Comparison of Sunn Pest Damage and Genotypic Differences

in Bread Wheat Varieties by SDS-Page Analysis

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Abstract

The research was carried out in five different locations in 2010 and 2011 years under in the ecological conditions of Hayrabolu, Malkara, Suleymanpasa, Şarköy and Saray district. Twenty-three bread wheat varieties were used as material in the study. the study carried out in the same area was made up of 2 different growing conditions, namely field conditions and a covered area covered with sunlight.

The sunn pest damage rates in wheat varieties grown in the open area were ranged from of 6.0. to 0.10 %. The sunn pest damage rates in bread wheat varieties grown in closing area was changed between 10.37 to 23.17% with a significant increase. the average of the highest sunn pest damage in two years was observed the numbered 15, 10, 1, 11 and 16 cultivars, while the lowest values was obtained form 4, 13, 8 and 3 varieties

According to the SDS-PAGE analysis in order to determine the genotypic differences of bread wheat varieties, protein band number in bread wheat varieties was ranged from 17 to 21, the density and molecular weight of protein bands were significant differences among the varieties. Protein bands are distributed predominantly in the omega region while in the gamma and beta regions a small number of bands were observed. There are no bands in bread wheat varieties in the alpha region.

Keywords: Sunn Pest, Quality, Sds-Page, Bread Wheat, Protein Band

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1. Introduction

Wheat, which is an important cultural plant for our country and region, has the most important place in terms of total sowing area and production. Twenty-one million tons of the 60 million tons of wheat produced in our country are produced from wheat production. The increase in total grainproductionwas1.6% while the increase in wheat production was 10% [1].

Yield and quality in wheat are the most important selection criteria for plant breeders and producers. Grain quality in wheat is affected by factors such as variety, climate, soil conditions, seed quantity, fertilizer, growing conditions, diseases and pests, storage conditions. One of the important factors affecting the quality of wheat is sunn damage.

When the temperature reached 20-22 ^{o}C with the arrival of spring, sunn pest (eurygaster integriceps put.) leave from the winter and they migrate to distances of 10-150 km and go to the cereal fields [2, 3]. The first (primary) plant of the downwind plains is mainly wheat, the plants which are fed as secondary or alternative hosts as barley, rye and corn [4]. The new generation of adults bugs feeding tensely on the spike and store fat in their bodies to pass the winter.

When the food resources are abundant and weather conditions are favorable, this period is completed within 10 days. This period may be longer in rainy periods [5, 6, 7, 8]. The region of the grain which has suffered damage to the sunn pest is softer than the other plant parts and when it is pressed with the nails, this region are easily collapsed to the inside in grain [9, 10].

Sunn pest (Eurygasterspp.: Heteroptera-Scutelleridae) is the main harmful factor affecting in the negative direction on the wheat quality and quantity in Turkey and especially in the region of the Thrace. Bug damage is common in bread wheat in the regions of the middle Anatolia and the Thrace. According to the results of studies carried out by different researchers, if there is not enough struggle with bug in areas where bug population is high, bug causes significant loss in quality and quantity of wheat [11, 12, 13, 14].

In the study, changes in bug damage rate and gluten protein properties of bread wheat cultivars with different phonological characteristics, which are widely grown in Thrace region, were investigated. As a result of evaluating the obtained data, it was tried to provide useful information to the breed selection criteria which are more resistant to sun damage and region producers for better quality pasta production

2. Materials and Method

In the study, bread wheat varieties with the different ripening groups, long and short plant height, alternative and winter growing nature, spike with awn and awness, soft-hard grain structure, red and white grain were used as materials. Genotypic differences of bread wheat cultivars used in the experiment were examined by SDS-PAGE analysis. In the study, twenty-three bread wheat varieties were grown in 2 different conditions in the experimental field of the Faculty of Agriculture. While one of the fields was covered with a white cover that covered the sun's rays, the same varieties were planted open in the field run (Figure 1). A two meter trial path was left between the open and open wheat varieties.

