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# A Contribution to the Knowledge of the Wheats of China

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The wheats of China, having evolved for centuries in their unique environment, are of exceptional interest to botanists and crop growers. According to the data of N. I. Vavilov the wheat cultu[illegible] was known in China as early as three millenia before our era, and this territory is one of the most ancient offshoots of the Outer Asiatic-Transcaucasian seat of the soft (42-chromosome) wheats. The latter are represented here by an unusual botanical variety and by a multitude of endemics. The investigations of the All-Union Plant Cultivation Institute (VIR) have shown, however, that extremely original endemic forms have developed here also among the tetraploid wheat species, including new forms that were formerly unknown to science.

Among the tetraploid group in China the following species are encountered: Tr. Durum Desf., Tr. turgidum L. (Tsxin' Shan'-bao, 1957), and also, according to the latest data, Tr. polonicum L. and Tr. turanicum Jakubz. Within the hexaploid wheats (Tr. aestivum L. and Tr. compactum Host.) there are, in addition, two new species named in the literature, Tr. amplissifolium Zhuk. (1947) and Tr. yunnanense King (1957). Diploid wheat species have not as yet been discovered in China.

Until recently, Chinese forms of the Tr. durum species were known only from Sinkiang (N. I. Vavilov's collection) and Manchuria. In recent years specimens of this species have been received from other districts (rayons) of China by the VIR. According to the data of Tsxin' Shan'-bao (1957) it is encountered mainly in Sinkiang province (where it is represented by a maximum variety of forms), in the autonomous region (oblast) of Inner Mongolia, and, according to our information, in Heilungkiang, Yunnan, and Suiyuan. In Sinkiang the hard wheat grows in the mountains as high as 2,250 meters (m) above sea level. The extreme eastern limit for this species was noted in Heilungkiang in the locality of An'd (125° east longitude). The local names of the species are: Chun-me, Chan man-may, and Lan'-may. Wintering forms were evidenced also among the Sinkiang varieties. The specific importance of this species in China is very insignificant - less than 1 % of the area planted in wheat; according to Chinese sources it derives its origin from Russia; only among the Sinkiang assortment, in the districts (rayons) of Kul'dzhi and Urumchi did we discover Mediterranean forms of ssp. falcatum Jakubz. under the name of Goloshan'. In addition to the varieties noted in

the literature ( leucurum Al., affine Koern., provinciale Al.), we also discovered melanopus Al. and apullicum Koern.

The local form of beardless hard wheat from Northwestern China (Kansu province) is new to science, and represents the result of an independent genesis and development on the basis of the subspecies expansum of the Tr. durum species (fig 1a).

Let us note the new districts (rayons) of hard wheat cultivation in Sinkiang that are in addition to the area fixed by N. I. Vavilov: Kalmak-Kyure (1,900 m above sea level), Bai (1,360 m), Yarkend (1,500 m), and Kucha (1, 020 m).

The species most frequently encountered in China is Tr. turgidum L., the specific importance of which exceeds 2 % (Tszin' Shan'-bao, 1957). According to literary data the area of the species includes the plateau of Northwestern and Southwestern China, and according to the investigations of the All-Union Plant Cultivation Institute it also includes Shantung in eastern China, Honan (Could he mean "Hunan?" - Translator's note) in south-central China, and Tibet. In Tibet is found the extreme altitudinal limit of this species on the Earth's surface (Lhasa, 3700 m above sea level). In Yunnan Tr. turgidum is cultivated at an altitude of 1,500-2,500 m. The easternmost point where this species is encountered is in Shantung (120° eastern longitude). Varieties of the simplex Schulz group are cultivated under the names of Yuy-may, Lao-bay-pi, and also Tszy-may (Shensi), Si-nan-shue (Yunnan), and others. They are represented by spring-crop and winter-crop forms; the varieties of the compositum L. group are all biologically spring-crop (although in China they are often sowed after the fall) and are encountered under various local names: Da-fu-syuo (Shantung), Fu-syu-may (Shensi), Tszyu-tou-tsi (Honan), Dyu-tou, Finchzhi, Fu-shou-may, Yuan'-chzhi-may, Bish-barmik, Ba-tsa-tou, Dni-zi-ta, Utsaolun, and others. In the last century, seed of the ramose wheat Tr. turgidum, which was called Khayruz, was imported into Russia. This Mediterranean species was initially imported by China from abroad, but under the influence of the environment here unique forms have developed. In the All-Union Plant Cultivation Institute original high-mountain forms of Tr. turgidum from Tibet (v. lusitanicum Koern.) were being studied. One of these was received from Chemdo (3,100 m above sea level), and the other from the Nutsyan river basin. That they belonged to this species was substantiated by cytological analysis (2n= 28). Moreover, high-mountain forms of this species were registered even earlier from Lhasa (Lein, 1949).

