



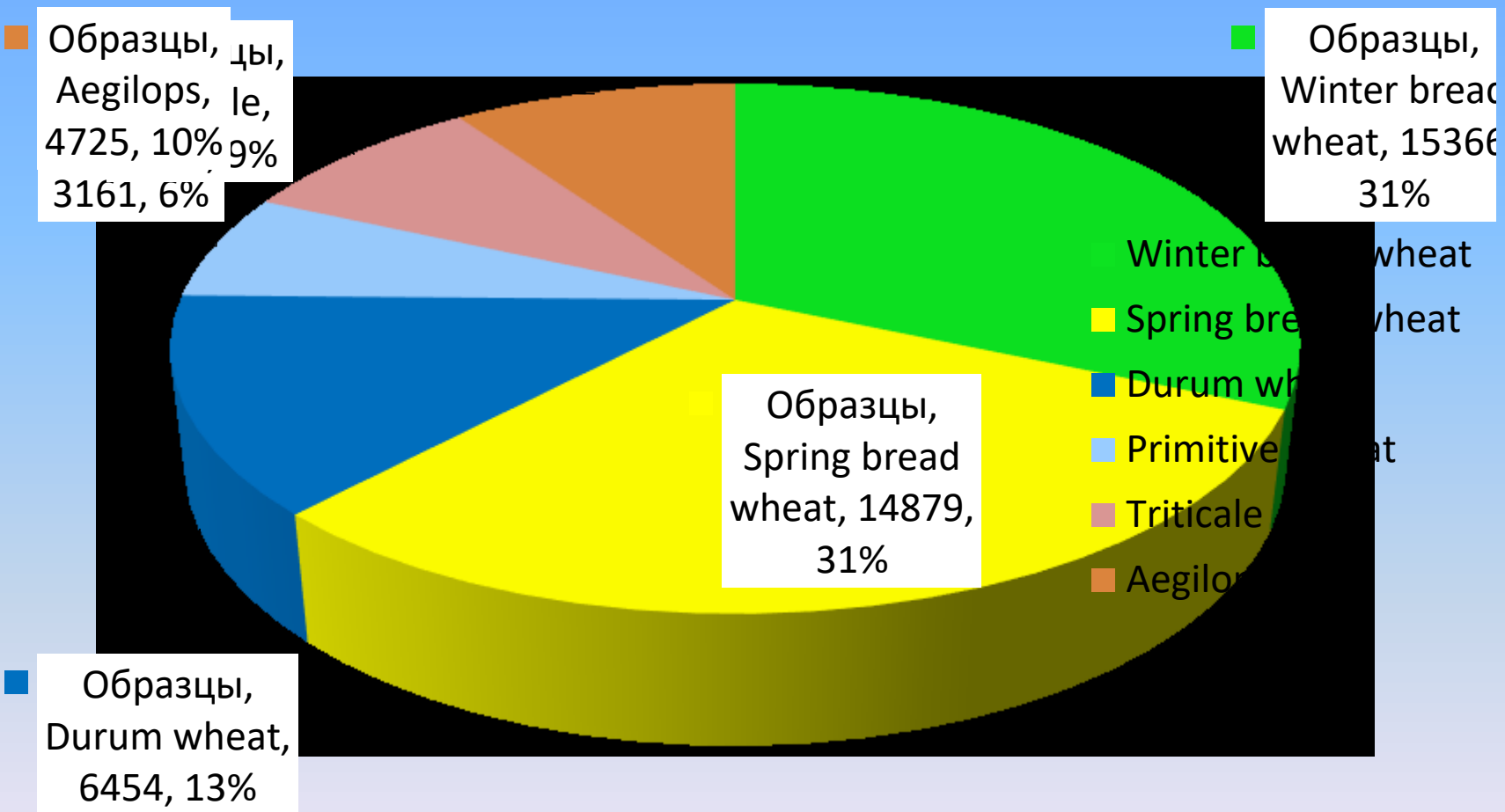
Methods for the identification of bread wheat accessions in the VIR collection

