CHAPTER - I

INTRODUCTION
India has the unique distinction of being the only country in the world producing all four varieties of natural silk, namely, mulberry, tasar, eri and muga on a commercial scale. India is presently the second largest silk producer in the world. North-eastern states are the only region in the world where all four types of silk are produced. Of these muga silk is an exclusive prerogative of North-east. More than ninety percent of the muga silk is produced in Assam alone. The famed and fabulous golden yellow muga silk is a unique possession and pride of Assam. Muga silk occupies a prominent position in the history and cultural heritage of Assamese people. Muga silk worm rearing, reeling and weaving of muga silk play a vital role in the economy of rural Assam.

The muga silk industry has been appropriately described as an 'Industry of the poor' and the muga silk 'The queen of fabrics'. Muga culture is an important cottage industry in the Brahmaputra valley engaging more than 20,000 families, who earn their livelihood from it either directly or indirectly. All the members of a family can engage themselves in muga culture. With the introduction of improved technology there is every hope that the muga industry will flourish and compete successfully with other silk in near future.

Muga silk is produced by *Antheraea assama* (Westwood) which is an endemic species prevalent in the Brahmaputra valley and adjoining hills. The most important muga cocoon growing areas are
North Lakhimpur, Dibrugarh and Sibasagar districts of Assam. It is also grown in the foothills of East Garo hills of Meghalaya, Cachar district of Assam, Arunachal Pradesh and South Tripura.

The commercial centre of muga reeling and weaving is Sualkuchi in Kamrup district of lower Assam, where almost 80% of total muga cocoon produced in Assam are reeled. In Kautilya's "Arthashastra" the name of Sualkuchi (then Subornakudya) was mentioned (Duarah et al. 1988). The name of this place in "Arthashastra" indicates that the weaving of muga fabric was in practice since 300 B.C.

The origin and development of muga culture is lost in antiquity. The first official record of muga silk and muga silk worm dates back to 1662, when the famous European traveller Jean Joseph Tavernier made special mention of a silk worm variety from Assam that remained on trees and the brilliant golden yellow fabric made out of them (Choudhury, 1982; Thangavelu et al. 1988). During the reign of the Ahoms, the royal families patronised the muga silk industry of Assam. Silk worm rearing, silk reeling and weaving were a daily core in the household of ancient Assam. Muga culture declined during British raj as the rulers did not give much interest in this industry. However, after India gained freedom, Government of India have initiated several developmental measures through Central Silk Board to give impetus to the growth and development of muga silk industry.
Muga silk worm is polyphagous, semi-domesticated and multivoltine in nature having five to six generations in a year. In accordance with the Assamese calendars, the different generations are listed in table 1.1 (Thangavelu et al. 1988).

**Table 1.1**

**Different generations of muga pupae**

<table>
<thead>
<tr>
<th>SL No</th>
<th>Assamese name</th>
<th>Season</th>
<th>Month</th>
<th>Type of Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jethua</td>
<td>Spring</td>
<td>May-June</td>
<td>Commercial crop</td>
</tr>
<tr>
<td>2</td>
<td>Aherua</td>
<td>Summer</td>
<td>June-July</td>
<td>Seed crop</td>
</tr>
<tr>
<td>3</td>
<td>Bhodia</td>
<td>Late summer</td>
<td>August-September</td>
<td>Seed crop</td>
</tr>
<tr>
<td>4</td>
<td>Katia</td>
<td>Autumn</td>
<td>October - November</td>
<td>Main commercial crop</td>
</tr>
<tr>
<td>5</td>
<td>Jarua</td>
<td>Winter</td>
<td>December - February</td>
<td>Seed crop</td>
</tr>
<tr>
<td>6</td>
<td>Chotia</td>
<td>Early Spring</td>
<td>March-April</td>
<td>Seed crop</td>
</tr>
</tbody>
</table>