It is remarkable that, in analogy with China's hard wheat, an unique beardless form was also discovered among Tr. turgidum (to the southeast from Lhasa, 3,560 m above sea level). Thus, the development in both of these species is proceeding in the same direction.

The high-mountain Tibetan forms, including the beardless, have already been singled out by us (1956) as the separate subspecies Tr. turgidum L. ssp. montanum Jakubz. Let us set forth here a short description of the new subspecies.

The plants are annual, spring crop, and 70-80 cm in height. The sprouts are green and covered with soft pili. The stems are erect, bare, and the joints slightly

hairy. The head is nonbranching, more or less shrunken and small (6-8 cm). The awns are of average length or almost nonexistent. The glumes are slightly swollen. The grains small and mealy.

According to an oral communication from Tszin' Shan'-bao (1957), in the county (uyezd) of Suenia of Szechwan province, original forms of the Tr. turgidum species have been discovered. These forms are distinguished by a very short straw and also by abbreviated heads and grains. Such forms figure in the literature under the name of Blue wheat. There is, however, in the VIR's collection from Yunnan a common form of Tr. turgidum that has a similar name, Kozy-may (violet wheat).

Forms of the species Tr. polonicum L. were discovered by us among the Sinkiang assortment. In this territory in the mountain steppe conditions of the Yarkend and Bai regions (1,350-1,500 m above sea level) one encounters bearded forms of the simplex group, the varieties levissimum Haller and pseudolevissimum Jakubz. In the counties (uyezds) of Luntan' and Zhouchan there are cultivated, in limited areas, endemic beardless analogues of the levissimum variety that have not been previously described in the literature. These forms are locally called Gobi, and have been designated by us as Tr. polonicum L. v. gorskiy Jakubz. (fig 1 b) in honor of A. M. Gorskiy, who had collected these types in Sinkiang in 1957. There is a basis to assume that these new forms draw their origin from Tibet, where even earlier (Lein, 1949) a high-mountain beardless variety was stated (but not described).

Forms of the Tr. turanicum Jakubz. species were revealed for the first time among the wheats of China. It is well known that this species is adapted to the Turan lowlands and to the irrigation methods encountered in the Central Asian republics. In Sinkiang this species is encountered in Ak-su (that is, on the opposite, Przhevalsk, side of the Tyan'-Shan') at an altitude of 900-1,000 m. Morphologically the Chinese forms differ sharply from the usual type of Turan wheat by the presence of long awnlike beaks on the flower glumes - f. aristiforme (fig 1 c) We distinguish them as a separate endemic group of the convariant montanostepposum Jakubz.

Tr. aestivum L., a basic species of wheat that is widely spread in China, over an area of about 25 million hectares, is distinguished by its exceptional diversity in complement of varieties and morphological features. In the literature (Tszin' Shan'-bao, 1957) there are 93 varieties shown; of these, 19 were described for the first time. An analysis of the VIR's expeditional material, particularly of that received from Tibet, allowed us to appreciably supplement the number of China's soft wheats.

The rule for separating the Chinese soft wheat into a special subspecies is shown in the literature (Vavilov, 1957). It was given the name Tr. aestivum ssp. sinicum Vav. (Vavilov, 1958 b). In this connection we note that the soft wheats of Northeastern China, which were mainly imported from Russia, are related to the subspecies indoeuropaeum Vav. The forms from Sinkiang, morphologically very close to the Central Asiatic, belong to the subspecies irano-turkestanicum Vav. The soft wheats of the other provinces of China (and Japan) can be referred to the subspecies sinicum Vav. by their unique complex of

characteristics. N. I. Vavilov collected this subspecies widely. In the light of new facts its boundaries are narrowed by the separation of the new subspecies ssp. amplicifolium Zhuk. (fig 1 d) and ssp. yunnanense King (fig 1 e), which were recognized earlier by Tszin' Shan'-bao as separate subspecies.

The specific features and combination of features characteristic for the Chinese subspecies of soft wheat are absent in the other subspecies (tabl. 1).

Khosono first distinguished the beardless form of the inflatum type among China's soft wheat as early as a quarter of a century ago. Tszin' Shan'-bao (1957) found 5 more analogous varieties among the inflatum. The completely beardless forms among the common (not inflatum) soft wheats, however, were unknown to science. We found such forms mainly among the assortment from Tibet, and also from the provinces of Honan, Kiangsu, and Shantung. We are designating them as vv. exalbidum, exlutescens, exalborubrum, and exmilturum. We consider it possible to segregate all of the completely beardless forms (inflatum and common) that are endemic for China as a separate subspecies, Tr. aestivum L. ssp. exmuticum Jakubz. (fig 2).

