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GAMMA RADIATION INFLUENCE ON MORPHOLOGICAL FEATURES AND BIOCHEMICAL PROPERTIES OF GENETICALLY DISTANT WHEAT HYBRIDS

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Abstract: It is studied the effect of different dose of ionizing gamma rays on the morphological characteristics (1000-grain weight, plant height, ear length, number of spikelet's per spike, the shape of the ear, color ear and embryo) and biochemical properties (vitamins, pigment, grain, solid matter) of five combinations of goat grass-wheat and wheat-rye three F1 hybrids and their parental forms. It is specified radioprotective properties of carotenoids and vitamins of distant hybrids of wheat grain.

Keywords: Gamma irradiation, biochemical properties, wheat, hybrids, morphology, genetic.

1. Introduction

Wheat - is one of the most common cereal that is respected and revered in the all world countries. Everyone knows that wheat grains are the main source of flour used for bread, but as it turns out, one can get even, and other equally useful products. There are several usages of nuclear techniques in agriculture. In plant improvement, the irradiation of seeds may cause genetic, variability that enable plant breeders to select new genotypes with improved characteristics such as precocity, salinity tolerance, grain yield and quality.

In contrast to the cultivars, their wild relatives have a higher resistance to pests, disease, fluctuations in environmental factors, adaptability to natural disasters. Among the other factors that can complicate crossing with wild relatives of cultivated varieties should note the difference in the periods of flowering of wild and cultivated forms, morphological mismatch (spikelets densely pressed, closed bloom, etc. Good luck to the use of wild relatives in interspecific and intergeneric crosses due to their belonging to a particular gene pool.

Ionizing radiations are also used to sterilize some agricultural products in order to increase their conservation time or to reduce pathogen propagation when trading these products within the same country or from country to country [1; 2].

A number of radiobiological parameters are commonly used in early assessment of effectiveness of radiation to induce mutations. Methods based on physiological changes such as inhibition of seed germination and shoot and root elongation have been reported for detection of irradiated cereal grains and legumes. Chaudhuri, K.S. reported that the irradiation of wheat seeds reduced shoot and root lengths upon germination [3].

Gamma radiation can be useful for the alteration of physiological characters (Kiong et al., 2008). The biological effect of gamma-rays is based on the interaction with atoms or molecules in the cell, particularly water, to produce free radicals [4].

These radicals can damage or modify important components of plant cells and have been reported to affect differentially the morphology, anatomy, biochemistry and physiology of plants depending on the radiation dose [5]. These effects include changes in the plant cellular structure and metabolism e.g., dilation of thylakoid membranes, alteration in photosynthesis, modulation of the anti-oxidative system, and accumulation of phenolic compounds [4-8]. Physiological Responses of *Citrus cinensis* [9], effect of γ-ray irradiation on the germinating characteristics of wheat seed [10] and some key physiological and biochemical characteristics of wheat seedlings [11].

2. Material

Studied the effect of different dose of ionizing gamma rays on the morphological characteristics (1000-grain weight, plant height, ear length, number of spikelets per spike, the shape of the ear, color ear and embryo) and biochemical (vitamins, pigment grain solid matter) properties of five combinations of goat grass-wheat and wheat-rye three F2 hybrids and their parental forms.

3. Methods

Wheat seeds were irradiated with 100-400 Gy by 50 Gy intervals and non-irradiated seeds of each genotype served as control. Carotenoids, vitamins and fatty oil is determined by method (Ermakov A,E. Practicum in Biochemistry, 1987.)

4. Discussion

Considering the effects of radiation on plants, the present study was conducted to determine the effects of radiation onto biochemical compound and morphological properties at genetically far hybrids of wheat.

We have studied the radioprotective effect of vitamins, extracts of wheat germ, sugar solid matter, pectins, fatty oil of wheat [11]. Antimutagenic factor has got peroxidase activity. These properties may be for grains familly of *Poaseae* Barnhart. with a high content of tocopherols that have radioprotective and antimutagenic activity.

It is known that a grain of wheat contains of many valuable substances in its content: amino acids, vitamins PP, especially deficient vitamin E. Most of these mineral components have lost during grain milling into flour and baking bread. Preparations also prepared directly from grains and wheat germ; do not lose these substances which provide antimutagenic and radio protective effect. The results of these experiments showed that the preparation of wheat seedlings in a wide range of concentrations do not modify the evolution of this type been formed, the level of spontaneous mutation does not increase and not decrease it. At the same time it was revealed that the the paste obtained of fresh wheat seddlings is also being tested in a wide range of concentrations however with a dose-dependent efficancy and inhibits induced mutagenesis. Their significance and role in improving overall resistance to environmental factors around is high.

We have grown a new variety of *Triticale* hybridization of rye with wheat. The amount of pectine substances in the grain structure of this plant is higher than parental forms. Productivity is 90-110 quintal out of a hectar within sowing conditions; amount of flavonoid, antosian and oil in grain content is so high that it can be produced in sufficient amount of substances with radioprotector properties.

