

Assessment of Karnal Bunt Disease of Wheat in Different Districts of South Western Punjab

Poonam Rani*, Gurjit Singh Rattan* and Anita Singh**

*Carrier Point University, Kota, Rajasthan

** University College of Agriculture, Guru Kashi University, Talwandi Sabo, Punjab-151302

Corresponding email ID: sburman69@gmail.com

Abstract

The present studies has been done on investigation of Karnal bunt in wheat produced in South Western Punjab. To know the status of wheat seed, 340 wheat samples were collected from 17 different grain markets belongs to 9 districts of Punjab. The major five Varieties of wheat i.e. HD 2967, HD 3086, HD 2733, PBW 502 and PBW 725 were collected from selected area. The results shows Karnal Bunt disease infection was ranged from 0 to 14.2% in south western Punjab. The most susceptible wheat varieties were HD 2967 and HD 3086, showing 5.0% and 14.2% of infestation respectively. The minimum incidence of Karnal Bunt was observed on the varieties PBW 725 (0.81% infection) and HD 2733 (2.41% infection). Whereas PBW 502 was Karnal Bunt free. It was also found that Karnal Bunt was least in Abohar district whereas Fazilka district was totally disease-free.

Index-Terms: Karnal Bunt, wheat, Grain market, Varieties

I. INTRODUCTION

Wheat is one of the foundation crops of India's agriculture. India occupies third position in the world in production of wheat (Singhet *et al.*, 2012). Whereas in India, Punjab is the major wheat producing state. Which contributed 60% of wheat every year (Sharma *et al.* 2004). The quality of wheat is decreased by many fungal disease. One of the fungal disease of wheat is Karnal Bunt (KB) caused by *Neovossia indica* (Mitra, 1931). The Karnal Bunt disease was first reported from Karnal district of Haryana (India) in 1930s (Singh *et al.*, 1989). This disease is widely found in all the wheat growing areas in North India, Northern Pakistan, Southern Nepal and Mexico (Duran, 1972).

Although it is considered as a minor disease but due to varietal reshuffle, intensive cultivation and high input technology factors are responsible for becoming it as a major production constraint. Total losses in India during severe epidemics have been around 0.3 to 0.5 per cent with incidence as high as 89 per cent in some fields (Joshi *et al.*, 1983). Karnal Bunt of wheat also known as 'partial bunt' causes reduction in yield and quality of grain, but due to strict quarantine and tolerance limit put to zero level by some countries has proved a major setback in capturing the international wheat market (Agarwal *et al.*, 1993; Singh, 2005).

This fungus are both seed and soil borne and retain up to four years (Krishna and Singh 1983; Vocke *et al.*, 2002). It affects the grains partially where some tissues of the grain remain normal and some converted into a mass of bunt spores. These spores fall to the ground when the glumes spread apart. Generally the infection spreads to the tissue along the groove of the grain, but the endosperm material lying along the groove of the grain remains uninfected. Except in very severe cases, the embryo is not destroyed. This leads to reduction in ears as well as number of spikelets (Ehsan-ul-Haq *et al.*, 2002). Wheat plants are more susceptible when spikes emerge, but infestation can take place throughout anthesis (Warham, 1984). This pathogen not only reduces the weight of seeds but also

causes deterioration of flour quality due to production of trimethylamine (Singh *et al.*, 1993). Therefore after knowing its seriousness an effort is made to highlight the status of Karnal Bunt in different grain markets of South Western Punjab.

II. MATERIALS AND METHODS

Sample collection

In order to observe frequency of seed abnormality, 17 grain markets were visited. Twenty samples of wheat grain, measuring about 500gm to 1Kg of seed of 5 wheat varieties; HD 2967, HD 3086, HD2733, PBW 502, PBW 725, were taken at an interval of 3 months for observation from selected grain markets. The collection of seeds was done in thick brown paper bags, randomly, from 4-5 places of each unclean heap belonging to different farmers and brought to the laboratory for further sampling.

Dry inspection of seeds

500-1000 g of different varieties of wheat seeds were collected. Each variety was examined by visual inspection under the stereoscopic binocular microscope for normal and abnormal seeds. Normal seeds were those with smooth coat, light brown to butter colour without discolouration or fungal propagates.