All-Russian Institute of plant genetic resources by name
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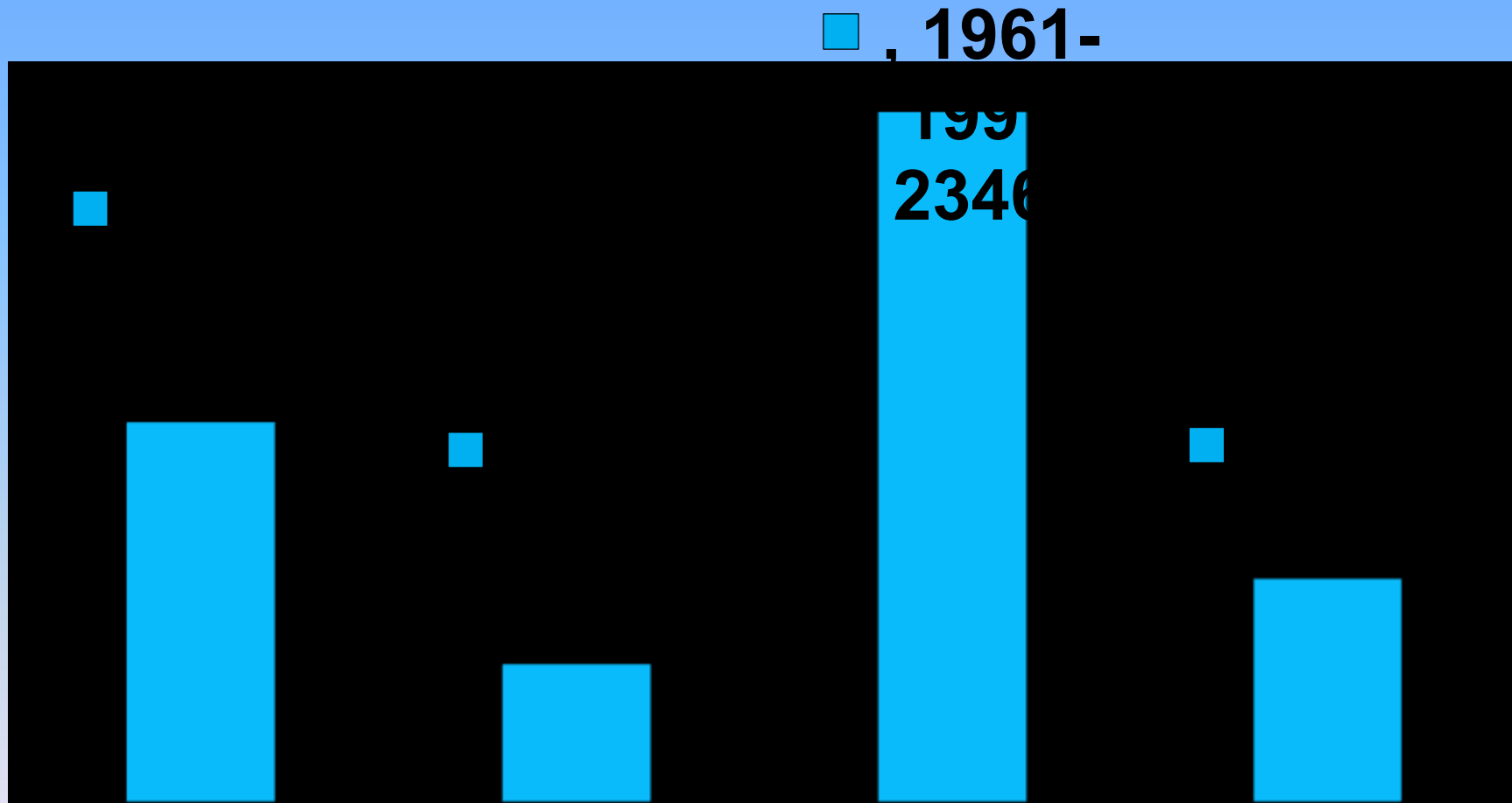


The VIR's Wheat Department Collection - 48749 accessions





The main stages of the creation of the VIR's wheat collections





Origin of the VIR's Wheat Collection

RUS	6863	AFG	590	ARG	299	KEN	134	LBN	34	VNM	9
UKR	2330	ISR	553	SYR	298	NLD	132	BOL	29	KOR	8
USA	1952	HUN	506	BRA	287	ZAF	131	LTU	29	ZMB	8
MEX	1535	UZB	471	TKM	258	EGY	125	YEM	21	SAU	7
CHN	1367	PAK	461	TUN	253	IRQ	98	SMR	20	TAI	6
KAZ	1331	CAN	458	KGZ	251	CYP	94	ZWE	20	MMR	3
DEU	1281	POL	428	GBR	245	COL	84	PAL	18	MRT	3
IND	1229	MLD	407	JPN	226	BEL	71	OMN	16	PRY	3
AZE	1180	GEO	405	MAR	219	LVA	71	URY	16	MLT	3
YUG	1135	TUR	383	BLR	211	ECU	69	PRK	16	UGA	2
BGR	882	CHL	379	GRC	210	DNK	65	ERI	14	IRL	1
FRA	874	SWE	372	FIN	203	ALB	64	GTM	14	MLI	1
ITA	839	ROM	350	PER	197	NZL	62	SDN	13	TCD	1
TJK	810	DZA	341	AUT	191	NPL	52	LBY	12	VEN	1
CSK	682	ETH	338	PRT	180	NOR	51	TZA	11		
ARM	666	IRN	333	MNG	174	EST	48	BGD	10		
AUS	609	ESP	306	CHE	136	JOR	43	THA	9		



The species of genus *Triticum* L. (V.F. Dorofeev et al., 1979)
maintaining in the VIR collection

Species	Genome	2n	Species	Genome	2n
<i>T. urartu</i>	A ^u	14	<i>T. compactum</i>	A ^u BD	42
<i>T. dicoccoides</i>	A ^u B	28	<i>T. aestivum</i>	“	“
<i>T. dicoccum</i>	“	“	<i>T. sphaerococcum</i>	“	“
<i>T. karamyshevii</i>	“	“	<i>T. petropavlovskyi</i>	“	“
<i>T. ispahanicum</i>	“	“	<i>T. boeoticum</i>	A ^b	14
<i>T. turgidum</i>	A ^u B	28	<i>T. monococcum</i>	“	“
<i>T. jakubzineri</i>	“	“	<i>T. sinskajae</i>	A ^b	14
<i>T. durum</i>	“	“	<i>T. araraticum</i>	A ^b G	28
<i>T. turanicum</i>	“	“	<i>T. timopheevii</i>	“	“
<i>T. polonicum</i>	“	“	<i>T. zhukovskyi</i>	A ^b A ^b G	42
<i>T. aethiopicum</i>	“	“	<i>T. militinae</i>	A ^b G	28
<i>T. persicum</i>	“	“	<i>T. kiharae</i>	A ^b GD	42
<i>T. macha</i>	A ^u BD	42			
<i>T. spelta</i>	“	“			
<i>T. vavilovii</i>	“	“			

