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DISTRIBUTION OF KARNAL BUNT OF WHEAT IN PAKISTAN

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A total of 2274 wheat seed samples were tested for Karnal bunt incidence during 1986-87 to 1991-92 by dry inspection method. Out of these, 1331 (58.53%) samples were found infected by Karnal bunt fungus (*Tilletia indica*). The highest infection percentage of Karnal bunt was found in Central Punjab (7.66%) and North West area of Pakistan (8.72%). On the basis of sample infection percentage, Rahim Yar Khan, Sukkur, Sakrand, Hyderabad and Quetta were the most suitable areas for the production of disease free quality seed. Comprehensive review regarding Karnal bunt investigation alongwith suggestions is given for planning effective disease management strategy. As the fungus has quarantine significance, domestic and international measures should be adopted to check its further spread.

Key words: Wheat seed lot, Karnal bunt, Pakistan.

Introduction

In wheat crop (*Triticum aestivum* L.), many factors contribute towards low yield in Pakistan but the problem of seed-born diseases of wheat generally responsible for appreciable losses in crop production are; loose smut, Karnal bunt, oil bunt, flage smut, root rot, leaf spot, leaf blight, bacterial blight and ear cockle [1-3].

Karnal bunt of wheat also called partial or new bunt, (*Tilletia indica* Mitra, (syn. *Neovossia indica* Mitra, Mundkur) has become a problem of national importance for the last few years. The disease was first reported in 1930 from the Karnal district of Punjab, India [4]. In Pakistan, the disease remained endemic to the foot hill areas (Sialkot district) of the country and was considered a disease of minor importance [5]. Later, the disease was recorded in traces from the plains [6] and has been spreading to new sites extending from Sialkot to Mardan in the north and towards Jhang, Khanewal and Muzaffargarh in the south [7]. The disease has been reported to occur in 17 districts of Punjab with its occurrence from traces to 3% in various commercial cultivars [8].

Work done during 1981-82 to 1983-84 and 1984-85 to 1985-86 at Danish Government Institute of Seed Pathology for Developing Countries (DGISP), Denmark and Federal Seed Certification Department, Islamabad revealed its infestation ranged from 0.03 to 4.6% and 0.03 to 5.5% respectively [1,3,9]. In a field survey of 23 districts of Punjab, Karnal bunt infection of wheat grains ranged from 0.0 - 3.50% [10]. The current situation of Karnal bunt is alarming as the disease is known to be both seed and soil-born [11], and an organism of this nature creates quarantine problems.

In view of the potential hazard due to Karnal bunt to our national food grain crop, an up-to-date detailed information about its presence in seed should be available to the breeders, plant protection experts, seed technologists and seed procurement agencies for planning better disease management strategy. For this purpose, 2274 wheat seed samples were tested at Central Seed Health Laboratory of the Federal Seed Certification Department, Islamabad.

Materials and Methods

Collection of seed samples. Seed sampling was carried out from the certified crop according to ISTA rules [12]. Primary samples were drawn randomly and mixed thoroughly to make submitted sample. From submitted sample, 120 g (approx. 3000 seeds) were randomly collected from the crop grown during 1986-87 to 1991-92 from different wheat growing areas through Seed Certification Department's network in the country (Fig. 1).

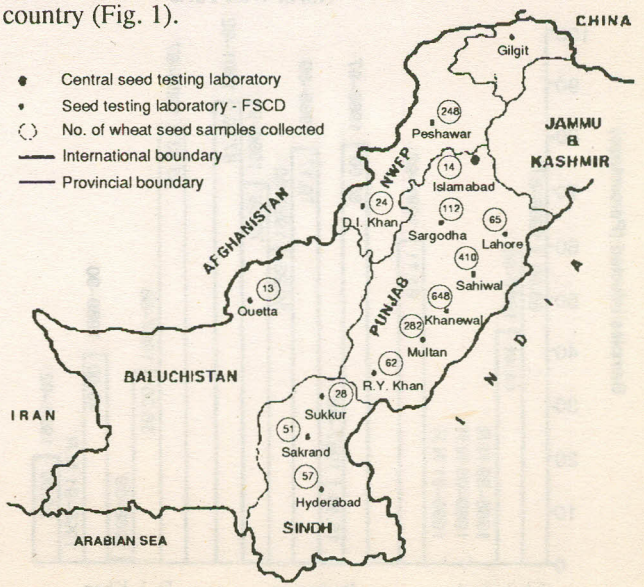

Fig. 1. Pakistan wheat area sampled and number of seed samples collected during 1986-87 to 1990-91.

