Ukrainian Journal of Ecology

Ukrainian Journal of Ecology, 2021, 11(8), 156-166, doi: 10.15421/2021_284

ORIGINAL ARTICLE

Ecological assessment of variability of quantitative signs of spring wheat samples

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Received: 28.09.2021. Accepted: 22.10.2021.

The article covers the assessment of the variety of the main species characteristics of spring wheat-ear length; length of awns; the number of spikelets in the ear; number of productive spikelets; the number of grains in one ear; weight of one ear; weight of grain from one ear; weight of 1000 seeds. The asymmetry index indicates how asymmetric the data distribution is relative to the normal distribution. If the asymmetry is a positive value, then most of the data has a value that exceeds the sample average.

Keywords: Spring wheat, Sample, Collection, Mass, Ear, Development, Asymmetry, Seeds.

Introduction

Objectively assess the prospects for the use of plant material in various breeding and genetic programs is possible only with a comprehensive study of a particular genotype. An important stage in the characterization of genetic diversity is the analysis of the variability of those traits that have a certain economic significance. In this case, a special place is occupied by biometric characteristics of the ear (ear length, length of awns, number of ears in the ear, weight of the ear), seed productivity (number of productive ears, number of seeds in the ear, weight of one ear, weight of 1000 seeds, yield) (Konovalov, et al., 1990).

Materials and Methods

Field research was conducted in 2018-2020 at the Educational Research and Production Center "Experimental Field of V.V. Dokuchaiev Kharkiv National Agrarian University (KhNAU named after V.V. Dokuchaiev). The experimental field is located within the land use of the educational and experimental farm of V.V. Dokuchaiev Kharkiv National Agrarian University in the north-eastern part of Kharkiv region.

Sowing was carried out in the optimal time for the culture of the first decade of April. Collectible samples were sown by hand under a marker, two rows 1 m long each with a row spacing of 0.15 m, at the rate of 100 grains per running meter. The estimated area of the plot for each sample was 1 m^2. All phenological observations were performed in accordance with the guidelines for the study of wheat collections.

The species were used as starting material of 76 samples *Triticum aestivum*, *Triticum durum*, *Triticum monococcum*, *Triticum boeoticum*, *Triticum sinskajae*, *Triticum timopheevii*, *Triticum militinae*, *Triticum dicoccum*, *Triticum ispahanicum*, *Triticum persicum*, *Triticum turgidum*, *Triticum aethiopicum*, *Triticum spelta*, *Triticum compactum* and amphidiploid specimens. The source material was obtained from the National Center for Plant Genetic Resources of Ukraine (NCGRRU) and has a number of economically valuable features. Samples were introduced from different ecological and geographical areas (Tables 1-3).

Table 1. Characteristics of the studying samples *Triticum aestivum* and *Triticum durum.*

n/a	National catalog number	Institution registration number	Sample name	Variety	Country of origin
			Triticum aestivum		
1	UA 0100098	IR 08517S	Sunnan	*var. lutescens*	SWE
2	UA 0101113	IR 11742S	Prokhorovka	*var. lutescens*	RUS
3	UA 0104110	IR 12602S	Kharkiv 30	*var. lutescens*	UKR
4	UA 0106145	IR 13173S	L 501	*var. lutescens*	RUS
5	UA 0110938	IR 15164S	Simkodamironovskaya	*var. lutescens*	UKR
6	UA 0111008	IR 15206S	Yrym	*var. erythrospermum*	KAZ
7	UA 0105661	IR 12049S	CIGM.250-	*var. erythrospermum*	MEX
8	UA 0110937	IR 14892S	Phyto 14/08	*var. erythrospermum*	UKR
9	UA 0110936	IR 14891S	Phyto 33/08	*var. erythrospermum*	UKR
10	UA 0111123	IR 15595S	L 685-12	*var. lutescens*	UKR
			Triticum durum Desf		

11	UA0201229	IR 12313S	Zolotko	*var. muticohordeiforme*	UKR
12	UA0201199	IR 13580S	Orenburgskaya 21	*var hordeiforme*	RUS
13	UA0201431	IR 14943S	Nurly	*var. hordeiforme*	KAZ
14	UA0201201	IR 14045S	Slavuta	*var. leucomelan*	UKR
15	UA0200923	IR 12773S	Bukuría	*var. melanopus*	UKR
16	UA0201428	IR 14941S	Altun Segus	*var. hordeiforme*	KAZ
17	UA0201386	IR 14438S	Metiska	*var. melanopus*	UKR
18	UA0201452	IR 15566S	Novacia	*var hordeiforme*	UKR
19	UA0201453	IR 15548S	Diana	*var. hordeiforme*	UKR
20	UA0201426	IR 14937S	Kustanayskaya 30	*var. hordeiforme*	KAZ

Note: * SWE-Sweden; RUS-Russia; UKR-Ukraine; KAZ-Kazakhstan; MEX-Mexico.