Total: 27 species



The species of genus *Aegilops* L. maintaining
in the VIR collection (Migushova, 1981)

Species	Genome	2n	Species	Genome	2n
<i>Ae. mutica</i>	M ^t (T)	14	<i>Ae. comosa</i>	M	14
<i>Ae. speltoides</i>	B ^{sp} (S)	14	<i>Ae. uniaristata</i>	M ^u (N)	14
<i>Ae. aucheri</i>	B ^{au} (S)	14	<i>Ae. heldreichii</i>	M	14
<i>Ae. sharonensis</i>	B ^{sh} (S)	14	<i>Ae. umbellulata</i>	U (C ^u)	14
<i>Ae. longissima</i>	B ^l (S)	14	<i>Ae. ovata</i>	UM ^o	28
<i>Ae. bicornis</i>	B ^{bic} (S)	14	<i>Ae. columnaris</i>	UM ^c	28
<i>Ae. searsii</i>	B ^{si} (S)	14	<i>Ae. biuncialis</i>	UM ^b	28
<i>Ae. tauschii</i>	D	14	<i>Ae. kotschyi</i>	US ^v	28
<i>Ae. crassa</i>	DM ^{cr}	28	<i>Ae. triaristata</i>	UM ^t	28
<i>Ae. crassa</i>	D ¹ D ² M ^{cr}	42	<i>Ae. variabilis</i>	US ^v	28
<i>Ae. ventricosa</i>	DM ^v	28	<i>Ae. recta</i>	UM ^{t1} M ^{t2}	42
<i>Ae. vavilovii</i>	DM ^{sp}	42	<i>Ae. triuncialis</i>	UC	28
<i>Ae. juvenalis</i>	DMU	42			
<i>Ae. caudata</i>	C	14			
<i>Ae. cylindrica</i>	CD	28			

Total: 27 species



There are 154 botanical variety of bread wheat in VIR collection





Multiplication of wheat, triticale and aegilops accessions on VIR's stations

VIR's stations	2016	2017	2018
Dagestan station	7126	8425	8253
Kuban station	1452	1608	1330
Yekaterinino station	575	518	463
Moscow station	450	450	450
Pushkin station	510	714	508
Total	10113	11715	11004

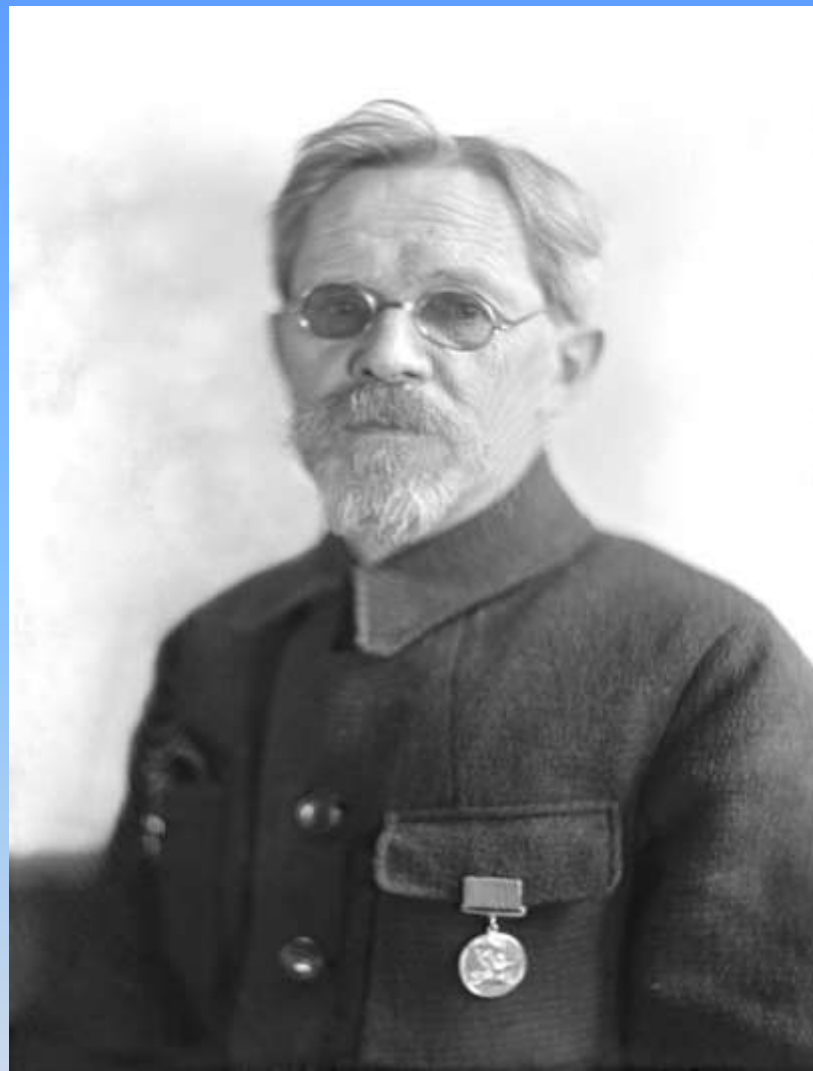


Yekaterinino VIR station (Tambov region)



Pushkin experimental field (Sankt-Petersburg)





Flaksberger Konstantin Andreyevich (1880-1942), an outstanding triticologist, Professor, Dr. (Biol. & Agri. Sci.) From 1907 to 1941, he worked at VIR; since 1940 he has occupied the position of the Head of the Cereal Crops Department.



