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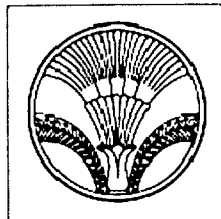
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Effect of Karnal Bunt on Grain Weight and Quality of Wheat

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ABSTRACT

Karnal bunt caused considerable reduction in 1000-grain weight ranging from 4.5 to 52.27% depending upon severity/grades of infection. The disease also affected the quality of grains and their market value. With the increase in level of infection, there was an increase in protein, phosphorus and phenolic contents while not much change in sedimentation value. Chapati making characteristics indicated the overall acceptability of flour upto 3% infected grains in a seed lot and above that unacceptable.

Key words : Karnal bunt, wheat, grain quality

INTRODUCTION

In Haryana, Karnal bunt is prevalent in entire state but its incidence is comparatively more in eastern zone districts than western zone and overall average infection ranged between 0.1-0.63% in different cultivars (Gupta *et al.*, 1990). McRae (1934) reported yield losses due to Karnal bunt infection upto 20% in different wheat cultivars. Besides the yield losses, the disease affects the germination and vigour of seedlings. Characteristics of bread, cookies and chapaties are also altered due to Karnal bunt which influence the consumers' acceptability (Mehdi *et al.*, 1973; Bedi *et al.*, 1981). Deterioration in quality characters occurs significant if there is 5% infection in the grain lot (Gill *et al.*, 1993). Apart from causing direct quantitative and qualitative losses in terms of yield, seed vigour and quality of grains, huge expenditure is also incurred in meeting the international quarantine measures due to non-acceptance of such produce by the countries where Karnal bunt is not known to occur. Keeping in view the economic and international importance of the disease, the proposed work was carried out to study the effect of Karnal bunt on grain weight and quality of wheat.

MATERIALS AND METHODS

The bunted grains of wheat variety HD 2329 obtained from artificially inoculated earheads were sorted out into four different grades of infection based on extent of damage to the grain by pathogen viz., 0 (healthy or no infection), 1 (less than 25% of endosperm affected), 2 (between 25-50% of endosperm affected), 3 (between 50-75% of endosperm affected) and 4 (more than 75% or practically whole of the endosperm affected) and 1000-grain weight was recorded for various grades of infection as well as of healthy seed for comparison. To determine the quality of grains, bunted grains were added to healthy grains of variety HD 2329 to obtain different levels of Karnal bunt infection (0.0, 1.0, 3.0, 5.0, 7.0, 10.0 and 15.0% w/w). Only 150 g of grains for each level were taken. These samples were ground into flour and analysed for protein, phosphorus, phenols, sedimentation value

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and chapati making characteristics. Estimation of crude protein and phosphorus was done by A. O. A. C (1990) method. Total phenols were estimated by following the method of Swain and Hills (1959). Chapati making properties were studied by the method of Austin and Ram (1971). SDS sedimentation test was carried out using the method of Axford *et al.* (1979). Chapaties prepared from these samples were got evaluated from a panel of tasters from consumers' acceptability point of view. The chapaties were scored for colour, flavour and taste giving a score of 7 for the best and below 5 was considered as unacceptable/poor.

RESULTS AND DISCUSSION

There was an increased reduction in 1000-grain weight with the increase in grade of infection. In grade-1 infection/severity, the reduction in 1000-grain weight was only 4.5%, 22.72% in grade-2 and maximum upto 52.27% in grains having grade-4 infection (Table 1). Physio-chemical characteristics of wheat flour prepared from bunted grains indicated that as the level of per cent infected grains increased there was an increase in protein, phosphorus and phenolic contents while not much change in sedimentation value (Table 2). Increase in protein content varied from 4.05 to 16.13% at different levels of infection. At 1% level of infection, there was not much increase in protein content i. e. 11.92% compared to 11.84% in healthy seed. There was an increasing trend in protein content from 5% level of infection i. e. 12.64 to 13.75% in seed lot having 15% bunted grains.

Table 1. Effect of Karnal bunt infection on grain weight

Grade of infection	1000-grain weight (g)	Per cent reduction in grain weight
0	44	-
1	42	4.5
2	34	22.72
3	30	31.61
4	21	52.27

The range of phosphorus in good quality wheat is between 110-312 mg/100 g. An increase in phosphorus content was observed with the increase in level of Karnal bunt infection which ranged from 13.29 to 69.14% increase at different levels (Table 2). At 5% level of infection, the phosphorus content was 343.75 mg/100 g which increased to 379.5 mg/100 g at 15% level of infection as compared to only 235.0 mg/100 g in healthy seed.

The infected grains had 5 to 85% more phenols as compared to healthy (Table 2). The maximum increase in level of phenols was in grains having 15% bunt infection. Phenolic content in healthy wheat ranged between 0.15 and 0.24%. There was considerable increase in phenolic content i. e. 0.25% at 5% level of infection which further increased upto 0.37% in seed lot with 15% bunted grains as compared to 0.20% with no infection. Not much change in sedimentation values was observed at different levels of infection as

Table 2. Physio-chemical characteristics of bunted wheat flour

Level of infection (%)	Protein content (%)	Sedimentation value (ml)	Phosphorus (mg/100 g)	Phenols (%)
0	11.84 (0)	42	235.0 (0)	0.20 (0)
1	11.92 (0.67)	42	266.25 (13.29)	0.21 (5.0)
3	12.32 (4.05)	41	297.50 (26.59)	0.23 (15.0)
5	12.64 (6.75)	41	343.75 (46.27)	0.25 (25.0)
7	13.11 (10.72)	41	362.50 (54.25)	0.28 (40.0)
10	13.43 (13.42)	40	378.75 (61.17)	0.30 (50.0)
15	13.75 (16.13)	40	397.50 (69.14)	0.37 (85.0)

Figures in parentheses are per cent increase over healthy.

compared to healthy check.

The effect of Karnal bunt on chapati making properties of variety HD 2329 revealed that the chapati quality was not much affected upto 3% level of infection (Table 3). However, at 5% level, a distinct deterioration in chapati quality was observed. There was a severe discolouration of dough and chapaties at increased levels of infection. Taste and flavour of the chapaties were badly affected above 5% level of infection and were found to be totally unacceptable.

There are reports on reduction of 1000-seed weight from 25 to 70% due to Karnal bunt disease depending upon severity of infection and being significant in severely infected seeds as compared to seeds having traces of infection (Bedi *et al.*, 1981; Aujla *et al.*, 1983). With the increase in level of bunt infection, there was an increase in phosphorus, protein and phenolic contents, whereas not much change in sedimentation value was observed in the present studies and these findings are in accordance with the earlier reports (Bhat *et al.*, 1980; Sekhon *et al.*, 1980; Bedi *et al.*, 1981). The chapati making characteristics also revealed the overall acceptability upto 3% level of bunt infection and at 5% or above

Table 3. Chapati characteristics of bunted wheat flour

Level of infection (%)	Colour			Flavour	Taste	Acceptability
	Flour	Dough	Chapati			
0	7.0	7.0	7.0	7.0	7.0	7.0
1	6.8	6.8	6.8	6.8	6.8	6.8
3	6.0	6.0	6.0	6.0	6.0	6.0
5	4.0	4.0	4.0	4.0	4.0	4.0
7	2.0	2.0	2.0	2.0	2.0	2.0
10	1.0	1.0	1.0	1.0	1.0	1.0
15	1.0	1.0	1.0	1.0	1.0	1.0

the chapatias were unacceptable. Singh (1988) also reported the unacceptability of bread, cookies and chapatias at 5% or higher levels of infection which confirm the present findings.

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