Table 2. Characteristics of the studied samples of the genus *Triticum L.*

n/a	National catalog number	Form	Variety	Country of origin
1	UA0300104	*monococcum*	*var. vulgare*	BGR
2	UA 0300221	*monococcum*	*var. monococcum*	AZE
3	UA 0300223	*monococcum*	*var. vulgare*	ALB
4	UA 0300254	*monococcum*	*var. monococcum*	ARM
5	UA 0300282	*monococcum*	*var. monococcum*	HUN
6	UA 0300310	*monococcum*	*var. hohensteinii*	GEO
7	UA 0300311	*monococcum*	*var. nigricultum*	SYR
8	UA 0300313	*monococcum*	-	HUN
9	UA0300402	*boeticum*	*var. boeticum*	UKR
10	UA0300224	*sinskajae*	*var. sinskajae*	RUS
11	UA0300545	*timopheevii*	*var. nigrum*	BLR
12	UA0300257	*militinae*	*var. militinae*	RUS
13	UA0300008	*dicoccum*	*var. aeruginosum*	RUS
14	UA0300327	*dicoccum*	*var. aeruginosum*	RUS
15	UA0300407	*dicoccum*	*var. nudidicoccum*	UKR
16	UA0300406	*dicoccum*	*var. nudirufum*	UKR
17	UA0300199	*dicoccum*	*var.pseudogunbadi*	IRN
18	UA0300009	*dicoccum*	*var.serbicum*	RUS
19	UA0300183	*dicoccum*	*var.serbicum*	RUS
20	UA0300021	*dicoccum*	*var. volgense*	KAZ
21	IU070615	*dicoccum*	*var.submajus*	BGR
22	IU0700070	*ispahanicum*	*var. ispahanicum*	IRN
23	UA0300490	*persicum*	*var. persicum*	GEO
24	UA0300495	*persicum*	*var. rubiginosum*	GEO
25	UA0300110	*turgidum*	*var. plinianum*	KGZ
26	UA0300237	*turgidum*	*var.rubroathrum*	GRC
27	UA0300376	*turgidum*	-	BGR
28	IU070589	*aethiopicum*	*var.nigriviolaceum*	ERI
29	UA0300238	*spelta*	*var.subbaktiaricum*	UZB
30	UA0300304	*spelta*	*var.album*	AUS
31	UA0300387	*spelta*	*var.caeruleum*	CAN
32	UA0300388	*spelta*	*var.duhamelianum*	CAN
33	UA0300391	*spelta*	*var.caeruleum*	CAN
34	UA0300392	*spelta*	*var.alefeldii*	CAN
35	UA0300398	*spelta*	*var.arduini*	UKR
36	UA0300443	*spelta*	*var.caeruleum*	RUS
37	UA0300546	*spelta*	*var.caeruleum*	RUS
38	UA0300240	*compactum*	*var.erinaceum*	ARM
39	UA0300354	*compactum*	*var.pseudoicterinum*	GRC
40	UA0300368	*compactum*	*var.humboldtinflatum*	CHN
41	UA0300528	*compactum*	*var.kerkianum*	GEO

Note: * RUS-Russia; UKR-Ukraine; KAZ-Kazakhstan; GRC-Greece; BGR-Bulgaria; AZE-Azerbaijan; ALB-Albania; ARM-Armenia; HUN-Hungary; GEO Georgia, SYR Syrian Arab Republic; BLR-Belarus, IRN-Iran; KGZ-Kergizia; UZB-Uzbekistan; AUS-Australia; CAN-Canada; ERI- Eritrea.

Table 3. Characteristics of the studied amphidiploid samples of the genus *Triticum L.*

n/a	National catalog number	Sample name	Pedigree	Country of origin	Institution of origin
1	UA0500004	PAG-12	*T. persicum* × *T.monococcum*	RUS	VIR
2	UA0500007	PAG-20	*T. timococcum* × *T.monococcum*	RUS	VIR
3	UA0500008	PAG-31	*T. dicoccum* и-329428, Poland × *T. monococcum* k-20636, Ispaniya	RUS	VIR, DOS VIR
4	UA0500009	PAG-32	*T. dicoccum* к-14055, Armenia × *T. monococcum* и-452639, Czech Republic	RUS	VIR, DOS VIR
5	UA0500010	PEAG	*T. dicoccum* и-244569, Germany × *Ae. Tauschii* л-110	RUS	VIR, DOS VIR
6	UA0500014	*Triticum* × *kiharae*	*T. timococcum* × *Ae. Tauschii*	JPN	
7	UA0500018	*Haynatricum*	AD (*T.dicoccum-D.villosum*)	RUS	Moscow Agricultural Academy. K.A. Timiryazeva, Russia
8	UA0500022	AD8	T. *dicoccum* × *Ae. triuncialis*	AZE	Research Institute of Genetics and Breeding of the Academy of Sciences of the Republic of Azerbaijan
9	UA0500023	PAG-13	*T. dicoccum* × *T. monococcum*	RUS	VIR
10	UA0500024	PAG-39	*T. dicoccum* × к-150007, Польша x *T.sinskajae*	RUS	VIR, DOS VIR
11	UA0500025	*Triticum* × *timococcum*	*T. timopheevii* × *T. monococcum*	RUS	Moscow Agricultural Academy. K.A. Timiryazeva, Russia
12	UA0500026	*Triticum* × *sinskourarticum*	*T. sinskajae* × *T.urartu*	ARM	Armenian CHI
13	UA0500043	PAG -4	*T. durum* v. *Stebutii* k-16477 × *T. monococcum v. macedonicum* k-18140	RUS	VIR
14	UA0500044	PAG-7	*T. durum* × T. *monococcum*	RUS	VIR
15	UA0300107	-	*T. timopheevii* × *timopheevii*	-	-

Note: * RUS-Russia; AZE-Azerbaijan; ARM-Armenia; JPN-Japan.

Results

During the research of economically valuable traits in the collection samples of spring wheat, a significant positive indicator of asymmetry (As=0.06-3.53, $p \leq 0.05$) was found in all studied samples in terms of grain weight per ear (Table 4). Significant positive asymmetry was observed in terms of ear length in samples UA0300391, CIGM.250-, Phyto33/08, UA0300223 and sample UA0300406 (respectively,

As=3.32; 1.91; 1.40; 1.35; 1.31) by the length of the spines in samples Phyto 33/08, Bucuria, Diana and sample UA 0300237 (respectively, As=2.41; 2.39; 2.12; 1.74; $p \leq 0.05$); by the number of spikelets in the ear in samples of Phyto 33/08, CIGM.250-, L 501, UA0300104, UA0300327 (respectively, As=2.32; 2.22; 1.47; 1.88; 1.39; $p \leq 0.05$); by the number of productive spikelets in the ear in samples UA0300391, UA0300104, Phyto 33/08, CIGM.250-, Triticum × sinskourarticum (respectively, As=2.64; 2.19; 2.18; 2.14; 1.37; $p \leq 0.05$); according to the number of grains in one ear samples L 685-12, Kharkiv 30, UA0300104, UA0300406, UA0300391 (respectively, As=3.09; 3.04; 2.34; 2.01; 1.95; $p \leq 0.05$); according to the indicator, the mass of one ear in the samples of Kharkiv 30, Slavuta, Metiska, UA03000009, UA0300104 (respectively, As=4.27; 3.28; 2.69; 2.25; 1.84; $p \leq 0,05$); in terms of grain weight from one ear, positive asymmetry was recorded in samples UA0300490, Slavuta, Kharkivska 30, UA 0300407, Metiska (respectively, As=5.14; 3.25; 3.18; 2.40; 2.16; $p \leq 0,05$).