K.Flyaksberger. Cereal botanical variety guide by Kernike. Proceedings of Applied Botany, 1908, T.1. N.3-4. P. 95-135

Опредѣлитель разновидностей настоящих хлѣбовъ по Кернике¹⁾.

Конст. Фляксбергеръ.

Въ русской ботанической литературѣ есть отличные опредѣлители растений, какъ напр., И. Шмальгаузена, Маевского, Кауфмана; есть и болѣе популярныя опредѣлители, но всѣ они даютъ таблицы для опредѣленія растений дикой флоры, тогда какъ нашимъ культурнымъ, воздѣлываемымъ растениямъ посвящается только по нѣскольку строкъ. Между тѣмъ умѣнье опредѣлять послѣднія имѣетъ большое практическое значеніе для нашихъ агрономовъ и сельскихъ хозяевъ, особенно въ виду той путаницы и неопредѣленности, которая содалась благодаря введенію понятія «сорта», понятія ничего опредѣленнаго не дающаго, такъ какъ подъ него подводятъ или продукты интенсивной культуры, теряющіе свои особенности при посѣвѣ въ неблагоприятныхъ условіяхъ, или просто торговыя марки. Среди этихъ сортовъ-марокъ, терпятся дѣйствительно константныя формы, какъ разновидности и расы. Это побудило меня для начала дать опредѣлитель настоящихъ хлѣбовъ по Fr. Körnicke (мѣстами данъ полный переводъ), положившаго въ основу чисто ботаническіе признаки. Подъ разновидностями Körnicke понимаетъ такія формы, которыя «и на отдѣльныхъ экземплярахъ въ нормально развитомъ состояніи отличаются опредѣленными, ясными признаками, каковы: присутствіе или отсутствіе остей, волосистость, окраска колосьевъ и зеренъ и т. д. Эти признаки и при дальнѣйшихъ посѣвахъ удерживаются силою или по крайней мѣрѣ отчасти» (стр. 19). Относительно «сортовъ» Кернике пишетъ такъ: «сорта какой-нибудь разновидности должны, конечно, обладать характерными признаками послѣдней, но они имѣютъ еще другіе признаки, менѣе про-

¹⁾ Fr. Körnicke. Die Arten und Varietäten des Getreides. Berlin. 1885.

II. Стержень колоса ломкій. Зерна при молотьбѣ остаются заключенными въ колосѣ.

5. *Triticum Spelta* L. *Полба*. Колосѣ съ остями или безъ нихъ, длинныя и тонкіе, рыхлыя, почти квадратныя. Чашечная чешуя поперекъ широко усѣченная, съ очень короткимъ тупымъ среднимъ зубцомъ, килевидная (не выступающая). Пленки выпуклыя.
6. *Triticum dicoccum* Schrank. *Двузернянки*¹⁾. Колосѣ почти всегда (см. таблицу разновидностей) съ остями, густые, съ боковъ сжатые, съ двурядной стороны шире, по черепчатой сторонѣ уже. Чашечная чешуя къ верхушкѣ закругленная, б. ч. съ острымъ среднимъ зубцомъ и рѣзкимъ или немного выступающимъ килемъ. Пленки узко-выпуклыя.

Triticum vulgare Vill. Обыкновенная мягкая пшеница.

Колосѣ съ остями или безъ остей, рыхлыя (у нѣкоторыхъ болѣе густыя), сжатые съ боковъ (двурядная сторона уже черепчатой)²⁾. Колоски дву-, пятизубковые. Чашечная чешуя къ верхушкѣ слабо килевидная, къ основанію б. ч. вогнутые, рѣдко слабо выраженный киль проходитъ до основанія. Пленка выпуклая, внутренняя съ 2-мя килемъ. Описание зеренъ смотри выше (стр. 100).

Обзоръ разновидностей.

I. Колосѣ безъ остей.

1. Колосѣ голые.

- | | | | |
|--------------------|---|------------------|---------------------------------------|
| A. Колосѣ бѣлые. | { | а. Зерна бѣлыя . | var. <i>albidum</i> Al. ³⁾ |
| | | б. » красныя | » <i>lutescens</i> Al. |
| B. Колосѣ красныя. | { | а. Зерна бѣлыя . | » <i>alborubrum</i> Kecke. |
| | | б. » красныя | » <i>millurum</i> Al. |

2. Колосѣ бархатистыя.

- | | | | |
|--------------------|---|------------------|------------------------------|
| A. Колосѣ бѣлые. | { | а. Зерна бѣлыя | » <i>leucospermum</i> Kecke. |
| | | б. » красныя | » <i>velutinum</i> Schübler. |
| B. Колосѣ красныя. | { | а. Зерна бѣлыя . | » <i>Delft</i> Kecke. |
| | | б. » красныя | » <i>prothrix</i> Al. |

¹⁾ Полушубы, Эмери.

²⁾ Сравн. *Triticum dicoccum* Schrank.

