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I. Research Notes

Genomic constitution of *Triticum ispahanicum* HESLOT

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Triticum ispahanicum, a tetraploid species of wheat was first described by HESLOT (1958, WIS Nos. 9-10, 1959), and was considered to be having the genomic constitution AABB. The meiotic behaviour of the hybrids involving *ispahanicum* with other tetraploid species was studied to provide the cytological evidence. One species each, from the free and non-free threshing groups, *T. orientale* and *T. dicoccoides,* respectively, were crossed with *T. ispahanicum.* The meiotic pairing at the first meiotic division was studied in the F_1 hybrids as well as in *ispahanicum.* Regular fourteen bivalents, with occasional two univalents and twelve bivalents (in two cells out of 50 studied), were observed at the first meiotic metaphase in *T. ispahanicum,* showing a regular meiotic behaviour.

Although the hybrid *dicoccoides* × *ispahanicum* shows a higher frequency of univalents per cell, than the hybrid *orientale* × *ispahanicum,* the majority of the cells studied in both the hybrids show fourteen bivalents. It is concluded from the above results that the genomic formula of *T. ispahanicum* is AABB and that it belongs to the Emmer group.

In the hybrid *dicoccoides* × *ispahanicum,* it was observed that the PMC's which were at late diakinesis or early metaphase stages had fourteen bivalents, whereas the advanced metaphase stages showed increased number of univalents. The possibility could be, that the genomes of *dicoccoides* and *ispahanicum,* in the hybrid, interact to initiate an early or precocious separation of bivalents which results in increased number of univalents at the metaphase (Table 1).

The karyotype of *T. ispahanicum* was also studied following the schedule of UPADHYA (1963, Stain Technol., 38: 293-295). The karyotype showed to be having typical two

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Table 1. Meiotic data of the hybrids

Types of chromosome associations	Frequency
1. *T. dicoccoides* x *ispahanicum*	
14_{II}	42
$13_{II} + 2_{I}$	6
$12_{II} + 4_{I}$	8
$11_{II} + 6_{I}$	13
$10_{II} + 8_{I}$	6
$9_{II} + 10_{I}$	4
$8_{II} + 12_{I}$	3
$7_{II} + 14_{I}$	3
$6_{II} + 16_{I}$	1
$5_{II} + 18_{I}$	1
$3_{II} + 22_{I}$	1
	Total 88
2. *T. orientale* x *ispahanicum*	
14_{II}	56
$13_{II} + 2_{I}$	10
$11_{II} + 6_{I}$	1
$1_{IV} + 12_{II}$	8
	Total 75

pairs of sub-medianly constricted chromosomes bearing large satellites on their short arms. The rest of the twelve pairs of chromosomes had either median or sub-median centromeres.

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On the ancestry of the *Triticum vulgare* varieties Gabo and Timstein

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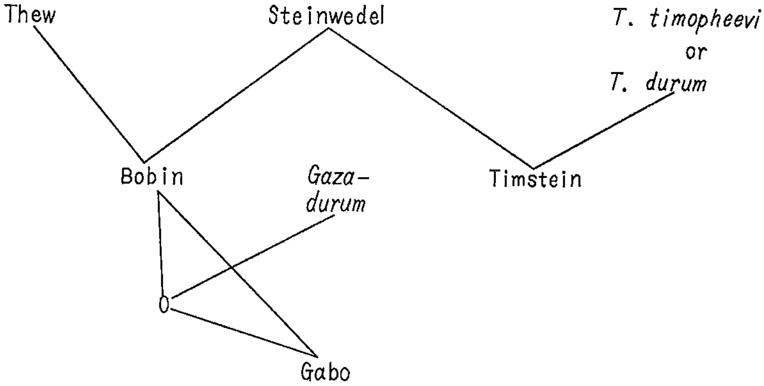
WATSON and STEWART (1956) and KNOTT and ANDERSON (1956) concluded from the similarity in their reaction of stem and leaf rust resistance of the *T. vulgare* varieties

Gabo and Timstein and the *T. durum* Gaza, that Timstein may be of the same parentage: (Bobin × Gaza) × Bobin (Watson and Waterhouse, 1949). So Timstein would not derive from *T. timopheevi* × Steinwedel, as is suggested by Pridham (1939). However, this conclusion appears to be premature because the investigations did not include Steinwedel. This should have been done as Steinwedel is one of the parents of Bobin (see Fig. 1).

Figure 1. The parentage of Bobin, Gabo and Steinwedel



Obviously the only conclusion was that the breeder of Timstein was in the belief that he used a plant of *T. timopheevi*, but actually used a plant of *T. durum*.

It would be of interest to check whether the genotypes for hybrid necrosis and hybrid dwarfness ("grass clump") could enable us to draw a more precise conclusion. Hermsen (1963 a, 1966) investigated these two types of hybrid weakness and found that Bobin, Gabo and Timstein carry the same genes $Ne_1^w ne_2 d_2 D_3$ (see Table 1).

Hermsen (1963 b) showed that Bobin got its Ne_1^w-gene from Steinwedel. Furthermore, Steinwedel's genotype for dwarfness must be identical to that of Bobin because Thew carries the genes $D_2 d_3$ (McMillan, 1936). So Timstein could have derived its $Ne_1^w ne_2 d_2 D_3$-genes from Steinwedel.

It is very likely that Bobin is the Ne_1^w-parent of Gabo as all the *T. durum* varieties and selections found to carry an Ne_1-gene, carry the Ne_1^s-allele (Hermsen, 1963 a; Zeven, 1965), also *T. durum* Gaza W 277 (Zeven, in press), which, originally coming from Giza, Egypt, was introduced into Australia and coded there Gaza W 277, and from there into USA as PI 189262.

The genotype for hybrid necrosis of only one *T. timopheevi*-derivative, CI 12633 has so far been determined viz $ne_1 ne_2$ (Zeven, in the press).

The genotype for hybrid chlorosis is not of any help in solving this problem as almost all *T. vulgare*-varieties have the same genotype $Ch_1 ch_2$ (Hermsen, in the press) and as the Ch_2-gene is located on chromosome 3 D (Tsunewaki and Kihara, 1961) it

Table 1. The genotypes for hybrid necrosis and hybrid dwarfness of one *T. durum*-variety and some *T. vulgare*-varieties

Variety	Haploid genotype and source			
	hybrid necrosis	source*	hybrid dwarfness	source*
Gaza-*durum*-W 277, PI 189262	$Ne_1^s ne_2$	1, 6	—	
Bobin	$Ne_1^w ne_2$	1	$D_1 d_2 D_3$	3
CI 12633	$ne_1 ne_2$	6	—	
Gabo	$Ne_1^w ne_2$	1	$D_1 d_2 D_3$	3
Steinwedel	$Ne_1^w ne_2$	2	$D_1 d_2 D_3$	5
Thew	$ne_1 ne_2$	2	$d_1 D_2 D_3$	4
Timstein	$Ne_1^w ne_2$	1	$D_1 d_2 D_3$	3

* Source: 1 HERMSEN, 1963a 2 HERMSEN, 1963b 3 HERMSEN, 1966
4 McMILLAN, 1936; quoted by HERMSEN, 1963 b 5 ZEVEN, this article 6 ZEVEN, in the press

(The D_1-gene is included although it is located on chromosome 2 D (HERMSEN, 1963 c) and therefore cannot derive from a tetraploid *Triticum* species).

cannot be used to distinguish in *T. vulgare*-wheats, *timopheevi*-characters from *durum*-characters.

Summarizing, the genotypes for hybrid necrosis, hybrid chlorosis and hybrid dwarfness of the varieties Bobin, CI 12633, Gabo, Steinwedel and Timstein cannot serve to identify the tetraploid parents of Timstein and so the conclusion of WATSON and STEWART, and KNOTT and ANDERSON that *T. durum* is one of the parents of Timstein might be correct. But it is certainly premature to say that Bobin in stead of Steinwedel is the *T. vulgare*-parent of this variety.

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A dominant short straw mutation induced by thermal neutrons in *durum* wheat.[1]

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Among several short straw mutants isolated in the cv. Cappelli (Scarascia-Mugnozza, 1965) a thermal neutron ($8.38 \times 10^{12}/cm^2$) induced mutant line (Cp B 132) demonstrated a good yielding ability, a better utilization of nitrogen manuring and an improved lodging resistance (Scarascia-Mugnozza *et al.*, 1965; Cavazza *et al.*, 1967).

Genetic analysis of this mutation showed that when the mutant line is crossed to the mother line Cappelli, the F_2 shows a distribution of heights indicating a monofactorial dominant behaviour of the mutation. In Table 1, the height distribution of parents, of F_1 individuals and F_2 progeny, is presented. Chi square analysis of segregation (173 tall; 48 short) gave a value of 1.27, corresponding to a P value between 25 and 30% for a 3:1 hypothesis.

Further genetic analysis will confirm such a behaviour, but preliminary data obtained

Table 1. Plant height distribution of parent lines, F_1 individuals and F_2 progeny in the cross Cp B 132 × Cappelli

Variety and crosses	Height classes (cm).																Number of plants analyzed
	60 ~ 65	66 ~ 70	71 ~ 75	76 ~ 80	81 ~ 85	86 ~ 90	91 ~ 95	96 ~ 100	101 ~ 105	106 ~ 110	111 ~ 115	116 ~ 120	121 ~ 125	126 ~ 130	131 ~ 135	135 ~ 140	
Cappelli									2	6	23	46	30	15	6	1	129
Cp B 132	11	26	42	44	8	3											134
F_1 (Cappelli × Cp B 132)				7	13	15	5										40
F_2 (Cappelli × Cp B 132)		12	26	48	44	33	10	0	7	9	11	13	5	3			221

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from crosses of the mutation to several other *durum* lines and varieties, seem to confirm its dominant and monofactorial condition.

As far as we are aware, this is the first case of a dominant mutation strongly reducing plant height (to about 80∼85 % of control) in *Triticum durum* which keeps a normal viability and good agronomic characteristics.

The dominant behaviour of the mutation, if confirmed, will allow its easy transfer to other lines by backcross procedures and may find utilization in hybrid wheat production.

(Received Feb. 7, 1967)

Additional cytoplasmic male sterility-fertility restoration systems in *Triticum*[1]

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Cytoplasmic male sterility in wheat has been obtained by substituting the *Triticum* nucleus into the cytoplasm of *Aegilops caudata* (KIHARA, 1951), *Ae. ovata* (FUKASAWA, 1953) and *T. timopheevi* (WILSON and ROSS, 1962). Also, the *T. durum* nucleus substituted into *T. timopheevi* cytoplasm gives male sterile plants (present authors, unpublished).

This paper reports two additional cytoplasmic male sterility-fertility restorer systems in *Triticum*. When the nucleus of the common wheat variety Justin was substituted into *T. zhukovskyi* cytoplasm, male sterile plants were produced. The *T. durum* nucleus substituted into a diploid wheat cytoplasm ($2n=14$, genome AA) produced male sterile $2n=28$ chromosome plants. Fertility restoration factor(s) for these two sources of male sterility are believed to have been recovered during the substitution backcrossing.

The diploid wheat used in these studies was a *T. boeoticum*-type of an unknown origin. One plant of this diploid was found in an F_2 population from the cross ms^t-Selkirk^2 × Chinese Spring mono-iso-7 D. This F_2 population was grown from the seed set on a male fertile F_1 plant with $20^{II}+iso+1^{I}$. This diploid plant and its progeny were morphologically distinguishable from *T. monococcum* and *T. boeoticum*.

This study was initiated to test the possible cytoplasmic effects of the *T. durum* nucleus substituted into the cytoplasm of this "derived diploid" and other diploid species of *Triticum*. A more detailed account of these investigations will be published elsewhere.

Observations

Chromosome Pairing : *T. zhukovskyi* ($2n=42$) has the genome constitution of AAAAGG

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(BOWDEN, 1959). The metaphase-1 chromosome pairing in the PMC of the F_1 hybrids of *T. aestivum* varieties "Justin" and "Chris" with *T. zhukovskyi* and the amphidiploid (*T. timopheevi* × *Aegilops squarrosa*)^2, respectively, is given in Table 1. In the F_1 hybrid

Table 1. Metaphase-1 chromosome pairing in the pollen mother cells of the F_1 hybrids

Cross	No. PMC studied	Average number per PMC	
		Bivalents	Univalents
T. zhukovskyi × *T. aestivum* "Justin"	30	16.3*	9.4
T. aestivum "Chris" × amphidiploid (*T. timopheevi* × *Ae. squarrosa*)^2	20	18.5*	4.9
amphidiploid (*T. timopheevi* × *T. durum*)^2 × *T. aestivum* "Justin"	20	21.7*	5.6
T. aestivum "Justin" × *T. boeoticum*-type	25	5.0**	18.0
T. durum × *T. boeoticum*-type	12	4.3**	12.4
T. boeoticum-type × *T. durum*	12	6.0**	9.0
T. monococcum × *T. dicoccum* v. Vernal	10	5.6**	9.8
T. monococcum × *T. durum* v. Mindum	10	5.8**	9.4
T. boeoticum-type × *T. monococcum*	50	7.0	0.0
T. boeoticum × *T. boeoticum*-type	50	7.0	0.0

* Including trivalents, tetravalents and other complex chromosome associations.
** Including chromosomes involved in a trivalent in a few of the PMC.

(AAAGBD) with *T. zhukovskyi* an average of 9.4 univalents per PMC was observed, and the remaining chromosome formed bivalents and other complex associations including $1-2^{III}$ and $1-2^{IV}$ per cell. The F_1 hybrid (AABGDD) from the cross with the amphidiploid had an average of 4.9 univalents, and a few PMC with no univalent chromosomes were observed. Also in this hybrid $1-2^{III}$ and 1^{IV} per PMC were common. The F_1 hybrid (AAABBGD) from a cross between an amphidiploid (*T. timopheevi* × *T. durum*)^2 and *T. aestivum* variety "Justin" had an average of 5.6 univalents and several trivalents per cell. Therefore, in these hybrids the majority of the B, G and D genome chromosomes were paired or otherwise associated with other chromosomes in most of the PMC.

The chromosome pairing in the F_1 hybrids from crosses of the *T. boeoticum*-type with *T. durum*, *T. aestivum* and *T. monococcum*, etc., is given in Table 1.

The *T. zhukovskyi*, *T. timopheevi*, and the amphidiploids (*T. timopheevi* × *Ae. squarrosa*)^2 and (*T. timopheevi* × *T. durum*)^2 used in this study were obtained from Dr. B. C. JENKINS, Department of Plant Science, University of Manitoba, Winnipeg, Canada.

T. zhukovskyi × *T. aestivum*: Among the 17 plants grown from the second backcross, *T. zhukovskyi* × *T. aestivum* variety "Justin^3", one plant (Pl. No. 1965C–4–150) was partially male fertile and set a few seeds on a bagged head. The remaining 16 sibs were completely male sterile. Of the four plants that grew to maturity from the selfed seed (produced on Pl. No. 1965 C−4−150), two plants with $20^{II}+1^{I}$ or $19^{II}+3^{I}$ produced anthers with good pollen. Of the other two plants, one was partially fertile and the other male sterile. One male sterile plant (ms^{z}−Justin^{3}−Pl. No. 1965C−4−154−1) was crossed with pollen from Justin, and the eight ms^{z}−Justin^{4} plants were completely male sterile. These included two with $2n=42$ (21^{II}) and six with $2n=41$ ($20^{II}+1^{I}$ or other configurations). The presence of hairs on leaves of the two fertile second backcross F_2 plants and the purple color anthers on one of them indicated the presence of chromosome (s) or chromosome segment (s) from *T. zhukovskyi* in these plants.

T. boeoticum-type × *T. durum*: The *T. boeoticum*-type diploid wheat ($2n=14$) was reciprocally crossed with *T. durum*. The F_1 hybrids from crosses with the diploid as female grew slower and headed later than those from the reciprocal cross. The diploid wheat had dark brown awns and glumes, and the *T. durum* had normal glume and awn color (white). The F_1 plants had dark black glumes and awns at maturity. All the F_1 plants were highly male and female sterile. However, eight seeds were obtained from the cross, (*T. boeoticum*-type × *T. durum*) F_1 × *T. durum*, and six of them produced mature plants. Four of these plants had $2n=29$ chromosomes, one had $2n=27$ and one was not studied cytologically. The latter two plants had complete male and female sterility, thin grassy leaves and straw, small narrow heads and bushy stunted growth. The chromosome pairing, fertility and vigor of these six plants are described in Table 2. Only one plant (No. 3095) produced functional pollen and set seed on bagged heads. All other plants had minute anthers with nonstaining (I_2KI_2) empty pollen.

