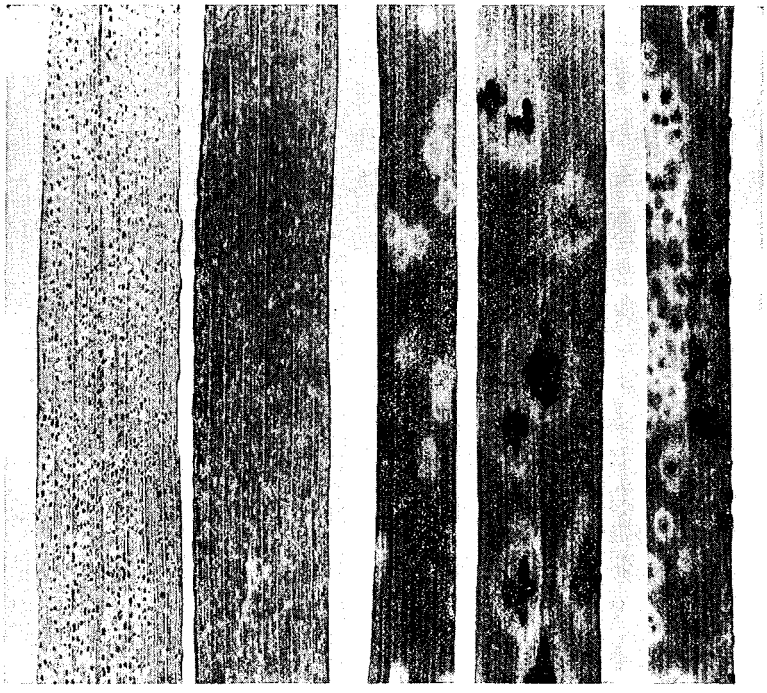
# WHEAT INFORMATION SERVICE



a b c

No. 36 March, 1973

Wheat Information Service
Biological Laboratory, Kyoto University
Kyoto, Japan

# CONTENTS


**I. Research Notes:** Page

Field reaction of different *Lr* genes to the Indian leaf rust races ..... S. C. ANAND and K. S. BAINS 1

Mutation in the length of internodes of wheat .....K. DJELEPOV 3

Induction of chlorophyll mutations in bread wheat .....A. H. KHAN 5

Improvement of quality and yield of wheat by mutation breeding.....A. H. KHAN 7

Mapping the gene $R_1$ for red seed color on chromosome 3D of wheat..... M. V. PRABHAKARA RAO 9

Glume fertility in primitive bread wheats of the Indian subcontinent .....G. M. WRIGHT 10

Genetics of dwarfing and awning by monomsomic analysis in wheat variety Mex. C.B. 116.....N. C. SINGHAL, M. P. SINGH and C. S. KALIA 14

Developing of a primary hexaploid *Tritical* T-AD (2n=6x=42) through the hybridization of *T. durum* (2n=28) and *S. cereale* L. (2n=14)...P. POPOV and S. TSVETKOV 16

Misdivision of an *Agropyron elongatum* chromosome .....T. T. THE and E. P. BAKER 19

Utilization of Iranian genetic material.....H. KUCKUCK 21

**II. News:** IV International Wheat Genetics Symposium ..... 27

**III. Editorial Remarks:**

Announcement for future issues .....29

Subscription .....29

Acknowledgement .....29

Coordinating Committee .....Cover iii

Explanation of the Figure on the Cover .....Cover iii

No. 36 1973

## I. Research Notes

### Field reaction of different *Lr* genes to the Indian leaf rust races

S. C. ANAND and K. S. BAINS
Punjab Agricultural University, Ludhiana-India

Among the three wheat rusts, leaf rust probably causes most widespread damage throughout whole of India. Most of the newly developed high yielding wheat varieties

Table 1. Reaction of various *Lr* genes and other stocks to different rates of leaf rust

| Varieties | Gene | Amount of infection | Type of pustule |
|---|---|---|---|
| Malakof × Wichita[10] | *Lr* 1 | Free | — |
| Webster × Wichita[7] | *Lr* 2 | Free-Trace | Resistant |
| Carina × Wichita[6] | *Lr* $2^1$ | Light-Moderate | Susceptible |
| Brevit × Wichita[8] | *Lr* $2^3$ | Moderate-Heavy | 〃 |
| Loros × Wichita[8] | *Lr* $2^4$ | 〃 | 〃 |
| Mediterranean × Wichita[10] | *Lr* 3 | Light-Moderate | 〃 |
| Democrat × Wichita[8] | *Lr* 3 | 〃 | 〃 |
| Transfer × Chinese Spring | *Lr* 9 | Free | — |
| Hussar × Wichita[6] | *Lr* 11 | Light | Susceptible |
| Wichita | | Heavy | 〃 |
| Chinese Spring | | Light | 〃 |
| Napo 63 | | Moderate | 〃 |
| Gaboto | | Heavy | 〃 |
| Sonora 64 | | Light | 〃 |
| Crespo 63 | | Trace | Resistant |
| Pentad × Marquis (E 129) | | 〃 | 〃 |
| Frontana | | Free | — |
| Centeria | | 〃 | — |
| Rio Negro | | 〃 | — |
| Transac | | 〃 | — |
| Lerma Rojo 64A | | 〃 | — |
| ($F_n$ × K58-N) (N10-B21-P14) Kt(E4870-1) | | 〃 | — |
| (Wt-Lee) ($F_n$-T0, 59) (E 8212) | | 〃 | — |

which carried some resistance to it are already getting heavily infected with new races and biotypes of leaf rust. Thus, there is great need to incorporate as many resistant genes as possible into our future commercial varieties. The first step was to identify different sources of resistance to various leaf rust races prevalent in India. A set of known *Lr* genes was obtained from Drs E.R. SEARS and D.R. KNOTT and was inoculated with a mixture of races comprising 77, 162A, 12, 162, 26 and 106. Since leaf rust does not appear in the seedling stage in India, the material was screened at the adult plant stage. The work was conducted at the Punjab Agricultural University, Ludhiana and mean of two year data has been presented in Table 1.

As evident from Table 1, $Lr_1$ gene from Malakof has shown high degree of resistance to leaf rust races and it was free from this disease for both the years. Wichita, the background under which it was transferred was heavily loaded with rust. $Lr_2$ gene from Webster also showed resistance as a maximum of trace infection with resistant type of pustules was observed on this line. *Lr* $2^1$ allele from Carina, *Lr* $2^3$ allele from Brevit and *Lr* 2 allele from Loros gave moderate to high susceptibility to leaf rust. Thus, the Indian races of leaf rust also differentiate between different alleles of *Lr* 2 locus. *Lr* 3 gene from Mediterranean and Democrat does not impart any resistance under Indian conditions, and both of them showed light to moderate infection with susceptible pustules. *Lr* 9 gene from Transfer was completely free from the disease. This was tested under Chinese Spring background which had light infection of leaf rust. *Lr* 11 gene from Hussar was ineffective against prevalent Indian races of leaf rust. Thus, the present study brings out the importance of *Lr* 1 gene from Malakof and *Lr* 9 from Transfer which could be used effectively. The gene from Webster could also be useful but as *Lr* 2 is a complex locus, it may be difficult to handle in the breeding process.

Among the other important genetic stocks, Napo 63, Gaboto and Sonora 64 were found to be susceptible. Crespo 63 and E 129 had trace infection, whereas, Frontana, Centeria, Rio Negro, Transac, Lerma Rojo 64A, E 4870–1 and E 8212 were found to be completely free from leaf rust. The number of resistant genes each one of these stocks carry is not known, however, they have been reported to be resistant at several locations. These stocks along with *Lr* 1 and *Lr* 9 genes should be able to provide sufficient protection against leaf rust in India and should be extensively used in wheat breeding programme.

(Received August 5, 1972)

# Mutation in the length of internodes of wheat

Kiril DJELEPOV
The Institute for Wheat and Sunflower, nearby General Toshevo, Bulgaria

Shortening of the last internode as a result of an influence with X-rays was being observed with some hard wheat experiments (DJELEPOV and CHAVDAROV 1969). In all cases up to now, this kind of mutation has a modificational character.

QUALSET *et al.* (1970) have, for the first time, selected through an influence with gamma-rays, a mutant in $M_2$, distinguished for the shortening of the first internode beneath the ear by 33 per cent as also of the second internode by 15 per cent which resulted in the total height of the mutant being shortened by 18 per cent compared to that of the starting variety.

The present article reports on an induced mutant in wheat, distinguished for its first internode beneath the ear being shortened by 30 per cent and for the curtailment of its second internode by 50 per cent.

Seeds of Mironovskaya 808 were subjected to X-ray treatments at doses of 10, 15 and 20 kR. A portion of the seeds in $M_2$ were treated with EMS at concentrations of 0.2 and 0.4 per cent. An immediate field sowing of the seeds followed the treatment and the rinsing with water.