Abnormal seeds were those with malformed seed shapes, wrinkled seed coats, discolouration or those with fungal propagates. Four replicate samples having 100 seeds per variety were examined and further abnormal grains counted were done in laboratory. Average percent of KB infection from each district was calculated from the total no. of grains used for analyzed of KB infection. The whole sample was poured in the tray (having white sheet or bottom) to look for the infected grain.

Calculation: Percent frequency of KB infected samples = $n/N \times 100$

Where n = number of seeds in one sample showing bunted grains and N = the total number of seeds in one sample $\times 100$

III. RESULTS AND DISCUSSION

A total of 17 grain markets have been surveyed in 2016-17 from 9 districts of Punjab. The total 340 samples were collected, which was further examined in laboratory (Table 1).

Table 1. Details of different grain markets of Punjab from where samples of wheat were collected

Districts	Total samples	Grain markets
Abohar	40	AboharMandi, Balluna
Barnala	20	BarnalaMandi
Bathinda	80	TalwandiSabo, Kotshamir/KotFatta, Pithu (RampuraPhul),

		Badhiwala(RampuraPhul)
Faridkot	40	FaridkotMandi, Kabuli Wala
Fazilka	20	FazilkaMandi
Ferozpur	40	FerozpurMandi, Jalalabad
Mansa	20	Sardulgarh
Moga	40	Dharamkot, Bhinder Kala
Muktsar	40	MuktsarMandi, MahanBhaddar

The present studies on the status of Karnal Bunt in different districts of south western Punjab revealed that the disease Karnal Bunt was least in Abohardistrict whereas Fazilkadistrict wastotally disease - free. Out of 17 grain market, 14 grain markets was identified with least KB (95% and above). One grain market was come under 91-95% KB- free area. Whereas only one grain market i.e. Kabuli Wala (Faridkot district) was come under 86-90 % KB – free area (Table 2).

Table 2. Status of Karnal Bunt (KB)- free in different grain markets of Punjab in 2017

Districts	% of KB- Free grain markets		
	86-90%	91-95%	95 % and above
Abohar	-	-	Abohar, Balluna
Bathinda	Pithu (RampuraPhul)	Badhiwala(RampuraPhul)	Kotshamir, TalwandiSabo
Barnala	-	-	Barnala
Faridkot	Kabuli Wala	-	Faridkot
Fazilka	-	-	FazilkaMandi
Ferozpur	-	-	Ferozpur, Zaalalabad
Moga	-	-	Dharamkot, Bhinder Kala
Muktsar	-	-	Muktsar Mandi, MahanBhaddar
Mansa	-	-	Mansa Mandi

The Karnal Bunt infected sample was maximum reported in Bathinda district(14.2%) and no infestation was reported from Abohar and Fazilka district (Table 3).

Table 3. Percentage of Karnal Bunt (KB) – infested samples in different districts of Punjab in 2016-2017

Districts	KB(%)
Abhoar	-
Barnala	0-0.75
Bathinda	0-14.2
Faridkot	0.53-10.71
Fazilka	-
Ferozpur	0-0.65
Mansa	2.35

Moga	0.5-5
------	-------

Five Varieties i.e. HD 2967, HD 3086, HD2733, PBW 502 and PBW 725 was consider for knowing the status of seed diseases studies. In these Varieties HD 2967 and HD 3086 was predominant during 2016-17, therefore more samples drawn from it. Study of incidence of normal and abnormal wheat seeds from dry inspection of seeds showed that there is maximum cut seeds found in variety HD2967 in Badhiala (54.6%) and minimum with variety HD3086 in Kotshmir (2.48%) of Bathinda district. Maximum entirely discoloured seeds was found in variety HD2967 in MahanBhaddar (7.5%) of Muktsar district and minimum with variety HD2733 in Talwandi Sabo (0.6%) of Bathinda district. The maximum Karnal Bunt seed found in variety HD3086 in Pithu (RampuraPhul) (14.2%) of Bathinda district and Karnal Bunt free areas were Abohar, Kotshmir of Bathinda district, Fazilka, Jalalabad of Ferozpur district and MuktsarMandi.

