



**Biotica
Research
Today**

Vol 2:12 **1228**
2020 **1230**

Karnal Bunt Disease of Wheat and Its Management

**Ramniwas Yadav*, P. S. Shekhawat and
Sushila Choudhary**

Division of Plant Pathology, Rajasthan Agricultural Research
Institute (RARI), Durgapura, Jaipur, Rajasthan (302 018), India

 **Open Access**

Corresponding Author

Ramniwas Yadav
e-mail: ramniwasadav918@gmail.com

 **Keywords**

Management, Quarantine, *Tilletia indica*, Wheat

How to cite this article?

Yadav *et al.*, 2020. Karnal Bunt Disease of Wheat and Its Management. Biotica Research Today 2(12): 1228-1230.

Abstract

Wheat (*Triticum aestivum* L.) is a source of staple food for humans since ancient times. Numerous factors like varietal reshuffle, intensive cultivation and high input technology are responsible for minor diseases to become major production constraint. One such disease that has caused much concern is Karnal bunt caused by *Tilletia indica* (Mitra) Mundkur; decreased in quality production of wheat due to prevalence of Karnal bunt by imparting a fishy odour and taste to the wheat. In the absence of strict domestic quarantine regulation, it has spreaded to new areas. The pathogen *T. indica* is seed and soil-borne and also has an air-borne sporidial stage, so infected seeds are the most important carrier of pathogens for trans-regional and long-distance dispersal of the spores. The fungus enters the grain through the germinal end and converts the kernels into sori filled with teliospores. Early recognition of the pathogen is a critical step in analysis and its management.

Introduction

Wheat (*Triticum aestivum* L.) is one of the foundations, dominant grain of the world commerce and staple food of millions of people. It is an important part of the daily diet of many millions more. Annual global wheat consumption is in excess of 550 million tonnes. Approximately two-thirds of the wheat produced in the world is used for human food and about one-sixth is used for livestock feed. Industrial uses, seed requirements, and post-harvest losses account for the remaining withdrawal from the world wheat granaries.

India ranks next to rice contributing about 27 percent of total food production with second largest wheat growing country in the world after China. It contributes 1/4th of the global wheat production and covers 1/5th of the total cropped area of the world. There has been tremendous increase in both production and productivity in India after independence which has gone up from 5.6 million metric tonnes to 100 million metric tonnes. In India total production of wheat is 106 million tonnes from an area of 29.55 million hectares with productivity of 33.18 q/ha. In India 8 major wheat growing states are Uttar Pradesh, Punjab, Haryana, Rajasthan, Delhi, Madhya Pradesh, Bihar and Gujarat.

The quality of wheat is decreased by various fungal diseases such as rusts, powdery mildew, loose smut, leaf blight and karnal bunt. Among these Karnal bunt is one of the major disease of wheat caused by the fungus, *Tilletia indica* (syn *Neovossia indica*) and limiting factor in increasing wheat yield (Sharma *et al.*, 2011). Karnal bunt of wheat caused by the smut fungus *Tilletia indica* Mitra [= *Neovossia indica* (Mitra) mundkur], was first discovered in 1930 at the botanical research station, Karnal, Haryana, in north-west India by Mitra (1931).

Article History

Received in 10th November 2020

Received in revised form 01st December 2020

Accepted in final form 02nd December 2020

E-mail: bioticapublications@gmail.com

Losses

Total losses in India during severe epidemics have been around 0.3 to 0.5 percent with incidence as high as 89 percent in some fields; whereas 68.9 percent wheat seed samples from Himachal Pradesh were infected with Karnal bunt (*Tilletia indica*) and highest disease incidence 76.8 percent was in Sirmour district. The incidence of this disease in Rajasthan was recorded 1.7 to 33.9 percent during 1996-97 to 2010-11 and maximum was in 2006-07 with infection range of 0.1-71 percent (Shekhawat et al., 2013). In recent years, re-emergence of Karnal bunt disease in North-western plains of India had seriously affected quality of wheat grain.