In the progeny of a plant of the 10 kR. plus 0.4 per cent variant, two of a total of eight plants with a greatly-shortened last but one internode and a shortened last internode were selected. The mutant plants produced, in their subsequent generations, plants with a mutant phenotype alone. Normal plants broke down into normal and mutant plants, at a ratio similar to that noted above. These data suggest of a recessive mutation, which, after a self-pollination in $M_2$, exhibits itself in a part of the plants which happen to be in a state of recessive homozygosis.

Table 1 gives the morphological characteristics of the mutant and of the starting variety. The analysis done was based on good levelled and consolidated plants of $M_6$.

Table 1. Characteristics of initial sort and mutation line

| Initial sort and mutation line | Height of plant | Tillering | | Main ear | | | | Grains per plant No. |
|---|---|---|---|---|---|---|---|---|
| | | general | productive | lenght cm. | spikelets No. | grains No. | weight of a grain gr. | |
| Micronovskaya 808-initial sort | 130.2±1.10 | 7.0±0.29 | 6.3±0.28 | 10.8±0.16 | 19.2±0.33 | 38.0±0.97 | 1.76±0.07 | 195.1±11.3 |
| M 189/255 | 86.2±1.24 | 9.1±0.43 | 7.6±0.40 | 6.9±0.16 | 14.0±0.28 | 15.7±0.80 | 0.39±0.03 | 68.4± 4.9 |

Fig. 1. Left : Mironovskaya 808-initial sort ; right : M 189/255

As seen, the mutant form is comparatively lower in size than the starting variety, it possesses a greater tillering ability and a shorter ear with less spikelets and grains in it. Rachis of the ear appears in a zigzag shape and shorter and more rounded are its spikelet glumes. Grain is small, rounded and less in number as a result of a partial sterility. The most essential difference between the mutant and the starting variety proves to be the length of the internodes. There is lengthening in the first to the third internodes, while the forth and fifth internodes shorten.

Leaves of the third and fourth node envelope the ear. The straw between the last node and the ear appears very thin and brittle. Compared to the starting variety, ear let out the leaves considerably later; then the last internode lengthen, yet, to the end of the vegetation process it remains shorter than that of the starting variety. The height of the mutant plants lessens in its average by 30~35 per cent than that of the starting variety (Fig. 1).

The similar mutant, described by QUALSET *et al.* (1970) is characteristic for the strong shortening of its last internode controlled by a dominant gene. To our case, more strongly is the shortening of the last but one internode and the data from the mutation manifestation show the mutation to be a recessive one.

The reduced values of the components which characterize the yielding and the partial sterility display the induced mutant to be with a lowered vitality. Cytological analysis indicates a normal chromosome number (2n=42). It is probably that the reasons for these abnormalities should lie in the semilethal effect of the recessive homozygotic condition.

The induced mutant M 189/255 represents a new sourse of dwarfness, which can be put to use in the selection of low-sized wheat varieties.

### Literature cited


Djelepov, K. P., G. A. Chavdarov 1969. Problems of Soft Wheat Selection and Agronomical Practices, Sofia.

Qualset, C. O., G. N. Fick, M. J. Constantin and T. S. Osborne 1970. Science **169**, No. 3950.



(Received August 17, 1972)


## Induction of chlorophyll mutations in bread wheat


A. H. Khan

Nuclear Institute for Agriculture and Biology, Lyallpur, Pakistan


*Triticum vulgare* variety Mexi-Pak (2n=42) was used in this study. Chlorophyll mutations occur very rarely in hexaploid wheat spontaneously but are induced frequently by chemical and radiation mutagens. Most of them are Mendelian recessive.

Seeds were soaked in deionized water for two hours and then treated with 0.5, 1.0, 1.5 and 2.0 per cent EMS for 6 hours. After the treatment, seeds were washed thoroughly in running water and dried before sowing. Dry seed with 12 per cent moisture content were irradiated with gamma-rays for 10, 15, 20 and 25 KR by $Co^{60}$ source of this Institute; and neutrons irradiation of 300, 400, 500 and 600 RAD was carried out by IAEA Laboratories, Vienna.

Seed germination and fertility was noted in $M_1$ and chlorophyll mutations were recorded in $M_2$ population. 20 seed per spike and 3 spike per $M_1$ plant sown for $M_2$ screening.

The frequency of chlorophyll mutations in Mexi-Pak in $M_2$ following treatment with various mutagens is shown in the Table I. The data do not suggest any relationship with the type of mutagen or the dose. The seed fertility of $M_1$ plants whose progenies segregated for chlorophyll mutations is also indicated in the Table 1. There is no relation between the seed fertility in $M_1$ and the occurrence of chlorophyll mutations

in $M_2$. Although no record was made but the frequency of *striata* and *albino* chlorophyll mutants was more in the irradiated material when most of the *xantha* and *viridis* mutants were produced in EMS-treatments.

Table 1. Spectrum of chlorophyll mutations in $M_2$ in bread wheat variety Mexi-Pak following irradiation and EMS-treatments

| | $M_1$ | | $M_2$ | | |
|---|---|---|---|---|---|
| Treatment | Germination (%) | Fartility (%) | Number of head progeny | Number of head progeny with mutants | Mutation rate (%) |
| Control | 100.00 | 95.73 | 203 | 0 | 0.0 |
| Neutrons : | | | | | |
| 300 RAD | 100.00 | 90.84 | 150 | 2 | 1.33 |
| 400 〃 | 97.85 | 87.80 | 104 | 1 | 0.96 |
| 500 〃 | 91.12 | 81.42 | 138 | 2 | 1.44 |
| 600 〃 | 80.00 | 81.12 | 105 | 5 | 4.76 |
| $\gamma$-rays : | | | | | |
| 10 KR | 93.00 | 91.89 | 90 | 2 | 2.22 |
| 15 〃 | 81.37 | 90.10 | 57 | 3 | 5.26 |
| 20 〃 | 83.21 | 87.76 | 51 | 1 | 1.96 |
| 25 〃 | 80.12 | 89.64 | 42 | 1 | 2.38 |
| EMS : | | | | | |
| 0.5% | 100.00 | 82.84 | 108 | 3 | 2.78 |
| 1.0 〃 | 97.32 | 75.02 | 300 | 19 | 6.33 |
| 1.5 〃 | 98.12 | 78.66 | 282 | 10 | 3.55 |
| 2.0 〃 | 96.87 | 83.14 | 130 | 7 | 5.38 |

(Received April 30, 1971)

## Improvement of quality and yield of wheat by mutation breeding

A. Hassan KHAN
Nuclear Institute for Agriculture & Biology, Lyallpur, Pakistan

Seeds of a standard variety Mexi-Pak-65 were irradiated with 400 rad neutron (fast), and were space planted. Single-spike progenies were grown in the M1 generation for the selection of desirable mutant plants. Through this procedure, seven dwarf and early maturing mutants were selected and their breeding behaviour was confirmed in M1 generation.

One gram seed of each of these mutants was taken for the estimation of protein by KJELDHAL method. The protein content of seven wheat mutants ranges from 13.68 to

Table 1. Protein values of promising wheat mutants

| S. No. | Mutant | Protein (Percent) | Increase % |
|---|---|---|---|
| 1 | M-3 | 15.60 | 24.90 |
| 2 | M-9 | 14.67 | 17.45 |
| 3 | M-11 | 16.26 | 30.18 |
| 4 | M-15 | 17.23 | 37.95 |
| 5 | M-17 | 14.87 | 19.06 |
| 6 | M-27 | 16.88 | 35.15 |
| 7 | M-244 | 13.66 | 9.53 |
| 8 | Mexi-Pak | 12.49 | — |

17.23 per cent while in Mexi-Pak it is only 12.49 per cent. Mutant-15 (Rageni) gave the highest percentage of protein (17.23) which is nearly 40 per cent increase over the control (12.49) (Table 1). The amino acid analysis of Ragent and the parent variety Mexi-Pak was conducted on the EEL 193 High Speed Amino Acid Analyser. The increase in case of mutant Rageni was found in all the sixteen amino acid analysed with significant increase in the three essential amino acids: lysine, methionine and threonine

Table 2. Essential amino acids of wheat mutant Rageni

| Amino acids | Mexipak | Rageni | Increase % |
|---|---|---|---|
| Lysine | 0.31 | 0.45 | +45.16 |
| Methionine | 0.09 | 0.15 | +66.67 |
| Threonine | 0.27 | 0.52 | +92.59 |

(Table 2). Knowing that the amino acid composition does not give an estimate of milling qualities, the increase in total production of amino acids of this magnitude is important.

