

# WHEAT INFORMATION SERVICE



No. 25

December, 1967

Wheat Information Service  
Biological Laboratory, Kyoto University  
Kyoto, Japan

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## Homology of chromosome II of Chinese Spring with a chromosome of *Triticum monococcum*

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OKAMOTO (1962) assigned fourteen chromosomes (formerly I~XIV) of Chinese Spring, a variety of *Triticum aestivum*, to the A and B genomes. Recently, CHAPMAN and RILEY (1966) confirmed OKAMOTO's assignment except for two chromosomes (II and XIII) belonging to the homoeologous group 2.

The present author crossed *T. monococcum* var. *vulgare* (Early) as pollen parent to a 29-chromosome plant derived from Chinese Spring-*durum* (LD 222) hybrid that was marked with telo II right; the 29-chromosome plant had thirteen normal and one heteromorphic bivalent and one univalent that is presumably 2D. Out of nine F<sub>1</sub>'s cytologically checked, only one was found to be the desired hybrid carrying the telocentric chromosome in addition to the 20 normal chromosomes of A and B genomes and one D genome chromosome. Chromosome pairing in the hybrid is summarized in the table below.

Mean pairing was such as could be expected in a *durum-monococcum* hybrid. The telocentric for chromosome II participated in pairing in more than 80 per cent of PMC's. The homologous partner of the telocentric seems to be one of the *T. monococcum* chromosomes because the extra D genome chromosome paired only very rarely with the telocentric and its homologue, forming a trivalent in the 29 chromosome parent. The present result is consistent with that of CHAPMAN and RILEY, indicating that chromosome II should be assigned to A genome.

Chromosome pairing at MI in the hybrid between *T. durum* telocentric for chromosome II right and *T. monococcum vulgare* :

Mean pairing				Percent of PMC's with telo in			
univ.	biv.	triv.	quadriv.	univ.	biv.	triv.	quadriv.
10.02	1.74	0.15	0.01	18.1	70.2	10.6	1.1
(7-12)	(4-7)	(0-2)	(0-1)				

Figures in parentheses represent the range.

(Received June 26, 1967)

## The colour of the coleoptile of wheat

### I. Anthocyanins of the coleoptiles of some *Triticinae*

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The origin of the tetraploid and hexaploid *Triticum* species has been investigated in many ways (JENKINS, 1966; JOHNSON and HALL, 1966; MAC KEY, 1966; REES and WALTERS, 1966, RILEY *et al.* 1967; RYAN, 1966 and TSUNEWAKI, 1966 to mention a few recent publications). It was hoped that by identifying the anthocyanidins obtained from the anthocyanins which colour the coleoptiles of some *Triticinae* lines additional data about this origin would be found. The identifications were carried out as described by VAN BRAGT *et al.*(1966). The results are given in Table 1. (pp. 3~4)

All lines but one contained cyanidin and peonidin. The line of *Aegilops bicornis* contained cyanidin only.

The uniformity of these results does not permit us to give any supplementary information on the origin of the *Triticum* species.

However, it is possible that further investigations of the flavonoids in the coleoptiles of wheat species will provide useful data for chemotaxonomic studies.

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Table 1. Species, I.V.P.-collection number and/or name and origin of the samples investigated.

Species	I.V.P.-collection number and/or name	Origin or nationality
<i>T. boeoticum</i>	No. 8	Usak, Turkey
<i>T. monococcum</i>	No. 8	?
<i>Ae. speltoides</i>	Nos. 6 and 7	Adana, Turkey
<i>Ae. bicornis</i>	No. 3	?
<i>T. dicoccoides</i>	No. 6	Kfar Giladi, Israel
<i>T. araraticum</i>	No. 1	Transcaucasia, U.S.S.R.
<i>T. timopheevi</i>	No. 4	Transcaucasia, U.S.S.R.
<i>Ae. squarrosa</i>	No. 1	Challus, Iran
<i>T. spelta</i>	No. 5, var. <i>recens</i>	?
"	No. 8, Roter Sommerspelz	Germany
"	No. 10	?
"	No. 11	?
"	No. 35, Spelz aus Tzaribrod	Bulgaria
<i>T. macha</i>	No. 3	Western Georgia, U.S.S.R.
<i>T. vulgare</i>	Dale	U.S.A.
"	Dente da Cani	Italy
"	Early Purple Straw	Australia
"	Espanhol Chamorro	Spain
"	Etoile de Choisy	France
"	La Porte	U.S.A.
"	Lutescens 758	U.S.S.R.
"	Lybia I	Lybia
"	P.L.M. 1	France
"	Selekcinskaja	U.S.S.R.
"	Shepherd	U.S.A.
"	Tassilo	Germany
"	Transec	U.S.A.

(Received Dec. 16, 1967)

## Microspectrophotometrical determination of DNA content of the individual chromosomes belonging to the D genome of common wheat

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A highly contracted and rod like metaphase chromosome is unfavorable for microspectrophotometrical measurement of DNA content. Instead, the micronucleus in pollen tetrads of aneuploids such as the monosomics provides an optically favorable material, whose DNA content must be equivalent to that of the specific univalent from which the micronucleus is derived.

Anthers of seven monosomics (1D-7D) of Chinese Spring were fixed with Carnoy's fluid and sectioned longitudinally ten microns thick. The procedure elaborated by SIBATANI and NAORA (1952) was followed for Feulgen staining after hydrolysis with N-HCl at 60°C for five minutes. Extinction of stained nuclei at the wave length of 550m $\mu$  was measured by NAORA's method (NAORA 1955) using an Olympus MSP A-IV.

The table below shows the relative DNA content of individual chromosomes and their length reported by SEARS (1954). It is apparent that the DNA content of the individual chromosomes is almost proportional to their length with the exception of chromosome 5D. Chromosome 5D contained a much larger amount of DNA than could be expected from its length. No reasonable explanation for this finding can be given at present.

DNA content (arbitrary unit) and length of seven chromosomes belonging to the D genome of common wheat:

Chromosome	DNA content ( $\bar{x} \pm s.d.$ )	Chromosome length*	
		M I	T II
1D	121 $\pm$ 17	5.02	5.55
2D	168 $\pm$ 15	5.58	8.18
3D	127 $\pm$ 19	5.86	7.45
4D	147 $\pm$ 22	4.90	6.85
5D	183 $\pm$ 14	4.83	5.77
6D	98 $\pm$ 8	4.22	5.90
7D	175 $\pm$ 17	6.16	9.06

\* Taken from SEARS (1954).

(Received June 26, 1967)

## Introduction of telocentric chromosomes of Chinese Spring into *Triticum durum*

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Telocentric chromosomes are very useful for cytogenetical investigation. OKAMOTO (1962) and CHAPMAN and RILEY (1966) used them for the identification of pairing chromosomes, and SEARS (1962) for the determination of gene-centromere distance.

OKAMOTO (1961) reported about *T. durum* with a telocentric for the long arm of chromosome 5A introduced from Chinese Spring by successive backcrosses. He provided the present author with seeds of  $F_1$ ,  $BC_1$ , or  $BC_2$  between respective telocentric lines of Chinese Spring for 1A long, 2A right, 3A right, 2B right and 3B long, and *T. durum* (LD 222) as a backcross parent. In addition to these, 22 telocentric lines of Chinese Spring for the A and B genome chromosomes, provided by Dr. E. R. SEARS were used for crosses to LD 222.

Chromosome pairing in 18 lines of pentaploid  $F_1$  which carry the respective telocentric chromosome in heterosomic condition was found to be mostly regular with exception of very rare multivalents and precocious desynapsis of some of the heteromorphic bivalents. As the table shows, 1A long, 3A right, 5A long and 6B long showed complete pairing, while 1B short was desynaptic in 60 per cent of PMC's in  $F_1$  and to a considerable extent in  $BC_2$ .

Seed setting on the backcrossed spikes varied depending on the telocentric involved. The percentages, however, should not be considered as conclusive because seed setting may be more or less improved if the D genome univalents are eliminated.

Transmission rate of telocentrics also varied. From the values, given in the table, 20-30 per cent of transmission rate can be expected for most of the lines tested. However, it should be noted that the telocentric for 1B long and that for 6B long, both being deficient for the long arm carrying the nucleolar organizer, were extremely low in transmission rate; 1B long was not transmitted from  $F_1$  to  $BC_1$ , nor 6B long from  $BC_1$  to  $BC_2$ . Contrary to expectation, all plants heterosomic for 2A (II) right have kept without exception an extra chromosome for three generations. It is presumably 2D, because it rarely paired to form a trivalent including 2A (II) right.

The plant heterosomic for 1A long and that for 3B long, both being free from D genome univalents, gave rise to the ditelocentrics for the respective arm by self-pollination.

