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Occurrence of Major Diseases of Wheat under Different Agro-climatic Zones of Pakistan

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INTRODUCTION

Wheat fields in different parts of Pakistan were extensively surveyed for the occurrence of diseases of economic importance. The development and spread of disease were greatly influenced by the climatic conditions. Complete bunt, yellow rust, flag smut and powdery mildew were the common diseases of upland and foothill areas of Pakistan whereas brown rust was the common disease of wheat in plains of wheat growing zones. Loose smut was the common disease both in the plains and upland areas. Use of resistant varieties showed control of rust and smut diseases.

Wheat (*Triticum aestivum* Linn.) is the staple food for the people of Pakistan. It is cultivated on an area of 8 million hectares with the production of approximately 20 million tons^[1]. In the wake of green revolution High Yielding Varieties (HYV) have been developed and introduced in different agro-climatic zones according to their performance in terms of yield. However, production level is still low and lagging behind as compared not only to the developed countries but also to India. Concerted efforts are, therefore, being made for increasing the fertility of the soil by adding fertilizers and using good quality seeds. Therefore there is need for more seed multiplication farms for producing good quality seeds.

Plant diseases have played a major role in causing losses of food production the world over. Cramer^[2] estimated loss in the production of food grains due to diseases on world basis at 133 million metric tones per annum. From neighboring country India, Joshi *et al.*^[3] have given a breakdown of loss in wheat growing areas in 1970's due to rust epidemics. In Pakistan, no work has been carried out so far to determine the exact loss in food production due to diseases. The loss is generally said to be 10% from insect-pests and diseases of various kinds per annum. According to a rough estimate, the loss from rust and smut diseases of wheat was 30,000 metric tones every year^[4]. Jamil Khan *et al.*^[5] have given an

account of seed-borne diseases of wheat of Pakistan. Four types of diseases caused by seedborne fungi viz., *Ustilago tritici* (loose smut), *Urocystis tritici* (flag smut), *Tilletia foetida* (complete bunt) and *Neovossia indica* (partial bunt) were identified.

For the study of the diseases, a series of wheat plants were observed and closely examined at the stage of maturity from the different climatic zones of Pakistan (Table 1). While recording the occurrence of rust, smut and bunt diseases, emphasis was laid on symptoms of the diseases appearing at a particular time of the year at different places with regard to temperature and humidity.

Three types of rust: brown or leaf; yellow or stripe and black or stem rust were found to attack wheat crop in Pakistan. The prevalence and severity of these rusts largely depended on temperature and humidity (Table 1).

Brown or leaf rust: (*Puccinia recondita*) was widely prevalent throughout the wheat growing areas in Pakistan. It appeared in February in the southern and coastal region and by early March and April in the central and northern regions. Pustules produced on leaves and leaf sheath were small, circular or slightly elliptical, scattered and reddish brown in colour. The diseases developed rapidly at 20°C with high humidity. At temperatures beyond 30°C, pustules turned black in colour (Fig. 3).

Yellow or stripe rust: (*Puccinia striiformis*) occurs at low temperature in northern region of Balochistan. The disease appeared in January and continued upto March due to the prevalence of low temperature. The pustules developed on leaves, leaf sheath and glumes appeared lemon yellow and were arranged in narrow stripes (Fig. 2). The disease developed rapidly at temperatures ranging between 12-17°C.

Black or stem rust: (*Puccinia graminis*) the disease appeared by mid February in the southern coastal region, by mid March in the central and by mid April in the