Table 2. Chromosome pairing and fertility of the first backcross plants from the cross: (*T. boeoticum*-type × *T. durum*) F_1 × *T. durum*

1965 Pl. No.	Chromosome pairing	Fertility		Vigor	
		Male	Female	Seedling	Maturity
3083	$14^{II}+1^{I}$; $13^{II}+3^{I}$; $12^{II}+5^{I}$	0	good	weak	below normal
3085	$13^{II}+3^{I}$; $12^{II}+1^{III}+2^{I}$; $14^{II}+1^{I}$	0	good	weak	below normal
3086	not studied	0	0	very weak	stunted, bushy
3087	$14^{II}+1^{I}$, most common	0	good	weak	below normal
3095	$14^{II}+1^{I}$, 80 % PMC	PF*	good	normal	average
3096	$12^{II}+3^{I}$, $11^{II}+5^{I}$	0	0	very weak	stunted, bushy

* Partially fertile with about 50 % pollen stained dark with I_2KI_2 solution.

Second Backcross: From the cross of plants 3083 and 3087 with *T. durum* pollen, 30 seeds were germinated and grown to maturity in the greenhouse during the summer, 1966.

In general, the seedlings were weak but all survived to maturity. All plants from these crosses were completely male sterile. The anthers were extremely small in size and were dry when the florets opened. Two of these 30 plants had $2n=29$ ($14^{II}+1^{I}$) chromosomes. The remaining 28 plants had normal chromosome pairing ($2n=28$, 14^{II}). Obviously the transmission of the extra chromosome was low.

Male Fertility Restoration: That the genome A of the diploid wheat has a male fertility restoring chromosome (s) is indicated by the partial male fertility of the trisomic plant No. 3095 (Table 2) and by the segregation for male fertility restoration factor (s) in the progeny from a cross (ms^{t}-Justin × *T. boeoticum*-type) F_1 × *T. aestivum* variety "Rescue". A partially male fertile 48 chromosome plant from this cross produced $2n=49$ to 46 chromosome plants. One of these with $2n=47$ ($21^{II}+1^{III}+2^{II}$, $18^{II}+1^{IV}+2^{III}+1^{I}$) was highly male fertile and gave good seed set on bagged heads. Others were either partially fertile or completely male sterile.

Conclusion: The authors concluded tentatively that substitution backcrossing of the common wheat variety "Justin" and *T. durum* into the cytoplasms of *T. zhukovskyi* and *T. boeoticum*-type diploid wheat, respectively, gives male sterile plants. Apparently male fertility restoring factors were present in some of the backcross plants. Reciprocal nuclear substitutions with *T. timopheevi* may be necessary to determine if the male sterility effects of these two cytoplasms are basically different from that of *T. timopheevi*. The occurance of a male sterility inducing cytoplasm at the three ploidy levels in *Triticum* may indicate that the cultivated tetraploid and hexaploid wheats were evolved after the migration of the A-genome to an alien cytoplasm of a genus (possibly *Aegilops speltoides*) that did not affect the male fertility of the new combinations.

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Negative evidence of the transmission of the cytoplasmic male sterility in wheat by embryo-endosperm grafting

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Investigations carried out by FRANKEL (1956, 1962) and Edwardson and Corbett (1961) in *Petunia*, which demonstrated the asexual transmission of cytoplasmic male sterility by grafting, as well as the negative results obtained by Sand (1960) working with *Nicotiana*, induced to the present author to test the possible asexual transmission of the cytoplasmic male sterility in wheat.

The material used (supplied by Dr. R. W. LIVERS, Hays, Kansas, U. S. A.) was as follows: line B (normal fertile) Bison wheat C. I. 12518; line A (cytoplasmic male sterile): *T. timopheevi* × Bison^{10}; line R (fertility restorer): (*T. timopheevi* × Marquis 3) × Bison F_4.

Table 1. Selfings

Plant	Number of ears selfed	Number of seeds obtained	Remarks
AB - 1	3	0	
AB - 2	3	0	
AB - 3	3	0	
AB - 4	2	0	
AA - 1	2	0	
BA - 1	2	27 + 31	
BA - 2	2	23 + 26	
BA - 3	2	25 + 31	
BA - 4	2	32 + 21	
BA - 6	1	22	
BA - 7	3	27+18+30	
BB - 1	2	42	Without bagging
BB - 2	2	46	

Plant AB: Embryo A on endosperm B
〃 AA: 〃 A 〃 〃 A
〃 BA: 〃 B 〃 〃 A
〃 BB: 〃 B 〃 〃 B

Investigation was made by grafting embryos of male sterile plants (A) on endosperms of fertile plants (B) and, reciprocally, B embryos on A endosperms. Selfings and crosses showed the following results:

Table 2. Crossings

a)

♀ ╲ ♂	BB-1		BB-2		R	
BA-1	20	16	20	12	20	19
BA-2	20	16	20	18	20	13
BA-3	20	19	20	18	20	18
BA-4	20	0	20	15	20	20
BA-6	20	15	20	20	20	17
BA-7	40	18	20	19	20	18
Total	140	84	120	102	120	105
	p.f.	s.o.	p.f.	s.o.	p.f.	s.o.

b)

♀ ╲ ♂	BB-1		BB-2		R	
AB-1	20	17	20	5	20	10
AB-2	20	9	20	10	20	18
AB-3	20	14	20	16	20	20
Total	60	40	60	31	60	48
	p.f.	s.o.	p.f.	s.o.	p.f.	s.o.

p.f.: Number of pollinated florets
s.o.: Number of seeds obtained

c)

♀ ╲ ♂	BB-1	BB-2	BA-1	BA-2	BA-3	BA-4	BA-7	R	
AA	20	20	20	20	20	20	20	20	pollinated florets
	11	19	18	20	16	20	20	8	seeds obtained

Results of Table 1 show that neither cytoplasmic male sterility nor fertility are asexually transmitted by embryo-endosperm grafting (plants BA and AB respectively). Tables 2 b and 2 c indicate that crossability of male sterile with maintainer lines is not modified by the graft.

Progeny obtained from the crossings indicated in Tables 2 a, 2 b and 2 c will be tested the next generation in order to verify whether or not the fertility restoring mechanism has been modified.

(Received June 29, 1966)

Simultaneous development of sets of monosomics, telocentrics and isosomics for use in intervarietal chromosome substitution in common wheat[1]

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The use of telocentric and isosomic stocks minimizes the risk of univalent shift during the backcrossing phase of intervarietal chromosome substitution (SEARS, 1953; PERSON, 1956). It also saves time and effort by eliminating the need for selfing after every backcross (UNRAU *et al.*, 1956). However, these stocks are available only in "Chinese Spring" wheat, and alternate selfing and backcrossing must be done when chromosome substitution is made into other varieties in which only monosomic sets are available.

In this paper we outline a procedure for the simultaneous development of monosomic, telosomic and isosomic sets in a recipient variety. The procedure minimizes the risk of univalent shift in developing monosomics, and at the same time transfers telocentrics and isochromosomes to the recipient variety for subsequent use in the intervarietal chromosome substitution.

The variety A can be crossed either as male or female with Chinese Spring telosomics or isosomics (MAAN and LUCKEN, 1966). The F_1 plants with an isochromosome or a telocentric ($2n=42$; 20^{II}+heteromorphic pair$=20^{II}+\mathrm{Het}^{II}$) can be crossed as female with pollen from variety A. After each backcross, plants with $2n=20^{II}+\mathrm{Het}^{II}$ can be selected by microscopic examination of the PMC at the first meiotic metaphase and crossed with pollen from variety A. When the desired number of backcrosses have been made, the plants with $2n=20^{II}+\mathrm{Het}^{II}$ are selfed, and individual plants of the progenies are examined for the number and pairing of chromosomes during meiosis. The plants with $2n=41$ ($20^{II}+1^{I}$ or 20^{II}+a telocentric or an isochromosome) are selected. If the monosomic is obtained first, the monotelosomic or mono-isosomic can be obtained from the cross of monosomic × a sister plant with $20^{II}+\mathrm{Het}^{II}$. If the monotelosomic or mono-isosomic is obtained first, the monosomic can be obtained from the cross of monotelosomic or mono-isosomic × variety A.

The frequency of monosomic and monotelosomic or mono-isosomic plants in the

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1) Contribution from the Department of Agronomy, North Dakota State University, Fargo, North Dakota, in cooperation with the Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture. Published with the approval of the Director, North Dakota Agricultural Experiment Station, as Journal Article No. 88.

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progeny of a plant with an isochromosome or a telocentric and its homologue ($2n=42$; $20^{II}+Het^{II}$) will be expected to vary for different chromosomes. This frequency will depend on the extent of asynapsis between the telocentric or isochromosome and its homologous chromosome during meiosis. The plants with an isochromosome ($2n=42$; $20^{II}+Het^{II}=20^{II}+iso+1^{I}$) would be expected to produce a higher proportion of monosomic plants than those with a telocentric ($2n=42$; $20^{II}+Het^{II}=20^{II}+telo+1^{I}$). The frequency of pairing with a homologue is higher for a telocentric than for an isochromosome, because the isochromosome often pairs with itself and the homologue remains unpaired. Also, the expected relative transmission rates of a univalent, telocentric and isochromosome through the male gametes would be as follows: univalent > telocentric > isochromosome. These considerations and the nonselective female transmission will explain the expected higher frequency of monosomics and mono-isosomics from plants with an isochromosome ($2n=42$; $20^{II}+Het^{II}=+iso+1^{I}$) than from plants with a telocentric ($2n=42$;$+Het^{II}=20^{II}+telo+1'$).

These monotelosomic or mono-isosomic stocks (in variety A) can be used as recurrent female parents in the substitution of individual chromosomes from variety B into the genetic background of the variety A. The use of these stocks will save time by avoiding the need for selfing after each backcross and will minimize the risk of univalent shift.

After the monosomic, telosomic and isosomic stocks have been developed in the recipient variety, these can be tested against the standard Chinese Spring stocks of telosomics and isosomics.

This procedure should prove useful for workers planning to initiate development of a monosomic set in a variety into which they later intend to substitute individual chromosomes from another variety.

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Cytology and fertility of hybrids between Mono V (5 B) Chinese Spring and *Secale cereale* L. and *Aegilops columnaris* ZHUK.

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In order to utilize the chromosome V (5 B) of *T. aestivum* as a mean to introduce into wheat the alien variation from its related species by meiotic recombination, crosses between a mono 5 B plant of Chinese Spring and rye ($2n=14$) and *Ae. columnaris* ZHUK. ($2n=28$) were made. Results are shown in Table 1.

Table 1

Crosses	Florets pollinated	Seeds obtained		Chromosome numbers of progeny
		Total	Viable	
Mono 5 B C. S. x *Secale cereale*	60	51	20	14 plants with $2n=27$ 2 〃 〃 $2n=28$ 1 〃 〃 $2n=29$ 3 〃 without control
Mono 5 B C. S. x *Ae. columnaris*	20	15	14	7 plants with $2n=34$ 7 〃 〃 $2n=35$

The chromosome numbers of the progenies indicate the different transmission rates of chromosome 5 B through the female gamete in both crosses: 17.6 % and 50 % in crosses involving *Secale cereale* and *Ae. columnaris* respectively.

According to meiotic observations, the plant with $2n=29$ chromosomes, found among the progeny of Mono 5 B Chinese Spring x rye, originated as a consequence of non-disjunction in a chromosome. Another cytological abnormality was found among the mono 5 B C. S. x *Ae. columnaris* progeny: a 35-chromosome hybrid had a very long chromosome in the somatic cells. Further meiotic observations showed the occurrence of inter-arm pairing, indicating that the long chromosome is an isochromosome.

Hybrid fertility was studied in normal conditions and after being treated with an 0.15 % aqueous colchicine solution during 48 or 72 hours using Bell's technique. Results are shown in Table 2. Percentages of fertility were calculated by considering each spikelet to have two florets.

Table 2.

Material	2n	Colchicine treatment	Plants observed	Ears		Total number of florets	Seeds obtained	% seed setting
				sterile	partially fertile			
Mono 5B Chinese Spring × *Secale cereale*	27	without	7	192	0	8,314	0	0
Mono 5B Chinese Spring × *Secale cereale*	28	〃	2	12	0	420	0	0
Mono 5B Chinese Spring × *Secale cereale*	29	〃	1	19	0	678	0	0
Mono 5B Chinese Spring × *Ae. columnaris*	34	〃	4	260	0	5,542	0	0
Mono 5B Chinese Spring × *Ae. columnaris*	35	〃	7	264	4	6,768	4	0.06
Mono 5B Chinese Spring × *Secale cereale*	27	with	4	73	7	3,926	15	0.38
Mono 5B Chinese Spring × *Ae. columnaris*	34	〃	5	124	6	2,626	41	1.56
Mono 5B Chinese Spring × *Ae. columnaris*	35	〃	1	7	2	196	4	2.04

On comparing the results obtained with and without colchicine treatment, clear differences in fertility of the hybrids become apparent, probably due to the production of chimaeras in the individuals treated with the drug. Different behaviour as to fertility of the hybrids deficient or not for chromosome 5B has been also observed, the lowest percentages of fertility corresponding to the deficient ones. Likewise, results seem to indicate a greater affinity between *T. aestivum* and *Ae. columnaris* than between *T. aestivum* and *Secale cereale.*

The external appearance of hybrid seeds is fairly good, specially that of *Ae. columnaris* hybrids.

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An unusual rate of transmission of double monosomics in wheat

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The monosomic lines of wheat variety Chinese Spring, developed by E. R. Sears, are being maintained at the Indian Agricultural Research Institute, New Delhi, for utilizing them for genetic analyses. In the course of a four year study it has been observed that the frequency of double monosomics $(19^{II}+2^{I})$ that have been recorded from among the monosomic $(20^{II}+1^{I})$ progenies is very high (Table 1), as compared with the reports available in the literature.

Table 1. Analysis of plants in monosomic progenies

Year	Disomes	Monosomes	Double monosomes	Other aneuploids
1962	40(51.2)	37(47.4)	Nil	1(1.2)
1963	23(50.0)	21(45.6)	2(4.3)	Nil
1964	38(36.5)	61(58.6)	5(4.8)	Nil
1965	63(47.7)	62(46.9)	4(3.0)	3(2.2)
Total	164(45.5)	181(50.2)	11(3.0)	4(1.1)
Mean frequency	45.5	50.2	3.0	1.1

Frequency in per cent is given in parentheses

Person (1956) in a study of 225 monosomic progenies found only one double monosomic plant and Mc Ginnis and Campbell (1960) have also reported a similarly low frequency (0.4 per cent). As compared with this the observed mean frequency of 3.0 per cent double monosomics in the present study is significantly higher and in fact corresponds to the expected frequency of nullisomics (20^{II}) that are expected on selfing monosomics. No definite explanation can be offered to explain this unusual transmission of double monosomics. It is possible that differences in temperatures existing at different locations may be responsible for this as has been reported by Riley (1966) with respect to chromosome pairing in nulli-5 D tetra-5 B material grown at different temperatures.

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Molecular approach to the phylogeny of wheat

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Bread wheat plant contains a large number of enzymes, which directly or indirectly are responsible for all morphological and physiological characteristics. The enzymes that we have studied so far, esterases, peroxidases, alcohol dehydrogeanse and leucine amino peptidase occur in multiple molecular forms. It is very likely that most, if not all other

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enzymes also occur in different molecular forms. Functionally similar, though not structurally identical enzymes are present in diploid and tetraploid species of wheat. Each of these enzymes is made of one or more polypeptide chains, and on the basis of our present knowledge of protein synthesis, we can say that the primary structure of each polypeptide chain is determined by the nucleotide sequence of the DNA in the structural gene. For any specific enzyme, this information should be highly redundant in hexaploid species, being contributed from three parental genomes.

Molecular heterogeneity of enzymes can be studied in a number of different ways, among others by characterizing their electrophoretic mobility, serological behaviour, reaction with coenzyme analogues and of course, by determination of the amino acid sequence. Some of these tests can be performed on relatively crude extracts. We have studied electrophoretic mobilities of few enzymatic proteins using polyacrylamide gel electrophoresis. By this technique it is possible to separate proteins from complex mixtures, on the basis of net charge and size of the molecule. The results indicate that bread wheat varieties of very diverse origin show a fairly uniform pattern with respect to the specific enzymes studied, though a few genetic variants were also observed. The enzyme heterogeniety is much greater between the species and between species of different ploidy. The present molecular forms in the hexaploid species must have evolved from the original forms contributed by the parental species.