1 **2** **3**

Fig. 1 After 200 Gy gamma radiation in the ear there is a black pigment; 2- After 200Gy gamma radiation shortness of the plant as protective functions in the morphological features were observed; 3- New high-yield (85-90 ts / ha.) Hybrid varieties of Triticale «Naxcivan 1".

The increased dose of gamma irradiation decreases: 1000-grain weight , plant height, ear length, number of spikelet's per spike, the shape of the ear**.** Increased dose of gamma irradiation (50 to 400 Gy) increases the carotenoid and other pigment solid matter wheat ear and grain.

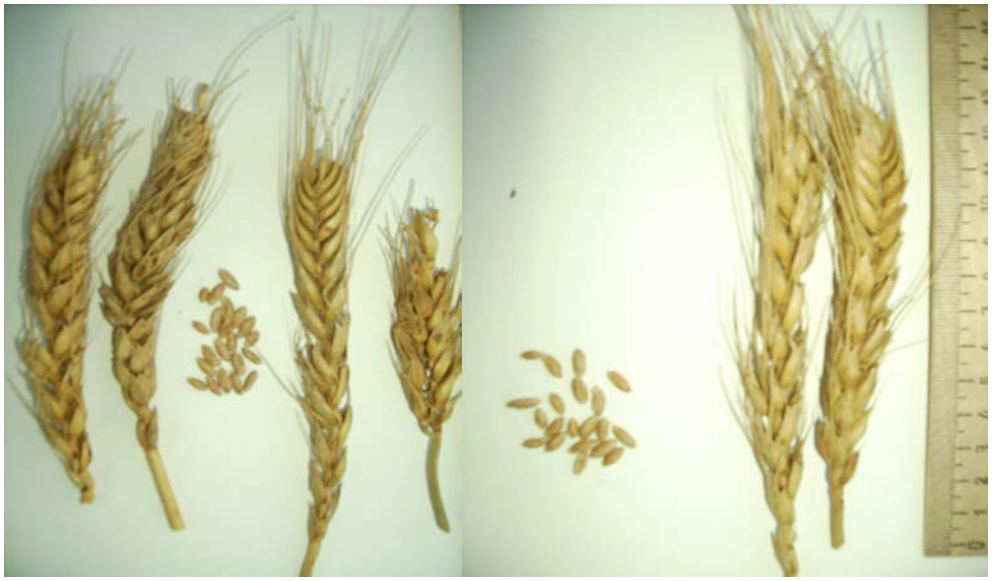

Fig. 2. Mutant forms of ear hybrid triticale under existing actions 300 Gy of gamma radiation.

After subjecte durum wheat ('Zogal bugday' variety) to 250Gy hydrated for 24 hours content of some vitamins increased 22 to 38% which showed protective functions of these vitamins. Changes of vitamin content of grain after irradiation: Vitamin C – 3.64mg-4.12mg; Vitamin A – 427mkq - 912mkq%; Vitamin B1 – 0.08mg-0,09mg; Vitamin B2 – 0.13mg-0,16mg; Vitamin B3 – 0.11mg; Vitamin B5 – 4,1mg-6.0mg; Vitamin B1– > 1mkg-1,4mkq; Vitamin E – 15.2mq%-13,4mq%; Folic acid – 29mkg-22.6mkg; Vitamin F – 0.76mq-0,89mq per each 100g of grain.

Table 1. Changing the content of carotenoids in the anatomical parts of the grain 200Gy of wheat after irradiation.

Carotenoids	In total carotinoids, in %			
	Total green	Endosperm	Embryon	Epidermis+aleyron
	T.dicoccum v.rufum			
Carotene	7,9	6,4	10,1	6,0
Xanthophylls	85,5	88,1	71,6	60,1
Xanthophyll-ether	6,6	5,5	18,4	33,9
	T.dicoccum v.rufum 200Gy rad.			
Carotine	11,8	8,8	9,1	6,9
Xanthophyll	55,0	63,3	87,8	34,9
Xanthophyll-ether	33,2	27,9	3,1	58,2

Table 2 The characteristic of some on quality of grain of hybrids and radiation rays effect (150 Gy)

Character	Hybrids				
	Cəfəri x S.Segetale St /150 Gy	*Sevinc x S.segetale* St /150Gy	*Zoğal buğda S.segetael* St /150Gy	*Bol buğda x S.Segetale* St /150Gy	Gürgənə x S.Segetale St /150 Gy
Glassiness, %	89,0±0,68 +7,0	89,3±0,90 +9,0	94,1±4,28 +6,0	93,9±2,65 +6,0	87,3±0,29 +8,0
Content gluten,%	36,8±1,83 +2,5	34,6±1,83 +2,6	36,3±1,80 +2,1	32,8±1,08 -1,2	33,1±1,80 +2,4
Extensibility gluten, sm	17,1±0,93 -2,4	18,8±0,35 -1,7	19,0±1,22 -2,2	16,4±1,03 -0,5	17,6±1,02 -3,1
Bread volume, sm3	544±11,1 -16,0	510±13,2 -19,0	553±11,9 -13,5	593±17,6 -33,5	591±12,6 -20,5
Ash-content (minerals), %	2,41±0,02 +0,04	2,23±0,08 +0, 10	2,33±0,06 +0,08	2,11±0,03 0,00	2,18±0,02 +0,05
Protein mass,%	18,6±1,08 19,5	14,8 ±1,13 16,3	13,9±1,08 14,9	18,8±0,3 19,6	16,9±1,01 16,5
Content amylum, %	53,2±1,03 -2,50	52,6±2,05 -3,23	55,4±2,09 +4,89	54,6±1,44 +2,45	53,2±1,92 +5,65
Estimator bread, point	4,2	3,9	4,0	4,2	4,0
Weight 1000 grain, g .	54,3±1,19 -8,30	59,9±1,35 -11,48	62,4±3,51 -4,79	51,2±1,33 -6,64	49,6±2,01 -4,43

