

## ON ACCESSORY CHROMOSOMES IN SECALE CEREALE (II)

The inheritance of accessory chromosomes in rye.

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### 호밀의 附屬染色體의 遺傳

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### ABSTRACT

1. Number of accessory chromosomes in the progenies of rye which were obtained from mother plants having 2, 4, and 6 accessory chromosomes by open pollination were observed. The result was shown in the Table 1.

2. Crosses between the plant with 14 ordinary chromosomes having chromosome breakage and normal plant with 14 ordinary chromosomes was carried out. A plant among the progeny of this cross was found to have two accessory chromosomes in addition to 14 ordinary chromosomes. This phenomenon may be useful to postulate the possible origin of accessory chromosome in rye.

### INTRODUCTION

Müntzing(1945) achieved extensive work on transmission and multiplication of accessory chromosomes in rye.

Furthermore, study of inheritance of accessories in *Festuca pratensis* and *Centaurea scabiosa* were carried out by Rosemark (1954, 1956) and Fröst(1957) respectively.

The present report deals with the transmission of the accessory chromosome in the progenies of rye obtained by open pollination. In addition, possible origin of accessory chromosomes in rye was investigated.

### MATERIALS AND METHODS

In 1962, a local variety of rye was collected from Sinnae-dong, outskirt of Seoul.

Seeds obtained in 1962 by open pollination from the plant with 2 accessories were grown in 1963. Of these 30 plants, 15 plants had 2 accessories and remaining 15 plants were found to have 4 accessories.

Seeds collected in 1963 from spikes of plants with 4 accessories were grown in the glass house in 1964 and chromosome count was not carried out in this year. Seeds were merely collected from unidentified plants by open pollination.

These seeds were grown in the experimental garden in 1965 and following plants were obtained: 21 plants without accessory, 29 with 2 accessories, 19 with 4 accessories, 9 with 6 accessories, 1 with 7 accessories and 1 with 8 accessories.

A part of the seeds obtained in 1965 by open pollination were sown in the green house in January of 1966. Then young plants were transplanted in the experimental garden in early spring. Cytological observation was carried out in meiosis of P.M.C. and cytological technique was described in previous paper(Lee and Min, 1965).

The phenomenon which a pair of ordinary chromosome was found to break into two fragments at the point of centromere occurring in the stage of diplotene or early diakinesis was reported in the previous paper (Lee and Min, 1965).

In the present work a plant collected from Sinnae-dong in 1965 was appeared to have such fragmentation. We referred this plant as 65-S-7(14+0 accessory having fragmentation). Crosses was carried out between the plant(65-S-7) and the plant(14+0 accessory without fragmentation, referred as 65-S-29). Cytological observation of the progenies obtained in these crosses was carried out in meiosis of P.M.C. in 1966.

## RESULT AND DISCUSSION

### 1. Progenies of open pollination

The result of cytological observation of open pollinated progenies are shown in Table 1.

Table 1. Chromosome numbers in progenies obtained by open pollination in 1965.

Mother plants		Number of accessory chromosomes in progenies									
Number of acc. chr.	Number of plants	0	1	2	3	4	5	6	7	Number of plants	M. acc. chr. per plant
2	5	27		62 <sup>1</sup>	3	21 <sup>2</sup>		1	1	115	2.00
4	7	1		14		13	4	10		42	3.81
6	8			3	1	9	2	8 <sup>3</sup>		23	4.48

1=One plant in addition one small acc. chr.

2== " " tve "

3= " " " "

Majority of accessories observed in present work were standard type. However, small accessories which were clearly distinguished in the first metaphase of meiosis were found in three plants. It may be assumed that these small accessories may be produced by misdivision of standard type of accessory as previously reported by Müntzing(1954).

Müntzing(1954) reported that the average number of accessories in the progenies of open pollinated rye with 2 accessories, 4 accessories, and 6 accessories were 1.43, 2.38, and 2.70 respectively. The present data revealed that numerical increase of accessories by open pollination were greater in our material than Swedish rye. This difference might be caused by different climatic and edaphic condition in two countries.

The seed settings of the plants with 7 and 8 accessories were very poor. 6 seeds were raised from former and only one seed was obtained from the later. These seeds were very poor and were not successful in germination.

The height of the plant with 8 accessories was much shortened clearly showing harmful effect of higher number of accessories.

### 2. Synthesis of accessory chromosomes in rye.

In the cross ♀ 65-S-7 x ♂ 65-S-29 seed setting was very low(3.6%) and only 2 seeds were obtained. Of these only one seed was successful in germination and this plant was found to possess 14+2 accessories. These accessories were assumed as the synthetic accessories.

In the reciprocal cross again, seed setting was very poor(1.5%) raising only one seed. This plant was appeared to have 14 ordinary chromosomes.

In the control 24 plants obtained from crosses between normal plants having 14 ordinary chromosomes were found to contain no accessories.

Synthetic accessories occurred in the present work look quite similar as usual accessories in rye and their behavior will be examined in the following generation.

Hypothesis which accessories may be derived from autosomes were postulated by Darlington. Darlington(1956) postulated that centric fragments or telocentric arms of A-chromosomes produced by misdivision may represent accessories.

In *Oenothera hookeri* two extra tiny chromosome were found in some populations and Cleland(1951) suggested that

they may be produced by a process of fragmentation.

In *Caltha palustris* two telocentric smaller chromosomes was produced by misdivision and new type of chromosomes look and behave like the ordinary accessory chromosomes in this species.

Occurrence of synthetic accessory chromosomes in rye in the present work supports the hypothesis which the centric fragments of A-chromosomes in parent plants will be transmitted to progeny plants and behave as newly arisen accessories.

However, further studies dealing with plants having such fragmentation of A-chromosomes occurred spontaneously or induced by radiation treatment are needed before we can confirm the hypothesis of origin of accessory chromosomes in rye.

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