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This work was supported by a grant from the National Institute (U.S.A.) of Health to Dr. E. R. SEARS and a grant from the Scientific Research Fund of the Ministry of Education (Japan), No. 61062.

nation. One ditelocentric for 1A long was highly male sterile and set no seed by self-pollination, whereas the other ditelocentric for 3B long was seedling lethal.

As described above, 19 out of the possible 28 telocentric lines in tetraploid wheat were investigated, the lacking nine lines remaining for further study. As to those 19 lines reported here, more backcrosses are necessary in order to eliminate the D genome univalents and/or to make the background homozygous. Also the new telocentric chromosomes which have not yet been isolated must be found, i. e. 1A short, 2A (II) left, 3A left, 6A long, 4B short and 5B short.

Chromosome pairing, fertility and transmission rate in  $F_1$  and backcrosses in 19 telocentric lines of Chinese Spring for A and B genome chromosomes and *Triticum durum* LD 222:

Heterosomic for	% PMC's with heteromorphic bivalent in $F_1$	BC-generation	Number of D genome chromosomes	Seed setting (%)	Transmission rate (%)
1A long	100.0	4	0	57.9	17.9
2A right*	97.6	4	1	63.3	37.5
3A right	100.0	3	0-1	42.1	30.0
4A left	85.9	2	1-2	—	20.0
5A long	100.0	2	0	60.3	35.7
short	72.7	2	0-2	41.4	23.8
6A ↗	67.8	2	3	65.0	50.0
7A long	86.4	2	0	50.8	9.7
short	95.2	2	2	50.0	21.4
1B long	—	( $F_1$ )	7	—	0.0
short	40.0	2	0	54.2	20.6
2B right**	70.9	4	0-1	29.7	26.5
3B long	94.0	5	0	59.5	25.6
4B ↗	89.3	1	2-6	5.0	18.2
5B ↗	93.3	1	0-7	—	27.8
6B ↗	100.0	1	3	35.4	0.0
short	70.9	1	1-5	—	31.6
7B long	69.4	2	1-3	59.4	33.3
short	75.9	1	3-6	—	20.0

\* Formerly 2B \*\* Formerly 2A

(Received June 26, 1967)



## Quality studies in induced bearded mutants of Ridley

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Dry seeds of Ridley having 9% moisture content were exposed to different dosages of X-rays, gamma-rays, fast-neutrons and radioisotopes ( $P^{32}$  and  $S^{35}$ ) to induce the awning. SINGH<sup>1)</sup> has discussed the relative performance of different selections from induced awned mutants. On the basis of thousand grain weight, single plant yield and small scale yield trials, it has now been confirmed that the yielding potentialities of Ridley bearded mutants are either at par or slightly superior to their control. The present study was undertaken to evaluate the quality performance of mutants, F. B-1, and F. B-2, in relation to control. The selection of these two mutants for this further evaluation was based on their better yielding performance. The tests were conducted in the Wheat Quality Laboratory of Indian Agricultural Research Institute and the results obtained are summarized in Table 1.

In earlier report, SINGH (2) suggested a monogenic difference between induced bearded mutants and Ridley control, which he explained, was due to the deletion of  $B_1$ ,

Table 1. Quality evaluation of two induced mutants of Ridley  
as compared to control

Seed material	Sedimentation value in ml.	Protein content	Gluten (on-oven-dry basis)	Chapati making characters			
				Loss of water on cooking	Loss of water after keeping for 4 hrs.	Handling properties	Texture
Ridley mutant F. B-1	38	12.27%	8.90	17.5%	9.0%	Sticky	Soft
Ridley mutant F. B-2	35	11.15	7.95	16.3	9.5	∥	∥
Ridley control	33	11.80	8.40	20.9	8.6	∥	∥

Note : Results are reported on 14% constant moisture basis.

a dominant awn inhibitor located on long arm of chromosome IX(5A). In these mutants, otherwise morphologically similar to Ridley, differences in the quality characters were observed (Table 1). The mean values for sedimentation value, protein percentage, gluten content and keeping quality of chapati showed differences among the two mutants. The numerical difference in some characters is not significant, but it is evident that in

general these two high yielding mutants are not inferior to control. In other characters, such as puffing, colour, aroma, taste, colour of flour and the colour of dough, no apparent difference could be detected. The variance for a character is invariably increased by radiation there by creating scope for selection of mutants with desirable characters.

VARUGHESE and SWAMINATHAN (3) have also reported increase in the protein percentage in radiation induced amber mutants in Sonora 63 and Sonora 64. The fact that F.B-1 mutant is comparatively better in quality than F. B-2 further suggests, that an immense scope for improvement in the nutritive value of food-stuffs, through genetic manipulation exists.

FRANK and WILLIAM (4) have obtained evidence for the corresponding increase in amino-acid, phenylalanine, and proline with an increase in the protein content of wheat. The proteins of F. B-1 mutant, if subjected to amino-acid analysis might provide some useful information. The present results along with that of VARUGHESE and SWAMINATHAN on wheat and KAUL and SHARMA (unpublished) on peas, indicate the possibility of selecting mutants with improved quality characters and high protein content in cereal grains if proper screening procedures are adopted.

*Acknowledgement*: The authors wish to thank Dr. A. AUSTIN for critically going through the manuscript.

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(Received July 24, 1967)

## II. Genetic Stocks

### Necrosis genes in U. S. varieties of common wheat

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Necrosis, which often occurs in wheat hybrids, is classified into necrosis in a narrow sense and chlorosis. Two complementary genes,  $Ne_1$  on chromosome 5B and  $Ne_2$  on chromosome 2B (XIII), control the former (TSUNEWAKI 1960), and genes  $Ch_1$ , location unknown, and  $Ch_2$  on chromosome 3D control the latter (HERMSEN 1966, TSUNEWAKI 1966). We are investigating the distribution of those genes in various geographical populations of common wheat in order to throw a light on its phylogenetic differentiation. In this article, results with the U. S. common wheat will be given.

We obtained 300 U. S. varieties of common wheat (*Triticum aestivum*) from Dr. J. C. CRADDOCK, World Collection of Small Grains, USDA. Of those 282 varieties were crossed to three testers for necrosis and chlorosis genes and their genotypes were determined. The results are given in Table 1. (Detailed analysis of the results was published in the Canadian Journal of Genetics and Cytology Vol. 9: 385-393, 1967.) Most variety names were abbreviated according to BRIGGLE and HEYNE (Wheat Newsletter 6: 17-24, 1959). Growth habit of each variety was also determined, as shown in the table by growing plants in growth chambers, that were operated at 20°C with 16hr illumination of 20,000 luxes. Varieties that headed after three months from sowing were determined as spring, those with visible ears inside the leaf sheath as intermediate and those showing no ear formation as winter type. Table 1: pp.10~18.

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1) Supported by a grant from the Japan Society for the Promotion of Science as part of the Japan-U. S. Cooperative Science Program.

Table 1. Phenotypes with respect to necrosis and chlorosis of F<sub>1</sub> hybrids between three testers and 282 common wheat varieties of U. S. A. and their genotype formulae (Origin and growth habit of each variety are also given.)

C. I. No.	Variety name	State	Growth habit	Tester			Necrosis genotype
				Jones Fife <i>ne<sub>1</sub>Ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>	Prelude <i>Ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>	Macha <i>Ne<sub>1</sub>ne<sub>2</sub>Ch<sub>1</sub>ch<sub>2</sub></i>	
1744	GG	N. Y.	W	+	+	c	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
1923	FZ	Md.	∥	+	+	c	∥
1970	Prp	Calif.	S	n	+	c	<i>Ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
2008	Mr	Okla.	W	+	+	c	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
2496	Sur	N. Y.	∥	+	+	c	∥
2986	SP	Calif.	S	+	+	c	∥
3088	Cp	Wash.	W	+	n	c	<i>ne<sub>1</sub>Ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3275	Lh	Utah	∥	+	+	c	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3326	Cr	Md.	∥	+	n	n, c	<i>ne<sub>1</sub>Ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3332		N. Y.	∥	+	?	c	<i>ne<sub>1</sub> ? ch<sub>1</sub>Ch<sub>2</sub></i>
3342	Ds	∥	∥	+	n	c	<i>ne<sub>1</sub>Ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3365	Pg	∥	∥	+	n	c	∥
3384	Do	∥	∥	+	n	c	∥
3392		∥	∥	+	n	n, c	<i>ne<sub>1</sub>Ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3436	Gs	∥	∥	+	+	c	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3483	OW	∥	S	+	+	c	∥
3488	Pl	∥	W	+	n	c	<i>ne<sub>1</sub>Ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3500	RW	∥	∥	+	n	c	∥
3516	RNY57	∥	∥	+	n	c	∥
3586	Ss	∥	S	+	+	c	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
3663	Dl	Utah	∥	+	+	c	∥
3690	Hb	N. Dak.	∥	+	+	c	∥
3697	Pr	∥	∥	+	+	c	∥
3703	RD	Vt.	∥	+	+	c	∥
3707		N. Dak.	W	+	+	?	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub> ?</i>
4066	LC	Wash.	S	+	+	c	<i>ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>
4067	Pb	Ore.	W	n	+	c	<i>Ne<sub>1</sub>ne<sub>2</sub>ch<sub>1</sub>Ch<sub>2</sub></i>