A separate group of varieties are comprised of the independently created clubbed forms of China (not as a result of synthetic selection as in Western Europe), which we are designating as conv. sinicocapitatum Jakubz. (fig 3 a).

The same applies to many Chinese forms of inflatum, which by their compressed heads resemble the Indo-pakistan species Tr. sphaerococcum (from which they are distinguished by a lesser sphericity of the grain and a larger head). We encountered such forms among the assortment from Tibet, and also from the provinces of Szechwan, Shantung, Chuydshou (transliterated directly from the Russian text - Translator's note) and others. They should be segregated as conv. sphaeroideum (Flaksb.) m. (fig 3 b).

We discovered aboriginal varieties of a soft wheat with a ramose head among the specimens from Kansu and Shantung. The forms from Shantung are cultivated under the name of Syacfoso. One of them - an analogue of v. exlutescens mihi (fig 3 c) - we are naming v. tarakanovi m., and the others (bearded) - v. ramosoeuerythrospermum m. (fig 3 d).

With every year polymorphism of the Chinese subspecies of soft wheat is becoming more evident. Recently, gray-headed and black-headed varieties have been detected among the assortment of South-central and other districts (rayons) of China. Their existence in China has been denied in the literature (Vavilov, 1958 b). Among the assortment from Tibet we discovered the following varieties, which have not been noted in the literature as existing among the wheats of China: vv. cyanotrix, cinereum, pseudomeridionale, pseudoheraticum, bengalense inflatum, suberythrolencon inflatum. In addition, we discovered new varieties there that were earlier unknown to science: vv. pseudovelutinum m., false-subferrugineum m., cinereoinflatum m., subrecurvatum m., subbarbarossa inflatum m., and subpseudohostianum m.

We discovered endemic forms of Tr. aestivum with unusual arrangements of the spikelets - intermediate between the inflatum and speltiforme phyla (fig 4 a).

One should note that in the structure of the head of many Chinese subspecies of wheat there is shown the result of a century long intensive farming culture and protracted artificial selection. If aboriginal beardless varieties are developed in the tetraploid species, which are commonly represented by the bearded forms, then there are forms that are devoid of even awnlike appendages developed in the hexaploid species, among which the beardless varieties are not a rarity. Many forms of the soft wheat have a clearly outlined fin. By the head structure many of China's soft wheats (particularly the beardless) are sharply distinguished when compared with an assortment of the other subspecies of Tr. aestivum L. In the Chinese soft wheats the head often has a regular form (prismatic) that shows in profile as a square or rectangle. The polychromatic head that is characteristic for China's assortment has also been developed as a result of the protracted intensive culture.

The presence of completely beardless forms among the Tr. compactum species is new, for example v. euwernerianum m., which was formerly unknown to science (fig 4 b). Also unmentioned by the literature was the existence in China's sowings of the varieties: suberinaceum inflatum Palm. (from Kansu), subcterinum Vav. et Kob. (from Szechwan), rufulum Koern. (from Shantung, sort Byan'suy Sao-may). We also made more precise the geography of other varieties as a supplement to the literary data, thus: the variety splendus was shown to be among the assortment from the provinces of Shensi and Hupei; the forms icterinum and creticum were represented among the wheats from Chekiang; the variety fetisovi was detected among the phyla of Shantung and Sinkiang; forms of erinaceum were encountered also in the provinces of Kansu, Chekiang, Honan, Hupei, and Sinkiang; and the varieties humboldti and wernerianum were discovered among the material from Kiangsu.

II. The Selectional Importance of China's Wheats and Their Role in World Agriculture.

The Chines soft wheats present great interest for plant-breeding. The most important quality of these wheats is their early ripening. By this criterion the Chinese forms of Tr. aestivum have no equal among the world's assortment. This applies primarily to the winter forms. An accelerated filling of the grain is characteristic for the Chinese wheats. According to the investigations of N. I. Vavilov the development of the grain begins a few days after flowering. This permits them to develop a normal grain with a high gloss even under arid conditions. The fast ripening of these wheats is the result of a process of natural and artificial selections influenced by the specific conditions of environment (monsoon climate), and by the demands of production (two harvests per year).