Biology and Symptoms

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. Approximately 70 countries place quarantine restriction on movement of wheat from countries where Karnal bunt is known to occur. Karnal Bunt is seed and soil-borne and also has an air-borne sporidial stage, so infected seeds are the most important carrier of pathogens for trans-regional and long-distance dispersal of the spores. The fungus enters the grain through the germinal end and partially converts the kernels into sori filled with teliospores. The main effect of extensive Karnal bunt is to reduce yield and impart a fishy odor and taste to wheat flour, thus reducing the quality of the flour. Yield and quality losses are considered by many smut pathologists to be minor. *T. indica* is a heterothallic fungus belonging to the order Ustilaginales and family Ustilaginaceae and undergoes sexual reproduction after teliospore germination. Primary and secondary sporidia or hyphae as compatible mating types must fuse to form a dikaryon which enhances the chances of variation due to heterozygosity that plays a significant role in the production of new variants (Figure 1). Due to seed borne nature, the symptoms of the Karnal bunt disease become evident only after threshing, infection of grains in an ear head by their swollen appearance and slightly wider opening of the glumes. The glumes open apart exposing the bunted grains which later fall off on the ground with a little jerk in severely infected spikelet. The pathogen infects the ovaries in the growing wheat heads and converts all or part of the wheat seed into a black powder (sori) consisting of millions of teliospores. In severely affected kernels, most of the endosperm along with longitudinal furrow, together with the scutellum, is destroyed leaving only the pericarp and the aleuronic layer. Freshly collected infected grains emit a foul smell, like rotten fish, due to production of trimethylamine (C_3H_9N) by the fungus. Wheat containing 3 percent bunted grains is unfit for human consumption.

Management

Since the pathogen perennates in soil, crop rotation is considered as the possible means of control of this disease. Seed treatment with either Brestanol 45W or Duter 20W at the rate of 0.25% before storage reduces pathogen inoculum by more than 95% and 85% respectively, without any injury to treated seeds. Two spray of Triazole group fungicides (0.1%) like (Hexaconazole, Propiconazole, Tebuconazole etc.) at 10 days intervals; 1st at ear-emergence and 2nd on 50 percent emergence of spikelet's. It has been found in the mid-1980's that infection of wheat flowers can be prevented by a spray of either Mancozeb (0.2%) or Carbendazim (0.1%) at the early heading stage before flowering of the crop. Use of resistant varieties may prove most effective method for disease control. For instance, sonalika variety of wheat has not permitted any significant build-up of inoculum and proves resistant to this disease wherever it is grown. Varieties HD 1907, HP 743, HI 358, L 176, L 191, M 137-A, MW 59-4X 6A have shown resistance against the pathogen. UP 270, UP 368, HD 2222, 2227, 2235 have remained free from the disease under natural conditions of infection. Varieties which prove to be susceptible to *T. indica* should not be preferred. Some of such varieties are HD 2099, 1982, Arjun, WG 357, WG 377, WL 711, UP 319, and UP 362.

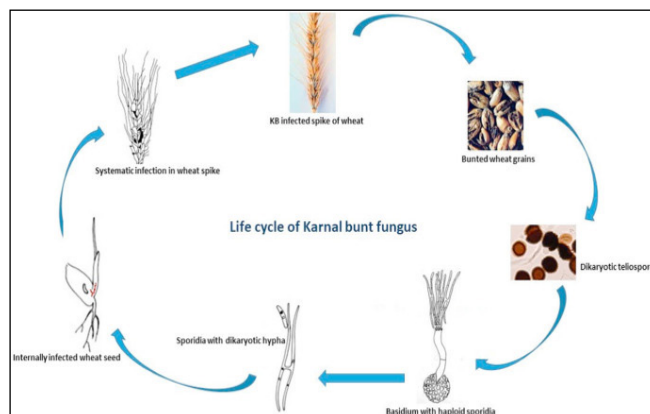


Figure 1: Life Cycle of *Tilletia Indica*



Figure 2: Infected Wheat seeds

Conclusion

Karnal bunt is a serious disease because of its influence on global trade of wheat grains. It has potentially serious phytosanitary implications for wheat production. For effective management of this disease, continuous efforts of scientists and regulators are required, which allow greater sensitivity and selectivity for elevated throughput and detection of multiple microbes. The management of Karnal bunt disease can be done by encouraging farmers for cultivation of bunt resistant varieties, discouraging broadcasting of seed to reduce the impact of germination of primary inoculums from infected seed material and by mass campaigning for use of fungicide in Karnal bunt sensitive area.

References

- Mitra, M., 1931. A new bunt on wheat in India. *Annual Applied Biology*, 18(2): 178-179.
- Sharma, R.C., Sharma, I., Kaur, D.J., Bala, R., 2011. Disease free seed production of wheat in Punjab: Achievements. *Journal of Wheat Research*, 3: 27-29.
- Shekhawat, P.S., Majumdar, V.L., Chawla, N., 2013. Status of Karnal bunt of wheat in Rajasthan and its management. *Journal of Mycology and Plant Pathology*, 43(4): 457-460.