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CHARACTERISTICS OF AMPHIDIPLOIDS IN THE *TRITICUM-AEGILOPS-HAYNALDIA-AGROPYRON* GROUP

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Abstract

Amphidiploids in Triticum-Aegilops-Haynaldia-Agropyron group are an important part of the modern wheat breeding process, because of their valuable characteristics: resistance to biotic and abiotic stress factors. Sixteen amphidiploids and 25 synthetic wheat lines are observed for biotic and abiotic stress resistance. Observations (excluding germination of some amphidiploids seeds) are made under field conditions. In all amphidiploids and synthetic wheat lines no symptoms of powdery mildew (Erysiphe graminis DC.), leaf rust (Puccinia recondita Rob. et Desm.), septoria blotch (Septoria tritici Desm.) occur in tillering and adult plant phase. Synthetic wheats show low resistance to tan spot (Pyrenophora tritici-repentis (Died) Drechs.) in all phases of their development. The amphidiploids Chinese Spring x Haynaldia villosa, 45k (T. durum x Ae. speltoides), A1-6 (T. durum x T. boeoticum) and A3-8 (T. polonicum x T. boeoticum) possess very low frost tolerance (20-40%) as evaluated under field conditions. Lines developed from T. aestivum x Agropyron species crosses exhibit very good frost tolerance. Some of the observed lines (amphidiploid No.114, and (T. timopheevi x Ae. tauschii)), are not attacked by the cereal leaf beetle (Lema melanopa L.), probably because of the presence of well-developed trichomes on the leaves and stems. T. turanicum x T. timopheevi amphidiploid is determined with very fragile spikes and very low germination (12.5%). Low seed germination is registered in the T. durum x Agr. elongatum amphidiploid, too. In spite of some negative spike characteristics, the amphidiploids involved in this study, are important sources of genes which could be successfully utilized in wheat breeding.

Key words: *amphidiploids, bread wheat, resistance, Triticum-Aegilops-Haynaldia-Agropyron species.*

INTRODUCTION

Common winter wheat *Triticum aestivum* (2n=6x=42, AABBDD) is a major food crop for the main part of the world population. Obtaining high yields of it is a priority objective for agricultural production. Environmental factors related to agriculture are crucial to the production and quantitative and qualitative indices of the harvest. Modern breeding, through its methods, aims to create varieties that possess genes for resistance and tolerance to biotic and abiotic factors. Effective method in this regard is the development of distant hybrids.

Amphidiploids are plant form created by interspecific or intergeneric hybridization incorporating diploid chromosome complexes of the two parental components [5]. This plants species provide a valuable starting breeding material to produce added and substituted wheat lines through distant hybridization methods. Creating amphidiploids plants faced many difficulties such as non-viable embryos and the sterility of initial hybrids but they are successfully overcome by methods of tissue culture and by doubling the chromosome number by treatment of hybrid plants with colchicine solution [17]. Amphidiploids plants, unlike intergeneric and interspecific F_1 hybrids, which originating from, are characterized with large fertility and stable meiosis occurred. In a large number of similar forms, there is high resistance to fungal pathogens [13] and tolerance to insect pests [17]. Amphidiploids possess a number of negative qualities such as partial sterility possible occurrence of hybrid necrosis, fragile spikes, shriveled grains [5, 17]. Synthetic hexaploid wheat (SHW) (2n=6x=42, AABBDD) is an artificial form, involving the genomes of various tetraploid wheats (2n=4x=28, AABB) and D-genome of wild species *Aegilops tauschii* (2n=2x=14, DD). Obtaining this specific amphidiploid is associated with crossing the two parental species and the subsequent doubling of chromosome number by colchicine treatment. Obtained amphidiploids are characterized with wide variation in relation to the morphology and physiology defined phenotypic expression of certain properties [15]. The creation of SHW is a direction which is associated with breeding of valuable wheat lines after backcross with pollen from the same species [14]. The resulting bread wheat lines, grown in defined medium, effectively adapt to local conditions, and possess high levels of tolerance to abiotic and biotic stress.