Table 4. Asymmetry of distribution of economically valuable features of collection samples of spring wheat on average for 2018-2021.

	Sign						
Collectible sample	**Ear length**	**Length of awns**	**The number of spikelets in the ear**	**Number of productive spikelets**	**The number of grains in one ear**	**Weight of one ear**	**Masa grain from one ear**
Triticum aestivum							
Sunnan	0.30	-	0.19	0.61	0.39	0.45	0.16
Prokhorovka	0.21	-	0.30	0.12	0.28	1.61	0.12
Kharkiv 30	0.09	-	0.65	0.80	3.04*	4.27*	3.18*
L 501	0.69	-	1.47*	1.10	0.55	1.04	1.39
Simkodamironovskaya	0.70	-	0.48	0.58	0.32	0.38	0.23
Yrym	0.31	0.17	0.10	0.42	0.27	0.58	0.39
CIGM.250-	1.91*	1.22	2.22*	2.14*	0.39	0.60	0.73
Phyto 14/08	0.24	0.05	0.06	0.46	0.13	0.81	0.49
Phyto 33/08	1.40*	2.41*	2.32*	2.18*	0.35	0.60	0.72
L 685-12	0.62	-	0.34	1.91	3.09*	0.34	0.52
Average in appearance	0.65	0.96	0.81	1.03	0.88	1.07	0.79
Triticum durum							
Zolotko	0.92		0.11	1.14	0.86	0.39	0.83
Orenburgskaya 21	0.15	0.65	0.34	0.47	0.93	0.42	1.53
Nurly	0.21	0.18	0.17	0.36	0.11	0.03	0.09
Slavuta	0.43	0.49	0.21	0.01	1.84	3.28*	3.25*
Bukuría	0.54	2.39*	0.48	0.69	0.07	1.34	0.06
Altun Segus	0.34	0.05	0.34	0.34	0.74	0.83	0.72
Metiska	0.16	0.05	0.88	1.27	1.93	2.69*	2.16
Novacia	0.16	0.20	0.55	0.01	0.12	1.14	0.23
Diana	0.29	2.12*	0.96	0.23	0.17	0.17	-0.10
Kustanayskaya 30	0.20	0.03	0.33	-0.70	0.07	1.30	1.26
Average in appearance	0.34	0.68	0.44	0.38	0.68	1.16	1.00
Uncommon types of wheat							
Tr. ispahanicum IU0700070	0.53	0.32	0.04	0.43	1.26	1.59	2.14
Tr. aethiopicum IU070589	0.61	1.73	0.02	0.07	0.59	1.86	1.69
Tr. sinskajae UA0300224	0.18	0.33	0.16	0.01	0.32	0.29	0.06
Tr. timopheeva UA0300545	0.48	0.04	0.11	0.28	0.01	0.21	2.11
Tr. militinae UA0300257	0.30	0.36	0.16	0.78	0.39	0.06	0.19
Average in appearance	0.42	0.56	0.10	0.31	0.51	0.80	1.24
Triticum monococcum							
UA0300104	0.24	0.80	1.88*	2.19*	2.34*	1.84*	2.12
UA0300221	0.37	0.42	1.12	0.67	0.22	1.10	0.70
UA0300223	1.35*	0.34	0.25	0.20	0.38	0.31	0.54
UA0300254	0.49	0.21	0.27	0.26	0.04	0.62	0.03
UA0300282	0.35	0.61	0.27	0.29	0.42	0.42	0.42
UA0300310	1.10	0.07	0.65	0.05	0.14	0.48	1.42
UA0300313	0.64	0.47	0.27	0.57	0.41	1.03	0.28
Average in appearance	0.65	0.42	0.67	0.60	0.56	0.83	0.79
Triticum dicoccum							

UA0300327	0.59	0.29	1.39*	0.82	0.31	0.56	0.55
UA0300407	0.13	0.49	0.46	1.08	0.68	0.75	2.40*
UA0300406	1.31*	0.18	0.92	1.09	2.01*	0.46	1.00
UA0300199	0.42	0.04	0.17	0.72	0.10	0.16	0.09
UA0300009	0.44	0.17	0.41	0.62	0.18	2.25*	0.29
UA0300183	0.54	0.04	0.21	0.10	0.31	0.06	0.23
UA0300021	0.01	0.32	0.01	0.86	0.20	0.27	0.22
IU070615	0.34	-	0.22	0.29	0.66	0.54	0.15
Average in appearance	0.47	0.22	0.47	0.70	0.56	0.63	0.62
Triticum spelta							
UA0300238	0.88	0.61	0.98	0.02	0.81	1.37	-0.05
UA0300304	0.05	-	0.21	0.36	0.50	0.26	-0.46
UA0300387	0.39	0.12	0.08	1.08	1.15	0.63	0.01
UA0300388	0.64	-	0.01	0.53	0.25	0.59	-0.23
UA0300391	3.32*	0.09	1.41	2.64*	1.95*	1.78	1.27
UA0300392	0.21	-	0.21	0.01	0.37	0.89	0.74
UA0300398	0.98	0.57	0.42	0.35	0.41	0.31	0.21
UA0300443	0.08	1.02	0.51	1.41	0.56	0.10	1.25
UA0300546	0.52	0.18	0.39	0.38	0.64	0.98	0.82
Average in appearance	0.79	0.43	0.47	0.75	0.74	0.77	0.39
Triticum compactum							
UA0300240	0.10	0.43	0.31	0.65	0.06	0.17	0.17
UA0300354	0.28	0.32	0.29	0.42	0.76	0.47	0.56
UA0300368	0.31	-	0.20	0.35	0.31	0.36	0.30
Average in appearance	0.23	0.38	0.27	0.47	0.38	0.33	0.34
Triticum turgidum							
UA0300110	0.23	0.10	0.24	0.18	0.53	0.76	0.70
UA0300237	0.36	1.74*	0.08	-0.17	0.35	0.76	0.62
UA0300376	0.34	0.23	0.14	0.05	0.71	1.29	0.31
Average in appearance	0.31	0.69	0.15	0.02	0.53	0.94	0.54
Triticum persicum							
UA0300490	0.09	0.49	0.15	0.04	0.52	0.76	5.14*
UA0300495	0.12	0.08	0.15	0.71	1.38	1.71	1.91
Average in appearance	0.11	0.29	0.15	0.38	0.95	1.24	3.53
Wheat amphidiploids							
PAG-12	0.22	0.14	0.60	0.58	0.53	1.13	0.71
PAG -20	0.01	1.11	0.69	0.08	0.33	0.30	0.59
PAG -31	0.79	0.02	0.81	1.03	1.02	0.36	1.50
PAG -32	0.75	0.12	1.00	0.16	0.26	0.51	0.12
Triticum x timococcum	0.01	0.52	0.01	0.54	0.85	0.15	0.93
PAG -4	0.14	0.07	0.23	0.99	1.28	0.82	0.77
PAG -7	0.04	0.48	0.11	0.85	0.34	0.61	0.16
PEAG	0.29	0.20	0.57	0.61	0.11	0.76	0.54
Haynatricum	0.08	0.20	0.29	0.29	0.02	0.33	0.08
AD 8	0.03	0.22	0.86	0.95	0.51	0.71	2.05
PAG -39	0.27	0.22	0.17	0.16	0.76	0.71	0.46
Triticum x kiharae	0.15	0.06	0.83	0.47	0.58	0.30	0.61
UA0300107	0.66	0.44	0.94	0.58	0.05	0.63	0.57
Triticum x sinskourarticum	0.48	1.03	0.87	1.37*	0.23	0.64	0.36
Average in appearance	0.28	0.35	0.57	0.60	0.49	0.57	0.61

