

OCCURRENCE AND SPREAD OF KARNAL BUNT OF WHEAT IN INDIA

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ABSTRACT : Extensive surveys were conducted in wheat growing states of India to determine the incidence of Karnal bunt (*Neovossia indica*) from 1975-79. The disease was noticed in Punjab, Haryana, Delhi, western Uttar Pradesh, Jammu & Kashmir and lower Himachal Pradesh, including eastern districts of Uttar Pradesh, North Bihar and north western parts of Rajasthan and Madhya Pradesh. The gradual increase of the disease may be attributed to cultivation of susceptible cultivars viz., Arjun, WL 711, WG 357, WG 377 and UP 262. Sonalika, the most dominant cultivar in the subcontinent had less infection as compared to above cultivars.

Partial or Karnal bunt of wheat (*Neovossia indica*) was first reported by Mitra (1931) from Karnal (Haryana). However, till recently, it was regarded as a disease of minor significance and between 1931-1968 there were few instances of its occurrence and that too mainly in the undivided Punjab and rarely in western parts of Uttar Pradesh. Some concern was expressed in 1969-70 when the disease appeared in North western region of the country. During 1974-75 crop season, it was observed in severe form in many places in North India, mainly along the Himalayan foot-hills and *Tarai* region of Uttar Pradesh, Punjab and Himachal Pradesh (Agarwal *et al.*, 1976 and Singh *et al.*, 1977).

A brief account of occurrence and distribution of this important disease during 1975-79, is presented in this paper.

MATERIAL AND METHODS : During the last four years (1975-79), 3095 wheat grain samples were collected by mobile survey teams. Field samples not less than 250 g were generally collected from the threshing floors in the states of Punjab, Haryana, Uttar Pradesh and Delhi during 1975-76 and 1976-77 crop seasons. In the subsequent years, the surveys were extended to other adjoining states covering Himachal Pradesh, Jammu and Kashmir, Rajasthan, Bihar and Madhya Pradesh. Some samples were also obtained through co-operators located in different agricultural universities and state departments of agriculture. The working sample of approximately 2,500 to 3,000 grains was obtained by division and redivision of the 250 g seed lot. Out of this working sample, 2,000 grains were taken and infected seeds were sorted to calculate the percentage of infection.

RESULTS AND DISCUSSION : In the crop years 1975-76, 1976-77, 1977-78, and 1978-79; 319, 326, 813 and 1637 wheat grain samples were collected and analysed respectively. The survey data show that there has been a gradual increase in the incidence of Karnal bunt during this period and it has also spread to areas like Bihar, eastern Uttar Pradesh and Madhya Pradesh, where it was not known before (Table 1). Normally Karnal bunt assumes epidemic proportions under low temperature and high humidity at the time of anthesis (Bedi *et al.*, 1949 and Goel *et al.*, 1977). The low

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TABLE 1. Incidence of Karnal bunt of wheat during 1977-79 crop seasons

State/Variety	1977-78			1978-79		
	Total samples/ infected samples	Maximum infection (%)	Average infection (%)	Total samples/ infected samples	Maximum infection (%)	Average infection (%)
1	2	3	4	5	6	7
<i>Punjab</i>						
Sonalika	26/15	3.6	0.65	33/32	10.4	1.75
Kalyansona	11/2	1.5	0.54	13/8	0.5	0.16
WG 357	39/24	7.8	0.82	13/7	10.9	1.35
WG 377	24/11	6.3	0.40	20/10	4.8	0.55
WL 711	13/6	10.5	2.67	81/67	19.0	2.80
Arjun	7/3	0.9	0.27	3/3	1.1	0.73
Improved wheat	2/1	0.2	0.1	—	—	—
Local	1/1	0.2	0.2	4/3	3.3	0.80
	123/63			167/130		
<i>Haryana</i>						
Sonalika	53/17	0.8	0.7	39/3	1.0	0.05
Kalyansona	16/4	0.5	0.1	10/2	0.1	0.02
Arjun	14/6	0.6	0.09	44/14	2.4	0.12
WG 357	6/2	0.2	0.05	10/0	—	—
WH 147	1/0	—	—	21/1	0.1	Traces
WL 711	—	—	—	15/2	0.2	0.02
Improved wheat	18/10	1.2	0.23	21/2	0.1	Traces
Local	9/1	1.2	0.10	24/7	0.9	0.1
	117/40			184/31		
<i>Uttar Pradesh</i>						
Sonalika	146/30	4.2	0.09	372/146	8.4	0.30
Kalyanson	19/7	0.4	0.07	20/8	0.4	0.08
Arjun	15/4	3.5	0.25	71/36	18.0	0.61
K 68	10/3	1.4	0.17	15/4	0.7	0.10
Janak	8/1	0.1	Traces	24/11	0.8	0.16
Pratap	8/0	—	—	24/11	0.9	0.15
WG 377	—	—	—	9/9	7.2	2.15
WL 711	—	—	—	8/7	52.2	9.63
UP 262	—	—	—	12/9	16.7	2.15
Improved wheat	29/7	1.0	0.11	74/38	50.3	1.98
Local	17/4	0.5	0.06	44/8	1.3	0.06
	252/56			673/287		