These generations often overlap. Katia and Jethua varieties having reelability of 54% and 48% (Sengupta and Ghose, 1991) are the commercial crops for producing reeling cocoon. In Sualkuchi, an overlapping variety, Bohagi, is also used for reeling. Bhodia and Jarua are the two main seed crops. The other generations are used for stock maintenance and seed multiplication purposes.
In order to sustain the age old muga culture, the government of Assam has initiated certain developmental measures with support from North Eastern Council and Central Silk Board. Department of Sericulture, Government of Assam has set up a cold storage at Khanapara near Guwahati. A number of muga seed farms have been established for producing seed cocoons and supply them to the rearers. In order to increase the area under muga food plantation, muga nursery and multiplication centres have been set up. As a result the area under muga plantation increased from 1167 ha in 1984-85 to 1958 ha in 1993-94, an increase of 67.8% over a period of eight years. The muga silk production which has shown a decline from 72 tonnes in 1971-72 to 52 tonnes in 1984-85, has increased to 75 tonnes in 1993-94 showing a growth rate 4.4% per year (Statistical Biennial, Central Silk Board).

More than 80 percent of the commercial muga crops, Jethua and Katia, are sold to commercial reelers of Sualkuchi (Choudhury, 1982; Thangavelu et al. 1988). The remaining cocoons are retained either as seed or for domestic reeling. Muga silk reeling involves cocoon stifling, de-gumming and reeling. Stifling involves exposing of cocoons to strong sun-rays or hot air which kill the chrysalis within cocoons without damaging the cocoon shell. Degumming is the process by which the gummy substance in cocoon is softened and the compact filaments are released for reeling. Muga cocoons are boiled in an alkaline solution, called khar or kharoni, for
Plate -1: Muga cocoons are boiled in alkali before reeling

Plate -2: In muga reeling children of reeler family are involved
Plate -3: During reeling threads about 7 cocoons are glued to form thread for weaving

Plate -4: Reeling of muga from cocoon
Plate -5: Products of muga industry A- Muga cocoon, B- Muga waste pupae, C- Reeled thread and D- Silk waste.

Plate -6: Dried muga waste pupae
about 15 to 30 minutes, depending on the strength of the solution and quality of cocoons. For this purpose alkaline ashes from certain leaves, woods or straw were being used. However, now a days reelers of Sualkuchi use soda i.e. sodium carbonate solution for degumming of cocoons. Almost the entire commercial reeling of muga silk is carried out in a primitive machine called ‘Bhir’. At the time of reeling, the muga cocoons are taken in lukewarm water in a basin, kept over a low fire. Muga silk reeling is a slow laborious process and the reelability is also very low.

After reeling the thread, inner pupae are thrown away as waste, a small fraction of which is used directly as feed for ducks and poultry. This results in not only the wastage of a potential resource but also creates environmental pollution and health hazard due to rapid putrefaction and degradation of waste pupae as during the reeling operation the pupae come in contact with alkali solution.

The average amount of waste muga pupae available at Sualkuchi is about 650 kg in dry weight per day. The proper utilization of this huge bio-waste will not only help the families engaged in muga reeling financially but will also solve the problem of environmental pollution arising out of the disposal of the waste.

Several attempts have been made to utilize the waste pupae of mulberry silk worm, Bombyx mori L. (Mathur et al. 1988 and Bose et al. 1989) and tasar silk worm, Antheraea mylitta D. (Sinha, 1985,
Begum et al. 1994, Nandeesha et al. 1989, 1990). Jayaram and Shetty (1980) had studied the growth rate of major carps fingerlings fed on silk worm pupae of *Bombyx mori* L. and found that pupae meal was as efficient as control diet containing fish meal. It has been recorded that mulberry waste pupae and tasar waste pupae contain high percentage of protein, total lipid and essential amino acids (Bose and Mazumder, 1990). It is a well known fact that in India there is a shortfall of protein components of feed for rearable animals like fish, poultry etc. According to the estimate of National Commission of Agriculture, there is a shortfall of 40-44 percent protein feed components of culturable species. Therefore it is essential to find some alternative source of protein to overcome this problem.

