CHARACTER ASSOCIATION STUDY IN *LINUM USITATISSIMUM* L.

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Abstract: The economic yield showed highly significant positive correlation coefficient with flower length, flower breadth, seed length and pollen grain number per anther per flower. The pollen tube length showed highly significant and positive correlation coefficient with male and female reproductive organ length.

Keywords: Linseed, Character association

INTRODUCTION

Among all the oil seed crops, linseed (*Linum usitatissimum*) ranks fourth in importance in term of area as well as production. It is cultivated in almost all the countries of the world. It is chiefly grown as a fibre crop in European and other temperate countries while in India it is exclusively cultivated as oil seed crop. The plant belong to family Linaceae of order Geraniales.. Rao and Singh (1983),Verma *et al*. (1994) and Mahto and Mahto (1997) observed the highly significant positive correlation coefficient between seed yield and capsule number per plant. Although much work has been done on various biometrical aspects of the plant under study but there are many gaps in the relevant information concerning the some characters such as the flower size, pollen production and pollen tube length. Neither these traits have been analysed statistically nor biometrically. The present study is an endeavour in this direction.

MATERIALS AND METHODS

The experimental materials consisting of ten genotypes of *Linum usitatissimum* namely TLP-1, RLC-29, LC-54, LC-185, T-397, Kiran, Nagarkot, Neelum, Shubra and Gaurav. The certified seeds were procured from Chandershekar Azad University of Agriculture and Technology, Kanpur India. They were sown in the month of November in a randomized block design with four replications spaced 45 cm apart. A distance of 20 cm in between them was maintained by thining some 15-20 days after sowing. A good crop was raised by following the recommended package of practice.

Genotypic and phenotypic correlation coefficient were estimated by Searle(1961) formulae. The significance of phenotypic correlation coefficient was tested against 'r' value from 'r' table of Fisher and Yates (1938), for (n-2) degree of freedom.

RESULTS & DISCUSSION

A thorough study of character association at genotypic, phenotypic and environmental level are given table 1. The high yield can be achieved by using better agricultural practice and improved varieties. If we wish to change the expression of one character in a population, we require the informations about the interrelationship among various characters. It provides the more source of information as to the nature, extent and direction of selection pressure. Most attempts to determine the effect of floral traits on outcrossing have made comparisons among closely related species or among nonspecific populations (Schoen, 1982a, Holtsford and Ellstrand 1992). Such studies have shown average amount of correlations between herkogamy and outcrossing rates (Rick *et al.* 1977). The result reveals the highly significant positive correlation coefficient at phenoltypic level for the following characters i.e., pollen tube length with flower breadth, male and female reproductive organ length. A strong positive association between anther–stigma as reported in other diverse taxa such as *Lycopersicon pimpinellifolium* (Rick *et al.* 1978), *Datura stramonium* (Motten and Stone 2000), and *Aquilegia caerulea* (Brunet and Eckert, 1998). Pollen grain number per flower with economic yield and pollen grain number per anther, pollen grain number per anther with economic yield, fruit length, flower breadth, biological yield, the seed length with flower length and breadth, economic yield, 1000 seed weight and fruit length, fruit length with male reproductive organ length, flower length, breadth and biological yield, and 1000 seed weight,

the 1000 seed weight with flower length, breadth and biological yield, the harvest index with economic yield, the economic yield with flower length, breadth and biological yield, the biological yield with flower length, breadth, the female reproductive organ length with flower length and breadth, the flower length with flower breadth. Hyesoon *et al.* (1991) reported the strong, persistent correlation between flower and fruit size, in spite of extensive phenotypic plasticity, was interpreted as indirect evidence for developmental correlation. The strength of association between these traits in unaltered by environmental effect. Srivastava and Devaiah (1988) observed that weight of 100 flowers was significantly associated with the flower diameter, petal width, petal length, anther length, floral bud length and width, and 100 bud weight in positive direction in jasmine. Berhe *et.al*(1998) also found the number of seeds per pod, seeds per plant and pods per plant had significant positive associations with seed yield across the three environments. The days to maturity had significant positive association with seed yield per plant only in faba bean. Sukhchain and Sidhu (1992) reported seed yield per plant showed significant positive correlation coefficients with branch number per panicle, panicle number per plant, panicle length, branch length, 100 seed weight and day to flower in Guinea grass. The components of seed yield considered are days to flowering, days to maturity, number of branches per plant, number of pods per plant, height at flowering, final height, pod length, pod width, number of seeds per pod and weight of hundred seeds. Seed yield per plant showed significant positive correlation with number of pods per plant, height at flowering, pod width and weight of hundred seeds in NH47-4 variety of okra, *Abelmoschus esculentus* (L.) by Akinyele and Osekita (2006). Significant positive correlation coefficient has observed for the following characters. The pollen tube length with seed length and pollen grain number per anther the pollen grain number per flower with biological yield, the pollen grain number per anther with female reproductive organ length and seed length, the *seed length* with female reproductive organ length and biological yield ,the fruit length with economic yield and harvest index, the 1000 seed weight with female reproductive organ length, economic yield and harvest index, the economic yield with female reproductive organ indicated that the association between different traits differed with environment and hence the correlation coefficient response of different traits to selection might vary with environment. The low positive phenotypic correlation coefficient could be due to the modifying effects of environment on the association of characters at genic level. Kathryn *et al.* (2008) measure the natural selection in hermaphrodite populations of *N. triandrus,* performance through the significant negative correlation between female and male fitness indicating sexspecific trade-offs in reproductive success.