The yield components of wheat mutant Rageni and the parent variety are given

Table 3. Yield components of wheat mutant "Rageni" and Mexi-Pak-65

| Characters | Rageni | Mexi-Pak-65 | LSD 5% |
|---|---|---|---|
| Plant height (cm) | 86.6 | 109.3 | 2.45* |
| Spike length (cm) | 11.10 | 11.90 | N.S. |
| No. of Spike-lets | 19.00 | 21.00 | 0.25* |
| Fertility (%) | 95.12 | 91.10 | N.S. |
| No. of tillers | 20.00 | 22.00 | N.S. |
| 1000 grain weight (gms) | 44.4 | 26.5 | 5.18* |
| Yield per plant (gm) | 48.7 | 29.1 | 18.36* |

* Significant. N.S. : Non significant.

in the Table 3. The mutant was further subjected to quality test. It has a hard, amber coloured and bold grain, and its "chapati" making quality is much better than that of Mexi-Pak-65. In order to assess the grain yield potential of mutant Rageni, the mutant

Table 4. Yield and quality performance of wheat mutant Rageni.

| | A-Normal Sowing | | B-Late Sowing | |
|---|---|---|---|---|
| Varieties | Rageni | Mexi-Pak | Ragent | SA-42 |
| Seed germination (percent) | 70.9 | 90.2 | 79.5 | 95.5 |
| Lodging (percent) | 0.0 | 48.0 | 0.0 | 0.0 |
| Maturity (days) | 159 | 180 | 119 | 126 |
| Grain yield (mds/acre) | 69.36 | 69.11 | 56.82 | 51.90 |
| Protein percent (mds/acre) | 17.23 (12.01) | 12.49 (8.63) | 17.23 (12.01) | 14.11 (7.32) |
| Colour | Amber | Amber | Amber | Amber |
| Texture | Hard | Hard | Hard | Hard |
| Baking quality score (percent) | 69.9 | 51.2 | 69.9 | 72.0 |

was tested against Mexi-Pak-65 and SA-42 (Table 4). The grain yield per acre is the same both in mutant (69.36 mds/acre and control (69.11 mds/acre). The Rageni mutant has high protein content so the per acre protein production is much more in mutant (12.01 mds/acre) than that in control (8.63 mds/acre). Mutant Rageni is early maturing and was harvested 3 weeks earlier than the control Mexi-Pak. It gives the farmers extra 21 days for the preparation of land for rice cultivation. Moreover, mutant can be safely recommended for late sowing; and in our experiment (Table 4) for late sowing, it has given 4 mds/acre (56.82 mds/acre) more yield than the yield of commercially grown late variety SA-42 (51.90 mds/acre).

Looking at the performance of wheat mutant Rageni; it can be safely concluded that it has superior potentialities for grain yield and nutritive value; and after large scale yield trials on the farmers fields, it can be recommended for general purpose commerical sowing.

(Received December 20, 1972)

# Mapping the gene $R_1$ for red seed colour on chromosome 3D of wheat

M. V. PRABHAKARA RAO
Biology & Agriculture Division, Bhabha Atomic Research Centre,
Trombay, Bombay-85, India

Chromosome 3D (formerly XVI) carries the dominant gene $R_1$ for red seed color in the common wheat variety, Chinese Spring (SEARS 1944). It was further shown that the alpha (right) arm of 3D carries this gene (SEARS 1954). However, the crossover distance of the gene from the centromere has not been ascertained. In the present study, a ditelocentric line for the alpha arm of 3D was used to determine the location of the gene.

The substitution line, *sphaerococcum*-3D (white seeds) was crossed to Chinese Spring ditelo-3D (alpha). The $F_1$ plants ($20_{II}+1$ $het_{II}$) were red grained. Segregation occurred for both seed color and ear type in the $F_2$ generation. Out of 260 $F_2$ plants, 129 were of *sphaerococcum* type and 131 of *aestivum* type indicating that there is no significant male transmission of telocentric 3D (alpha) in competition with the entire 3D. Among the *sphaerococcum* type plants, 86 had red seeds and 43 white seeds. Of the 131 *aestivum* type plants, 97 had red seeds and 34 white seeds. The segregation data give a statistically good fit to the expected ratio (3: 1: 3: 1) for independent assortment of the *S* and $R_1$ genes ($X^2=4.83$; d.f.$=3$; $P=0.25$ to $0.10$).

PRABHAKARA RAO (1971) found that the *sphaerococcum* gene *s* is most probably located on the beta (left) arm of 3D. In the $F_1$ plants of the present experiment, pairing and crossing-over would be limited to the alpha arm of 3D. So, the crossover distance between the genes $R_1$ and *S* would correspond to the distance of the $R_1$ gene from the centromere. Since the *sphaerococcum* and red seed genes segregated independently of each other, it can be concluded that the $R_1$ gene is located 50 or more crossover units from the centromere, i.e., it has a distal location on the alpha arm of 3D.

## Literature cited

SEARS, E. R. 1944. Cytogenetic studies with polyploid species of wheat. II. Additional chromosomal aberrations in *Triticum vulgare*. Genetics **29**: 232～246.

—— 1954. The aneuploids of common wheat. Mo. Agr. Exp. Sta. Res. Bul. **572**: 59.

PRABHAKARA RAO, M. V. 1971. An attempt to map the *sphaerococcum* gene on chromosome 3D of wheat. EWAC Newsletter **3**: 64.

(Received Sept. 28, 1972)

# Glume fertility in primitive bread wheats of the Indian subcontinent

G. M. WRIGHT
Crop Research Division, Department of Scientific and Industrial Research,
Lincoln, New Zealand

A wheat spikelet is said to have a "fertile" glume if a flower or some flower part, however rudimentary, is present in the axil of the upper glume (WRIGHT 1969). The level of glume fertility is strongly inherited, and for most purposes is adequately measured as the proportion of terminal spikelets with fertile glumes. Variation in glume fertility among primitive bread wheats may be related to their evolutionary history. At least, glume fertility has been showed to be lowest in wheats from high altitudes, and in wheats from countries furthest from South-west Asia, and it has been suggested that the wheats with fertile glumes are the more recently synthesised (WRIGHT 1972). No such pattern was established in *Triticum turgidum*, in which high levels of glume fertility are rare.

None of the Pakistani wheats in the Crop Research Division collection, and few from India, were included in the previous study. The majority were collected in the mid 1920's for the British Board of Trade, and information on their places of origin, and in some cases names, has been obtained recently from the Plant Breeding Institute, Cambridge, England. The wheats from India, Pakistan, Nepal, Sikkim, and Bhutan were scored for glume fertility in 1971～72. Those with fertile glumes from India which had also been recorded in 1969～70 averaged 48.4 and 47.9 percent of fertile terminal-spikelet upper glumes respectively, so that no seasonal adjustment was required, and counts of all wheats scored in both seasons were combined. If no fertile glumes are found in 10 ears no further ears are taken; otherwise 10 more ears are examined, and the line scores 1 with 1 to 4 fertile terminal spikelets, 2 with 5 to 9 and 3 with 10 to 20. In 7 percent of the wheats fewer than 20 ears were available for recording.

Among the major wheat-growing regions of India Gujarat, Maharashtra, and Rajasthan are not represented. The numbers of wheats from most regions are low, with at best perhaps one line per 7,000 hectares of wheat from Kashmir and one per 50,000 hectares from Uttar Pradesh (cf. PAL 1966, p. 8), and there is probably some duplication and misidentification of lines. Among the named varieties, however, there were 9 accessions of the widely-grown Pusa wheat N.P. 4, of which only one had been identified before scoring. These had similar herbarium specimens and gave similar scores for glume fertility (0 or 1), but one line as now grown has tip awns instead of being awnless. There were several duplicates of other pure line selections, and in some of the few cases where these were different a description in PAL (1966) was available to identify

Table 1. Frequency distribution of glume fertility scores of primitive bread wheats

| Region | Score 0 | 1 | 2 | 3 | No. lines | Avg. score | Source* |
|---|---|---|---|---|---|---|---|
| Madhya Pradesh : | | | | | | | |
| Indore | 0 | 1 | 2 | 11 | 14 | 2.71 | a |
| Rewa | 1 | 5 | 4 | 8 | 18 | 2.06 | 〃 |
| other | 0 | 2 | 2 | 1 | 5 | 1.80 | b |
| Uttar Pradesh : | | | | | | | |
| Fatehpur | 3 | 4 | 2 | 7 | 16 | 1.81 | c |
| Mainpuri-Kanpur | 0 | 14 | 9 | 13 | 36 | 1.97 | 〃 |
| Unnão | 0 | 3 | 3 | 4 | 10 | 2.10 | d |
| N. of Ghaghara R. | 1 | 7 | 5 | 2 | 15 | 1.53 | 〃 |
| Bihar | 2 | 1 | 1 | 0 | 4 | 0.75 | b |
| Nepal, Sikkim, Bhutan | 7 | 2 | 1 | 0 | 10 | 0.40 | e |
| Kashmir | 12 | 4 | 6 | 1 | 23 | 0.83 | e, f |
| Punjab (predivision) | 3 | 3 | 8 | 7 | 21 | 1.90 | b |
| Baluchistan : | | | | | | | |
| Bela | 1 | 0 | 2 | 4 | 7 | 2.29 | d |
| Sibi | 7 | 9 | 6 | 4 | 26 | 1.27 | 〃 |
| Loralai | 3 | 2 | 2 | 4 | 11 | 1.64 | 〃 |
| Chagai | 8 | 3 | 1 | 2 | 14 | 0.79 | e |
| Sind | 9 | 4 | 2 | 9 | 24 | 1.46 | b |

* Sources of wheats :

a. Pure lines. Dr. J.B. HUTCHINSON, Division of Plant Industry, Indore, India, 1936.
b. Pure lines. Dr. A.E. WATKINS, P.B.I., Cambridge, England, 1930～31.
c. Market samples. 〃 〃
d. Farm crops. 〃 〃
e. Various. 〃 〃
f. Various. Prof. A. WALL, Canterbury University College, Christchurch, New Zealand, 1932.

the correct line. A different situation was shown by 5 lines of N.P. 12, which were similar in appearance but had more than chance variation in glume fertility. This variety appears twice in the Bihar wheats of Table 1, scoring 0 and 2.

