



BIOCHEMICAL CHANGES IN WHEAT VARIETIES DUE TO ATTACK OF *TROGODERMA GRANARIUM* EVERTS.

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ABSTRACT

The investigations were carried out in the laboratory to find out the various changes in biochemical characters including sugar, protein, mineral (Ash) contents. Sugar and mineral (Ash) contents decreased in infested grains, while protein contents increased in infested grains in comparison to fresh grains. Total sugar ranged from 3.24 to 4.82 percent in fresh grains from 3.24 to 4.82 percent in fresh grains of different wheat varieties. The minimum sugar was in variety WH-896 which was followed by K-68, Raj-3077, C-306, HD-2329, HD-2687, WH-157, Raj-3765, RR-21, HP-2643, DL-784-3, K-9862, HUW-206, WH-542, PBW-343, HP-1731, Jay Raj, HUW-468, K-8020, K-9006, DSN-72, DL-803-3, Kalyansona, UP-2338, UP-2382, K-8434, K-8804, K-9107, HD-2428 and K-7903. Maximum decrease was observed in variety K-7903 (51.87 percent) which was at par with K-8804, K-68, K-9107, WH-542, Jay Raj, HD-2428, HP-1731, K-8434, C-306, DSN-72, WH-157, PBW-343, WH-896, Raj-3077, and Kalyansona ranged from 46.60 to 14.61 percent, respectively. Protein content in fresh grains of different wheat varieties ranged from 10.35 to 13.90 percent. The minimum protein was found in variety Kalyansona which was followed by K-7903, UP-2382, PBW-343, Jay Raj, HUW-468, K-68, HP-2643, K-8434, Raj-3077, HP-1731, K-8962, DL-784-3, WH-542, WH-896, Raj-3765, HD-2687, K-9107, WH-157, HD-2428, DL-803-3, K-8804, K-8020, K-9006, DSN-72, HUW-206, UP-2338, RR-21, HD-2329. The protein content also increased in infested grains in comparison to fresh grains, which ranged from 1.36 to 22.59 percent. The Ash (mineral matters) contents in the fresh grains of various varieties of wheat ranged from 1.49 to 2.11 percent respectively. The Ash content also decreased in infested grains in comparison to fresh grains which ranged from 4.12 to 9.90 percent./

Keywords : Biochemical Changes, Grains, Infestation, *Trogoderma Granarium* Everts, Wheat Varieties.

I. INTRODUCTION

Wheat play an important role in northern Indian diet and are the basic source of protein, sugar and minerals. Different wheat varieties contain 10.35 to 13.90 percent protein, 3.24 to 4.82 percent sugar and 1.49 to 2.11 percent minerals. India is the second largest wheat growing country in the world sharing 26.00 million hectares

area and contributes over 69.00 million tonnes of the total production (FAO production year book, 1997). The wheat grains are much suffered during storage by a number of insect pests out of which, *Trogoderma granarium* Everts. is one of the most destructive pest and causes heavy losses both quantitatively and qualitatively. Tiwari et al.¹ stated that *T. granarium* caused 58.27 percent loss in weight, and also affect the nutritive value of wheat grains. The qualitative loss is attributed to changes the chemical composition of grains. Hira et al., Charjan et al., Krymanska et al., Saxena and Sharma²⁻⁶ studied the biochemical character of wheat grains and they also observed changes in biochemical character. More over the wheat are also deteriorated by the contamination with insects excretion, their dead bodies, body fragments, uric acid and other toxic substances which finally affect the market value and consumers acceptance of wheat.

II. MATERIALS AND METHODS

The thirty varieties of wheat viz.- K-68, K-7903 (Halana), K-8020, K-8434, K-8804, K-8962, K-9006, K-9107, Kalyansona, HP-1731 (Raj Laxmi), HP-2643, HUW-206, HUW-468, HD-2329, HD-2428, HD-2687, Jay Raj, C-306, DL-784-3 (Vaishali), DL-803-3, DSN-72, PBW-343, RR-21, Raj-3077, Raj-3765, UP-2338, UP-2382, WH-157, WH-542 and WH-896 were used in the investigations, which were obtained from the various F.C.I. (Food Corporation of India) Godowns and Rabi cereals section, C.S.A. University of Agriculture and Technology, Kanpur. Sugar, protein and mineral contents of these wheat varieties were estimated.