1	2	3	4	5	6	7
<i>Delhi</i>						
Sonalika	8/0	—	—	4/0	—	—
Kalyansona	1/0	—	—	—	—	—
Arjun	2/1	0.2	0.1	2/1	0.1	0.05
WL 711	1/1	0.1	0.1	4/1	0.1	0.03
Improved wheat	9/2	0.8	0.1	7/1	0.1	Traces
Local	2/0	—	—	1/0	—	—
	23/4			18/3		
<i>Himachal Pradesh</i>						
Sonalika	8/0	—	—	33/19	4.9	0.74
Kalayanson	5/0	—	—	7/6	3.7	1.13
WL 711	1/1	11.2	11.2	1/1	0.1	0.1
Improved wheat	3/3	2.8	2.5	—	—	—
Local	3/1	1.7	0.5	14/13	4.1	1.26
	20/5			55/39		
<i>Jammu & Kashmir</i>						
Sonalika	5/2	0.2	0.04	6/4	3.0	1.0
Kalyansona	7/2	1.0	0.1	10/10	9.8	2.63
WL 711	—	—	—	4/4	35.0	16.0
WL 410	—	—	—	1/1	17.5	17.5
Arjun	1/1	0.1	0.1	2/1	7.2	3.6
Local	3/0	—	—	4/4	3.2	2.2
	16/5			27/24		
<i>Rajasthan</i>						
Sonalika	13/0	—	—	67/1	0.3	Traces
Kalyansona	86/1	0.1	0.1	104/0	—	—
Arjun	6/0	—	—	18/3	1.1	0.07
Raj 911	23/0	—	—	6/0	—	—
WL 711	3/0	—	—	12/6	1.0	0.21
Improved wheat	18/0	—	—	18/3	0.2	0.02
Local	21/0	—	—	57/0	—	—
	170/1			282/13		
<i>Bihar</i>						
Sonalika	114/0	—	—	32/1	0.1	Traces
Kalyansona	3/0	—	—	1/0	—	—
Janak	8/0	—	—	—	—	—
Pratap	8/0	—	—	—	—	—
HP 1102	4/0	—	—	—	—	—
Improved wheat	—	—	—	35/3	0.1	0.1
Local	3/0	—	—	38/0	—	—
	140/0			106/4		
<i>Madhya Pradesh</i>						
Sonalika	3/0	—	—	21/5	8.6	0.46
Kalyansona	5/0	—	—	17/2	5.2	0.38
WH 147	—	—	—	2/0	—	—
Narmada-4	5/0	—	—	1/0	—	—
Improved wheat	13/0	—	—	30/2	22.8	0.76
Local	5/0	—	—	28/1	0.1	0.03
	31/0			99/10		

incidence of the disease in 1976-77 might have been due to prevailing high temperature at the flowering stage. In this connection the meteorological data of about 40 stations in the main wheat belt at the time of anthesis was analysed. It was observed that maximum temperature was above 23°C in wheat belt while optimum maximum temperature for was 20°C and minimum was 10°C ($\pm 2^\circ\text{C}$).

Karnal bunt was restricted to few areas mainly in the sub-mountainous districts and plains of Punjab and Uttar Pradesh (Munjal, 1970). In 1970 its infection, ranging from traces to 4 per cent, was reported in the North-western plains comprising of states of Punjab, Haryana, Rajasthan and western Uttar Pradesh, (Swaminathan *et al.*, 1971). In 1974-75, it appeared in severe form in some isolated pockets such as Pantnagar, Hempur (U. P.); Dhaura Kuaon (H. P.); Gurdaspur and Rupar (Punjab) affecting some commercial varieties like Kalyansona, Sonalika and Arjun (Agarwal *et al.*, 1976; Singh *et al.*, 1977). The data presented in Table 1 show that the disease has increased in intensity and has gradually occupied wider areas in the country. It is now present in the states of Punjab, Haryana, Delhi, Uttar Pradesh, parts of Bihar, lower Himachal Pradesh, foot-hills of Jammu and Kashmir, northern parts of Madhya Pradesh and Rajasthan. However, disease has not yet been observed in Karnataka, Maharashtra and Andhra Pradesh. There is no information in its occurrence in Bengal, Orissa and Tamil Nadu.

