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THE DISTRIBUTION OF *AEGILOPS TAUSCHII* COSSON IN CHINA AND WITH REFERENCE TO THE ORIGIN OF THE CHINESE COMMON WHEAT

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SUMMARY

There are two distribution areas of *Aegilops tauschii* in China. One is Yili River valley, it grows in natural vegetation. Another is along the middle part of Yellow River, as a weed race.

The *Ae. tauschii* was proved to be a native species in China, and therefor the origin of those special kinds of the Chinese common wheat can be explained. Because not any wild emmer has been found in China, a special *Ae. tauschii* should be the donor.

Electrophoretic evidence of analogous esterase enzymes shows that the Chinese *Ae. tauschii* is quite different from that of foreign sources.

Many scientists maintain that *Triticum aestivum* L. was introduced into China from the Middle East of Asia. However, this proposition does not tally with a number of facts. Take the well known cv. Chinese Spring for example. Riley *et al.* (1967) pointed out that none of the chromosomes in its genomes were found to have interchanged. Thus, the native cultivar Chinese Spring of Sichuan province of China is a primitive hexaploid wheat. The Tibetan common wheat of the brittle rachis weed race (= *T. aestivum* subsp. *Tibetanum* Shao, Li et Basang) and the Yunnan hulled wheat (= *T. aestivum* subsp. *yunnanense* King) which belong to primitive *Inflatum* Vav., and Xinjiang rice wheat (= *T. petropavlovskyi* Vdocz et Migusc.) a Polish wheat-like hexaploid wheat, are all special primitive forms found in China. Where are they from? Their migration from West Asia is not likely, because none of them have ever been found anywhere except in China.

On the other hand, if some special kinds of hexaploid wheats originated in China, a special *Ae. tauschii* must have served as the donor, because not any wild emmer has been found in China.

THE DISTRIBUTION OF *AE. TAUSCHII* IN CHINA

In 1955, the *Ae. tauschii* was discovered for first time by D. X. Ye in Xinjiang county, Henan, China. It was collected by Y. T. Xie in Xian, Shanxi the next year. Afterwards, botanists found it at many places along the middle reaches of the Yellow River. We have found all the plants under investigation are of weed race, although they are widely dispersed over 11,000 km^2.

In Xinjiang, L. R. Zhang collected a specimen in the semi-desert lowland near the

Gong-nai-si sheep farm in 1976. We found this specimen to be *Ae. tauschii*. In 1981–1982, we sent two parties to the Yili River vally for further survey. The *Ae. tauschii* has been proved to be a native species which grows in the natural vegetation of this region. In the semi-desert lowland, it is a small thin grass growing together with *Artemisia boratalensis*, *A. terrae-alba*, *Kochia protrate*, *Bromus gedosianus*, *Phleum phleoides*, *Eremopyrum triticeum*, *E. orientale* etc. As the elevation rises to 1420 m, *Ae. tauschii* and *B. gedosianus* which gain an adventage over others become tall grasses, and form a dense steppe community, sometimes, over several hundred hectares. It looks quite like an immense piece of cultivated wheat field. *Ae. tauschii* often grows with red clover and salvia in the meadow by little streams. In general it is a component of the steppe.

The spikes of the Chinese *Ae. tauschii* vary in color, ranging from brown black to pale yellow. The plants are biennial winter grasses. Cytological observation shows that the plants are diploid, and there is no diffence at chromosome level as compared with those materials from the Middle East.

MATERIALS AND METHODS ON ESTERASE ISOZYMES ANALYSIS

The materials involved in the present study are listed as follows:

1. *Ae. tauschii*, introduced from France, originated in Iran; Creeping and strong winter in habit; dark green in color.
2. *Ae. tauschii*, introduced from DDR, originated in Caucasia; upward and winter in habit; light green in color.
3. *Ae. tauschii*, collected in Wu-gong, Shanxi, China; upward and winter in habit, light green in color.
4. *Ae. tauschii*, collected in Gong-nai-si, Xinjiang, China; upward and winter in habit; light green in color.
5. *Ae. tauschii*, collected in Lu-shi, Henan, China; upward and winter in habit; light green in color.

The analogous esterase enzymes were analysed by means of vertical polyacrylamide gel electrophoretic method. The seeds of that every year maintaining high viability were used for the present analysis. They were surface sterilised and soaked for germination in an incubator kept at the temperature of 25°C. The coleoptiles developed to 1.5–3 cm long were used as the sample. 1 g of each sample was crushed in 4 ml of cold homogenieation Tris-cit. buffer (pH of 8.2). Then, the homogenate was centrifuged. The supernatant was added with an equal volume of 40% sucrose solution and with a small quantity of bromophenol blue solution.