CONCLUSION

Floral traits usually play a key role in rapid diversification, as their modification can easily lead to reproductive isolation and species formation. Flowers provides the site for all the reproductive events for development of a new generation. Infact flower provides the base for pollination and hence locate for artificial genetic manipulation of resulting progeny *i.e;* seed. Rapid selection of floral traits over consecutive generations allowing for large-scale changes in a relatively short period of time. The genetic manipulation can be done by changing the floral biology particularly in selfers. The plant species react to their environment and reciprocates to form an integrated system. A breeding programme aimed to develop phenotypically stable varieties. It requires information of genotype X environment interaction for better seed yield. So attention should be focused on the dynamic interplay of the forces with special emphasis in the unity and necesssity of the plant. Floral traits are likely to have been fine tuned by stabilizing selection and thus are expected to have relatively low genetic variation and show significantly high phenotypic and genetic correlations. However, empirical evidence does not support these considerations. In several families morphological diversity of flowers in one genus contrasts with morphological similarity in other genera that occur in a similar range of environments.

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Table 1. Correlation coefficient estimates among various characters in *Linum usitatissimum.*

Sl. No.	CHARACTERS	Flower Breadth	Male reproductive organ length	Female reproductive organ length	Biological Yield	Economic Yield	Harvest Index	1000 Seed Weight	Fruit Length	Seed Length	Capsule number/ plant	Seed Number/ Capsule	Pollen grain number/ Anther	Pollen grain/ Flower	Pollen Tube Length
1-	Flower Length	rg0.765 rp0.697** re0.224	0.541 0.464 0.004	0.815 0.719** 0.128	0.830 0.726 0.133	0.836 0.706** 0.052	0.689 0.463 -0.168	0.853 0.708** -0.025	0.851 0.702** -0.087	0.804 0.714** -0.160	0.006 0.011 0.143	-0.233 -0.160 0.046	0.494 0.444 0.055	0.436 0.389 0.202	0.464 0.415 0.068
2-	Flower Breadth	--------	0.511 0.456 -0.066	0.856 0.702** -0.137	0.801 0.687** -0.123	0.779 0.713** -0.251	0.330 0.240 -0.090	0.666 0.641** -0.047	0.683 0.596* -0.095	0.819 0.702** -0.104	0.270 0.261 0.153	0.144 0.118 0.035	0.700 0.658** 0.033	0.743 0.615** -0.108	0.705 0.652** 0.223
3-	Male reproductive organ length		--------	0.578 0.500 0.223	0.359 0.341 0.215	0.356 0.347 0.266	0.331 0.241 -0.041	0.577 0.540* -0.171	0.781 0.663** -0.095	0.516 0.481 0.357	-0.144 -0.135 -0.054	-0.289 -0.192 0.132	0.485 0.440 -0.039	0.368 0.323 0.121	0.694 0.671** 0.473
4-	Female reproductive organ length			--------	0.807 0.680** 0.222	0.733 0.602** 0.125	0.295 0.201 -0.156	0.684 0.607** 0.115	0.705 0.603** -0.193	0.809 0.630** 0.157	0.293 0.274 0.051	-0.042 0.013 0.275	0.642 0.591** -0.142	0.688 0.557** -0.182	0.730 0.672** -0.021
5-	Biological Yield				--------	0.780 0.650** 0.730	0.744 0.423 -0.610	0.812 0.653** -0.238	0.779 0.685** 0.120	0.802 0.630** 0.226	0.439 0.395 0.023	0.254 0.281 0.419	0.814 0.706** -0.305	0.804 0.639* -0.127	0.488 0.461 0.243
6-	Economic Yield					--------	0.802 0.683** 0.082	0.817 0.622** -0.166	0.729 0.635** 0.215	0.816 0.710** 0.036	0.35 0.324 -0.059	0.205 0.199 0.275	0.792 0.644** -0.083	0.807 0.674** -0.133	0.343 0.244 0.370
7-	Harvest Index						--------	0.770 0.619* 0.144	0.725 0.546** 0.045	0.623 0.355 -0.266	0.082 0.043 -0.123	0.044 -0.072 -0.285	0.540 0.473 0.374	0.499 0.360 0.027	-0.086 -0.054 0.077
8-	Harvest Index							--------	0.808 0.702** -0.342	0.821 0.712** -0.023	-0.091 -0.085 0.249	0.108 0.083 -0.203	0.655 0.639** 0.260	0.577 0.507 -0.002	0.459 0.412 -0.159
9-	Fruit Length								--------	0.809 0.693** -0.097	0.051 0.047 0.012	0.026 0.018 0.269	0.802 0.708** -0.102	0.707 0.554** -0.103	0.611 0.512 -0.266
10-	Seed Length									--------	0.019 0.010 0.290	-0.082 0.033 0.310	0.646 0.519** -0.241	0.580 0.511 0.287	0.630 0.527** 0.001
11-	Capsule number/plant										--------	0.253 0.234 0.229	0.517 0.474 -0.139	0.672 0.593** 0.187	0.021 -0.001 -0.262
12-	Seed Number/Capsule											--------	0.543 0.397 -0.218	0.537 0.380 -0.005	0.178 0.171 0.201
13-	Pollen grain number/ Anther												--------	0.715 0.676** 0.070	0.569 0.545** 0.201
14-	Pollen grain/Flower													--------	0.535 0.431 -0.161