Although a vast quantity of waste muga pupae is available at Sualkuchi, no systematic and scientific approach has been made to utilize this natural resource. The present study is designed to evaluate the availability of waste muga pupae, determination of their biochemical composition and possibility of their utilization as protein substitute in poultry ration.

A. SURVEY

To boost up the muga silk industry to a viable level, it is essential to study the socio-economic condition of the reelers and weavers, who will be directly benefited by the utilization of waste muga pupae. Since more than 80% of the total commercial muga
cocoons produced in Assam are reeled and weaved in Sualkuchi so it is necessary to have a detailed information regarding socio-economic condition of those engaged in commercial reeling and weaving of muga silk. Durarah et al. (1988) made a case history of Sualkuchi reelers and weavers. Deka and Lahkar (1990) studied the socio economic condition of rearers of North Lakhimpur. However no comprehensive statistics regarding socio-economic conditions of muga reelers and weavers is available to date. The present survey has been conducted at Sualkuchi to determine the quantum of availability of waste muga silk worm pupae, number of person and family engaged in muga reeling and weaving as well as the economic condition of reelers and weavers.

B. BIOCHEMICAL ANALYSIS

For proper utilization of the waste muga silk worm pupae it is necessary to have a detailed knowledge of its biochemical composition. Several workers (Sinha, 1985; Bose and Mazumder, 1990; Majhi et al., 1991) evaluated the chemical composition of waste pupae of tasar (Antheraea mylitta D.) and mulberry (Bombyx mori L.). Various workers have reported that silk waste pupae contains glycogen, crude protein, soluble protein, amino acids and some micronutrients (Kilbey, 1963; Alikunhi, 1966; Choudhury, 1982; Sinha, 1985; Choudhury et al.1992). Although waste muga silk worm pupae are available in a large quantity at Sualkuchi but no information regarding its biochemical composition is available. The present
investigation was conducted to evaluate some of the chemical components of the waste muga pupae so as to utilize this bio-waste for commercial purpose. Biochemical components in terms of moisture and ash contents, crude fibre, crude protein, soluble protein, glycogen, total lipid, total free amino acids and minerals like iron, phosphorus and calcium have been determined by standard methods. Most of these components have been determined in three varieties of waste muga silk worm pupae, namely, Jethua, Katia and Bohagi.

Lipids extracted from silk waste pupae is of animal origin. Extraction of lipids from waste silk worm pupae by using different solvents like petroleum ether and n-hexane has been tried by Sinha (1985). Bose and Mazumder (1990) tried various solvents for the extraction of lipids from pupae by both hot and cold extraction processes. Bose and Mazumder (1990) characterized the lipid extracted from pupae of *Bombyx mori* L. Goel *et al.* (1988) studied the lipid contents in the moths of tasar silkworm, *Antheraea mylitta* D.

Fats and oils, collectively termed as lipids, are in great demand for food and non-food use. In 1985 total worldwide production of fats and oils of vegetable origin was 44.6 million tonne and those of animal origin was 19.2 million tonne (Mielke, 1988). Most of these materials (around 80%) are used for human food and a further 6% are used for animal to produce yet more human food. The remaining 14% serves as source material for the oleochemical industries. About 90% of this is used in the production of soap and other surface active
substances, and the balance is used for other purposes (Gunstone, 1996).

The main source of lipids of animal origin are butter and fat from cow’s milk, lard from pig, tallow from cattle and sheep, and fish oil. These animal fats contain low but significant levels of acids with an odd number of carbon atoms, with branched chains, and with traces of unsaturation. Compared with vegetable oils these animal fats are rich in cholesterol. Fish oils are the best sources of long chain polyunsaturated acids (Padley, 1994). The protein rich meal remaining after the extraction of fish oil is used for animal feed.

