches in both the cases. The direct effects of both characters were negative but the former had highest negative effects on root yield. The positive genotypic correlation could be due to indirect positive effects of stem branches and plant height. Root branches showed significant positive genotypic association with root yield and other components except seed yield. Although the direct effect of root branches was negative, high positive indirect effect via other characters, such as, stem branches, root

length and plant height contributed towards the significant positive correlation coefficient between root branches and root yield. The residual effects were considerably high.

These results indicate that plant height and stem branches had strong positive association with root yield and also showed highest positive direct effect on root yield. They also showed positive contribution through indirect effect of other components traits showing positive association with root yield. Thus, direct selection for plant height and stem branches will increase the breeding efficiency for root yield in ashwagandha.

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