Direct (visual) inspection of seed samples. Working sample of 120 g (Approx. 3000 seeds) of each seed sample was thoroughly examined visually for bunted grains. The doubtful seeds were observed under stereomicroscope. Confusion with black point disease was avoided by preparing slide and confirming the presence of teliospores under compound microscope. Bunted seeds were counted and percentage of infection calculated for each sample [3,13].

Results and Discussion

During direct inspection of seed samples, the degree of discolouration due to Karnal bunt varied considerably from one infected grain to another. Out of 2274 wheat seed samples tested for Karnal bunt, 1331 (58.53%) had bunted grains.

The incidence of the disease was highly variable in different localities both within the same year as well as between the years (Fig. 2a & b and Table 1). Low incidence of

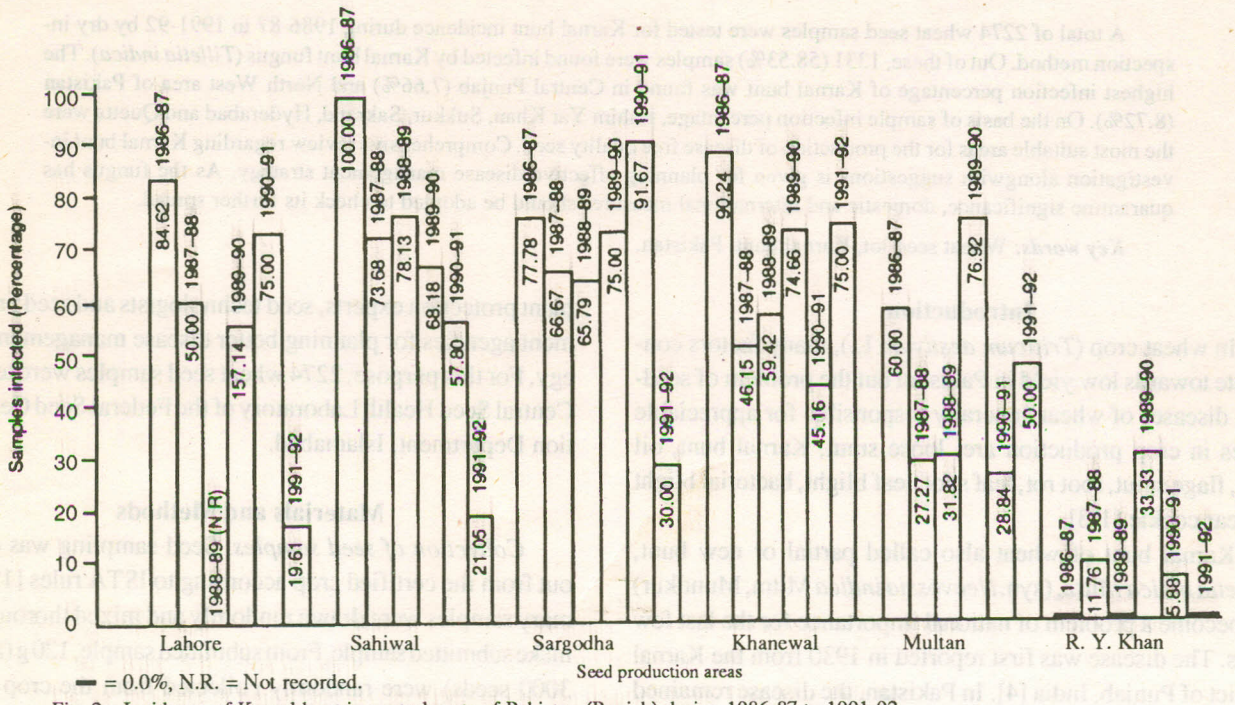

Fig. 2a. Incidence of Karnal bunt in central parts of Pakistan (Punjab) during 1986-87 to 1991-92.