The percentage range of normal seeds (Fig.1) was 10.9 – 87.5%. Range of abnormal seeds which includes: cut seeds (Fig. 2), entirely discoloured seeds (Fig. 3), Karnal Bunt disease infested seeds (Fig. 4) were 2.48-54.6%, 0.6 – 7.5% and 0 – 12.5% respectively. There is maximum abnormality mean range in cut seed (28.54%) and least in Karnal Bunt (6.25%), vary according to area and variety (Table 4). The dry inspection of seeds revealed a higher incidence of cut and discoloured than normal seeds. According to Tyagi and Olugbemi (1980); Sisterna and Sarandon (2010) the grain discoloration was the results of fungal infection of wheat heads under humid conditions. They also reported that the grain weathering manifests as discoloration, rough appearance, shriveling and loss of texture or reduced in grain size.

Table 4. Incidence of normal and abnormal wheat seeds in sample collected from different grain market of Punjab

DISTRICT	AREA	VARIETY	NORMAL SEEDS (%)	CUT SEEDS (%)	ENTIRELY DISCOLOURED SEEDS (%)	KB (%)
Abohar	Balluna	HD 2967	62.9	13.58	1.69	-
	Abohar	HD2967	83.5	3	2	-
Moga	Dharamkot	HD 2967	36.38	34.5	4.5	5
	Bhinderkala	HD 2967	13.5	43	4	0.5
Bathinda	Talwandi Sabo	HD 2733	69	15.52	0.6	2.41
	Kotshmir/ KotFatta	HD 3086	87.5	2.48	0.77	-
	Badhiwala (Rampuraphul) Pithu (RampuraPhul)	HD 2967	10.9	54.6	3.90	4.68
		HD 3086	30.35	19.64	1.78	14.2
Barnala	BarnalaMandi	HD 2967	53.92	26.5	0.75	0.75
		HD 2733	60.6	21.75	1.75	-
Fazilka	FazilkaMandi	HD 2967	72.38	11.5	1	-
Ferozpur	FerozpurMandi	HD 2967	33.9	-	3.92	0.65
	Jalalabad	PBW 502	86.2	4.80	2.99	-
Faridkot	FaridkotMandi	HD 3086	39.36	17.28	4.52	0.53

	Kabuliwala	HD 3086	20	32.14	-	10.71
Mansa	Sardulgarh	HD 2967	18.6	36.18	7	2.33
Muktsar	MuktsarMandi	HD 2967	44	31.19	3.03	-
		HD 2967	28.75	40	3.33	0.83
	MahanBhaddar	HD 2967	20.62	48.12	7.5	3.12
		PBW 725	35.2	27.86	-	0.81
Percentage Range			10.9– 87.5%.	2.48-54.6%	0.6 – 7.5%	0– 12.5%



Fig.1:Normal seeds of wheat



Fig.2: Cut seeds of wheat



Fig.3: Discoloured seeds of wheat



Fig.4: KarnalBunt infected wheat seeds

However as the disease is highly dependent on the climatic factors during the crop season, year to year variations in the disease are likely to occur. Many authors in previous years reported KB from different region of India. They also reported the variations in disease development is related to varietal susceptibility and the environmental conditions prevalent in different years at vulnerable stage of wheat growth (Joshi, 1978,1988; Bedi and Dhiman, 1982; Singh *et al.*, 1986; Aujlaet *al.*, 1986, 1987; Sharma *et al.*,1998). This information will be significant for the trader who are involve in wheat marketing.

ACKNOWLEDGEMENT:

Authors are thankful to the Dr. Jagtar Singh Dhiman, formerAdditional Director Research of PAU and Senior Plant pathologist for identification of diseases from wheat sample.