The present study includes the extraction of lipids from muga silk worm by soxhlet extraction using different solvents like petroleum ether, n-hexane and methanol-chloroform mixture (2:1 V/V). Lipid extraction was also done by refluxing with petroleum ether using magnetic stirrer. The total lipid content was determined gravimetrically using method of Folch et al., (1957). For characterizing the lipid of waste muga pupae a few lipid parameters viz., iodine value, saponification value and acid value were also determined.
C. UTILIZATION OF WASTE MUGA SILKWORM PUPAE AS PROTEIN COMPONENT IN BROILER RATION

In India broiler has emerged as the fastest growing segment of poultry industry. Broiler production is an attractive enterprise because of the flexibility of operations. It provides an opportunity of producing animal protein within two months from the date the chicks hatch out. Thus a farmer can raise 5 to 6 crops of broiler in a year.

According to FAO, in the livestock sector of the developing countries the outputs of bovine, goat and sheep meat grew by hardly 3% per year between 1970 to 1980, pork output increased by about 5%, whereas poultry meat increased by as much as 8.5%. Average per capita consumption of both egg (25 numbers per year) and poultry meat (170 g per year) have almost been doubled. Even these figures are too low when compared to developed countries (Devegowda, 1986). Keeping pace with human population growth it is essential to increase the poultry production to reach at least 50% of the international recommendations of per capita consumption of eggs and meat. It has been reported that meat, milk and eggs are the three major livestock products contributing about 1/6th of the calories and 1/3rd of the protein in the per capita food supplies in the world. The per capita consumption of meat in India is 14 g per day as against an optimum of 34 g per day as recommended by the ICMR (Salvi, 1987). In the words of Dr. M.S. Swaminathan, father of India’s green revolution,
"Achievement in poultry is comparable to the advances made in wheat revolution" (Rao, 1982). This rapid growth was possible due to many factors — widespread adoption of modern methods of poultry farming, availability of inputs, quick, assured and better returns from poultry when compared with other forms of agricultural production, the widespread acceptance of potential value of poultry in a social role in helping to overcome poverty and malnutrition, and at least, but not least, the entry of private entrepreneurs who literally built paths to the doors of prospective poultry farmers and spread the word about the returns to be had from poultry farming (Rao, 1982).

Inspite of all these encouraging information on profitable poultry farming, a major drawback has been the expenditure involved towards meeting the feed costs, which may be as high as 60-75% of the total costs. Hence a poultry farmer requires not only an efficient and quality food but also one which is economical. The feed going into production of broilers is in the form of by-products and cereals not directly consumed by the people and these poor quality plant proteins are converted into higher quality animal proteins. Broilers convert large amounts of waste products into high quality human food and they are the most efficient converters of feed into food. So a poultry ration should be formulated in such a way as to ensure balanced quantities of nutrients namely protein, energy, fats, minerals and vitamins. Energy and protein are the two major nutrients which cost anywhere between 80 per cent and 90 per cent of the total value of layer’s and broiler’s diets. In each case, the lowest energy level
used resulted in the lowest feed cost per kilogram of live or dressed bird. Since birds primarily eat to fulfill an energy requirement, if energy level of the diet increases, the birds will eat less and do a better job of converting feed to meat. Along with this the protein level of diet also must be increased and proper protein intake is to be maintained.

Proper broiler ration can be derived by the application of the nutritional information which requires knowledge of the nutrients, the feed stuff available to supply these nutrients and the amount of nutrients needed for the production proper protein and amino acid requirements for young growing chicks. Deficiency of either will reduce their growth rate. A fixed amount of total dietary protein and essential amino acids is needed to support a given rate of growth (Nesheim et al. 1979). As the broilers grow, they require increasing amount of energy and protein. However as the broiler grows less protein is required per unit of energy in the diet. Scot et al. (1976) has given recommended values of metabolizable energy (kcal / kg) and protein content (%) in the starter and finisher ration (Table 1.2).
Table 1.2
ME and protein requirements in starter and finisher broiler ration