By further chemical characterization of the molecular homologies of a specific enzyme in hexaploid, tetraploid and diploid species, probable genome donors, their hybrids and the synthesised polyploids it should be possible to infer evolutionary relationships and to trace back the evolutionary pattern of the genetic loci controlling these enzymes. Further, on the basis of this information, some of the molecular alterations in the DNA contributed by each of the genome donors can be infered. This considered in conjunction with the available morphological and cytogenetical evidence will help in elucidating evolutionary relationships.

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Chromosome variation in *Aegilops umbellulata* ZHUK.

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Ae. umbellulata plants grown from a collection secured from Western Iran were crossed with two Turkish collections of this diploid species. Five F_1 hybrids between the Iranian × the two Turkish lines have been examined. All five hybrids were characterized by the frequent occurrence of a quadrivalut in metaphase I, i. e. were heterozygous for a reciprocal translocation. In contrast, Turkey × Turkey inter-varietal hybrids did not show any chromosomal difference. The latter, as well as the parental lines were characterized by regular formation of 7 bivalents. The following notes summarize pertinent geographical and morphological information on the *Ae. umbellulata* collections employed.

1. Acc. 007: South West Iran: 2 km north-east of Shiraz. Hills with limestone bedrock. Spiny *Astragalus* formation, overgrazed. Collected D. ZOHARY, 1960. Relatively small, condensed spikes.
2. Acc. 6044: South Turkey: 7 km north of Gaziantep on road to Marash. Basaltic soil, steppe-like vegetation. Collected D. ZOHARY, 1959. Spikes relatively big; with long pedicelled upper spikelets.
3. Acc. 301: West Turkey: 10 km west of Denizli. Marly soil. Open herbaceous vegetation at roadside. Collected D. ZOHARY, 1962. Spikes rather small and compact.

The information gathered indicates the presence of translocation difference within diploid *Ae. umbellulata.* It should be noted that the Iranian collection employed comes from the South East corner of the distribution area of this diploid. It might well be that the translocation difference found reflects eco-geographical divergence; and that the Zagros Mountains range harbors a distinct translocation race of this species.

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Nuclear and interphase chromosome volumes of four *Triticum* species and of eight species from related genera

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Interphase chromosome volume has been shown by us to be the primary factor determining radiosensitivity not only of higher plants (SPARROW *et al.* 1965, Radiation Botany, Suppl. 1: 101), but also of other organisms ranging from unicellular systems to higher animals (UNDERBRINK and SPARROW 1966, J. Cell Biol. 31: 119A). Recently, we have also shown that this volume is a useful tool in cytotaxonomical research (ICHIKAWA *et al.*, in preparation). This note reports the nuclear and interphase chromosome volumes of some *Triticum, Aegilops, Secale, Hynaldia, Agropyron* and *Hordeum* species and briefly indicates how these values can be applied by a cytotaxonomist.

For determining the nuclear volumes, vegetative apical shoots were removed from young seedlings (2- or 3-leaf stage), fixed with Craf III, sectioned at 8 or 10 μ, and stained with safranin and fast green. The nuclear volumes were obtained from these preparations by the method described elsewhere (SPARROW *et al.* 1965, see above). When the nuclear volumes are divided by the somatic chromosome numbers, the average interphase chromosome volumes characteristic of each species can be calculated.

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The volumes determined are presented in Table 1. The average nuclear volumes for di-, tetra- and hexaploid *Triticum* species are 248, 461 and 642 μ^3, respectively, giving a ratio of 1 : 1.86 : 2.59. The volumes of the polyploids are smaller than those expected from a proportional relationship between the ploidy levels. As a consequence, the average interphase chromosome volumes for these three levels show a decrease with increasing

Table 1. Nuclear and interphase chromosome volumes of *Triticum*, *Aegilops*, *Secale*, *Hynaldia*, *Agropyron* and *Hordeum* species

Species	Ploidy (x)	2n	Nuclear volume (μ^3)	Interphase chromosome volume (μ^3)
Triticum				
aegilopoides var. *boeoticum*	2	14	243 ± 8	17.4 ± 0.6
monococcum	2	14	244 ± 18	17.4 ± 1.3
monococcum var. *flavescens*	2	14	258 ± 8	18.4 ± 0.5
			(av. 248)	(av. 17.7)
durum	4	28	459 ± 27	16.4 ± 1.0
durum var. *hordeiforme*	4	28	446 ± 32	15.9 ± 1.1
durum var. *reichenbachii*	4	28	479 ± 21	17.1 ± 0.8
			(av. 461)	(av. 16.5)
aestivum ssp. *vulgare* HV. Marfed	6	42	672 ± 28	16.0 ± 0.7
aestivum ssp. *vulgare* HV. Pawnee	6	42	612 ± 45	14.6 ± 1.1
			(av. 642)	(av. 15.3)
Aegilops				
speltoides	2	14	234 ± 8	16.7 ± 0.6
squarrosa var. *typica*	2	14	222 ± 7	15.8 ± 0.5
Secale				
cereale HV. Abruzzi	2	14	267 ± 11	19.0 ± 0.8
Hynaldia				
villosa	2	14	298 ± 9	21.3 ± 0.6
Agropyron				
cristatum	2	14	355 ± 18	25.4 ± 1.3
subsecundum	4	28	338 ± 17	12.1 ± 0.6
intermedium (=*glaucum*)	6	42	432 ± 29	10.3 ± 0.7
Hordeum				
vulgare HV. Himalaya	2	14	189 ± 11	13.5 ± 0.8
vulgare HV. Hannchen	2	14	185 ± 8	13.2 ± 0.6

ploidy, i. e., 17.7, 16.5 and 15.3 μ^3, respectively. The above ratio of nuclear volumes does not agree with the ratio of total length of mitotic metaphase chromosomes, 2x : 4x : 6x = 1 : 1.7 : 2.1 by MARSHAK and BRADLEY (1944, Proc. Nat. Acad. Sci., U. S. 30 : 231) nor 1 : 1.6 : 2.0 by BHASKARAN and SWAMINATHAN (1960, Exptl. Cell Res. 20 : 598). It has been widely accepted that tetraploid wheat was derived from hybridization and amphiploid formation between diploid wheat and probably *Aegilops speltoides*, and that the hexaploid wheat came from the tetraploid and *Ae. squarrosa*. A "synthesized" value for the average nuclear volume of tetraploid wheat can be obtained by adding the average value calculated for the three diploid wheats measured to the *Ae. speltoides* value. The result is 482 μ^3 which is close to 461 μ^3, the average nuclear volume for the tetraploid wheat. Similarly, adding the values obtained for the tetraploid wheat and *Ae. squarrosa* results in 683 μ^3 which is also close to the average volume for the hexaploid, 642 μ^3. Although there is only a little difference (5 to 6 %) between the "synthesized" and measured volumes, we should not ignore the fact that the measured volumes are smaller than the "synthesized" volumes in both cases. Another "synthesized" volume of 704 μ^3 determined from the values for the diploid wheat species, *Ae. speltoides* and *Ae. squarrosa*, is about 10 % larger than the measured volume of the hexaploid wheat. Similar decreases of interphase chromosome volumes in polyploids have been observed in *Avena* (unpub.) and more strikingly in *Rumex* (ICHIKAWA *et al.*, in preparation), *Chrysanthemum*, *Sedum*, *Tradescantia* and several other genera (SPARROW 1965, In, Cellular Radiation Biology, p. 199).

Agropyron cristatum, *Hynaldia villosa* and *Secale cereale* (all 2 x) have larger average interphase chromosome volumes than any of the *Triticum* species studied, while *Agropyron subsecundum* (4 x), *Ag. intermedium* (6 x) and *Hordeum vulgare* (2x) have smaller interphase chromosome volumes.

The research was carried out at Brookhaven National Laboratory under the auspices of the U. S. Atomic Energy Commission.

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Genome analysis of the genus *Eremopyrum*

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Morphological and cytogenetical studies of *Eremopyrum*, a genus of the tribe Triticeae, were carried out in 14 different interspecific hybrids among three strains of two diploid species, *Er. buonapartis* (SPRENG.) NEVSKI and *Er. triticeum* (GAERTN.) NEVSKI and nine strains of two tetraploid species, *Er. buonapartis* and *Er. orientale* (LINN.) JAUB. et SPACH.

The main characteristics of the hybrids were as follows: (1) vigorous growth of hybrids, and normal tillering and flowering; (2) intermediate spikelet characters of the hybrids between parents; (3) very high pollen sterility and complete seed sterility in all hybrid combinations.

Hybrids' average chromosome pairing per cell at MI of PMC's is shown in Table 1. From these data, the following conclusions are drawn: (1) the genome of diploid *Er. buonapartis* is found in tetraploid *Er. buonapartis*; (2) the genome of diploid *Er. triticeum* occurs in *Er. orientale*; (3) a common genome is shared by tetraploid *Er. buonapartis* and *Er. orientale*.

The morphological characteristics and chromosome pairing of F_1 hybrids between the diploid species *Er. distans* (C. KOCH) NEVSKI and *Er. triticeum* had been previously examined (SAKAMOTO and MURAMATSU 1963). Also a karyotypical comparison had been previously carried out for diploid and tetraploid *Er. buonapartis*, *Er. distans* and *Er. orientale* (SAKAMOTO and MURAMATSU 1965). From those and the present studies, it is assumed that the tetraploid *Er. buonapartis* has originated from an amphidiploid between diploid *Er. buonapartis* and *Er. distans*, while the tetraploid *Er. orientale* was derived from an amphidiploid between *Er. distans* and *Er. triticeum*.

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Table 1. Average chromosome pairing per cell in the PMC's of interspecific *Eremopyrum* hybrids

Cross combinations (♀ × ♂)	No. of cells observed	Average chromosome pairing per cell		
		III	II	I
Er. buonapartis (4 x) × *Er. buonapartis* (2 x):				
7034 × 7035	189		6.95	7.11
Er. buonapartis (4 x) × *Er. triticeum* (2 x):				
7031* × *Er. triticeum*-1	156		1.37	18.27
7032 × 〃	306	0.01	1.35	18.30
7033 × 〃	183		0.97	19.06
7034 × 〃	408	0.02	1.13	18.70
7034 × *Er. triticeum*-2	139	0.02	1.73	17.48
7036 × *Er. triticeum*-1	115		0.97	19.05
7038 × 〃	425	0.01	1.35	18.28
7042 × 〃	273		0.76	19.48
7043 × 〃	346		1.01	18.70
Er. buonapartis(4 x) × *Er. orientale*(4 x):				
7031* × 7037	1,054**	0.02	6.69	14.54
7034 × 7037	276		6.22	15.55
Er. orientale(4 x) × *Er. buonapartis*(4 x):				
7037 × 7042	445	0.00	6.62	14.76
Er. orientale(4 x) × *Er. triticeum*(2 x):				
7037 × *Er. triticeum*-1	725	0.00	6.82	7.34
Er. distans(2 x) × *Er. triticeum*(2 x)***:				
7041 × *Er. triticeum*-2	263	0.01	0.70	12.59

* As to spikelet morphology this strain closely resembles *Er. orientale*.

** In three cells a quadrivalent was observed.

*** SAKAMOTO and MURAMATSU (1963).

II. Exploration Results of the BMUK 1959

Some aspects regarding the collected materials of *Triticum* and *Aegilops* from the Eastern Mediterranean Countries. III.*

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11. Section Vertebrata of *Aegilops*

Among five species belonging to the section Vertebrata, *Ae. crassa* BOISS. (tetraploid and hexaploid, genome symbols being $DDM^{cr}M^{cr}$ and $DDD_2D_2M^{cr}M^{cr}$, respectively) and *Ae. ventricosa* TAUSCH (tetraploid, genome symbol being $DDM^{v}M^{v}$), were collected.

Ae. ventricosa was collected from one habitat, 30 km SW of Alexandria, Egypt, where will be the eastern limit of the distribution of this species.

Ae. crassa found in a habitat in Lebanon was thought to be a tetraploid species morphologically, and the one found in a habitat in Syria, was examined cytologically to be tetraploid, while two strains collected near the border between Syria and Jordan were hexaploid (Table 15).

Table 15. List of habitats and collections of *Aegilops crassa* BOISS. and *Ae. ventricosa* TAUSCH

Habitats	Collections
Egypt: 6 km W of El-Amiriya (30 km SW of Alexandria)	*Ae. ventricosa* var. *vulgaris*, 4x
Jordan: 2 habitats, 2–16 km S of the Syrian border	*Ae. crassa* var. *palaestina*, 6x
Lebanon: Suburbs of Baalbek	*Ae. crassa*, 4x ? (immature with no seeds)
Syria: Suburbs of Kamichliye	*Ae. crassa* var. *macrathera*, 4x

Ae. crassa has been known to occur through Palestina, Syria, Iraq, Afghanistan and Turkestan (EIG 1929). It was reported previously in WIS No. 5, pp. 11–12, that all the strains of *Ae. crassa* from Iran and Iraq are 4x, while 6x forms grow mixed together with 4x forms in Afghanistan, and that the strains from Turkestan are 6x. From these data, it can be said that 6x form originated in the northern stretch of the Hindukush Range in Afghanistan.

However, 6x forms were collected also near the border between Syria and Jordan.

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* Contributions of the BMUK 1959, No. 4.

According to Eig (1929), these 6x strains can be referred to as var. *palaestina*. But the genome constitution of this variety is most probably $DDM^{cr}M^{cr}S^{1}S^{1}$ (Tanaka, umpublished): hence, it should be recognized as a new species. It would be the same which Chennaveeraiah (1960) established as a new species *Ae. vavilovii* based on his karyotype studies.

12. *Aegilops triaristata*

Table 16. List of habitats and collections of *Ae. triaristata* Villd.

Habitats	Collections
Turkey:	
Kirikhan—Aleppo	var. *vulgaris*, 4x ? (immature with no seeds)
55 km N of Adana	〃 4x
Ankara	〃 〃
Suburbs of Ankara	〃 〃
Ankara—Ayas	〃 〃
2 habitats betw. Ankara—Bolu	var. *vulgaris*, var. *trojona*, 4x
Suburbs of Izmit	var. *vulgaris*, 4x
3 habitats betw. Izmit—Istanbul	var. *vulgaris*, var. *quradriaristata*, 4x
5 habitats betw. Konya—Antalya	var. *vulgaris*, 4x
Suburbs of Kutahya	〃 〃
Suburbs of Bergama	〃 〃
4 habitats betw. Bursa—Bandirma	〃 〃
2 habitats betw. Bandirma—Gönen	〃 〃
Suburbs of Gönen	〃 〃
Greece:	
Suburbs of Lachanas	var. *vulgaris*, 4x
Suburbs of Vasilika	〃 〃
Suburbs of Portaria	〃 6x
Suburbs of Volos	〃 〃
Olympia	〃 〃
Tripolis	〃 〃
Italy:	
4 habitats in suburbs of Rome	var. *vulgaris*, 6x

Ae. triaristata Willd. includes the tetraploid ($C^uC^uM^tM^t$) and hexaploid ($C^uC^uM^tM^tM^{t2}M^{t2}$).

Ae. triaristata was collected in various habitats in Turkey, Greece and Italy (Table 16). Especially in North-western Turkey and Greece this species occurred almost everywhere along the highways or on the hillsides.

The specimens of this species from most parts of Turkey were 4x, except for one from a habitat in North-western Turkey. Those from Northern Greece were 4x, while those from Central and Southern Greece and Italy were 6x. According to the genome-analytical studies, it can be said that the 6x form of *Ae. triaristata* arose as an amphiploid of the hybrids between the 4x form of *Ae. triaristata* with $C^uC^uM^tM^t$ and *Ae. comosa* *Ae. heldreichii* or *Ae. uniaristata* with MM-genomes. *Ae. heldreichii* was actually collected from the North-western Turkey. Based on the collection data, the place where 6x forms arose, is supposed to North-western Turkey.

13. *Aegilops variabilis* and *Ae. kotschyi*

Aegilops variabilis Eig and *Ae. kotschyi* Boiss. have the same genome constitution ($C^uC^uS^vS^v$); the former is different from the latter by 1–2 pairs of translocation chromosomes, but this will not be essential because such translocations have been found also within each species.

