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THIRD INTERNATIONAL WHEAT GENETICS SYMPOSIUM
SPONSORED BY THE AUSTRALIAN ACADEMY OF SCIENCE CANBERRA 5-9 AUGUST 1968

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Proc. 3rd Int. Wheat Genet. Symp. Canberra 1968,
Aust. Acad. Sci. Canberra. pp. 155-158

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In recent years, Kyoto University has sent several scientific expedition parties abroad, including four wheat and *Aegilops* collecting ones by Dr. H. KIHARA and his group as listed below. Namely,

1. to the Karakoram and Hindukush in 1955 (KUSE),
2. to the Eastern Mediterranean regions in 1959 (BMUK),
3. to the Caucasus in 1966 (BEC), and
4. to Ethiopia in 1968 (KUSES).

The results of the KUSE 1955 have been published in Volume I of the series of the reports of the results of the Kyoto University Scientific Expedition to the Karakoram and Hindukush (8 volumes in all), and those of the BMUK 1959 have been published from time to time in the Wheat Information Service (WIS). The materials of the other two expeditions are under investigation.

In the present paper, some of the leading results of genetical and cytological importance will be described.

MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERS AND DISTRIBUTION

1. Aegilops

In *Aegilops*, the localities of all the existing species except *Ae. juvenalis* have been plotted. Among them *Ae. mutica* and *Ae. vavilovi* occurred in very restricted areas and *Ae. bicornis* var. *mutica* and *Ae. caudata* var. *typica* rarely. In *Ae. crassa* a new form with no awn was found and in *Ae. longissima* a form with only one long awn.

In *Ae. squarrosa*, var. *typica* and var. *anathera* were found widely in the whole area of the distribution of the species, while var. *meyeri* and ssp. *strangulata* were only found in a restricted area along the Caspian Coast.

Some of the strains of var. *meyeri* and ssp. *strangulata* showed resistance to brown and black rusts (HIRATSUKA, 1959). These materials will be useful for

breeding purposes in synthesizing hexaploid wheats resistant to those rusts. Actually a synthesized hexaploid using var. *meyeri*, ABD No. 22, showed a considerable resistance. Most of the varieties of *Ae. squarrosa* have winter habit, but those from Quetta (Pakistan) to Kabul (Afghanistan) showed spring habit.

In Azerbaijan, Armenia and Georgia, *Ae. squarrosa, cylindrica* and *triuncialis* occurred very commonly.

In *Ae. caudata*, an awned var. *polyathera* occurred very widely, but an awnless var. *typica* occurred only in localities in the periphery of the distribution of the species. It is interesting to note that there is hybrid sterility between the two varieties.

2. Triticum

Many strains of *Triticum* species were collected mainly from the fields. *T. aegilopoides* (in wild) and *monococcum* (under cultivation) were found in western Turkey and elsewhere. *T. dicoccoides* was collected in the skirt area of Mt. Hermon in Syria. *T. araraticum* was found in a limited area near Garni, Armenia. *T. timopheevi, T. vavilovi* and *T. macha* were also obtained by the courtesy of Dr. MENABDE, Georgian Academy of Science, Tbilisi.

With respect to morphological characters (awn length, hairiness of empty glumes, glume color and seed color), *T. vulgare* strains from Tehran, Isfahan (Iran) and Kabul (Afghanistan) showed wide variation, while those from Gorgan and Tabriz (Iran) were less variable. Three new varieties were found.

T. compactum was found mainly in the mountainous area in Afghanistan and in the area from Pahlavi to Ardabil in Iran. The Afghan strains were characterized by slight square-headedness while those from Iran were normal.

SPECIES RELATIONS IN *AEGILOPS* AND *TRITICUM*

In the northern stretch of the Hindukush range, an association of 4*x* and 6*x* forms of *Ae. crassa* was observed. According to KIHARA *et al.* (1958) the 6*x* form has the D genome in addition to the 4*x* form. It is generally thought that the additional D genome was derived from *Ae. squarrosa* occurring in the same association. In other words the 6*x* form arose in this area.