³⁾ Сокращенія авторовъ обозначаются: Al.—Alefeld; A. Br.—A. Braun; Asch. & Gr.—Ascherson & Graciner; Kecke.—Körnicke; Kr.—Krauss; Lam.—Lamarck; L.—Linné; Str.—Strige; Willd.—Willdenow.



Bread wheat botanical varieties by Kornike

albidum Alef.,
lutescens Alef.,
alborubrum Koern.
milturum Alef.,
Leucospermum Koern.,
velutinum Schubl.,
delfi Koern.,
pyrothrix Alef.,
cyanothrix Koern.
nigrum Koern.,
graecum Koern.,

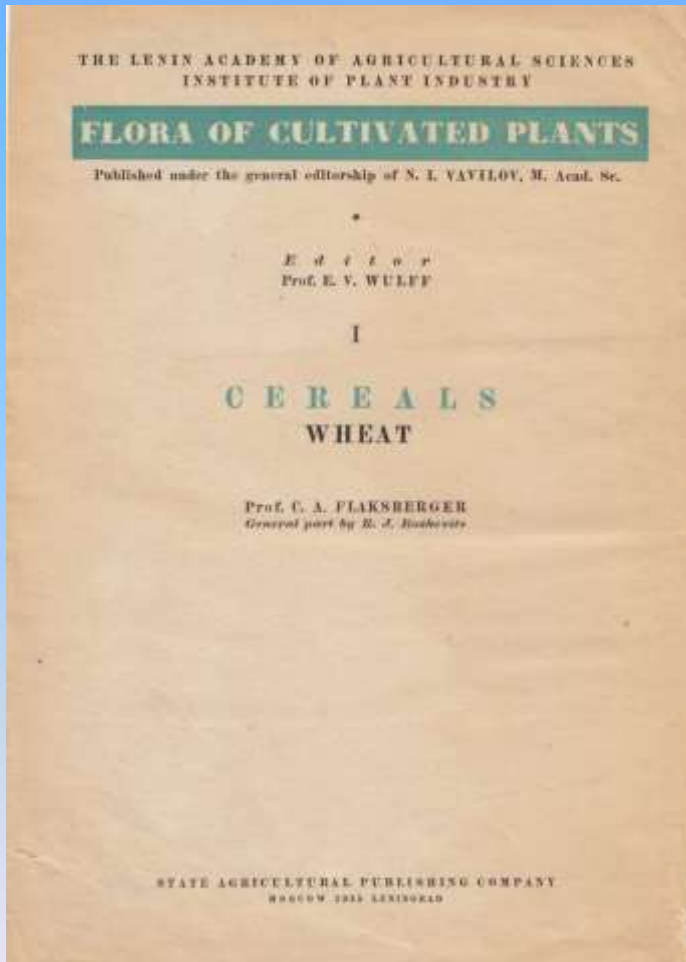
erythrosperrum Koern. ,
erythroleucon Koern. ,
ferrugineum Alef.,
sardoum Koern. ,
caesium Alef.,
meridionale Koern. ,
hostianum Clem.,
turcicum Koern. ,
barbarossa Alef.,
coeruleovelutinum Koern. ,
fuliginosum Alef.



**Vavilov Nikolai
Ivanovich** (1887-
1943), a prominent
scientist who had
laid foundations of
new trends in plant
industry, botany,
genetics, breeding
and other sciences;
Academician,
Director of VIR
from 1920 to 1940.



K.A. Flaksberger. “Cultivated Flora of the USSR. T. 1. Wheat” (1935) and “Key to True Cereals” (1939)

