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CORRELATION AND PATH COEFFICIENT ANALYSIS AMONG QUANTITATIVE CHARACTERS OF *Solanum Khasianum* CLARKE

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ABSTRACT

Correlation and path coefficient analysis among 14 characters of 30 genotypes of *S.khasianum* have been studied. Phenotypic correlation of berry yield per plant exhibited positive and highly significant correlation with number of berries per bunch, plant height, number of branches, plant spread, number of berries per plant, volume per berry, weight per berry and solasodine yield per plant. Positive significant genotypic correlations were also observed in all these attributes except volume per berry. Direct positive contribution of days to fruting, days to maturity, number of flowers per bunch, number of branches, weight per berry and solasodine yield per plant were observed towards berry yield per plant. The residual effect was of a low magnitude (0.0378).

Berries of *Solanum khasianum* are a source of the alkaloid solasodine, which has considerable potential in the production of cortico-steroids and oral contraceptives. Solasodine is chemically very close to diosgenin and it can serve effectively as a replacement for diosgenin (Mann, 1978). Knowledge of the association of quantitative characters, especially of yield and its attributes, will be of immense practical value in crop breeding programme. Path coefficient analysis measures the direct influence of one variable upon another and permits the separation of correlation coefficients into components of direct and indirect effect according to Dewey and Lu (1959). The present investigation was undertaken to determine characters associated with berry yield and their degree of association in *Solanum khasianum*.

MATERIALS AND METHODS

Thirty genotypes of *S.khasianum* having diverse origin were collected from different parts of the country and used for this study at Regional Research Laboratory, Jorhat (Assam). The field lay out was a randomised block design with three replications. The observations were made on five plants in each of the three replications selected randomly. In the present study, as many as fourteen variable namely days to flowering, days to fruiting, days to maturity, number of flowers per bunch, number of berries per bunch, plant height, number of branches, plant spread, number of berries per plant, berry yield per plant, volume per berry, solasodine content (%), weight per berry and solasodine yield per plant were considered. Solasodine was estimated following the method of Upadhyaya *et.al.* (1976) and Panina and Pimenova (1972). Correlation coefficients between berry yield per plant and its components were estimated as suggested by Al-Jibouri *et al.*, (1958). Path coefficient analysis was done following the method of Dewey and Lu (1959).

RESULTS AND DISCUSSION

Phenotypic, genotypic and environmental correlation coefficients among the different pairs of characters were estimated and presented in Table 1. The berry yield per plant showed positive significant phenotypic correlation coefficients with number of berries per bunch, plant height, number of branches, plant spread, number of berries per plant, volume per berry, weight per berry and solasodine yield per plant. All these characters exhibited significant positive genotypic correlations with berry yield expect volume per berry.

High positive significant environmental correlation coefficients were exhibited by number of berries per bunch, plant height and volume per berry with berry yield per plant.

Further significant and positive phenotypic correlation coefficients were observed in the following combinations; days to flowering with days to fruiting; number of flowers per bunch with number of berries per bunch; number of berries per bunch with plant height, plant spread, number of berries per plant berry yield and solasodine yield per plant; plant height with number of branches, plant spread, number of berries per plant, solasodine yield per plant; number of branches with plant spread, number of berries per plant and berry yield, solasodine yield per plant; plant spread with

Table 1. Phenotypic, genotypic and environmental correlation coefficients among 14 characters in *S.khasianum*