After Eig (1929,) the morphological difference between the two species is based on the existence of awns in outer glumes and the hardness of ear. Namely *Ae. kotschyi* has flexible ears with 1–3 awns in outer glumes, while *Ae. variabilis* has hard ears with no awns. It was observed that *Ae. variabilis* and *Ae. kotschyi* occur side by side in common habitats in Jordan. Therefore, there is a possibility of hybridization between the two species. Probably this would account for wide and continuous variation in the species and also for various exceptional forms, such as *variabilis*-type with flexible ears, and *kotschyi*-type with hard ears. Accordingly, it was difficult to give a clearcut classification between the two species based on the morphological analysis.

These two species occurred almost everywhere we travelled. In Egypt *Ae. kotschyi* dominated over *Ae. variabilis*, and in Jordan and Syria these species and their varieties occurred abundantly (Table 17).

In the area of Dead Sea in Jordan we found the variation from short to long spikes and from long to non- or vestigial-awns. In Lebanon, Turkey and Greece only *Ae. variabilis* was found and in Italy only *Ae. kotschyi* (Table 18).

From these data, it can be said that *Ae. variabilis* and *Ae. kotschyi* originated in Palestina as an amphidiploid of the hybrids between *Ae. umbellulata* with C^u-genome

Table 17. List of habitats and collections of *Ae. variabilis* Eig and *Ae. kotschyi* Boiss.

Habitats	Collections
Egypt:	
2 habitats betw. Cairo—Alexandria	*Ae. kotschyi* var. *palaestina*
20 km W of Alexandria	〃 〃
Many habitats betw. Alexandria—Matruh	〃 〃
Suburbs of Matruh	〃 〃
	Ae. variabilis var. *peregrina*
Jordan:	
2 habitats betw. Jerusalem—Hebron	*Ae. kotschyi* var. *palaestina*
	〃 var. *leptostachya*
	Ae. variabilis var. *multiaristata*
4 habitats betw. Jerusalem—Dead Sea	*Ae. kotschyi* var. *palaestina*
	〃 var. *leptostachya*
	Ae. variabilis var. *typica*
	〃 var. *intermedia*
5 habitats in the basin of the Jordan River	*Ae. kotschyi* var. *typica*
	Ae. variabilis var. *intermedia*
	〃 var. *typica*
	〃 var. *brachyathera*
	〃 var. *elongata*
Many habitats betw. Amman—Dead Sea	*Ae. kotschyi* var. *typica*
	Ae. variabilis var. *intermedia*
	〃 var. *typica*
	〃 var. *multiaristata*
	〃 var. *peregrina*
40 km N of Amman	*Ae. kotschyi* var. *typica*
Lebanon:	
Suburbs of Beirut	*Ae. variabilis* var. *multiaristata*
Biblos	〃 var. *typica*
Syria:	
Near by the Mt. Hermon	*Ae. kotschyi* var. *palaestina*

Table 17. (Continued)

20 km NW of Damascus	*Ae. kotschyi* var. *palaestina*
2 habitats betw. Damascus—Hama	*Ae. kotschyi* var. *typica*
	Ae. variabilis var. *intermedia*
Aleppo—Kirikhan	〃 〃
Turkey:	
Suburbs of Kirikhan	*Ae. variabilis* var. *intermedia*
	〃 var. *multiaristata*
Greece:	
Suburbs of Chania (Crete Island)	*Ae. variabilis* var. *intermedia*
Italy:	
Agrigento (Sicily Island)	*Ae. kotschyi* var. *palaestina*

Table 18. The number of varieties of *Ae. kotschyi* and *Ae. variabilis* in respective regions

Regions	Number of varieties	
	Ae. variabilis	*Ae. kotschyi*
Egypt	1	1
Jordan	6	3
Syria	1	2
Lebanon	2	0
Turkey	2	0
Greece	1	0
Italy (Sicily Island)	0	1

and *Ae. longissima*, *Ae. sharonensis* or *Ae. bicornis* with S-genome, as have been reported by TANAKA (1955).

14. *Aegilops columnaris*

Ae. columnaris ZHUK. (4x, genome symbol $C^uC^uM^cM^c$) was collected from only three habitats in Ankara and its suburbs, in Turkey (Table 19). This species was always found in a mixed population with *Ae. triuncialis*, *Ae. caudata*, *Ae. umbellulata* and *Ae.*

Table 19. List of habitats and collections of *Ae. columnaris* Zhuk.

Habitats	Collections
Turkey:	
Garden of Japanese Embassy in Ankara	var. *typica* (with waxy spike)
Ankara—Air Port of Ankara (8.5 km NE of Ankara)	〃
20 km NW of Ankara (Ankara—Bolu)	〃

cylindrica etc..

According to Eig (1929), this species occupies a very limited area in Central Turkey. This was also found in Iran by the Kyoto University Scientific Expedition in 1955 (WIS No. 6, p. 13 and KUSE Vol. 1, pp. 1-118).

15. *Aegilops biuncialis*

Aegilops biuncialis Vis. (4x, genome symbol $C^uC^uM^bM^b$) was collected from Syria Turkey and Greece (Table 20). Especially in Turkey and Greece, this species occurred almost everywhere. According to Eig (1929), its distribution is from the east of the Caspian Sea to Italy.

Table 20. List of habitats and collections of *Ae. biuncialis* Vis.

Habitats	Collections
Syria:	
Suburbs of Damascus	var. *macrochaeta*
Hama—Damascus	var. *typica*
Suburbs of Aleppo	〃
Turkey:	
Suburbs of Kirikhan	var. *typica* & var. *macrochaeta*
Suburbs of Bardur	〃
Denizli	〃
Efes	var. *macrochaeta*
Bergama	var. *typica* & var. *macrochaeta*
5 habitats betw. Samsun—Amasya	var. *macrochaeta*

Table 20. (Continued)

5 habitats betw. Amasya—Corum	var. *macrochaeta*
Corum—Yozgat	〃
2 habitats betw. Corum—Cerikli	〃
3 habitats betw. Cerikli—Ankara	〃
Ankara	var. *typica* & var. *macrochaeta*
90 km ES of Ankara	var. *macrochaeta*
Suburbs of Ayas	〃
Suburbs of Eskisehir	var. *typica* & var. *macrochaeta*
4 habitats betw. Bursa—Bandirma	〃
Suburbs of Gönen	〃
Ismit—Istanbul	〃
Greece:	
Suburbs of Lachanas	var. typica
Suburbs of Vasilika	〃
Suburbs of Portaria	〃
Suburbs of Volos	〃
Suburbs of Athens	〃
Olympia	〃
Tripolis	〃
Suburbs of Chania (Crete Island)	〃
Suburbs of Iraklion (Crete Island)	〃

Ae. biuncialis involves three varieties, viz. *typica* Vis., *macrochaeta* Eig and *archipelagica* Eig. All the collected strains were var. *typica* or var. *macrochaeta*; the former bears a sparse hair glume, while the latter a dense hair glume. Var. *macrochaeta* has been hitherto described to have waxy spike but the collected one does not have waxy spike. These two varieties were also found in a mixed population or in the neighboring separate populations, in Turkey.

16. *Aegilops ovata*

Ae. ovata L. (4x, genome symbol $C^uC^uM^oM^o$) was collected in many habitats as listed in Table 21. We found it almost everywhere, in Jordan, Lebanon, Syria, Turkey, Greece

Table 21. List of habitats and collections of *Ae. ovata* L.

Habitats	Collections
Jordan :	
2 habitats betw. Jerusalem—Hebron	var. *vulgaris*
Jerusalem	〃
2 habitats betw. Jerusalem—Dead Sea	〃
2 habitats betw. Amman—Dead Sea	〃
Lebanon :	
Suburbs of Saida	var. *vulgaris*
Suburbs of Beirut	〃
Syria :	
Near by the Mt. Hermon	var. *vulgaris*
20 km NW of Damascus	〃
4 habitats betw. Damascus—Hama	var. *vulgaris* & var. *africana*
2 habitats betw. Hama—Aleppo	var. *vulgaris*
Suburbs of Aleppo	〃
Turkey :	
Suburbs of Kirikhan	var. *vulgaris* & var. *hirsuta*
55 km N of Adana	var. *vulgaris*
Cerikli—Corum	〃
5 habitats in Samsun	〃
Amasya	〃
Bergama	〃
5 habitats betw. Bursa—Bandirma	〃
6 habitats betw. Bandirma—Gönen	〃
2 habitats betw. Bolu—Izmit	〃
6 habitats betw. Izmit—Istanbul	〃
Greece :	
Suburbs of Lachanas	var. *vulgaris*
Suburbs of Vasilika	〃
Suburbs of Chania (Crete Island)	〃

Table 21. (Continued)

Italy:	
4 habitats betw. Rome—Naples	var. *vulgaris*
Suburbs of Palermo (Sicily Island)	〃
Agrigento (Sicily Island)	〃

and Italy, but none in Egypt. The population size was always larger than that of any other species. Especially we met with large growth of *Ae. ovata* in the suburbs of Gönen, Turkey and the hillside of Agrigento in Sicily Island, Italy.

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III. Genetic Stocks

Necrosis genes in Japanese local varieties of common wheat[1]

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There are about 250 varieties of common wheat, *Triticum aestivum* L. *em.* THELL., in Japan, which can be called local. They have been maintained in the Central Agricultural Experiment Station, Konosu. Of those, 198 varieties were crossed to three testers of necrosis and chlorosis genes, and their genotypes were determined. The results are given in the following table:

Table 1. Phenotypes with respect to necrosis and chlorosis of F_1 hybrids between three testers and 198 Japanese local varieties of common wheat, and their genotype formulae

Variety	Origin (Prefecture)	Tester			Genotype of tested variety
		Jones Fife $ne_1Ne_2ch_1Ch_2$	Prelude $Ne_1ne_2ch_1Ch_2$	Macha $Ne_1ne_2Ch_1ch_2$	
Aburakomugi	Fukuoka	—	—	c	$ne_1ne_2ch_1Ch_2$
Aizukomugi	Fukushima	—	—	c	〃
Aka	Tokyo	—	—	c	〃
Akaboro No. 1	Tochigi	—	—	c	〃
Akaboshi	Kagoshima	—	—	c	〃
Akabozu	Saitama	n	—	c	$Ne_1ne_2ch_1Ch_2$
Akabozu No. 1	Tochigi	—	—	—	$ne_1ne_2ch_1ch_2$
Akabozuko No. 34	Gunma	—	—	c	$ne_1ne_2ch_1Ch_2$
Akabungo	Oita	n	—	c	$Ne_1ne_2ch_1Ch_2$
Akachiku No. 1	Aichi	—	—	c	$ne_1ne_2ch_1Ch_2$
Akadaruma	Kanagawa	n	—	c	$Ne_1ne_2ch_1Ch_2$
Akaemidashi	Tokyo	—	—	c	$ne_1ne_2ch_1Ch_2$
Akakan-Ibaragi No. 1	Ibaragi	—	—	c	〃
Akagegunbai	Yamanashi	n	—	c	$Ne_1ne_2ch_1Ch_2$
Akakomugi	Fukui	—	—	c	$ne_1ne_2ch_1Ch_2$

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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. (Continued)

Akagawaaka	Hokkaido	—	?	c	ne_1 ? ch_1Ch_2
Akakarashi	Kanagawa	n	—	c	$Ne_1ne_2ch_1Ch_2$
Akamugi	Fukushima	n	—	c	〃
Akanankin	Kanagawa	n	—	c	〃
Akitazairai	Akita	—	n	c	$ne_1Ne_2ch_1Ch_2$
Amayoke	Miyazaki	n	—	c	$Ne_1ne_2ch_1Ch_2$
Asahi	Iwate	—	—	c	$ne_1ne_2ch_1Ch_2$
Asozairai (awned)	Kumamoto	n	—	c	$Ne_1ne_2ch_1Ch_2$
Asozairai (awnless)	Kumamoto	—	—	c	$ne_1ne_2ch_1Ch_2$
Azumanishiki	Chiba	—	—	c	〃
Bankyo No. 1	Shiga	—	—	c	〃
Bingo	Okayama	n	—	c	$Ne_1ne_2ch_1Ch_2$
Bozu	Okayama	—	n	c	$ne_1Ne_2ch_1Ch_2$
Buredorei	Nagano	n	—	c	$Ne_1ne_2ch_1Ch_2$
Chikurin No. 36	Gifu	—	—	c	$ne_1ne_2ch_1Ch_2$
Chinko No. 1	Kyoto	—	—	c	〃
Chinko	Hiroshima	n	—	c	$Ne_1ne_2ch_1Ch_2$
Chikuzen	Saga	—	—	c	$ne_1ne_2ch_1Ch_2$
Chuchinko	Hyogo	n	—	c	$Ne_1ne_2ch_1Ch_2$
Chuko	Hyogo	—	—	c	$ne_1ne_2ch_1Ch_2$
Daruma	Gunma	n	—	c	$Ne_1ne_2ch_1Ch_2$
Emidashi	Tochigi	n	—	c	〃
Ejima	Shimane	—	—	c	$ne_1ne_2ch_1Ch_2$
Ejimachinko No. 1	Kagawa	—	n	c	$ne_1Ne_2ch_1Ch_2$
Ejimajinriki	Fukuoka	—	—	c	$ne_1ne_2ch_1Ch_2$
Fukoku	Ibaragi	—	—	c	〃
Fukuraku	Fukuoka	—	—	c	$ne_1ne_2ch_1Ch_2$
Fuyujiro	Yamagata	—	n	c	$ne_1Ne_2ch_1Ch_2$
Gunbai	Yamanashi	n	?	c	$Ne_1ne_2ch_1Ch_2$
Hachiwoji	Kanagawa	n	—	c	〃
Hatakedakomugi	Okayama	—	—	?	$ne_1ne_2ch_1$?

Table 1. (Continued)

Hatsukakomugi	Miyazaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Hayabozu	Oita	—	—	c	〃
Hayakomugi	Fukuoka	—	—	c	〃
Hayamehaikara	Nagasaki	—	—	c	〃
Hidawase No. 1	Gifu	n	—	c	$Ne_1ne_2ch_1Ch_2$
Higo No. 1	Kumamoto	n	—	c	〃
Hikawa	Shimane	—	—	c	$ne_1ne_2ch_1Ch_2$
Hiodoshi	Hiroshima	—	—	c	〃
Hirakikomugi	Tottori	—	—	c	〃
Hiroshimashiprei	Hiroshima	—	—	c	〃
Honaga	Yamagata	?	n	c	$ne_1Ne_2ch_1Ch_2$
Hosokan	Chiba	n	—	c	$Ne_1ne_2ch_1Ch_2$
Homan	Tochigi	—	—	c	$ne_1ne_2ch_1Ch_2$
Hozoroi	Tochigi	—	—	c	〃
Hozu	Gifu	n	—	c	$Ne_1ne_2ch_1Ch_2$
Ichigo-Hiderikomugi	Kumamoto	—	—	c	$ne_1ne_2ch_1Ch_2$
Ichigo-Kumamotokomugi	Kumamoto	—	—	c	〃
Ichijiro	Mie	n	—	c	$Ne_1ne_2ch_1Ch_2$
Igachikugo	Saga	—	—	c	$ne_1ne_2ch_1Ch_2$
Itokomugi	Miyazaki	n	—	c	$Ne_1ne_2ch_1Ch_2$
Ineyamakomugi	Kyoto	n	—	c	〃
Ishiwari	Miyazaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Iwate	Iwate	—	n	c	$ne_1Ne_2ch_1Ch_2$
Iwateshiro	Iwate	—	n	c	〃
Jujokomugi	Saga	n	—	c	$Ne_1ne_2ch_1Ch_2$
Jabara	Miyazaki	n	—	c	〃
Kagoshima	Kagoshima	—	—	c	$ne_1ne_2ch_1Ch_2$
Kairyochikuzen	Nagasaki	—	—	c	〃
Kanpei	(unknown)	—	—	c	〃
Karauchiwa	Kumamoto	—	—	c	〃
Kawabe	Hyogo	n	—	c	$Ne_1ne_2ch_1Ch_2$

Table 1. (Continued)

