Introduction
CHAPTER I

INTRODUCTION

Since time immemorial rice cultivation is the economic life line of the society in Assam. For the same reason over ages, it has become a part of tradition and culture of Assam particularly of rural society. Rice being the staple food of India it contributes consistently to around 45 per cent of India's total cereal production. The annual requirement of food grain of rice in India is 86 million tonnes while the current production is 84.74 million tonnes in the year 1998-99. The country has the potential of keeping pace with the increasing demand of its staple food rice for the growing population for many more decades to come. Rice is stored in the form of paddy, which is essential and common practice in the paddy growing areas in India. In the N.E. region, since rice is the staple food for a large section of population, hence it is cultivated widely in the plains, valleys and in terraces. In Assam, paddy is the most extensively grown cereal crop in all the six agro-climatic zones covering an area of 26.52 lakh hectares with an average production of 39.00 lakh tonnes in 1999-2000 and for about 95 per cent of its population, rice is the staple food. In Assam the average paddy yield was recorded to be 1954 kg / ha (Venkataramani, 2000). About 85 per cent of the cultivated area in Assam is under paddy cultivation and hundreds of varieties (local cultivars and HYV) are cultivated. Barpeta district lies in Lower Brahmaputra Valley Zone and is one of the predominantly rice growing districts of the state with an area of 1 lakh hectare and production of 1.44 lakh tonnes in 1999-2000. More than 40 rice varieties including local cultivars are grown in different rice growing pockets of the district.
About 75-80 per cent of the paddy produced, is retained by the farmers in their traditional storage structures. The type of storage structures varies from area to area under the different local names. Most of the farmers store paddy for home consumption and seed purposes for a varying period or until the next harvest. Quality of grain to a large extent depends on the type of storage structures / containers. Most of the farm level structures are becoming obsolete and not suited for the safe storage of food grains. Colossal losses of food grains that takes place in the farm level traditional storage structures have been reported by various workers from the different parts of India (Hira et al., 1988; Girish et al., 1990).

Stored grains and their products are subjected to attack by a group of insect-pests. Considerable losses in terms of quality and quantity occur during storage period due to infestation of stored insect-pests. Amongst the various stored grain insect-pests, the rice weevil, *Sitophilus oryzae* Linn. and the grain moth, *Sitotroga cerealella* Oliv. are the most widely distributed and destructive insect-pests in stored rice grains in Assam (Deka, 1981). Both these pest species infest paddy and rice grains during storage are common, causing quantitative and qualitative losses to stored paddy and rice grains which result in reduction in germinability and glutinous quality of grains and make them unfit for seed and human consumption purposes. *Sitophilus oryzae* and *Sitotroga cerealella* develop within the grain kernels causing considerable damage. Because of their similar habits larvae of *S. oryzae* and *S. cerealella* have been regarded as ecological homologues (Arbogast and Mullen, 1987).

All stages of the rice weevil are active throughout the year and oviposition continues throughout the year. Both adults and larvae attack the whole grain. They feed voraciously rendering grain unfit for even human
consumption. The female makes a small excavation in the soft part of the grain where it lays egg and then plug the cavity with gelatinous secretion. The newly hatched tiny young larva bores into seed and feeds on starchy contents hollowing it out to leave only the shell. Larvae pupates inside the hollow grain. The whole developmental life being spent inside the grain. In case of heavy infestation grains become a lump of broken debris.

The grain moth infests only husked rice grains on mature standing crop in the field and also grains during post-harvest processing period like harvesting, threshing, drying and storage. Latent infestation of this insect is common through its minute eggs hidden in cracks and crevices of old storage structures / containers and their depositions on debris of a used structure. Being a lepidopteran, larval stage is more injurious to grain. The newly hatched larva enters the grain through a minute hole and feeds on it. It completes its life cycle inside the grain before emerging as adult moth. In this way the larva completely destroys the grain leaving behind the shell. *S. cerealella* is known to deteriorate quality of stored paddy when it infest not only by direct feeding on germ / grain kernels but also by contaminating the grains with several storage fungi during its vertical and horizontal movements in storage and also by reducing seed viability. Highly infested paddy grains appears to be golden-yellow due to the presence of scales on the grains and are considered to be of poor market quality.

The district of Barpeta experiences a warm humid climate with a hot summer followed by the monsoon season with heavy rainfall and a relatively cool winter with scanty rainfall. As a result stored paddy grains, seeds and their products suffer from varying degrees of infestation of *S. oryzae* and *S. cerealella* at farmers' level in the district. Accurate statistics of the
damage and extent of losses to the stored products caused by *S. oryzae* and *S. cerealella* in Assam is not available. However, factors contributing to insect incidence and its density level were analysed to develop accurate recommendations to control these pests.

