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STUDIES ON THE CV. GRANA WHEAT (*TRITICUM AESTIVUM* L.) LINES WITH THE CV. DAŃKOWSKIE ZŁOTE RYE (*SECALE CEREALE* L.) CHROMOSOME ADDITIONS
I. CHROMOSOME CONFIGURATIONS AT METAPHASE I[1]

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Summary. In this paper metaphase I has been analysed in the monosomic addition Grana-Dańkowskie Złote lines 1R, 3R, 4R and disomic 2R and 4R lines. The addition lines, except the monosomic line 4R, had more bivalents in the form of rods than the cv. Grana wheat. Disomic lines differed from one another in respect of the mean number of univalents per single cell. The cv. Grana had averagely 44.85 chiazmata per cell. In comparison to wheat the mean number of chiazmata was larger in disomic and smaller in monosomic lines.

Wheat plants with rye chromosome additions at metaphase I are observed to have bivalents and univalents. In the monosomic additive lines rye chromosomes occur most frequently as univalents (Miazga et al. 1986). In the disomic lines rye chromosomes often form rod-shaped bivalents (Schlegel 1978).

The purpose of the present paper was to analyse the stage of metaphase I in the so-far identified addition lines of Grana-Dańkowskie Złote and in wheat.

MATERIAL AND METHODS

Material for the studies consisted of the monosomic wheat-rye addition lines 1R 3R, 4R and disomic lines 2R, 4R, as well as of the wheat cv. Grana. Spikes for the studies on meiosis were taken during the vegetation and fixed in Carnoy's fixative. Chromosomes were stained in acetocarmine and squash preparations were made. The occurrence of bivalents and univalents as well as the frequency of chiazmata were analysed. The significance of differences between wheat and addition lines was confirmed by the Student's *t*-test (Oktaba 1980).

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RESULTS

The wheat cv. Grana had on the average 0.10 univalents, 18.97 ring-shaped bivalents and 1.99 rod-shaped bivalents per cell (Table 1).

Table 1. Chromosome configurations at metaphase I in the addition lines and wheat cv. Grana

Line	Number of analysed cells	Average number of chromosomes:		
		rod-shaped	ring-shaped	univalents
1×1R	66	2.26	18.74	1.00
1×3R	42	2.33	18.67	1.00
1×4R	153	1.44*	19.57	1.00
2×2R	340	2.22	19.69*	0.17
2×4R	46	2.21	19.79*	0.00
Grana cv.	204	1.99	18.97	0.10

* differences between the addition lines and the cv. Grana significant at the level of $\alpha = 0.05$.

Monosomic addition lines were always found to have only a single univalent (Fig. 1), besides a metaphase plate. The mean number of bivalents in the form of rods in the lines 1R and 3R was larger and in the line 4R significantly lower than that in wheat. The lines 1R and 3R differed from one another by the number of bivalents in the form of rods.

The disomic addition line 2R had averagely 0.17 univalents per cell. The number of univalents ranged from 0 to 2 (Fig. 2). The line 4R was not observed to have univalents at all. The both lines had more bivalents in the form of rings than wheat. The mean number of rods was slightly larger in lines than in wheat.

Table 2. Chiazma frequency in the addition lines and wheat cv. Grana

Line	Number of analysed cells	Mean number of chiazmata per cell
1×4R	33	44.72
2×2R	120	45.55
2×4R	43	46.38*
Grana cv.	39	44.87

* differences between the addition lines and the cv. Grana significant at the level of $\alpha = 0.05$

The frequency of chiazmata was determined in wheat and in the monosomic lines 4R and disomic 2R and 4R (Table 2). The wheat cv. Grana had 44.87 chiazmata per cell. The average number of chiazmata in the monosomic line 4R was on the level of wheat, while in the disomic line it was significantly larger (Table 2). In the line 2R the chiazma number was larger than in wheat and amounted to 45.55.

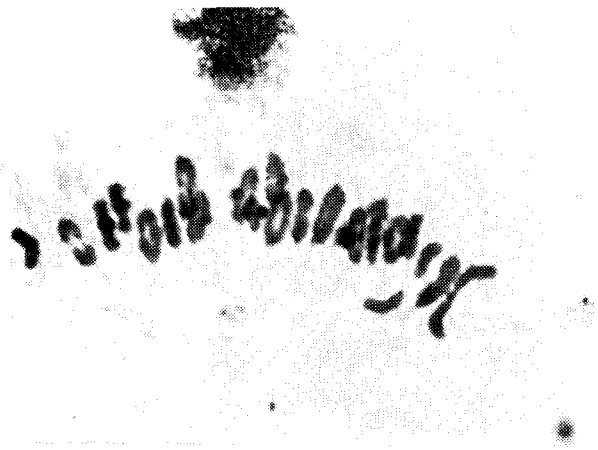

Fig. 1. Monosomic line 4R. A univalent visible beyond the plate

Fig. 2. Disomic line 2R. Two univalents visible beyond the plate

DISCUSSION

In the studied three monosomic addition lines all the analysed cells had always only a single univalent.