Fig. 1: Black or stem rust



Fig. 4: Loose smut



Fig. 2: Yellow or stripe rust



Fig. 5: Karnal bunt

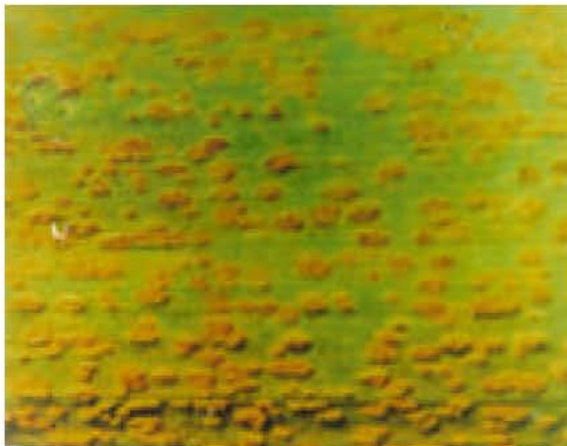


Fig. 3: Brown or leaf rust



Fig. 6: Complete bunt



Fig. 7: Flag smut



Fig. 8: Powdery mildew



Fig. 9: Ear cockle

northern areas of Pakistan. Pustules developed on leaves, stem, stem sheath and ears were elongated and dark reddish brown in colour. A temperature of 25°C or above favoured the rapid spread of the stem rust disease. The pustules later turned black (Fig. 1).

Wheat Var. Punjab-81, Kohinoor-85, Sutlej-86, Faisalabad-85, Zarghoon, Soghat-90, Inqilab, Sindh-81, Mehran-89, Marvi-2000 and TJ-83 were found to be mostly resistant to rust infection against 3 rust diseases.

Loose smut (*Ustilago tritici*): The disease occurred both in plains and hills. The disease is an internally seed-borne disease and became visible only when the smutted head/spikes emerged. The affected ears, which emerged out, were sooty black in colour and contained instead of grains, a black powder mass of spores of the causal fungus (Fig. 4).

Karnal bunt or Partial bunt (*Neovossia indica*): Karnal bunt is a seed or soil-borne disease and is generally found in the plains of Punjab. The partial bunt cannot be identified until the ear-head of wheat plants emerged. The affected plants ripened earlier than the healthy ones.

The whole grain was not found infected. Generally, the embryo side or the grooves of the grain were diseased. The diseased portions were black and contained spores of the causal fungus (Fig. 5).

Complete bunt of wheat (*Tilletia foetida*): Complete bunt of wheat was found in Balochistan and in foothills of NWFP and FATA. The disease is also called stinking smut as the smutted kernels emit foul smell of rotten fish. The incidence of the disease was recorded upto 13% from the infected areas. The infected plants were found stunted as compared to the healthy plants. The infected ears appeared erect, rigid and darker in colour and contained grains, which were filled with black powdery mass of the causal fungus. The infected grains turned into bunt balls, which are more or less spherical in shape and dull grey to brown in colour. Soon the bunted balls/kernels dried up and were clearly distinguished with the healthy grains. The bunted kernels (Fig. 6) were usually broken during threshing and got mixed with the healthy seeds.

Flag smut (*Urocystis tritici*): The disease was found in Potohar plateau area of the central region. The disease was recognised by the appearance of blackened narrow stripes, which were filled with powdery spore mass just below the epidermis. They developed on leaf sheaths and occasionally on culms also. Diseased plants were stunted

Table 1: Major diseases of wheat in four agro-climatic zones of Pakistan prevailing during wheat seasons 2000-2001

Wheat diseases	Major agro-climatic zones of Pakistan			
	North west Balochistan and NWFP*	Upland NWFP* and FATA **	Central Punjab	Southren Sindh and coastal areas
	Parameters			
	April Av. Temp. 13°C RH: 30%	April Av. Temp. 17°C RH: 35%	March Av. Temp. 22°C RH: 50%	February Av. Temp. 20°C RH: 70%
<i>Puccinia recondita</i> (Brown or leaf rust)	P	P	P	P
<i>Puccinia graminis tritici</i> (Stem or black rust)	P	P	P	P
<i>Puccinia striiformis</i> (Yellow or stripe rust)	P	P	A	A
<i>Ustilago tritici</i> (Loose smut)	P	P	P	P
<i>Urocystis tritici</i> (Flag smut)	A	A	P	A
<i>Tilletia foetida</i> (Complete bunt or stinking smut)	P	P	P	A
<i>Neovossia indica</i> (Karnal bunt or partial bunt)	A	A	P	A
<i>Erysiphe graminis</i> (Powdery mildew)	P	P	A	A
<i>Anguina tritici</i> (Ear cockle)	P	P	A	A

P = Present, A = Absent * NWFP = North-West Frontier Province ** FATA = Federally Administered Tribal Areas

and the spikes often did not emerge. Severely infected leaves rolled up (Fig. 7).