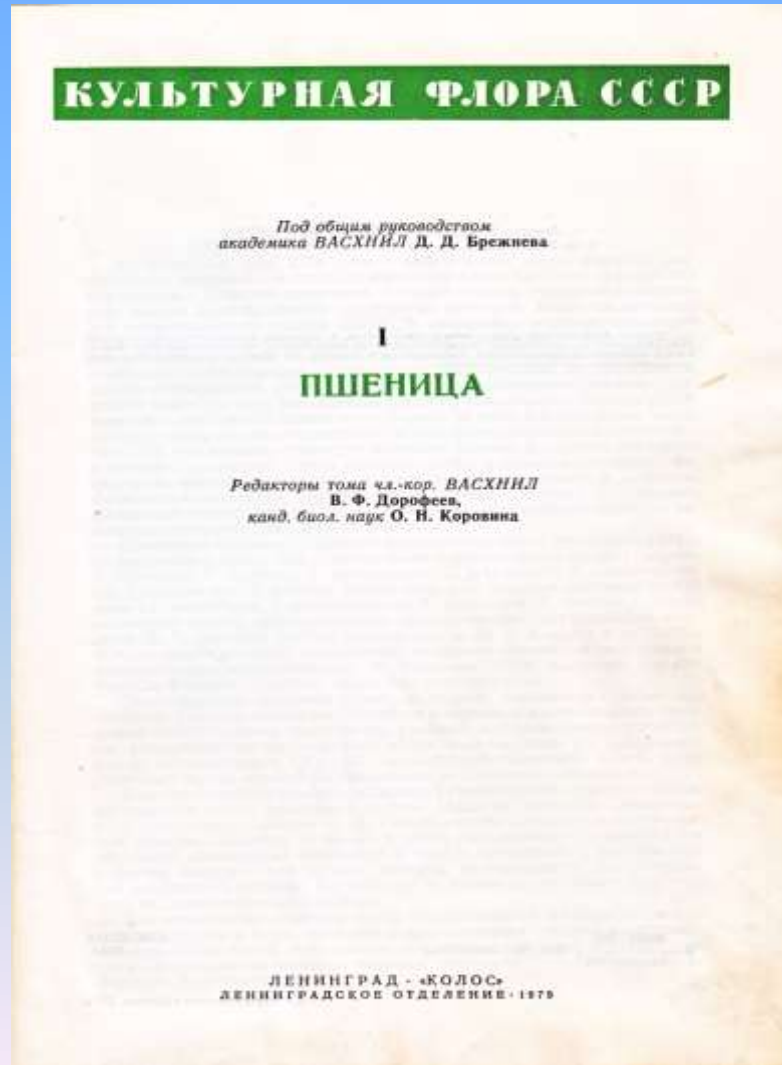




- **Rudolf Mansfeld (1901-1960)**, a German botanist. After World War II, he worked on the systematics of cereals in Gatersleben.



V.F. Dorofeev et al. “Cultivated Flora of the USSR. I. Wheat” , 1979





Dorofeev Vladimir Filimonovich (1919-1987), Dr. (Agr.Sci.), Academician, started working in the VIR network in 1955, first as the Head of a Base Station in Derbent (Dagestan), then in 1960 as a senior researcher at the Department of Cereal Crops. In 1965 he was promoted Head of the Department of Wheat, and from 1979 to 1987 he was Director of the VIR



Udachin Roald Arsenyevich (1932-2010), Dr. (Agr.Sci.), Professor, started working at VIR in 1956; from 1979 to 1988 headed the Laboratory of Bread Wheat, and in 1989-1995 was employed as a chief researcher at the Department of Wheat. Since 2000, he has occupied the position of a leading researcher and VIR historiographer



ОПРЕДЕЛИТЕЛЬ
ПШЕНИЦ АЗЕРБАЙДЖАНА
ИЛИ А. А. А. А.

ОПРЕДЕЛИТЕЛЬ
ПШЕНИЦ
АЗЕРБАЙДЖАНА



Mustafayev Imam Dashdemyr oglu (1910-1998), Dr. (Biol.Sci.), Academician of the Academy of Sciences of Azerbaijan, a geneticist and breeder. In 1954, he started working at the Institute of Genetics and Breeding of the Academy of Sciences of Azerbaijan, and from 1971 to 1998 was Director of said institute.

- **Gandilyan Papin Artashesovich (1929-2001)**, a botanist, geneticist, breeder, prominent expert in grain crops and their wild relatives in Armenia, Dr. (Biol.Sci.), Professor, Member of the Academy of Agricultural Sciences of Armenia.



var. *erythrospermum* = «ar-nu-al-ru»

the first syllable “ar” (from “aristatus” – awned)
defined the presence of awns;

the second one, “nu” (from “nudus” – glabrous),
referred to the absence of glume pubescence;

the third one, “al” (i.e., “albus” – white), described
the glume color; and

the fourth syllable “ru” (from “ruber” – reddish)
defined the kernel color.



Goncharov Nikolay Petrovich - Academician of the Russian Academy of Sciences. Since 1990, he is the Head of the Wheat Genetics Section at the Institute of Cytology and Genetics in Novosibirsk.



- **Identification of bread wheat accessions using complexes of spike and kernel characters**



The most frequent complexes of spike and kernel characters in bread wheat

Name of the complex of characters	Presence of awns	Glume pubescence	Glume color	Kernel color
<i>lutescens</i>	no	no	white	red
<i>milturum</i>	no	no	red	red
<i>albidum</i>	no	no	white	white
<i>albirubrum</i>	no	no	red	white
<i>velutinum</i>	no	yes	white	red
<i>pyrothrix</i>	no	yes	red	red
<i>leucospermum</i>	no	yes	white	white
<i>delfii</i>	no	yes	red	white
<i>erythropermum</i>	yes	no	white	red
<i>ferrugineum</i>	yes	no	red	red
<i>graecum</i>	yes	no	white	white
<i>erythroleucum</i>	yes	no	red	white
<i>hostianum</i>	yes	yes	white	red
<i>barbarossa</i>	yes	yes	red	red
<i>meridionale</i>	yes	yes	white	white
<i>turcicum</i>	yes	yes	red	white



- **The main spike and kernel characters used for describing bread wheat diversity**



Character	Option	Abbreviated Latin designation
Kernel color	White	-
	Red	-
	Purple	<i>violaceo-</i>
	Green	<i>virido-</i>