As was shown by the investigations of V. I. Razumov, these wheats are specified also by their phases. As a whole the winter wheats of the majority of China's districts (rayons) possess a short vernalization phase. Even in the wheats of the high-mountain regions (Sinkiang and Tibet) this phase amounts to only 30-35 days. By the data of the Wheat Laboratory and the Physiology Dept. of the VIR, the current winter forms have been shown to exist only among the soft wheats from eastern China, particularly from Shantung, Inner Mongolia and Tibet; South-central and Southwestern China are represented primarily by the spring-crop. The principal mass of the Chinese

soft wheats is biologically semi-winter crop (table 2). We detected .o current winter-crop among the assortment from Northeastern China, where, according to the literary data, such forms are to be encountered (Khuan Tzi-fan et al, 1957).

The majority of China's soft wheats reacts slightly to a short day. An exception is comprised by the forms from those districts (rayons) of China where heading occurs under the conditions of a prolonged day (more than 14 hours), for example from Northern China, Sinkiang, and Tibet. In extreme cases in a short day such wheats are retarded by their heading for 49-59 days. Many forms are distinguished by their heat requirement during their light phase.

A valuable characteristic of many Chinese soft wheats is the multi-flowering of the spikelet, which distinguishes these forms from the world's assortment. The number of flowers in a spikelet averages 5, sometimes 6-7. The multiflowering spikelets of China's soft wheat (in conjunction with the early ripening) attracted the attention of Italian plant breeders; as a result many valuable sorts have been created.

The grain of the Chinese soft wheats is small, but in shape nearly spherical; this sphericity is valuable for the milling industry (a reduction of the bran portion in the milling). The protein content in these wheats on their native s il averages 13 %; in the conditions of the USSR, even with a fall planting and irrigation, it is significantly higher.

A selective analysis of the protein content in the soft wheats from the various zones of China, conducted at our request by the Biochemical Laboratory of the VIR (F. O. Dimenshtein) on the material in a Tashkent reproduction of a fall sowing with irrigation, showed that the spring-crop wheats contain more protein than the forms of the winter-crop culture from the same district (rayon). Among the winter and semi-winter wheats the grain from the arid provinces of South-central and Northwestern China is richer in protein ( an average of 17.41 and 17.76 %) than that from the country's more moist Southwest (14.97 %). Analogous regularities were shown on more extensive material in a similar reproduction by the Biochemical Laboratory of the VIR's Central-Asiatic station (L. V. Milovanova). Evidently, the protein of the grain from the arid Northeast is higherthan that of the Tibetan wheats. Thus, according to the 1958 data of the VIR, the Tibetan wheats had a protein content of 16.90 % in a reproduction at Kuban; the Harbin wheats had 17.45 %. The indices of a Derbent reproduction (with irrigation) was respectively 16.15 and 17.35 % (the standard protein content of Novoukrain at Kuban is 17.6 %, at Derbent 18.2 %).

The Chinese soft wheat's feature of a short stalk is very valuable for selection. The great majority of them possesses a weak stem. This applies also to many of Tibet's high-mountain forms. Some of the short stalked forms are noted for their durable straw. The tight enclosure of the grain in the glumes (resistance to grain loss) distinguishes all of Sinkiang's soft wheats. In contrast, the basic mass of soft wheats from the other districts (rayons) of China (except in the Northeast) have glumes and flower glumes that are very delicate, and their grain loss is high. The forms from these districts, which according to head formation resemble the type inflatum (for example, from Tibet), as a whole combine an easy threshing with a resistance to grain loss.

For its resistance to grain loss (in conjunction with an immunity to yellow rust) the Chinese soft wheat was selected for hybridization by plant breeder, W. O. Backhouse in Argentina; this hybridization resulted in the popular sort 38 M. A. and many of its derivatives.

The disease resistance of the Chinese subspecies of soft wheat is pointed out in the literature (Vavilov, 1958 a). Our investigations of several years' standing, particularly in the post-war years, do not substantiate this thesis. In their majority the soft wheats of China are susceptible to fungal diseases (particularly the forms from Tibet). Together with this, among the Chinese assortment there have been populations evidenced that are valuable by their disease resistance. Thus, in an experiment of the VIR in 1956-1958 in the Northern Caucasus the sort Chuy-Ba-shuy displayed a resistance to Puccinia triticina, and also showed a resistance to wheat smut (T. tritici) in an experimental infection near Leningrad. Many of the local populations from Tibet are almost unaffected by powdery mildew. The same applies to several spring-crop sorts of Northeastern China (which belong to the Indoeuropean subspecies Tr. aestivum - Kharbinskaya (Harbin) 2270, Kharbinskaya 3197, No. 96, Kharbinskaya 3602, Kharbinskaya 4385 [Gorya, 1958]). In the pre-war experiments of the VIR at the Pushkin base (K. F. Letov) there were spring-crop forms that were distinguished by their resistance to Puccinia triticina; these were from the North (Chzhili No 28351 and others), from the East (Shantung No. 28397), and from the Northwest of China (Kansu No 28651). Some forms proved to be resistant to powdery mildew; these were from the Southern provinces (Fukien 29146, Honan 28884, Anwhei 28751) and particularly from Northern China (Shansi 28571, 28754, and Hopei 28825). Some winter forms from Northern China (Shansi 28485) also showed resistance to Puccinia triticina in experiments of 1957.