<table>
<thead>
<tr>
<th>Starter ration</th>
<th>Finisher ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME (kcal / kg)</td>
<td>Protein (%)</td>
</tr>
<tr>
<td>2750</td>
<td>20.8</td>
</tr>
<tr>
<td>2860</td>
<td>21.7</td>
</tr>
<tr>
<td>2970</td>
<td>22.5</td>
</tr>
<tr>
<td>3080</td>
<td>23.3</td>
</tr>
<tr>
<td>3190</td>
<td>24.2</td>
</tr>
<tr>
<td>3300</td>
<td>25.0</td>
</tr>
</tbody>
</table>

On the basis of studies on protein and energy level in broiler ration ARC (1975), NRC (1977) and ISI (1979) have recommended varying protein levels in the diets based on the energy levels in them so that the calorie : protein (C:P) ratio will be maintained more or less constants at each phase of feeding (Table 1.3).
Table 1.3:
Recommended crude protein (CP %), calorie: protein (C:P) ratio and ME level for two to three phase feeding of broiler

<table>
<thead>
<tr>
<th>Reference</th>
<th>Phase</th>
<th>Age (Weeks)</th>
<th>ME (kcal/kg)</th>
<th>CP (%)</th>
<th>C:P ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC (1975)</td>
<td>1</td>
<td>0-4</td>
<td>3100</td>
<td>18.8</td>
<td>165</td>
</tr>
<tr>
<td>ARC (1975)</td>
<td>2</td>
<td>5-8</td>
<td>3100</td>
<td>15.6</td>
<td>199</td>
</tr>
<tr>
<td>NRC (1977)</td>
<td>1</td>
<td>0-3</td>
<td>3200</td>
<td>23.0</td>
<td>139</td>
</tr>
<tr>
<td>NRC (1977)</td>
<td>2</td>
<td>4-6</td>
<td>3200</td>
<td>20.0</td>
<td>160</td>
</tr>
<tr>
<td>NRC (1977)</td>
<td>3</td>
<td>7-9</td>
<td>3200</td>
<td>18.0</td>
<td>178</td>
</tr>
<tr>
<td>ISI (1979)</td>
<td>1</td>
<td>0-4</td>
<td>2900</td>
<td>22.0</td>
<td>132</td>
</tr>
<tr>
<td>ISI (1979)</td>
<td>2</td>
<td>5-8</td>
<td>3000</td>
<td>19.0</td>
<td>158</td>
</tr>
</tbody>
</table>

ISI (1979) has suggested lower energy levels in broiler diets than ARC (1975) and NRC (1977). This is because the ISI has recommended it for use in India where environmental temperature is higher compared to UK and USA. In the present study the ISI recommended feed is used to grow broilers.

Protein and energy components of poultry diets contribute between 80 and 90% of the total value of broiler diets. High protein ingredients are more expensive than low protein ingredients. In
general, protein tends to be more limiting in poultry diets than is energy. Therefore, the protein and amino acid requirements of the bird become a critical factor in feed formulation.

A mixture of vegetable protein and animal protein is used in the broiler ration to have the proper quality of the protein component of the ration. Soya bean meal is the primary source of vegetable protein for poultry in a large part of the world. Other high protein feed stuff are often compared to soya bean meal on a price per unit (kilogram) of protein. Soya bean meal contributes 50 to 75 % of the total protein in broiler diet (Potter, 1986). Similar to soya bean for vegetable protein the primary source of animal protein for poultry ration in India is fish meal (FM).

Very often the fish meal is found to be of inferior quality containing only 25-27% crude protein (CP). Moreover high cost of transportation from the coastal regions makes the poultry ration costlier in Assam and other North-eastern states compared to other parts of the country, which affects the broiler rearing industry of this region.