Similarly with *Ae. triaristata*, 4*x* and 6*x* forms occurred mixed near Bandirma in Turkey. The 6*x* form has the M genome in addition to 4*x* forms possibly derived from *Ae. heldreichii* occurring in the same or nearby association. This indicates that the 6*x* form arose in the above place.

A 6*x* form found near the Jordan-Syria border was identified as *Ae. crassa* var. *vavilovi* Zhuk. The genome constitution of this form was found to be $DM^{cr}S^{1}$, which is different from the 6*x* form from Afghanistan with the genome constitution $DM^{cr}D^{2}$.

Ae. triuncialis ssp. *eu-triuncialis* is distributed widely, but in Maimana (Afghanistan) ssp. *orientalis* occurred in a mixture. This indicates that ssp. *orientalis* had possibly originated there.

TANAKA (unpublished) carried out extensive cytological studies on the hybrids between *T. araraticum* and *T. timopheevi* and found that the chromosome pairing in F_1 was 13.96″, chiasma frequency 32.5 per nucleus, pollen fertility 42.47% and seed fertility 31.0%, on an average. Furthermore in F_2, almost all individuals had 14″ and showed normal fertility. On the other hand, SVETOZAROVA (1939), SACHS (1953) and WAGENAAR (1961, 1966) reported that the hybrids between the two species are entirely sterile though the pairing of chromosomes in PMC's is normal. Using the collected materials of *T. araraticum* in the same cross combination, TANAKA (unpublished) identified two different strains of *T. araraticum*; with *T. timopheevi* one gave the fertile hybrids while the other gave the sterile hybrids. The former strain was characterized by dark green leaves, procumbent tillering habit and late maturity, and the latter by light green leaves, semi-erect tillering habit and early maturity.

SYNTHESIS OF 6X WHEAT

Since it was confirmed that *Ae. squarrosa* is one of the ancestors of common wheat, the synthesis of allohexaploid wheats from various crosses between emmer wheats and this species has been attempted on a wide scale. The collection of *Ae. squarrosa* was enriched by the above expeditions, and the work of synthesizing 6*x* wheat became more extensive using not only var. *typica* but also var. *meyeri* and ssp. *strangulata*. The production of those triploid combinations was always successful.

As is already known (KIHARA and LILIENFELD, 1949), unreduced functional gametes with 21 chromosomes due to restitution are often found. Those gametes may combine in a synthesis of 6*x* wheat. In the cross combination of *T. persicum* with ssp. *strangulata* or var. *meyeri* a high percentage of fertile pollen (maximum 96.8%) and as well as seed fertility (maximum 73.3%) resulted. It was also found that the fertility was higher in late maturing ears than in early maturing ears. Since in some cross combinations the seed fertility was less than 10%, this will indicate that the above combination, *T. persicum* x ssp. *strangulata* or *meyeri*, would have most probably taken part in the origin of 6*x* cultivated wheat.

However, *T. persicum*, a Persian wheat, was not found anywhere in Iran, by the KUSE 1955. This species was found to occur in the Caucasus by BEC 1966.

VARIATION IN MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERS

In *speltoides*, a form with compact head was found near Ankara (Turkey). It was noted that the variation of *Ae. squarrosa* is centred in Iran, that of *variabilis* in Jordan and that of *T. compactum* in Afghanistan.

Emmer wheats from Ethiopia showed wide variations as expected. However, none of the related species of Gramineae was found. Rich collections from there are now under classification.

As noted from the FAO/IBP Conference discussion, "wheat is the most impor-

tant of all the cereal crops, and its centres of diversity are geographically well delineated and genetic erosion of the primitive races of wheat as they are increasingly replaced by modern cultivars is already far advanced". Therefore "wheat should receive top priority for exploration".*

A large number of the strains of wheat and *Aegilops* collected by the former expeditions are maintained mainly in the field of the Research Institute for Agricultural Plants, Kyoto University. Most of it does not appear to be useful at the present time. Nevertheless the material is a contribution to the reserve of genetic material which may be of value in future genetic analysis and plant breeding work.

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* Quoted from a letter of Dr. J. VALLEGA, Director, Plant Production and Protection Division, FAO, Rome, Italy.