Since the launching wide hybridization of Barelle in 1807 many developed amphidiploids of *Triticum-Aegilops-Haynaldia-Agropyron* group have been reported. Summary of results for obtained amfidiploids are reported by Sharma and Gill [11], Spetsov and Savov [13], Stoyanov [17]. The main directions of work with amphidiploidns plants is associated mainly with the transfer of valuable genes in the genome of bread wheat, as well as creating new cultural amphidiploids relevant to meet the new needs of agriculture and industry. Because of this it is necessary to characterize different amphidiploids and synthetic lines and to establish their morphological, ecological, biochemical, physiological, phytopathological, entomological properties. The large differences in parental components involved in the crosses refer to a wide variation in the factors listed above, depending on the genomic constitutions, chromosomal interactions and physiological processes. Therefore, it is important to determine the differences in accessions with a certain pedigree in the response to environmental conditions (biotic and abiotic factors). Despite the differences it should be also determined the similarities to the process of reaction to environmental conditions by establishing accessions representing a source of valuable genes in the selection of bread wheat in the country.

The main objective of this study is to identify key characteristics which determine the influence of biotic and abiotic stress factors in amphidiploid accessions of the group *Triticum-Aegilops-Haynaldia-Agropyron*, and to assess their suitability for a starting breeding material.

MATERIAL AND METHOD

Sixteen amphidiploid accession are used (presented in Table 1). It is also used twenty-five synthetic hexaploid wheat lines (SHW), which are obtained by the scheme shown in Fig. 1. Observed SHW plants are C_3-generation, obtained after double selfing of the initial amphidiploids. Parental tetraploid wheat forms 45390 and 45398 involved in the creation of maternal component (510), belong to the species *Triticum turgidum* ssp. *dicoccon*, and are derived from ICARDA – Syria, wheat collection. The used paternal parent belongs to the species *Aegilops tauschii*, accession № 19088, originating from IPGR-Sadovo.

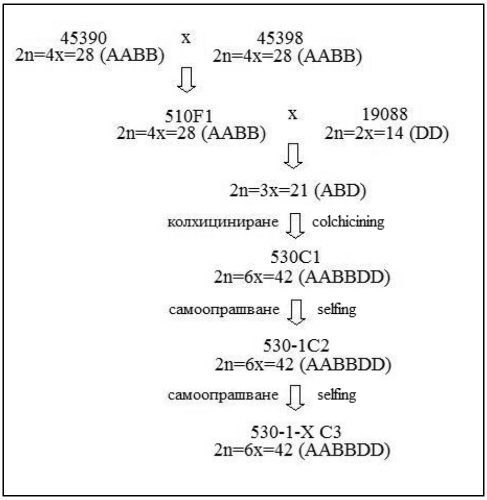

Fig. 1. Sheme of synthetic hexaploid wheat lines 530-1 obtaining generation C3

Under field conditions 15 seed from each sample were sown in scheme 30-5cm. Sowing under field conditions was carried out in the land of Stozher, Dobrich region, Bulgaria. Sowing dates are presented in Table 1. It is reported the number of plants grown (GN) and field germination (FG) on samples. To summarize the complex winter tolerance they are reported frosted (FN) and pulled-out (PN) plants. The influence of winter conditions (WCI) is presented as the ratio of the sum of the number of frosted and pulled-out plants to the number of germinated plants (GN) plants. It is reported the number of wintering plants (WN).