According to the investigations of L. L. Dekaprelevich (in 1959) the soft winter wheats of China proved to be the most desirable initial material for hybridization with the widespread local East Georgian sorts to increase the latter's resistance to Puccinia triticina and yellow rust. In pre-war experiments of the VIR, in an artificial infection, forms from Northeastern China (of the subspecies indoeuropaeum Vav.), as a whole, proved to be resistant to wheat smut (T. tritici); the forms of the subspecies sinicum Vav. are susceptible, particularly those received from Southwestern China. The Chinese forms of soft wheat have been shown to be resistant to head fusariosis (Ivashchenko, in 1954).

Foreign practice effectively uses China's assortment in selection for immunity. Thus, in Argentina, the sorts resistant to the wheat smut, Ustilago tritici, are related through their origin to the soft Chinese wheat. In Germany the form Kitayskaya (Chinese) 166 was shown to be immune to many strains of yellow rust. In the U. S. A. and in South America, Chinese wheat (specifically, the forms Kitayskaya (Chinese) 466, and CI 6223) is used in selection for its resistance to the most destructive 15th strain of stem rust. In Canada the wheat Kitayskaya Krasnaya (Chinese Red) is suitable for hybridization with wheatgrass and is used as a back cross. In this way there are created the amphidiploids W 276 (fig 5 a), 292, 327, 588-2, which in a series of experiments by the VIR retained, under various conditions, their resistance to Puccinia triticina, to yellow rust, and also to powdery mildew.

The existence of absolutely beardless spikelets in a great number of the soft wheats is of selectional interest from the point of view of increasing the food value of the chaff.

According to the evaluation of N. I. Vavilov (1958 b) the Chinese wheats, which as a whole are insufficiently resistant to soil dryness, showed a hardiness to heat in the conditions of 1936 in the South of the USSR. The winterhardiness of the soft winter wheats of China is very low in comparison with the worldwide assortment; some of the forms from Sinkiang (26009, 26055), however, according to the data of the VIR (I.P. Panchenko), are distinguished by their frost resistance, that is, by an increased capacity to harden.

The soft wheats of China at present hold the world's record in yield. In 1958 a yield of 45.6 centners per hectare was received on an area of 2,260 hectares in Yanshi county (uyezd) of Honan province. In places the wheat yield attains 80-160 centners per hectare and more.

The soft wheats of China have played a prominent role in the world's plant breeding. Thus, the wheat culture in Japan and Korea was derived from China (Vavilov, 1957). The Chinese wheats are reflected also in the assortments of other countries. It is sufficient to remind that China's soft wheat participates directly in the popular Argentinan sort 38 M. A., which in turn has given rise to many new and valuable sorts: Kleyn 40, Kleyn 47, Kleyn 66, Kleyn Kometa, Sola 50, Leprevizion 3, Rafaela 6 M. A., Sinvar Benvenuto, Sinvalokho M. A., Magnif M. G., and others. China's assortment has also been effectively utilized in wheat selection in Uruguay.

Italian wheat selection has created many popular sorts (Ardito, Strampelli, Mentana, and many others) through the use of a form of Akagomugi, which in turn owes its origin to the Chinese assortment.

It is necessary to point out that the sort Ardito, which was produced from a Chinese wheat, participates in the valuable French sorts Vil'moren Zyud and Etual'shmachi, in the Argentinan hybrids Kleyn 31, Kleyn 32, Kleyn Atgert, and in the widespread Polish winter sort Vysokolitovka Shtyvnyasloma (table 3).

Another Italian wheat, Mentana (fig 5 b), which was derived from the Chinese, was being cultivated in Albania even before the war. From there it quickly took over the wheat areas of Greece by displacing the old sorts of hard wheat. Mentana is also cultivated in France, Spain, Turkey, Mexico, Chile, India, and on Madagascar. It is widely used for hybridization in Algeria, Morocco and Kenya.

This sort participates in the popular Bulgarian winter wheat Okkerman (and in its derivatives - Yubileynaya 2, Yubileynaya 3) and in the Turkish sort [illegible]. And it is not accidental that the Mentana wheat and the sort Chshunda 2419, which was culled from it in the Nanking Agricultural Institute, do so well in many of China's provinces.