III. SUGAR ESTIMATION

Sugar was determined by the volumetric method of A.O.A.C. 20g sample of healthy grains of each variety were placed in a beaker containing 100 ml of 95 percent ethanol. The mixture was placed on water bath to boil for 30 seconds, allowed to cool and then filtered through a funnel. The residue was washed with 100 ml of hot 80 percent ethanol to extract all the soluble sugars. The extracts were combined and the alcohol was evaporated on water bath at 95°C, saturated neutral lead acetate was added to the extract to remove the impurities of interfering nature drop by drop the saturated potassium oxalate was further added to precipitate the excess lead. The precipitate was filtered out and discarded. Total sugar in term of glucose was determined by acid hydrolysis method of A.O.A.C. and non-reducing sugars were calculated by the difference between total sugar and reducing sugar.

IV. PROTEIN ESTIMATION

Protein content was estimated by Biuret Method. The ground sample of variety was treated with carbon tetrachloride to remove fat and 50 ml Biuret Solution was added to it. The developed blue colour was achieved. Intensity of the colour of each were calculated with the help of calibration curve of Kjeldahl's values versus Biuret values of known samples.

V. MINERAL (ASH) ESTIMATION

Mineral content was estimated by A.O.A.C. procedure in which 2g sample of each variety was taken into porcelain crucible and kept in muffle furnace at $550 \pm 5^{\circ}\text{C}$ for two hours till gray ash was obtained. The crucible were transferred in desiccator, cooled at room temperature and weighed. The results were expressed in terms of percent ash content.

VI. RESULTS AND DISCUSSION

The observations were recorded for sugar, protein and mineral content of different wheat varieties to find out the biochemical changes due to attack of *T. granarium*. (Table-1, 2 & 3)

VII. SUGAR CONTENT

It is evident from the data that in fresh grain the minimum sugar content was found in variety WH-896 (3.24 percent) which was followed by K-68, Raj-3077, C-306, HD-2329, HD-2687, WH-157, Raj-3765, RR-21, HP-2643, DL-784-3, K-9862, HUW-206, WH-542, PBW-343, HP-1731, Jay Raj, HUW-468, K-8020, K-9006, DSN-72, DL-803-3, Kalyansona, UP-2338, UP-2382, K-8434, K-8804, K-9107, HD-2428 and K-7903 being 3.28, 3.32, 3.36, 3.38, 3.40, 3.43, 3.49, 3.55, 3.60, 3.63, 3.65, 3.68, 3.74, 3.74, 3.75, 3.77, 3.78, 3.78, 3.82, 3.87, 3.93, 3.93, 3.93, 3.98, 4.01, 4.12, 4.49, 4.78 and 4.82 percent respectively. Total sugar content in infested grains of wheat varieties was minimum in K-68 and maximum in HD-2428. The total sugar content significantly decreased in infested grains in comparison to fresh grain. Maximum decrease was observed in variety K-7903 (51.87 percent) and it was followed by K-8804, K-68, K-9107, WH-542, Jay Raj, HD-2428, HP-1731, K-8434, C-306, DSN-72, WH-157, PBW-343, WH-896, Raj-3077, Kalyansona being 46.60, 42.99, 41.65, 38.24, 32.10, 30.96, 29.33, 28.43, 28.27, 28.17, 27.99, 27.81, 27.78, 27.11 and 26.97 percent respectively. The minimum decrease of sugar content was recorded in variety Raj-3765 (14.61 percent), which was followed by K-8962, HD-2687, HP-2643, K-9006 and DL-784-3 being 15.34, 16.76, 17.22, 17.28 and 17.63 percent respectively. (Table-1)

