Chiasma Frequency and Chromosome Pairing at Tobacco Genotypes (Nicotiana tabacum) in the Middle Black Sea Region

Ahmet Okumus and A. Gulumsar
Onokuz Mayis University, Agriculture Faculty, 55139 Samsun-TR, Turkey

Abstract: The study covers the relationship between tobacco genotypes in terms of chromosome homology by pairing configurations and chiasma frequency growing at different areas of the middle black sea region. For this purpose, three genotypes (Samsun, Bafra, and Merzifon) and their crosses were studied by acetocarmine stain technique at the stage of metaphase I of meiosis. Consequently, parents and their hybrids showed that bivalent type of chromosome pairing (0.6-1.1 rod type and 22.0-23.4 ring type) and chiasma frequency between 46.90-47.40%. This type of pairing is considered to be from the close similarity of the chromosomes of genotypes.

Keywords: Chromosome, pairing, tobacco

Introduction
Tobacco is an industrial plant and a polyploid in nature. Its species show a similarity upon genomic structure. The species growing in the middle black sea region which is N. tabacum 2n = 48, is a amphidiploid consisting S and T genome plant although the origin of plant belongs to America. Continental. The S genome of amphidiploid created from two diploid plant was transferred from N. sylvestris dan, whereas T genome was taken from N. tomentosiformis, N. otophore and N. tomentosa hybrids (Parakonny and Kenton, 1994). The complex structure of genus is getting more force to evaluate the evolution mechanism of species. The tobacco plant named as Samsun tobacco (N. tabacum) was used, in the studies on the origin of the genome, its genomic DNA was analyzed for displaying the similarity of them, by repetitive DNA sequence using fluorescence in-situ hybridization (FISH) techniques and physical map had been occurred by Parakonny and Kenton (1994).

Tobacco can be used to explain pairing mechanism through its complex genome formula. Up to date, some plants were analyzed both either at metaphase I or prophase I pairing behaviour using FISH techniques, electron and light microscopy (Lolium spp., Festuca spp., Secale spp. etc.) (Begl, 1973, 1982; Sagsiz, 1982, Baysal, 1973; Parakonny and Kenton, 1994; Taylor and Evans, 1997; Evans and Davies, 1983; Evans and Aung, 1986; Jenkins, 1988). Samsun tobacco types were used for the quantitative analysis as phenotypic evaluation (Camag et al., 1988) but here the relationship between tobacco genotypes growing in the area were aimed to investigate chromosome pairing.

Materials and Methods
Tobacco parent plants were collected from the middle black sea region from three growth areas and were crossed each others. Pollen mother cells (PMC) of parents and their hybrids were used for the evaluation of chromosome pairing at the flowers picked up from their early buds. The plants were collected from three microclimate areas of Samsun territory (Samsun-center, Bafra, Merzifon), whose seeds were transferred and grown in the pots after germinating under the seed-beds. Three types were crossed and were grown for the meiosis analysis. The buds collected from the hybrids were saved in canny fixative (6:3:1) and examined for chromosome pairing configurations using light microscopy due to the acetic acid squash method suggested by some authors (Baysal, 1973; Bgl, 1982; Okumug, 1985; Sagsiz, 1982). In the meiotic cells, interspecific relations were observed by chromosome pairing configurations and chiasma frequency as percent. The results from genotypes were tested using X2 (Chi-square) test, statistically.

Results and Discussion
Pairing configurations and chiasma frequency of genotypes were summarized in Table 1. The parent plants and the crosses exhibited bivalent type of chromosome pairing configuration with close chiasma frequency. The typical bivalents were pictured in Fig. 1.

Table 1: The number chromosome pairing type (rod and ring) and chiasma frequency (%) of tobacco genotypes

<table>
<thead>
<tr>
<th>Genotype</th>
<th>No.</th>
<th>Chromosome Pairing</th>
<th>Chiasma Frequency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samsun (S)</td>
<td>30</td>
<td>0.6</td>
<td>23.4</td>
</tr>
<tr>
<td>Bafra (Bf)</td>
<td>30</td>
<td>0.9</td>
<td>23.1</td>
</tr>
<tr>
<td>Merzifon (M)</td>
<td>30</td>
<td>1.0</td>
<td>23.0</td>
</tr>
<tr>
<td>SxM</td>
<td>15</td>
<td>1.1</td>
<td>22.9</td>
</tr>
<tr>
<td>SxBf</td>
<td>15</td>
<td>1.1</td>
<td>22.9</td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td>4.6</td>
<td>115.4</td>
</tr>
</tbody>
</table>

S: Samsun-Merzifon Bf: Bafra M: Merzifon B: Bivalent

The parents of plants showed either ring or rod bivalent pairing configurations. Samsun-center, Bafra and Merzifon parents showed respectively, 23.4, 23.1, 23.0 rod and 0.6, 0.9, 1.0 rod bivalent and 47.40, 47.10, 47.00% chiasma frequency. Samsun x Bafra crosses showed 1.1 rod and 22.9 ring bivalent ratios; whereas Samsun x Merzifon cross line 1 rod and 23 ring bivalent configurations. The parents and their cross did not show any significant difference at the sake of pairing, statistically (p > 0.05).

Pairing configurations between chromosomes are controlled by the genes (Okumu, 1996). It is implied that chromosomes can pair as bivalents as seen in tobacco, but the chromosomes can also, make preferential pairing by increasing homology between them (John and Henderson, 1962). The similar type of pairing was observed at autotetraploids as seen at allopolyploids as well, though these chromosomes indicate some differences at the angle of homology (Sved, 1996). Besides, Festuca arundinacea, carries out the AABBC genome and 2n = 6x = 42 chromosomes as allopolyploid, shows ordinary bivalent pairing and disomic inheritance (2x2). Chromosome pairing is homologous and Jauhar (1976) displayed that this pairing is controlled genetically by the studies on the monosomic plants. At the metaphase I stage of this monosomic plant, chromosome configurations manifested homologous pairing rather than homologous pairing.
Okumus and Gulkaner: Oliosma frequency and chromosome pairing at Tobacco genotypes

showed some differences concerning homology, it is considered that these differences come out from their DNA sequences in terms of the types of genes related rather than chromosome homology (Parokonny and Kanton, 1989). Because, the morphological differences on growth tobacco plants had been studied by Camag et al. (1989). Due to these workers, these genotypes bear some morphological differences concerning dry leaf yield and number, leaf length-width and quality. Recently, it can be said that there is either a relationship between these tobacco genotypes or a similarity regarding to chromosome homology.

References