Wheat (*Triticum* spp. L.) is one of the most important food crops in the world and has been the basic staple food of the major civilizations of Europe, West Asia and North Africa for 8000 years (Curtis 2002). It is a primary source of energy, protein and dietary fibre in human nutrition and supplements around 19 per cent of our total calories. Approximately 65% of all the wheat grain is used directly as human food, 21% to feed livestock, 8% as seed and the remaining 6% for other uses (Gooding and Davies 1997; Curtis 2002; Shewry 2009). China, India, United States, Russian Federation, Kazakhstan and Canada are the major wheat producers in the world (Curtis 2002). According to some estimates (FAO 2006, 2007; Rosegrant *et al*., 2001), the global wheat production must increase at least by 1.6 per cent annually during 2010-2020 to meet a projected wheat demand of 760 million tons by 2020. By the year 2050, the world population is estimated to be 9 billion and the demand for wheat will be more than 900 million ton, which will grow faster than the demand for rice.

Wheat is the most important winter cereal in India and along with rice, serves as the life-sustaining crop for more than 1 billion population. It contributes approximately 12% to the world wheat basket and holds the global share of 11% area under cultivation of wheat. As a result of consistent efforts during the last 40 years, India has recorded an all-time high wheat production and maintained its second position among wheat producing nations next only to China. This achievement in India’s wheat production has been perhaps most important and unparalleled in the history of developing world. This self-sufficiency in food was accomplished due to increased wheat production which must be sustained over the coming years. A moderate growth rate of 2.25% during the past 25 years posed a challenge to wheat workers for enhanced production to meet the targeted need of 109 m tons by 2020AD.

Despite of a record in wheat production, India continues to be under pressure due to high population growth rate and utilization of fertile land for urbanization and industrialization. In near future, various constraints or limitations like shrinking the
land availability, depleting natural resources, soaring cost of critical inputs, unpredictable climate changes would adversely affect wheat production. The available weather information for the last fifty years clearly indicates that global temperature increased by 1°C. This warming trend is likely to continue with minor interruption throughout the whole world for the next century. India will also suffer severely from potential changes in temperature and precipitation (Panayotou et al., 1999). These changes will influence plant disease development and the productivity of the entire agriculture system.

Wheat in all stages of growth and natural environments are subject to various mechanical, physiological and biological stresses that interfere with their normal growth and development. One of the major constraints in boosting up the wheat production is the prevalence and emergence of a number of diseases. About 50 are routinely important economically, and nearly 200 have been described. All diseases, noninfectious as well as infectious, are injurious in some areas, in some years, and on some plant part. The principle biological agents that cause wheat diseases are fungi. These agents are parasitic and cause infectious diseases that are transmissible from plant to plant. Among the major fungal diseases of wheat, important ones are three rusts- stem, leaf and stripe, loose smut, flag smut and karnal bunt. These diseases pose a big threat to wheat quantity and quality. Climate change may alter phasing of life cycle stages and their rates of development for pests and pathogens and associated antagonistic organisms (Chakraborty 2011). It may modify mechanisms of host resistance, host-pathogen relationships and the geographical distribution of hosts and pathogens. The level of crop losses will increase while the efficacy of control measures (Coakley et al., 1999) could fall when faced with greater populations of pests and pathogens. Increased fecundity of fungi results from elevated carbon dioxide concentration and higher temperatures. Increased rainfall events would reduce weather-windows for spray application and allow greater likelihood of contact sprays being washed off from canopies. Raised carbon dioxide could increase the thickness of epicuticular waxes resulting in slower penetration of pesticides. Rising temperatures could increase the range of pathogens. One should never underestimate the importance of genotype and gene flow in terms of the spread of diseases. As variation in climate continues to increase, the possibility of the evolution of a new pest or disease to a region will also increase. Continued
vigilance and investigation of changes in the biology and genetics of pathogen populations is clearly warranted. So, to achieve the target demand of wheat, we need to understand the effect of new pest or disease to a region. This entails understanding their ecology, distribution, virulence patterns, and variability across geographical areas, including their evolution over time.

