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ASSOCIATION STUDIES IN NIGER (*GUIZOTIA ABYSSINICA* CASS.) GERMPLASM

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ABSTRACT

Correlation studies indicated higher estimates of genotypic correlation coefficient than those obtained at phenotypic level for almost all the characters. The seed yield was largely accounted for by the characters, such as number of capitulum per plant, number of primary branches per plant, 1000-seed weight and plant height, as these characters were associated with seed yield appreciable and favourably. Construction of selection indices with these characters for the improvement of seed yield is suggested.

Key words : *Correlation, path analysis, niger.*

Among the oil seed crops, niger (*Guizotia abyssinica* Cass.) is one of the minor crops grown in India and Eastern parts of the Africa (Getinet and Sharma, 1966). It is said by originated and domesticated in Africa (Ethiopia to Malawi) and introduced in India probably in 3rd millennium BC (Doggett, 1987). Although it has a fatty acid composition typical for seed oils of Asteraceae members, it has been underutilized and highly neglected crop. Niger is a completely out crossing species with sporophytic self-incompatibility mechanism. Insects, particularly bees are the major agents of pollination. Niger seed contain about 39-43% oil (ICAR, 1992) with fatty acid composition similar to that of safflower and sunflower oils. Slow drying property similar to that of sunflower, used in food, paints, soap, as an illuminant and folk medicine against rheumatism (Duke, 1983).

MATERIALS AND METHODS

The present investigation was carried out during *Kharif* 1997 at the Niger experimental plot of Ranchi Agriculture College, Birsa Agricultural University, Ranchi. The experimental material consisting of 72 genotypes of Niger. The seed were sown in Randomized Block Design (R.B.D.) with three replication on the rows 30 cm apart. Intra row plant distance of 10 cm was maintained by thinning after 25 days of sowing. The observations were taken on five randomly selected plants from middle row in each germplasm in each replication for nine quantitative attributes such as plant height (cm), number of primary branches per plant, number of secondary branches per plant, Number of capitulam per plant, capitulam diameter (cm), 1000 seed weight (g), days to 50% flowering, days to maturity, yield per plant (g). The genotypic and phenotypic correlation coefficients were worked out by using the formula suggested by Millar *et al.* (1958) while, path coefficient analysis, as applied by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Correlation studies were carried out primarily to assess the suitability of different parameters for an indirect selection and framing of selection indices. In the present study phenotypic and genotypic correlation coefficients were computed among eight yield attributing characters and with yield itself and are presented in Table-1. Correlation coefficients at genotypic level were observed to be of higher values which could not be obtained or repeated at phenotypic level for many characters because of interaction with the environment (Table-1).

A perusal of the table-1 reveals that the degree of association of seed yield per plant with other traits at phenotypic level varied largely by proportionate variation in the characters like number of capitulum per plant and number of primary branches per plant. The association of seed yield with number of capitulum per plant was highly significant at phenotypic level (r = 0.381), with number of primary branches per plant was significant at both phenotypic and genotypic level (r = 0.282 and r =0.243) respectively.

Seed yield per plant had a weak but favourable association at phenotypic level with 1000-seed weight (r = 0.212), plant height (r = 0.195) and number of secondary branches per plant (r = 0.139) but association with capitulum diameter (r = 0.097), days to

50 per cent flowering (r = 0.002) was though in favourable direction but was negligible. Days to maturity had shown negative correlation with seed yield (r = -0.057) at phenotypic level. At genotypic level seed yield per plant had positive and highly significant association with number of secondary branches per plant (r = 0.690), however number of primary branches per plant (r = 0.243), capitulum diameter (r = 0.301) and 1000 - seed weight (r = 0.263) had positive and significant association.

Correlation coefficients of 1000-seed weight with other yield traits were presented in table-1 at phenotypic as well as genotypic level. However favourable correlation of 1000-seed weight with capitulum diameter may be considered. At phenotypic level though association of 1000 - seed weight with other traits was in favourable direction but was in negative direction with many other traits. Highly significant and favourable correlation was observe among capitulum diameter with plant height (r = 0.430), number of capitulum per plant with number of primary branches per plant (r = 0.643) and number of capitulum per plant with number of econdary branches per plant (r = 0.275) and number of secondary branches per plant with number of primary branches per plant (r = 0.250) at phenotypic level, whereas days to maturity had strong negative correlation with capitulum diameter (r =) -0.559 at genotypic level and with plant height (r = -0.400) at phenotypic level.