Table 1. Name of accessions, date of sowing and origin of plant material

No	Amphidiploid's name	Date of sowing	Origin	Form
1	Amphidiploid 114	29.10.2011	DAI-GT	N/A
2	45к C3 Zagorka x *Ae.speltoides*	29.10.2011	DAI-GT	N/A
3	*Tr. durum* x *Elytrigia elongatum*	29.10.2011	DAI-GT	N/A
4	*Tr. timopheevi* x *Ae. tauschii*	29.10.2011	DAI-GT	N/A
5	*Tr. turanicum* x *Tr. timopheevi*	29.10.2011	DAI-GT	N/A
6	Trakia x *Ae. ovata*	29.10.2011	DAI-GT	N/A
7	Chinese Spring x *H. villosa*	29.10.2011	UM-C	N/A
8	A1-6 *Tr. durum* x *Tr. boeoticum*	06.11.2011	DAI-GT	N/A
9	A3-8 *Tr. polonicum* x *Tr. boeoticum*	06.11.2011	DAI-GT	N/A
10	TRI 10365 *Tri.* x *Agr.* x *Agr.*	04.12.2011	IPK-G	W
11	TRI 10366 *Tri.* x Agr. x *Agr.*	04.12.2011	IPK-G	W
12	TRI 12911 *Tri.* x *Agr.*	04.12.2011	IPK-G	W
13	TRI 17927 x*Aegilotriticum erebuni*	04.12.2011	IPK-G	W
14	TRI 12087 *Ae. ven.* x *Tr. dicoccoides*	10.03.2012	IPK-G	S
15	TRI 12090 *Ae. ven.* x *Tr. carthlicum*	10.03.2012	IPK-G	S
16	TRI 11943 *Ae. ven.* x *Tr. dicoccum*	10.03.2012	IPK-G	S
17	Syntethic hexaploid lines	06.11.2011	DAI-GT	W

DAI-GT – Dobrudzha Agricultural Institute – General Toshevo, Bulgaria; IPK-G - The Institute of Plant Genetics and Crop Plant Research – Gatersleben, Germany; UM-C – University of Massachusetts – Columbia, th USA; N/A – no information; W – winter type; S – spring type.

In laboratory conditions seven amphidiploids were placed to germinate. After germination and reporting of laboratory germination (LG) seedlings are planted into pots and acclimatized in an unheated plastic greenhouse, and subsequently placed under field conditions. Sowing and planting dates are shown in Table 1. It is reported GN, FN, WN and WCI.

A statistical analysis of the total variability index for FG/LG and WCI is made as per accessions and groups of origin. To consolidate the data and variability analysis software Microsoft Excel 2007 is used.

At the same scheme are sown and reported data for standards for wheat cold resistance – Mironovska 808, Bezostaya 1, Rusalka, № 301, San Pastore, and standards for susceptibility to powdery mildew (*Erysiphe graminis*) - Sadovska ranozreyka, brown rust (*Puccinia recondita*) - Michigan Amber, septoria blotch (*Septoria tritici*) - Enola. A comparative analysis of winter tolerance and susceptibility to infection of phytopathogenic amfidiploidnite samples is made to those varieties of wheat.

It is summarized data of average daily temperatures during the period 01.10.2011 - 31.03.2011, the snow cover during the same period and the amount of rainfall in the period 31.10.2011-30.06.2012. Data of temperature and precipitation were obtained by measurements with an automatic weather station LaCrosse. Measurements were made twice daily at 07:00 and 19:00. Data of snow cover is determined using snowmeter precised to 0.5 cm.

The determination of phytopathogens attack is performed under field conditions, for powdery mildew (EG) using the methodology of Stoilova and Spetsov [16], for brown rust (PR) using the methodology of Ivanova [4], for septoria blotch (ST) using methodology of Eyal et al. [2], for tan spot (PTR) in methodology of Duveiller at al. [1]. Reporting is done by established: resistant (R), medium resistant (M) and susceptible (S) samples. Insects attack was confirmed by visual inspections.

RESULTS AND DISCUSSIONS

The results of conducted studies about establishing the influence of environmental factors on amphidiploids and synthetic lines are presented in Tables 2, 3, 5 and 6. In the tables it could be easily traced the diversity of response patterns to different climatic and biotic factors.

With regard to the field germination (Table 2, Table 5), four accessions (A1-6, A3-8, TRI10366, TRI17927) showed unsatisfactory results, 3 of them (A3-8, TRI10366, TRI17927) have demonstrated low germination outside the standard deviation. In synthetic hexaploid lines (Table 3, Table 5) 3 samples (530-1-3-1, 530-1-1-4, 530-1-1-3) showed lower scores on this indicator. With the best field germination are amphidiploids TRI10365, TRI12087, TRI12090 and TRI11943. In accession TRI12087, TRI12090 and TRI11943, high field germination is conditioned by the fact that they are spring forms and vegetate during March-April 2012, when the soil had sufficient moisture. In contrast, the highest germination in TRI10365 is proved by the ability of seeds to overcome the adverse conditions.