VIII. PROTEIN CONTENT

The protein content in fresh grains of different wheat varieties ranged from 10.35 to 13.90 percent. The highest protein content was found in variety C-306 (13.90 percent), which was followed by HD-2329, RR-21, UP-2338, HUW-206, DSN-72, K-9006, K-8020, K-8804, DL-803-3, HD-2428, WH-157, K-9107, HD-2687, Raj-3765, WH-896, WH-542, DL-784-3, K-8962, HP-1731, Raj-3077, K-8434, HP-2643, K-68, HUW-468, Jay Raj, PBW-343, UP-2382, K-7903 and Kalyansona being 13.30, 12.98, 12.60, 12.37, 12.32, 12.27, 12.10, 12.03, 12.01, 11.93, 11.65, 11.50, 11.50, 11.42, 11.40, 11.39, 11.38, 11.23, 11.21, 11.19, 11.12, 11.12, 11.06, 11.06, 11.02, 11.00, 10.87, 10.80 and 10.35 percent, respectively. Protein content in infested grains of wheat varieties ranged from 10.56 to 14.70 percent being minimum in variety Kalyansona and maximum in variety C-306. Protein content of different varieties increased in comparison to fresh grains. Maximum increase in protein content was found in variety Raj-3765 (22.59 percent) and other varieties it ranged from 1.36 to 16.95 percent. (Table-2)

IX. MINERAL (ASH) CONTENT

The Ash content in fresh wheat grains was found lowest in Jay Raj (1.49 percent) which was followed by DSN-72, Raj-3077, HP-2643, PBW-343, Kalyansona. HUW-206, Raj-3765, UP-2382, UP-2338, DL-784-3, HD-2428, K-8434, WH-157, DL-803-3, HUW-468, K-8020, K-9107, K-68, K-7903, K-8962, K-8804, WH-896, C-306, RR-21, WH-542, HP-1731, HD-2329, K-9006 and HD-2687 being 1.54, 1.54, 1.57, 1.58, 1.59, 1.60, 1.60, 1.60, 1.65, 1.69, 1.70, 1.74, 1.76, 1.80, 1.80, 1.81, 1.82, 1.89, 1.90, 1.90, 1.94, 1.94, 1.98, 2.02, 2.04, 2.05, 2.10, 2.10 and 2.11 percent respectively. Ash content in infested grains of wheat varieties varied from 1.38 to 2.02 percent being minimum in variety Jay Raj and maximum in HD-2687. The total Ash content significantly decreased in infested grains in comparison to fresh grains. Maximum decrease in mineral matters was observed in variety RR-21 (9.90 percent) while it was minimum in variety WH-896 (4.12 percent). The decrease in ash content in other varieties ranged from 4.27 to 9.09 percent (Table-3).

TABLE1: Total Sugar content in fresh and infested grains of wheat varieties due to attack of *T. granarium* Everts.

Varieties	Total sugar in grains (percent)		percent decrease
	Fresh	Infested	
K-68	3.28	1.87	42.99
K-7903	4.82	2.32	51.87
K-8020	3.78	2.92	22.75
K-8434	4.01	2.87	28.43
K-8804	4.12	2.20	46.60
K-8962	3.65	3.09	15.34
K-9006	3.82	3.16	17.28
K-9107	4.49	2.62	41.65
Kalyansona	3.93	2.87	26.97
HP-1731 (Raj Laxmi)	3.75	2.65	29.33
HP-2643	3.60	2.98	17.22
HUW-206	3.68	2.74	25.54
HUW-406	3.78	2.81	25.66
HD-2329	3.38	2.70	20.12
HD-2428	4.78	3.30	30.96



HD-2687	3.40	2.83	16.76
Jay Raj	3.77	2.56	32.10
C-306	3.36	2.41	28.27
DL-784-3	3.63	2.99	17.63
DL-803-3	3.93	3.14	20.10
DSN-72	3.87	2.78	28.17
PBW-343	3.74	2.70	27.81
RR-21	3.55	2.81	20.85
Raj-3077	3.32	2.42	27.11
Raj-3765	3.49	2.98	14.61
UP-2338	3.93	3.05	22.39
UP-2382	3.98	3.04	23.62
WH-157	3.43	2.47	27.99
WH-542	3.74	2.31	38.24
WH-896	3.24	2.34	27.78
T (test statistic)			11.18 *

* Significant at 5 percent probability level.

TABLE- 2: Protein content in fresh and infested grains of wheat varieties due to attack of *T. granarium* Everts.