Many new hybrid sorts of wheat that have been localised on the Northern Caucasus (Skorospelka 3) or in the Transcaucasus (Azerbaijan 1, Azerbaijan 2) have been brought out with the participation of the sort Kleyn 33; thus, they, too, are derived to some degree from the wheat of China.

Investigations in the USSR (V. Ye. Pisarev) and abroad have shown that the Chinese soft wheats in general are outstanding among the entire world's assortment by their ease in hybridization with rye.

One should also note the reciprocal influence of the wheat assortments of China and the USSR.

According to the investigations of V. Ye. Pisarev the contemporary original soft wheat - the Siberian fast ripening (the basis of the sorts Alen'kaya Pitirka, Tayezhnaya 4, and others) - derives its origin from China (through Mongolia). They have common features with the forms from China and Mongolia, both morphological and physiologic l (fast ripening).

On the other hand, many forms of the soft wheats from Northern China were initially imported from Russia. According to the theory of Tszin-Shan'-Suo, the same applies to the hard wheats of China.

The role of the USSR's wheat is also reflected in the new Chinese assortment. Thus, in the province of Shensi, Ukrainka (in the North) and Novo-ukrainka (in the South) are pushing forward. Both of these sorts are being cultivated in Sinkiang. In the county (uyezd) of Tsyuisyan of Shantung province the sort Sino-Soviet Friendship has been originated by crossing the Georgian wheat Lagodekhskaya with the local wheat Bima 1.

Of the selectional sorts of China's soft wheat the most popular is Bima 1, which is particularly valued in Shensi province. The following are worthy of attention: Bima 4, Sinun 6028, Nan'da 2419, Yan'da, Aylido, Iyaoyanmay, and others.

The spring-crop sorts with an erect straw, Kan'eyu (resistant to stem rust) and Tkhabuchi, which are from Northern China, may be of interest for the USSR's Far East.

## Literature


Vavilov, N. I.: (1935)
Scientific principles of wheat selection. Theoretical principles of selection, 2.

Vavilov, N. I.: (1957)
World resources of grain cultures and flax. An experiment of agro-ecological review of the most important field cultures.

Vavilov, N. I.: (1958 a)
New data concerning the cultural flora of China and its importance for Soviet selection. Izv. AN SSSR, biolog. ser., 6: 744-757.

Vavilov, N. I.: (1958 b)
Endemic wheats and their importance for selection. Izv. AN SSSR, biolog. ser., 5: 748-751.

Volodarskiy, M. I.: (1959)
Record harvests of winter wheat in the Chinese People's Republic. Sel'sk. khoz. Sev. Kavkaza, 2: 96-98.

Gorya, V. S.: (1958)
A study of collections of soft wheats of new introduction by the VIR for resistance to diseases in the conditions of Kuban' and Derbant. VIR Bull. 5.
Dogonadze, R. I.: (1957)
Selection and seed growing in Albania. Selection and Seed Growing, 4.
Orlov, A.: (1922-1925)
The geographical center of the origin and the area of cultivating hard wheat. Treatise on applied botany, XIII.
Pisarev, V. E.: (1956)
The origin of agriculture and field cultures of Eastern Siberia, Material on the history of agriculture in the USSR, II.
Popov, P., and Konishev, P.: (1957)
Selectional achievements on some agricultural cultures in the People's Republic of Bulgaria. The International Agricultural Journal, 2.
Prutskov, F. M.: (1958)
Wheat selection in China. Selection and Seed Growing, 4: 67-73.
Razumov, V. I.: (1954)
The habitat and peculiarities of plant evolution.
Ten' Shan'-bao; Tsai Shchyu. U Dun Chen; and U Tszao-su: (1957)
Wheat sort Chzhunda 2419 (In Chinese with a resume in Russian).
Khuan Tszi-fan; Khu Khan'; Chen' Shao-lin'; Chan Chzhi-zhen'; Li Tsze-shu; Li Te-te; and Syue Ke-tszyun': (1957)
An investigation of the peculiarities of the vernalization phase and the light phase of the wheat from Sunpan'(China). Treatise on applied botany, IV: 1-29.
Tszin' Shan'-bao: (1957)
Species of Chinese wheat and their area (In Chinese with a resume in Russian).
Yakubziner, M. M.: (1957)
The endemic wheats of Tibet. VIR Bull. 4: 54-56.
Yakubziner, M. M.: (1958 a)
The selectional value of wheats from the countries participating in the SEV. International Agricultural Journal, 2.
Yakubziner, M. M.: (1958 b)
The variety of wheat species of Sinkiang. VIR Bull. 5: 58-59.
Yakubziner, M. M.: (1959 a)
The selectional importance of Chinese wheats. Selection and Seed Growing, 4: 74-75.
Yakubziner, M. M.: (1959 b)
The immunity of wheat species to infectious diseases in the light of new facts. The thesis of a report at the III All-Union Conference on Immunity.
Aberg, E.: (1957)
Praktist vaerdefulla egenskaper hos tibetangkt Korn in veta. Zhur. "Sveriges Utsaedesforenings Tidskrift". LVII, 3: 260-272.
Grillot, S: (1953)
Les blés italiens and Maroc. Atti del Convegno Internationale di Cerealicoltura Mediterranean cereal Cultivation. Genet. Agf., 3.
Hen, C. M.:
Regional Tests of Promising Varieties of wheat. College of Agriculture and Forestry, Univ. of Nanking, Bull. 20.