The district-wise distribution of Karnal bunt based on the date of its incidence during 1975-79 crop seasons in the country is as under :

- Punjab — Gurdaspur, Amritsar, Ferozpur, Ludhiana, Jullundhur, Kapurthala, Hoshiarpur, Rupar, Patiala, Sangrur and Bhatinda.
- Haryana — Ambala, Karnal, Rohtak, Gurgaon, Sonapat, Kurukshetra, Sirsa and Hissar.
- Uttar Pradesh — Moradabad, Nainital (tarai region), Rampur, Bareilly, Pilibhit, Shahjahanpur, Saharanpur, Muzaffarnagar, Meerut, Ghaziabad, Aligarh, Bulandshahar, Mathura, Agra, Etah, Mainpuri, Farukhabad, Kanpur, Fatehpur, Banda, Allahabad, Lakhimpur-kheri, Sitapur, Unnao, Lucknow, Bahraich, Gonda, Barabanki, Faizabad, Basti, Gorakhpur, Azamgarh and Varanasi.
- Bihar — Smastipur and Muzaffarpur.
- Rajasthan — Ganganagar, Sikar, Jaipur, Chittorgarh and Bharatpur.
- Himachal Pradesh — Una, Kangra and Sirmaur.
- Jammu & Kashmir — Jammu, Kathua and Udhampur.
- Madhya Pradesh — Morena, Sivpuri, Chhattarpur, Rajgarh and Sehore.
- Delhi — Alipur, Najafgarh and Mehroli blocks.

During 1975-76 crop season, the maximum prevalence of Karnal bunt was recorded in Punjab, where 39 per cent field samples were infected as compared to 9 per cent in Haryana. The percentage of infected samples reached a level of 78 per cent in Punjab during 1978-79, while in Haryana the incidence fell down from 34 per cent in 1977-78 to 17 per cent in 1978-79. Himachal Pradesh and Jammu & Kashmir also recorded increase in the incidence of the disease from 25 per cent in 1977-78 to 71

and 89 per cent, respectively, in the following crop season. Likewise, there has been gradual spread of the disease in other states also (Fig. 1).

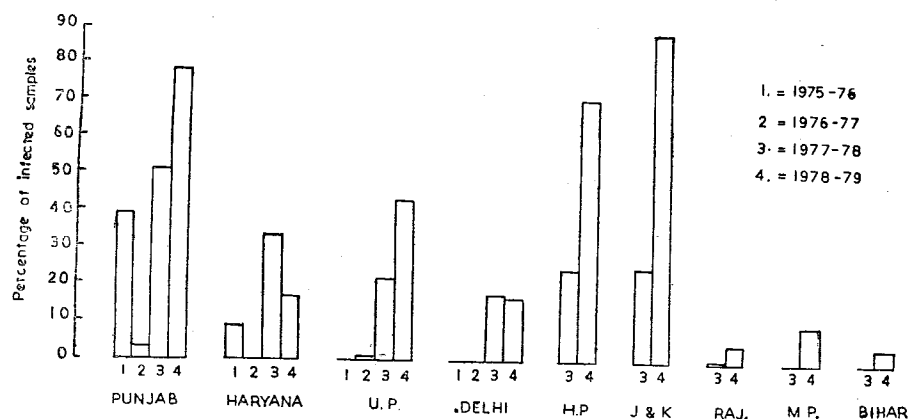


Fig. 1. Frequency of Karnal bunt infected samples from different states during 1975-79.

It can be seen from the data presented in Table 1 that in general Sonalika the chief commercial variety in the entire subcontinent and Kalyansona, predominant variety till 1975-76 had much less incidence as compared to the newly released cultivars such as Arjun, WG 357, WG 377, WL 711 and UP 262. However, the average infection on Sonalika in Punjab, Himachal Pradesh and Jammu & Kashmir was comparatively higher than in other states. Average infection on Sonalika in Punjab in 1977-78 and 1978-79 was 0.65 and 1.75 per cent, respectively, whereas in foot-hills of Himachal Pradesh it was 0.74 per cent in 1978-79 but was absent during 1977-78. In Jammu region it was 1.0 per cent during 1978-79. In other states including Uttar Pradesh the average infection of this variety was much less. In Punjab, Kalyansona and Sonalika were replaced by new strains such as WG 357, WG 377 and WL 711 which are much more susceptible to Karnal bunt as compared to Sonalika and Kalyansona (Anon, 1978) and their extensive cultivation in the state must have favoured multiplication of inoculum which possibly led to higher incidence of the disease on Sonalika also. On the other hand in Uttar Pradesh, Sonalika still occupies maximum area sown with improved wheats. It appears that this variety has not permitted any significant build up of inoculum and possibly this account for low incidence of the disease in the state. However, the severity of the disease in some areas of Uttar Pradesh was much higher due to the cultivation of varieties like WG 377, WL 711 and UP 262. Possibly the low incidence in Haryana during 1978-79 is due to the cultivation of Sonalika and WH 147.

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