The summary of scores in Table 1 shows some of the pattern of variation over the subcontinent. There is a rather irregular decline in glume fertility from central to Northeast India, with very low, though imprecise, averages in Northern Bihar and the Himalayan foothills. The wheats from the undivided Punjab and Kashmir are in line with these, inasmuch as they show a decline with increasing altitude. The regions or districts in Baluchistan relate quite well to accessibility from the coast, and the figures for Sibi and Loralai, districts near the Bolan Pass, are close to the 1.54 found in the adjacent Kandahar region of Afghanistan (WRIGHT 1972). The Chagai region appears to be as isolated as Kashmir.

The wheats from Sind were pure line selections maintained at the Agricultural Re-

search Station, Sakrand, and their average score appears far too low, but it is possible that wheats from outside the state are included. The distribution of individual scores of the Sind wheats suggests heterogeneity: no other reasonably large sample has had a high proportion of both 0 and 3 scores. Further, two of the wheats scoring 0 were classed as "late" in ear emergence, which is more characteristic of wheats from high altitudes, whereas most of Sind is below 200 m.

On the other hand the Sind collection included the only clavate (clubbed, not compactum) wheats from the subcontinent. There were 5 of these, not included in Table 1, with an average score of 2,00. Similar wheats came from the highlands of Afghanistan (WRIGHT 1972).

*Subterminal spikelets:*

Wheats with at least 5 fertile glumes in the first subterminal spikelets in the 20-ear sample, and with at least 50 percent more fertile glumes in this position than in the terminal spikelet, were shown in the previous study to have a highly non-random distribution: in Afghanistan they were found only in high-altitude regions. Of the 254 wheats in Table 1, 24 were of this type. Although 5 were from Kashmir and 2 from Sikkim, in line with the distribution in Afghanistan, there were 8 from Uttar Pradesh and 4 from Sibi, and even one from Bela, on the coast. There is no pattern in the distribution, except that the proportion is highest in the mountain valleys of the north.

Two of the Punjab pure lines, 8A and 17B, were of this type. Among 18 improved wheats from Lyallpur and Pusa (not included in Table 1) there were also two of this type: C. 518, bred from 8A (PAL 1966), and N.P. 90 (not mentioned by PAL).

*High-level glume fertility:*

In some wheats fertile glumes are found further down the ear than the top one or two spikelets discussed so far, and generally in most of the spikelets above the lowest affected spikelet. In more extreme cases, including some sub-compactoids, there may be a fairly coherent block of affected spikelets at the base of the ear also. In one Pakistani wheat, "Sind 5", the second glumes of nearly all spikelets were fertile, and in some ears both glumes of the subterminal spikelet were fertile.

The presence in the standard sample of at least one ear with a fertile glume below the sixth spikelet is used to define a high level of glume fertility. In Afghanistan this type was rare in all high-altitude areas, and none occurred in the regions in which there was a high ratio of subterminal to terminal spikelet fertility. Only one Indian wheat, from Rewa, achieved this level, though several from adjacent areas approached it. Except for Bela and Chagai, however, there were one or two in each group of Pakistani wheat in Table 1, so that the distribution overlapped that of the subterminal type. Besides "Sind 5" the 6 high-fertility Pakistani wheats included Punjab line 15 and the compactoid-like Sind line 15.

Table 2. Glume fertility scores from hairy- and smooth-glumed wheats from "accessible" and "inaccessible" regions

| Region | Numbers of lines | | Average scores | |
|---|---|---|---|---|
| | hairy | smooth | hairy | smooth |
| Accessible regions : | | | | |
| India (Central and U.P.) | 10 | 104 | 1.50 | 2.05 |
| Pakistan (E. Baluch•Punjab) | 31 | 34 | 1.52 | 1.74 |
| Afghanistan (Herat etc)* | 33 | 96 | 1.19 | 1.66 |
| Inaccessible regions : | | | | |
| North of India | 8 | 29 | 0.88 | 0.66 |
| Pakistan (Chagai) | 5 | 9 | 1.20 | 0.56 |
| Afghanistan (mountains)* | 41 | 46 | 0.71 | 0.69 |

* Derived from Table 6, WRIGHT 1972.

The improved wheats C. 591 and N.P. 90 appeared to be of this type also, and it may be noted that neither of the parents of C. 591, Punjab 8B and Punjab 9, showed any glume fertility below the second spikelet.

*Association with other characters:*

The presence of awns or tip awns and the level of glume hairiness were recorded. For India and Pakistan as a whole the percentages of awned wheats were 67 and 65 respectively, but all the wheats from Indore and Loralai, most from Kashmir, none from Bihar and only three from Nepal-Bhutan were awned. There was no constant association between awnedness and glume fertility.

Proportions of wheats with hairy glumes also varied considerably. The separate Pakistani samples varied from a third to a half, averaging 43 percent with hairy glumes, while the average for the mountain regions was 18 percent, for the northern foothills 26 percent, and for the remainder of India 7 percent. In Afghanistan (WRIGHT 1972, Table 6) there were few wheats with hairy glumes in the more accessible regions, and these had lower glume fertility scores than those with smooth glumes, while in the high valleys hairy-glumed wheats were more common but both types had low scores. The comparisons in Table 2 show a very similar pattern of association of the two characters in India and Afghanistan. Classing northern Bihar, with the four early Pusa wheats, as inaccessible was admittedly influenced by their low average score (Table 1), and without these the averages for "North of India" are 1.00 and 0.63.

The averages for the Pakistani wheats agree reasonably well also, provided the Sind lines are excluded. The unusual pattern of glume fertility shown by the Sind wheats was noted above, and it may be added that combining the wheats from Chagai and Las Bela in Baluchistan gives a two-way table for terminal spikelet scores and glume hairiness similar to that for Sind (2, 1, 2, 3; 7, 2, 1, 3 compared with 2, 0, 1, 5; 7, 4, 1, 4).

## Discussion

An explanation of the origin and general distribution of wheats with flower parts in the axils of glumes, or glume fertility, and its slight association with glume hairiness, was suggested by Wright (1972). The present results are in general agreement with those previously reported, particularly those from the Afghan wheats. They suggest that the principal route of the more recent primitive wheats from their area of origin to the Indian subcontinent was across the Arabian sea rather than over land. To establish this more firmly it would be necessary to have samples of primitive wheats from Gujarat and Maharashtra, which should have high levels of glume fertility, and it would be desirable to be able to confirm that the Sind wheats included a substantial proportion obtained from distant parts of Baluchistan or the North-west Frontier, to explain the number of low-scoring lines among them.

## Literature cited

PAL, B. P. 1966. Wheat. Indian Council of Agricultural Research, New Delhi.

WRIGHT, G. M. 1969. A developmentally unstable character in wheat: glume fertility. New Zealand J. Botany **7**: 30~35.

—— 1972. Fertile glumes in primitive cultivated wheats. Evolution **26** : 415~426.

(Received Oct. 20, 1972)

# Genetics of dwarfing and awning by monosomic analysis in wheat variety Mex. C.B. 116

N. C. SINGHAL, M. P. SINGH, C. S. KALIA

Genetics Division, Indian Agricultural Research Institute, New Delhi-12, India

In order to locate the gene (S) for dwarfing and awning on a particular chromosome, the wheat variety Mex. C.B. 116 was crossed with all the 21 identified monosomic lines of Chinese Spring. The $F_1$ plants of all the monosomic progenies were screened for awning and height. The results obtained on the expression of awning are summarised in Table 1. The variety Mex. C.B. 116 is derived from the cross (Nai 60×TT-64)×(L.R.×Son. 64). The variety seems to have partial dominance effect, as in $F_1$, all the plants were showing tendency to appear more towards dwarf parent. Chromosome 6D of Mex. C.B. 116 seems to carry genes for dwarfing, as maximum manifestation of dwarfing was observed.