Kikuchi	Saga	n	—	c	$Ne_1ne_2ch_1Ch_2$
Kidaisabishirazu	(unknown)	—	—	c	$ne_1ne_2ch_1Ch_2$
Kinnishiki	Ibaragi	—	—	c	〃
Kinoshitakomugi	Yamanashi	—	—	c	〃
Koborehachikoku	Tochigi	—	—	c	〃
Kobozu	Kyushu	—	—	c	〃
Kokko	Gunma	n	—	c	$Ne_1ne_2ch_1Ch_2$
Kokububozu	Kagoshima	—	—	c	$ne_1ne_2ch_1Ch_2$
Komugijingoro	Kagawa	—	—	c	〃
Kozo	Tohoku	—	—	c	〃
Konpira	Kagawa	n	—	—	$Ne_1ne_2ch_1ch_2$
Koshigunzairai	Niigata	n	—	c	$Ne_1ne_2ch_1Ch_2$
Kumamotokomugi	Kumamoto	—	—	c	$ne_1ne_2ch_1Ch_2$
Kyotoakakomugi	Kyoto	n	—	c	$Ne_1ne_2ch_1Ch_2$
Maruhokomugi	Kyushu	—	—	c	$ne_1ne_2ch_1Ch_2$
Mihara	Hyogo	—	—	c	〃
Miyagibozu No. 32	Miyagi	—	—	c	〃
Moriya	(unknown)	—	—	c	〃
Motonokomugi	Nagasaki	—	—	c	〃
Mubochinko	Hiroshima	—	—	c	〃
Murasakiaka	Niigata	n	—	c	$Ne_1ne_2ch_1Ch_2$
Nagahokomugi	Nagasaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Nagasakikomugi	Nagasaki	—	—	c	〃
Nakamura	Aichi	—	—	c	〃
Nakasoshu	Kagawa	—	—	c	〃
Nakategunbai	Chiba	n	—	c	$Ne_1ne_2ch_1Ch_2$
Nakateshiro	Yamanashi	—	—	c	$ne_1ne_2ch_1Ch_2$
Nakatesoshu No. 6	Kagawa	—	—	c	〃
Naramisawa	Nara	—	—	c	〃
Nishimura	Yamagata	—	—	c	〃
Nittawase	Gunma	n	—	c	$Ne_1ne_2ch_1Ch_2$

Table 1. (Continued)

Nobeokabozukomugi	Miyazaki	n	—	c	$Ne_1ne_2ch_1Ch_2$
Nyubai	Ibaragi	n	—	c	〃
Oinoue	(unknown)	—	n	c	$ne_1Ne_2ch_1Ch_2$
Oishi	Nagasaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Oitachikutatsu	Oita	—	—	c	〃
Oitakomugi	Oita	—	—	c	〃
Onakayama	Hokkaido	n	—	c	$Ne_1ne_2ch_1Ch_2$
Ojimawase	Saitama	n	—	c	〃
Okinawazairai (awnless)	Chiba	n	—	c	〃
Okinawazairai (awned)	Miyazaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Okubo	(unknown)	—	—	c	〃
Okuteaka	Osaka	—	—	c	〃
Onibozu	Tokyo	n	—	c	$Ne_1ne_2ch_1Ch_2$
Rondenkomugi	Shimane	—	—	c	$ne_1ne_2ch_1Ch_2$
Sabimasari	Hokkaido	—	n	c	$ne_1Ne_2ch_1Ch_2$
Sadabozu	Miyazaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Saigokuhozoroi	Aichi	—	—	c	〃
Sakigake No. 1	Kagoshima	n	—	c	$Ne_1ne_2ch_1Ch_2$
Sakobore	Shizuoka	n	—	c	〃
Sanjaku	Miyagi	n	—	c	〃
Sanshukochiku	Shizuoka	n	—	c	〃
Sapporoharukomugi	Hokkaido	—	—	c	$ne_1ne_2ch_1Ch_2$
Sapporoharumaki	Hokkaido	—	—	c	〃
Satsuki	Aichi	—	—	c	〃
Seichiko	Okayama	—	—	c	〃
Seichiku	Nagano	—	—	c	〃
Sekitori No. 1	Tochigi	—	—	c	〃
Sendaibozu	Iwate	—	n	c	$ne_1Ne_2ch_1Ch_2$
Senhoku	Iwate	—	—	c	$ne_1ne_2ch_1Ch_2$
Senhokubozu	Iwate	—	n	c	$ne_1Ne_2ch_1Ch_2$
Senshutsuwase	Hokkaido	—	—	c	$ne_1ne_2ch_1Ch_2$

Table 1. (Continued)

Shibushirazu	Nagano	—	—	c	$ne_1ne_2ch_1Ch_2$
Shigawase No. 8	Shiga	—	—	c	〃
Shimerishirazu	(unknown)	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shinchinko No. 1	Hyogo	—	—	c	$ne_1ne_2ch_1Ch_2$
Shinchunaga	Hyogo	—	—	c	〃
Shinrikikomugi	Hyogo	—	—	c	〃
Shinano No. 1	Nagano	—	—	c	〃
Shiro II	Hokkaido	—	n	c	$ne_1Ne_2ch_1Ch_2$
Shirobunbu	Kumamoto	—	—	c	$ne_1ne_2ch_1Ch_2$
Shirochabo	Tokai	—	—	—	$ne_1ne_2ch_1ch_2$
Shirobo	Tochigi	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shirobotakesoroi	Yamanashi	n	—	c	〃
Shiroboro No. 1	Tochigi	n	—	c	〃
Shirobozu	Tochigi	—	—	—	$ne_1ne_2ch_1ch_2$
Shirodaruma	Kanagawa	—	—	c	$ne_1ne_2ch_1Ch_2$
Shiroemidashi	Kyushu	—	—	c	〃
Shirogenankin	Yamanashi	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shirogeshirokawa	Iwate	—	n	c	$ne_1Ne_2ch_1Ch_2$
Shirogeshiromubo	(unknown)	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shirohada	Hokkaido	—	n	c	$ne_1Ne_2ch_1Ch_2$
Shirokagura	(unknown)	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shirokaniho	Yamanashi	n	—	c	〃
Shirokawa	Iwate	—	—	c	$ne_1ne_2ch_1Ch_2$
Shirokawashiro	Iwate	—	n	c	$ne_1Ne_2ch_1Ch_2$
Shirokirisu	Okayama	—	—	c	$ne_1ne_2ch_1Ch_2$
Shirokomugi	Saga	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shiromugi	Kumamoto	n	—	c	〃
Shironankin	Hyogo	—	—	?	$ne_1ne_2ch_1$?
Shirosanjaku	Ibaragi	—	—	c	$ne_1ne_2ch_1Ch_2$
Shirosayaibaragi No. 1	Ibaragi	—	—	c	〃
Shirosaya	Ibaragi	—	—	c	〃

Table 1. (Continued)

Shirosaya No. 1	Ibaragi	—	?	c	ne_1 ? ch_1Ch_2
Shirosaya No. 2	Ibaragi	—	—	c	$ne_1ne_2ch_1Ch_2$
Shirotobidashi	Nagano	—	—	c	〃
Shisen No. 1	Iwate	n	—	c	$Ne_1ne_2ch_1Ch_2$
Shokomugi II	Kumamoto	—	—	c	$ne_1ne_2ch_1Ch_2$
Shonan	Kanagawa	—	—	c	〃
Showa	Kanagawa	—	—	c	〃
Sobakomugi	Kagoshima	—	—	c	〃
Sojukuakage	Saga	—	—	c	〃
Sojukuchinko	Hiroshima	n	—	c	$Ne_1ne_2ch_1Ch_2$
Somenkomugi	Nagasaki	n	—	c	〃
Sorachi	Niigata	—	n	c	$ne_1Ne_2ch_1Ch_2$
Soshu	Kanagawa	n	—	c	$Ne_1ne_2ch_1Ch_2$
Sotome	Nagasaki	—	—	c	$ne_1ne_2ch_1Ch_2$
Sunagawadaruma No. 2	Ibaragi	—	—	c	〃
Sunekiri No. 15	Gunma	—	—	c	〃
Taikankomugi	Tottori	—	—	c	〃
Teradabozu	(unknown)	—	—	c	〃
Tobarukomugi	Oita	—	—	c	〃
Tokorozawa	Saitama	—	—	c	〃
Tokushimachikuma No. 29	Tokushima	—	—	c	〃
Toranoo	Tohoku	n	—	c	$Ne_1ne_2ch_1Ch_2$
Toyamawase No. 1	Toyama	?	—	c	? $ne_2ch_1Ch_2$
Toyokuni	Niigata	n	—	c	$Ne_1ne_2ch_1Ch_2$
Waikei I	Saitama	—	—	c	$ne_1ne_2ch_1Ch_2$
Wakayama	Wakayama	n	—	c	$Ne_1ne_2ch_1Ch_2$
Waseaka	Tokyo	n	—	c	〃
Yaebara	Chiba	—	—	c	$ne_1ne_2ch_1Ch_2$

—: normal, n: necrotic, c: chlorotic, ?: no hybrid obtained or genotype partially undetermined.

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Necrosis genes in KUSE wheat[1]

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Leading the Kyoto University Scientific Expedition (KUSE) to the Karakoram and Hindukush, Dr. H. KIHARA and one of the members, Dr. K. YAMASHITA, collected 284 strains of common wheat (*Triticum aestivum* L. *em.* THELL.) in 1955 in Iran, Afghanistan and Pakistan. Details of their morphological and physiological characteristics were given by KIHARA, YAMASHITA and TANAKA (1965).

Of those, 218 were crossed to three testers of necrosis and chlorosis genes, i. e., Jones Fife, Prelude and Macha, and their genotypes were determined. The results are given in the following table:

Table 1. Phenotypes with respect to necrosis and chlorosis of F_1 hybrids between three testers and 218 common wheat strains from Iran, Afghanistan and Pakistan, and their genotype formulae

Cult. No.	Country	Locality[2]	Tester			Genotype of tested strain
			Jones Fife $ne_1Ne_2ch_1Ch_2$	Prelude $Ne_1ne_2ch_1Ch_2$	Macha $Ne_1ne_2Ch_1ch_2$	
3003	Pakistan	Quetta	—	—	c*	$ne_1ne_2ch_1Ch_2$
3004	〃	〃	—	—	c*	〃
3005	〃	〃	—	—	c	〃
3006	〃	Hudda	—	—	c	〃
3007	〃	〃	—	—	c	〃
3008	〃	〃	—	—	c	〃
3009	〃	〃	—	—	c	〃
3010	〃	Quetta	—	—	c	〃
3011	〃	Hazar Gangi	—	—	c	〃
3012	〃	〃	—	—	c*	〃
3013	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3014	〃	〃	—	—	c*	$ne_1ne_2ch_1Ch_2$
3015	〃	〃	—	—	c*	〃
3016	〃	〃	—	—	c	〃

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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.

2) Locality is given roughly; for details refer to Kihara, Yamashita and Tanaka (1965).

Table 2. (Continued)

3017	Pakistan	Hazar Gangi	—	—	?	$ne_1ne_2ch_1$?
3019	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3021	〃	〃	—	—	c*	〃
3023	〃	〃	—	—	c	〃
3024	〃	〃	—	—	c*	〃
3025	〃	〃	—	—	c*	〃
3026	〃	〃	—	—	c*	〃
3027	〃	〃	—	—	c*	〃
3029	〃	Gulistan	—	—	c	〃
3030	〃	〃	—	—	c	〃
3031	〃	〃	—	—	c*	〃
3032	〃	Chaman	n	—	c	$Ne_1ne_2ch_1Ch_2$
3033	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3034	〃	〃	—	—	c	〃
3035	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3036	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3038	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3039	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3041	〃	〃	—	—	c	〃
3042	〃	〃	—	—	c	〃
3043	〃	〃	—	—	c*	〃
3044	〃	〃	—	—	c*	〃
3045	Afghanistan	Kandahar	—	—	c	〃
3046	〃	〃	—	—	c	〃
3047	〃	〃	—	?	c	ne_1 ? ch_1Ch_2
3049	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3050	〃	〃	—	—	c	〃
3051	〃	〃	—	—	c	〃
3053	〃	Ghazni	n	—	c	$Ne_1ne_2ch_1Ch_2$
3054	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3056	〃	〃	—	?	c	ne_1 ? ch_1Ch_2

Table 2. (Continued)

3057	Afghanistan	Ghazni	n	?	c	$Ne_1ne_2ch_1Ch_2$
3059	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3060	〃	〃	—	—	c	〃
3062	〃	Kabul	—	—	c	〃
3063	〃	〃	—	—	c	〃
3064	〃	〃	—	—	c	〃
3065	〃	〃	—	—	c	〃
3066	〃	〃	—	—	c	〃
3067	〃	〃	—	—	c*	〃
3068	〃	〃	—	—	c	〃
3069	〃	Jalalabad	—	—	c	〃
3070	〃	〃	—	—	c	〃
3071	〃	〃	—	—	c	〃
3074	〃	〃	—	—	c	〃
3076	〃	〃	—	—	c	〃
3077	〃	〃	—	—	c	〃
3078	〃	〃	—	—	c	〃
3079	〃	〃	—	—	c	〃
3080	〃	Pulimatah-syagird	?	—	c	? $ne_2ch_1Ch_2$
3081	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3082	〃	〃	—	—	c	〃
3083	〃	Pul-i-Khumri	—	—	c	〃
3085	〃	Maimana	—	—	c	〃
3086	〃	〃	—	—	c	〃
3087	〃	〃	—	—	c	〃
3088	〃	〃	—	—	c	〃
3089	〃	〃	—	—	c*	〃
3090	〃	〃	—	—	c	〃
3091	〃	〃	—	—	c	〃
3092	〃	〃	—	—	c	〃
3097	Iran	Mashhad	—	—	c	〃

Table 2. (Continued)

3098	Iran	Mashhad	—	—	c	$ne_1ne_2ch_1Ch_2$
3099	〃	〃	—	—	c	〃
3100	〃	〃	—	—	c	〃
3101	〃	Sabzawar	—	—	c	〃
3102	〃	〃	—	—	c	〃
3103	〃	〃	—	—	c	〃
3104	〃	〃	—	—	c	〃
3105	〃	〃	—	—	c	〃
3106	〃	〃	—	?	c	ne_1 ? ch_1Ch_2
3108	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3109	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3110	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3112	〃	〃	—	—	c	〃
3113	〃	Shahrud	—	—	c	〃
3114	〃	〃	—	—	c	〃
3115	〃	〃	—	—	c	〃
3116	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3118	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3119	〃	Semnan	—	?	c	ne_1 ? ch_1Ch_2
3120	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3121	〃	Isfahan	—	—	c	〃
3122	〃	〃	—	—	c	〃
3123	〃	〃	—	—	c	〃
3124	〃	〃	—	—	c	〃
3125	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3126	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3127	〃	〃	—	—	c	〃
3129	〃	〃	—	—	c	〃
3130	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3131	〃	〃	n	—	c	〃
3132	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$

Table 2. (Continued)

3134	Iran	Isfahan	—	—	c	$ne_1ne_2ch_1Ch_2$
3135	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3137	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3138	〃	〃	—	—	c	〃
3139	〃	〃	—	—	c	〃
3140	〃	〃	—	—	c	〃
3141	〃	Damaneh	—	—	c	〃
3142	〃	〃	—	—	c	〃
3144	〃	〃	—	—	c	〃
3145	〃	〃	—	—	c	〃
3146	〃	〃	—	—	c	〃
3147	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3151	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3152	〃	〃	—	—	c	〃
3153	〃	〃	—	—	c	〃
3155	〃	〃	—	—	c	〃
3156	〃	〃	—	—	c	〃
3157	〃	〃	n	—	?	$Ne_1ne_2ch_1$?
3160	〃	Tehran	—	—	c	$ne_1ne_2ch_1Ch_2$
3162	〃	Karaj	—	—	c	〃
3163	〃	〃	—	—	c	〃
3164	〃	〃	—	—	c	〃
3167	〃	〃	—	—	c	〃
3169	〃	〃	—	—	c	〃
3171	〃	〃	—	—	c	〃
3175	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3176	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3179	〃	Sari	n	—	c	$Ne_1ne_2ch_1Ch_2$
3180	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3181	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3182	〃	〃	—	—	c	〃

Table 2. (Continued)