The high positive indicator of asymmetry indicates a tendency of variability of certain features in these samples towards smaller values of the manifestation of the feature. All other sample-feature combinations showed little or no asymmetry. According to the indicators of asymmetry, certain differences in the nature of the distribution of economically valuable traits at interspecific levels have been established (Table 4).

Table 5. Asymmetry of distribution of economically valuable features of spring wheat depending on the species.

Collectible sample	ear length	Sign length of awns	the number of spikelets in the ear	Number of productive spikelets	Number of grains in one ear	Weight of one ear	Masa grain from one ear
Triticum aestivum	0.65	0.96	0.81	1.03	0.88	1.07	0.79
Triticum durum	0.34	0.68	0.44	0.38	0.68	1.16	1.00
Uncommon types of wheat	0.42	0.56	0.10	0.31	0.51	0.80	1.24
Triticum monococcum	0.65	0.42	0.67	0.60	0.56	0.83	0.79
Triticum dicoccum	0.47	0.22	0.47	0.70	0.56	0.63	0.62
Triticum spelta	0.79	0.43	0.47	0.75	0.74	0.77	0.39
Triticum compactum	0.23	0.38	0.27	0.47	0.38	0.33	0.34
Triticum turgidum	0.31	0.69	0.15	0.02	0.53	0.94	0.54
Triticum persicum	0.11	0.29	0.15	0.38	0.95	1.24	3.53
Wheat amphidiploids	0.28	0.35	0.57	0.60	0.49	0.57	0.61

High asymmetry was observed in the species *Triticum spelta, Triticum monococcum, Triticum aestivum* (respectively, As=0.79; 0.65; 0.65; $p \leq 0.05$). Species *Triticum aestivum, Triticum turgidum, Triticum durum* were characterized by a positive asymmetry in the length of the awns (As=0.96; 0.69 and 0.68, respectively; $p \leq 0.05$). The species *Triticum aestivum* and *Triticum monococcum* showed an average level of asymmetry (As=0.81; 0.67; $p \leq 0.05$) in terms of the number of spikelets in the ear. For the species *Triticum aestivum and Triticum spelta,* a high level of asymmetry was also noted in terms of the number of productive spikelets in the ear (respectively, As=1.03; 0.75; $p \leq 0.05$). For the species *Triticum persicum* and *Triticum aestivum* in terms of the number of grains in one ear and the weight of grain from one ear, the level of asymmetry showed high values of As was 0.95, respectively; 0.88 and 1.24; 1.07. In terms of grain weight per ear, a high asymmetry index was recorded in the species *Triticum persicum* and amounted to 3.53; $p \leq 0.05$.

The presence of a certain indicator of asymmetry in the samples of the studied species of spring wheat indicates a tendency of variability of the studied traits in the direction of the corresponding values (smaller or larger). The presence of a significant and medium level of asymmetry allows us to talk about the heterogeneity of the studied plant material and determines the possibility of selection by any of the studied features. Slight or absent asymmetry may indicate the stability of the symptom. According to researchers, the greatest value for selection are samples that are characterized by high variability with slight asymmetry. A high level of variability contributes to the effective selection of certain traits, and slight or no asymmetry can serve as an auxiliary indicator to achieve trait stability. The results obtained by us indicate that all samples of the studied collection of spring wheat meet these criteria and are a promising material for the selection of spring wheat in different areas of use. Analysis of the nature of the distribution of economically valuable traits revealed a significant positive excess for some collection samples of spring wheat (Table 5).

So in the sample UA 0300391 (Table 6) the value of excess in terms of ear length is 14,65, $p \leq 0,05$. For the collection sample of Bucuria, a significant positive excess in the length of the awns was recorded, which amounted to 11,20 $p \leq 0,05$. This level of excess indicates that the environmental conditions in which the studies were conducted, contributed to the manifestation of the average values of the characteristics in the respective samples.

Table 6. The value of the excess distribution of economically valuable features of the collection samples of spring wheat on average 2018-2021.