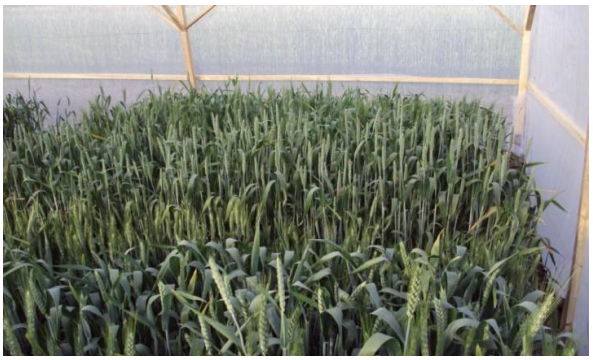

Figure 1. Experiment in the same area open and closed

Sowing was done by throwing 500 seeds per square meter. A total of 150 adults, 75 males and 75 females were released into the greenhouse on 30 April 2010 (3 males per m^2). The necessary observations and measurements were made on the plants in both the greenhouse and uncontrolled conditions. As a result of observations, 39 nimf in m^2 in the greenhouse and 12 nimf in m^2 in the uncontrolled conditions were determined. The rates of sunn pest damage and SDS page analyzes were done separately on the plants obtained from both sides.

The proportional mobility values of bread wheat genotypes were calculated using Neepawa's molecular weight values as a standard. The proportional mobility (Rm) values in the evaluation of the gliadin band patterns of the wheat genotypes were made according to the French system used by [15]. According to this evaluation, omega (ω) is between 0-59, gamma (γ) between 59-74, beta (β) between 74-85 and alpha (α) between 85-100 are taken as gliadin region. According to the information obtained, distributions of gliadin bands of bread wheat varieties were formed [16].

3. Results and Discussıon

In the study, sunn pest damage rates of the bread wheat cultivars (the control and uncontrolled conditions) were determined separately in two different growing conditions. The obtained rates of sunn pest damage and properties of gliadin bands are given in Tables 1, 2 3 and 4. As can be seen in the results, the rates of sunn pest damage as the average of two year has ranged from 1.60 to 3.08% in uncontrolled condition and from 4.93 to 12.75% in controlled conditions. The rates of sun pest damage were changed significantly in both conditions. The lower sun pest damage rates were observed the bread wheat varieties as Gelibolu, Kate A1, Golia, Pehlivan, Selimiye, and Krasunia. On the other hand, the highest damage rates were obtained from varieties as Geya, Tekirdağ, Saraybosna, Za 75, Kranodorskaya 95 and Odessa 266. Protein bands with molecular weights of 13, 16, 44, 47, 50, and 72 kDa were commonly observed in bread wheat varieties with lower sunn pest damage.

When the molecular weights of the gliadin bands are examined in Geya, Enola, Guadralop and Odeska 266 varieties, gliadin bands with molecular weights of 15, 30, 44, 47, 53, 64 and 70 kDa were commonly found in bread wheat varieties except Enola variety. The bands having molecular weights of 47 and 44 showed the same staining intensity in all varieties. SDP-PAGE electrophoresis results were evaluated using the computer program UviPhotoMW on photographs of 9 x 13 cm size. The N-Neepawa was used as a Standard for calculating the proportional mobility values of protein bands [17].

When gliadin band characteristics of bread wheat genotypes are examined, it is seen that band numbers change between 17-20 unit and band weights change between 13- 79 kDa. In bread wheat varieties, gliadin bands were predominantly distributed in the omega region and secondary in the gamma region. All of the bread wheat varieties did not produce any gliadin band in the alpha region.

The protein band patterns obtained by the SDS-PAGE method to reveal the genotypic differences of wheat cultivars were shown in Figure 2. When analyzing the properties of the protein band, the neepawa variety which is molecular weight known was used as standard. High and low molecular weight glutenin subunits are important for wheat quality characteristics and the higher molecular weight glutenin molecules are more effective in the functional properties of glutenin molecules ([18, 19].

As seen in Table 2, while there were 19 gliadin bands in Tekirdağ, Za 75, Sana and Krasnadors. 95 bread wheat varieties, the molecular weight of bands in these genotypes varied between 12-79 kDa. While the bands of these varieties were predominantly located in the omega and gama regions, there were no bands in the Beta region in the Tekirdag variety. As in the previous chart, all four of the high sun pest damage losses were common, with a band of 44 and 47 kDa molecular weight. Among the four varieties, Dropia is among. The varieties with low sun pest damage rate and gliadin band number is 20. The molecular weight of the gliadin bands of varieties varied between 12-77 kDa. As in other varieties, gliadin bands in these varieties are predominantly concentrated in the omega and gamma regions.