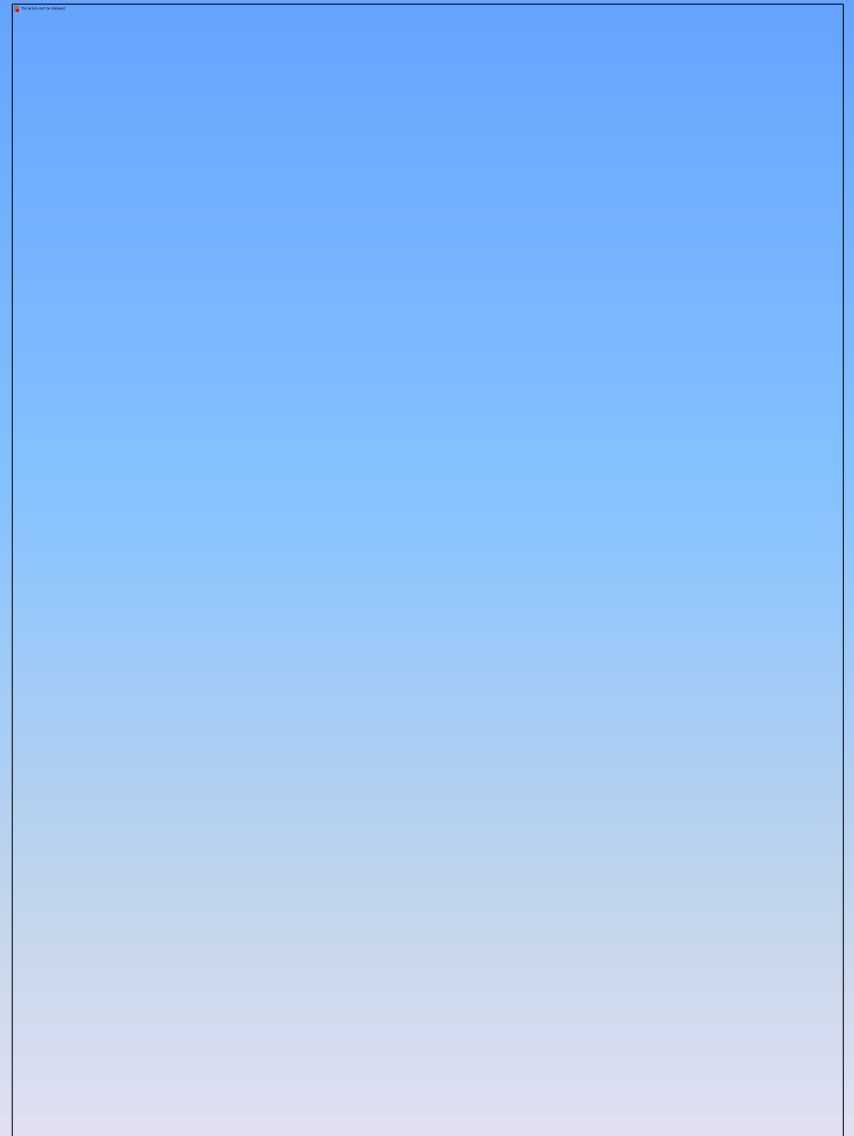




Character	Option	Abbreviated Latin designation
Glume color	White or stramineous	-
	Red	-
	White or red in combination with black (blue-black) that shows up in the glume central part	<i>nigro-</i>
	White or red in combination with black along the glume edge	<i>maesto-</i>
	White or red in combination with smoked-grayish (bluish-gray) that shows up in the glume central part	<i>glauco-</i>