Horovitz, N.: (1945)
Descripcion de las principales variedades agricolas de trigo cultivadas en la republica Argentina. Jour. "La fiscalisacion oficial en el lanzamiento de nuevas variedades de cereales y granos oleaginosis," 20.
Hosono, S.: (1935)
Beitrag zur Kenntnis der chinesischen Landweizen. Memoirs of the College of Agriculture of Kyoto Imperial University, 34 (4).
Jonard, P.: (1951)
Les blés tendres (Triticum vulgare Vill.) cultivés en France. Determination et caracteristiques culturales.
Lein, A.: (1949)
Asiatische Weizensortimente. Kuehn-Archiv, 62, B: 216-310.

Table 1

The features and combination of features of the Chinese subspecies of soft wheats

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|---|---|
| The features lacking in the other subspecies. | The fully accelerated filling of the grain.<br>Complete beardlessness (the lack of awn-like appendages on the flower glumes).<br>Abnormal friability of the head (13 segments for the stem's 10 centimeters of length). |
| The features that are very seldom encountered in the other subspecies. | Broadening of the tegular side in contrast to the front.<br>Abnormally delicate glumes.<br>Very short awns along the entire length of the head.<br>Awns of the furcatum type.<br>Polychromy.<br>A very short head.<br>A small spherical grain.<br>Narrow (small) glumes.<br>Ramose head stem.<br>Weak leafing.<br>Short straw.<br>Abnormally weak enclosure of the grain in the glumes. |
| The combination of features that are lacking in the other subspecies. | The clubbing of the head and the inflatum type.<br>The abbreviated head - clubbing.<br>The inflatum type and a compressed head.<br>The inflatum type and a weak enclosure of the grain in the glumes.<br>The ramose stem and the weak swelling of the glumes.<br>The sharp fin and the easy milling.<br>The short awn and the delicate head. |

Table 2

The area of China's soft wheat according to life type.

| Areas | Spring Crop | Winter Crop | Semi-winter Crop |
|---|---|---|---|
| Northeast | ++ | - | - |
| North | +++ (Hupei & others) + (Shansi) | + | +++ |
| East | + | +++ (Shantung) + + (Chekiang) | - |
| South Central | +++ (The southern seaside provinces) | - | - |
| | ++ (The other provinces) | - | ++ |
| Southwest | +++ | + | + |
| Northwest | ++ | + | ++ |
| Inner Mongolia | +++ | - | - |
| Tibet | +++ | - | + |

Note: Three crosses indicates prevalence, two indicates median occurrence, one indicates uncommon location in the plantings, minus sign indicates that it was not evidenced.

Table 3

Examples of the effective use of China's sorts in world-wide selection.

| The original sort of Chinese origin. | The sorts produced from it and the country of the originator. | The sorts produced from the latter and the country of the originator. | |
|---|---|---|---|
| Akagomugi | Ardito - Italy | Kleyn Ateero | Argentina |
| | | " 31 | " |
| | | " 32 | " |
| | | " 33 | " |
| | | " Palantelyan | " |
| | | Benvenuto 1761 | " |
| | | Salto | Itnly |
| | | Tevere | " |
| | | San Dzhordzaio | " |
| | | Vil'moren Zyud | France |
| | | Et[illegible]' Shuazi | " |
| | | Vysokolitavka, Shtyvnyasloma. | Poland |
| Akagomugi | Mentana - Italy | Benvenuto Inka | Argentina |
| | | Kauderna | Italy |
| | | Frontana | " |
| Chino | 38 M.A. -Argentina | Kleyn Al'berti | Argentina |
| | | " 40 | " |
| | | " 47 | " |
| | | " 66 | " |
| | | " Kometa | " |
| | | Sola 50 | " |
| | | Le previsian 3 | " |
| | | Rafaela 6 M.A. | " |
| | | Sinvar Benvenuto | " |
| | | Sinvalokho M.A. | " |
| | | Benvenuto 1761 | " |

Fig. 1 a.) The endemic beardless form of Tr. durum Desf. (K-28661, Kansu); b.) Tr. polonicum L. v. gorskyi Jakubz. (K-220224, Sinkiang); c., Tr. turanicum Jakubz. f. aristiforme (K-220511, Sinkiang); d.) Tr. aestivum L. ssp. ampliusifolium Zhuk. (K-39218, Szechwan); e.) Tr. aestivum L. ssp. yunnanense King (K-213004, Hupei).