Table 1. Properties of gliadin bands on bread wheat genotypes (band counts, molecular weights, band density and distribution)

Varieties																			
Enola		Guadralop		Nina		Edirne		Krasunia		Gelibolu		Pehlivan		Flamura 85		Odeskaya 266		Geya	
ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd
13	1	13	1	**15**	3	**16**	4	13	1	13	1	13	1	15	3	12	2	12	1
16	2	**15**	2	18	4	18	4	16	3	16	3	16	3	18	4	15	2	15	3
19	1	21	3	23	1	28	2	18	3	18	2	17	2	23	1	17	2	18	3
30	1	22	1	27	1	30	2	27	2	26	1	27	1	26	2	20	2	27	5
44	5	27	1	30	1	33	1	30	1	29	1	30	2	30	2	27	1	30	3
47	5	30	1	33	1	44	5	33	1	34	1	33	1	32	1	30	2	32	2
49	3	32	1	44	5	47	5	44	5	44	5	44	5	33	1	44	5	33	4
50	4	33	1	47	5	48	2	47	5	47	5	47	5	44	5	47	5	36	2
53	2	44	5	52	1	51	2	48	1	48	1	48	1	47	5	49	1	44	5
56	3	47	5	54	1	56	3	50	1	50	1	50	1	49	1	53	2	47	5
58	1	49	1	56	2	58	4	54	3	53	3	54	3	51	2	56	3	51	4
61	4	53	1	60	3	60	4	61	1	56	1	58	1	54	2	57	4	53	2
64	5	57	3	62	3	64	1	64	3	58	1	61	4	56	3	60	4	56	2
70	2	61	3	64	4	67	1	72	4	60	4	63	4	60	1	64	5	58	5
74	1	64	4	70	2	71	2	74	2	63	3	64	2	64	3	70	2	59	3
76	4	66	4	74	2	72	2	76	1	72	2	72	3	70	4	74	3	64	4
79	2	70	3	76	1	76	4	78	3	76	2	74	2	74	2	78	1	70	2
		75	1	79	2					78	2	76	2	76	1	79	1	72	2
		76	2											78	1			74	4
		79	2															78	1
Band number	17		20		18		17		17		18		18		19		18		20
Gliadin band distribution																			
Omega	11		13		11		11		11		13		12		13		12		14
Gama	4		4		5		5		4		3		5		4		4		5
Beta	2		3		2		1		2		2		1		2		2		1
Alfa	-																		
Sunnpest damage %	11.10		10.25		9.60		-		8.52		4.93		8.00		-		10.75		12.75
	1.60		2.22		2.78				1.63		2.15		2.25				2.45		2.80

ma: molecular weight, bd: band density

Table 2. Properties of gliadin bands on bread wheat genotypes (band counts, molecular weights, band density and distribution)

Varieties																			
Dropia		Krasn. 95		Tekirdağ		Za 75		Esperia		Sana		Alga		Pobeda		Sadova		Yubileyneya	
ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd
12	1	12	1	12	1	12	1	12	2	16	2	16	3	13	1	13	2	16	3
15	3	15	3	15	3	15	3	15	3	19	3	19	2	16	2	16	2	19	3
18	2	18	4	18	2	18	2	17	3	22	1	23	1	19	2	18	2	28	1
19	2	26	1	19	2	22	3	20	3	25	2	27	1	22	1	21	2	30	1
23	2	29	2	23	1	25	3	27	3	26	1	31	1	29	1	27	1	44	5
27	1	33	1	26	1	27	2	44	5	35	1	35	1	35	1	30	1	47	5
29	1	44	5	29	1	28	2	47	5	44	5	44	5	44	1	34	1	49	1
44	5	47	5	44	5	44	5	49	2	47	5	47	5	47	5	44	5	51	2
47	5	48	2	47	5	47	5	53	2	50	4	51	1	49	5	47	5	52	1
49	1	53	1	50	1	47	2	57	4	52	5	53	1	51	2	50	2	55	2
53	1	56	1	53	1	49	2	59	4	55	2	56	1	55	1	52	2	56	3
56	2	60	4	56	2	52	2	61	3	58	3	58	3	57	2	54	2	58	1
58	3	62	5	58	1	55	3	64	2	61	4	61	4	61	3	56	3	61	4
59	2	64	2	59	2	59	3	69	2	64	3	64	1	63	4	58	2	63	3
61	3	69	4	63	2	61	2	71	1	65	3	67	3	66	1	63	5	66	5
64	2	72	2	64	2	69	2	74	2	67	2	71	2	71	3	65	4	71	2
69	4	74	2	69	1	71	2	77	2	71	2	73	1	73	2	69	5	75	2
71	4	76	1	71	1	75	3	78	2	74	2	78	3	75	3	73	3	77	2
75	1	79	2	73	2	77	2			77	2			77	1	77	3	79	2
77	4																		
Band number	20		19		19		19		18		19		18		20		19		19
							Gliadin band distribution												
Omega	14		11		14		14		11		12		12		13		14		12
Gama	4		6		5		3		5		6		5		5		4		4
Beta	2		2		-		2		2		1		1		2		1		3
Alfa																			
Sunnpest damage %	8.60		11.25		12.75		12.00		-		12.00		8.75		9.40		9.40		9.75
	1.60		2.80		3.08		2.73				2.65		2.95		2.50		2.85		2.73