Characters		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	P	-	0.93**	0.04	0.14	-0.09	-0.25	-0.04	-0.08	-0.24	-0.25	-0.18	0.11	-0.16	-0.14
	G	-	1.00	-0.22	0.20	-0.07	-0.06	-0.04	0.19	-0.23	-0.06	0.15	1.17	0.65	0.19
	E	-	0.86	0.14	0.11	-0.11	-0.36	-0.04	-0.17	-0.25	-0.38	-0.22	-0.13	-0.26	-0.38
2	P		-	0.17	0.08	-0.07	-0.23	-0.11	-0.10	-0.25	-0.25	-0.22	0.10	-0.17	-0.14
	G		-	-0.10	0.22	-0.08	-0.20	-0.14	-0.04	-0.34	-0.20	-0.33	1.24	-0.39	0.12
	E		-	0.28	0.00	-0.07	-0.27	-0.10	-0.13	-0.18	-0.29	-0.19	-0.12	-0.22	-0.31
3	P			-	-0.18	-0.07	0.01	0.10	-0.10	-0.08	-0.07	-0.21	-0.05	-0.11	-0.08
	G			-	0.02	-0.07	0.36	-0.37	-0.74	-0.29	-0.29	-1.00	-1.12	-0.92	-0.43
	E			-	-0.22	-0.07	-0.03	0.19	-0.05	-0.03	-0.03	-0.07	0.04	-0.10	0.00
4	P				-	0.61**	0.17	0.08	0.15	0.28	0.25	0.09	-0.09	0.21	0.14
	G				-	0.78	-0.68	-0.32	-0.99	0.11	-0.05	-0.14	-0.22	-6.47	-0.21
	E				-	0.56	0.34	0.22	0.31	0.36	0.36	0.16	-0.07	0.39	0.27
5	P					-	0.47**	0.12	0.45**	0.56**	0.52**	0.24	0.04	0.28	0.41*
	G					-	-0.43	-0.05	-0.29	0.71	0.42	-0.57	1.25	-8.60	0.53
	E					-	0.61	0.17	0.54	0.53	0.56	0.43	-0.09	0.45	0.38
6	P						-	0.41*	0.63**	0.60**	0.62**	0.22	0.09	0.34	0.51**
	G						-	1.20	0.66	0.96	0.57	-0.68	1.67	-8.25	0.82
	E						-	0.27	0.63	0.56	0.66	0.37	-0.03	0.46	0.47
7	P							-	0.45**	0.48**	0.46**	0.11	0.19	0.10	0.42*
	G							-	1.51	0.67	0.65	0.02	0.96	0.10	0.66
	E							-	0.33	0.41	0.39	0.14	0.10	0.12	0.33
8	P								-	0.56**	0.53**	0.15	0.13	0.18	0.45**
	G								-	0.97	0.67	-0.38	2.95	-3.12	1.13
	E								-	0.55	0.54	0.22	-0.02	0.22	0.38
9	P									-	0.92**	0.30	0.20	0.34	0.79**
	G									-	1.00	0.14	1.02	2.65	0.95
	E									-	0.89	0.37	0.07	0.35	0.71
10	P										-	0.41*	0.17	0.58**	0.82**
	G										-	0.28	1.18	1.89	0.98
	E										-	0.45	0.26	0.64	0.75
11	P											-	-0.04	0.49**	0.28
	G											-	0.22	3.49	0.21
	E											-	-0.08	0.49	0.30
12	P												-	-0.17	0.67**
	G												-	6.33	1.13
	E												-	-0.23	0.65
13	P													-	0.37*
	G													-	2.87
	E													-	0.37

P = Phenotypic, G = Genotypic, E = Environmental, * = Significant at P=0.05; ** = Significant at P=0.01, (1) Days to flowering, (2) Days to fruiting, (3) Days to maturity, (4) Number of flowers per bunch, (5) Number of berries per bunch, (6) Plant height (cm), (7) number of branches, (8) Plant spread (diameter in m.), (9) Number of berries per plant, (10) Berry yield per plant (kg), (11) Volume per berry (cc), (12) solasodine content (% dry wt. of berry), (13) Weight per berry (g), (14) solasodine yield per plant (g).

number of berries per plant and berry solasodine yield per plant; number of berries per plant with berry weight solasodine yield per plant; volume per berry with weight per berry; solasodine content with solasodine yield per plant and weight per berry with solasodine yield per plant. Phenotypic

Table 2. Correlation coefficients, direct (underlined) and indirect contributions of 13 characters towards berry yield per plant in *S.khasianum*

Characters studied	Contribution of characters number													Genotypic correlation coefficient
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1	-1.0073	0.9671	-0.0199	0.1162	0.0148	0.0343	-0.0370	0.0065	0.0789	0.0343	-0.6458	0.0184	0.03769	-0.0624
2	-1.0077	0.9667	-0.0036	0.1251	0.0168	0.1074	-0.1398	-0.0015	0.1180	0.0740	-0.6841	-0.0110	0.2430	-0.2015
3	0.2242	-0.0930	0.0897	0.0107	0.0145	-0.1974	-0.3691	-0.0248	0.0984	0.2274	0.6194	-0.0264	-0.8625	-0.2890
4	-0.2032	0.2100	0.0017	0.5762	-0.1569	0.3697	-0.3256	-0.0329	-0.0377	0.0323	0.1220	-0.1850	-0.4232	-0.0528
5	0.0744	-0.0813	-0.0065	0.4507	-0.2005	0.2337	-0.0513	-0.0096	-0.2433	0.1309	-0.6870	-0.2456	1.0516	0.4163
6	0.0638	-0.1917	0.0327	-0.3933	0.0865	-0.5415	1.2069	0.0219	-0.3284	0.1555	-0.9225	-0.2359	1.1624	0.5782
7	0.0370	-0.1342	-0.0329	-0.1863	0.0102	-0.6490	1.0069	0.0505	-0.2288	-0.0038	-0.5278	0.0029	1.3042	0.6489
8	-0.1962	-0.0434	-0.0666	-0.5678	-0.0577	-0.3547	1.5211	-0.0334	-0.3333	0.0858	-1.6272	-0.0892	2.2495	0.6691
9	0.2320	-0.3327	-0.0257	0.0633	-0.1423	-0.5187	0.6719	0.0325	-0.3428	-0.0317	-0.5645	0.0756	1.8893	1.0063
10	0.1518	-0.3142	-0.0895	-0.0815	0.1152	0.3692	0.0168	-0.0126	-0.0476	-0.2279	-0.1202	0.0997	0.4238	0.2833
11	-1.1800	1.1997	-0.1008	-0.1275	-0.2499	-0.9062	0.9639	0.0987	-0.3510	-0.0497	-0.5513	0.1810	2.2556	1.1826
12	-0.0652	-0.3732	-0.0829	-3.7326	1.7238	4.4717	0.1036	-0.1045	-0.9078	-0.7958	-3.4933	0.0285	5.7057	1.8911
13	-0.1911	0.1183	-0.0389	-0.1227	-0.1061	-0.4428	0.6610	0.0379	-0.3260	-0.0486	-0.6259	0.0821	1.9867	0.9837

