SECTION - A

CHAPTER : I

GENERAL INTRODUCTION
Of all the physical factors of environment, temperature plays an immensely important and often decisive role in the distribution of living organisms over the face of earth. Based on their temperature requirement microorganisms can be categorized as — psychrophiles, mesophiles and thermophiles. As defined by Cooney and Emerson (1964), thermophiles are those organisms with a minimum for growth at 20°C or above and maximum for growth at 50°C or above. The earlier studies on thermophiles were centered around their occurrence in different habitats (Apinis and Pugh, 1967; Mulinge and Apinis, 1969; Flannigan, 1969, 1970; Evans, 1971; Tansey, 1971a, 1973, 1975; Pora and Larah, 1967; Pope et al., 1962; Greaves, 1975).

The thermophilic fungi in particular are involved in the breakdown of complex materials leading to the process of humification and conversion of waste materials into valuable fertilizers. Kellis (1952) and Mønssen (1957) have concluded that high temperature composting holds considerable promise for practical use in agriculture. Of late, considerable attention has been paid towards the disposal of municipal wastes and refuse with the help of thermophiles (Muller, 1964; Cooney and Emerson, 1964). The high temperature in self-heating process kills the pests present in the compost (Atkins, 1961).
Processing of chocolate (Chatt, 1953) and tobacco (Garner, 1946) involves a thermogenic fermentation in which quality and flavour are dependent upon the microorganisms that develop and the conditions that are maintained. Thermophilic fungi are active agents in the retting of guayule (Cooney and Emerson, 1964). According to Muller (1961), the controlled self-heating and microbial treatment of various kinds of fodder converts it into better feed, as judged by weight gains of the experimental animals. Recently, thermophilic organisms have been used as producers of enzymes, amylase and cellulase (Fergus, 1969a, b; Chapman et al., 1975); lipase and acid protease (Sankuti et al., 1967, 1968a-c; Ong and Gaucher, 1973; Mukerjee and Chaudhary, 1977); lactase (Sorensen and Crisan, 1974; Yu et al., 1969); and amyloglucosidase (Mangallam et al., 1977) as well.

The paucity of literature on the physiology and biochemistry of morphogenesis in thermophilic fungi has attracted attention of the microbiologists lately towards this direction (Celerin and Fergus, 1971; Chang, 1967; Streets and Ingle, 1972; Crisan, 1973; Deploey and Fergus, 1975; Sahm and Chapman, 1976; Mumma et al., 1970, 1971a, b). The morphogenetic process may be defined as a change in fungal form towards either greater complexity or simplification. Turian (1966) has distinguished it into two phases, viz., an initial stage corresponding to the vegetative phenomenon of spore germination and a final,
corresponding to the reproductive phenomenon of spore formation. Spore germination is defined as the transformation of an inactive spore to the highly active vegetative thallus. This process is characterized by the absorption of water (Strobil, 1965) and by an increase in the respiratory enzymes (Caltrider and Gottlieb, 1963) followed by biosynthesis of many cell components. As described by Manners (1966), three stages can be distinguished during germination, viz., (i) the internal physiological and morphological changes that will occur within the spore-wall before any outgrowth occurs, (ii) the act of protrusion of the germtube from the spore wall, and (iii) elongation of the germtube and the establishment of growth.

The germination of fungal spores in general has received considerable attention in recent years though metabolic aspects have, with few exceptions, been overlooked. This is especially true for thermophilic fungi. Thakre and Johri (1974) have reported that there is remarkable synchrony of spore swelling, germination process and germtube length in case of Rhizopus rhizophodiformis. In view of paucity of data on germination behaviour and due to the availability of synchronized sporangiospores, this organism was selected for the present investigation. The main aims were as follows and emphasis has specially been placed on the swelling phase and sporangiospore germination:
(i) Nutritional aspects of the swelling phase and sporangiospore germination.

(ii) Biochemical events during the germination phase, especially with reference to amino acids, proteins and nucleic acids.

(iii) Role of known germination stimulators and inhibitors on the biochemical events.

(iv) Respiratory changes taking place during swelling and germination.

(v) Enzyme production, especially related to amylase and cellulase.