4141	Cv	Colo.	S	+	n	c	$ne_1Ne_2ch_1Ch_2$
4155		Ore.	W	+	?	c	$ne_1 ? ch_1Ch_2$
4156	Gc	◇	◇	+	+	c	$ne_1ne_2ch_1Ch_2$
4158		◇	S	?	+	c	? $ne_2ch_1Ch_2$
4160	Hbr143	Wash.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
4241	RC	◇	◇	+	+	c	◇
4257	BC	Ore.	I	+	+	c	◇
4298	SM	Calif.	◇	+	+	c	◇
4376		S. Dak.	S	+	+	c	◇
4377	NK	Colo.	W	+	+	c	◇
4397	Er	Neb.	◇	+	+	c	◇
4398		◇	◇	+	+	c	◇
4430	Sm	Mont.	◇	+	+	c	◇
4444		◇	S	+	+	c	◇
4463	Mt	Ida.	W	+	+	+	$ne_1ne_2ch_1ch_2$
4468	JF	Wash.	◇	+	n	c	$ne_1Ne_2ch_1Ch_2$
4475	Od	Minn.	S	+	n	+(n ?)	$ne_1Ne_2ch_1ch_2$
4489	Id	Ida.	◇	n	+	c	$Ne_1ne_2ch_1Ch_2$
4509	RR	Wash.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
4510	Hbr63	◇	◇	+	n	c	$ne_1Ne_2ch_1Ch_2$
4511	Hbr123	◇	◇	+	n	c	◇
4512	Hbr128	◇	◇	+	n	c	◇
4646	Sst	◇	S	+	n	c	◇
4648		◇	I	+	n	c	◇
4655	WO	Ida.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
4682	Et	Ore.	◇	+	n	c	$ne_1Ne_2ch_1Ch_2$
4762	Gsm	Ida.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
4782	Cpl	S. Dak.	◇	n	+	c	◇
4798	Pi	Neb.	◇	n	+	c	◇
4811	FM	Pa.	W	+	?	n	$ne_1Ne_2ch_1ch_2$
4816	WI	◇	◇	+	n	?	$ne_1Ne_2ch_1 ?$
4823		Va.	◇	+	n	c	$ne_1Ne_2ch_1Ch_2$
4843	Hs	Ill.	◇	+	+	c	$ne_1ne_2ch_1Ch_2$
4898	Ma	Ky.	S	+	+	c	◇
4966		Minn.	◇	+	n	n	$ne_1Ne_2ch_1ch_2$

5146	Kr	Kan.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
5147	Nb28	∥	∥	+	+	c	∥
5149	Mh	Minn.	∥	+	n	c	$ne_1Ne_2ch_1Ch_2$
5177	JK	Ore.	I	+	+	c	$ne_1ne_2ch_1Ch_2$
5180	GC	∥	W	+	n	+(n ?)	$ne_1Ne_2'ch_1ch_2$
5189	Kn	∥	I	+	?	n, c	$ne_1Ne_2ch_1Ch_2$
5208	Ht	∥	S	+	+	c	$ne_1ne_2ch_1Ch_2$
5240		∥	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
5246	Fs	∥	S	+	n	c	∥
5256	BC	∥	W	+	+	c	$ne_1ne_2ch_1Ch_2$
5274		Ill.	S	+	+	c	∥
5277		Wash.	∥	+	+	c	∥
5303	Mi	Mo.	W	+	+	c	∥
5314	HQ	∥	∥	+	n	c	$ne_1Ne_2ch_1Ch_2$
5336	RM	∥	∥	+	n	c	∥
5338	IA	∥	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
5366	Ng	Ohio	∥	+	n	c	∥
5380	Ppr	W. Va.	∥	+	+	c	∥
5406	IC	Ill.	∥	+	+	c	∥
5407		Wash.	S	+	+	c	∥
5408	Tlt	∥	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
5540	Pc	Calif.	I	n	+	c	$Ne_1ne_2ch_1Ch_2$
5549	Mtn36	Mont.	S	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
5597	RRc	Ark.	W	+	n	n, c	∥
5620	MA	Ind.	∥	+	?	n, c	∥
5644	Gdn	Ohio	I	n	+	c	$Ne_1ne_2ch_1Ch_2$
5654	Ptg	∥	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
5657	Tb	∥	∥	+	n	c	∥
5693	Rsr	Pa.	∥	+	n	c	∥
5734		Va.	∥	+	+	c	∥
5737	Rsn	∥	∥	+	n	c	$ne_1ne_2ch_1Ch_2$
5757		∥	∥	?	+	c	? $ne_2ch_1Ch_2$
5823	Lbl	Pa.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
5868		Ore.	S	+	+	c	∥
5874		Wash.	I	+	+	c	∥

5878		Mont.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
5915	Ws	N. Y.	◇	+	+	c	◇
5920	Rp	◇	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
5921	RNY6	◇	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
5923	Vl	◇	W	+	+	c	$ne_1ne_2ch_1Ch_2$
5928	RRd	◇	◇	+	n	c	$ne_1Ne_2ch_1Ch_2$
5947		◇	I	+	+	c	$ne_1ne_2ch_1Ch_2$
5948		◇	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
6002		Ore.	S	?	+	c	? $ne_2ch_1Ch_2$
6009		Wash.	I	n	+	c	$Ne_1ne_2ch_1Ch_2$
6011	Nz	Utah	◇	n	+	c	◇
6017	Ts	◇	S	+	+	c	$ne_1ne_2ch_1Ch_2$
6049	Dn	N. Dak.	◇	n	+	c	$Ne_1ne_2ch_1Ch_2$
6155	Mtr	Minn.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
6156	Bs	Wis.	S	+	+	c	◇
6161	Hnr	N. Y.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
6162		Va.	◇	+	+	c	$ne_1ne_2ch_1Ch_2$
6163	Sh	Ind.	◇	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
6165		N. Max.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
6247	Sve	Ill.	W	+	+	?	$ne_1ne_2ch_1$ ?
6249		S. Dak.	◇	+	+	c	$ne_1ne_2ch_1Ch_2$
6250	Nb6	◇	◇	n / +	+	c	$Ne_1/ne_1ne_2ch_1Ch_2$
6251	Bh	Kan.	◇	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
6282	CR	Calif.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
6301	OI	N. C.	◇	n	+	c	◇
6307	Fnt	Ga.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
6316	GD	Ark.	S	+	n	c	$ne_1Ne_2ch_1Ch_2$
6585		Neb.	W	+	n	n	$ne_1Ne_2ch_1ch_2$
6588		N. Y.	◇	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
6607		Calif.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
6680	AK	Wis.	W	+	+	c	◇
6683	WP2	◇	◇	+	+	c	◇
6687		Mont.	◇	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
6691	Fw	N. Y.	◇	+	+	c	$ne_1ne_2ch_1Ch_2$
6692	Aln	Ky.	◇	+	n	n, c	$ne_1Ne_2ch_1Ch_2$

6700	Km	Mont.	W	+	?	c	$ne_1 ? ch_1Ch_2$
6703	Rdt	Wash.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
6797	Wb	∥	S	+	+	c	∥
6886		Minn.	∥	+	+	c	∥
6887	Mq1	∥	∥	n	+	c	$Ne_1ne_2ch_1Ch_2$
6900	Crs	N. Dak.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
6902	Prs	Wis.	∥	+	+	c	∥
6934	TOb	Iowa	W	+	+	c	∥
6935	Nt	Mont.	∥	+	+	c	∥
6936	Tm	Kan.	∥	+	+	c	∥
6937		∥	I	+	+	c	∥
6962	Ntm	Pa.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
6971		N. Y.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
6990	Mik	Ind.	∥	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
6999	Fh	Ohio	∥	+	n	c	∥
7001		∥	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
7359	OZ	Ore.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
7364	Rg	∥	W	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
7366		∥	∥	+	n	n, c	∥
7368		∥	S	+	+	c	$ne_1ne_2ch_1Ch_2$
7370	RI	N. Dak.	∥	+	+	c	∥
7379		Okla.	∥	+	+	c	∥
7381		Iowa	∥	+	+	c	∥
7382		Minn.	∥	n	+	c	$Ne_1ne_2ch_1Ch_2$
7383		Mont.	∥	n	+	c	∥
8177		S. Dak.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
8180		Kan.	W	+	+	c	∥
8194	Rf	Mont.	S	+	+	c	∥
8215		Minn.	W	+	+	c	∥
8216		∥	S	+	+	c	∥
8219	Ir	Ill.	∥	+	+	c	∥
8220	Oro	Ore.	W	+	+	c	∥
8223		Calif.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
8240	Ec	∥	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
8241	RO	∥	∥	+	+	c	∥