REFERENCES

- V. K. Agarwal, S.S. Chahal and S. B. Mathur, "Karnalbunt. In: *Seed borne diseases and seed health testing of wheat*," (Eds.Mathur, S.B. and Confer, B.M.), Danish Govt. Institute of Seed Pathology for Developing Countries, Denmark, 1993, pp. 31-43.
- S.S. Aujla, S.Indu and I.Sharma, "New host records of *Neovossiaindica*",vol. 40,*In Phytopathol*, 1987, pp. 437.
- S. S. Aujla, I. Sharma, K. S. Gill and A. S. Grewal, "Prevalence of Karnal bunt in Punjab as influenced by varietal susceptibility and meteorological factors", vol.1, *PI DisRes*, 1986, pp.51-55.
- P. S. Bedi and J. S. Dhiman," All about Karnal bunt of wheat", vol.8, *Seeds and Farms*, 1982, pp. 9-16.
- R.Duran," Further aspects of teliospore germination in North American smut fungi II", vol. 50, *Canadian J. Bot.*, 1972, pp. 2569-73.
- Ehsan-ul-haq, Atiq-ur-rehmanrattu and Javediqbalmirza, "Prevalence of Karnal Bunt of Wheat in NWFP (Pakistan)".Crop Diseases Research Institute,Murree-Pakistan,vol.4(1), *IJAB*,2002, pp.150-152.
- L. M. Joshi, "Wheat disease survey and control measures", *Infarming*, 1978,pp. 19-21.
- L. M. Joshi, "Plant Pathological problems as exemplified by Karnal bunt of wheat",vol. 17, *In J of Mycol and Pl Path.*, 1988, pp. XI – XXI.
- L. M. Joshi, D. V. Singh, K. D. Srivastava and R. D. Wilcoxson, "Karnal bunt- A minor disease that is now a new threat to wheat", vol. 43,*Bot Rev*, 1983, pp. 309-338.
- A. Krishna, and R.A. Singh, "Longevity of teliospores of *Neovossiaindica*causing Karnal bunt of wheat", vol. 13, *Indian J. Mycol. Pl. Pathol.*, 1983, pp.97-8.
- M. Mitra, "A new bunt on wheat in India", vol. 18, *Ann of App Biol.*, 1931, pp.178-179.
- I. Sharma, G. S. Nanda, P. K. Kalotyand A. S.Grewal," Prevalence of Karnal bunt of wheat in Punjab", vol. 26, *Seed Res*, 1998, pp. 155-160.
- I. Sharma, G. S. Nanda, H. Singh and R. C. Sharma, "Status of Karnal bunt disease of wheat in Punjab (1994-2004)", vol. 57, *IndPhytopathol*, 2004, pp.435-9.
- B. Singh, C. S. Kalha , V. K. Razdan , A.Vaidand S. K. Singh, "Status of Karnal bunt of wheat in Jammu division (J&K)", vol.5(2),*International Journal of Plant Protection*, 2012, PP. 375-377.
- D. V. R. Singh, J. K. Agarwal, B. R. Shrestha, Thapa and H. J. Dubin,"First report of *Tilletia indica* on wheat in Nepal (disease note)", vol.73, *Pl Dis*, 1989, pp. 273.
- D.V. Singh, "Karnal bunt of wheat: A global perspective", vol. 58, *Indian Phytopathol.*, 2005, pp. 1-9.
- D. V. Singh, L. M. Joshi andK. D. Srivastava, "Varietal susceptibility and spread of Karnal bunt of wheat in India", vol. 5, *Rachis Barley and Wheat Newsletter*, 1986, pp.40-42.
- B. B. Singh, S. S. Aujla, and I. Sharma," Integrated management of wheat Karnalbunt", vol. 39, *Int. J. Pest Manage.*, 1993, pp. 431-434.
- M. Sisterna and S. Sarandon, "Wheat grain discoloration in Argentina: Current Status", vol. 3 (Special issue 1), *The Americas Journal of Plant Science and Biotechnology*, 2010, pp. 54-64.
- P. D. Tyagi and L. B. Olugbemi, "Rain-fed wheat in Nigeria as influenced by fungal pathogens and adverse weather conditions", vol. 91, *Samaru Miscellaneous paper*, 1980, pp. 1 – 15.
- G. Vocke, E.W. Allen and J. M. Price, "Economic Analysis of Ending the Issuance ofKarnal Bunt Phytosanitary Wheat Export Certificates", *Wheat Yearbook/WHS-2002*. USDA Economic Research Service, 2002, pp. 1-13.
- E.J. Warham, "A comparison of inoculation methods for Karnalbunt*Neovossiaindica*", vol. 74, *Phytopathol*, 1984, pp. 856-7.

AUTHORS

First Author: Mrs. Poonam Rani, M.Sc., Carrier Point University, Kota, Rajasthan, sburman69@gmail.com

Second Author:Gurjit Singh Rattan, Ph. D., Carrier Point University, Kota, Rajasthan,gurjitsrattangs@gmail.com

Third Author: Anita Singh, Ph. D., University College of Agriculture, Guru Kashi University, Talwandi Sabo, Punjab-151302, anita.singh282@gmail.com

Correspondence Author: Mrs. Poonam Rani, M.Sc., Carrier Point University, Kota, Rajasthan,sburman69@gmail.com