Table 2. Initial data about germination and winter condition influence for observed amphidiploids

No	Amphidiploid's name	SN	GN	WN (SuN*)	FN	PN	DN
1	Amphidiploid 114	6	5	2	3	0	-
2	45к C3 Zagorka x *Ae.speltoides*	6	6	1	5	0	-
3	Tr. durum x *Elytrigia elongatum*	1	0	0	0	0	-
4	*Tr. timopheevi* x *Ae. tauschii*	10	9	5	4	0	-
5	*Tr. turanicum* x *Tr. timopheevi*	8	1	1	0	0	-
6	Trakia x *Ae. ovata*	5	5	5	0	0	-
7	Chinese Spring x *H. villosa*	5	5	2	3	0	-
8	A1-6 *Tr. durum* x *Tr. boeoticum*	15	6	5	0	1	-
9	A3-8 *Tr. polonicum* x *Tr. boeoticum*	15	5	3	0	2	-
10	TRI 10365 *Tri.* x *Agr.* x *Agr.*	15	11	10	1	0	-
11	TRI 10366 *Tri.* x *Agr.* x *Agr.*	15	2	2	0	0	-
12	TRI 12911 *Tri.* x *Agr.*	15	11	9	2	0	-
13	TRI 17927 x*Aegilotriticum erebuni*	15	1	1	0	0	-
14	TRI 12087 *Ae. ven.* x *Tr. dicoccoides*	15	12	8*	-	-	4
15	TRI 12090 *Ae. ven.* x *Tr. carthlicum*	15	11	9*	-	-	2
16	TRI 11943 *Ae. ven.* x *Tr. dicoccum*	15	11	10*	-	-	1

SN – sown seeds number, GN – germinated seeds number, WN – wintered plants number, PN – pulled out plants number, FN – frosted plants number, DN – dead plants number. *SuN – survived plants number (only for summer forms).

In samples germinated in laboratory conditions, unsatisfactory results indicate *Tr. durum* x *Elytrigia elongatum* and *Tr. turanicum* x *Tr. timopheevi*. This is probably due to the incompatibility between the embryo and enodesperm, as evidenced the weak and shriveled seeds. Similar results in relation to laboratory germination are reported by Kolev [5] and Tsitsin [19].

Plants root poorly in slightly less depth, do not develop a sufficient number of tillers, which is a prerequisite for poor hardening. With regard to plants, grown in plastic pots, rainfall was important only indirectly associated with increased atmospheric humidity and the possibility of inoculation of pathogens, because of their weak root system needed regular watering to ensure rapid growth in a small volume of soil substrate.

Table 3. Initial data about germination and winter condition influence for observed synthetic hexaploid lines

No	Accession No	SN	GN	WN	PN	FN
1	67-530-1-1-1	15	9	8	0	1
2	67-530-1-1-2	15	12	10	1	1
3	67-530-1-1-3	14	0	0	0	0
4	67-530-1-1-4	15	4	0	0	4
5	67-530-1-1-5	15	8	3	0	5
6	68-530-1-2-1	15	8	3	1	4
7	68-530-1-2-2	15	13	7	1	5
8	68-530-1-2-3	15	9	6	1	3
9	68-530-1-2-4	15	12	8	1	3
10	68-530-1-2-5	15	15	12	0	3
11	68-530-1-2-6	15	10	8	1	1
12	69-530-1-3-1	15	5	3	0	2
13	69-530-1-3-2	15	12	10	1	1
14	69-530-1-3-3	15	6	4	0	2
15	69-530-1-3-4	15	10	8	0	2
16	69-530-1-3-5	15	9	7	1	1
17	69-530-1-3-6	15	11	4	1	6
18	70-530-1-4-1	15	12	9	0	3
19	70-530-1-4-2	15	10	6	0	4
20	70-530-1-4-3	15	7	5	0	2
21	70-530-1-4-4	15	10	7	0	3
22	71-530-1-5-1	10	4	1	0	3
23	71-530-1-5-2	15	6	5	0	1
24	71-530-1-5-3	15	15	14	0	1
25	71-530-1-5-4	15	11	10	0	1

SN – sown seeds number, GN – germinated seeds number, WN – wintered plants number, PN – pulled out plants number, FN – frosted plants number.