Collectible sample	ear length	length of awns	Sign the number of spikelets in the ear	Number of productive spikelets	The number of grains in one ear	Weight of one ear	Masa grain from one ear
			Triticum aestivum				
Sunnan	0.37		0.78	0.32	4.11	0.38	0.51
Prokhorovka	0.84		0.01	0.69	2.18	3.62	1.29
Kharkiv 30	0.32	-	0.54	1.10	29.3	20.8	15.6
L 501	0.61		2.60	2.21	0.57	1.05	2.23
Simkodamironovskaya	1.38	-	0.68	0.50	2.19	0.99	1.38
Yrym	0.61	0.92	0.40	0.29	0.19	0.69	0.62
CIGM.250-	6.07	4.15	8.76	7.22	0.80	0.61	0.07
Phyto 14/08	0.77	0.52	1.12	0.15	0.92	0.29	0.03

Phyto 33/08	0.44	0.42	1.31	0.28	0.04	0.27	0.10
L 685-12	0.25		0.83	7.14	29.41	0.82	0.89
Average in appearance	1.17	1.50	1.70	1.99	6.97	2.95	2.27
Triticum durum							
Zolotko	0.77		0.61	2.585	6.55	0.07	4.39
Orenburgskaya 21	0.93	0.01	0.69	-0.41	3.25	2.69	4.05
Nurly	0.82	0.06	0.64	0.61	2.45	0.91	3.29
Slavuta	0.19	0.60	1.02	0.01	5.18	10.70	10.71
Bukuría	0.12	11.20	0.82	0.22	0.79	0.89	1.07
Altun Segus	0.59	0.67	0.94	0.27	0.31	1.49	0.12
Metiska	0.53	1.00	1.47	1.62	4.33	8.96	5.01
Novacia	2.27	1.00	0.49	0.12	0.96	0.02	0.44
Diana	0.95	0.02	1.10	0.03	0.83	0.22	1.31
Kustanayskaya 30	1.19	0.90	0.73	0.49	0.40	2.39	2.86
Average in appearance	0.84	1.72	0.85	0.40	1.90	2.84	2.97
Uncommon types of wheat							
Tr. ispahanicum IU0700070	2.01	0.73	0.71	0.59	3.18	5.60	7.84
Tr. aethiopicum IU070589	0.40	6.35	1.3	0.05	0.80	4.51	3.92
Tr. sinskajae UA0300224	1.14	0.49	0.47	0.33	0.67	-0.755	0.55
Tr. timopheeva UA0300545	0.81	0.06	1.00	0.89	0.86	0.65	6.1
Tr. militinae UA0300257	0.40	0.03	0.58	0.25	1.06	0.08	0.03
Average in appearance	0.95	1.53	0.81	0.17	0.71	2.02	3.46
Triticum monococcum							
UA0300104	0.62	0.41	3.80	5.09	6.17	4.06	4.99
UA0300221	0.67	1.42	1.48	0.29	1.02	0.06	0.65
UA0300223	5.10	0.15	0.52	0.40	0.46	0.86	0.40
UA0300254	0.44	0.12	0.44	0.43	0.12	0.41	0.74
UA0300282	0.98	0.57	0.08	1.22	0.89	0.16	0.25
UA0300310	1.01	1.54	0.45	0.49	0.44	0.32	2.32
UA0300313	3.59	0.42	0.90	0.13	0.14	1.21	0.68
Average in appearance	1.77	0.66	1.10	1.15	1.32	1.01	1.43
Triticum dicoccum							
UA0300327	0.98	1.09	4.1	1.39	0.71	0.70	1.24
UA0300407	0.04	0.23	1.65	1.88	0.45	0.73	9.42
UA0300406	1.10	0.49	0.31	0.72	5.81	0.54	1.04
UA0300199	0.10	1.19	0.73	0.15	1.31	0.71	1.32
UA0300009	0.86	1.05	0.59	0.03	0.10	9.16	0.65
UA0300183	0.87	0.90	1.01	0.92	0.71	0.79	0.72
UA0300021	0.41	0.91	1.02	1.315	0.85	-0.5	0.61
IU070615	0.41	-	0.99	0.4	17.57	0.26	0.04
Average in appearance	0.60	0.84	1.30	0.62	3.44	1.37	1.88
Triticum spelta							
UA0300238	1.29	1.08	1.7	0.59	0.90	1.36	0.02
UA0300304	0.80	-	0.81	0.48	10.96	0.50	3.44
UA0300387	0.84	0.81	0.84	2.22	1.62	0.07	0.04
UA0300388	0.61	-	1.50	0.10	1.64	3.97	0.13
UA0300391	14.65	0.83	3.01	11.8	6.26	10.42	5.84
UA0300392	0.01	-	0.19	0.11	3.5	0.55	1.16
UA0300398	1.15	0.23	0.71	0.61	1.07	1.27	1.34
UA0300443	0.83	2.33	0.7	4.53	1.02	1.03	3.3
UA0300546	0.38	0.16	0.38	0.51	0.24	0.31	0.28
Average in appearance	2.28	0.91	1.09	2.17	2.79	2.16	1.73
Triticum compactum							
UA0300240	1.71	0.73	0.65	0.13	0.47	1.10	0.33
UA0300354	0.22	0.37	1.12	0.70	0.20	0.52	0.08
UA0300368	0.14		0.79	0.21	4.56	0.08	0.55
Average in appearance	0.69	0.55	0.85	0.35	1.74	0.57	0.32
Triticum turgidum							

