

Exploitation of Phenotypic Expression of Developmental and Quantitative Trait(s) towards Seedlessness as Major Genetic Potential in Cotton (*Gossypium* spp.)

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Introduction

Cotton (*Gossypium* spp.) has retained its prominent position in the international arena despite stiff competition from synthetic fibre. One of the major cotton producing countries in the world, occupying the third place (2.6 million M.T.) and having the largest acreage (8.8 million ha.), India is still lacking far behind in terms of cotton productivity (298 Kg lint/ha) as compared to the highest productivity level (1667 Kg lint/ha.) as achieved by Israel (Mayee et al. 2001). The figures indicate that the major genetic potential remains yet to be fully exploited. Seedlessness in cotton may prove to be an essential indirect selection index for increased lint yield.

Methods

An experiment was carried out in locally adapted three diploid ($2n=26$) genotypes viz. Turabh, Jawahar Tapti and DLSA-17 and in two tetraploid ($2n=52$) genotypes viz. JK-4 and Khandwa-2 in five replications during 2002-03 cropping season at Regional Agriculture Research Centre, AICCIP, J.N. Agriculture University, Khandwa (M.P.), India. Major developmental and quantitative traits used as indicators for seedlessness in cotton were number of seeds per boll, mean weight of one seed (g), seed volume per boll (cc), mean density of one seed (g/cc), initial boll weight (g), final boll weight less seed (g), lint volume per boll (cc) and lint density per boll (g/cc). All the weight measurements were recorded on Sartorius Universal balance and the volumetric measurements were quantified by volumetric cylinder method. The data were analyzed using Randomized Complete Block Design (Dudley, 1997).

Results

Strong relationships among number of seeds per boll, mean weight of one seed (g), seed volume per boll (cc) and mean density of one seed (g/cc) were observed. The presence of no-relationship between seed and fibre parameters was signified by the opposite trend between them (Fig.1). The volume of seeds and lint in a single boll averaged 2.6 and 1.1 cc, respectively over the five genotypes and represented 70.27% as the potential volume for lint, occupied by seeds (Table1).

Conclusions

Changes in the nuclear chromatin content as revealed by the variation in ploidy levels in various genotypes under study have significantly affected the component developmental and quantitative traits for seedlessness in cotton. The presence of no-relationship between seed and fibre parameters, as expressed in significant phenotypic variations for the traits, lead to the hypothesis that the enzyme systems operating in the development of seeds and fibres follow separate biosynthetic pathways. Plants possess integrated signaling network that mediate the nuclear responses such as gibberellins hormonal response of plant growth and development (Satpute and Satpute, 2003). *Ex situ* gibberellin treatment at pre-blooming stage in *Vitis vinifera* was reportedly resulted in a significant reduction in number and size of seed (Striem, 1994). Work is under progress to determine specific role of auxin, as internal signaling molecule in gibberellic acid pathway for its involvement in the induction of seedlessness in cotton. In seedless floral mutants of an agriculturally interesting crop, seediness in fruits on hand pollination was reportedly established for its commercial multiplication (Yao et al. 2001). Significant lint yield increases can be achieved in cotton by making direct selection for the trait under the crop improvement programme.

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Table1. Phenotypic variations in seed and fibre parameters at various levels of polyploidy in different genotypes of cotton. SEM_± = Standard Error of mean; CV% = Co-efficient of variation; *, **, *, ns: sig. Slop at $P < 0.05$, $P < 0.01$, $P < 0.001$, $P > 0.05$.**