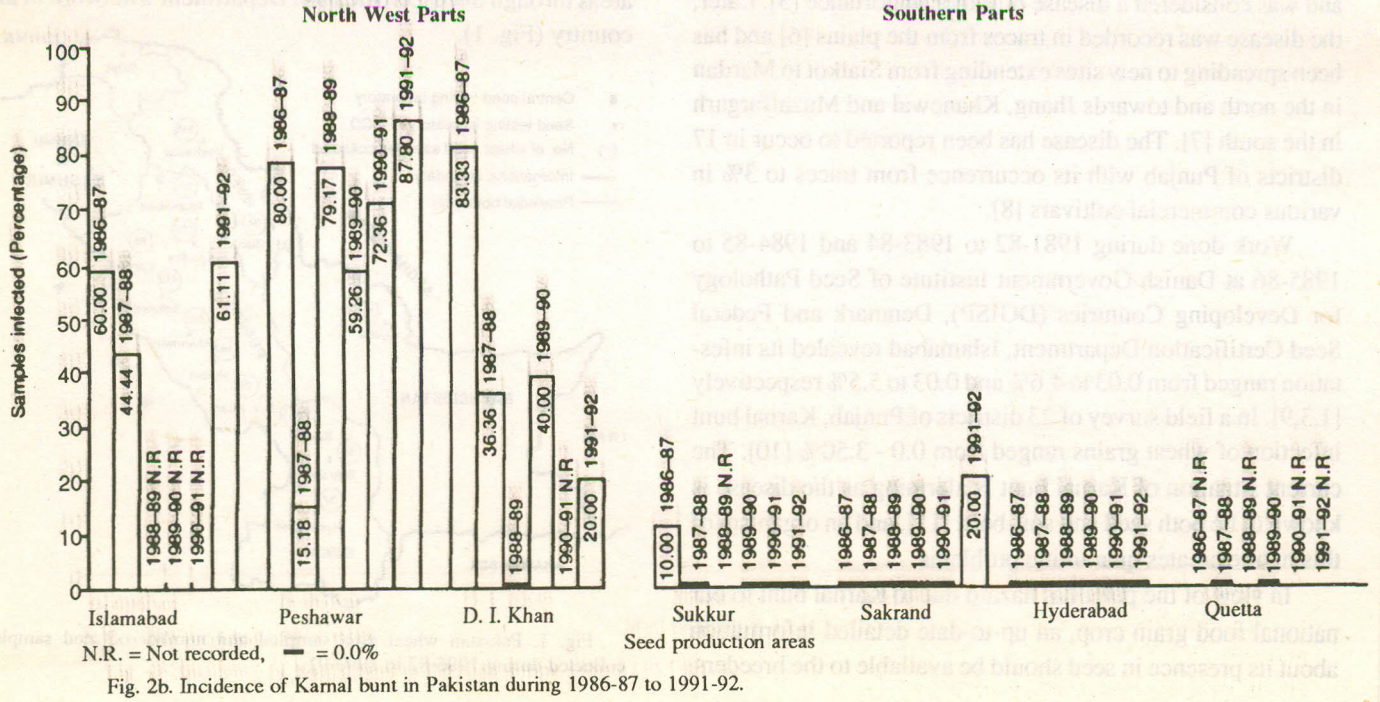

Fig. 2b. Incidence of Karnal bunt in Pakistan during 1986-87 to 1991-92.

TABLE 1. INFECTION PERCENTAGE RANGE OF KERNEL BUNT (*TILLETIA INDICA*) IN WHEAT SEED LOTS DURING 1986-87 TO 1991-92 IN PAKISTAN.

Seed production areas		Infection percentage range of infected wheat seed sample					
Province/Zone	Station	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92
Punjab	Lahore	0.03-5.0	0.0-0.53	(-)	0.03-1.40	0.0-0.17	0.08-0.41
	Sahiwal	0.06-5.4	0.03-4.43	0.0-0.03	0.06-0.4	0.02-2.7	0.03-0.23
	Sargodha	0.03-2.0	0.03-3.7	0.03-2.83	0.16-2.0	0.04-1.8	0.06-0.40
	R.Y. Khan	0.0	0.03	0.0	0.03	0.06	0.0
	Multan	0.03-0.4	0.03-2.6	0.03-0.53	0.03-3.27	0.03-1.2	0.4-3.03
	Khanewal	0.03-7.66	0.03-1.03	0.03-3.76	0.03-1.83	0.03-0.6	0.03-0.46
Sindh	Hyderabad	0.0	0.0	0.0	0.0	0.0	0.0
	Sakrand	0.0	0.0	0.0	0.0	0.0	0.03
	Sukkur	0.2	0.0	(-)	0.0	0.0	(-)
N.W.F.P.	Peshawar	0.03-2.7	0.03-5.8	0.03-2.1	0.04-0.93	0.05-7.46	0.02-8.72
	D.I. Khan	0.03-0.7	0.03-0.46	0.0	0.03	(-)	0.13
Baluchistan	Quetta	(-)	0.0	(-)	0.0	(-)	(-)
Federal Capital	Islamabad	0.03-1.2	0.03-0.1	(-)	(-)	(-)	0.05-0.23

Note: (-) seed samples were not available.

this disease was observed at Rahim Yar Khan, Sukkur and Sakrand while no sample was found with bunted grain from Hyderabad and Quetta. Similarly, Ahmad *et al.* [1] and Begum and Mathur [3] observed that the southern parts (Rahim Yar Khan, Sakrand, Hyderabad and Quetta) of the country were completely free from Karnal bunt till 1987. This may be due to the drought conditions of these areas. Zhang *et al.* [14] observed inhibition of teliospore germination at temperature above 30°. They also observed that free water was essential for spore germination process.