Varieties	Protein in grains (percent)		percent increase
	Fresh	Infested	
K-68	11.06	12.67	14.56
K-7903	10.80	12.39	14.72
K-8020	12.10	14.15	16.94
K-8434	11.12	11.45	2.97
K-8804	12.03	13.00	8.06
K-8962	11.23	11.89	5.88
K-9006	12.27	14.35	16.95



K-9107	11.50	13.10	13.91
Kalyansona	10.35	10.56	1.85
HP-1731 (Raj Laxmi)	11.21	11.72	4.55
HP-2643	11.12	11.97	7.64
HUW-206	12.37	13.10	5.90
HUW-406	11.06	12.40	12.12
HD-2329	13.30	13.90	4.51
HD-2428	11.93	12.35	3.52
HD-2687	11.50	12.17	5.83
Jay Raj	11.02	11.17	1.36
C-306	13.90	14.70	5.76
DL-784-3	11.38	11.80	3.69
DL-803-3	12.01	12.83	6.83
DSN-72	12.32	12.64	2.60
PBW-343	11.00	12.70	15.45
RR-21	12.98	14.12	8.78
Raj-3077	11.19	11.60	4.38
Raj-3765	11.42	14.00	22.59
UP-2338	12.60	13.17	4.52
UP-2382	10.87	11.90	9.48
WH-157	11.65	12.85	10.30
WH-542	11.39	11.69	2.63
WH-896	11.40	12.00	5.26
T (test statistic)			4.02 *

* Significant at 5 percent probability level.

TABLE- 3: Ash content in fresh and infested grains of wheat varieties due to attack of *T. granarium* Everts.

Varieties	Ash content in grains (percent)	percent decrease
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	Fresh	Infested	
K-68	1.89	1.77	6.35
K-7903	1.90	1.75	7.89
K-8020	1.81	1.70	6.08
K-8434	1.74	1.65	5.17
K-8804	1.94	1.79	7.73
K-8962	1.90	1.76	7.37
K-9006	2.10	2.00	4.76
K-9107	1.82	1.69	7.14
Kalyansona	1.59	1.48	6.92
HP-1731 (Raj Laxmi)	2.05	1.92	6.34
HP-2643	1.57	1.50	4.46
HUW-206	1.60	1.52	5.00
HUW-406	1.80	1.67	7.22
HD-2329	2.10	1.98	5.71
HD-2428	1.70	1.61	5.29
HD-2687	2.11	2.02	4.27
Jay Raj	1.49	1.38	7.38
C-306	1.98	1.83	7.58
DL-784-3	1.69	1.58	6.51
DL-803-3	1.80	1.68	6.67
DSN-72	1.54	1.45	5.84
PBW-343	1.58	1.46	7.59
RR-21	2.02	1.82	9.90
Raj-3077	1.54	1.42	7.79
Raj-3765	1.60	1.47	8.13
UP-2338	1.65	1.50	9.09
UP-2382	1.60	1.46	8.75
WH-157	1.76	1.62	7.95
WH-542	2.04	1.90	6.84

WH-896	1.94	1.86	4.12
T (test statistic)			2.44 *

*** Significant at 5 percent probability level.**

X. CONCLUSION

The final conclusion recorded for Sugar, protein and mineral content of different wheat varieties to find out the biochemical changes due to attack of *T. granarium* as shown in Table-1, 2 & 3.

It is evident from the data that in fresh grains the sugar content was found from 3.24 to 4.82 percent. But infested grains the minimum sugar content was seen K-68 and maximum in HD-2428. Further the maximum decrease was observed in variety K-7903 (51.87 percent)

As far as protein content in fresh grains of different wheat varieties seen from 10.35 to 13.90 percent. Protein content in infested grains of wheat varieties ranged from 10.56 to 14.70 percent. Protein content of different varieties increased in comparison to fresh grains from 1.36 to 22.59 percent.

As far as Ash content which received in fresh grains was found from 1.49 to 2.11 percent. In infested grains it was 1.38 to 2.02 percent. Finally it is seen that Ash content significantly decreased in infested grains in comparison to fresh grains from 4.27 to 9.09 percent.

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