Mex. C.B. 116 is a fully bearded type (mean awn length 7.76 cms), while Chinese Spring is awnless. All the $F_1$'s monosomic plants were identified on the basis of their

Table 1. Observation on awn expression in $F_1$ monosomics cross

| Meterial | Range in awn expression (cms) | Mean length (cms) | Awn expression |
|---|---|---|---|
| Mex. C.B. 116 | 6.5~8.1 | 7.76 | F.B. |
| Ch. Spring | – | – | A.L. |
| Normal Cross (Ch. Spring × Mex. C.B. 116) | 1.2~3.5 | 2.35 | T |
| Ch. Spring 1A × Mex. C.B. 116 | 1.7~3.1 | 2.37 | T |
| 2A | 0.7~3.2 | 1.28 | T |
| 3A | 2.5~4.5 | 3.40+ | L.T |
| 4A | 0.3~2.2 | 1.14 | T |
| 5A | 1.8~3.8 | 2.46 | T |
| 6A | 1.5~3.9 | 2.34 | T |
| 7A | 0.4~1.5 | 1.01 | T |
| 1B | 2.0~3.9 | 2.74 | T |
| 2B | 0.6~2.5 | 1.25 | T |
| 3B | 1.7~4.1 | 2.87 | T |
| 4B | 4.1~5.5 | 4.87+ | H.B. |
| 5B | 0.6~1.1 | 0.90− | ST/AL |
| 6B | 4.9~6.8 | 6.05+ | F.B. |
| 7B | 1.4~3.7 | 2.80 | T |
| 1D | 3.0~5.6 | 3.70+ | L.T. |
| 2D | 1.3~2.8 | 1.80 | T |
| 3D | 2.7~4.9 | 3.62+ | L.T. |
| 4D | 2.0~3.9 | 2.78 | T |
| 5D | 0.5~3.6 | 3.42+ | L.T. |
| 6D | 1.4~1.2 | 0.84− | ST/AL |
| 7D | 2.0~3.7 | 2.87 | T |

(+ and − indicate significant deviation from normal cross.)

chromosome number, 2n=41. Depending on awn expression the $F_1$ plants were classified as fully bearded (F.B), half bearded (H.B), long tipped (L.T), tipped (T) short tipped (S.T) and awnless (A.L), Table 1. The identified monosomic plants were selected and their comparison was done with their respective disomics. Normal crosses between Chinese Spring × Mex. C.B. 116 showed tipped awn expression in $F_1$, thereby indicating a partial dominance of awnless condition. Monosomic $F_1$ plants of 6B line were having maximum phenotypic manifestation of awning (6.05 cms) and monosomic plants in line 4B showed half bearded nature of awning. It thus became obvious that variety Mex. C.B. carried recessive genes $b_1$ and *hd* on chromosome 6B and 4B respectively.

In the absence of dominant awn inhibitors $B_1$ and *HD* of Chinese Spring (Sears 1954), the recessive gene (*S*) contributed by Mex. C.B. 116 give expression to awning, though the expressivity is reduced. Significant increased awning in monosomic plants in

line 3A, 1D, 3D and 5D could possibly be due to presence of awn promotor genes. It was interesting that the line 5B and 6D showed almost an awnless condition. Similar observations were recorded, when variety Hira was crossed with Chinese Spring monosomic lines (SINGHAL and SINGH unpublished).

Exact genetics of dwarfing and awning will be discussed in more details after critical analysis of $F_2$ populations.


## Acknowledgements

Our thanks are due to Dr. H. K. JAIN for his interest and to Dr. E. R. SEARS for providing the Chinese Spring monosomic material.


## Literature cited


SEARS, E. R. 1954. The aneuploids of Common Wheat. Research Bulletin University of Missouri.

SINGHAL, N. C. and M. P. SINGH, under publication 1973.



(Received February 2, 1973)


# Developing of a primary hexaploid *Triticale* T-AD (2n=6x=42) through the hybridization of *T. durum* DESF. (2n=28) and *S. cereale* L. (2n=14)

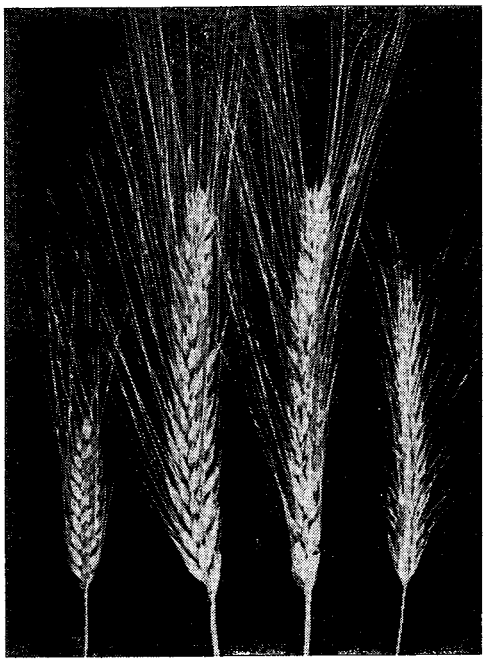

P. POPOV and S. TSVETKOV

The Institute for Wheat and Sunflower, General Toshevo, Bulgaria


Nowadays, for the needs of selection and perhaps of practice many primary and secondary hexaploid lines of *Triticale* (2n=42) are being developed. Of these, more difficult appears the development of primary 42-chromosome lines of *Triticale*, as seen from the scarceness of literature on this subject (DERZHAVIN 1938, O'MARA 1948, NAKAJIMA 1953, KISS and REDEI 1953, SANCHEZ-MONGE 1956, SHULINDIN and NAUMOVA 1965, POPOV and TSVETKOV 1970).

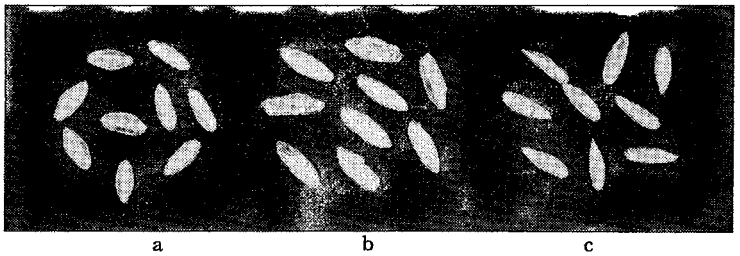
The first primary hexaploid *Triticale* (2n=42) in Bulgaria was brought forth in 1967 through a hybridization of *T. durum* DESF. (2n=28) and *S. cereale* L. (2n=14), (POPOV and TSVETKOV 1970), namely, variety No. 13 of hard wheat (var. *melanopus* Al.) and variety No. 59 of rye. The $F_1$ hybrid plants were treated with colchicine, and the technique of CAUDERON and SAIGNE (1961) was applied, so that sterility be overcomed. The colchicine treatment resulted in six amphidiploid plants.

Cytological analyses of mitosis showed that the number of somatic chromosomes of the amphidiploid plants turns out 2n=42. This proved the development of a new primary hexaploid *Triticale*, T-AD (2n=42) with an AABBss genome formula, to which a fusion has



a b c d

Fig. 1. Ears : a. ♀No. 13 (*T. durum* DESF.) ; b-c. *Triticale* T-AD (2n=42) ; d. ♂No. 59 (*S. cereale* L.)



a b c

Fig. 2. Seeds : a. ♀No. 13 (*T. durum* DESF.) ; b. *Triticale* T-AD (2n=42) ; c. ♂No. 59 (*S. cereale* L.).

been accomplished on the part of the AA and BB subgenomes of *T. durum* DESF. and of the as genome *S. cereale*.

The newly developed primary *Triticale*, T-AD (2n=42), characterizes for the intermediate arrangement of its ears (Fig. 1). It also combines the hairiness of the maternal variety (♀No. 13, var. *melanopus* Al.) with the immense length of the ear, inherited from the fraternal ♂No. 59 variety (*S. cereale* L.).

Mean fertility of the ears of *Triticale* T-AD (2n=42) runs up to 64.15 per cent compared to 80.38 per cent for the hard wheat (♀No. 13) and 77.98 per cent for the rye (No. 59). In spite of the lower fertility with the ears of *Triticale* T-AD (2n=42) the

Table 1. Field resistance to diseases in per cent

| Parental forms and *Triticale* | Leaf rust | Stem rust | Powdery mildew |
|---|---|---|---|
| ♀No. 13 (*T. durum* DESF.) | 100 | 65 | 40 |
| ♂No. 59 (*S. cereale* L.) | 65 | 25 | 40 |
| T-AD (2n=42, *Triticale*) | 0 | 5 | 0 |

average number of grains per ear of T-AD (2n=42) just equalizes to that of the maternal No. 13 variety (*T. durum* DESF.), due to their comparatively bigger length and more florets per spikelet.

At time of vegetation, *Triticale* T-AD (2n=42) sets up a thick stem with an anthocyanine colouring partly on it, partly on the leaves. Plants demonstrate high field resistance to leaf rust and stem rust and powdery mildew, as seen from Table 1.