The gel slab was made of polyacrylamide containing Tris-cit. The pH value of its upper part was 6.8 and that of the lower one 8.9 for esterses migration. The Tris-glycin was used as the buffer with a pH of 8.7. 50 μl of supernatant of each sample was placed in the sample slots of the gel slab. The electric current was adjusted to 100 V, 2 mA for the first 55 minutes, and then adjusted to 200 V, 6 mA for another 190 minutes. The entire apparatus was kept in a cooling chamber adjusted to 4°C.

After electrophoresis, the gel slab was removed from plexiglass chamber and stained

with Fast Blue RR-α-naphtyle acetate in 0.1 N phosphate buffer with a pH of 7.5. This reaction took place under 37°C for 30 minutes in an incubator.

For convenience of description scales are used on the left side of the figure to express in arbitrary units the distances of migration (Dm) of the bands. The Arabic numbers on the right are designated for the bands of different isozymes.

RESULTS AND DISCUSSION

The esterase zymograms found in *Ae. tauschii* in this study can be divided into 4 types as is shown in Fig. 1. Form the origin toward the anode, there are three zones in the zymograms of *Ae. tauschii*: (1) slow migrating zone (from origin to 5 Dm) in which there are 6 bands; (2) medium zone (from 5 to 7.6 Dm) where another 6 bands are there; and (3) fast zone (from 7.6 to 9.5 Dm) in which there 4 fast migrating bands. E-1 (esterase 1) and E-3 of the fast zone and E-5 of the medium zone are highly active bands which stain densely. The bands of the slow zone stain very densely except those of *Ae. tauchii* from the Caucasia.

The difference of these four types are described as follows:

Type 1. *Ae. tauschii* from Iran. (Fig. 1. i-j) E-1, E-4, E-5, E-11, E-12, E-13 and E-14 are very active bands which stain very densely.

Type 2. *Ae. tauschii* from the Caucasia (Fig. 1. g-h). This type is similar to type 1 except that bands E-2, E-3 and E-6 are daker than those of type 1, while E-11, E-13 and E-14 are much lighter in color.

Type 3. *Ae. tauschii* from Wu-gong and Lu-shi (Fig. 1. e-f and a-b). These two show identical zymograms. This type differs from type 2 in the lack of band E-1, and in the darkening color of the bands E-2, E-4, E-8, E-9, E-12, E-13 and E-15.

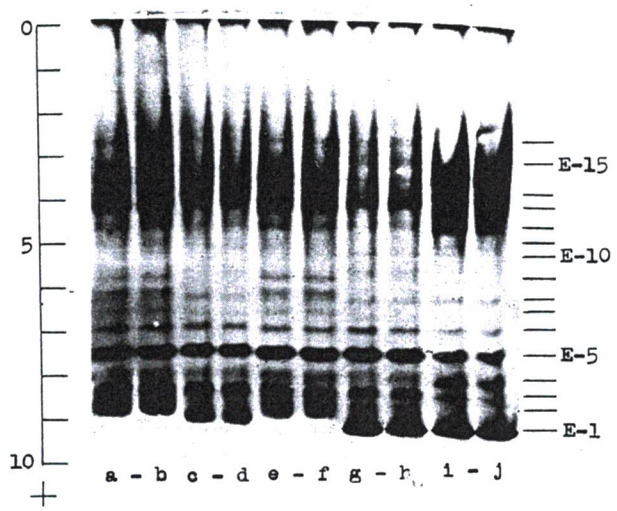

Fig. 1. Esterase zymograms of *Aegilops tauschii* Cosson: a-b from Lu-shi, Henan, China; c-d from Gong-nai-si, Xinjiang, China; e-f from Wu-gong, Shanxi, China; g-h from the Caucasia; i-j from the Iran.

Type 4. *Ae. tauschii* from Xinjiang (Fig. 1. e–d), which is similar to that of type 3 except that the band E–2 migrates slightly faster. This phenomenon shows there is some molecular diversity of E–2 between these two types. In addtion, bands E–8 and E–9 in the medium zone are slightly weaker than those of type 3.

Form the above observation, we come to the conclusion that *Ae. tauschii* from the middle reaches of the Yellow River are identical in esterase isozymes. The *Ae. tauschii* in Xinjiang of China is similar to that along the Yellow River except for a minor isozymatic diversity. The Chinese *Ae. tauschii* is quite different from that of foreign origin in band E–1. The band E–1 of foreign origin is a densely stained esterase with a high enzymatic activity.

Since *Ae. tauschii* exists in China, the special kinds of primitive hexaploid wheat might result from the natural hybridization between cultivated emmers and Chinese *Ae. tauschii* in those areas where the two species grow together.

From the ecological point of view, the *Ae. tauschii* along the middle reaches of the Yellow River might have migrated from Xinjiang (Yen *et al.* 1983). Nevertheless, the authors believe that the cultivated emmers were introduced from West Asia to China along the silk-road in prehistoric period by primitive farmers. The proposition that some special kinds of hexaploid wheats might have originated in China, however, does not go in contradiction with the view that some hexaploid wheats in China were introduced from West Asia just like those cultivars of the emmer mentioned above.

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