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F_2-Monosomic Analysis of Plant Height in Triticum Cultivar Crosses Involving 'Diplomat' and 'Caribo' Monosomic Lines

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밀의 草長決定 遺傳子分析

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ABSTRACT

F_2 progenies from the crosses between 'Caribo' monosomic lines and 'Diplomat' revealed significant differences in plant height in 7 F_2 populations. Well known effects of monosomic constritution of group 2 homoeologues and chromosome 5A sufficiently well explain reduced or increased plant height in these crosses respectively. Minor gene effects were recognized from 'Diplomat' chromosomes 3B, 6A and 7A and interpreted to explain or to contribute to genetic control of the rather small differences in plant height between cv. 'Caribo' and 'Diplomat'.

INTRODUCTION

Aneuploid lines in 'Chinese Spring' wheat (*Sears*, 1953, 1954) have been widely used for genetic analysis of plant height in wheat. Several authors reported many responsible genes with varying effects of this triait.

In the present study two winter-wheat cultivars Caribo' and 'Diplomat', and 'Caribo' monosomic lines were used to determine the influence of the seven homoeologous groups of chromosomes on plant height.

MATERIALS AND METHODS

Crosses were made between 'Diplomat' and each of the 'Caribo' monosomic lines (Chae *et al.*, 1979). Monosomic F_1 plants were identified by root-tip mitotic observation and then selfed for F_2 populations. Seeds of all the monosomic F_2 populations together with euploid F_2 and parents were spaced 5cm apart within rows in the field in October, 1978. Randomized block design with two replications was used to lay out all materials. Plant height was measured in centimeters from the ground to the top of the spike of the main tiller in each plant at maturity. Mean plant height of each monosomic F_2 populations was compared with that of the euploid F_2 cross to assess differences in plant height.

RESULTS AND DISCUSSION

Seven chromosomes affected plant height expression when the progeny in the F_2 monosomic crosses were compared with the euploid F_2 mean (Table 1). Six of them decreased plant height and one of them increased it significantly.

No difference between the mean plant height

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in all the non-critical crosses and the mean of euploid F_2 cross indicates that plant height in the critical crosses resulted either from the effects of the donated 'Diplomat' chromosomes or from dosage effects connected with the monosomic constitution of many of the F_2 progenies.

The magnitudes of decreased plant height in the homoeologous group 2 chromosomes and of increased plant height in chromosome 5A very clearly exceeded the height decreasing effects of chromosomes 6A, 7A and 3B.

The height decreasing effects in monosomic segregates of the group 2 chromosomes and increasing effects in monosomics of chromosome 5A have been reported from other studies using F_2 monosomic analyses with 'Chiness Spring' monosomic lines (Allan and Vogel, 1963; Peach and Evans, 1968); Baier *et al.*, 1974) as well as from observations with monosomic offsprings in aneuploid sets of different wheat cultivars (Sears, 1954; Law and Worland, 1972; Kleijer and Fossati, 1977). They also appeared in the series of aneuploid lines developped from winter wheat cv. 'Caribo' (Chae *et al.*, 1979) which was used in this study. It is generally accepted therefore that major genes responsible for plant height in wheat are located on these 4 chromosomes.

Specific effects of the group 2 and 5A 'Diplomat' chromosomes are difficult to detect, since the majority of aneuploid offsprings explains the strongly deviating mean in plant height of these population sufficiently well. Since only, small differences in plant height exist between 'Caribo' and Diplomat' differentiation in major gene constitution may not be expected either.

The study however reveals minor gene effects from 'Diplomat' chromosomes 3B, 6A and 7A to explain or to contribute to genetic control of reduced plant height of cv. 'Diplomat'. All of these chromosomes also have been mentioned in the study of Baier *et al.*(1974) to contribute minor effects to the expression of plant height in a series of crosses between cv. 'Solo' and the monosomic set of 'Chinese Spring'.

Table 1. Comparison of plant height in parents, euploid and monosomic F_2 populations between 'Caribo' and 'Diplomatic'.

Population	Mean plant height cm	Difference from euploid F_2
1A	111.0	+4.2
1B	106.7	- 0.1
1D	107.4	+0.6
2A	88.3	- 18.5***
2B	85.9	- 20.9***
2D	82.2	- 24.6***
3A	104.3	- 2.5
3B	99.0	- 7.8**
3D	105.9	- 0.9
4A	107.3	+0.5
4B	103.3	+1.5
4D	105.7	- 1.1
5A	117.2	+10.4***
5D	106.7	- 0.1
6A	99.6	- 7.3***
6B	103.8	- 2.9
6D	105.0	- 1.8
7A	101.7	- 5.1**
7D	102.1	- 4.7
5B/7B	107.4	+0.6
7B/5B	109.2	+2.4
F_2	107.1	0.0
'Caribo'	106.8	+6.7*** (diff. from Diplomat)
'Diplomat	100.1	
Total+	106.5	

*and *** are significant at 1% and 0.1%, respectively.

+excludes significant monosomic crosses.

摘 要

밀의 草長을 決定하는 遺傳子의 소재를 밝히기 위하여 21個 Caribo monosomic lines에 栽培種인 Diplomat을 交配하여 얻은 F_1植物體를 근 선단부의 염색체를 검경하여 monosomic F_1을 確認한 다음 자식시켜 F_2集團을 얻었다. 草長을 決定하는 遺傳子를 밝히기 위하여 monosomic F_2平均과 정상교배 F_2 平均을 比較한 結果 적어도 7個의 遺傳子가 草長에 관여하고 있었다. 이중 2A, 2B, 2D는 草長을 작게 하는 주인자로, 그리고 5A는 草長을 크게 하는 주

인자로 나타났다. 또한 3B, 6A, 7A도 草長을 작게 하는 因子이다. 2A, 2B, 2D 및 5A와는 달리 그 効果가 작은 것으로 分析 또는 解釋되었다.

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