The data in Table 4 can help to trace the dynamics of rainfall during the growing season of plants. Stands to November 2011, which seems too dry, which is a cause for too variable field germination. Residual moisture from October 2011 initializes process of germination and subsequent drought cause very adverse effects on the seeds. As a result of these conditions, seed germination is too difficult and inharmonious, their growth has weakened.

Table 4. Precipitation in the period 10.2011 – 06.2012

Months	Precipitation, mm
October	162
November	3
December	55
January	101
February	23
March	24
April	48
May	190
June	22
Total	628

The data in Table 7 and Fig. 2 follow the dynamics of temperature and snow cover during the period 01.10.2011-31.03.2012. It clearly outlines the period of very low average temperatures which is below the threshold of biological development of plants the *Triticum-Aegilops-Haynaldia-Agropyron* group. This, combined with the dynamics in snow cover and a slight hardening creates conditions for damage caused by frost and pulling-out [18].

Table 5. Germination and winter condition influence data and conditions of growing

No	Amphidiploid's name	FG	LG	WCI	CGO
1	Amphidiploid 114	-	83.3%	60.0%	ppo
2	45к C3 Zagorka x *Ae.speltoides*	-	100.0%	83.3%	ppo
3	*Tr. durum* x *Elytrigia elongatum*	-	0.0%	-	-
4	*Tr. timopheevi* x *Ae. tauschii*	-	90.0%	44.4%	ppo
5	*Tr. turanicum* x *Tr. timopheevi*	-	12.5%	0.0%	ppo
6	Trakia x *Ae. ovata*	-	100.0%	0.0%	ppo
7	Chinese Spring *x H. villosa*	-	100.0%	60.0%	ppo
8	A1-6 *Tr. durum* x *Tr. boeoticum*	40.0%	-	16.7%	f
9	A3-8 *Tr. polonicum* x *Tr. boeoticum*	33.3%	-	40.0%	f
10	TRI 10365 *Tri.* x *Agr.* x *Agr.*	73.3%	-	9.1%	f
11	TRI 10366 *Tri.* x *Agr.* x *Agr.*	13.3%	-	0.0%	f
12	TRI 12911 *Tri.* x *Agr.*	73.3%	-	18.2%	f
13	TRI 17927 x*Aegilotriticum erebuni*	6.7%	-	0.0%	f
14	TRI 12087 *Ae. ven.* x *Tr. dicoccoides*	80.0%	-	*	f
15	TRI 12090 *Ae. ven.* x *Tr. carthlicum*	73.3%	-	*	f
16	TRI 11943 *Ae. ven.* x *Tr. dicoccum*	73.3%	-	*	f
17	67-530-1-1-1	60.0%	-	11.1%	f
18	67-530-1-1-2	80.0%	-	16.7%	f
19	67-530-1-1-3	0.0%	-	-	f
20	67-530-1-1-4	26.7%	-	100.0%	f
21	67-530-1-1-5	53.3%	-	62.5%	f
22	68-530-1-2-1	53.3%	-	62.5%	f
23	68-530-1-2-2	86.7%	-	46.2%	f
24	68-530-1-2-3	60.0%	-	44.4%	f
25	68-530-1-2-4	80.0%	-	33.3%	f
26	68-530-1-2-5	100.0%	-	20.0%	f
27	68-530-1-2-6	66.7%	-	20.0%	f
28	69-530-1-3-1	33.3%	-	40.0%	f
29	69-530-1-3-2	80.0%	-	16.7%	f
30	69-530-1-3-3	40.0%	-	33.3%	f
31	69-530-1-3-4	66.7%	-	20.0%	f
32	69-530-1-3-5	60.0%	-	22.2%	f
33	69-530-1-3-6	73.3%	-	63.6%	f
34	70-530-1-4-1	80.0%	-	25.0%	f
35	70-530-1-4-2	66.7%	-	40.0%	f
36	70-530-1-4-3	46.7%	-	28.6%	f
37	70-530-1-4-4	66.7%	-	30.0%	f
38	71-530-1-5-1	40.0%	-	75.0%	f
39	71-530-1-5-2	40.0%	-	16.7%	f
40	71-530-1-5-3	100.0%	-	6.7%	f
41	71-530-1-5-4	73.3%	-	9.1%	f

FG – field germination, LG – laboratory germination, WCI – winter conditions influence, CGO – conditions of growing; ppo – plastic pots outside; f – field conditions.