3183	Iran	Sari	n	—	c	$Ne_1ne_2ch_1Ch_2$
3184	〃	〃	n	—	c	〃
3185	〃	〃	n	—	c	〃
3186	〃	〃	n	—	c	〃
3187	〃	〃	n	—	c	〃
3188	〃	〃	n	—	c	〃
3189	〃	Gorgan	—	—	c	$ne_1ne_2ch_1Ch_2$
3190	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3191	〃	Shahrud	—	—	c	$ne_1ne_2ch_1Ch_2$
3193	〃	〃	—	—	c	〃
3194	〃	〃	—	—	c*	〃
3197	〃	〃	—	—	?	$ne_1ne_2ch_1$?
3198	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3199	〃	〃	—	—	c	〃
3201	〃	Tehran	—	—	c	〃
3202	〃	〃	—	—	c	〃
3203	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3205	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3206	〃	〃	—	—	c	〃
3210	〃	〃	—	—	c	〃
3211	〃	〃	—	?	c	ne_1 ? ch_1Ch_2
3213	〃	Firuzkuh	—	—	c	$ne_1ne_2ch_1Ch_2$
3216	〃	〃	—	—	c	〃
3217	〃	〃	—	—	c	〃
3226	〃	〃	—	—	c*	〃
3227	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3229	〃	Sari	n	—	c	〃
3230	〃	Behshahr	n	—	c	〃
3231	〃	〃	n	—	c	〃
3232	〃	Chalus	n	—	c	〃
3233	〃	〃	n	—	c	〃

Table 2. (Continued)

3234	Iran	Chalus	—	—	c	$ne_1ne_2ch_1Ch_2$
3235	〃	Pahlavi	n	—	c	$Ne_1ne_2ch_1Ch_2$
3236	〃	Astara	n	—	c	〃
3237	〃	〃	n	—	c	〃
3239	〃	〃	n	—	c	〃
3240	〃	〃	n	—	c	〃
3241	〃	Ardabil	n	—	c	〃
3242	〃	〃	n	—	c	〃
3243	〃	〃	n	—	c	〃
3244	〃	〃	n	—	c	〃
3245	〃	〃	n	—	c	〃
3246	〃	〃	n	—	c	〃
3247	〃	〃	n	—	c	〃
3248	〃	〃	n	—	c	〃
3249	〃	〃	n	—	c	〃
3250	〃	〃	n	—	c	〃
3252	〃	〃	n	—	c	〃
3254	〃	〃	n	?	c	〃
3255	〃	〃	n	—	?	$Ne_1ne_2ch_1$?
3256	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3257	〃	Sarab	n	—	c	〃
3259	〃	〃	n	—	c	〃
3260	〃	〃	n	—	c	〃
3261	〃	〃	n	—	c	〃
3262	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3263	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3264	〃	〃	n	—	c	〃
3265	〃	〃	n	—	c	〃
3270	〃	〃	n	—	c	〃
3272	〃	Tabriz	n	—	c	〃
3273	〃	〃	n	—	c	〃

Table 2. (Continued)

3274	Iran	Tabriz	n	—	c	$Ne_1ne_2ch_1Ch_2$
3275	〃	〃	n	—	c	〃
3276	〃	〃	—	—	c	$ne_1ne_2ch_1Ch_2$
3280	〃	〃	—	—	c	〃
3281	〃	〃	—	—	c	〃
3282	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3283	〃	Miyanduab	n	—	c	〃
3286	〃	Mahabad	n	—	c	〃
3288	〃	〃	n	—	c	〃
3289	〃	Rezaiyeh	—	—	c	$ne_1ne_2ch_1Ch_2$
3291	〃	Khoy	—	—	c	〃
3292	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3293	〃	〃	n	—	c	〃
3294	〃	〃	—	?	c	ne_1 ? ch_1Ch_2
3295	〃	Marand	—	—	c	$ne_1ne_2ch_1Ch_2$
3296	〃	〃	—	—	c	〃
3297	〃	〃	n	—	c	$Ne_1ne_2ch_1Ch_2$
3298	〃	Karaj	—	—	c	$ne_1ne_2ch_1Ch_2$

* Completely lethal chlorosis, —: normal, n: necrotic, c: chlorotic, ?: no hybrid obtained or genotype partially undetermined.

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List of *Aegilops* collected by BMUK, 1959

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Aegilops strains were collected in Egypt, Lebanon, Jordan, Syria, Turkey, Greece and Italy by the Botanical Mission of University of Kyoto (BMUK) to the Eastern Mediterranean Countries in 1959. They are maintained at the Research Institute for the Agricultural Plants, Faculty of Agriculture, Kyoto University, Kyoto, Japan. Variety names have been determined by TANAKA according to Eig (1929).

Aegilops mutica Boiss. (n=7)

Stock No.	Variety	Locality	
5501	var. *loliacea* Eig	12 km NW of Yerköy (Yozğat—Cerikli),	Turkey
5502	〃	〃	〃
5503	〃	〃	〃
5521	var. *typica* Boiss.	Denizli,	〃
5522	〃	〃	〃

Aegilops speltoides Tausch and *Ae. aucheri* Boiss. (n=7)

Stock No.	Variety	Locality	
5702 A	*aucheri* var. *typica*	16 km W of Amasya (Amasya—Corum),	Turkey
B	〃 var. *polyathera* Eig	〃	〃
C	*speltoides*	〃	〃
D	〃	〃	〃
5704	〃	6 km SE of Cerikli (Cerikli—Yozgat),	〃
5714 A	*aucheri* var. *typica*	〃	〃
B	〃 var. *polyathera* Eig	〃	〃
5715	*speltoides*	〃	〃
5716 A	〃	〃	〃
B	〃	〃	〃
5719	*aucheri* var. *typica*	〃	〃
5720 A	*speltoides*	〃	〃
B	*aucheri* var. *polyathera* Eig	〃	〃
C	〃 var. *typica*	〃	〃
5725 A	*speltoides*	12 km NE of Ankara,	〃
B	〃	〃	〃
C	〃	〃	〃
D	〃	〃	〃
E	〃	〃	〃

Aegilops longissima Schweinf. *et* Mushl. (n=7)

Stock No.	Variety	Locality	
5751	new variety (*nova*)	13 km N of Hebron (Hebron—Jerusalem),	Jordan
5752	var. *typica*	16 km E of Dead Sea (Dead Sea—Amman),	〃
5754	〃	Basin of the Jordan River (Amman—Salt—Dead Sea),	〃
5755	〃	Suburbs of Ramtha (Amman—Damascus),	Syria
5756	〃	Suburbs of Gabagib (A) (Amman—Damascus),	〃
5758	new variety (*nova*)	〃	〃
5760	var. *typica*	Suburbs of Gabagib (B) (Amman—Damascus),	〃

Aegilops bicornis (Forsk.) Jaub. *et* Sp. (n=7)

Stock No.	Variety	Locality	
5782	var. *typica*	Matruh,	Egypt
5783	〃	〃	〃
5786	〃	21 km W of Alexandria (A) (Alexandria—Cairo),	〃
5787	〃	〃	〃
5788	〃	〃	〃
5790	〃	21 km W of Alexandria (B) (Alexandria—Cairo),	〃
5791	var. *mutica* (Aschers.) Eig	〃 (C) (〃),	〃
5793	var. *typica*	〃	〃

Aegilops heldreichii (Holz.) Eig and *Aegilops uniaristata* Vis. (n=7)

Stock No.	Variety	Locality	
5801	*heldreichii* var. *subventricosa* Boiss.	39 km W of Ismit (Istanbul—Izmit),	Turkey
5804	〃	65 km W of Izmit (〃),	〃
5805	〃	〃	〃
5806	〃	64 km W of Izmit (Istanbul—Izmit),	〃
5807	〃	In the ruins of Olympia,	Greece
5809	〃	Drouva's hill in Olympia,	〃
5810	〃	〃	〃

5812	*heldreichii* var. *subventricosa* Boiss.	Drouva's hill in Olympia,	Greece
5813	〃	〃	〃
5814	*heldreichii* var. *biaristata* Eig	Chania—Souda, Crete Island,	〃
5816	〃	〃	〃
5817	〃	〃	〃
5819	*uniaristata*	In the ruins of Olympia,	〃
5820	〃	〃	〃

Aegilops caudata L. (n=7)

Stock No.	Variety	Locality	
5851	var. *typica*	11 km S of Ma'aret el Nu'man (Aleppo—Hama),	Syria
5852	var. *polyathera* Boiss.	16 km W of Amasya (Corum—Amasya),	Turkey
5853	〃	6 km NW of Cerikli (Cerikli—Yozgat),	〃
5854	〃	17 km SW of Sungurlu (Cerikli—Sungurlu),	〃
5855	〃	3 km W of Kirikkale (Ankara—Kirikkale),	〃
5856	〃	27 km NW of 〃 (〃),	〃
5857	〃	12 km NE of Ankara,	〃
5858	〃	12 km E of Ayas (Ayas—Ankara),	〃
5859	〃	22 km W of Ayas,	〃
5860	〃	58 km S of Ankara,	〃
5862	〃	38 km E of Sivrihisar (Ankara—Eskisehir),	〃
5863	〃	10 km W of 〃 (〃),	〃
5864	var. *typica*	17 km W of Karacabey (Bursa—Bandirma),	〃
5865	var. *polyathera* Boiss.	Kayseri,	〃
5867	〃	Suburbs of Akseki,	〃
5868	var. *typica*	Suburbs of Volos,	Greece
5871	〃	In the ruins of Olympia,	〃
5872	〃	Olympia,	〃
5873	〃	〃	〃
5874	〃	〃	〃
5875	〃	Drouva's hill in Olympia,	〃
5876	〃	〃	〃

5877	var. *typica*	Chania—Souda, Crete Island,	Greece
5878	〃	〃	〃
5879	〃	〃	〃
5880	〃	〃	〃
5881	〃	〃	〃
5884	〃	Iraklion, Crete Island,	〃

Aegilops umbellulata ZHUK. (n=7)

Stock No.	Variety	Locality	
5901	var. *typica*	6 km W of Qatana (Damascus—Mt. Hermon),	Syria
5902	〃	〃	〃
5903	〃	6 km N of Amasya (Samsun—Amasya),	Turkey
5904	〃	Amasya (stony mountain side),	〃
5906	〃	〃	〃
5907	〃	〃	〃
5908	〃	〃	〃
5910	〃	20 km E of Mecitözü (Amasya—Corum),	〃
5911	〃	14 km NE of Corum (Corum—Alicik),	〃
5912	〃	3 km W of Kirikkale (Ankara—Kirikkale),	〃
5913	〃	27 km NW of 〃 (〃),	〃
5914	〃	20 km E of Ankara (〃),	〃
5915	〃	12 km NW of Ankara,	〃
5918	〃	8 km NE of 〃	〃
5919	〃	8.5 km NE of 〃	〃
5920	〃	In the garden of Japanese Embassy in Ankara,	〃
5922	〃	〃	〃
5923	〃	20 km N of Ankara (Bolu—Ankara),	〃
5924	〃	10 km S of Pazar (〃),	〃
5925	〃	12 km E of Ayas (Ayas—Ankara),	〃
5926	〃	5 km E of 〃 (〃),	〃
5927	〃	Ayas,	〃
5928	〃	22km W of Ayas,	〃

5930	var. *typica*	22 km W of Ayas,	Turkey
5931	〃	10 km W of Sivrihisar (Ankara—Eskisehir),	〃
5933	〃	6 km S of Ankara,	〃
5934	〃	Suburbs of Kayseri,	〃
5935	〃	Akseki (A),	〃
5936	var. *pilosa* EIG	〃 (A),	〃
5937	var. *typica*	〃 (B),	〃
5938	〃	〃 (B),	〃
5939	var. *pilosa* EIG	Burdur (A),	〃
5940	〃	Suburbs of Burdur (A),	〃
5941	var. *typica*	〃 (A),	〃
5942	var. *pilosa* EIG	〃 (A),	〃
5943	var. *typica*	〃 (C),	〃
5944	〃	〃 (D),	〃
5946	〃	〃 (D),	〃
5947	var. *pilosa* EIG	〃 (E),	〃
5948	var. *typica*	Denizli,	〃
5949	〃	Suburbs of Bergama (A),	〃
5950	〃	〃 (B),	〃
5951	〃	〃 (C),	〃
5952	〃	〃 (D),	〃
5953	〃	Suburbs of Kutahia,	〃
5954	〃	〃	〃

Aegilops ovata L. (n=14)

Stock No.	Variety	Locality	
6001	var. *vulgaris* EIG	13 km E of Jerusalem (Dead Sea—Jerusalem),	Jordan
6002	〃	10 km S of Bethlehem (Jerusalem—Hebron),	〃
6003	〃	Jerusalem,	〃
6004	〃	In the garden of the Shepherd Hotel, Jerusalem,	〃
6006	〃	17 km E of Jerusalem (Jerusalem—Dead Sea),	〃
6007	〃	1 km E of Salt (Amman—Salt—Dead Sea),	〃

6008	var. *vulgaris* EIG	9 km NE of Salt (Amman—Salt—Dead Sea),	Jordon
6009	〃	30 km S of Saida,	Lebanon
6010	〃	4 km NE of Jida (Beirut—Damascus),	〃
6011	〃	5 km W of Damascus (Beirut—Damascus),	Syria
6012	〃	6 km W of Qatana (Damascus—Mt. Hermon),	〃
6014	〃	20 km N of Quteifeh (Damascus—Homs),	〃
6015	〃	〃	〃
6016	var. *africana* EIG	5 km N of Deir Atiye (Damascus—Homs),	〃
6017	var. *vulgaris* EIG	12 km S of Homs (Damascus—Homs),	〃
6018	〃	11 km S of Ma'aret el Nu'man (Homs—Aleppo),	〃
6019	〃	8 km N of 〃 (〃),	〃
6020	〃	Air Port of Aleppo,	〃
6021	var. *hirsuta* EIG	10 km SW of Kirikhan (Aleppo—Adana),	Turkey
6022	var. *vulgaris* EIG	〃	〃
6023	var. *hirsuta* EIG	4 km NE of Belen (Aleppo—Adana),	〃
6024	var. *vulgaris* EIG	Suburbs of 〃 (〃),	〃
6027	〃	59 km S of Pozanti (Adana—Ankara),	〃
6028	〃	16 km SW of Samsun (Corum—Samsun),	Syria
6031	〃	15 km SW of Havze (〃),	〃
6032	〃	22 km NE of Corum (〃),	〃
6033	〃	9 km NE of 〃 (〃),	〃
6034	〃	5 km N of Amasya (Samsun—Amasya),	〃
6035	〃	Amasya (stony mountain side),	〃
6036	〃	28 km SW of Corum (Sungurlu—Corum),	〃
6037	〃	33 km E of Izmit (Izmit—Bolu),	〃
6038	〃	59 km W of 〃 (〃),	〃
6039	〃	7 km W of 〃 (〃),	〃
6040	〃	61 km W of 〃 (〃),	〃
6041	〃	65 km W of 〃 (〃),	〃
6042	〃	28 km E of Istanbul (Izmit—Bolu),	〃
6043	〃	20 km E of 〃 (〃),	〃
6044	〃	12 km E of 〃 (〃),	〃
6045	〃	28 km E of Karacabey (Bursa—Bandirma),	〃

6047	var. *vulgaris* Eig	8 km W of Karacabey (Bursa—Bandirma),	Syria
6048	〃	11 km W of 〃 (〃),	〃
6049	〃	16 km W of 〃 (〃),	〃
6050	〃	〃	〃
6051	〃	20 km W of Karacabey (Bursa—Bandirma),	〃
6052	〃	8 km W of Bandirma (Bandirma—Gönen),	〃
6053	〃	1 km SW of Edincik (〃),	〃
6054	〃	7 km SW of 〃 (〃),	〃
6055	〃	〃	〃
6056	〃	12 km SW of Edincik (Bandirma—Gönen),	〃
6057	〃	3 km SW of 〃 (〃),	〃
6058	〃	10 km SW of 〃 (〃),	〃
6059	〃	13 km NE of Gönen (〃),	〃
6060	〃	Suburbs of Bergama,	〃
6061	〃	Lachanas,	Greece
6062	〃	〃	〃
6063	〃	Suburbs of Vasilika,	〃
6064	〃	〃	〃
6065	〃	〃	〃
6066	〃	〃	〃
6067	〃	Chania—Souda, Crete Island,	〃
6068	〃	40 km SE of Rome (Rome—Naples),	Italy
6069	〃	7 km SE of Fondi (〃),	〃
6070	〃	33 km NW of Naples (〃),	〃
6071	〃	20 km NW of 〃 (〃),	〃
6072	〃	Suburbs of Palermo (A) Sicily Island,	〃
6073	〃	〃 (B) 〃	〃
6074	〃	〃 (C) 〃	〃
6075	〃	In the ruins of Agrigento, Sicily Island,	〃
6076	〃	〃	〃
6077	〃	Suburbs of Agrigento, Sicily Island,	〃
6078	〃	〃	〃
6079	〃	〃	〃

