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Genesis and rationale of the project:

Wheat (*Triticum aestivum*) is a major food crop of the world and India is the second largest producer of wheat. Among biotic stresses, fungal diseases are among the most important constraints to wheat production and productivity. The Karnal bunt (*Tilletia indica* (Mitra)) of wheat is native to South Asia and was identified in 1931 (Mitra, 1931,1935) from Punjab. In India, it occurs in the states of Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Uttranchal, Delhi, Rajasthan and Bihar. The disease is endemic in Gurdaspur, Hoshiarpur, Jalandhar and Ropar districts of Punjab and along the rivers and canal network of Satluj and Beas.The disease seldom caused any severe production concern (Gill *et al.*, 1993). Due to unexplainable reasons this cosmetic disease of wheat that had very limited world wide distribution (Nagarajan *et al.*, 1997) became a quarantine concern interfering with free and fair grain trade. India now exports reasonable quantities of wheat and faces the risk of imposition of trade barrier as traces of Karnal bunt much above the tolerance limit (NSP, 1996) occurs in some of the consignments originating from Punjab. The importance of KB is because of the limitation it imposes in the global grain trade. The disease also impairs the grain quality and affects the consumer preferences for wheat and wheat based products.

KB Infected Grains

KB symptoms in wheat spike

Difficulty of spraying in large fields as well as high cost of fungicides makes chemical control of Karnal bunt less popular among farmers. Alternatively, use of host resistance is the most effective strategy to control this disease. It is desirable to develop varieties with wider genetic base for resistance capable of containing the area specific pathotypic flora of Karnal bunt pathiogen. Hence, it becomes

imperative to screen the diverse germplasm against the prevalent pathotypes for obtaining stable resistant stocks. Variability in the pathogen (presence of pathotypes) has been established by identifying six pathotypes whose pathogenicity is regulated by the heterothallic nature of the pathogen..Area specific prevalence of these pathotypes has also been noted. There is a need to resolve area specific spectrum of pathotypes existing under natural conditions in different ecological zones of north west India where Karnal bunt is a serious menace. By doing intensive field sampling in all districts of states in north west India, it would be possible to conjecture the heterothallic alleles whose pairs yield specific pathotypes. In this way, pathotypic map for every small zone can be obtained and suitable specific stocks can be employed for breeding resistant varieties for that particular zone. A pilot study has already been furnished in this regard during the previous tenure of this project. These studies would be continued on a large scale during the proposed tenure of the project.

Traditional markers used to study the variability in plant pathogens are based on the differential hosts, cultural characteristics, morphological markers and biochemical tests. These markers distinguish pathogens on the basis of their physiological characters i. e. pathogenicity and growth behaviour. But these markers are influenced by host age, inoculum quality and environmental conditions. Moreover, these techniques are time consuming, laborious and in some host-pathogen systems, differential hosts are not available. In such cases, molecular markers are used for studying genetic variability in plant pathogens. Using PCR, very closely related strain of a pathogen can be distinguished without prior knowledge of the nature of polymorphic regions by the use of RAPD (William et al., 1990). Studies on resistant sources identification and genetics of resistance will help breeders in developing resistant varieties to Karnal bunt. Biological control assumes special significance in being an ecofriendly and cost effective strategy for disease management, which can be used also in integration with other strategies to afford greater level of protection and sustain wheat yields.

Objectives

- **To keep vigil on the occurrence of Karnal bunt and its distribution**
- **To study the variability in *Tilletia indica* isolates / monosporidial lines of wheat through host pathogen interaction and molecular approaches**
- **Identification of sources of resistance**
- **To study the disease dynamics under different resource conservation technologies and changing climatic scenario**
- **Management of Karnal bunt by Integrated Disease Management approach**