Plants grown in plastic pots, although they are developed properly, due to assuring of optimal conditions for their growth and development, exposure to the effects of low winter temperatures, is a prerequisite for easy frost, because their root system is not protected enough by powerful soil horizon. The roots are exposing to the action of temperatures close to ambient temperature. With regard to the plants damaged by the effects of the winter conditions the worst results exhibit three amphidiploids (Amphidiploid 114, 45k C3, Chinese Spring x *H.villosa*).

Table 6. Disease resistance data of observed accessions

No	Amphidiploid's name	EG	PR	ST	EG	PR	ST	P TR
		Tillering			Adult plants			
1	Amphidiploid 114	R	R	R	R*	R	R	R
2	45к C3 Zagorka x *Ae.speltoides*	R	R	R	R	R	R	R
3	*Tr. durum* x *Elytrigia elongatum*	R	R	R	R	R	R	R
4	*Tr. timopheevi* x *Ae. tauschii*	R	R	R	R	R	R	R
5	*Tr. turanicum* x *Tr. timopheevi*	R	R	R	R	R	R	R
6	Trakia x *Ae. ovata*	R	R	R	R	R	R	R
7	Chinese Spring x *H. villosa*	R	R	R	R	R	R	R
8	A1-6 *Tr. durum* x *Tr. boeoticum*	R	R	R	R	R	R	R
9	A3-8 *Tr. polonicum* x *Tr. boeoticum*	R	R	R	R	R	R	R
10	TRI 10365 *Tri.* x *Agr.* x *Agr.*	R	R	R	R	M	M	R
11	TRI 10366 *Tri.* x Agr. x *Agr.*	R	R	R	R	R	M	R
12	TRI 12911 *Tri.* x *Agr.*	R	R	R	R	M	M	R
13	TRI 17927 x*Aegilotriticum erebuni*	R	R	R	R	R	R	R
14	TRI 12087 *Ae. ven.* x *Tr. dicoccoides*	R	R	R	R	M	R	R
15	TRI 12090 *Ae. ven.* x *Tr. carthlicum*	R	R	R	R	M	R	R
16	TRI 11943 *Ae. ven.* x *Tr. dicoccum*	R	R	R	R	M	R	R
17	Syntethic hexaploid lines	R	R	R	R	R	R	S

Perhaps, these values of the indicator are due to two factors: growing them into pots and exposure of the root system at temperatures close to air temperature during the period of active low temperatures; maternal components involved in crossing to obtain amphidiploids are spring forms. The probability of the second hypothesis is more significant as well as amphidiploids *Tr. turanicum* x *Tr. timopheevi* and Trakia x *Ae. ovata* showed slight damage due to low temperatures - all plants survived, despite being grown in pots.

Wide variation was observed in relation to damage caused by the effects of winter conditions on the synthetic hexaploid lines. For them, only one sample 530-1-5-3 exhibit good values of winter tolerance. This is probably due to the alignment of the properties in the hybrid generation and differentiation of homozygous dominant organism refers to observed characteristic. This fact is demonstrated by

Limin [9] in conducting a similar study of such synthetic hexaploid lines.

Table 7. Average monthly temperature and total snow cover data in 01.10.2011-31.03.2012 period

Months	AMT, ºC	TSC, cm
October	10.80	0.0
November	3.75	10.0
December	4.00	30.0
January	-1.60	160.0
February	-3.57	110.0
March	5.77	10.0
April	3.19	-
Total	-	320.0

AMT – average monthly temperature, TSC – total snow cover.

The possibility of occurrence of phytopathogenic attack is very limited in the largest part of the vegetation of plants, due to relatively low temperatures and lack of moisture, which does not allowing initial inoculation. Therefore, before flowering, at all observed samples, including standards for the susceptibility of the pathogens no signs of the disease are occurred (Table 6). After flowering in May-June period 2012, due to the intense rainfall and high temperatures, on a concrete samples was observed only slight attack by powdery mildew, brown rust and septoria blight. Too high temperatures, however, inhibit the development of pathogens which caused the lack of significance in some accessions.