6080	var. *vulgaris* EIG	Suburbs of Agrigento, Sicily Island,	Itary
6081	〃	〃	〃
6082	〃	Collection of University of Pavia,	〃
6083	〃	〃	〃
6085	var. *brachyathera* (POMEL) EIG	Cyprus Island	
6087	var. *hirsuta* EIG	〃	
6748	var. *brachyathera* (POMEL) EIG	Chania—Souda, Crete Island,	Greece
6749	〃	Suburbs of Agrigento, Sicili Island,	Italy
6750	〃	Cyprus Island	
6752	〃	〃	

Aegilops triaristata WILD. (n=14 or 21)

Stock No.	Variety		Locality	
6201	4x	var. *vulgaris* EIG	59 km S of Pozanti (Adana—Ankara),	Turkey
6202	〃	〃	Konya—Beysehir,	〃
6204	〃	〃	Akseki (A) (Konya—Antalya),	〃
6205	〃	〃	〃 (A)	〃
6206	〃	〃	〃 (A)	〃
6210	〃	〃	〃 (B)	〃
6211	〃	〃	〃 (B)	〃
6214	〃	〃	〃 (C)	〃
6215	〃	〃	〃 (D)	〃
6216	〃	〃	〃 (D)	〃
6217	〃	〃	Serik,	〃
6218	〃	〃	Perge (A),	〃
6219	〃	〃	〃 (B),	〃
6220	〃	〃	〃 (B),	〃
6221	〃	〃	〃 (B),	〃
6222	〃	〃	Suburbs of Antalya,	〃
6223	〃	〃	12 km NE of Ankara,	〃
6224	〃	〃	〃	〃
6225	〃	〃	〃	〃

6227	4x	var. *vulgaris* EIG	12 km NE of Ankara,	Turkey
6229	〃	〃	〃	〃
6230	〃	〃	In the garden of Japanese Embassy in Ankara,	〃
6231	〃	〃	〃	〃
6232	〃	〃	5 km E of Ayas (Ayas—Ankara),	〃
6233	〃	var. *trojona* EIG	5 km S of Kizilcahamam (Ankara—Bolu),	〃
6235	〃	var. *vulgaris* EIG	〃	〃
6236	〃	〃	28 km E of Bolu (Ankara—Bolu),	〃
6238	〃	〃	59 km W of Izmit (Izmit—Istanbul),	〃
6240	〃	var. *quadriaristata* EIG	60 km W of 〃 (〃),	〃
6241	〃	〃	65 km W of 〃 (〃),	〃
6242	〃	〃	64 km W of 〃 (〃),	〃
6243	〃	var. *vulgaris* EIG	〃	〃
6244	〃	〃	Suburbs of Kutahya (A),	〃
6245	〃	〃	〃 (B),	〃
6247	〃	〃	〃 (C),	〃
6250	〃	〃	〃 (C),	〃
6251	〃	〃	10 km W of Bursa (Bursa—Bandirma),	〃
6252	〃	〃	〃	〃
6253	〃	〃	〃	〃
6254	〃	〃	14 km W of Karacabey (Bursa—Bandirma),	〃
6256	〃	〃	16 km W of 〃 (〃),	〃
6257	〃	〃	20 km W of 〃 (〃),	〃
6258	〃	〃	〃	〃
6260	〃	〃	1 km E of Edincik (Bandirma—Gönen),	〃
6261	〃	〃	10 km E of 〃 (〃),	〃
6262	6x	〃	〃	〃
6263	〃	〃	13 km N of Gönen (Bandirma—Gönen),	〃
6265	4x	〃	〃	〃
6266	〃	〃	Suburbs of Bergama,	〃
6267	〃	〃	Unknown,	〃
6268	〃	〃	〃	〃
6270	〃	〃	Lachanas,	Greece

6271	4x	var. *vulgaris* Eig	Lachanas,	Greece
6273	〃	〃	Vasilika,	〃
6276	〃	〃	Volos,	〃
6277	6x	〃	〃	〃
6278	〃	〃	Portaria,	〃
6280	〃	〃	〃	〃
6282	〃	〃	〃	〃
6283	〃	〃	〃	〃
6286	〃	〃	Tripolis,	〃
6289	〃	〃	〃	〃
6290	〃	〃	〃	〃
6291	〃	〃	Suburbs of Tripolis,	〃
6293	〃	〃	〃	〃
6295	〃	〃	In the ruins of Olympia,	〃
6298	〃	〃	〃	〃
6299	〃	〃	〃	〃
6300	〃	〃	〃	〃
6303	〃	〃	〃	〃
6305	〃	〃	Olympia,	〃
6308	〃	〃	〃	〃
6309	〃	〃	〃	〃
6310	〃	〃	〃	〃
6311	〃	〃	〃	〃
6312	〃	〃	〃	〃
6313	〃	〃	Drouva's hill in Olympia,	〃
6314	〃	〃	〃	〃
6317	〃	〃	〃	〃
6318	〃	〃	〃	〃
6319	〃	〃	〃	〃
6320	〃	〃	〃	〃
6322	〃	〃	〃	〃
6324	〃	〃	〃	〃
6326	〃	〃	〃	〃

6327	6x	var. *vulgaris* EIG	Drouva's hill in Olympia,	Greece
6328	〃	〃	〃	〃
6330	〃	〃	〃	〃
6332	〃	〃	〃	〃
6333	〃	〃	〃	〃
6335	〃	〃	〃	〃
6336	〃	〃	〃	〃
6338	〃	〃	〃	〃
6341	〃	〃	〃	〃
6342	〃	〃	〃	〃
6343	〃	〃	〃	〃
6345	〃	〃	〃	〃
6347	〃	〃	〃	〃
6348	〃	〃	Suburbs of Rome (A),	Italy
6350	〃	〃	〃 (A),	〃
6351	〃	〃	〃 (B),	〃
6354	〃	〃	〃 (C),	〃
6357	〃	〃	25 km SE of Rome (Rome—Naples),	〃
6358	〃	〃	Collection of University of Pavia,	〃
6359	〃	〃	〃	〃
6360	〃	〃	〃	〃

Aegilops biuncialis Vis.

Stock No.	Variety	Locality	
6401	var. *typica*	5 km W of Damascus (Beirut—Damascus),	Syria
6402	〃	8 km N of Ma'aret el Nu'man (Homs—Aleppo),	〃
6404	〃	10 km SW of Kirikhan (Aleppo—Adana),	Turkey
6405	〃	Airpot of Aleppo,	Syria
6406	〃	10 km SW of Kirikhan (Aleppo—Adana),	Turkey
6407	var. *macrochaeta* (Susttl. *et* Huet) Eig	〃	〃
6408	var. *ty*pica	〃	〃
6410	〃	Suburbs of Belen (Aleppo—Adana),	〃
6411	var. *archipelagica* Eig	〃	〃
6412	〃	〃	〃
6413	var. *macrochaeta* (Shuttl. *et* Huet) Eig	10 km SW of Havza (Corum—Samsun),	〃
6414	var. *typica*	19 km SE of Suluova (Samsun—Amasya),	〃
6415	var. *macrochaeta* (Shuttl. *et* Huet) Eig	5 km N of Amasya (〃),	〃
6416	〃	3 km N of 〃 (〃),	〃
6417	〃	Amasya (stony mountain side),	〃
6420	〃	〃	〃
6423	〃	〃	〃
6424	〃	24 km E of Mecitözü (Amasya—Corum),	〃
6427	〃	43 km NE of Yozgat (Corum—Yozgat),	〃
6428	〃	19 km NE of Cerikli (Cerikli—Sungurlu),	〃
6429	〃	13 km NE of 〃 (〃),	〃
6430	〃	15 km NE of Kirikkale (Cerikli—Kirikkale),	〃
6431	〃	27 km NW of 〃 (Ankara—Kirikkale),	〃
6432	〃	33 km NW of 〃 (〃),	〃
6433	〃	In the garden of Japanese Embassy in Ankara,	〃
6434	〃	〃	〃
6435	var. *typica*	〃	〃
6437	var. *macrochaeta* (Shuttl. *et* Huet) Eig	20 km W of Ayas,	〃
6438	〃	23 km W of 〃	〃
6439	〃	Ayas,	〃

6440	var. *macrochaeta* (Shuttl. *et* Huet) Eig	61 km S of Ankara,	Turkey
6442	〃	10 km W of Sivrihisar (Ankara—Eskisehir),	〃
6443	〃	48 km SE of Eskisehir (〃),	〃
6444	〃	28 km NW of 〃 (Eskisehir—Bursa),	〃
6446	var. *archipelagica* Eig	28 km E of Karacabey (Bursa—Bandirma),	〃
6447	var. *macrochaeta* (Shuttl. *et* Huet) Eig	〃	〃
6448	var. *typica*	8 km W of Karacabey (Bursa—Bandirma),	〃
6449	var. *macrochaeta* (Shuttl. *et* Huet) Eig	14 km W of 〃 (〃),	〃
6450	〃	20 km W of 〃 (〃),	〃
6451	var. *macrochaeta* (Shuttl. *et* Huet) Eig	〃	〃
6452	〃	10 km SW of Edincik (Bandirma—Gönen),	〃
6453	var. *archipelagica* Eig	13 km NE of Gönen (〃),	〃
6456	var. *macrochaeta* (Shuttl. *et* Huet) Eig	65 km W of Izmit (Istanbul—Izmit),	〃
6457	var. *typica*	64 km W of Izmit (〃),	〃
6458	〃	Burdur (A),	〃
6459	〃	〃 (B),	〃
6460	〃	〃 (C),	〃
6461	var. *macrochaeta* (Shuttl. *et* Huet) Eig	〃 (D),	〃
6463	〃	〃 (E),	〃
6464	var. *typica*	Denizli (A),	〃
6465	〃	〃 (A),	〃
6466	var. *archipelagica* Eig	〃 (B),	〃
6467	var. *typica*	〃 (C),	〃
6469	〃	〃 (C),	〃
6470	var. *macrochaeta* (Shuttl. *et* Huet) Eig	Suburbs of Bergama,	〃
6472	〃	Efes,	〃
6473	var. *typica*	Lachanas,	Greece
6474	var. *archipelagica* Eig	Suburbs of Vasilika,	〃
6476	var. *typica*	Volos,	〃
6478	〃	Portaria,	〃
6480	var. *macrochaeta* (Shuttl. *et* Huet) Eig	Chania—Souda, Crete Island,	〃
6481	var. *archipelagica* Eig	〃	〃
6483	〃	〃	〃

6484	var. *archipelagica* Eig	Iraklion, Crete Island,	Greece
6485	〃	〃	〃
6488	var. *macrochaeta* (Shuttl. *et* Huet) Eig	Suburbs of Tripolis,	〃
6489	var. *typica*	Drouva's hill in Olympia,	〃
6490	〃	In the ruins of Elevsis, Dophini (near Athens),	〃
6491	var. *macrochaeta* (Shuttl. *et* Huet) Eig	Dophini—Athens,	〃
6492	var. *typica*	Volos,	〃
6493	〃	Portaria,	〃
6495	〃	〃	〃
6496	〃	〃	〃
6497	var. *archipelagica* Eig	Vasilika,	〃
6498	〃	〃	〃
6499	var. *macrochaeta* (Shuttl. *et* Heut) Eig	Lachanas,	〃
6500	var. *typica*	〃	〃

Aegilops columnaris Zhuk. (n=14)

Stock No.	Variety	Locality	
6551	var. *typica*	20 km N of Ankara (Bolu—Ankara),	Turkey
6552	〃	8 km NE of 〃 (〃),	〃
6553	〃	8.5 km NE of 〃 (〃),	〃
6554	〃	In the garden of Japanese Embassy in Ankara,	〃

Aegilops variabilis Eig and *Ae. kotschyi* Boiss. (n=14)

Stock No.	Variety	Locality	
6601	*kotschyi* var. *palaestina* Eig	69 km N of Rest House (Cairo—Alexandria),	Egypt
6603	〃	68 km N of 〃 (〃),	〃
6604	〃	〃	〃
6605	〃	〃	〃
6609	〃	69 km N of 〃 (〃),	〃
6610	〃	72 km N of 〃 (〃),	〃
6611	〃	77 km N of 〃 (〃),	〃

6612	*kotschyi* var. *palaestina* EIG	77 km N of Rest House (Cairo—Alexandria),	Egypt
6613	〃	21 km W of Alexandria (Alexandria—Cairo),	〃
6614	〃	118 km E of Matruh (Alexandria—Matruh),	〃
6615	〃	114 km E of 〃 (〃),	〃
6616	〃	72 km E of 〃 (〃),	〃
6617	〃	66 km E of 〃 (〃),	〃
6618	〃	49 km E of 〃 (〃),	〃
6619	〃	35 km E of 〃 (〃),	〃
6620	〃	Matruh,	〃
6621	〃	〃	〃
6622	〃	〃	〃
6623	*variabilis* var. *peregrina* (HACKEL) EIG *et* FEINBRUN	7 km S of Jerusalem (Jerusalem—Hebron),	Jordan
6625	〃 var. *multiaristata* EIG *et* FEINBRUN	〃	〃
6626	*kotschyi* var. *leptostachya* (BORNM.) EIG	Jerusalem,	〃
6627	〃 var. *palaestina* EIG	In the garden of the Shepherd Hotel, Jerusalem,	〃
6628	*variabilis* var. *intermedia* EIG *et* FEINBRUN	〃	〃
6630	〃	13 km E of Jerusalem (Dead Sea—Jerusalem),	〃
6631	*variabilis var. typica*	〃	〃
6632	〃	〃	〃
6633	*variabilis* var. *intermedia* EIG *et* FEINBRUN	〃	〃
6634	〃 var. *typica*	〃	〃
6636	〃	〃	〃
6637	*kotschyi* var. *leptostachya* (BORNM.) EIG	〃	〃
6638	*variabilis* var. *intermedia* EIG *et* FEINBRUN	〃	〃
6639	*kotschyi* var. *palaestina* EIG	21 km W of Dead Sea Hotel (Dead Sea—Jerusalem),	〃
6641	〃	〃	〃
6642	*variabilis* var. *brachyathera* EIG *et* FEINBRUN	〃	〃
6643	〃	5 km S of Jiftlik (Dead Sea—Jiftlik),	〃
6644	*variabilis* var. *elongata* EIG *et* FEINBRUN	〃	〃
6645	〃 var. *brachyathera* EIG *et* FEINBRUN	〃	〃
6647	〃	〃	〃
6649	〃	〃	〃
6650	*variabilis* var. *brachyathera* EIG *et* FEINBRUN	〃	〃

6655	*variabilis* var. *brachyathera* Eig *et* Feinbrun	5 km S of Jiftlik (Dead Sea—Jiftlik),	Jardon
6658	〃	〃	〃
6660	〃	〃	〃
6661	*variabilis* var. *typica*	〃	〃
6663	〃	9 km NW of 〃 (〃),	〃
6664	*variabilis* var. *intermedia* Eig *et* Feinbrun	〃	〃
6665	〃 var. *brachyathera* Eig *et* Feinbrun	24 km NW of 〃 (〃),	〃
6666	〃	Basin of the Jordan River (A) (Amman—Salt—Dead Sea),	〃
6668	〃	〃	〃
6671	*variabilis* var. *elongata* Eig *et* Feinbrun	〃	〃
6672	〃 var. *brachyathera* Eig *et* Feinbrun	〃	〃
6675	〃 var. *aristata* Eic *et* Feindrum	〃	〃
6676	〃	〃	〃
6677	*kotschyi* var. *leptostachya* (Bornm.) Eig	〃	〃
6679	*variabilis* var. *aristata* Eig *et* Feinbrum	〃	〃
6681	〃 var. *elongata* Eig *et* Feinbrum	〃	〃
6684	〃 var. *brachyathera* Eig *et* Feinbrum	〃	〃
6685	〃 var. *elongata* Eig *et* Feinbrum	〃	〃
6686	〃 var. *brachyathera* Eig *et* Feinbrum	〃	〃
6687	〃	〃	〃
6689	〃	〃	〃
6690	*variabilis* var. *elongata* Eig *et* Feinbrum	〃	〃
6692	*kotschyi* var. *typica*	〃	〃
6693	〃 var. *leptostachya* (Bornm.) Eig	〃	〃
6695	〃	〃	〃
6696	*variabilis* var. *intermedia* Eig *et* Feinbrum	Basin of the Jordan River (B) (Amman—Salt—Dead Sea),	〃
6697	〃 var. *multiaristata* Eig *et* Feinbrum	〃	〃
6698	〃 var. *intermedia* Eig *et* Feinbrum	〃	〃
6700	〃 var. *brachyathera* Eig *et* Feinbrum	〃	〃
6701	〃 var. *elongata* Eig *et* Feinbrum	〃	〃
6702	*kotschyi* var. *typica*	16 km E of Dead Sea (Dead Sea—Amman),	〃
6704	〃	26 km E of 〃 (〃),	〃
6706	*variabilis* var. *typica*	〃	〃

