EWAC Newsletter 1992 Proceedings of the EWAC Workshop 1991 Cordoba (Eds.Jouve and Worland).

Differentiation of six disomic - *A. variabilis* addition lines through their phenotype and reaction to yellow rust

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1.Status of aneuploid stocks

Several disomic wheat-alien addition lines have been obtained by crossing a winter wheat cultivar to *Ae.variabilis* (awned type, accession No.13.133). All of them are of highly resistant to powdery mildew, and have been maintained by selfing.

Using the amphiploid *T.aestivum* cv. Kiten x *Ae.kotschyi* as a pollen parent in crosses to wheat, an F2-population was obtained that included plants with of 43, 44 and 46 chromosomes. These too manifest high resistance to powdery mildew and are now being grown for developing addition or substitution lines.

2.Disease resistance

In a programme to transfer powdery mildew resistance to wheat, amphiploids and BC1 plants incorporating *Ae.variabilis* and *Ae.kotschyi*, have been produced. Among the wheat cultivars, Roussalka (IWS-Gen. Toshevo selection) was chosen as a mother parent because of its high ability to form from 3 to 9 rod bivalents in F1 intergeneric hybrids. BC1 plants were produced from two groups of F1 hybrids, either irradiated with gamma rays or non-irradiated. BC2 plants were grown in an infection field and the resistant progenies were selected each year by self-pollinating the derivates.

The addition lines (2n=44) were identified as resistant during inoculation with mildew isolates whose pathogenicity components matched all known combinations of pathogenicity found in Bulgaria. Studies on resistance to yellow rust at the seedling and adult plant stage show differences among the wheat-*Ae.variabilis* additions. As wheat variety Roussalka is highly resistant to yellow rust, while the alien species is susceptible, the reaction of additions to this disease may serve as a marker in identification the lines if they are morphologically indistinguishable.

From a total of 9 addition lines involved in the study, six are highly resistant to 18 races of yellow rust at the seedling stage, one line is resistant to 11 races, but susceptible to 7, and two other lines are attacked by 2 different races of the pathogen. The reaction of additions to yellow rust on the infection field is almost the same as that in the greenhouse.

3.Cytological analysis

All of the disomic addition lines had a first meiotic metaphase configuration of twenty-two bivalents and, as between 10-15 plants of each line were observed, no disturbances of the normal pairing and gamete formation were recorded. Particular attention was paid to checking the cytology of line 9. From a total 44 plants only one plant had forty-three chromosomes. Monosomic addition progeny was recovered to a very low degree in lines No. 3 and No. 7. Normal meiotic pattern in the majority of the self-pollinated progeny of

other disomic addition lines resulted in the selection of very few 43 chromosome plants where alien chromosomes failed to pair.

Line No. 6 differs in respect of the chromosome constitution. From a total of 22 plants counted for mitotic chromosome number, 13 possessed 42-chromosomes, 7 - 43 monosomic additions and 2 being 44 disomic additions. In the previous year one plant having 42-chromosomes was isolated from the same population, this new line, designated No. 6-9, seems to be a spontaneously translocated line and manifests high powdery mildew resistance.

4.1 Clustering based on reaction to yellow rust infection

Using the data for reaction to yellow rust at seedling and adult plant stage, 4 groups of lines can be distinguished (Table 1).

TABLE 1 Grouping of lines based on reaction to yellow rust

Clusters Lines, No.	Number of races inoculated at seedling stage	Reaction to yellow rust			Field assessment
		R	MS	S	
No. 2	18	16	1	1	50 MS
No. 3	18	17	0	1	20 MS
Nos. 4, 5, 6, 7, 8, 9	18	18	0	0	0 *
No. 10	18	11	0	7	20 MS

* No. 8 differs in its reaction to yellow rust, having an estimate of 30 MS.

The largest cluster consists of 6 lines, including line No. 6, that segregates 42, 43 and 44 chromosome plants.