8242		Calif.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
8243		Ore.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
8246		∕	I	n	+	c	$Ne_1ne_2ch_1Ch_2$
8247		∕	W	n	+	c	∕
8254		∕	S	+	+	c	$ne_1ne_2ch_1Ch_2$
8255	HF31	∕	∕	+	+	c	∕
8257	Fulhard	Kan.	W	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
8265	Dt	Tex.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
8272	BR	Mich.	W	+	+	c	∕
8273		Mont.	S	+	+	c	∕
8274		Ariz.	∕	+	+	c	∕
8275	Ab	Wash.	W	+	+	+	$ne_1ne_2ch_1ch_2$
8276	Prc	Ida.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
8277		?	S	+	+	c	∕
8381	PK	Ind.	W	+	+	c	∕
8382	RI	Ohio	∕	+	+	c	∕
8855		Ida.	S	+	+	c	∕
8856	EB	Kan.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
8857		∕	∕	+	n	n, c	∕
8858	CKn	∕	∕	+	n	n, c	∕
8868	EC	Okla.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
12561	At166	N. C.	∕	+	+	c	∕
12566		S. C.	∕	+	+	+	$ne_1ne_2ch_1ch_2$
12567	Sd	N. Dak.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
12611	Sb	Tex.	∕	+	+	c	∕
12653	Ge	N. Y.	W	+	+	c	∕
12672	Ndl	Del.	∕	+	+	c	∕
12673		Ohio	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
12674	Sln	Ill.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
12677		Wash.	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
12687		∕	I	n	+	c	$Ne_1ne_2ch_1Ch_2$
12691		Calif.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
12696		Wash.	W	+	?	+	$ne_1ne_2ch_1ch_2$
12702	Ctt	Tex.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
12706	Sfr	Kan.	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$

12713	RJ	Kan.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
12719	KK	∥	∥	+	n	n, c	∥
12748		Ind.	∥	+	n	n, c	∥
12755	Pn	Pa.	∥	+	n	c	∥
12761	Tln	Md.	∥	+	n	c	∥
12762	KQ	Kan.	∥	+	n	c	∥
12763		Calif.	S	+	n	n, c	∥
12798	Knox	Ind.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
12804	Ottawa	Kan.	∥	+	+	c	∥
12865	Coloraw	Neb.	∥	+	+	c	∥
12871	Kaw	Kan.	∥	+	+	c	∥
12928	Cln	Ore.	∥	+	+	c	∥
12930	Wmt	∥	∥	+	+	c	∥
12933	It	∥	∥	+	+	c	∥
12974	Cnt	Mont.	S	+	+	c	∥
12988		Mo.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
12990	Lc	Ohio	∥	+	n	n, c	∥
13015	Om	Neb.	∥	+	+	?	$ne_1ne_2ch_1 ?$
13016	Atc	∥	∥	+	n	c	$ne_1Ne_2ch_1Ch_2$
13023	Tes	Tex.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
13068	Lmh53	Ida.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
13069		Calif.	∥	n	+	c	∥
13072	Omar	Wash.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13129		?	∥	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
13130		?	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
13133		?	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
13146	Bi	Tex.	I	+	+	?	$ne_1ne_2ch_1 ?$
13147	Tvs	∥	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
13170	Redcoat	Ind.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
13172	Rcn	Wis.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
13181	Rego	Mont.	∥	+	+	+	$ne_1ne_2ch_1ch_2$
13190	Wrr	Neb.	∥	+	+	c	$ne_1ne_2ch_1Ch_2$
13193	Shoshoni	Wyo.	∥	+	+	c	∥
13228	Ars	Ind.	∥	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
13238	Bds	Ga.	∥	n	+	+	$Ne_1ne_2ch_1ch_2$

13249	Tlr49	N. C.	I	+	n	c	$ne_1Ne_2ch_1Ch_2$
13252	SCh	Wash.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13257	Onas53	Calif.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
13258	Lmh53	Ida.	∕	n	+	c	∕
13263		Mont.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13264		Ida.	I	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
13265		∕	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13266		∕	∕	+	+	c	∕
13278	Mnn	Ind.	∕	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
13304	Santana	Mont.	S	+	+	c	$ne_1ne_2ch_1Ch_2$
13361	WFd54	Calif.	∕	n	+	c	$Ne_1ne_2ch_1Ch_2$
13362	KC	Tenn.	W	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
13363	Rtt	Okla.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
13364	Hv	Kan.	∕	+	+	c	∕
13369	Milam	Tex.	S	+	+	c	∕
13372	Wd	Ind.	I	+	n	n, c	$ne_1Ne_2ch_1Ch_2$
13373	Dir	∕	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13374		Ga.	∕	+	+	c	∕
13375		∕	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
13376		∕	∕	+	n	c	∕
13378	Ctd	Pa.	∕	+	n	c	∕
13382	Wln	N. C.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
13384	Ace	Ark.	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
13389		Ky.	I	+	n	c	∕
13395	A	Okla.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13397		∕	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
13426	Tendoy	Ida.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
13434		∕	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
13442	Delmar	Utah	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
13448	Gaines	Wash.	∕	+	+	c	∕
13450		Ida.	∕	+	+	c	∕
13457	Lathrop	Wis.	S	+	+	c	∕
13477	Avon	N. Y.	I	+	n	c	$ne_1Ne_2ch_1Ch_2$
13513	Reed	Ind.	W	+	n	c	∕
13560	Radco	?	∕	+	+	c	$ne_1ne_2ch_1Ch_2$

13628		Ind.	W	+	n	c	$ne_1Ne_2ch_1Ch_2$
13631	Idaed 59	Ida.	S	n	+	c	$Ne_1ne_2ch_1Ch_2$
13632		∕	∕	n	+	c	∕
13634		∕	∕	n	+	c	∕
13643	BC60	Calif.	W	+	+	c	$ne_1ne_2ch_1Ch_2$
13664		Wash.	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
13667	Improved Triumph	Okla.	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
13668	Newest Improved Triumph	∕	∕	+	n	c	$ne_1Ne_2ch_1Ch_2$
13669	Super Triumph	∕	∕	+	+	c	$ne_1ne_2ch_1Ch_2$
13701	Knox 62	Ind.	∕	+	+	c	∕

Note : Symbols for growth habit=W : winter type, I : intermediate type, S : spring type.

Symbols for necrosis=+ : normal, n : necrotic, c : chlorotic, ? : no hybrids obtained  
or genotype partially undetermined.

(Received Aug. 12, 1967)

**Report of a joint expedition through Turkey to collect species of the  
*Triticinae*—under the auspices of the University of California, U.S.A.,  
Kungl. Skogs-och Lantbruksakademien of Sweden and The Food and  
Agriculture Organization of the United Nations**

B. L. JOHNSON and Ove HALL

Recent research by the writers suggests that the method of protein electrophoresis provides a new approach to the study of evolution which promises to be especially effective in clarifying genome relationships and species origins in polyploid series. For this reason as early as January 1964 an expedition to Turkey was planned to collect material for a comprehensive study of evolution in the amphiploid series of *Triticum* and *Aegilops*. Funds to support this expedition were provided by the University of California Agricultural Experiment Station and Kungl. Skogs-och Lantbruksakademien of Sweden.

The Food and Agriculture Organization of the United Nations entered into the plans through the efforts of Professor Hermann KUCKUCK, Project Manager, United Nations Special Fund, Crop Research and Introduction Centre, Izmir, Turkey. Dr. Basri DEVECIOGLU, Co-manager, joined the expedition as the representative of FAO which also provided a Toyota Land Cruiser with a driver. These provisions proved to be indispensable to the success of the excursion.