*Significant at 5% level. **Significant at 1% level

REFERENCES

Akinyele, B.O.; Osekita, O.S. (2006). Correlation and path coefficient analyses of seed yield attributes in okra (*Abelmoschus esculentus* (L.) Moench). *African Journal of Biotechnology*, **5** (14):1330-1336.

Berhe, A.; Bejiga, G.; Konnen, D. (1998). Association of some characters with seed yield in local varieties of faba bean. *African Crop Science Journal*, **6** (2):197-204.

Brunet, J.; Eckert, C.G. (1998). Effects of floral morphology and display on outcrossing in blue columbine, *Aquilegia caerulea* (Ranunculaceae). *Functional Ecology*,**12**: 596–606.

Fisher, R.A.; Yates, F. (1938) . Statistical tables for biological agricultural and medical research **(ed.)** Longman Group London

Holtsford ,T. P.; Ellstr, N.C. (1992). Genetic and environmental variation in floral traits affecting outcrossing rate in *Clarkia tembloriensis* (Onagraceae) . *Evolution* , **46** : 216–225.

Hyesoon, K.; Primack, R.B. (1991). Temporal Variation of Flower and Fruit Size in Relation to Seed Yield in Celandine Poppy (*Chelidonium majus*; Papaveraceae). *American Journal of Botany*,**78** (5): 711-722.

Kathryn, A.; Spencer, C.; Barrett, H. (2008) . Natural selection on floral traits through male and female function in wild population of the heterostylous Daffodil *Narcissus triandrus*, *Evolution*:10.1111/j.1558-5646. (Online Accepted)

Mahto, R.N.; Mahto, J.L. (1977). Correlation regression and path coefficient analysis in rainfed linseed. *Madras Agriculture Journal*, **84**: 188-191.

Motten, A.F.; Stone, J.L. (2000). Heritability of stigma position and the effect of stigma-anther separation on outcrossing in a predominantly self-fertilizing weed, *Datura stramonium* (Solanaceae). *Am. J. Botany*, **87**: 339–347.

Rao, S.K.; Singhal, S.K. (1983). Analysis of yield factors in segregating population and their implication in selection of flax.(*Linum usitatissimum).Canadian Journal of Genetic and Cytology*, **25**: 495-501.

Rick, C.M.; Fobes, J.F.; Holle, M. (1977) . Genetic variation in *Lycopersicon pimpinellifolium*: evidence of evolutionary change in mating systems. *Plant Systematics and Evolution* , **127** :139–170.

Schoen, D.J. (1982a). The breeding system of *Gilia achilleifolia*, variation in floral characteristics and outcrossing rate. *Evolution*, **36**: 352–360.

Searle, S.R. (1961). Phenotypic, genotypic and environmental correlation. *Biometrics*, **17**: 474-480.

Srivastavam, H.C.; Devaiah, K.A. (1988). Correlation and path analysis in jasmine. *Plant Breeding*. **100**: 235-237.

Sukchain,; Sidhu, B.S.(1992). Correlation and path coefficient analysis for reproductive traits in guinea grass (*Panicum maximum jacq). Euphytica*, **60**: 57-60.

Verma, A.; Sinha, K.; Mahto, J.L. (1994). Correlation studies between yield and some components in linseed. *National Symposium on Frontiers in Plant Science Research*. Febuary 13-14, 1994,129 PP(Abstract).