(1) Days to flowering, (2) Days to fruiting, (3) Days to maturity, (4) Number of flowers per bunch, (5) Number of berries per bunch, (6) Plant height (cm), (7) Number of branches, (8) Plant spread (m), (9) Number of berries per plant, (10) Volume per berry (cc), (11) Solasodine content (%), (12) Weight per berry (g), (13) Solasodine yield per plant (g). Residual value = 0.0378

correlations were higher in number of berries per bunch with plant height, number of branches, plant spread and berry yield than the genotypic correlations and the environmental correlations were higher than either of the two indicated that these traits were more influenced by environments.

In some cases, the genotypic correlation coefficients exceed the limit of unity. Such a situation may arise when error variance are higher than the genotypic variance leading to small denominator in the formula or if the signs of the progeny and error mean products are different leading to a relatively large genotypic mean products (numerator in the formula).

A perusal of the results obtained in genotypic path analysis (Table 2) revealed that the maximum direct positive effect on berry yield was exhibited by solasodine yield per plant followed by number of branches, days to fruiting, number of flowers per bunch, days to maturity and weight per berry. Similarly, the highest negative direct effect on berry yield was exhibited by days to flowering followed by solasodine content, plant height, number of berries per plant, volume per berry, number of berries per bunch and plant spread. Further, positive and significant genotypic correlation coefficients between number of berries per bunch and berry yield per plant may be due to high indirect effects via number of flowers per bunch and plant height. The high positive correlation coefficient between plant height and berry yield per plant appears mainly to be due to high positive indirect effect of number of branches. Correlation coefficient between number of branches and berry yield is due to high positive direct effect; the high correlation between plant spread and berry yield is due to high indirect contribution of number of branches; the positive and high correlation between number of berries per plant and berry yield is due to high positive indirect effect of number of branches; the high correlation

coefficient between solasodine content and berry yield is due to high positive indirect effect of days to fruting and number of branches and the high correlation coefficient between weight per berry and berry yield is mainly due to high indirect effects of number of branches, plant spread and solasodine yield per plant.

In the present study, the residual effect was of low magnitude (0.0378) suggesting that most of the important contributing attributes to berry yield per plant have been utilised.

Path analysis may or may not give results identical to correlation studies. In case of disparities, reliance must be placed on path analysis. Therefore, more emphasis should be given during selection on days to fruiting, number of flowers per bunch, number of branches, plant height, plant spread and weight per berry. Selection based on these component attributes might be helpful in evolving high yielding varieties of *S.khasianum*.

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EVALUATION OF THE HEDGE LUCERNE (*Desmanthus Virgatus*) AS FORAGE CROP UNDER DIFFERENT IRRIGATIONS AND IN COMBINATION WITH GUINEA GRASS

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ABSTRACT

The fodder yield and quality from monocrop of hedge lucerne (*Desmanthus virgatus*) was compared with its intercrop with guinea grass (hamil variety) in 1 : 2 ratio in the year 1987-88 under three irrigation conditions: 1) Weekly irrigation, 2) Fortnightly irrigation, 3) No irrigation (rainfed crop). The annual fresh yields of the monocrop under three conditions were 90.1, 77.76, 30.87 t/ha and for intercrop 249.4, 212.23 and 70.87 t/ha respectively. The cost of production of the green monocrop was Rs.296, 317, 386 and for the intercrop Rs.120, 131 and 195 per tonne respectively. The dry matter content varied from 25.74 to 26.97% for monocrop and 18.45 to 21.11% for the intercrop. Crude protein content on D M basis ranged from 22.63 to 24.20% and 13.12 to 13.80% respectively. With reduction in irrigation source, the returns per/ha reduced considerably. The intercrop was more economical than the single crop though both cropping systems were profitable.

Feeding of leguminous fodder to milch cows can effect reduction in concentrate requirement. The cost of cultivation of conventional legumes such as lucerne is high. Hedge lucerne (*Desmanthus virgatus*) is a leguminous shrub naturally found in tropical and sub-tropical America and South Asia. It is grazed by cattle or periodically harvested for feeding. When used as a hedge plant, one metre length of hedge yielded 30 kg from a single cut. In the field, it produced 39 t/ha under irrigation and 13 t/ha in rainfed condition (Sundararaj and Nagarajan, 1963). Its intercrop with napier grass yielded 187.1 tonnes grass and 39.8 tonnes legume/ha (Chandrasekharan *et al.*, 1983). Plantation of *Desmanthus* in grain crops was found to increase the grain yield (Desai