The expedition left headquarters in Izmir on July 27, 1965 and travelled via Cardak, Konya, and Adana to Gaziantep. This portion of the route passed through territory covered in recent explorations for *Triticum* and *Aegilops* by Dr. Daniel ZOHARY of Israel. From Urfa through Diyarbakier and Bitlis to Tatvan the route passed through an area from which, to our knowledge, no previous collection of *Triticinae* is available, but which yielded many species of importance to genetic research and the breeding of wheat. The route from Tatvan through Agri, Dogubayazit and Kars to Erzurum continued through territory not represented by known collections. This area yielded valuable collections of *Secale* at high elevations and a few species of *Aegilops* at lower elevations. On the return trip from Erzurum through Elazier, Malatya, Kayseri, Ankara, Afyon and Denizli to Izmir most if not all the endemic species of *Aegilops* were collected as well as *Triticum* and *Secale*. The expedition terminated in Izmir on August 15, 1965, having covered about 5700 km and having made 241 seed collections.

Evidence from conventional methods suggests that *Ae. speltoides* or *Ae. bicornis* is the donor of the B genome to tetraploid and hexaploid wheats. Electrophoretic studies of the materials heretofore available throw some doubt upon this conclusion. However,

the great variability of the *Ae. speltoides* complex including *Ae. ligustica* and *Ae. sharonensis*, suggests that variation within this group must be considered before final conclusions can be drawn. The abundance of material of *Ae. speltoides* and *Ae. ligustica* obtained in the present expedition will be invaluable to the solution of this problem.

A possibly significant observation is the fact that *Ae. ligustica*, the form widely distributed among plant breeders and geneticists as *Ae. speltoides*, tends to occur where typical *Ae. speltoides* grows intermixed with *Triticum boeoticum*. Frequent spikes of the *ligustica* form in mixed populations were observed to be sterile. Sterility is also very high in the material distributed among plant breeders.

The A genome of polyploid wheats presumably was contributed by the wild diploid species, *Triticum boeoticum* or its cultivated derivative, *T. monococcum*. On cytological as well as electrophoretic criteria, however, the *monococcum* genome is quite different from the A genome of the polyploid species. The extensive collection of *T. boeoticum* obtained in the present excursion will provide evidence regarding existing variability in the A genome which may provide an explanation of the observed discrepancy.

The sympatric occurrence of *T. boeoticum* (AA) and *Ae. speltoides* (BB) throughout south-central Turkey suggests that that is also a plausible area for the origin of tetraploid (AABB) wheats. However, the wild tetraploid, *T. dicoccoides* was not observed there.

Contrary to expectation, *Ae. squarrosa* (DD) the presumed donor of the D genome to hexaploid wheats (AABBDD) was not observed in the areas of eastern Turkey visited by the expedition. This observation strengthens the belief that the hexaploid wheats most probably originated in Iran. *Ae. cylindrica* which carries the D genome was collected in several areas of eastern Turkey, and as far west as Ankara.

The genome composition of polyploid species in *Aegilops* has been worked out in considerable detail from cytological evidence. This work together with the present collection of *Aegilops* species is invaluable for testing the ultimate usefulness of the electrophoretic method for analyzing polyploid series.

Many local varieties of wheat in Turkey are threatened with extinction by the increasing cultivation of widely adapted introduced varieties. To guard against the eventual loss of valuable genetic material, collections were made of various plant types in fields of *T. durum*, *T. compactum* and *T. aestivum*. Further efforts, however, should be made to preserve this valuable breeding material.

Likewise collections of various plant types were made in fields of cultivated rye, and in wild populations of *Secale* which occurred in abundance in the Dogubayazit-Kars area.

Quite apart from meeting the needs of studies now in progress the present collection will be available to all research workers. At present it is held at the Swedish Seed Association, Svalöf, Sweden until final identification has been completed. The accessions with collection data will be catalogued at the Crop Research and Introduction Centre, Izmir. Responsibility for seed increase is assumed by the senior author.

## Collection Diary and Summary

Report of a joint expedition through Turkey to collect species of the *Triticinae*-under the auspices of the University of California, U. S. A., Kungl. Skogs-och Lantbruksakademien of Sweden and The Food and Agriculture Organization of the United Nations by B. L. Johnson and Ove Hall

1965 July 27. Speedometer reading at Izmir :

18607. 7

18921; 1km. west of Cardak.

Harvested field of *T. durum*

No. 11. *Secale cereale*

18929; 8km. east of Cardak at

Aci Göl. Sparse pear trees.

Not heavily grazed.

No. 2. *Aegilops biuncialis*

✧ 3. *Dianthus* sp.

✧ 4. *Ae. biuncialis*

✧ 5. *Ae. ovata*

18947; 26 km. n. e. of Cardak.

No. 6. *Aegilops mutica*

19033; 110 km. n. e. of Cardak.

No. 7. *Ae. triuncialis*  
(glabrous)

✧ 8. *T. boeoticum*

✧ 9. *Ae. triuncialis*  
(pubescent)

✧ 10. *Hordeum bulbosum*

July 28. 19257; 24 km. e. of Konya., alt

1000 m.

No. 11. (Unidentified.)

19359; 26 km. e. of Konya, alt.

1000 m. Piles of threshed grain. Identification supplied by Dr. Devecioglu and the owner of the wheat.

No. 12. *T. compactum* var.  
*pseudo-rubriceps*

✧ 13. *T. aestivum* var.

*Delphi*

✧ 14. *T. compactum* 52

Certak (a cloth bag of the same species for Dr. Hall.)

✧ 15. *Secale cereale* (no var. designated.)

(A cloth bag of the same for Dr. Devecioglu.)

✧ 16B. *T. durum* var.

*hordeaeformis*.

The letter B following collection numbers (e. g. 16 B) designates collections made by Dr. Basri Devecioglu and deposited at the Crop Research and Introduction Center, Izmir.

19373; 6, 5 km. e. of Yarma, alt.

1000 m. Field of mixed-rye, wheat and barley.

No. 17. *T. compactum* (white)

✧ 18. *T. compactum* var.

*Rubriceps*

✧ 19. *Secale* sp.

✧ 20B. *Secale* sp.

19487; Opposite Eregli, alt. 1250

m. At edge of irrigation canal.

No. 21. *Ae. triuncialis*

✧ 22. *Ae. triuncialis*

19528; 41 km. e. of Eregli at

railroad overhead, among thistles, *Euphorbia* and misc. grasses, alt. 1450 m.

No. 23. *Ae. triuncialis*

✧ 24. *Agropyron* sp.

✧ 25. *Agropyron* sp.

- ♀ 26. *Dianthus* sp.  
 ♀ 27B. *Secale* sp.  
 19553; 66 km. e. of Eregli, alt.  
 1150 m. Just beyond  
 Ulukisla, along the road.  
 No. 28. *Ae. ovata*  
 ♀ 29-1. *Ae. triuncialis*  
 ♀ 29-2. *Ae. biuncialis*  
 ♀ 30. *Ae. triuncialis*  
 ♀ 31. *Ae. mutica*(glabrous)  
 ♀ 32. *Ae. mutica*(pubescent)  
 ♀ 33. *Secale* sp.  
 19571; 84 km. e. of Eregli, alt. 850  
 m. Pass through the Toros  
 Mts. towards Adana. Roadside.  
 No. 34. *Ae. speltoides*  
 ♀ 35. *Ae. speltoides*  
 (glabrous)  
 ♀ 36. *Ae. speltoides*  
 (pubescent)  
 ♀ 37. *Ae. triuncialis*  
 ♀ 38. *Ae. ovata*  
 ♀ 39. *Ae. biuncialis*  
 July 29. 19719; 19 km. e. of Adana, alt. 90  
 m. Roadside.  
 No. 40. *Dianthus* sp.  
 19812; 112 km. e. of Adana, alt.  
 400 m. Roadside grazed area.  
 Collection from the ground.  
 No. 41. *Ae. ovata*  
 ♀ 42. ♀ *speltoides*  
 19837; 137 km. e. of Adana, alt.  
 1100 m.  
 No. 43. *Ae. triaristata*  
 ♀ 43.5. *T. durum* (100 km.  
 w. of Gaziantep).  
 19910; 210 km. e. of Adana, 25  
 km. w. of Gaziantep, alt.  
 1000 m.  
 No. 44. *Ae. ovata*  
 ♀ 45. ♀ *biuncialis*  
 ♀ 46. ♀ *speltoides*  
 ♀ 47. ♀ ♀  
 ♀ 48. ♀ *caudata*  
 ♀ 49. ♀ *triuncialis*  
 19943; 8 km. e. of Gaziantep, alt.  
 950 m. Along roadside near  
 vieyard.  
 No. 50. *Ae. triuncialis*  
 ♀ 51. ♀ ♀  
 ♀ 52. ♀ *ovata*  
 19962; 28 km. e. of Gaziantep.  
 No. 53. *Ae. ovata*  
 ♀ 54. ♀ *triuncialis*  
 ♀ 55. ♀ ♀ (with  
 longer spikes and  
 more lateral awns).  
 20073; 8km. w. of Urfa, alt. 750 m.  
 No. 56. *Ae. triuncialis*.  
 July 30. 20093; 11 km. n. of Urfa, alt. 700 m.  
 No. 57. *Ae. ovata*  
 ♀ 58. ♀ *triuncialis*  
 ♀ 59. ♀ *speltoides*  
 ♀ 60. ♀ *ligustica*  
 20138; 56 km. n.e. of Urfa near  
 Hilvan. From a pile of  
 harvested grain (unthreshed)  
 No. 61. *T. durum*  
 (*duro-compactum*)  
 20151; 69 km. n. e. of Urfa, alt.  
 620 m. A roadside population  
 of *T. boeoticum* and *Ae. spelt-*  
*oides* mixed. In both species  
 only a few spikelets adhered  
 to the straw' which was up  
 to 60 cm. tall. Adjacent to a  
 cultivated field.  
 No. 62. *Ae. ligustica* (from  
 spikelet adhering to  
 straw).  
 ♀ 63. *T. boeoticum* (from  
 spikelet adhering to  
 straw).  
 ♀ 64. *Ae. speltoides*