In the majority of the accessions during the tillering phase and after flowering, they show full resistance to pathogens of powdery mildew, brown rust and septoria blotch. In Amphidiploid 114 is observed very weak expression of powdery mildew expressed in the occurrence of some poorly developed pustules, with weak and undeveloped cleistotecia and mycelium. In the spring forms amphidiploids involving *Aegilops ventricosa*, is recorded occurrence of brown rust, expressed little uredinia on single leaves of plants, mainly on aging leaves.

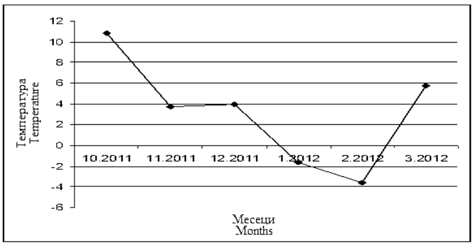

Fig. 2. Dynamics of average monthly temperature in 01.10.2011-31.03.2012 period

This is reason these amphidiploids to be classified as medium resistant to the pathogen. Such expressions show amphidiploids TRI12911 and TRI10365. Synthetic hexaploid lines indicate a high degree of natural resistance to the presence of pathogens of powdery mildew, brown rust and septoria blotch. However, all 25 samples are susceptible to the pathogen of tan spot throughout their whole period of development.

Studies on the reaction of amphidiploids to phytopathogens, indicate that they largely show resistance to powdery mildew and brown rust. Bred in DZI-GT, amfidiploids, referring to a *Triticum-Aegilops-Haynaldia-Agropyron* group in the period 1950-1990, possess a high degree of resistance to the listed pathogens [13]. Similar results are reported by Tsitsin [19], Kolev [5], Kwiatek [6], Sharma and Gill [11], Oliver et al. [10], Wang et al. [20], Lalkova et al. [7], in studies of amfidiploids from *Triticum-Aegilops-Haynaldia-Agropyron* group.

With regard to insects during vegetation it is found adults and larvae of *Lema melanopa* and *Lema lichensis*, with numbers below the threshold of economic harmfulness about common bread wheat [8]. In amphidiploids *Tr. timopheevi* x *Ae. tauschii* and Amphidiploid 114 damage from these insect pests is not observed. This is due to the strong pubescence of the plants of these two samples, and they are not preferred by insects [3, 12]. In all other samples is reported an attack by adult and larval forms of both enemies. In rare cases it is detected adult representatives of the family *Scutelleridae*.

The amphidiploid accessions *Tr. timopheevi* x *Ae. tauschii*, A3-8, A1-6, *Tr. turanicum* x *Tr. timopheevi* and Trakia x *Ae. ovata*, are determined with their very fragile spikes. The spikes break into single spikelets before maturing. The amphidiploid *Tr. turanicum* x *Tr. timopheevi* possess the most fragile spikes which break at the peduncle. The cause of spike fragileness is the presence of wild species' chromosome complex into the genome of amphidiploid plants [11, 15].

CONCLUSIONS

From the foregoing results the following conclusins can be drawn: Amphidiploids from *Triticum-Aegilops-Haynaldia-Agropyron* group, exhibit a wide variation in relation to reported field germination and demonstrated winter tolerance due to a combination of different parental genomes in hybrid plants. Synthetic hexaploid wheat lines exhibit a wide variation in field germination and winter tolerance caused by the hybrid nature of plants and their high heterozygosity. Many of the amphidiploids plants possess very fragile spikes due to adventitious genes from wild parental components. The studied amphidiploids exhibit resistance to the pathogens of powdery mildew, brown rust and septoria blotch, except for spring forms of *Aegilops venticosa*. Synthetic haxaploid lines are susceptible only to the pathogen of tan spot. Due to its strong pubescence on all plant organs, amfidiploids *Tr. timopheevi* x *Ae. tauschii* and Amphidiploid 114 possess tolerance to attack by cereal leaf beetle.

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