At genotypic level too, highly significant and positive correlation for number of capitulum per plant with number of primary branches per plant (r = 0.756) and number of secondary branches per plant (r = 0.810) was maintained. However, association of number of capitulum with days to 50 per cent flowering (r = 0.349) at genotypic level was positive and highly significant, whereas at phenotypic level it was negative but weak (r = -0.031). Plant height had positive but weak association with number of primary branches per plant (r = 0.071), number of capitulum per plant (r = 0.230) and 1000 - seed weight (r = 0.071) but its association with days to 50 per cent flowering was negative (r = -0.085) at phenotypic level. Number of primary branches per plant (r = -0.317), days to 50 per cent flowering (r = -0.388) and days to maturity (r = -0.539) were negatively and highly significantly associated with plant height at genotypic level. Number of primary branches per plant was highly significantly and favourably associated with number of capitulum per plant (r = 0.643) and also with number of secondary branches per plant, which was significant (r = 0.250) at phenotypic level but association was highly significant (r = 0.942 and r = 0.756) at genotypic level. Number of primary branches per plant was also favourably and significantly correlated with days to maturity (r = 0.270) at genotypic level and negatively associated with days to 50 per cent flowering (r = -0.080) at phenotypic level. There was weak and negative association of number of secondary branches per plant with days to 50 per cent flowering (r = -0.187) and days to maturity (r = -0.006) at phenotypic level. At genotypic level, the correlation was in positive direction with days to 50 per cent flowering (r = 0.087) and days to maturity (r = 0.060) though, it was weak. Highly significant favourable association was noted for days to 50 per cent flowering with days to maturity (r = 0.880), number of capitulum per plant (r = 0.349) 1000 seed weight (r = 0.924) at genotypic level but remained weak and in positive direction for days to maturity (r = 0.199) and negative association with number of capitulum per plant (r = -0.031) and 1000-seed weight (r = -0.119) at phenotypic level.

Path coefficient analysis

In order to partition the phenotypic correlation coefficients into direct and indirect effects of the characters 1000-seed weight, capitulum diameter, number of capitulum per plant, plant height, capitulum diameter, number of capitulum per plant, plant height, number of primary branches per plant, number of secondary branches per plant, days to 50 per cent flowering and days to maturity in relation to the end product, the seed yield, the method suggested by Dewey and LU (1959) for path coefficient analysis was adopted. The magnitude of effect of yield contributing characters on seed yield have been given in table-2. Direct effect of various characters on seed yield per plant was observed between -0.045 to 0.303 Number of capitulum per plant had maximum favourable direct effect (0.303) on seed yield where as direct effect of days to maturity was negative and low in magnitude (-0.045). Thousand seed weight had positive direct (0.174) effect on seed yield per plant. Its indirect effects via capitulum diameter (0.009), number of capitulum per plant (0.025), and plant height (0.005) were though positive but low in magnitude. Indirect effects via number of primary branches per plant and days to maturity (-0.002) were negative. Capitulum diameter recorded positive but low direct effect (0.040) on seed yield per plant. Indirect effects of this character on seed yield were negative via number of capitulum per plant (-0.012), number of primary branches per plant (-0.007) and number of secondary branches per plant (-0.010). However positive indirect

Table–1 : Phenotypic and Genotypic correlation coefficient among seed yield and its characters.

Characters		Number of Primary branches / plant	Number of Sec. branches / plant	Days to 50% flowering	Days to maturity	No. of Capitulam/ plant	Capitulam diameter (cm)	1000 seed weight (g)	Yield/ Plant (g)
Plant height	P	0.071	-0.006	-0.085	-0.400**	0.230	0.430**	0.071	0.195
	G	-0.317*	-0.001	-0.388*	-0.539**	-0.008	0.044	0.229	0.160
Number of Pri. branches / plant	P		0.250*	-0.080	0.086	0.643**	-0.126	-0.037	0.282*
	G		0.942**	0.214	0.270*	0.756**	-0.380**	-0.159	0.243*
Number of Sec. branches / plant	P			-0.187	-0.006	0.275*	-0.190	0.000	0.139
	G			0.087	0.060	0.810**	-0.253*	-0.207	0.690**
Days to 50% flowering	P				0.199	-0.031	0.063	-0.119	0.002
	G				0.880*	0.349**	0.115	0.924**	0.147
Days to maturity	P					0.038	-0.257*	0.052	-0.057
	G					0.134	-0.559**	-0.034	-0.111
No. of capitulam / plant	P						-0.039	0.084	0.381**
	G						-0.183	-0.005	0.215
Capitulam diameter (cm)	P							0.231	0.097
	G							0.301*	0.301*
1000 seed weight (g)	P								0.212
	G								0.263*

*Significant at 5% probablity level **Significant at 1% probablity level P=Phenotypic, G=genotypic

Table-2 : Direct and Indirect effects of various traits on seed yield in Niger.