*Fusarium* head blight (FHB), also known as scab, is a destructive disease of wheat and emerged as a disease of economic importance affecting the quantity and quality of wheat worldwide (Dill-Macky 2010), with recent outbreaks reported from USA (Starkey et al., 2007; Ward et al., 2008; Alvarez et al., 2009; Sampietro et al., 2010, 2011; Gale et al., 2011; Reynoso et al., 2011; McMullen et al., 2012), Africa (O’Donnell et al., 2008; Kriel and Pretorius 2008; Muthomi et al., 2008; Wagacha et al., 2010; Boutigny et al., 2011), Eurasia (Parry et al., 1995; McCormick, 2003), Australia (Burgess et al., 1987; Akinsanmi et al., 2004), and Asia (Qu et al., 2008a, b; Zhang et al., 2013). The disease is important especially in the humid and semi humid wheat growing areas (McMullen et al., 1997). Epidemics of FHB occur sporadically (Fernando et al., 2000). FHB is currently not a severe problem in India but, under warm and wet weather conditions during flowering, the disease has the potential to cause considerable loss in grain yield and quality. Such favorable weather may also occur more frequently as a consequence of global weather change. Infestation of wheat with *Fusarium* spp. results decrease in yield and grain quality, but even greater threat represents food and feed safety risk due to mycotoxin contamination (Matthies et al., 2000). Mycotoxin-contaminated grains can pose risk to human and animal health (Desjardins 1993; Desjardins, 2006). Consumption of contaminated feeds by livestock has been associated with a variety of adverse health effects, including feed refusal, reduced weight gain, diarrhoea and emesis (Krska et al., 2001). Molds from *Fusarium* genus have the ability to produce several hundred different mycotoxins characterized by different chemical and biological properties, and extremely different toxigenic activities (carcinogenic, genotoxic, teratogenic, hapatoxic, immunotoxic) (Zinadine et al., 2006). Among toxins produced by the pathogens of the genus *Fusarium*, the most frequent and the most important ones in a great number of agricultural products are deoxynivalenol (DON), commonly
called vomitoxins, zearalenone (ZEA) and nivalenol (NIV) toxins (JECFA 2001). Deoxynivalenol is a member of the trichothecene family of mycotoxins. It is among the least toxic of the trichothecenes, but it is the most frequently detected one throughout the world. Its occurrence is considered to be an indicator of possible presence of other, more toxic trichothecenes (Lombaert 2002). Under new WTO regime, wheat quality will be of paramount importance as this disease may hinder exports. One of the major challenges for all wheat producers and exporting countries will be to meet strict regulatory standards for low deoxynivalenol (DON) toxin content. European Union (EU) regulation 856/2005 establishes a maximum level of 750 mg/kg (0.75 ppm) for DON in cereal flour (excluding durum wheat, oat and maize flour). These mycotoxin-contaminated grains are usually discarded by the cereal industry thus causing huge economic losses.

Various control measures have been practiced to manage this disease, including destruction of diseased plants, sanitary measures, use of disease-free tissue culture planting material, use of tolerant varieties and other integrated management methods. But promising options for controlling *Fusarium* head blight include chemical measures and the development of resistant cultivars. Registered fungicides can be somewhat effective in reducing FHB (Jones 2000; Matthies and Buchenauer 2000; Suty and Mauler-Machnik 1997), but residue concerns regarding the use of fungicides late in crop development and environmental hazards lessen their attractiveness. Advances in developing resistant cultivars using traditional breeding (Bai *et al*., 2000) and genetic engineering (Bushnell *et al*., 1998) are occurring, but complexity of resistance, poor agronomic characters linked to resistance and low industrial quality make it difficult and all wheat cultivars currently in production remain vulnerable to infection. Although, conventional tillage of fields after harvesting to bury plant residues is partially effective in reducing FHB but it is not compatible with the soil conservation practice of minimum tillage (Dill-Macky and Jones 2000; Miller *et al*., 1998) Therefore further research is needed in this area to clarify these conflicting results and plan the integrated and ecofriendly management strategy to control this devastating disease.
Keeping this in view, the current research work entitled “Variability study in *Fusarium* spp./isolates causing *Fusarium* head blight in wheat and ecofriendly management through bioagents” has been planned with following objectives:

- To survey and collect diseased samples of FHB for isolation of *Fusarium* spp./isolates from different geographical regions of India
- Isolation, identification and pathogenicity test of *Fusarium* spp./isolates
- To study the pathogenic variation among *Fusarium* spp./isolates causing FHB in wheat
- To study the genetic variability among *Fusarium* spp./isolates using DNA molecular markers
- Ecofriendly management of FHB of wheat