For some years at this Institute, an intensive selection work has been carrying out, aiming at developing of new dwarf lines of secondary hexaploid *Triticale* (2n=42) on the grounds of hybridizing the newly developed primary *Triticale*, T-AD (2n=42), with dwarf octaploid *Triticale* (2n=56) of the Rudorf type as also with the winter dwarf common wheat Tom Pouce Blanc (*T. aestivum* L.).

## Literature cited


1. DERZHAN, A. 1938. Izv. Akad. Nauk USSR, ser. biol., **3** : 663～666.
2. CAUDERON, J. and B. SAIGNE 1961. Annale de l'ameration des plantes, **3** : 363～373.
3. KISS, A. and A. G. REDAI 1953. Acta Agron. Hung., **3** : 257～276.
4. NAKAJIMA, G. 1953. Japan J. Breed. **2** : 178～184.
5. O'MARA, J. G. 1948. Genet. Soc. Amer. Res. **1** : 17～52.
6. POPOV, P. and S. TSVETKOV 1970. Comptes rendus de l'Academie bulgare des Science, **12** : 1533～1536.
7. SANCHEZ-MONGE, E. 1956. An. Aula Dei **4** : 191～207.
8. SHULINDIN, A. F. and L. N. NAUMOVA 1965. Sel. Semenov. **1** · 52～55.


(Received February 12, 1973)

## Misdivision of an *Agropyron elongatum* chromosome

T. T. THE and E. P. BAKER
Department of Agricultural Botany, Faculty of Agriculture, University of Sydney, Sydney, N.S.W. 2006, Australia

*Agropyron elongatum* (Host) BEAUV. provides a source of resistance to both wheat stem rust (*Puccinia graminis tritici* ERIKS. and HENN.) and wheat leaf rust (*P. recondita* ROB. ex DESM.). One means of making use of these resistances has been *via* the amphidiploid P.P.W. 327 (2n=56) which has the three genomes of Chinese Spring wheat together with one genome (7 chromosome pairs) from polyploid *A. elongatum* (2n=70). This amphiploid was produced by L. H. SHEBESKI in Canada. It is difficult to determine whether *Agropyron* has contributed the adult plant type leaf rust resistance exhibited by the amphiploid since Chinese Spring also possesses resistance of this type. Disomic ad-

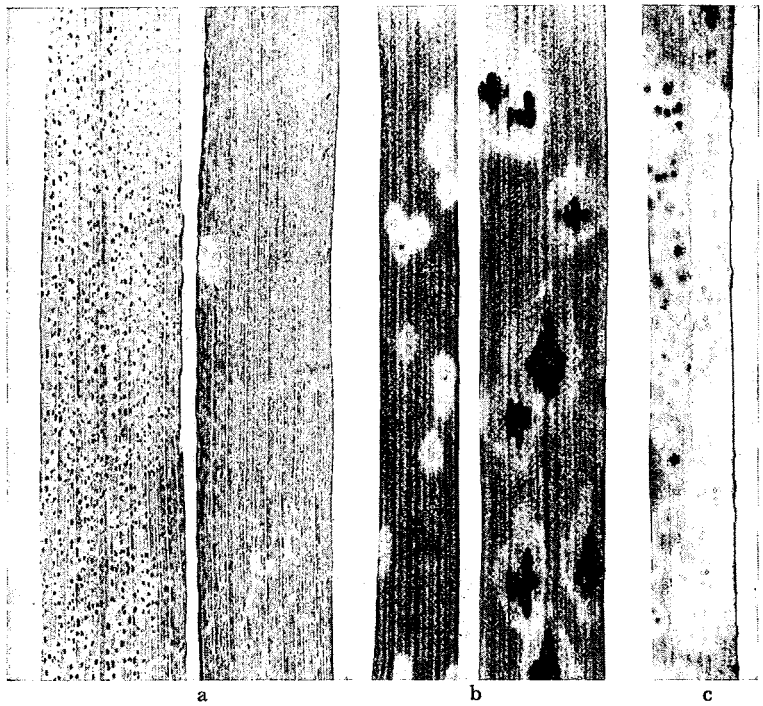



Figure 1. a. Leaves of adult plants with alternative telocentric chromosomes inoculated with leaf rust strain 76-0 ; left susceptible. right resistant. (×2.5)
b. Leaves of seedlings with alternative telocentric chromosomes inoculated with stem rust strain 21-2 ; left resistant, right susceptible. (×5.5)
c. Chimaeric primary leaf from embryo possessing telocentric chromosome conditioning stem rust resistance inoculated with stem rust strain 21-2 ; L.H.S. resistant, R.H.S. susceptible. (×5.5)

dition lines possessing seedling resistance to Australian stem rust strains have been produced at this Institution by backcrossing P.W. 327 with susceptible cultivars as recurrent parents. Besides stem rust resistance these addition lines possess resistance to leaf rust carried by the *Agropyron* chromosome pair.

KNOTT (1961) suggested that the gene(s) conditioning stem and leaf rust resistances were carried on the same chromosome in single *Agropyron* chromosome addition lines to wheat, the added chromosome pair being derived from P.W. 327. The same *Agropyron* chromosome was apparently involved in both instances since in both KNOTT's and our studies it substitutes for group 6 wheat chromosomes. KNOTT found that some families segregated for resistance to stem rust but not leaf rust and *vice versa* and proposed that the gene(s) for stem and leaf rust resistances were on opposite arms of the same *Agropyron* chromosome. He suggested that chromosome misdivision producing telocentric chromosomes, evidence for which he did not obtain cytologically, could result in the separation of the two resistances.

In the present studies the *Agropyron* univalent was found to undergo spontaneous misdivision permitting isolation of the two derived telocentric stocks. These have been maintained as ditelosomic addition lines in a Gabo background. One telosome possesses resistance to stem rust, whereas the other carries adult plant leaf rust resistance (Fig. 1 a and b), thus verifying KNOTT's suggestion.

One of the features exhibited by seedlings possessing either the monosomic or telocentric chromosome conditioning stem rust resistance is frequent somatic loss (approx. 1 in 450 seedlings) resulting in chimaerism for infection type which is always observed initially on the primary seedling leaf (Fig. 1 c). The extent of sectoring in the primary leaf varies markedly. Frequently the line of demarcation is at the midrib; in other instances smaller or larger sectors are resistant, indicating presumably that loss may occur at different stages in ontogeny. Somatic loss of the telocentric conditioning leaf rust resistance probably occurs but is less readily detected since such resistance is only operative at the adult plant stage when screening of large populations is technically more difficult.

## Literature cited

KNOTT, D.R. 1961. The inheritance of rust resistance. VI. The transfer of stem rust resistance from *Agropyron elongatum* to common wheat. Can. J. Plant Sci. **41** : 109～123.

(Received Nov. 28, 1971)

# Utilization of Iranian genetic material[1)]

Hermann KUCKUCK
Institute of Applied Genetics, Technical University, Hannover, Germany (West)

This paper aims to demonstrate with the aid of some examples taken from my Iranian collections how germplasm of native populations and wild species may be evaluated and utilized in plant breeding programmes of the country concerned as well as in the research work in other countries through international cooperation.

The routes of 6 excursions carried out in 1952～54 whilst I was acting as FAO-expert on cereal breeding in Iran (s. KUCKUCK 1956, FAO Report No. 517), are shown on a map (Fig. 1). Samples from 500 localities were collected. The locations of the samples are pinpointed on this map by successive numbers 1～500. The names of the species grown and collected in the localities concerned at the time can be identified by different symbols on the map.

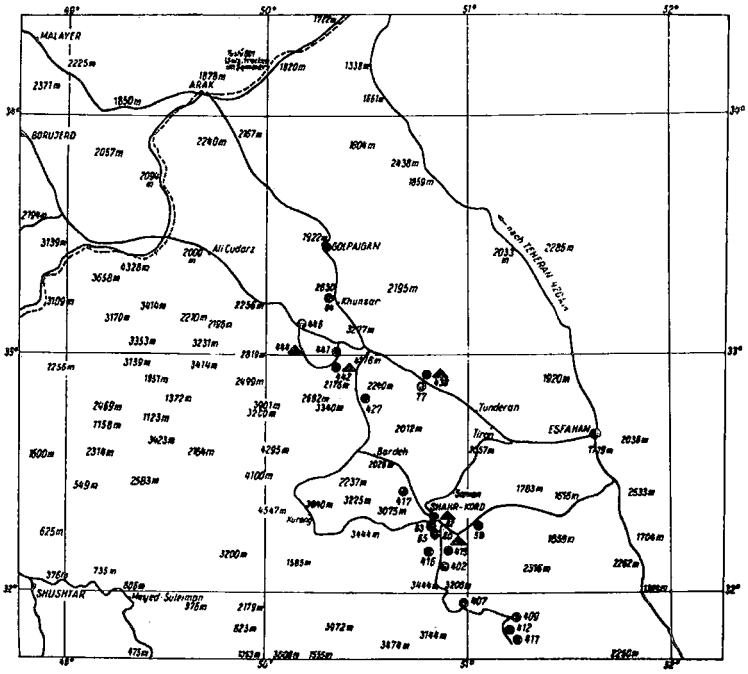



Fig. 1. Localities of *T. aestivum* ssp. *spelta* (●) and of *T. dicoccum* (▲) in the high platean of Shahr-Kord (1 : 1,000,000) after KUCKUCK and SCHIEMANN, 1957.