UA0300110	0.74	1.03	0.56	0.36	0.74	0.91	0.91
UA0300237	0.61	6.46	1.34	0.26	0.67	0.3	0.51
UA0300376	0.16	0.74	0.49	0.4	1.68	3.48	0.30
Average in appearance	0.50	2.74	0.80	0.34	1.03	1.56	0.57
Triticum persicum							
UA0300490	0.36	0.49	0.18	0.63	0.59	0.06	1.81
UA0300495	0.79	0.67	1.26	1.14	1.92	3.29	4.27
Average in appearance	0.58	0.58	0.72	0.89	1.26	1.68	3.04
Wheat amphidiploids							
PAG -12	0.17	0.35	0.04	0.39	0.21	2.32	0.47
PAG -20	1.00	1.26	0.22	1.22	0.18	0.15	0.62
PAG -31	0.30	0.48	0.11	1.41	0.92	0.49	3.34
PAG -32	0.50	1.09	5.10	1.01	0.64	0.40	0.49
Triticum x timococcum	1.04	0.49	0.09	0.07	1.135	1.28	1.46
PAG -4	0.02	0.09	0.81	0.83	2.39	0.27	0.26
PAG -7	0.74	0.07	0.76	1.47	2.70	0.81	3.02
PEAG	0.35	0.10	0.30	1.02	2.07	8.41	0.23
Haynatricum	0.34	0.64	0.01	0.51	0.98	0.57	0.98
AD 8	0.25	0.72	0.91	1.23	0.56	0.17	8.77
PAG -39	0.23	0.79	0.66	0.20	1.43	0.21	0.31
Triticum x kiharae	0.33	1.09	0.79	0.32	0.57	0.62	0.59
UA0300107	2.54	0.60	1.25	1.30	0.72	0.29	0.09
Triticum x sinskourarticum	0.14	4.86	0.73	3.74	0.71	0.51	0.94
Average in appearance	0.57	0.90	0.84	1.05	1.09	1.15	1.54

Analysis of the nature of the distribution at the interspecific level showed the presence of significant positive excess in samples of the species *Triticum spelta* in terms of ear length (Ex=2.28; $p \leq 0.05$).

According to the indicator, the length of the awns (Ex=2.74; $p \leq 0.05$) in samples of the species *Triticum turgidum*; the number of productive spikelets (Ex=2.17; $p \leq 0.05$) was observed in *Triticum spelta*. Samples of the species *Triticum aestivum* showed a positive Ex in terms of the number of grains in one ear and the weight of one ear (respectively Ex=6.97; 2.95; $p \leq 0.05$). In terms of grain weight from one ear, positive excess was observed in uncommon samples and amounted to 3.46.

Therefore, plants in populations of these species of spring wheat are characterized mainly by the average values of these characteristics (Table 7).

Table 7. The value of the excess distribution of economically valuable traits depending on the type of spring wheat.

Collectible sample	**Sign**						
	ear length	**length of awns**	**the number of spikelets in the ear**	**Number of productive spikelets**	**The number of grains in one ear**	**Weight of one ear**	**Masa grain from one ear**
Triticum aestivum	1.17	1.50	1.70	1.99	6.97*	2.95*	2.27
Triticum durum	0.84	1.72	0.85	0.40	1.90	2.84	2.97
Uncommon types of wheat	0.95	1.53	0.81	0.17	0.71	2.02	3.46*
Triticum monococcum	1.77	0.66	1.10	1.15	1.32	1.01	1.43
Triticum dicoccum	0.60	0.84	1.30	0.62	3.44	1.37	1.88
Triticum spelta	2.28*	0.91	1.09	2.17*	2.79	2.16	1.73
Triticum compactum	0.69	0.55	0.85	0.35	1.74	0.57	0.32
Triticum turgidum	0.50	2.74*	0.80	0.34	1.03	1.56	0.57
Triticum persicum	0.58	0.58	0.72	0.89	1.26	1.68	3.04
Wheat amphidiploids	0.57	0.90	0.84	1.05	1.09	1.15	1.54

The results of research revealed the variability of collection samples of spring wheat on economically valuable traits, the level of which varied depending on the genotype, species and a certain trait. All structural elements play an important role in the formation of a certain harvest, namely: the number of productive ears, the mass of grain from the ear, the mass of grain from one ear (Fig. 1).

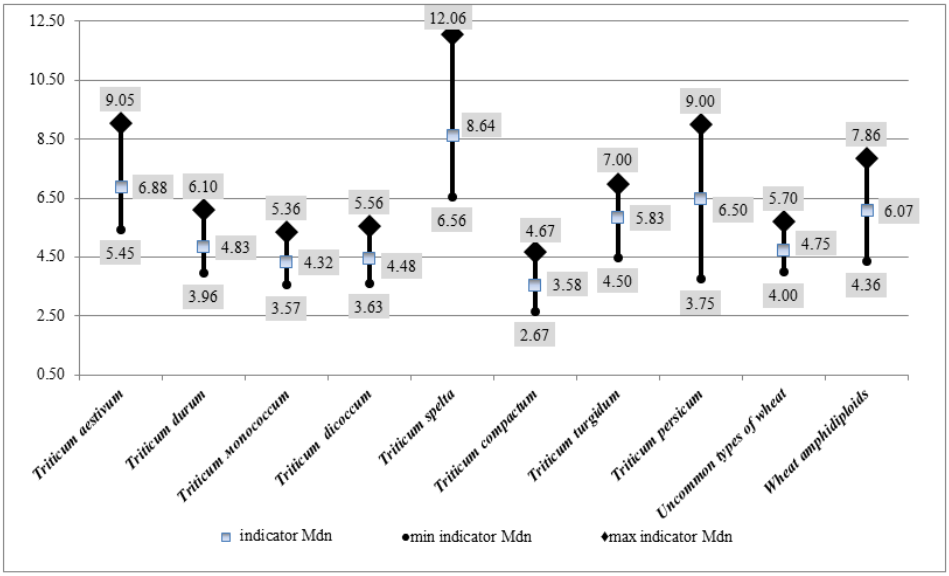

Fig. 1. Variability of spring wheat collection by ear length at the interspecific level. Mdn-median; min-the minimum value; max-the maximum value.

The study of the productivity of samples of spring wheat in the Kharkiv region showed that the plants, depending on the countries of origin and their characteristics, reacted differently to arid conditions. The value of the median on the length of the ear ranged from 3,00 [2,50; 4,00] in the sample UA0300257 *Triticum militinae* to 11,00 [10,00: 13,00] in the sample UA 0300388. The highest indicators were recorded in the samples of the species *Triticum spelta*, namely UA 0300546 and UA0300392, respectively (Mdn=10,75 [7,00: 17,50] and [Mdn=10,00] [6,00: 14,00].

According to the indicator, the length of the awns varied from 1,00 [0,80: 2,00] in the Diana sample to 12.00 [10: 13,5] in the IU070589 *Triticum aethiopicum* sample. A significant positive indicator was observed in samples of *Triticum durum*, namely Diana and Kustanaiska 30 (Mdn=12,00 [1,00: 13,50] and (Mdn=11,90] [10,00: 14,00]) (Fig. 2).