Characters	Plant height (cm)	Number of Pri. branches / plant	Number of Sec. branches / plant	Days to 50% flowering	Days to maturity	No. of Capitulam / plant	Capitulam diameter (cm)	1000seed weight (g)
Plant height (cm)	0.076	0.005	0.000	-0.007	-0.030	0.017	0.033	0.005
Number of Pri. branches / plant	0.004	0.056	0.014	-0.004	0.005	0.036	-0.007	-0.002
Number of Sec. branches / plant	0.000	0.013	0.052	-0.008	-0.000	0.014	-0.010	0.000
Days to 50% flowering	-0.001	-0.001	-0.003	0.017	0.003	0.000	0.001	0.002
Days to maturity	0.018	-0.004	0.000	-0.009	-0.045	-0.002	0.011	-0.002
No. of Capitulam/ plant	0.069	0.195	0.083	-0.009	0.01	0.303	-0.012	0.025
Capitulam diameter (cm)	0.017	-0.005	-0.008	0.002	-0.010	-0.009	0.040	0.009
1000 seed weight (g)	0.012	-0.006	0.000	0.021	0.009	0.015	0.040	0.174
Yield / Plant(g)	0.195	0.252	0.139	0.002	-0.057	0.381	0.097	0.212

Bold Figure show Direct EffectResidual effect=0.897

effects of this trait on seed yield were contributed via 1000-seed weight (0.040), days to 50 per cent flowering (0.0001), plant height (0.033) and days to maturity (0.011) with its positive correlation coefficient (r = 0.097) for seed yield. Direct effect of number of capitulum per plant (0.303) on seed yield per plant was maximum. Its indirect effect was positive in most of the characters though, their magnitude was low. Negative indirect effect was also recorded via days to maturity (-0.002) and capitulum diameter (-0.009) reducing correlation coefficient (r = 0.381) which was maximum in this study.

Days to maturity had the lowest value of unfavourable direct effect (-0.045) on seed yield per plant. Its indirect effect was also negative via plant height (-0.036) and capitulum diameter (-0.010). However, positive indirect effects were noticed through number of primary branches per plant (0.005), days to 50 per cent flowering (0.003), number of capitulum per plant (0.011) and 1000-seed weight (0.009) on seed yield per plant. Days to 50 per cent flowering also had positive direct effect on seed yield per plant with very low magnitude (0.017). Correlation coefficient (r = 0.002) was contributed by indirect effects via number of capitulum diameter (-0.002), and 1000-seed weight (0.021), plant height (-0.007), number of primary branches per plant (-0.0004), number of secondary branches per plant (-0.008), days to maturity (-0.009) and number of capitulum per plant (-0.009), recorded negative indirect effects on seed per plant. Direct positive effect of number of secondary branches per plant on seed yield per plant (0.052) was recorded. The indirect effects via most of the characters were positive but low in magnitude. Negative indirect effect were seen via days to 50 per cent flowering (-0.003) and capitulum diameter (-0.008). The character number of primary branches per plant also showed low positive direct effect on seed yield per plant (0.056). Its indirect effects through the character4s plant height (0.005), number of secondary branches (0.013) and number of capitulum per plant (0.195) were positive while capitulum diameter (0.005), days to 50 per cent flowering (-0.001), days to maturity (-0.004) and 1000-seed weight (-0.006) gave negative indirect effects. Plant height had positive direct effect on seed yield per plant but was low in magnitude (0.076). Its indirect effect via 1000-seed weight (0.001), capitulum diameter (0.017), number of capitulum per plant (0.069), no of primary branches per plant (0.004) and days to maturity (0.018) were positive whereas days to 50 per cent flowering (-0.001) imposed negative indirect effects on its correlation coefficient with seed yield. Residual effect was considerable (0.8972) and indicated that other characters are also contributing towards seed yield per plant which are not included in the present study.