High incidence of bunted samples were found in central parts of the country i.e. 19.61 to 100% except Rahim Yar Khan. Similarly, in northern parts of the country, bunted percentage samples were upto 87.33 and 87.80% at Dera Ismail Khan and Peshawar during 1986-87 and 1991-92, respectively. This is not only due to climatic conditions but also due to continuous seed supply from central Punjab (Lahore, Sahiwal and Khanewal) to northern areas as NWFP (North Western Frontier Province) has no viable seed industry. In central Punjab (Khanewal, Sahiwal, Gujranwala, Sargodha and Mianwali) highest incidence ranging 2.68 to 3.50% was recorded by Ilyas *et. al* [10] and stated that it may be attributed to the quality of seeds used, amount of inoculum present in the field from the previous crop, level of susceptibility of cultivars sown and climatic and soil conditions of these areas. They also reported that wheat samples from Multan, Muzaffargarh, Layyah, Rahim Yar Khan, Dera Ghazi Khan and Rajanpur were completely free from Karnal bunt disease during 1987-88 but in this investigation, seed samples with bunted grains were found upto 33.33% at Rahim Yar Khan and 76.92% at Multan during the same period. This disease used to be confined to high humidity and high rainfall areas [15] but now it is prevalent in other areas also.

At this stage, resistant varieties are available. The maximum disease incidence of Karnal bunt observed was 7.66% in variety FD-83 at Khanewal (1986-87), 5.80% in Pirsabak at Peshawar (1987-88), 3.76% in PB-85 at Multan (1989-90) and 7.46 and 8.72% in Pirsabak during (1990-91 and 1991-92) at Peshawar, respectively. This shows that disease incidence varied from year to year. Previous investigations revealed that disease severity came down from 4.6 in 1981-82 to 3.0% in 1982-83 and 0.65% in 1983-84 but it went up from 3.16 to 5.5% in 1984-85 and 1985-86, respectively [1,3]. Susceptibility of present commercial cultivars is due to Mexican blood (Genetic wheat breeding materials) which is being imported into Pakistan every year and may carry infection of Karnal bunt introduction to Maxico from India. Agarwal *et al.* [16] reported that 7.5% of seed infection was present in Indian Punjab. Pakistan might have got more potential inoculum from India during 1977-78 when seed of wheat varieties WL-711, Sonalika and HD-2009 etc. were imported. This held true that before this, Karnal bunt was confined to limited acres. However, incidence variation in different cultivars in various localities is mainly due to continuous cultivation of different banned and susceptible cultivars including WL-711 and Blue Silver by small farmers. In Pakistan, seed treatment with fungicide is also not a regular practice as yet. On the contrary, the incidence of Karnal bunt in pre-basic and basic seed lots remained below 0.9% during 1986-87 to 1990-91 due to strict seed certification programme [17].

Conclusion

Wheat seed health testing for Karnal bunt during 1986-87 to 1991-92 showed that the incidence of Karnal bunt in wheat lots increased and varied from variety to variety and locality to locality. This needs integrated efforts at national level regarding domestic quarantine measures.

Seed samples from Hyderabad and Quetta were found completely free from Karnal bunt while very few samples were found infected in Rahim Yar Khan, Sukkur and Sakrand areas. So these parts of the country should preferably be used for production of disease free seeds.

Teliospore of the fungus can live for a long time in soil. Therefore, national quarantine services need to be more vigilant in intercepting of such species not only in seed consignment but also strict inspection of wheat breeding materials imported from international organizations.

Keeping in view the nature of this disease, the wheat seed must be treated with suitable fungicide at pre-basic and basic level for control of seed infection under the strict seed health certification system [18]. Ilyas *et al.* [10] observed best control of Karnal bunt by seed treatment @ 2g/kg with Raxil 10 WS, Liromenzeb, Ceresan, Pencozeb and Raxil 2 DS which caused 69.65, 63.68, 61.96 and 55.98% reduction in bunted grain, respectively. Moreover, every seed lot to be used for seed multiplication should be tested against Karnal bunt.

Research organizations should establish coordinated research project for detail studies on epidemiology and fixing of disease tolerance limits. A need exists to establish forecasting services for this disease.

There is an urgent need to generate resistance and breed resistant varieties.

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