Table 3. Properties of gliadin bands on bread wheat genotypes (band counts, molecular weights, band density and distribution)

Varieties																			
Tina		**Pinzon**		**Selimiye**		**Renan**		**Todora**		**Anopo**		**Golia**		**Saraybosna**		**Bezostoja 1**		Kate A1	
ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd	ma	bd
16	3	16	3	13	1	13	1	13	1	13	1	16	2	16	1	12	1	13	1
18	3	19	3	16	3	16	1	17	2	16	2	19	2	18	3	16	2	16	2
23	1	28	1	19	3	18	1	18	1	19	3	27	1	26	2	18	1	18	1
26	1	30	1	24	1	21	1	26	1	25	1	30	1	29	1	21	2	29	1
29	1	44	5	26	1	24	2	27	1	33	1	44	5	33	1	24	1	33	1
32	1	47	5	30	2	27	1	29	1	44	5	47	5	44	5	27	1	44	5
34	1	53	2	34	1	28	1	44	5	47	5	49	1	47	5	29	1	47	5
44	5	57	3	44	5	30	1	47	5	49	3	51	1	49	1	44	1	49	2
47	5	60	4	47	5	44	5	48	3	53	2	52	1	51	1	47	5	51	1
50	2	64	4	50	2	47	5	50	4	56	3	56	1	53	1	49	5	53	1
52	2	66	1	52	2	49	3	53	2	60	3	60	1	56	2	51	1	56	2
54	2	69	1	54	3	51	2	56	3	63	4	63	2	59	3	53	1	59	3
56	2	71	2	56	2	53	1	60	3	65	3	65	2	62	2	55	1	62	2
60	3	72	1	60	2	56	3	62	2	70	2	72	3	64	2	57	2	64	4
62	2	75	3	64	4	59	2	65	4	74	2	74	1	68	2	59	1	69	1
65	4	78	2	66	4	60	4	70	2	75	1	76	1	69	2	62	3	73	1
71	1			72	4	65	1	72	1	78	2	78	1	71	1	64	3	75	1
73	1			75	3	69	3	75	3	81	2			75	3	69	3	77	1
77	1			78	4	71	1	76	2							70	2		
78	1					76	3									74	2		
						78	1									76	3		
Band number	20		17		19		21		19		18		17		18		21		18
							Gliadin band distribution												
Omega	13		8		13		15		12		11		10		12		15		12
Gama	5		6		3		4		5		5		5		5		5		4
Beta	2		2		2		2		2		3		2		1		1		2
Alfa																			
Sunnpest damage%	9.40		-		8.25		10.10		-		-		7.85		12.30		-		7.75
	2.50				2.28		2.88						2.50		2.68				2.15