1) Paper presented at the Eurarpia Conference on European and Regional Gene Banks, held on April 10～15 at Izmir Turkey.

A review is given in Table 1 to the extent in which the indigenous genetic material had been used in the wheat breeding programme of Iran in an attempt to develop uniform improved varieties by the pedigree method. This programme has resulted in the release of 4 commercial varieties (MUDRA 1960 and 1972).

Table 1. Number of lines selected and tested in the Iranian wheat breeding programme (pedigreee method) after MUDRA 1972

| Year | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 |
|---|---|---|---|---|---|---|---|---|---|---|
| Single head progenies | 2472 | 8034 | 1835 | 2856 | 2379 | 365 | — | 10 | 30 | 55 |
| Preliminary tests | 1201 | 1063 | 682 | 293 | 404 | 312 | — | — | — | 13 |
| Comparative yielding tests of the selected lines | 63 | 330 | 325 | 240 | 112 | 126 | 95 | 61 | 30 | 42 |

In Table 2 the locations of the populations from which these new cultivars were selected are specified; furthermore information is also given on the yielding capacity of the new cultivars, and on their average yield in comparison with the respective local populations and on the areas where they are commercially grown. These cultivars are superior in the high plateau of Iran—and that is the major arid region—to introduced Mexican

Table 2. Basic material, areas of growing and performance of 4 wheat varieties (data collected out from MUDRA 1960 and 1972)

| Name | Origin of the population | Commercially grown | Yielding capacity | Average yield local population = 100 |
|---|---|---|---|---|
| Ommid | Saveh<br>Teheran Province | Asarbaidshan<br>Khorassan<br>Kurdistan<br>Lorestan | 50 dz/ha | 125 in Asarbaidshan<br>118 in Khorassan<br>140 in Kurdistan<br>and Lorestan |
| Roshan | Mianeh<br>Asarbaidshan | Isfahan<br>Northern Fars | 50~70 dz/ha | 173 |
| Sholeh | Khuzistan | Khuzistan | 30 dz/ha | 148 |
| Azar | Asarbaidshan | Asarbaidshan<br>Western Iran | 25 dz/ha under rainfed condition | — |

Table 3. Seedling tests of 4 Iranian wheat varieties with different races of yellow rust (*Puccinia striiformis*) (E. FUCHS, Braunschweig, Germany-West, unpublished)

| race / variety | 20A Iran | 20A Turkey | 3/55 Europe | 54 Europe | 60 Europe |
|---|---|---|---|---|---|
| Ommid | IV | 0 | 0 | 0 | 0 |
| Roshan | IV | 0 | 0 | 0 | 0 |
| Sholeh | IV | 0 | 0 | II-IV | II-IV |
| Akova | IV | 0-II | IV | IV | IV |

0 : resistant, II : moderately resistant/susceptible, IV : susceptible

varieties.

These uniform Iranian varieties have also become of great interest to breeders in other countries including in Europe. According to the investigations of Mrs. Dr. E. FUCHS, Biologische Bundesanstalt, Braunschweig, West-Germany (information through correspondence), the 4 varieties proved to be susceptible to race 20 Iran of *Puccinia striiformis* but resistant to race 20 Turkey; 2 varieties are resistant to 3 races prevalent in Europe.

In 1952 growing of *Triticum aestivum* ssp. *spelta* was found on the high plateau of Shahr-Kord near Isfahan. The extent of this spelta growing area was determined by taking samples from 18 localities which are pintpointed in the map by dark circles (Fig. 1). The genetic variation of these samples was analysed in a research programme as to the variation of the *spelta*-complex and other characters such as winter-summer type etc. The *spelta* complex is some times broken up, and great numbers of transitorial types to the free threshing *T. aestivum* ssp. *vulgare* could be detected. Thus a contribution could be given on the problem—being yet unsolved at that time—of the evolution of the hexaploid wheat as to whether *T. aestivum* ssp. *spelta* ist the ancestor of the free threshing hexaploid wheats or a derivative which has arisen from free threshing types by mutation recently occurred in Europe. Since the analysis of the *spelta* findings in Iran had been made the latter hypothesis forwarded by SCHIEMANN and FLAKSBERGER simultaneously in 1930 is now to be abolished (GÖKGÖL 1961, KUCKUCK 1964, KUCKUCK und SCHIEMANN 1957, POHLENDT 1958). Spelta growing in Iran has disappeared completely in the course of the past 15 years; meaning this small center of wheat evolution is now irridicated. However the former selected lines of the Iranian spelta are being maintained in the gene bank at Braunschweig-Völkenrode. Furthermore the findings of *Secale vavilovii*, a rather rare wild species proved to be of great value for breeding purposes and research in other fields as well. All data on this matter are summarized in Table 4. I succeeded to collect two samples of this species which are located in a distance of 63 and 9 km from Hamadan respectively: one sample as weed in a wheat field and the second on a steep road side.

Table 4. *Secale vavilovii* (wild type) in Iran

| Collection No. | Locality | Characteristics | Distributed samples | Publications |
|---|---|---|---|---|
| 114 | 63 km from Hamadan in a wheat field 2300 m | fragile cleistogamous 114 and 119 identic, stabile genome | 20 | 12 |
| 119 | 9 km from Hamadan steep road side | | | |

Evolutionary studies : 2 translocation etc.

Resistance studies : fully susceptible to all strains of *Puccinia graminis secalis* and *Puccinia graminis tritici*.

Breeding : 2x derivatives *S. cereale* × *S. vavilovii* cleistogamous (induction of mutation).
4x derivatives *S. cereale* × *S. vavilovii* dwarf types (80~100 m), long dense ears, cleistogamous.

The progenies of both samples turned out to be completely identical and uniform. The genome proved to be very stable as to spontaneous mutations and also after treatment by X-rays. *S. vavilovii* is characterized by fragile ears, very small grains and cleistogamous flowers. It is fully self fertil. Samples were distributed to about 20 research institutes the results of which have been presented in about 12 publications up to now (KRANZ 1957, 1973, KUCKUCK und KRANZ 1953, KUSH 1963). Genetic-cytological studies carried out with a view to problems of evolution of cultivated rye revealed the fact that *Secale vavilovii* is differentiated from *S. cereale* by two translocations and some smaller chromosomal differences. However the chromosome number of both species is the same 2n=14 (KRANZ 1961, 1973, KUSH 1963).

In respect to breeding problems in Hannover the transference of the cleistogamy and self fertility from the wild to the cultivated species by crossing and backcrosses became successful. In the middle of the Fig. 2 a derivative of this cross is represented; the empty anthers of which are pushed out from the flowers by the developing grains (KUCKUCK und PETERS 1967 and 1970). Tetraploid derivatives induced by colchicine treatment proved to be semidwarfs of about 80~100 cm with very long dense ears. They are fully self fertile and cleistogamous (KUCKUCK unpublished).

Fig. 2. From left to right : *Secale cereale* (selfsterill), derivatives from *S. cereale* × *S. vavilovii* (selffertile and cleistogamous) and *S. vavilovii.*

As regards to resistance studies WATSON stated that *S. vavilovii* is fully susceptible to all strains of *Puccinia graminis secalis* and *tritici* (information through correspondence). This result was very well received by the scientists dealing with resistance studies.

Recently cytoplasmatic male sterile types were found by GEIGER (1971) in a so-called macropopulation II of primitive "weed" rye growing in wheat fields. This macropopulation II covers the area Marand-Koy-Maku in Asarbaidshan (Table 5). After the rye populations had been screened by my student KRANZ (1957) some populations which seemed to be more or less identical as to their gene pool were bulked (=combined) in order to facilitate the preservation.

To conclude it is to be noted that it takes several years of screening and investigations in order to find out which collected material might be considered to be useful and valuable for breeding programmes or research purposes in the related fields. As to the

Table 5. Cytoplasmatic male sterile types in rye populations (*Secale cereale*) in Asarbaidshan, Iran

| Collection No. | | Locality | Publication |
|---|---|---|---|
| 224 | Macropopulation II | Marand | Geiger, H.H., 1971 Naturwissenschaften 58, 98–99 |
| 225 | | 〃 | |
| 227 | | 〃 | |
| 235 | | Koy | |
| 229 | | 〃 | |
| 230 | | Maku | |

utilization of collected material in plant breeding programmes of other countries one should not rely too much on ecological analogies and should not spent too much time and energy in order to collect the necessary data for these analogies. Screening on a large scale through international cooperation should be given preference.

## Literature cited


GEIGER, H. H. 1971. Cytoplasmatisch genische Pollensterilität in Roggenformen iranischer Abstammung. Die Naturwissenschaften **58**: Jahrg. 98～99.