4.2. Clustering by weighted pair-group method

A dendogram, based on the data on 11 characters of the addition lines, shows 5 clusters: first - line No. 3, second - No. 9, third cluster - lines Nos. 7, 5 and 4, fourth - Nos. 10 and 6, and fifth - Nos. 8 and 2 (Fig.1)

Line No. 1 is the wheat cultivar Roussalka and it forms another, separate cluster. The reaction to yellow rust clearly differentiates line No. 10 from line No. 6, and line No. 8 from No. 2 (Table 1).

Finally, using the data of 11 plant characteristics and the reaction to yellow rust, six aneuploid genotypes (2n=44) have been isolated and maintained.

TABLE 2 Six aneuploid genotypes have been isolated and maintained at the IWS "Dobroudja", General Toshevo, Bulgaria

Genotypes, No	1	2	3	4	5	6
Lines (2n=44)	No. 2	No. 3 No. 5* No. 6* No. 7*	No. 4*	No. 8	No. 9*	No. 10*

* obtained from F1 that was irradiated by gamma rays (10 kR).

Assuming that no mutations have occurred in the genotype of Roussalka when F1's were irradiated,it is now obvious that six different homologous pairs of *Ae.variabilis* chromosomes are added to a wheat genome. Each pair of the alien chromosomes confers very high resistance to powdery mildew, but three of them (Genotype Nos. 3, 4 and 5) promote a high level of yellow rust resistance too.

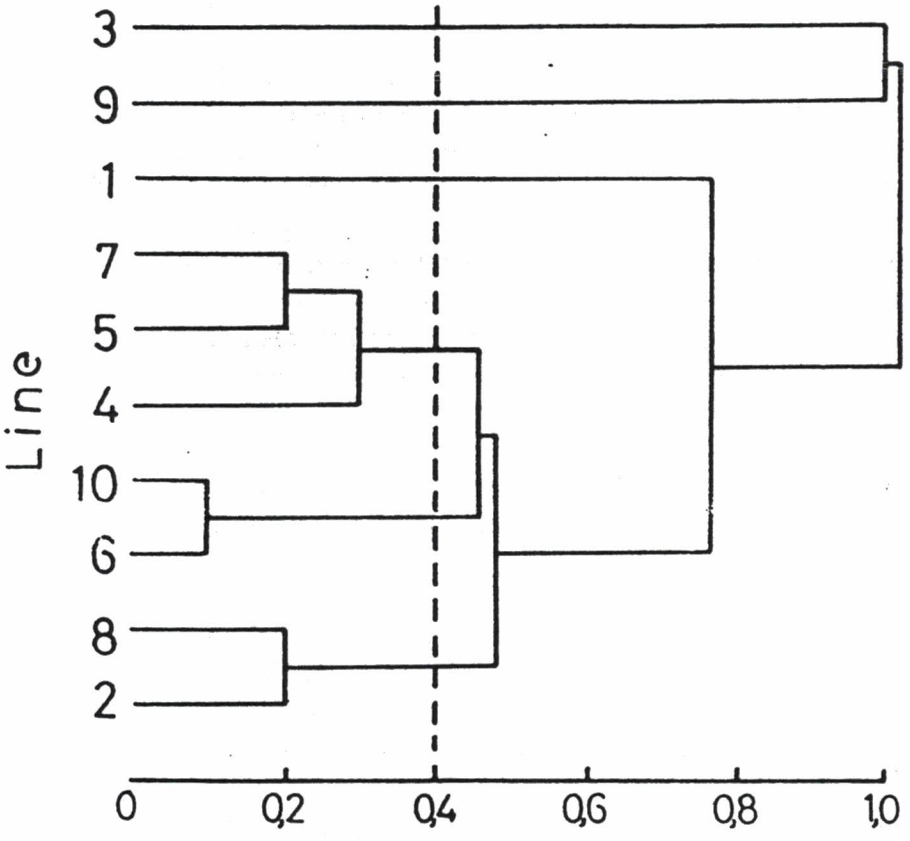

Fig.1: A dendrogram obtained from cluster analysis on 11 plant characters of the nine disomic addition lines