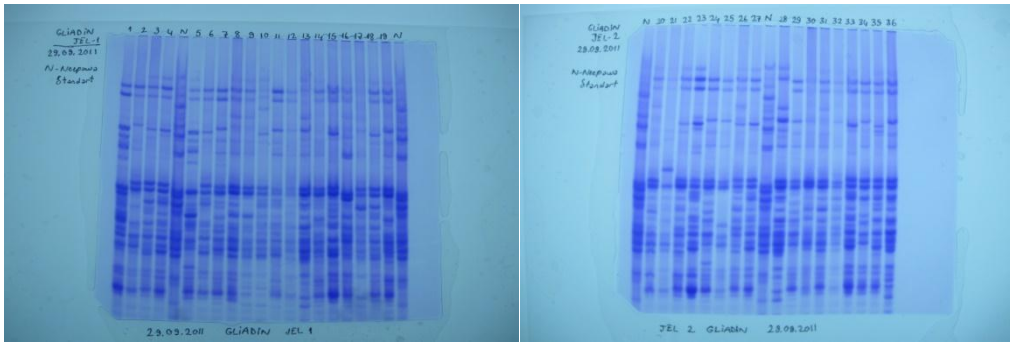

Figure 2. Gliadin band patterns in bread wheat varieties

Saraybosna, Sana and Renan varieties, which was found in the numbers of the highest gliadin band. The number of gliadin bands in the Renan variety, which has having the longest maturation period in the experiment was 21, while in the Saraybosna having shorter maturation period was found had 18 bands. The bands of the three varieties were predominantly distributed in the omega and gamma regions. The band number in the beta region is less and the band is not formed in the alpha region. The molecular weights of the gliadin bands of the varieties have varied between 13-79 kDa. When gliadin band molecular weights are examined in three bread wheat varieties, the gliadin bands with 44 and 47 kDa molecular weight were observed in all of the 10 bread wheat varieties with high sunn pest damage. This suggested that these bands could be a sign of being negatively affected by the sunn pest damage

Table 4. Molecular weight of gliadin bands in wheat cultivars with low and high sunn pest damage

Low sunn pest damage							High sunn pest damage						
Molecul weight	Kat.	Gol	Peh	Sel	Kra.	Similar band	Geya	Tek.	Sar	Za 75	Kras	Ode.	Similar band
13	13	16	13	13	13	13	12	12	16	12	12	12	15
16	16	19	16	16	16	16	15	15	18	15	15	15	
18	18	27	17	19	18		18	18	26	18	18	17	18
26	29	30	27	24	27		27	19	29	22	26	20	
29	33	44	30	26	30		30	23	33	25	29	27	
34	44	47	33	30	33		32	26	44	27	33	30	
44	47	49	44	34	44	44	33	29	47	28	44	44	44
47	49	51	47	44	47	47	36	44	49	44	47	47	47
48	51	52	48	47	48		44	47	51	47	48	49	53
50	53	56	50	50	50	50	47	50	53	47	53	53	56
53	56	60	54	52	54		51	53	56	49	56	56	
56	59	63	58	54	61		53	56	59	52	60	57	
58	62	65	61	56	64		56	58	62	55	62	60	64
60	64	72	63	60	72		58	59	64	59	64	64	
63	69	74	64	64	74		59	63	68	61	69	70	
72	73	76	72	66	76	72	64	64	69	69	72	74	
76	75	78	74	72	78		70	69	71	71	74	78	
78	77		76	75			72	71	75	75	76	79	
				78			74	73		77	79		

The numbers of gliadin band of the Kate A1, Golia, and Selimiye varieties which are seen in low sunn pest damage was varied according to the varieties. The molecular weights of the gliadin bands in these wheat varieties was ranged from 13 to 78 kDa and gliadin bands were found predominantly in alpha and gamma regions as in other varieties. The bands with molecular weights of 13, 16, 44, 47, 50 and 72 kDa were predominantly found these three bread wheat varieties with low sunn pest damage. The characteristics of the gliadin bands of the six wheat varieties with the lowest and highest sun pest damage in bread wheat varieties are given in Table 4.

When the bread wheat cultivars showing the highest and lowest sun pest damage rate were examined, it is seen that there are some significant differences in the molecular weights of gliadin bands. Gliadin bands with molecular weights of 13, 16, 44, 47, 50 and 72 kDa are predominantly seen in 6 bread wheat varieties with the lowest sunn pest damage. However, gliadin bands at molecular weights of 12, 15, 18, 44, 47, 53 and 64 kDa were found to be in the highest sun damaged six wheat varieties. Gliadin bands with a molecular weight of 44 and 47 kDa was observed in all of the bread wheat varieties.

4. Conclusion

The results show that gladine bands with molecular weights of 13, 50 and 72 kDa are predominantly present in wheat varieties with low sun pest damage rates. Besides, the gliadin bands with molecular weights of 12, 15, 53 and 64 kDa are generally seen in wheat varieties with high sunn pest damage rates. The gliadin band properties of the Golia variety with low sunn pets damage rate and Saraybosna with high sunn pest damage were observed diversity. This result, which are seen in the data of these varieties, may be due to the varieties giving not stable results in the region. the results show that gliadin band properties may be used effectively in sunn pest resistant wheat breeding.

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