Resistant varieties were found to be mostly effective for the control of smut diseases. Application of systemic seed dressing fungicides viz. Triadimenol (Baytan), Tradimefon (Bayleton) and Carboxin (Vitavax)@ 1-1.59 kg⁻¹ of seeds were observed to control smut/bunt diseases.

Powdery mildew (*Erysiphe graminis*): It is an important disease of wheat mostly prevalent in the cooler places where temperature ranges between 15-22°C with humidity upto 75%. The symptom of the disease was indicated by white to pale, gray, fuzzy powdery mass of mycelia and conidia which developed on the upper surface of leaves and leaf sheaths (Fig. 8). Resistant varieties were found effective for disease control. Spraying with fungicides like Benlate, Dithane M-45 and Sulforon were also found to control the disease.

Ear cockle (*Anguina tritici*): The disease popularly known as Mamnia was commonly observed in northern wheat growing areas. Moderately cool weather at the time of sowing the crop increased its attack. The disease is caused by the combined action of a nematode (*Anguina tritici*) and a bacterium (*Corynebacterium tritici*). The disease was recognised by the appearance of rolled, wrinkled leaves and twisted stem and with the formation of nematode galls in spikes (Fig. 9).

Rusts, smuts and bunts were the major diseases of wheat occurring in Pakistan during 2000-2001. Wheat Var. Punjab-81, Kohinoor-85, Sutlej-86, Faisalabad-85, Zarghoon, Soghat-90, Inqalab-97, Sindh-81, Mehran-89, Marvi-2000 and TJ-83 were found more resistant to rust than other varieties of wheat. These varieties could be

cultivated in preference to other varieties to escape rust infection. Forecasting is of great importance in predicting the threat due to air-borne diseases. Haque^[6] highlighted the importance of forecasting in Pakistan in an international symposium. Ghaffar^[7] placed emphasis for plant disease forecasting in Southern West Pakistan where plant diseases take a heavy toll and cause immense loss in production of food and fruits. In order to contain and/or minimize the loss in yield of wheat from diseases, an all out effort should be made to control the incidence of such diseases. Plant disease forecasting is likely to play an important role in taking preventive measures on time before the diseases spread causing economic level injury. For avoiding infection from rust, smut and bunt, certified seeds should be used for sowing and before sowing deep ploughing should be practised to bury the soil-borne spores and thus decrease the inoculum load.

REFERENCES

1. Anonymous, 2003. Agricultural Statistics of Pakistan (2002-2003) Govt. of Pakistan, Ministry of Food, Agriculture and Live Stock Economic Wing, Islamabad, pp: 29-33.
2. Cramer, H.H., 1967. Plant protection and world crop production. Pub. Farbenfabriken Bayer Ag. Leverkusen, pp: 524.
3. Joshi, L.M., K.D. Srivastava, D.V. Singh and K. Ramanujan, 1980. Wheat rust epidemics in India since 1970. Cereal Rusts Bulletin, 8: 17-21.
4. Hassan, S.F., M. Hussain and S.A. Rizvi, 1979. Wheat Disease Situation in Pakistan. National Seminar on Wheat Res. and Production in Pakistan. Pak. Agric. Res. Council, Islamabad, Pakistan, pp: 231-234.

5. Jamil Khan, S.A., M. Jalaluddin and A. Ghaffar, 1992. Major seed-borne diseases of wheat in Pakistan. Status of Plant Pathology in Pakistan, University of Karachi, Pakistan, pp: 111-115.
6. Haque, H., 1964. FAO/IUFO symposium on internationally dangerous diseases and insects. Oxford, UK.
7. Ghaffar, A., 1966. Plant disease forecasting in Southern West Pakistan. A preliminary study on brown rust of wheat and early blight of potato. Karachi University Studies, 3: 48-52.