Joshi et al. (1979), Virk et al. (1980), Fagoonee (1983) and Narahari et al. (1990) have reported the utilization of silk worm pupae meal (SWPM) in poultry ration. But report on muga silk worm pupae meal as ingredient in poultry ration is very scanty. Bora and Sharma (1965) made a preliminary investigation on the effect of waste muga
silk worm pupae meal (MSWPM) on the growth of Leghorn chicks. Das and Saikia (1972) also used waste muga pupae as feed component of poultry ration in the growth of White Leghorn chicks. It is also reported that waste muga pupae could be utilized as effective protein supplement of fish feed (Choudhury et al. 1995) and poultry ration (Sengupta et al. 1995).

The analysis of waste muga pupae has revealed the presence of high percentage of protein and a number of essential amino acids (Choudhury et al. 1995). In the present study it was thought worthwhile to utilize both raw muga waste pupae and de-oiled muga waste pupae as a replacement of fish meal in broiler ration.

Use of antibiotics and probiotics in broiler ration

The productivity and deficiency of feed utilization of broiler ration can be achieved by utilizing various feed additives like antibiotics, probiotics, enzymes, antifungals etc.

Antibiotic feed supplements have been widely used throughout the world for nearly five decades. The term antibiotic means against life or destructive for life. An antibiotic is a metabolic product of living organism which inhibits the growth of another organism. Realization that the antibiotics would stimulate the growth rate of chicks and young pigs fed with diet containing only vegetable proteins have come largely from the reports of Stokstad and Jukes (1949).
Stokstad and Jukes (1950) demonstrated that pure chlorotetracycline was responsible for growth stimulation.

Antibiotics are drugs and not nutrients. The specific method by which antibiotics exert the influence on growth has not fully been explained, although several theories have been proposed, each of which seems to fit some of the facts, but not all of them. Antibiotics have been shown to have a number of specific beneficial effect on growing animals. On some diets they spare nutrients either by reducing the bacterial destruction of vitamin and amino acids by favouring bacteria that synthesize essential nutrients, or by reducing the competition of intestinal microflora of host animal.

Another mode of action as proposed by Visek (1969) in the ‘inhibition of toxin producing bacteria’. Ammonia is highly toxic and since its level in the portal blood of both germ free and antibiotic fed animals is much lower than in conventional animal, it is proposed that antibiotics depress bacterial urease production.

Forbes and Park (1959) put forward ‘disease level’ theory using germ free chicks. On antibiotic corn-soya bean meal diet, the chicks hatched and reared in the absence of bacteria and fungi grew 18 to 25 percent faster than other chicks from the same batch and reared in the same condition and management.
Watson (1975) has shown that antibiotics cause lesions in the cell wall, making bacteria more susceptible to natural defence mechanism of the body and to other therapeutic agents.

Sanford and Mathur (1965) conducted a series of experiment with erythromycin, zinc bacitracin and tylosin on broilers for 8 weeks and observed that combinations of zinc bacitracin and tylosin were superior in growth promotion to any other supplement used in these experiments.

Potter et al. (1971) observed that antibiotics are effective in increasing body weight and feed efficiencies under certain conditions. Olson et al. (1972) reported that addition of zinc bacitracin in the broiler ration resulted in the improvement in weight gain and feed efficiency. Stutz et al. (1983) conducted an experiment to demonstrate the activity of bacitracin as growth permittant for poultry. Sreenivasiah et al. (1986) observed that mean weight gain during 6 to 8 weeks of age in broiler chicks was significantly higher as compared to control when zinc bacitracin was used in the diet.

Waldroup et al. (1990) conducted nine trials on the response of broiler chickens to combinations of zinc bacitracin and roxarsone. They found that zinc bacitracin at the rate of 55 mg per kg significantly improved growth rate and feed utilization.
Khire et al. (1992) observed that the diet supplemented with 300 g zinc bacitracin per tonne has pronounced effect in the growth rate of broiler.

