CHAPTER – 1

INTRODUCTION

STUDIES ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF HAMPShIRE, DUROC AND THEIR CROSSES WITH INDIGENOUS PIGS USING MOLECULAR MARKER
Swine breeding is one of the important facets of livestock industries in most of the developed countries, but almost neglected in developing countries. In India, the swine industry is at its primitive stage but it has a special significance with reference to the improvement of the socio-economic status of the sizable sections of the weaker community.

The demand for animal protein in India is ever increasing due to rapid growth of population and purchasing power of people. The protein sources available are insufficient to meet such an increasing demand and there is a need to narrow down this gap between the requirement and availability.

There is a lack of animal protein in the diet available to human population. As per the recommendation of the Indian Council of Medical Research, the requirement of animal protein is 10.95 kg per annum per head and the per capita availability is 3.24 kg per annum, thus showing a deficit of 7.71 kg per annum (Pradhan, 1999). The first step to bridge the wide gap between the availability and actual requirement of animal protein is to breed and multiply all classes of meat producing animals. Pigs are double cropping in nature with high prolificacy, shorter generation interval, faster growth rate and excellent feed conversion ability. Due to these desirable characteristics pigs play an important role in increasing meat production to fill the wide gap between low availability and large requirement of animal protein. The importances of pig rearing are as follows:
• Pigs convert inedible feeds, forages, certain grain byproducts obtained from mills, meat by products, damaged feeds and garbage into valuable nutritious meat. Most of these feeds are either not edible or not very palatable to human beings.

• Pig grows fast and is a prolific breeder, farrowing 10 to 14 piglets at a time. It is capable of producing two litters per year under optimal management conditions.

• The carcass return is quite high i.e. 60-80 percent of live body weight.

• With a small investment on building and equipment, proper feeding and sound disease control programme the farmer can profitably utilize his time and labour in this subsidiary occupation.

• The faeces of pigs is used as a manure to maintain soil fertility.

According to the Basic Animal Husbandry Statistics (2006), Department of Animal Husbandry, Dairying and Fishery, Ministry of Agriculture, Government of India, the total pig populations during 2003 in different states of North Eastern Region are as follows:

<table>
<thead>
<tr>
<th>State</th>
<th>Pig Population (thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arunachal Pradesh</td>
<td>330</td>
</tr>
<tr>
<td>Assam</td>
<td>1543</td>
</tr>
<tr>
<td>Manipur</td>
<td>415</td>
</tr>
<tr>
<td>Meghalaya</td>
<td>419</td>
</tr>
<tr>
<td>Mizoram</td>
<td>218</td>
</tr>
<tr>
<td>Nagaland</td>
<td>644</td>
</tr>
<tr>
<td>Sikkim</td>
<td>38</td>
</tr>
<tr>
<td>Tripura</td>
<td>209</td>
</tr>
</tbody>
</table>
Thus the total pig population in North East Region is 3816 thousand and Assam alone possesses 40.43 percent of the total pigs population of this region.

India is very rich in its livestock resources. In spite of this, availability of animal protein is far less than the requirement. This is primarily due to the fact that the major chunks of the populace do not consume beef, although the cattle population of the country is very large which is 199.69 million (Singhal, 1998). Under such a situation small ruminants and also pigs, besides poultry, play a significant role in India's meat production system.

NE region provides ample scope for piggery development because of the traditional involvement of rural, tribal and other weaker sections of the population in pig raising, their food habits and absence of taboo against consumption of pork and pork products. Assam is regarded as the parent state of this region having the highest population of pigs. The popularity of pig farming in Assam as well as in other parts of NE India is gaining momentum in recent years as the farmers are finding it as profitable enterprise. Due to population explosion, perennial flood, high rainfall and low soil pH, the traditional cropping system is getting less remunerative and at times risky. Today pigs are reared not only for supplementary income support, but also as a means of livelihood. Educated farmers and youths have come forward in large numbers and helped in entrepreneurship development through piggery.