White glume



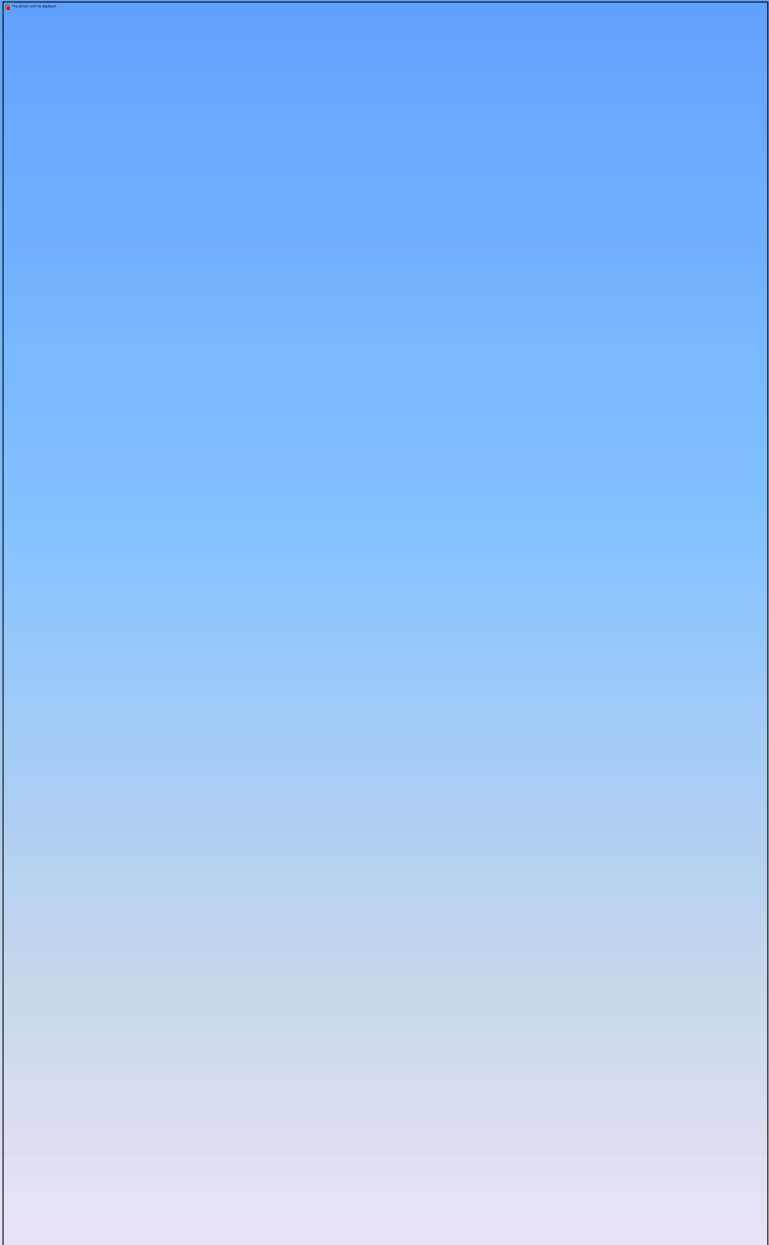
Red glume



White in combination with black



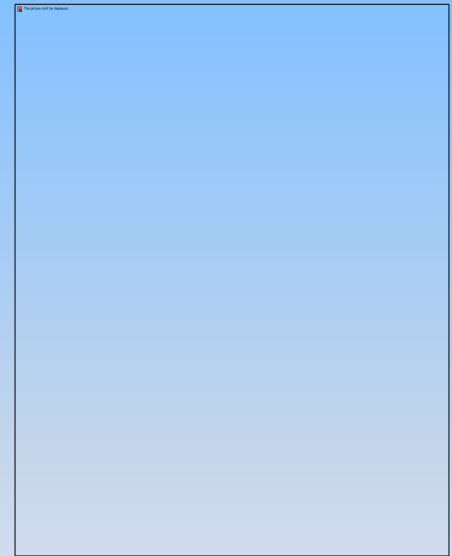
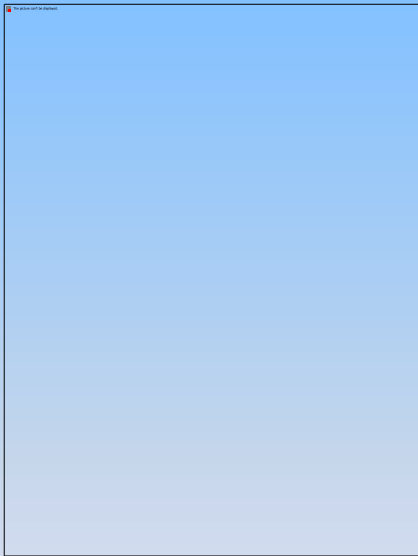
White in combination with black along the glume edge



Red in combination with smoked-grayish

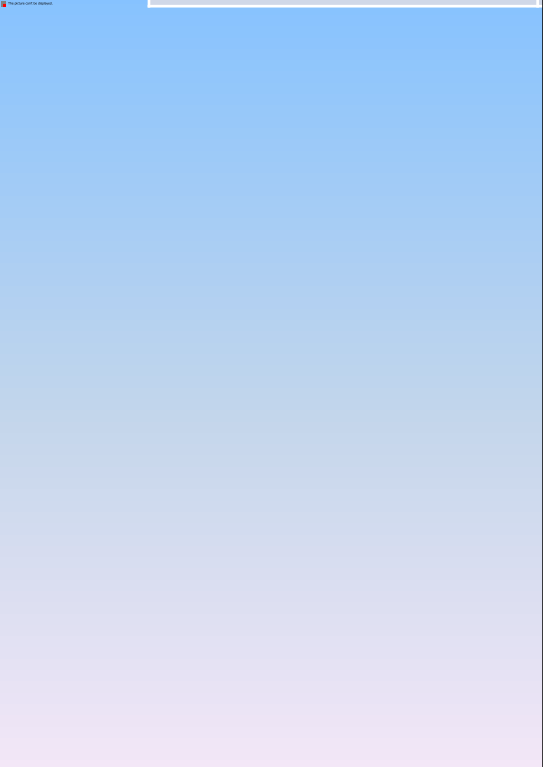


Character	Option	Abbreviated Latin designation
Glume pubescence	Glabrous glume	-
	Pubescent glume	-





Character	Option	Abbreviated Latin designation
Awns presence	Awnless (awns are either absent or awn-like points shorter than 2.0 cm are available)	-
	Short awns (from 2.1 to 6 cm long)	<i>sub-</i>
	Normal awns (6.1 cm and longer)	-





Character	Option	Abbreviated Latin designation
Awns color	Same color as of glumes	-
	Black	<i>pseudo-</i>





- **Additional spike and kernel characters used for describing bread wheat diversity**



Character	Option	Abbreviated Latin designation
Presence of awns or awn-like projections	Complete absence	<i>eu-</i>
	Spike of the awnless type, but its 2-3 upper spikelets have awn-like projections over 2.0 cm	<i>sub-</i>





Character	Option	Abbreviated Latin designation
<i>Inflatum</i> -type spike	Strongly expressed (Fig. 18)	<i>-inflatum</i>
	Weakly expressed	<i>false-</i>





Character	Option	Abbreviated Latin designation
Spike shape	Clavate (square-headed)	<i>-capitatum</i>
	Compactoid type	<i>-compactoides</i>
	Speltoid type	<i>-speltiforme</i>





Character	Option	Abbreviated Latin designation
Secondary rachis of the spike	branching spike	<i>ramoso-</i>
Stem (straw) below the spike	Plump (parenchyma-filled)	<i>pleno-</i>
Waxiness of spike	Absent	<i>epru-</i>
Spike threshing and glume structure	Hard to thresh; coarse glume	<i>-rigidum</i>
Presence of ligule	Absent	<i>quasi-</i>





- **Accession authenticity determination using morphological characters**









E.V. Zuev, A. Amri, A.N. Brykova, V.P. Pyukkenen, O.P. Mitrofanova
**Atlas of bread wheat (*Triticum aestivum* L.) genetic diversity
based on spike and kernel characters**



St-Petersburg, 2019



Thanks for attention !