In recent years application of probiotics, instead of antibiotics, in feed as growth promoter is gaining popularity. Indiscriminate use of antibiotics will lead to drug resistant strains of various bacteria. So use of probiotics is gaining some popularity in the process of limiting the use of antibiotics in feed to promote increased weight gain and feed efficiency in poultry.

Probiotics are referred to as live microbial feed supplement which beneficially affect the host animals by improving its intestinal balance (House and Sozzi, 1991). They defined probiotics as ‘cultures of living organism which are able to proliferate in host’s intestinal tract resulting in a balanced microflora.’ Practically the probiotics include only microbial culture suspensions and crude microbial products.

*Lactobacilli* are generally used as a probiotic bacteria. These probiotics being mostly *Bacillus* group, are spore forming which will withstand high and low temperatures, pH variation etc. Probiotics help in release of enzymes and synthesis of vitamins, and also release some metabolites which possess anti-microbial effects.
Tortuero (1973) while investigating the syndrome of malabsorption of fat in chicks observed that feeding *L. acidophilus* culture in broiler and Leghorn chicks improved weight gain, feed efficiency and marginally fat digestibility. The effect of supplementation of broiler diets with *Lactobacillus* species and / or yeast cultures was studied by Burkitt *et al.* (1977) and observed a beneficial effect in growth on yeast addition and an additive effect in the presence of both, resulting in greater pigmentation and fat deposition. Dilwarth and Day (1978) while feeding probiotics at 6 levels ranging from 0 to 0.75 per cent observed significant improvement in growth and feed efficiency in broilers.

However, Buenrostro and Kratzer (1983) found that broiler growth in battery brooders and fed on a diet containing a *Lactobacillus* culture did not perform well as compared to the controlled birds or those fed on antibiotics. The same authors also reported that there was no improvement in the performance of broiler when probiotics were included in the drinking water.

On the other hand Devegowda *et al.* (1987) claimed that UCAL, a water soluble probiotic preparation had helped in improving the weight gain significantly. Doragerendai and Tiborgipperi (1988) also reported the increase in the body mass of broiler fed on probiotic supplemented feed. Sharma (1988) tested the probiotic 'Farmore' on broilers and reported the weight gain in broiler. Sissins (1988) has
reported a significant improvement of 13.09 percent in live weight gain and 9.82 percent in feed efficiency.

Buche et al. (1992) tested two levels of probiotic 0.02% and 0.04% for 8 weeks and concluded that inclusion of lower level (0.02%) probiotic (*Lactobacillus* spore powder) was beneficial for broiler production. Moses (1992) reported that broiler chicks fed with probiotics up to 7th week gained significantly in body weight than the control.

Dhande et al. (1993) reported that broiler receiving 0.02 to 0.05 percent probiotic in their feed grew faster and gained body weight.

However report of Baidya et al. (1994) does not show encouraging result for probiotic. Results of their experiment on the performance of broiler on feeding probiotic containing diet showed that body weight gain, feed intake and feed efficiency ratio did not differ significantly. The final body weight in control and probiotic groups were 1261.47 g and 1288.51 g respectively. Similarly Mandal et al. (1994) while evaluating the efficiency in different growth promoters including probiotic on the performance of broiler reared for 8 weeks did not find any significant differences among the various treatments.

On the other hand, Kukreja (1995) observed that addition of probiotic in feed resulted in significant increase in body weight and
improved feed conversion ratio compared to the control group. The most striking feature of this study was a considerable reduction in mortality in the *Lactosacc* treated group. Pradhan *et al.* (1995) conducted an experiment on Vancob broiler chick fed with three different commercial probiotics and observed good growth response over the control.

As muga waste pupae can be used as a substitute of fish meal in broiler ration it is thought worthwhile to test the stimulating effect of antibiotic and probiotic on broiler ration containing MSWPM as animal protein supplement. The present study was designed to investigate the stimulating effect of antibiotic and probiotic on the growth, feed efficiency, protein efficiency and food economy of broiler ration using MSWPM as protein supplement.