- ♣ 65. *Ae. triuncialis*  
 ♣ 66. *T. durum* var. *pseudohordeaeformis*  
 from adjacent field.  
 ♣ 67. *Ae. ligustica*  
 20172; 90 km. n. e. of Urfa.  
 No. 68. *Ae. ligustica*  
 ♣ 69. ♣ *triaristata*  
 ♣ 70. ♣ *triuncialis*  
 20217; ca. 60 km. w. of Diyarbakir,  
 alt. 1300 m. Stony, uncultivated area.  
 No. 71. *Ae. ligustica*  
 ♣ 72. *Ae. triuncialis*  
 ♣ 73. *T. boeoticum*
- July 31. This day was spent in Diyarbakir identifying and arranging the material collected.
- Aug. 1. 2032; 20 km. n. e. of Diyarbakir, alt. 720 m. Adjacent to harvested field. Here the variation in *Ae. speltoides* suggested transfer of genes from *T. boeoticum* (i. e. typical *Ae. speltoides* and a variant type with more lateral awns—probably *Ae. ligustica*).  
 No. 74. *Ae. ligustica*  
 ♣ 75. *T. boeoticum*  
 ♣ 76. *T. durum* (*durocompactum*) or *orientale* in unharvested field.  
 2040; 31 km. n. e. of Diyarbakir, alt. 780.  
 No. 77. *Ae. triuncialis*  
 ♣ 78. *Ae. triaristata*  
 ♣ 79. *Ae. speltoides*  
 20361; 58 km. n. e. of Diyarbakir, alt. 790 m.  
 No. 80. *Ae. triuncialis*  
 ♣ 81. *Ae. triaristata*  
 ♣ 82. *Ae. speltoides*  
 20408; 16 km. e. of Silvan, alt. 760 m. Roadside, near field.  
 No. 83. *Ae. triuncialis*  
 ♣ 84-1. *Ae. triaristata*  
 ♣ 84-2. *Ae. ovata*  
 ♣ 85. *T. aestivum*  
 ♣ 86. *T. durum*  
 20458; 155 km. n. e. of Diyarbakir, alt. 700 m. River Valley. Roadside adjacent to harvested field.  
 No. 87. *Ae. speltoides*  
 ♣ 88. *Ae. triuncialis*  
 ♣ 89. *Ae. triaristata*  
 20532; 229 km. n. e. of Diyarbakir, alt. 1350 m. Grazed mountain side.  
 No. 90. *Secale* sp.  
 ♣ 91. *Ae. cylindrica*  
 ♣ 92. *Ae. triuncialis*  
 20540; 3 km. s. w. of Bitlis, alt. 1430 m. Shoulder of road.  
 No. 93. *Ae. cylindrica*  
 ♣ 94. *Secale* sp.  
 20548; 5 km. n. of Bitlis, alt. 1630 m. Roadside.  
 No. 95. *Secale* sp.
- Aug. 2. 20593; 3 km. n. e. of Tatvan in field of Durum.  
 No. 96. *Secale* sp.  
 20599; 9 km. n. e. of Tatvan.  
 No. 97. *Dianthus* sp.  
 20586; 4 km. s. e. of Tatvan.  
 No. 98. *Secale* sp.  
 ♣ 99. *Secale* sp.  
 ♣ 100. *T. aestivum*
- Collections No. 98-100 were made in the morning prior to No. 96, but were recorded in the afternoon.  
 — 10 km. from Tatvan on road to Bitlis.  
 No. 101. *T. aestivum*  
 — 5 km. from Bitlis, towards



- No. 130. *Secale cereale*  
 20971; 73 km. n. w. of Ercis, alt.  
 1630 m. Roadside, near wheat  
 field.  
 No. 131. *Secale* sp.  
 20997; 99 km. n.w. of Ercis, alt.  
 1540 m. Mountain side.  
 No. 132. *Secale* sp.  
 Aug. 5. 21055; 11 km. e. of Agri, alt. 1600  
 m.  
 No. 133. *Ae. cylindrica*  
 21083; 38 km. e. of Agri, alt. 1770  
 m.  
 No. 134 B. *Secale* sp.  
 21188; 18 km. n. of Dogubayazit  
 towards Igdir, alt. 1500 m.  
 Stony roadside.  
 No. 135. *Secale* sp.  
 21201; 31 km. n. of Dogubayazit,  
 alt. 1800 m. Stony mountain  
 side.  
 No. 136. *Ae. cylindrica*  
 ↗ 137 B. *T. aestivum?* or  
*carthlicum*  
 21205; 35 km. n. of Dogubayazit,  
 alt. 1530 m.  
 No. 138. *Secale* sp.  
 21207; 37 km. n. of Dogubayazit,  
 alt. 1510 m.  
 No. 139. *Ae. cylindrica*  
 21208; 38 km. n. of Dogubayazit,  
 alt. 1450 m.  
 No. 140. *Secale* sp.  
 21313; 143 km. n.w. of Dogubayazit  
 towards Kars, alt. 1100 m.  
 No. 141. *Secale cereale*  
 21337; 217 km. n. w. of Dogubayazit,  
 alt. 1220 m.  
 No. 142. *Ae. triuncialis*  
 ↗ 143. *Ae. cylindrica*  
 ↗ 144 B. *Secale cereale*
- Aug. 6. 21452; 38 km. s.w. of Kars, alt.  
 1800 m. Wheat field.  
 No. 145. *Triticum* sp. Selected  
 spikes presumed to be  
*T. carthlicum* because of  
 awned glumes.  
 ↗ 146. *T. aestivum*  
 ↗ 147 B. *T. aestivum* and/or  
*T. carthlicum*  
 21506; 92 km. s.w. of Kars, alt.  
 1520 m. Rye field.  
 No. 148. *Secal cereale*  
 21523; 109 km. s.w. of Kars, alt.  
 1480 m. Rye field.  
 No. 149. *Secale cereale*  
 21568; 154 km. s.w. of Kars, alt.  
 1600m. Field of mixed *T.*  
*compactum*, *T. aestivum* and  
 rye.  
 No. 150. *T. compactum* var.  
*Sivas*  
 ↗ 151. *T. aestivum* var. *Delphi*  
 (Kirik).  
 ↗ 152. *Secale cereale*  
 21588; 174 km. s.w. of Kars, alt.  
 1600 m. Field of *T. aestivum*.  
 No. 153. *Secale cereale*  
 Aug. 7. 21666; University Farm, Erzurum,  
 alt. Roadside.  
 No. 154. *Secale* sp.  
 21715; 30 km. n. of Erzurum to-  
 wards Tortum; alt. 1800 m.  
 Entrance to Yesildere village  
 on highway to Tortum.  
 No. 155 B. *T. aestivum* and  
 possibly *T. carthlicum*.  
 Too green to germi-  
 nate. Dr. DEVECIOGLU  
 will identify and  
 request mature spikes  
 from Ataturk Univer-