Growth is an important economic trait in profitable swine enterprises. It is pronouncedly related to maturity age or slaughter weight and in turn has positive
bearing on life time production. Similarly, knowledge on rate of gain in terms of body weight gains in pigs clearly depicts its pork production potential.

The following points must be taken care to get the maximum benefits out of pig rearing

- Proper Feeding
- Proper Housing
- Proper Estrus Detection and Mating
- Proper Care of Pregnant Sow
- Hygienic Farrowing pen
- Proper care of new born piglets
- Early weaning
- Early post partum mating
- Proper health coverage

To accomplish the improved rearing of pigs it is considered as important to characterize the genetic traits of pig of different origin. The various qualitative traits can be identified and maintained through biochemical and molecular techniques and breeding technologies. The DNA level assessments of quantities are proved to be fruitful in the improved rearing of pigs in commercial scale. The invention of polymerase chain reaction technique in 1986 by Kary Mullis, permitted minute amounts of DNA to be increased exponentially (amplification) so that they can be used in various types of molecular genetic studies (Mullis., 1986). This technique is very sensitive, rapid and specific in detecting and amplifying DNA sequences. Among the first demonstrated DNA level marker (Grodzicker, 1974) is the restriction fragment length polymorphism (RFLP). RFLPs are simply variations in the length of the DNA fragments produced by cleaving DNA molecules with specific restriction endonucleases (RE). These RFLPs may directly affect gene expression by changing the splicing of mRNA, stability of mRNA, rate of gene transcription, or the sequence of the gene product (Botstein, 1980). It may also serve as genetic endonucleases (RE). Since REs
cut DNA in a sequence specific manner, every homologous DNA molecule from every cell of a totally homozygous organism will be cut at exactly at the same site. However, the DNAs isolated from organisms in populations that have evolved independently for substantial periods of time will usually exhibit sequence divergences that yield RFLPs i.e. base pair substitutions, deletions and additions have occurred and some of these changes have altered the position of restriction enzyme cleavage sites. These RFLPs may directly affect gene expression by changing the splicing of mRNA, stability of mRNA, rate of gene transcription, or the sequence of the gene product (Botstein et al., 1980). It may also serve as genetic markers if linked to QTL (Beckmann and Soller, 1983). Hence the determination of RFLP in candidate genes is of great interest.

Porcine GH is synthesized as 190-amino acid peptide and secreted pulsatile by acidophilic or somatotropic cells of the anterior pituitary [Kato et al. 1990]. Growth hormone (GH) is a peptide hormone which regulates growth and various metabolic activities (Sterile, 1995; Yuan, 1996). Injection of GH into growing pigs increased growth rate of the animals and the fat percentage of muscle, and while fat accretion was decreased (Bonneau, 1991; Fabry, 1991; Mikel et al., 1993). GH gene is thus a major candidate for controlling growth and fat deposit in pigs. Association between GH polymorphisms and variations in growth and fatness traits has been established in pigs (Knorr et al., 1997; Krenkova et al., 1999; Pierzchala et al., 1999; Cheng et al., 2000; Song et al., 2001). Treating pigs with exogenous porcine GH improves daily live weight gain, feed efficiency and lean content of carcass.

The present study was undertaken with a view to study the genetic behavior of growth as well as weight gain traits during pre weaning growth periods in Hampshire, Duroc and their crosses with indigenous pigs along with the
reproductive traits in order to explore the possibility of its utilization for assessing the changes that may come about due to planned breeding in the process of evolving new breeds or strains. The following were the objectives under this investigation.

1. To study the productive and reproductive performances of Hampshire, Duroc and their crosses with indigenous pigs.
2. To characterize the growth hormone gene and growth hormone releasing hormone gene of Hampshire, Duroc and their crosses with indigenous pigs.
3. To study the seasonal effect on farrowing performance.