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Meiotic Studies in the Haploids ($2n=2\times=26$) of the Tetraploid Cottons ($2n=4\times=52$)

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Meiosis and Pollen formation were studied in the two haploid ($2n=2x=26$) plants of tetraploid ($2n=4x=52$) *G. hirsutum* and *G. barbadense* cottons. Varying degrees of bivalents and chiasma per bivalent were observed in first meiotic division. The number of microspores varied in different PMCs. The range was 1–8 per PMC. The Pollen formed were variable in size. Average size was 66.05 and 51.31μ in haploids as compared to 122.30 and 120.20μ in normal tetraploids of *G. hirsutum* and *G. barbadense* respectively. The formation of normal bivalents was attributed to the intergenomic homology.

Key Words: **Cotton haploids**, **Polyhaploids**, *Gossypium hirsutum*, *Gossypium barbadense*, **Chromosome pairing**

Introduction

The specific chromosome or genomic constitution of haploids offers a modern aid in the fundamental and basic research problems in genetics, cytology, mutation breeding and gene cytoplasm, and gene environmental interactions. Apart from this, haploids have been recognised to be a component in the range of cytogenetic anomolies present in some species. The spontaneous occurrences of haploids in different crop species including *Gossypium* have been reviewed (Kimber & Riley 1963) along with their cytology and pairing behaviour of chromosomes. Mehetre and Thombre (1980) isolated spontaneously occurred monoembryonic haploids and studied the quantitative relationship of morphological characters with their respective diploids. In the present report the detailed observations on meiosis and pollen formation are reported.

Materials and Methods

The young flower buds of the haploids IAH 468 and Giza 45 plants were fixed in Cornoy's Fluid (6:3:1) and squashed in two per cent acetocarmine. The analysis of PMCs were made from temporary mounts.

Results and Discussion

The number of microspores varied in different PMCs. The range was 1–8 per PMC. The pollen formed were with variable sizes. The size of 100 pollens measured indicated that average size was 66.05 and 122.30 and 51.31 and 120.00 microns in haploids and diploids of *G. hirsutum* and *G. barbadense*.

Varying degrees of bivalents and chiasma per bivalent were observed in the first meiotic division in these haploids. The term bivalent rather than association is used here as chaisma formation appeared in the synapsed chromosomes.

The observations of chromosome behaviour were confirmatory to previous workers. Beasley (1942), Endrizzi (1959) and Brown (1961) reported 7–9 associations without any chiasmata between A and D chromosomes during pachytene of *G. hirsutum* haploids. Beasley (1940, 1941), Harland (1936), Silow and Stephens (1944) and Meyer and Justus (1969) observed haploids in *G. hirsutum* but did not report detailed cytological observations.

The haploids of *G. barbadense* cotton have been reported by Burd (1924), Beasley (1940) Harland (1936, 1939, 1955) and Kimber (1958). Webber (1940) reported average 2-II per PMC while 26-I were reported by Kimber (1960, 1961).

Instances of rod or ring bivalents observed during meiosis of haploids instead of univalents have been mentioned by Burnham (1962) and Kimber and Riley (1963).

Table 1 *The observations on chromosome behaviour during meiosis studied in the G. hirsutum and G. barbadense haploids (2n=2x=26)*

Haploids	Meiotic stages	Chromosome association		No. of PMCs Examined
		I	II	
IAH. 468	Pachytene	25.76	0.12	6
Giza–45		24.68	0.66	6
IAH. 468	Diakinesis	24.00	1.00	20
Giza–45		23.76	1.22	25
IAH. 468	Metaphase-I	24.00	1.00	50
Giza–45		23.00	1.50	50

Table 2 *Distribution of univalents at each pole during anaphase-I of haploids*

Haploids	Chromosomes distribution at each pole									Total PMCs
	21–5	20–6	19–7	18–8	17–9	16–10	15–11	14–12	13–13	
G. hirsutum IAH. 468	1	2	4	3	9	26	20	13	12	100
G. barbadense Giza–45	—	—	6	4	16	30	27	10	7	100

Formation of bi- or tripolar splindles and univalents outside the spindle resulting in appearance like metanaphase have been reported by Tometrop (1939). Unequal chromosome seperation at metaphase-I, formation of more than four microspores, variable sized pollen grains without spines on exines, rarely fertile pollen arising from monads have been observed. Similar observations were made by Barrow (1971).

Haploids might occur in nature from unfertilized synergids as antipodal cells in cotton degenerate some time prior to fertilization (Gore 1932 Silow Stephens 1944). Bivalent formation in allopolyploids has been explained by Kimber and Riley (1963) and Endrizzi (1962) cn the basis of intergenomic homologies. Observations made in the present study reflect a similar mechanism operative in polyhaploids of tetraploid cottons.

References

Barrow J R 1971 Meiosis and pollen development in haploid cotton plants; *J. Hered.* **66** 277–280

Beasley J O 1940 The production of polyploids in *Gossypium*; *J. Hered.* **31** 39–48

—— 1941 Hybridization, cytology and polyploids in *Gossypium*; *Chron. Bot.* **6** 394

—— 1942 Meiotic chromosome behaviour in species, species hybrids, haploids and induced polyploids of *Gossypium*; *Genetics* **27** 25–54

Brown M S 1961 Chromosome differentiation in *Gossypium*; *Amer. J. Bot.* **48** 532

Burd L W 1924 A preliminary note on a sterile dwarf rouge in Sea Island cotton; *Emp. Cott. Gr. Rev.* **1** 46–48

Burnham C R 1962 *Discussions in Cytogenetics* (Minneapolis: Burgess Publ. Co. Minnesota USA)

Endrizzi J E 1959 Cytogenetics of four sets of twins in cotton; *J. Hered.* **50** 222–226

—— 1962 A diploid-like cytological behaviour of tetraploid cotton; *Evolution* **46** 325–329

Gore U R 1932 Development of female gametophyte and embryo in cotton; *Amer. J. Bot.* **19** 795-805

Harland S C 1936 Haploids in the polyembryonic seeds of Sea Island cotton; *J. Hered.* **27** 229–231

—— 1939 *The Genetics of Cotton.* (London: Jonathan Cape) 143 pp

—— 1955 The use of haploids in cotton breeding; *Indian J. Genet.* **15** 15–17

Kimber G 1958 Cryptic twin plants in New World cotton; *Emp. Cotton* Gr. Rev. **35** 24–25

—— 1960 Association of chromosome in haploid cotton; *Heredity* **15** 453

—— 1961 The basis for diploid-like cytological behaviour of polyploid cotton; *Nature* (Lond.) **191** 98-100

—— and Riley R 1963 Haploid angiosperms; *Bot. Rev.* **29** 480-531

Lammerts W L 1934 On the nature of chromosome association in *Nicotiana tabacum* haploid; *Cytologia* **6** 38–50

Mehetre S S and Thombre M V 1980 Comparative studies of morphological characters of haploid and diploid plants of cotton. (*Gossypium* spp.); *Indian J. agric. Res.* 14 (in press)

Meyer R and Justus N 1960 Potential value of doubled haploids in cotton; *Genetics* **45** 999

Silow R A and Stephens S G 1944 "Twinning" in cotton; *J. Hered.* **35** 76–78

Tometrop G 1939 Cytological studies in *Hordeum distichum*; *Hereditas* **35** 241–254

Webber J M 1940 Polyembryony; *Bot. Rev.* **6** 575–598