- sity about the end of Sept.
- 21718; 28 km. n. of Erzurum, alt. 1760 m. Field of cultivated rye.
- No. 156. *Secale cereale*
- Numerous observations during Aug. 5-7 at the higher elevations south of Kars, between Kars and Erzurum and north of Erzurum (30 km.) showed no *Aegilops*. This cannot be attributed to the earliness of the season since *Bromus* species were mature and *Agropyron* species were well headed. Cultivated wheats were in the dough stage mostly. In a few instances wheat kernels were not developed to full size. *Aegilops* species do not seem to occur in this area. For this reason the search for *Ae. squarrosa* in eastern Turkey will be discontinued.
- Occasional spikes resembling *T. carihlicum* were found in fields of *T. aestivum* in several locations. The identity of these will be verified.
- Aug. 8. 21774; 26 km. w. of Erzurum, alt. 1630 m. Field of *T. compactum*.
- No. 157. *T. compactum* var. *pseudo-rubriceps*
- ↗ 158 B. *S. cereale*
- 21876; 78 km. w. of Erzurum, alt. 1540 m.
- No. 159. (Unidentified.)
- 21863; 115 km. s.w. of Erzurum, alt. 1300 m. Rye field.
- No. 160. *Secale cereale*
- 21886; 138 km. s.w. of Erzurum, alt. 1250 m. Rocky roadside.
- No. 161. *Ae. triuncialis*
- ↗ 162. *Ae. ovata*
- ↗ 163. *Ae. triaristata*
- 21902; 154 km. s. w. of Erzurum, alt. 1200 m. Rocky roadside.
- No. 164. *Ae. speltoides (typica)*
- ↗ 165. *Ae. ligustica*
- ↗ 166. *Ae. umbellulata*
- ↗ 167. *T. boeoticum*
- Ae. triuncialis* observed but not collected.
- 21919; 171 km. s.w. of Erzurum towards Elazig, alt. 1700 m. Uncultivated area.
- No. 168. *Hordeum bulbosum*
- 21936; 186 km. s.w. of Erzurum, alt. 1300 m. Roadside adjacent to field of *T. compactum*.
- No. 169. *Ae. cylindrica*
- ↗ 170 B. *Secale cereale*
- 21983; 235 km. s.w. of Erzurum, alt. 990 m.
- No. 171. *Ae. triuncialis*
- ↗ 172. *Ae. cylindrica*
- 22017; 243 km. s.w. of Erzurum, alt. 920 m.
- No. 173. *Ae. speltoides*
- ↗ 174. *Ae. ovata*
- ↗ 175. *Ae. triuncialis*
- 22030; 266 km. s.w. of Erzurum.
- No. 176. *Ae. ligustica*
- ↗ 177. *T. boeoticum*
- ↗ 178. *Ae. ligustica*
- These species were intermixed with *Ae. speltoides* along the road adjacent to fields of wheat and maize.
- 22077; 303 km. s. w. of Erzurum, near Elazig, alt. 1000 m.
- No. 179. *Ae. speltoides*
- ↗ 180-1. *Ae. triuncialis*
- ↗ 180-2. *Ae. triaristata*
- ↗ 180-3. *Ae. ovata*

- Aug. 9. 22227; 22 km. n. of Malatya, alt. 710 m.  
No. 181. *Ae. triuncialis*
- Aug. 10. 22323; 29 km. s. of Malatya towards Akday Pass, alt. 1030 m. Roadside adjacent to harvested fields.  
No. 182. *Ae. triuncialis*  
 ✧ 183. *Ae. speltoides*  
 ✧ 184. *Ae. ligustica*  
 ✧ 185. *T. boeoticum*  
 ✧ 186. *T. boeoticum* (one plant with a normal and a zig-zag spike.)
- Note the presence of the *ligustica* type with *Ae. speltoides* and *T. boeoticum*. Note also the unusual morph. type of spike in No. 186 as in *Ae. ligustica*.
- No. 187. *Ae. speltoides* (a type intermediate between *ligustica* and *speltoides*.)  
 ✧ 188. *T. boeoticum*  
 ✧ 189. *T. boeoticum* (mass collection of seed for electrophoresis.)
- 22326; 32 km. s. of Malatya, alt. 1010 m. Roadside.  
No. 190. *T. boeoticum* (black spike—a single plant collection.)
- 22399; 24 km. n. of Malatya towards Arapkir, alt. 735 m.  
No. 191. *Ae. triuncialis*.
- 22408; 33 km. n. of Malatya towards Arapkir, alt. 820 m.  
No. 192. *Ae. speltoides*  
 ✧ 193. *Ae. caudata*  
 ✧ 194. *Ae. ligustica*  
 ✧ 195. *Ae. cylindrica*
- 22411; 36 km. n. of Malatya towards Arapkir, alt. 820m. Large area of *Ae. speltoides* near cultivated fields. No *T. boeoticum* observed.
- No. 196. *Ae. speltoides*  
 ✧ 197. *Ae. ligustica*  
 22414; 39 km. n. of Malatya towards Arapkir, alt. 800 m.  
No. 198. *Ae. mutica*  
 ✧ 199. *Dianthus* sp.
- Aug. 11; 22522; 55 km. w. of Malatya, alt. 1700 m. Roadside near wheat field.  
No. 200. *Ae. triuncialis*  
 ✧ 201. *Secale cereale*  
 22672; 205 km. w. of Malatya, alt. 1790 m. Roadside near rye field.  
No. 202. *Secale* sp. (volunteering or wild along roadside.)  
 ✧ 203. *Secale cereale* (cultivated.)  
 22752; 285k m. w. of Malatya, alt. 1450 m. Rye field.  
No. 204. *Secale cereale*
- Aug. 12. 23032; 16 km. s. e. of Kirsehir, alt. 1120 m. Roadside near harvested field.  
No. 205. *Ae. triuncialis*  
 23057; 4 km. n. w. of Kirsehir, alt. 1020 m. Uncultivated roadside.  
No. 206. *Ae. biuncialis*  
 ✧ 207. *Ae. umbellulata*  
 ✧ 208-1. *Ae. columnaris*  
 ✧ 208-2. *Ae. triuncialis*  
 23082; 29 km. n.w. of Kirsehir, alt. 1190 m. Field of mixed wheat and rye.  
No. 209. *Secale cereale*  
 23102; 49 km. n. w. of Kirsehir, alt. 1080 m. Roadside near cultivated fields.

- No. 210. *T. boeoticum*  
23122; 69 km. n. w. of Kirsehir,  
alt. 960 m. Roadside near  
cultivated fields.
- No. 211. *T. boeoticum* (select-  
ed for black hulls)  
◇ 212. *Ae. triuncialis*  
◇ 213. *Ae. biuncialis*  
23173; 120 km. n. w. of Kirsehir,  
alt. 1200 m. Roadside near  
cultivated fields.
- No. 214. *Ae. cylindrica*  
◇ 215. *Ae. cylindrica*  
◇ 216. *Ae. mutica*  
◇ 217. *Dianthus* sp.  
◇ 218. *Ae. triuncialis*  
◇ 219. — a species  
of crucifer.
- 23180; 127 km. n. w. of Kirsehir,  
alt. 1200 m.  
No. 220. *Ae. triuncialis*  
◇ 221. ◇ ◇  
◇ 222. *Ae. cylindrica*
- 23212; 160 km. n. w. of Kirsehir,  
alt. 1600 m.  
No. 223. *B. Secale* sp.
- Aug. 13. 23361; 94 km. n. of Ankara, 1 km.  
n. of intersection of Candir  
road. This is the location of  
ZOHARY'S collection of *Ae.*  
*mutica*, alt. 920 m.  
No. 224. *Ae. triuncialis*  
◇ 225. ◇ ◇ (pubescent)
- 23372; 83 km. n. of Ankara, alt.  
830 m.  
No. 226. *Agropyron* sp.
- Aug. 14. 23486; 10 km. s. w. of Ankara to-  
wards Afyon; alt. 800 m.  
Weedy roadside.  
No. 227. *Ae. cylindrica*  
23536; 60 km. s. w. of Ankara, alt.  
780 m.  
No. 228. *Dianthus* sp.  
23599; 123 km. s. w. of Ankara, alt.  
No. 229. *Ae. triuncialis*  
◇ 230. *Ae. umbellulata*  
23684; 208 km. s. w. of Ankara,  
alt. 980 m.  
No. 231. *Ae. columnaris*  
◇ 232. *Ae. biuncialis*  
23708; 232 km. s. w. of Ankara,  
alt. 1100 m. Volunteering  
plants along roadside at a  
distance from cultivated fields.  
No. 233. *Triticum* sp.  
◇ 234. *Brassica* sp.
- Aug. 14. 23774; 34 km. s. w. of Afyon to-  
wards Dinar, alt. 1200 m.  
No. 235. *Ae. columnaris*  
23865; 125 km. s. w. of Afyon, alt.  
1000 m. Roadside.  
No. 236. *T. boeoticum*  
◇ 237. *Ae. columnaris*
- Aug. 15. 24042; 26 km. n. w. of Denizli to-  
wards Sarayköy, alt. 150 m.  
No. 238. *Ae. triuncialis*  
24044; 28 km. n. w. of Denizli,  
alt. 150 m.  
No. 239. *Ae. triuncialis*  
◇ 240. *Ae. biuncialis*  
◇ 241. *Ae. ovata*