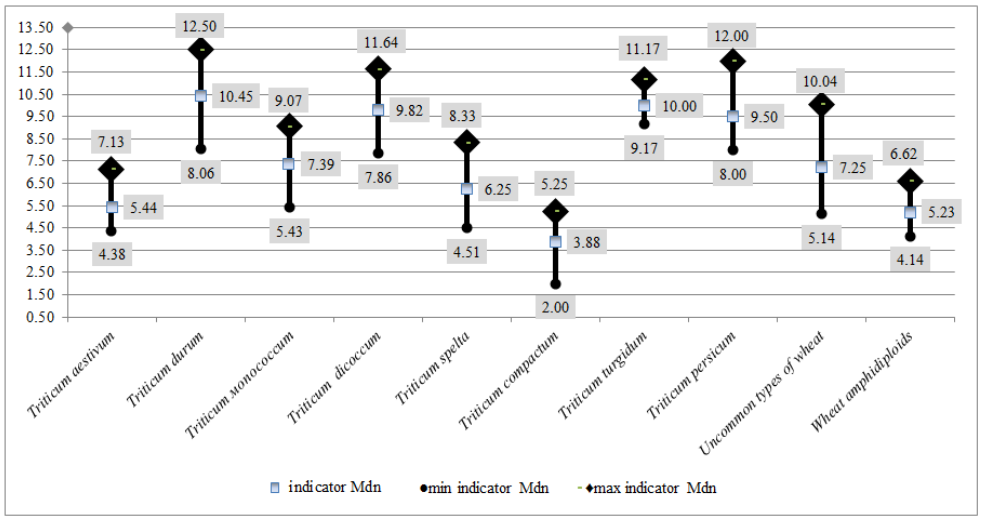

Fig. 2. Variability of spring wheat collection by length of spines at interspecific level. Mdn-median; min-the minimum value; max-the maximum value.

The highest number of productive spikelets was determined in samples of the species *Triticum monococum*, namely: UA 0300310 Mdn 17, 00 [13.00: 21.00], UA 0300221 Mdn 16, 00 [13.00: 21.00], and amphidiploid sample spring PAG-7 Mdn 17.00 [8.00: 21.00], and the lowest value was observed in the sample PAG-12 (Mdn=5.00 [3.00: 14.00] respectively).

The highest values for the number of grains in the ear were observed in the samples Gold of the species *Triticum durum* (Mdn=34.00 [9.00: 16.00] pcs), the sample Prokhorovka of the species *Triticum aestium* (Mdn=32.00 [28.00: 36.00] pcs.) and sample UA 0300238 species *Triticum spelta* (Mdn=30.00 [23.00: 41.00] pcs.) By the number of grains in one ear, the lowest values of the trait were observed in amphidiploid species, namely in samples of Triticum x sinskourarticum, PAG-12, PAG-31, PEAG (Mdn=6.0 [2.00: 14.00]) pcs., 8.0 [4.00: 9.00] pcs., 11.00 [5.00: 26.00] pcs, 11.00 [4.00: 32.00] pcs respectively) (Fig. 3, 4).

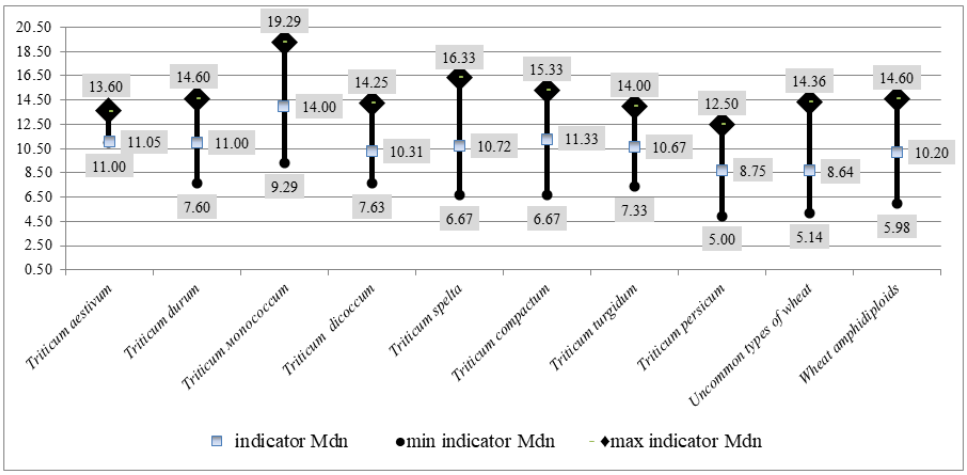

Fig. 3. Variability of spring wheat collection by the number of productive spikelets at the interspecific level. Mdn-median; min-the minimum value; max-the maximum value.

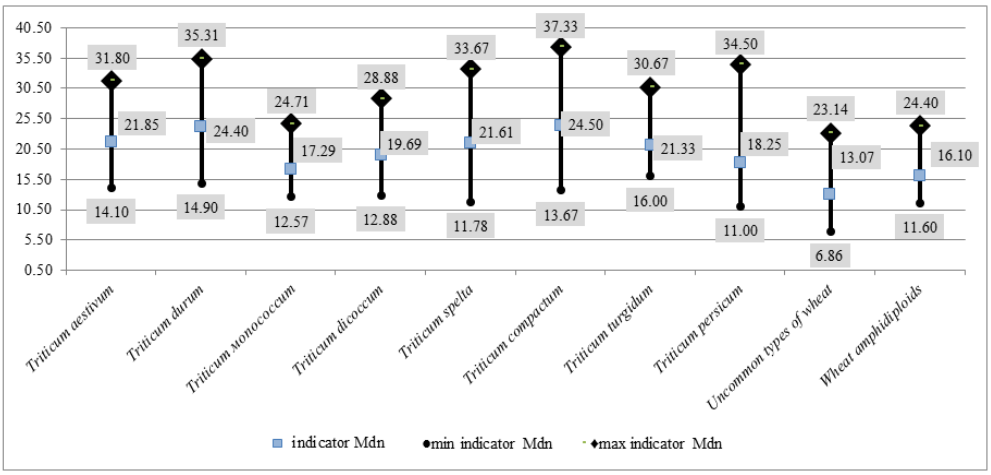

Fig. 4. Variability of spring wheat collection by the number of grains in the ear at the interspecific level. Mdn-median; min-the minimum value; max-the maximum value.

