CHAPTER 1
INTRODUCTION

The term “vermicompost” originated from a latin word “vermes” meaning “worms” and the process of composting of organic material using earthworms is known as vermicomposting. Earthworms that influences soil microbial community, physical and chemical properties are popularly known as the “farmer’s friend” or “nature’s plowman”. Earthworms have the ability to breakdown the large soil particles and leaf litter and thereby increase the availability of organic matter for microbial degradation. Vermicompost is the product of non-thermophilic biodegradation of organic material by joint action of earthworms and associated microorganisms. This product is a highly fertile, finely divided peat-like material with high porosity, aeration, water-holding capacity and low C:N ratios (Dominguez and Edwards 2004; Subler et al. 1998). The soil volume, microflora and fauna influenced by earthworms have been termed as "drilosphere" (Lavelle et al. 1989).

Due to the exponential increase in human population and decrease in land availability for cultivation and waste disposal there is a need to intensify crop production and improve waste disposal systems. However, crop intensification has led to indiscriminate use of chemical fertilizers and pesticides which in turn has resulted into environmental pollution and ecological disturbances by destroying natural predators of crop pests, plant growth-promoting bacteria and other soil micro and macro flora and fauna. Therefore, alternate system of crop production through organic farming is the need of the hour.

Composting of organic waste is an efficient technology to convert organic wastes into useful composts which could be used as biofertilizers for sustainable agriculture. In
conventional composting microbes alone participate in degradation process. Since conventional composting is a thermophilic process there is a possibility to lose beneficial microbes that couldn’t tolerate high temperature. In this situation, vermicomposting is the best alternative to conventional composting as it is a mesophilic process which takes the advantage of earthworms and their associated beneficial microbial partners, to degrade the organic matter. Vermicomposting hastens the composting process and in addition it preserves the diverse beneficial microflora, thus providing even more nutritive and biologically active biofertilizers. Earthworms transform a wide variety of organic wastes into valuable vermicomposts by grinding and digesting them with the help of microbes which play a key role in biogeochemical processes (Maboeta and Rensberg 2003). Earthworm activities are found to enhance the beneficial microbes and suppress harmful microbes to an extent that they even convert infectious hospital wastes into risk-free materials (Mathur et al. 2006).

Vermicomposts possess remarkable plant growth-promoting properties due to the presence of nutrients in plant available forms such as nitrates, exchangeable calcium, phosphorus and soluble potassium (Edwards and Burrows 1988) in addition to the presence of plant growth regulators such as auxins, gibberellins and cytokinins of microbial origin (Grappelli et al. 1987; Krishnamoorthy and Vajranabhiah 1986; Muscolo et al. 1999; Tomati et al. 1987 and 1988) and humic acids in appreciable quantities (Atiyeh et al. 2002; Msciandaro et al. 1997; Senesi et al. 1992). Microbial antagonism is an important mechanism for disease suppression. Similar to thermophilic composts (Goldstein 1998; Hoitink and Grebus 1997) vermicomposts also possess disease-suppressive potential on a wide range of phytopathogens (Rivera et al. 2004; Sahni et al. 2008; Szczech and Smolinska 2001). Addition of organic amendments enhances antagonistic microbial population and their diversity. Unlike traditional thermophilic composts, non-thermophilic
vermicomposts are rich sources of microbial diversity and harbour a wide variety of potent antagonistic bacteria (Chaoui et al. 2002; Scheuerell et al. 2005; Singh et al. 2008). Knowledge on the diversity and functional potential of drilospheric microorganisms is an essential prerequisite for better understanding of the biology of vermicomposts and their role in plant growth promotion, disease suppression and conversion of hazardous biological wastes. Therefore, present investigation was carried out to study the molecular and functional diversity of drilospheric soil bacteria of vermicompost.

Objectives of present investigation were formulated as follows:

1. Production of vermicompost using earthworm species, Eisenia fetida and agricultural wastes
2. Isolation of drilospheric bacteria from vermicompost
3. Phenotypic characterization of drilospheric bacteria by
   (i) Biochemical traits (Oxidase, catalase, gelatinase, urease, nitrate reductase, growth at 4°C, 42°C and salt tolerance, citrate utilization, carbon utilization profiles)
   (ii) Functional traits (plant growth-promoting enzymes and hormones, siderophores, extracellular enzymes, secondary metabolites, antagonistic potential against phytopathogenic fungi and human pathogens)
4. Molecular characterization of drilospheric bacteria by 16S rRNA
5. Phylogenetic tree analysis of drilospheric bacteria by
   (i) Biochemical traits
   (ii) Functional traits
   (iii) 16S rRNA