Characters	No. of seeds per Boll	Mean Weight of One Seed (g)	Seed Volume per Boll (cc)	Mean Density of One Seed (g/cc)	Initial Boll Weight (g)	Final Boll Weight Less Seed (g)	Lint Volume per Boll (cc)	Lint Density per Boll (g/cc)
Local Genotypes (Ploidy levels)	1)	2)	3)	4)	5)	6)	7)	8)
Khnadwa-2 (2n=52)	27.8 ^{ns}	0.089	3.9	0.628*	4.06	1.30	1.7	0.82*
JK-4 (2n=52)	27.0*	0.076 ^{ns}	3.2*	0.627*	3.42*	1.10 ^{ns}	1.2***	0.94 ^{ns}
DLSA-17(2n=26)	31.6	0.065**	2.4***	0.840	3.30*	1.06 ^{ns}	1.0***	1.06
J. Tapti (2n=26)	25.6**	0.062**	1.9***	0.824 ^{ns}	2.64***	0.84**	1.0***	0.84 ^{ns}
Turabh(2n=26)	24.8**	0.055***	1.7***	0.794 ^{ns}	2.42***	0.88**	1.0***	0.88 ^{ns}
Mean	27.40	0.069	2.6	0.742	3.16	1.03	1.1	0.90
SEM _±	1.34	0.005	0.2	0.070	0.21	0.09	0.1	0.07
CV%	10.97	17.493	19.2	20.540	14.74	20.67	12.7	18.62

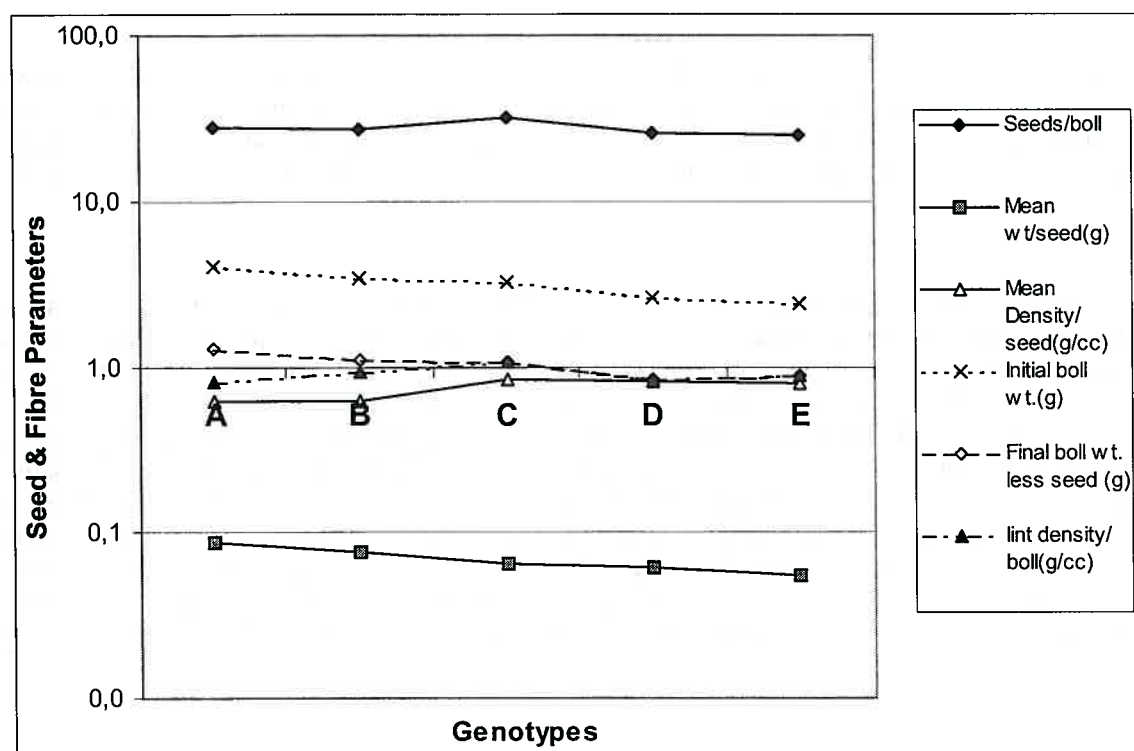


Figure 1. Trends of various parameters of seed and fibre over five locally adapted genotypes of different ploidy levels. [A=Khandwa-2(2n=52), B= JK-4(2n=52), C= DLSA-17(2n=26), D= J.Tapti(2n=26), E= Turabh(2n=26)]