Identification of Chromosomes Involved in Certain Barley Translocations

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Received September 11, 1975

In view of the manifold utility of translocations (Burnham 1962, Burnham *et al.* 1954, Hagberg 1962, Hanson 1952, Kasha and Burnham 1965a, 1965b, Ramage 1964), work on their production was initiated at this laboratory and several homozygous translocation lines were established through irradiation of dry seeds of barley with gamma-rays and neutrons. In some of these lines, chromosomes involved were identified and breakpoints were located (Das *et al.* 1971, Dubey 1969). The present paper describes the identification of chromosomes involved in three induced translocations in barley.

Materials and methods

Three radiation induced homozygous translocation lines in a 6-rowed barley variety K 12, namely, 3047, 3103, and 3104 were crossed with translocation testers obtained from Prof. C. R. Burnham of the University of Minnesota, U. S. A. The tester stocks used were T1-2a, T1-6a, T1-7d, T2-4a, T3-5b, T3-7a and T4-5a. F₁ plants were grown and sporocytes were collected. Meiosis was studied in PMCs using the acetocarmine smear technique to identify the chromosomes involved in the translocations.

Results and discussion

The hybrids between homozygous translocation lines and translocation testers show various types of configurations at metaphase I in respect to the chromosomes involved. When the chromosomes involved in unknown translocation line and translocation tester are quite different, two chains or rings of 4 chromosomes are observed (Fig. 1). When one chromosome is common in both translocations, one ring of 6 chromosomes is observed (Fig. 2). On the other hand, when chromosomes involved in both the translocations are the same, bivalents are expected. However, a ring of 4 chromosomes may also be observed if the chromosomes involved are the same but arrangements of the chromosome ends are different (Hagberg 1954, Kasha and Burnham 1965b). When the translocation line is crossed with normal, F₁ shows chain or ring of four chromosomes (Fig. 3)

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The F_1 's of the crosses of line 3047 with the testers T3-5b and T3-7a showed $2\odot 4+3$ II at MI (Table 1) which indicated that the chromosomes 3,5 and 7 were

Figs. 1-3. Chromosome configurations in the hybrids of translocation lines and translocation testers. 1, $2\odot 4+3$ II, 2, $\odot 6+4$ II. 3, $\odot 4+5$ II.

Table 1. Chromosome configurations in the meiotic cells of F_1 plants of the crosses of translocation lines with translocation testers*

Translocation testers	Homozygous translocation lines		
	3047	3103	3104
T1-2a	$\odot 6+4$ II	$\odot 6+4$ II	$2\odot 4+3$ II
T1-6a	$\odot 6+4$ II	$\odot 6+4$ II	$2\odot 4+3$ II
T1-7d	$\odot 6+4$ II	$\odot 6+4$ II	$\odot 6+4$ II
T2-4a	$\odot 6+4$ II	$2\odot 4+3$ II	$\odot 6+4$ II
T3-5b	$2\odot 4+3$ II	$\odot 6+4$ II	$2\odot 4+3$ II
T3-7a	$2\odot 4+3$ II	$\odot 6+4$ II	$\odot 6+4$ II
T4-5a	$\odot 6+4$ II	$2\odot 4+3$ II	$\odot 6+4$ II
Standard normal	$\odot 4+5$ II	$\odot 4+5$ II	$\odot 4+5$ II
Chromosomes involved	1-4	1-3	4-7

* $\odot 4$ =ring of 4 chromosomes

$\odot 6$ =ring of 6 chromosomes

II=bivalent.

not involved in translocation. On the other hand, $\odot 6+4$ II were observed in crosses with testers T1-2a, T1-6a and T1-7d and since chromosome 1 was common to all the testers, this chromosome appeared to be involved in the translocation. Again, a configuration of $\odot 6+4$ II was observed when the line was crossed with T2-4a and T4-5a. This suggested that chromosome 4 which was common to both testers was also involved in this line. Thus line 3047 appeared to be T1-4.

Line 3103 showed $2\odot 4+3$ II at M I in the crosses with T2-4a and T4-5a indicating that none of the chromosomes 2, 4 and 5 was involved in this translocation (Table 1). On the other hand, $\odot 6+4$ II in crosses with T1-2a, T1-6a and T1-7d suggested that chromosome 1 was one of the chromosomes of this translocation. Crosses with testers T3-5b and T3-7a also gave $\odot 6+4$ II configuration. Chromosome 3 which was common to both the testers appeared to be the other chromosome of this translocation which was thus T1-3.

In line 3104, $2\odot 4+3$ II were observed with testers T1-2a, T1-6a and T3-5b suggesting that the chromosomes 1, 2, 3, 5 and 6 were not involved in this trans-

location (Table 1). However, in crosses with T1-7d, and T3-7a, a configuration of $\odot 6+4$ II was observed which indicated that chromosome 7, common to both testers, was one of the chromosomes of this translocation. In crosses with T2-4a and T4-5a again $\odot 6+4$ II suggested that chromosome 4 was apparently involved in this interchange. The line 3104 was, therefore, T4-7.

Summary

Chromosomes involved in three translocation lines in a 6-rowed barley variety K 12 were identified by studying the meiosis in the hybrids between the translocation lines and Burnham's translocation testers. The chromosomes identified were 1-4 (line 3047), 1-3 (line 3103) and 4-7 (line 3104).

Acknowledgement

I wish to express my sincere gratitude to Dr. K. Das for his advice and encouragement throughout the course of this study. Thanks are also due to the I. C. A. R., New Delhi for financial help.

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