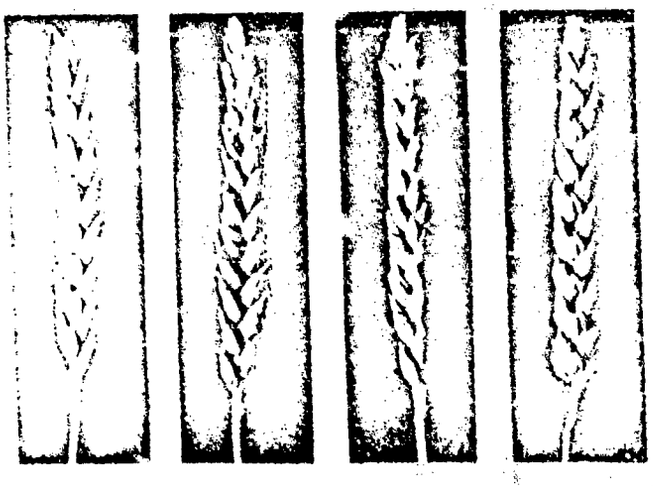

Fig 2 . The different varieties (a-d) of Tr. aestivum L. ssp. eumuticum Jakubz. from Northern and Eastern China (K-28396, K-28377, K-28542, K-28552).

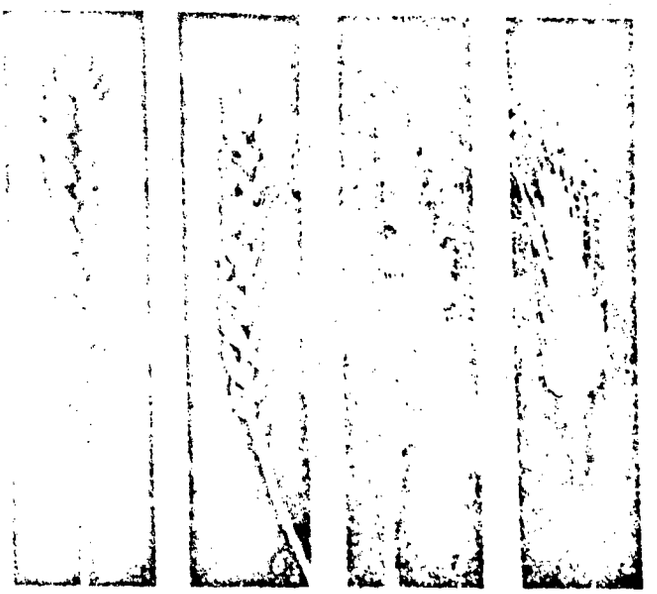

Fig. 3. Tr. aestivum L.
a.) conv. sinicocapitatum Jakubz. (K-28470, Shensi); b.) conv. sphaeroideum Jakubz. (K-28574, Shansi); c) v. tarakanovi Jakubz. (K-41696, Shantung); d.) v. ramosoeuerythrospermum Jakubz. (K-215350, Shantung).

Fig. 4. a.) An unique form of Tr. aestivum L. (K-21561, sort S'ian'-khun-bo din); b.) Tr. compactum Host. v. euvernerianum Jakubz.

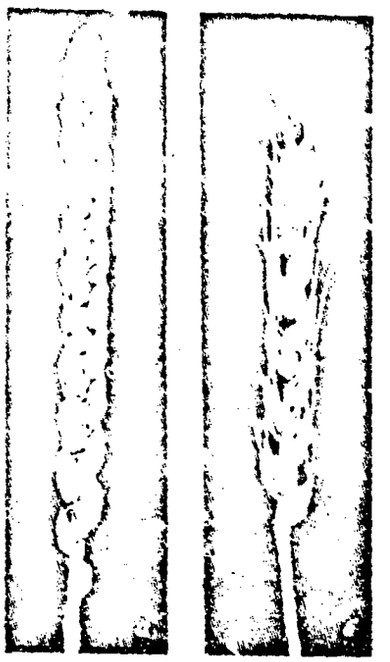

Fig 5

a.) The Canadian amphidiploid W 276; b.) The Italian wheat, Montana.