Summary of collections classified according to species

Species	Collection Nos.
<i>Aegilops biuncialis</i> VIS.	2, 4, 29-2, 39, 45, 206, 213, 232, 240
<i>Aegilops caudata</i> L.	48, 193
<i>Aegilops columnaris</i> ZHUK.	208-1, 231, 235, 237
<i>Aegilops cylindrica</i> HOST.	91, 93, 133, 136, 139, 143, 169, 172, 195, 214, 215, 222, 227
<i>Aegilops ligustica</i> COSS.	60, 62, 67, 68, 71, 74, 165, 176, 178, 184, 194, 197
<i>Aegilops mutica</i> BOISS.	6, 31, 32, 198, 216
<i>Aegilops ovata</i> L.	5, 28, 38, 41, 44, 52, 53, 57, 84-2, 162, 174, 180-3, 241
<i>Aegilops speltoides</i> TAUSCH.	34, 35, 36, 42, 46, 47, 59, 64, 79, 82, 87, 164, 173, 179, 183, 187, 192, 196
<i>Aegilops triaristata</i> WILLD.	43, 69, 78, 81, 84-1, 89, 106, 163, 180-2
<i>Aegilops triuncialis</i> L.	7, 9, 21, 22, 23, 29-1, 30, 37, 49, 50, 51, 54, 55, 56, 58, 65, 70, 72, 77, 80, 83, 88, 92, 104, 105, 118, 126, 127, 142, 161, 171, 175, 180-1, 181, 182, 191, 200, 205, 208-2, 211, 218, 220, 221, 224, 225, 229, 238, 239
<i>Aegilops umbellulata</i> ZHUK.	166, 207, 230
<i>Triticum aestivum</i> L.	13, 63, 75, 85, 100, 101, 110, 111 B, 113, 114, 115, 125 B, 129 B, 137 B, 146, 147 B, 151, 155 B
<i>Triticum boeoticum</i> BOISS.	8, 73, 167, 177, 185, 186, 188, 189, 190, 210, 211, 236
<i>Triticum carthlicum</i> NEVSKI.	137 B, 145, 147 B, 155 B
<i>Triticum compactum</i> HOST.	12, 14, 17, 18, 103, 129 B, 150, 157
<i>Triticum durum</i> DESF.	16 B, 43-5, 61, 66, 76, 86
<i>Triticum</i> sp.	233
<i>Secale cereale</i> L.	1, 15, 27 B, 116 B, 117 B, 120, 121 B, 122 B, 123 B, 124 B, 130, 134 B, 141, 144 B, 148, 149, 152, 153, 156, 158 B, 160, 170 B, 201, 203, 204, 209, 223 B
<i>Secale</i> sp.	19, 20 B, 33, 90, 94, 95, 96, 98, 99, 102, 107, 108, 109, 112 B, 128 B, 131, 132, 135, 138, 140, 154, 202
<i>Agropyron</i> sp.	24, 25, 226
<i>Hordeum bulbosum</i>	10, 168
<i>Hordeum murinum</i>	119
<i>Dianthus</i> sp.	3, 26, 40, 97, 199, 217, 228
Unidentified	11, 159, 219, 234

(Received Dec. 20, 1967)

### III. News

#### 1. Third International Wheat Genetics Symposium

##### The International Organising Committee:

Chairman: Professor J. MAC KEY (Sweden)  
Secretary: Dr. K. W. FINLAY (Australia)  
Dr. D. R. Knott (Canada) Dr. A. T. PUGSLEY (Australia)  
Dr. R. RILEY (Great Britain) Dr. M. S. SWAMINATHAN (India)

##### Programme

The programme will be concerned with the following sections of wheat genetics and breeding :

Evolution and taxonomy	Cytogenetic structure	Aneuploidy
Incorporation of alien genetic material	Mutation	Disease resistance
Recent developments in breeding methods	Biochemical and physiological genetics	
Miscellaneous.		

The local Programme Committee intends to depart from the format of previous symposia and provide an opportunity for a larger number of contributed papers to be presented at the 1968 meeting. Therefore, in addition to invited papers and addresses, it is planned to include contributed papers in most sections.

Details of the final programme will be circulated to members completing the enclosed form.

##### Symposium language

English will be used as symposium language for both presentation and discussion of papers and final publication of the proceedings.

##### Publication

The local Organising Committee intends to supply stencilled copies of the papers prior to the symposium. A volume of proceedings will be published after the symposium. All authors accepted as contributors to the symposium will be required to submit their full paper not later than 1 May, 1968. The Programme Committee reserves the right to exclude papers not received by this date.

##### Registration for the symposium

The registration fee for the symposium will be:

Full membership.....	\$A 20
Associate membership .....	\$A 5

(\$Aust. 1.00 = approximately \$U.S. 1.12)



Full membership entitles the participant to attend the symposium, to receive the symposium literature and to take part in social events.  
Associate membership covers attendance at receptions and ladies' programme.

### Accommodation

Single accommodation has been arranged in Bruce Hall, a modern residential college of the Australian National University.

Cost- \$A 7.50 per day (including meals).

Family accommodation will be available in nearby hotels.

Cost- From \$A 8.00 per day for a double room (meals excluded).

### Tours

The local Organising Committee is planning pre-and post-symposium tours. The pre-symposium tour will enable overseas visitors to see some of the wheat research and agriculture in south-eastern Australia and also to enjoy the vegetation, wild life and scenery of this region. It is planned to commence the pre-symposium tour at Adelaide on Tuesday 30, July. It is suggested that visitors entering Australia from Europe, the near East and South-East Asia should try to arrange their flights to enter via Perth if they wish to visit the western part of Australia before proceeding to Adelaide.

The post-symposium tour will commence from Sydney and include areas of agricultural interest in the eastern regions of Australia. The tour will terminate in Brisbane on 15 August. Connecting flights are available from Brisbane to Tokyo for those proceeding to the XII International Congress of Genetics.

Approximate cost of tours per person :

6 day pre-symposium tour.....	\$A 82 (plus meals)
4 day post-symposium tour.....	\$A 56 (plus meals)

### Clothing

Overseas visitors are advised that the weather in Canberra in early August can be very cool (mean maximum 13°C, mean minimum 1°C) due to the close proximity of the Australian Alps. Suitable winter clothing should be included in your luggage.

### Social functions

Several social functions are being arranged to provide an opportunity for members to get to know each other.

### Venue of meetings

All meetings will take place in the Australian Academy of Science Building in Canberra. This building, of modern architectural design, provides first class lecture accommodation and other facilities close to the residential accommodation at Bruce Hall.

## Travel arrangements

A travel agent will be available throughout the period of the symposium for the convenience of members.

## 2. The Death of Dr. S. MATSUMURA

It is really regrettable to report that Dr. Seiji MATSUMURA, Head of the Department of Induced Mutation, the National Institute of Genetics, Misima, Japan, passed away due to leukemia on 19 February, 1967. He made considerable contributions to WIS as one of the Members of the Coordinating Committee. His death means certainly a serious loss to the world of science. (K. Y.)

## IV. Editorial Remarks

### Announcement for future issues

WIS No. 26 will be ready for publication in March, 1968. Manuscripts for the issue are accepted any time, and they will go to press as soon as they cover planned pages.

WIS is open to all contributions regarding methods, materials and stocks, ideas and research results related to genetics and cytology of *Triticum*, *Aegilops*, *Agropyron*, *Secale*, *Haynaldia* and related genera. Contributions should be typewritten in English. The manuscripts should not exceed three printed pages. Lists of stocks are exempted from this page limit. One text-figure (smaller than 7×7 cm<sup>2</sup>) will be accepted for each article, if indispensable.

Communication regarding editorial matters should be addressed to:

K. YAMASHITA

Wheat Information Service  
Biological Laboratory  
Yoshida College, Kyoto University  
Kyoto, Japan

### Acknowledgement

The cost of the present publication has been defrayed partly by the Grant in Aid for Publishing Research Results from the Ministry of Education, Government of Japan, and partly by contributions from the Flour Millers Association, Tokyo, Japan. We wish to express our sincere thanks to those organizations. We should also like to express our sincere gratitude for favorable comments regarding WIS Nos. 1-24, and valuable contributions for the present numbers. Increased support for future issues would be appreciated.

*The Managing Editor*

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YAMASHITA, K., <i>Managing Editor</i>	

#### Explanation of the figure on the cover

Armenian carving from a modern building in Erevan, Armenia, U.S.S.R.

(K.Y. 1966)