Chromosome Associations in Diploid and Autotetraploid *Zea mays* Linn.¹

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Cytological studies of the pollen mother cells of *Zea mays* Linn., ($2n=20$) and experimentally induced autotetraploid ($4n=40$) were undertaken to examine the pairing behaviour of chromosomes. The autotetraploid maize seeds were obtained from United States Department of Agriculture. In the diploid maize,

Figs. 1-4. 1, PMC of diploid ($2n=20$) maize showing $8\text{II}+1\text{IV}$. The arrow shows a quadri-valent. $\times 600$. 2, PMC of autotetraploid maize showing 10IV . $\times 600$. 3, PMC of autotetraploid maize showing $8\text{II}+2\text{IV}+2\text{VIII}$. The arrows show the octovalent configurations. $\times 600$. 3A, camera Lucida drawing of Fig. 3. $\times 600$. 4, somatic metaphase of the progeny of autotetraploid maize showing 40 chromosomes. $\times 600$.

10 bivalents were regularly formed but secondary pairing between non-homologous bivalents was observed at diakinesis. At maximum, 9 bivalents associated to form a group and 1 bivalent was far away from the group. Five

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groups of chromosomes were formed. It was also noticed 5 bivalents forming a separate group. These indicated the basic chromosome number of gramineae is five. Darlington (1928) and Lawrence (1931) ascribed secondary pairing to the specific affinity between chromosomes. Further, only 2 bivalents have very closely associated to give a quadrivalent configuration (Fig. 1). In the anaphase I movement lagging chromosomes were noticed due to the delay in separation of chromosomes. However anaphase I movement was normal

Table 1. Frequency of secondary pairing, quadrivalent and octovalent configuration at diakinesis

Plant number	Maximum number of groups formed due to secondary pairing	Percentage of cells		
		Secondary pairing	Quadrivalent configuration	Octovalent configuration in autotetraploid
Diploid (2n=20)				
1	4	34.8	3.4	
2	5	41.1	5.5	
3	5	50.0	7.1	
4	4	48.7	2.5	
5	4	44.3	1.1	
6	4	44.0	2.0	
		Mean 43.82	3.6	
Autotetraploid (parent seeds) (4n=40)	Groupings irregular		All the PMCs showed quadrivalents in the range of 2 to 10 nos. per cell	
1		32.7		Nil
2		33.3		4.2
3		46.7		10.0
		Mean 37.57		4.73
First progeny (4n=40)	"		"	
1		23.9		7.4
2		33.3		4.3
3		22.9		7.1
4		24.5		8.2
		Mean 26.15		6.75

with 10 chromosomes at each pole. Ghatnekar (1965) observed in Italian maize (2n=20) secondary pairing and found often 2 bivalents were connected by thin matrix thread giving an open chain quadrivalent configuration.

In the autotetraploid maize similar behaviour was noticed. At diakinesis all the chromosomes formed a zig zag chain due to the affinity between the chromosomes. In a few cells 2 groups were formed leaving one bivalent. In the PMC with 3 groupings, 2 quadrivalents were found far away. Perhaps the differentiation of chromosomes might have occurred. The groupings were irregular with quadrivalents and bivalents formation. Randolph (1935) stated

that the homologous chromosomes pair as bivalents, trivalents plus univalents and most frequently as quadrivalents. Snope (1967) opined that meiosis is subject to certain irregularities that can be attributed to the presence of four sets of chromosomes. Five groups of chromosomes were observed. A maximum of 10 quadrivalents were noticed (Fig. 2). Lagging chromosomes at anaphase I movement were noticed. Further a thin connecting thread was noticed between 2 quadrivalents giving an octovalent configuration (Figs. 3 and 3A). From the progeny raised of the parent plants, 40 chromosomes were counted in the root tip cells indicating equal distribution of chromosomes in the anaphase I movement (Fig. 4).

Collins (1912) formulated a hypothesis that maize ($2n=20$) originated as a hybrid between teosinte (*Euchloena mexicana*., Schrad. $n=10$) and an unknown grass belonging to the tribe Andropogoneae. The present investigations infer that maize might have originated as a hybrid between two, very closely related genera with $n=10$ of a basic number of five. This explains the quadrivalent configuration in diploid and octovalent configuration in autotetraploid maize.

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* Original not seen.