Proximity to rice field to storage facilities has a great bearing on the intensity of field infestation by rice weevil and grain moth (Cogburn and Vick, 1981; Howlader and Matin, 1988). Pre-harvest field infestation of rice was recorded in some parts of India. Comprehensive investigation in this regard was not taken up in this district before the present work. Cracks and crevices of walls and floors of storage structures, grain residues and debris are known to be the sources of infestation of both *S. oryzae* and *S. cerealella* but no detailed investigation was ever undertaken to assess the role of such species in this region. Studies on alternate host spectrum of *S. oryzae* and *S. cerealella* were conducted in other regions of the country. Crevices on barks of naturally grown trees in and around the paddy field might act as hiding site for both the pest species. Other plants growing in the vicinity of rice fields are also might be possible sources for sheltering and feeding of these pests.

Storage receptacles are the habitats of most of the storage insects. Studies on distribution of population of these pests in each type of receptacle are utmost necessary for formulation of sound pest management programme. No concerted effort has ever been made so far in this district to study the population and infestation levels of these pest species in commonly used storage receptacles.

Traditionally, the majority of farmers store their harvested paddy as threshed and cleaned grains. However, the practices of storing
threshed unclean and unthreshed grains are also prevalent to a certain extent. It is worthwhile therefore, to evaluate these practices in the light of heavy infestations of stored grain pests with special reference to *S. oryzae* and *S. cerealella*, in the present investigation.

The farmers store rice grains mostly in ventilated traditional storage receptacles like 'Gutibhoral' and 'Duli'. Airtight receptacles like polythene bag, plastic bin are also found used by some farmers of this district. Activities of storage insect-pests are largely influenced by the condition (airtight or otherwise) of the storage receptacles. The effect of storage conditions on the infestation build-up of these storage pests is also considered to be necessary in this research work for devising appropriate management practices.

The moisture content of the stored grains was considered to be the most important factor determining vulnerability of the stored grains to the attack of stored grain pests. At the time of storing of rice grains at farmers' level the moisture content of grains is normally within the range of 11 to 17 per cent. Studies on infestation of *S. oryzae* and *S. cerealella* under different storage practices and storage conditions with relation to grain moisture content and the relative period of storage are felt imperative to study in this investigation.

Several workers studied the seasonal incidence of *S. oryzae* and *S. cerealella* in different parts of the country but the information available are far from complete. The precise role of abiotic and biotic environmental factors on the infestation of both these storage pest species are yet lacking to
be analysed properly. Research on such lines therefore have been undertaken expecting invaluable informations towards tackling the problem of these menacing storage pest in this region.

Rice varieties vary in their resistance not only to *S. oryzae* and *S. cerealella* but also to other stored grain pests (Russell and Cogburn, 1977; Dhotmal and Dumbre, 1983). More than 40 rice cultivars are under cultivation in Barpeta district alone since long. Some of these cultivars like 'Hasakumra' and 'Aijong' are more popular in certain pockets of the district. The recently introduced varieties like Pankaj, Ranjit etc. are also slowly gaining popularity in the district. It is obvious that these cultivars would exhibit varying degree of resistance towards these stored grain pests. No systematic effort has been made hitherto in order to evaluate these cultivars for their resistance against these pests. Besides these cultivars have not so far found place in the works on varietal resistance carried out in other parts of India. So, an effort has been made to evaluate the possible resistance of some of the cultivars grown in the district of Barpeta in this research work.

Studies on biology of a pest gives information about bionomics and behaviour of various life stages which are considered vital for divising management practices against it. Information available on various aspects of biology of *S. royzae* and *S. cerealella* are so far fragmentary in nature. No serious effort had been made earlier to bridge the gap of knowledge on certain aspects of their biology. Detailed study on biology has not been conducted under the prevailing condition of N.E states including Assam in general and in the Barpeta district in particular. Keeping this in view, the present study was planned to investigate "eco-biology of rice weevil, *Sitophilus oryzae* Linn. and grain moth, *Sitotroga cerealella* Oliv. under agro-climatic conditions of Barpeta district, Assam" with the following objectives —
1) To estimate the sources of infestation.

2) To evaluate the distribution of *S. oryzae* and *S. cerealella* in different storage types used at farmers' level of Barpeta district.

3) To assess the storage practices at farmers' level of Barpeta district.

4) To estimate the effect of storage practices and period of storage required for the infestation of *S. oryzae* and *S. cerealella*.

5) To evaluate the effect of storage conditions on infestation of *S. oryzae* and *S. cerealella*.

6) To estimate the seasonal incidence of *S. oryzae* and *S. cerealella*.

7) To study the infestation of *S. oryzae* and *S. cerealella* under Barpeta district in relation to physical characters and chemical constituents of grains.

8) To study the life cycle of *S. oryzae* and *S. cerealella* under the agro-climatic conditions of Barpeta district.

The work was done at farmers' level and in the laboratory. The findings thereof are incorporated in this thesis leading to the recommendations and suggestions in the discussion to the farmers as well as initiating other workers in future to follow the vista shown here for further consolidation of the control and prevention technology to the best benefit of the poor farmers of the district and to that matter to the farmers of the state of Assam.