By the mass of one ear, the highest median values were observed in the sample of the species *Triticum spelta* (Mdn=2.26 [1.47:2.74] g), Orenburg 21 species of *Triticum durum* (Mdn=2.14 [1.60:2.50)] d) and the *Sunnan* sample of the species *Triticum aestium* (Mdn=1.92 [1.20:1.93] d), and the minimum value for the same indicator was recorded in amphidiploid species, namely: AD 8, Triticum x timococcum, *Triticum x sinskourarticum* [Mdn=0.32 [0.11:0.75] g; Mdn=0.43 [0.21:0.81] g; Mdn=0.54 [0.28:0.86] g) (Fig. 5).

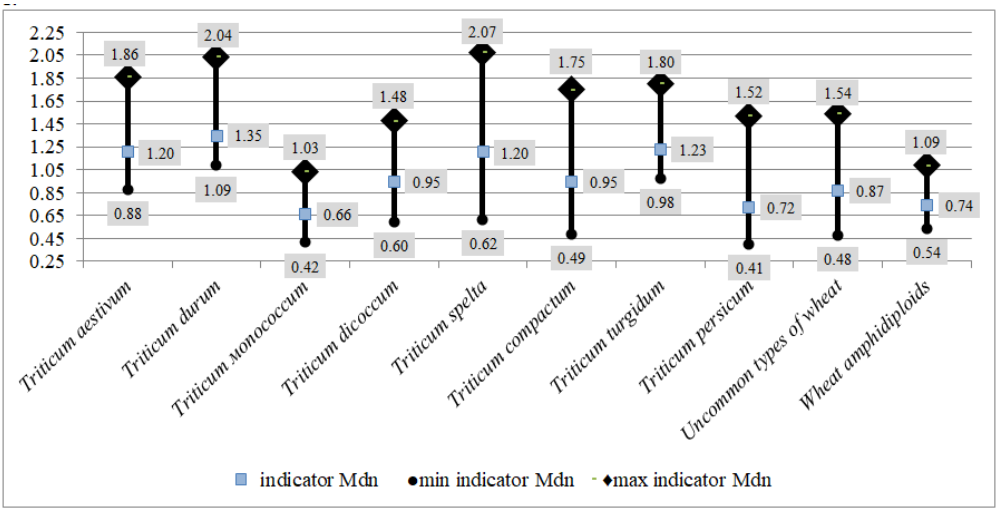

Fig. 5 Variability of spring wheat collection by weight of one ear at the interspecific level. Mdn-median; min-the minimum value; max-the maximum value.

In terms of grain weight from one ear, the highest value of the median was observed in the sample of the species *Triticum durum*, namely: Orenburg 21 (Mdn=1.68 [0.70:2.10] g), UA 0300238 species *Triticum spelta* (Mdn=1.26 [1.05:1.81] g) and the *Sunnan* sample of *Triticum aestium* (Mdn=1.21 [0.80:2.02] g), and the minimum value in terms of grain weight per ear was observed in

amphidiploid species, namely: AD 8, Triticum x sinskourarticum, UA0300257 *Tr. militinae* (Mdn=0.12 [0.01:1.17] g; Mdn=0.13[0.02:0.26] g; Mdn=0.23 [0.01:0.52] g) (Fig. 6).

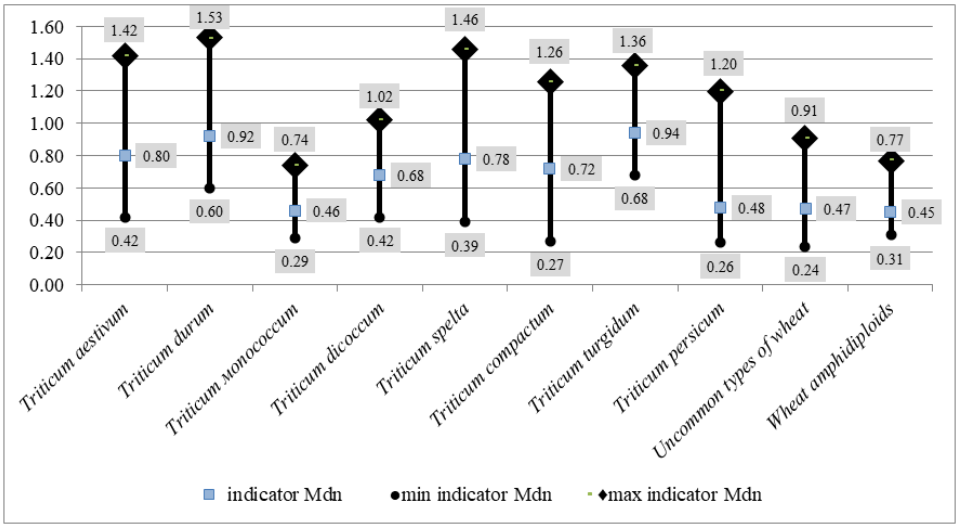

Fig. 6. Variability of spring wheat collection by grain weight of one ear at the interspecific level. Mdn-median; min-the minimum value; max-the maximum value.

Conclusion

Thus, a high level of variability of economically valuable traits of spring wheat has been established, which indicates a significant genetic diversity of the studied samples and makes it possible to plan the selection for any of the studied traits. A positive asymmetry was observed in samples of the species *Triticum monococcum, Triticum spelta*, *Triticum aestivum* As=0.79; 0.65; 0.65; $p \leq 0.05$.

The presence of a certain indicator of asymmetry in the studied samples of *Triticum* L. indicates a tendency of variability of the studied features in the direction of the corresponding values (smaller or larger).

The presence of a significant and medium level of asymmetry allows us to talk about the heterogeneity of the studied plant material and determines the possibility of selection by any of the studied features.

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Citation:

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