Triticale seed protein fraction (%) and Productiveness					
Prolamin, %	44,5±1,02 -2,07	43,8±0,84 -1,93	46,4±1,02 -3,32	40,6±0,72 -2,39	43,8±0,72 -1,02
Glutenin, %	30,8±0,65 -2,03	31,3±0,21 +1,09*	29,2±0,73 -2,50	28,61±0,83 -2,40	26,8±0,82 -3,93
Albumin, %	12,3±0,21 +2,04	13,2±0,26 -1,92*	14,4±0,82 +3,53	18,1±0,14 +2,56	18,1±1,02 +3,39
Globulin, %	9,6±0,11 +1, 95	10,4±0,19 +2,65	10,2±0,19 +2,45	9,3±0,26 +2,03	10,4±0,93 +1,56
Production performanse, g/м2	523±11,5 -16,7	594±14,3 -19,2	631±21,6 -14,8	596±11,6 -16,3	643±22,1 -15,9

It was determined that wheat and rye sprouts have been balanced with vitamins. Since ancient times various wheat varieties were cultivated in Azerbaijan for production of radioprotectors rich with vitamins. One of these wheat varieties is spelta of which different products are produced in folk medicine. Protective creams and masks are made of wheat sprouts in cosmetics.

5. Results

1. Productivity of 150 and 200 Gy irradiated plants decreases.
2. Weight of 1000 grains of 150 and 200 Gy irradiated plants decreases and this decrease emerges in various sorts, types and hybrids differently.
3. Glassiness increases in grain of 150 and 200 Gy irradiated plants.
4. Protein in grain of 150 and 200 Gy irradiated plants increases relatively to standard.
5. Gliadin and gluten fractions in grains of 150 and 200 Gy irradiated plants decrease in comparison with albumin and globulin fractions.
6. Gluten extension (penetration level) decreases, hence it causes deterioration of bread quality. It becomes dauby and frail.
7. Weight of Wet gluten in grain of 150 and 200 Gy irradiated plants increases to a certain extent and it differs according to each sample.
8. Spectrum intensity of gliadin fraction of 100, 150 and 200 Gy irradiated plants changes and it shows increase or decrease in weight (synthesis) of some spectrum.

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ВЛИЯНИЕ ГАММА-ОБЛУЧЕНИЯ НА МОРФОЛОГИЧЕСКИЕ ПРИЗНАКИ И БИОХИМИЧЕСКИЕ СВОЙСТВА ГЕНЕТИЧЕСКИ ОТДАЛЕННЫХ ГИБРИДОВ ПШЕНИЦЫ

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Резюме: Изучены различные дозы ионизирующих гамма лучей на морфологические признаки (вес 1000 зерен, высота растений, длина колоса, число колосков в колосе, форма колоса, цвет колоса и зародыша) и биохимические свойства (витамины, пигментные вещества зерна) у пяти комбинаций гибридов – аэглотритикум, тритикале (F_2) и их родительских форм. Выявлены радиопротекторные свойства каротиноидов и витаминов зерна отдаленных гибридов пшеницы.

Ключевые слова: Гамма-излучение, биохимические свойства, пшеница, гибриды, морфология, генетика.

QAMMA ŞÜALANMANIN TƏSİRİNDƏN GENETİK UZAQ BUĞDA HİBRİDLƏRİNDƏ BİOKİMYƏVİ VƏ MORFOLOJİ ƏLAMƏTLƏRİN DƏYİŞİLMƏSİ

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Xülasə: Müxtəliff dozalı qamma şüaların buğdanın genetik uzaq hibridlərində-egilotritikum, tritikale (F_2), və onların valideyn formalarında morfoloji əlamətlərə (1000 ədəd dənin çəkisi, bitkinin hündürlüyü, sünbülün uzunluğu, sünbüldə sünbülcüklərin sayı, sünbülün forması, sünbülün və dənin rəngi); biokimyəvi maddələr: dənin tərkibində olan bəzi vitaminlər və piqment maddələrinə təsiri öyrənilmişdir. Buğdanın uzaq hibridlərində bəzi vitaminlərin və karotinoidlərin radioprotektor xüsusiyyətinə malik olduğu müəyyən edilmişdir.

Açar sözlər: Qamma şüalanma, biokimyəvi xassələri, buğda hibridləri, morfologiya, genetika.