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Seiken Zihô **17**: *43～45* *(1965)*

Awn Inhibitor in Redman Wheat

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Reprinted from SEIKEN ZIHÔ, Report of the
Kihara Institute for Biological Research, Yokohama
No. 17, Dec. 1965

財団法人　木原生物学研究所　**生研時報**　第17号　別刷
昭和40年12月30日発行
横　浜

Koichiro TSUNEWAKI: **Awn Inhibitor in Redman Wheat**[1]. *Seiken Zihô* **17**: *43～45* (*1965*).

CAMPBELL and MCGINNIS (1958) reported that a common wheat variety, Redman, carries two complementary genes for awn suppression on the chromosomes 5A (formerly IX) and 1D (XVII). One of them, located on chromosome 5A, seems to be an allele of B_1 gene that is already known in many awnless varieties. The other gene, on chromosome 1D, was designated as B_3 by TSUNEWAKI and JENKINS (1961) according to the rules set by HEYNE and LIVERS (1953).

In an attempt to establish isogenic marker lines in another common wheat variety, S-615, B_3 has been chosen as a marker gene for chromosome 1D. In the course of transferring this gene from Redman to S-615, however, it was unexpectedly found that Redman carries only a single dominant gene instead of two complementary genes. Therefore, a further investigation has been made in order to reveal the gene system for awnlessness of Redman wheat. The results of this investigation are here reported.

Materials and Methods Redman, Elgin and Jones Fife are all awnless, while Prelude and

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S-615 are awned varieties of common wheat.

Some seeds of mono-5A of Redman were obtained by courtesy of Dr. R. C. McGINNIS. Among the plants raised from them a few monosomics were cytologically selected and crossed as female parents to S-615. Again, in the F_1 generation, a cytological examination was made in order to distinguish disomic and monosomic hybrids. Selfed progenies of both types were tested for the segregation of awned and awnless plants in F_2.

At the same time, Redman as well as Elgin and Jones Fife was crossed to Prelude and S-615, and segregation in awnedness was examined in the F_2 generation.

Results and Discussion Segregation data in F_1 and F_2 generations of the cross, Redman mono-5A×S-615, are summarized in Table 1. Similarly to the result of CAMPBELL and McGINNIS (1958), all disomic F_1 plants produced from either disomic or mono-5A parents were awnless, while F_1 mono-5A's were all awned. In the F_2 generation of the disomics, however, 1:3 ratio of awned *vs.* awnless was obtained instead of 7:9 ratio expected from segregation of two complementary genes. No awnless plants were found in the offspring of F_1 mono-5A. These results clearly indicate that a single dominant gene located on chromosome 5A is responsible for the awnlessness of Redman, when it is tested against the awnedness of S-615.

Table1. F_1 and F_2 data of the cross, Redman mono-5A×S-615

♀ parent	No. of plants			χ^2	
	Total	Awned	Awnless	1 : 3	7 : 9
F_1 generation					
Disomic	17	0	17	—	—
Mono-5A	38	27^{+}	11^{++}	—	—
F_2 generation					
Disomic F_1	89	25	64	0.45	8.87**
Mono-5A F_1	60	60	0	—	—

$^{+}$ All plants were monosomic.
$^{++}$ All plants were disomic.
** Significant at the 1% level.

In order to confirm this result, Redman and two other awnless varieties, Elgin and Jones Fife, which are known to carry only the B_1 gene, were crossed to two awned varieties, Prelude and S-615. Data on the F_2 segregation of those crosses are summarized in Table 2. Actual segregation ratios of all six crosses fitted the 1:3 ratio, disproving the 7:9 ratio of awned *vs.* awnless. From this result it can be said that the gene system for awnlessness of Redman is not different from that of Elgin and Jones Fife, indicating only one dominant inhibitor, B_1.

As already mentioned, CAMPBELL and McGINNIS (1958) concluded that Redman carries two complementary awn inhibitors on chromosomes 5A and 1D based on the F_1 data of a series of crosses, Redman monosomics×Prelude. Later, McGinnis and Campbell (1961) reported that only a single gene on chromosome 5A of Redman is responsible for its awnlessness when crossed to two other awned varieties, Huron and Canus. Discrepancy of those results was explained by them to be due to a different mode of inheritance of this character in different but phenotypically similar cross combinations.

Table 2. F_2 data for awnedness of six crosses between awnless and awned varieties of common wheat

Cross combination (awnless×awned)	No. of plants			χ^2	
	Total	Awned	Awnless	1 : 3	7 : 9
Redman×Prelude	189	50	139	0.21	22.98**
〃 ×S-615	89	25	64	0.45	8.87**
Elgin×Prelude	379	92	287	0.11	58.41**
〃 ×S-615	440	106	334	0.19	69.10**
Jones Fife×Prelude	70	17	53	0.02	10.78**
〃 ×S-615	428	115	313	0.80	49.56**

** Significant at the 1% level.

Contrary to the result of Campbell and McGinnis (1958), the present F_2 data obtained for the same cross, Redman×Prelude, indicate the presence of a single dominant inhibitor as was the case of Redman crossed by S-615, Huron or Canus. Person (1956) has already pointed out that univalent shifts and other cytological changes may occur in monosomics due to occasional meiotic irregularities. Therefore, it is necessary to carry out a monosomic analysis, at least, to the F_2 generation and compare the F_1 record with the segregation data in F_2. By such procedures a wrong conclusion due to occasional cytological change that occurred in a certain monosomic line may be avoided.

Summary A gene analysis was carried out in order to reveal the gene system for awnlessness of Redman wheat. Contrary to a previous result of Campbell and McGinnis (1958), Redman differed by a single dominant awn-inhibitor, B_1, from Prelude and S-615. Caution was advised in drawing any definite conclusion from the F_1 data of monosomic crosses without testing the segregation pattern in the F_2 generation.

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