Riley (1960) while analysing the stage of metaphase I in five monosomic and four disomic additive lines, Holdfast — King II, found that the univalent number ranged from 2 to 6 in the disomic lines and from 1 to 5 in monosomic lines. In the monosomic addition line III, Holdfast-King II, 83% of the cells had only a single univalents, and in line V such cells constituted 96%.

The addition Holdfast-King II lines had more univalents than the cv. Holdfast. Similarly the studied by us Grana-Dańkowskie Złote lines, except the disomic line 4R, had more cells with univalents than wheat. The lines 4R was not observed to have univalents at all. In four disomic addition lines analysed by Riley (1960) the univalents always occurred at a different frequency. In additive lines bivalents occur chiefly as a result of asynapsis.

Schlegel (1978), Orellana et al. (1983) analysed homologous conjugation of rye and wheat chromosomes in the addition lines of Holdfast-King II and Chinese Spring-Imperial by the use of Giemsa technique. These authors displayed that the added rye chromosomes have an influence on the conjugation of wheat chromosomes.

Schlegel (1978) analysed separately the frequency of univalents and bivalents in the form of rings and rods formed from wheat and rye chromosomes. He revealed that a particularly large influence on the frequency of univalents and bivalents in the form of rods formed from wheat chromosomes was exerted by chromosomes VI, VII, telocentric II^s of rye King II and 3 of rye Imperial. In the both series the lines differed by the average number of rods per cell. Similarly in the studied monosomic addition lines of Grana-Dańkowskie Złote, the average number of rods, probably wheat ones, changed depending on the added chromosome, as from our previous studies (Miazga et al. 1986) it follows that the monosomic addition lines of Grana-Dańkowskie Złote have 42 wheat and 1 rye chromosomes.

The frequency of rods and univalents in addition lines increases in comparison to that of wheat (Orellana et al. 1983). According to Schlegel (1978) the rod frequency depends on the genotype. The series Holdfast-King II analysed by the author had more bivalents in the form of rods than the cv. Holdfast. On the other hand, in the series Chinese Spring — Imperial most of the lines had less rods than the wheat Chinese Spring. The lines studied by us differed by the average number of rods. The differences were larger between monosomic than between disomic lines.

Schlegel (1978) reports that some rye chromosomes after addition to wheat, form rod-shaped bivalents more frequently than others. The most frequently rod-shaped bivalents were formed by rye chromosomes I, II, VII in the series Holdfast-king II and 6 in the series Chinese Spring-Imperial. O'Mara (1953) reports that in disomic additive lines rye chromosomes frequently occur as univalents. Our studies suggest that in the disomic addition lines rye chromosomes occur as bivalents. Application of Giemsa technique will make it possible to identify in the nearest time certain bivalents.

From the performed studies it follows that rye chromosome additions may have an influence on the number of chiazmata. In the wheat cv. Grana the average number of chiazmata per cell was 44.87. The mean number of chiazmata in the disomic line 4R was significantly larger, and in the monosomic line it maintained on the level of that of the wheat cv. Grana.

CONCLUSIONS

1. Rye chromosome additions had an influence on conjugation of wheat chromosomes.
2. It has been found that depending on the added rye chromosome, the frequency of rod-shaped bivalents formed from wheat chromosomes in monosomic addition lines is different.
3. The addition lines, except disomic 4R, had more univalents than the cv. Grana wheat.
4. In comparison to wheat the average number of chiazmata was larger in the disomic and smaller in the monosomic lines.

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BADANIA NAD LINIAMI PSZENICY ODMIANY GRANA Z DODANYMI CHROMOSOMAMI ŻYTA DAŃKOWSKIE ZŁOTE
I. UKŁADY CHROMOSOMÓW W METAFAZIE I

Streszczenie

Analizowano stadium metafazy I w monosomicznych liniach Grana-Dańkowskie Złote 1R, 3R, 4R oraz w disomicznych 2R i 4R. Stwierdzono, że w liniach addycyjnych, z wyjątkiem monosomicznej linii 4R, było więcej biwalentów w postaci prętów niż u pszenicy. Linie disomiczne różniły się między sobą pod względem średniej liczby uniwalentów przypadających na jedną komórkę. U pszenicy odmiany Grana w jednej komórce było średnio 44.85 chiazm. Średnia liczba chiazm w liniach disomicznych była wyższa niż u pszenicy, natomiast w liniach monosomicznych niższa.

ИССЛЕДОВАНИЯ ЛИНИЙ РЖИ СОРТА ГРАНА С ПРИБАВЛЕННЫМИ ХРОМОСОМАМИ РЖИ СОРТА ДАНЬКОВСКЕ ЗЛОТЕ
I. КОНФИГУРАЦИЯ ХРОМОСОМ В МЕТАФАЗЕ I

Резюме

В настоящей работе анализировалась стадия метафазы I в моносомных линиях Грана-Данькowске Злоте 1R, 3R, 4R, а также в дисомных линиях 2R и 4R. Было установлено, что в аддитивных линиях, за исключением моносомной линии 4R, было больше палочкообразных бивалентов, чем у пшеницы Грана. Дисомные линии отличались друг от друга по среднему числу унивалентов, приходящихся на одну клетку. У сорта Грана на одну клетку в среднем приходилось 44.85 хиазм. По сравнению с пшеницей среднее число хиазм было больше в дисомных линиях и меньше в моносомных.