GÖKGÖL, M. 1961. Die iranischen Weizen. Zeitschrift für Pflanzenzüchtung **45**: 315～333.

KRANZ, A. R. 1957. Populationsgenetische Untersuchungen am iranischen Primitivroggen. Ein Beitrag zur Systematik, Evolution und Züchtung des Roggens. Zeitschrift für Pflanzenzüchtung **38**: 101～146.

—— 1961. Cytologische Untersuchungen und genetische Beobachtungen an den Bastarden zwischen *Secale cereale* L. und *Secale vavilovii* GROSSH. Züchter **31**: 219～225.

—— 1973. Wildarten und Primitivformen des Roggens (*Secale* L.) Cytogenetik, Genokologie, Evolution und züchterische Bedeutung. "Fortschritte der Pflanzenzüchtung", Beiheft No. 3 der Zeitschrift für Pflanzenzüchtung, 605.

KUCKUCK, H. 1956. Distribution and variation of cereals in Iran. FAO Report No. 517.

—— und E. SCHIEMANN 1957. Über das Vorkommen von Spelz und Emmer *Triticum spelta* L. und *Triticum dicoccum* SCHÜBL. im Iran. Zeitschrift für Pflanzenzüchtung **38**: 383～396.

—— and A. R. KRAN 1957. A genetic analysis of rye populations from Iran. Wheat Information Service No. **6**: 20～21.

—— 1964. Experimentelle Untersuchungen zur Entstehung der Kulturweizen. I. Die Variation des iranischen Spelzweizens und seine genetischen Beziehungen zu *Triticum aestivum* ssp. *vulgare* (VILL., HOST.) MAC KEY, ssp. *spelta* (L.) THELL. und ssp. *Macha* (DEK. et MEN). MAC KEY mit einem Beitrag zur Genetik des Spelta Komplexes. Zeitschrift für Pflanzenzüchtung **51**: 97～140.

—— und R. PETERS 1967. Genetische Untersuchungen über die Selbstfertilitat bei *Secale vavilovii* GROSSH- und *Secale cereale* L. var. Dakold im Hinblick auf die Probleme der Züchtung und Phylogenie. Zeitschrift für Pflanzenzüchtung **57**: 167～188.

—— und R. PETERS 1970. Weitere genetisch-züchterische Untersuchungen an *Secale vavilovii* GROSSH. Zeitschrift für Pflanzenzüchtung **64**: 182～200.

KUSH, G. S. 1963. Cytogenetic and Evolutionary Studies in *Secale*. IV. *Secale vavilovii* and its Biosystematic Status. Zeitschrift für Pflanzenzüchtung **50**: 34～43.

MUDRA, A. 1960. Getreidezuchtung im Iran. Zeitschrift für Pflanzenzüchtung **44**: 279～300.

—— 1972. Weizenzüchtung im Iran—Ein Beitrag zum Problem der HY-Sorten. Zeitschrift für Pflanzenzüchtung, **68** : 181～212.

POHLENDT, G. 1958. Anatomische Untersuchungen über die Brüchigkeit der hexaploiden Weizen unter Berücksichtigung der Iranischen Spelzfunde. Zeitschrift für Pflanzenzüchtung **39**: 339～347.

(Received July 4, 1972)

## II. News

### IV International Wheat Genetics Symposium

The International Organizing Committee has the pleasure of inviting you to attend the Fourth Symposium to be held at Columbia, Missouri, US.A., from the 6th to the 11th of August, 1973.

The program of the six-day Symposium will be divided into various sections, some of which may have to be held simultaneously, and will cover as many aspects of wheat genetics as possible including some, or all, of the subjects listed below.

General Genetic Analysis — Aneuploidy
Cytoplasmic Inheritance — Hybrid Wheat
Developmental and Physiological Genetics
Genetics of Quantitative Characters — Natural and Induced Variability
Species Relationships and Evolution — Regulation of Chromosome Pairing
Genetics of Reaction to Pests — Alien Genetic Material
Breeding — Nomenclature — Miscellaneous

The registration fee for the Symposium will be $40.00 U.S. and, apart from attendance at the Symposium, includes a copy of the Proceedings, further Symposium literature, participation in the social events, the dinner and local transportation. The payment of this fee will not be required until approximately the middle of 1973.

Rooms have been reserved for some 300 participants in a residence on the University campus. This residence, which is air-conditioned and offers food and recreational facilities, is located within easy walking distance of the meeting rooms. Accommodation (2 per room) and meals from the evening of the 5th of August until the morning of the 12th of August will cost approximately $80.00 per person. In addition to this residence, accommodation will be available in local motels and will cost approximately $14.00 per single room, $18.00 per double room, per night and does not include meals. Further details of the accommodation and its reservation will be made available in the Second Notice to delegates.

A tour committee is planning and organizing both pre- and post-symposium tours. Since the International Genetics Congress will be held on the West Coast approximately one week after the Wheat Symposium, the pre-Symposium tour will commence on the East Coast and terminate in Columbia, and the post-Symposium tour will start in Columbia and terminate in San Francisco.

The cost to the participant of the pre-Symposium tour (including transportation, by

bus, and accommodation, but excluding meals) will be approximately $75.00. The cost to the participant of the post-Symposium tour (transportation by bus and air, plus accommodation, but excluding meals) will be approximately $125.00.

Please indicate on the Provisional Reply Form if you would like to participate in either or both of these tours. Participation in the tours may have to be limited in number due to restrictions in transportation facilities.

Demonstration material to be grown and to be inspected on the post-Symposium tour at Fargo can be accepted up to the 31st of January, 1973. All material must be of spring habit, clearly labeled and mailed to reach the Secretary accompanied with the appropriate quarantine documents by the above date. Please indicate on your provisional reply form if you would like to take advantage of this facility.

**Local Organizing Committee:** W. Q. Loegering, R. L. Mitchell, J. M. Poehlman, L. M. S. Sears, E. R. Sears, D. Sechler and G. Kimber, Secretary.

## III. Editorial Remarks

### Announcement for future issues

WIS No. 37 will be planned for publication in September 1973. Manuscripts for this issue are accepted any time, not later than July 31, 1973.

WIS is open to all contributions regarding methods, materials and stocks, ideas and research results related to genetics and cytology of *Triticum, Aegiolops, Secale, Haynaldia* and related genera. Manuscripts should be typewriten in English, and submitted with duplicates. One article should not exceed five printed pages, including one textfigure (smaller than $7 \times 7$ cm$^2$). Lists of stocks are exempted from this page limit. Authors receive 50 reprints of their contributions free of charge. Extra copies are printed by order at cost prince. Communications regarding editorial matters should be addressed to:

Kosuke YAMASHITA
Wheat Information Service
Kihara Institute for Biological Research
Yokohama, Japan

### Raise of Membership Fee

Due to the economic situations, the yearly Membership Fee is raised up to ¥700 for foreign member and ¥500 for Japanese member from the fiscal year beginning April 1973. The money should be paid by the Foreign Postal Money Order, othersiwe considerable loss is caused due to the bank charges. Back numbers are available.

### Acknowledgement

The cost of the present publication has been defrayed partly by the Grant in Aid for Publishing Research Results from the Ministry of Education, Government of Japan, and partly by contributions from the Flour Millers Association, Tokyo, Japan, and the Jenkins Foundation for Research, Sallinas, California, U S A. We wish to express our sincere thanks to those organizations. We should also like to express our sincere gratitude for favorable comments regarding WIS Nos. 1~35, and valuable contributions for the present issue. Increased support would be appreciated

*The Managing Editor*

## Coordinating Committee

| | | |
|---|---|---|
| HIRATSUKA, N. | HIRAYOSHI, I. | IMAMURA, S. |
| JENKINS, B. C. (U.S.A.) | KATAYAMA, Y. | KIHARA, H., *Chairman* |
| LILIENFELD, F. A. (U.S.A.) | MATSUMOTO, K. | MOCHIZUKI, A. |
| MÜNTZING, A. (Sweden) | NISHIYAMA, I. | PAL, B. P. (India) |
| RILEY, R. (England) | SEARS, E. R. (U.S.A.) | TANAKA, M. |
| TSUNEWAKI, K. | YAMAMOTO, Y. | YAMASHITA, K. |

## Editorial Board

KIHARA, H. LILIENFELD, F. A.

YAMASHITA, K., *Managing Editor*


*Explanation of the Figure on the Cover*

a. Leaves of adult plants with alternative telocentric chromosomes inoculated with leaf rust strain 76–0; left susceptible, right resistant. (×2.5) b. Leaves of seedlings with altenative telocentric chromosomes inoculated with stem rust strain 21–2; left resistant, right susceptible. (×5.5) c. Chimaeric primary leaf from embryo possessing telocentric chromosome conditioning stem rust resistance inoculated with stem rust strain 21–2; L.H.S. resistant, R.H.S. susceptible. (×5.5); by T. T. THE and E. P. BAKER (Figure 1 p. 19, present issue of WIS).