6707	*variabilis* var. *typica*	26 km E of Dead Sea (Dead Sea—Amman),	Jordan
6708	〃	〃	〃
6709	*variabilis* var. *intermedia* Eig *et* Feinbrum	〃	〃
6710	〃 var. *typica*	〃	〃
6711	〃	30 km NE of Dead Sea (Dead Sea—Amman),	〃
6712	*variabilis* var. *intermedia* Eig *et* Feinbrum	9 km NW of Salt (Amman—Salt—Dead Sea),	〃
6713	〃	〃	〃
6715	〃	7 km NW of 〃 (〃),	〃
6717	*variabilis* var. *peregrina* (Hackel) Eig *et* Feinbrum	〃	〃
6718	〃 var. *multiaristata* Eig *et* Feinbrum	1 km E of 〃 (〃),	〃
6719	〃	9 km NW of 〃 (〃),	〃
6721	*variabilis* var. *typica*	4 km E of 〃 (〃),	〃
6722	*kotschyi* var. *palestina* Eig	40 km NE of Amman (Damascus—Amman),	〃
6724	〃	〃	〃
6725	*variabilis* var. *multiaristata* Eig *et* Feinbrum	Beirut,	Lebanon
6727	〃	〃	〃
6728	〃	〃	〃
6730	*variabilis* var. *typica*	Biblos,	〃
6732	〃 var. *intermedia* Eig *et* Feinbrum	Airport of Beirut,	〃
6734	〃	〃	〃
6737	*kotschyi* var. *palaestina* Eig	6 km W of Qatana (Damascus—Mt. Hermon),	Syria
6739	〃	5 km W of Damascus (Beirut—Damascus),	〃
6740	*variabilis* var. *intermedia* Eig *et* Feinbrum	36 km N of 〃 (Damascus—Homs),	〃
6741	*kotschyi* var. *typica*	5 km N of Deir Ataiyé (〃),	〃
6742	〃	〃	〃
6743	*variabilis* var. *intermedia* Eig *et* Feinbrum	Suburbs of Dana (Aleppo—Adana),	〃
6744	〃	Suburbs of Belen (〃),	Turkey
6745	*variabilis* var. *multiaristata* Eig *et* Feinbrum	〃	〃
6746	*kotschyi* var. *leptostachya* (Bornm.) Eig	〃	〃
6747	〃 var. *palaestina* Eig	16 km W of Karacabey (Bursa—Bandirma),	〃
6754	*variabilis* var. *plarispicula* Eig *et* Feinbrum	Cyprus Island	
6755	〃 var. *brachyathera* Eig *et* Feinbrum	〃	
6756	〃 var. *typica*	〃	

6757	*variabilis* var. *brachyathera* Eig *et* Feinbrum	Cyprus Island
6758	〃	〃

Aegilops triuncialis L. (n=14)

Stock No.	Variety	Locality	
6801	subsp. *eu-triuncialis* Eig var. *typica*	Suburbs of Dana (Aleppo—Adana),	Syria
6802	〃	10 km SW of Kirikhan (〃),	Turkey
6803	〃	Suburbs of Belen (〃),	〃
6804	〃	Kayseri,	〃
6805	〃	〃	〃
6806	〃	Suburbs of Kayseri,	〃
6807	〃	〃	〃
6808	〃	Göreme (near Nevsehir).	〃
6809	〃	Konya—Beysehir (A),	〃
6810	〃	〃 (B),	〃
6811	subsp. *orientalis* Eig var. *assyriaca* Eig	〃 (C),	〃
6812	subsp. *eu-triuncialis* Eig var. *typica*	Akseki,	〃
6813	〃	Burdur (A),	〃
6814	〃	〃 (A),	〃
6815	〃	〃 (B),	〃
6816	〃	〃 (C),	〃
6817	〃	〃 (D),	〃
6818	〃	Suburbs of Burdur (A),	〃
6819	〃	〃 (A),	〃
6820	〃	〃 (A),	〃
6821	〃	〃 (A),	〃
6822	〃	〃 (B),	〃
6823	〃	〃 (C),	〃
6824	subsp. *eu-triuncialis* Eig var. *constantinopolitana* Eig	Afyon (A),	〃
6825	subsp. *eu-triuncialis* Eig var. *typica*	〃 (A),	〃
6826	〃	〃 (B),	〃
6827	〃	〃 (B),	〃

6828	subsp. *eu-triuncialis* Eɪɢ var. *typica*	Afyon (B),	Turkey
6829	〃	Denizli (A),	〃
6830	〃	〃 (B),	〃
6831	〃	Suburbs of Bergama (A),	〃
6832	〃	〃 (B),	〃
6833	〃	〃 (C),	〃
6834	〃	〃 (D),	〃
6835	〃	〃 (E),	〃
6836	〃	〃 (F),	〃
6837	〃	〃 (C),	〃
6838	〃	〃 (D),	〃
6839	〃	〃 (E),	〃
6840	〃	10 km SW of Havza (Corum—Samsun),	〃
6841	〃	14 km SW of 〃 (〃),	〃
6842	〃	19 km SE of Suluova (Samsun—Amasya)	〃
6843	〃	〃	〃
6844	〃	3 km N of Amasya (〃),	〃
6845	〃	Amasya (Stony Mountain side),	〃
6846	subsp. *eu-triuncialis* Eɪɢ var. *constantinopolitana* Eɪɢ	12 km W of Amasya (Amasya—Corum),	〃
6847	〃	16 km W of 〃 (〃),	〃
6848	subsp. *eu-triuncialis* Eɪɢ var. *typica*	Gokhoyok (〃),	〃
6849	〃	〃	〃
6850	subsp. *eu-triuncialis* Eɪɢ var. *constantinopolitana* Eɪɢ	〃	〃
6851	subsp. *eu-triuncialis* Eɪɢ var. *typica*	〃	〃
6852	〃	24 km E of Mecitözü (〃),	〃
6853	〃	〃	〃
6854	〃	9 km NE of Corum (Corum—Samsun),	〃
6855	〃	20 km NE of Sungurlu (Sungurlu—Corum),	〃
6856	〃	12 km SW of 〃 (Cerikli—Sungurlu),	〃
6857	〃	17 km SW of 〃 (〃),	〃
6858	〃	19 km NE of Cerikli (〃),	〃
6859	subsp. *eu-triuncialis* Eɪɢ var. *constantinopolitana* Eɪɢ	13 km NE of 〃 (〃),	〃
6860	subsp. *eu-triuncialis* Eɪɢ var. *typica*	11 km SW of Yozgat (Cerikli—Yozgat),	〃

6861	subsp. *eu-triuncialis* EIG var. *typica*	11 km NE of Cerikli (Cerikli—Yozgat),	Turkey
6862	〃	16 km NW of Kirikkale (Ankara—Kirikkale),	〃
6863	〃	〃	〃
6864	〃	27 km NW of Kirikkale (〃),	〃
6865	〃	20 km E of Ankara (〃),	〃
6866	〃	In the garden of Japanese Embassy in Ankara,	〃
6867	〃	8.5 km NE of Ankara,	〃
6868	〃	〃	〃
6869	〃	12 km NE of Ankara,	〃
6870	〃	〃	〃
6871	〃	13 km NE of Ankara,	〃
6872	subsp. *eu-triuncialis* EIG var. *constantinopolitana* EIG	〃	〃
6873	subsp. *eu-triuncialis* EIG var. *typica*	52 km NW of Ankara (Ankara—Bolu),	〃
6874	〃	24 km E of Ayas (Ankara—Ayas),	〃
6875	〃	Ayas,	〃
6876	subsp. *eu-triuncialis* EIG var. *constantinopolitana* EIG	〃	〃
6877	subsp. *eu-triuncialis* EIG var. *typica*	16 km W of Ayas,	〃
6878	subsp. *eu-triuncialis* EIG var. *constantinopolitana* EIG	〃	〃
6879	subsp. *eu-triuncialis* EIG var. *typica*	22 km W of Ayas,	〃
6880	〃	23 km W of Ayas,	〃
6881	〃	17 km S of Ankara,	〃
6882	〃	〃	〃
6883	〃	61 km S of Ankara,	〃
6884	〃	〃	〃
6885	〃	79 km S of Ankara,	〃
6886	subsp. *eu-triuncialis* EIG var. *constantinopolitana* EIG	15 km SW of Polatli (Ankara—Eskisehir),	〃
6887	subsp. *eu-triuncialis* EIG var. *typica*	27 km E of Sivrihisar (Ankara—Eskisehir),	〃
6888	〃	10 km W of 〃 (〃),	〃
6889	〃	〃	〃
6890	〃	28 km E of Karacabey (Bursa—Bandirma),	〃
6891	〃	〃	〃
6892	subsp. *eu-triuncialis* EIG var. *constantinopolitana* Eig	16 km W of Karacabey (Bursa—Bandirma),	〃
6893	〃	1 km E of Edincik (Bandirma—Gönen),	〃

6894	subsp. *eu-triuncialis* Eɪɢ var. *constantinopolitana* Eɪɢ	2 km SW of Edincik (Bandirma—Gönen),	Turkey
6895	〃	7 km SW of 〃 (〃),	〃
6896	〃	13 km NE of Gönen (〃),	〃
6897	〃	4 km NE of 〃 (〃),	〃
6898	subsp. *eu-triuncialis* Eɪɢ var. *typica*	65 km W of Izmit (Istanbul—Izmit)	〃
6899	〃	In the ruins of Olympia,	Greece
6900	subsp. *eu-triuncialis* var. *constantinopolitana* Eɪɢ	Drouva's hill in Olympia,	〃
6901	〃	〃	〃
6902	subsp. *eu-triuncialis* Eɪɢ var. *typica*	Suburbs of Volos,	〃
6903	〃	〃	〃
6904	〃	Suburbs of Portaria,	〃
6905	〃	〃	〃
6906	〃	Suburbs of Vasilika,	〃
6907	〃	〃	〃
6908	〃	〃	〃
6909	〃	Drouva's hill in Olympia,	〃

Aegilops cylindrica Hᴏsᴛ. (n=14)

Stock No.	Variety	Locality	
6951	var. *typica*	Suburbs of Dogubayazit,	Turkey
6952	〃	Amasya (Stony Mountain side),	〃
6953	〃	Gokhoyok (Amasya—Corum),	〃
6954	〃	〃	〃
6955	〃	24 km E of Mecitözü (Amasya—Corum).	〃
6956	〃	15 km SW of Havza (Corum—Samsun),	〃
6957	〃	9 km NE of Corum (〃),	〃
6958	〃	20 km NE of Sungurlu (Sungurlu—Corum),	〃
6959	var. *pauciaristata* Eɪɢ	12 km SM of 〃 (Cerikli—Sungurlu),	〃
6960	〃	17 km SW of 〃 (〃),	〃
6961	〃	19 km NE of Cerikli (〃),	〃
6962	var. *typica*	6 km SE of 〃 (Cerikli—Yozgat),	〃
6963	〃	13 km NE of Ankara,	〃

6964	var. *pauciaristata* Eig	15 km NE of Ankara,	Turkey
6965	〃	In the garden of Japanese Embassy in Ankara,	〃
6966	var. *typica*	〃	〃
6967	〃	51 km S of Ankara,	〃
6968	〃	58 km S of 〃	〃
6969	var. *pauciaristata* Eig	61 km S of 〃	〃
6970	〃	79 km S of 〃	〃
6971	var. *typica*	12 km S of Polatli (Ankara—Eskisehir),	〃
6972	〃	15 km SW of 〃 (〃),	〃

Aegilops ventricosa (n=14), *Ae. crassa* (n=14), *Ae. vavilovii* (n=21) and *Ae. squarrosa* (n=7)

Stock No.	Variety	Locality	
6991	*Ae. ventricosa* Tausch var. *vulgaris* Eig	6 km W of El-Amilia,	Egypt
6992	*Ae. vavilovi* Zhuk. (*Ae. crassa* Boiss. var. *palaestina* Eig)	2 km S of the border (Damascus—Amman),	Jordan
6993	〃	16 km S of the border (〃),	〃
6994	*Ae. crassa* Boiss. var. *macrathera* Boiss.	Kamichliye,	Syria
6995	*Ae. squarrosa* L. var. *typica*	Collection of University of Pavia,	Italy
6996	*Ae. ventricosa* Tausch var. *comosa* Coss. *et* Dur.	〃	〃

IV. News

THE SIXTH WHEAT GENETICS SYMPOSIUM, JAPAN

Cytogenetics and Breeding of Intergeneric and Interspecific Hybrids

National Institute of Genetics, Misima, Japan
April 16 (Sat.), 1966
Organized by National Institute of Genetics and Kihara
Institute for Biological Research

PROGRAM

Opening Speech …… H. KIHARA

Session I, Wheat-rye Hybrids

  Chairman: M. SASAKI

    "Crossability in wheat-rye hybrids."
      T. TOZU (Sizuoka Univ.)

    "Cytogenetics in wheat-rye hybrids."
      G. NAKAJIMA & A. ZENNYOZI (Gumma Univ.)

    "Biochemistry in crossability …… On the germinability in hybrid seeds."
      H. NAKAMURA (Nihon Noyaku Co. Ltd.)

  Lunch

Session II, Problems in Hybrid Wheat

  Chairman: A. MOCHIZUKI

    "Fundamental problems in hybrid wheat I."
      H. KIHARA (Natl. Inst. Genet.)

    "Fundamental problems in hybrid wheat II."
      K. TSUNEWAKI (Kyoto Univ.)

  Tea Break

  Chairman: K. YAMASHITA

    "On the heterosis in wheat hybrids."
      H. AKEMINE & K. KUMAGAI (Natl. Inst. Agric. Sci.)

    "Hybrids wheats in the United States."
      J. W. SCHMIDT (Univ. Nebraska, U. S. A.)

Banquet

    "Plan of the botanical expedition to the Caucasus."
      K. YAMASHITA (Kyoto Univ.)

V. Editorial Remarks

Corrections

1. WIS No. 21, p. 16: "The frequency of twin seedlings in New Zealand wheats" by J. M. McEwan and K. J. Vizer. The following corrections should be noted.

Table 1. Last column

Read "1,299" for "8,042"; Read "1,508" for "36,383";
Read "2,230" for "18,181"; Read "1,573" for "36,526"

2. WIS No. 21, pp. 27-28: "Frequency and geographical distribution of rye with accessory chromosomes in Korea" by W. J. Lee and B. R. Min.

Page	line		Corrections
27	Table 1		Read "populations" for "population"
27	Table 1	line 4 from bottom	Read "18-13" for "17-13"
28	Table 1	line 2 from bottom	Read "20-1" for "10-1"

Announcement for further issues

WIS Nos. 25 and 26 will be published during the fiscal year from April, 1967 to March, 1968. Manuscripts for those issues are accepted any time, and they will go to press in sequence as soon as they cover planned pages of each number.

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 cm^2) will be accepted for each article, if indispensable.

Communication regarding editorial matters should be addressed to:

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The Managing Editor

Explanation of the Figure on the Cover

"Germless seeds", a new effect of *Aegilops caudata* cytoplasm on the manifestation of wheat genomes...... *Triticum aestivum* var. *erythrospermum* with *caudata* cytoplasm sets germless seeds at a high frequency(10～20%).

Upper: Germless seeds (right) compared with normal ones (left).

Lower: Result of germination testi no germination of germless seeds (right) in contrast to germinated normal ones (left).

H. Kihara and K. Tsunewaki