Estimates of phenotypic and genotypic correlations among various characters are useful in planning and evaluation of breeding programme. Correlation between useful and useless characters may reveal that some of the latter are useful as indicators of the one or more of the former. In the present investigation, correlations have been studied at phenotypic and genotypic level to identify characters of importance. Johnson et al. (1955) suggested that genetic correlation coefficient provides a measure of the genotypic associations between the characters and thus give an indication of characters that may be useful ones under consideration. Correlation coefficient may not give a complete picture of a rather complex situation, path coefficient analysis has also been done in order to assess the direct and indirect causes of association and a detailed examination of specific forces acting to produce a given correlation and to measure the relative importance of each causal factor.

In the present study the estimates of genotypic correlation coefficient are, in general, higher than those obtained at phenotypic level for almost all the characters studied, indicating inherent relationship among the characters which to certain extent could not be expressed at phenotypic level. This is not unusual as has been reported by many earlier oil seed workers and in niger by Channarayaeppa (1987); and Trivedi (1988); Singh and patra (1989); Mathur and Gupta (1995) and Borloe and Patil (1997). The association of seed yield was largely accounted for by the characters such as number of capitulum per plant and number of primary branches per plant. The seed yield strongly correlated with number of capitulum per plant as obtained in present study, was further confirmed by the high direct effect of number of capitulum per plant on seed yield. Ram and Trivedi (1988); Singh and Patra (1989); Abraham and Gupta (1989); Mathur and Gupta (1995) in niger and Pandya *et al.* (1997) in safflower reported similar associationship. The association of 1000-seed weight was substantially favourable with capitulum diameter, days to 50 per cent flowering, number of capitulum per plant, plant height and also with the seed yield. This is possible because of positive direct and indirect effects via all the traits except number of primary branches per plant. This is in conformity with the findings of Singh and Patra (1989); Mathur and gupta (1995) in niger, Murthy and Shambulingappa (1989) in sunflower and Pandya *et al.* (1997) in safflower. Correlation between capitulum diameter and seed yield was favourably weak. The sum of positive effects obtained through direct and indirect effects via plant height, days to 50 per cent flowering, days to maturity and 1000-seed weight could counter balance the negative indirect effects via number of primary branches per plant, number of secondary branches per plant and number of capitulum per plant, resulting in weak association with seed yield. Ram and Trivedi (1988) in niger and Vanisree *et al.* (1988) and Murthy and Shambulingappa (1989) in sunflower also reported positive correlation of capitulum diameter with seed yield.

Number of capitulum per plant was strongly correlated with number of primary branches per plant and number of secondary branches per plant and plant height. Similarly number of capitulum per plant was also associated with seed yield strongly and favourably. It was further confirmed by high direct effect of number of capitulum per plant with seed yield and positive indirect effects via number of primary branches per plant, number of secondary branches per plant, plant height and 1000-seed weight. This finding is further substantiated by the findings reported by Ram and Trivedi (1988); Singh and Patra (1989); Mathur and Gupta (1995) in niger and Pandey *et al.* (1997) in safflower. Days to 50 per cent flowering had weak positive correlation with seed yield whereas it was in negative direction with days to maturity. Though days to maturity expressed negative effect on seed yield but it was some how compensated by the positive indirect effects via captiulum diameter and 1000- seed weight. Ram and Trivedi (1988); Abraham and Gupta (1989) and Mishra (1995) also noticed similar correlation in their studies. Association of number of primary branches per plant and number of secondary branches per plant with seed yield was strong because of the direct and indirect role these played via number of capitulum and plant height. Similar association is corresponded with the finding of Channarayaeppa (1987); Ram and Trivedi (1988); Singh and Patra (1989); Patil *et al.* (1996); Mathur and Gupta (1995) and Mishra (1995).

It is intresting to observe that plant height expressed considerable association with seed yield and numbr of capitulum per plant. Association with other characters such as number of primary branches per plant was substantial. Plant height had substantial inherent relationship with seed yield but its relationship at phenotypic level was suppressed because of negative indirect effects via days to 50 per cent flowering. This is in accordance with the finding of Ram and Trivedi (1988).

Considering the overall results of the correlation studies it would appear that number of capitulum per plant followed by number of primary branches per plant, 1000-seed weight and plant height showed favourable association with seed yield. Selection based on these characters would improve the yield potential of niger population.

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