INTRODUCTION

Silk is a very unique fabric, and a luxury product, signifies liberty, life, sensuality, pleasure, tenderness, warmth, purity, serenity nature and universalism. Silk is queen of textile and natural protein fibers comprising sericin and fibron used for weaving of fibers. India stands at a unique place for producing all commercially valued natural silk viz. Mulberry, Tropical Tasar, Temperate Tasar (Oak Tasar), Eri and Muga. All these five types of commercially important silks are obtained from different species of silkworms which feeds on different of food plants.

Temperate (Oak) tasar silk is produced by silkworm (*Antheraea proylei* **Jolly.)** in India and (*Antheraea pernyi* **Guerin**-**Meneville**) in China which feed on the leaves of various oak leaves. In India, Oak tasar culture, is a new culture; it is produced in Jammu and Kashmir, Himachal Pradesh, Uttarakhand in North -West and Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram and Nagaland in North -Eastern sub-Himalayan Oak belt.

Antheraea proylei **Jolly.** temperate tasar silkworm feeds on *Quercus serrata, Quercus acutissima*, *Quercus griffithii*, *Lithocarpus dealbata* in North-Eastern Himalayas and *Quercus glauca*, *Q. leucotrichophora*, *Q.floribunda* and *Q.semecarpifolia* in North–Western Himalayan. Leaf of *Quercus serrata* is used for Oak tasar (temperate tasar) silkworm rearing and is considered to be the primary host plant in North- Eastern Indian states.

Table 1. Distribution and acreage of Oak species used as host plants of *A.proylei* in India.

Sl no.	States	Area under exploitable (Hac)	Exploitable OakArea (Hac)	Exploitable species of Oak tasar rearing
1	Arunachal Pradesh	12,25,000	5,000	*Quercus griffithii* 900-1800 mASL
2	Assam	24,000	2,000	*Q.serrata* 600-1200 mASL *Q.acutissima* 600-1200 mASL *Lithocarpus dealbata* 600-750 mASL
3	Manipur	40000	20000	*Q.serrata* 600-1800 mASL *Q.acutissima* 600-1800 mASL *Q.griffithii* 900-1800 mASL *Q.semiserrata* 600-900 mASL *Lithocarpus dealbata* 600-750 mASL
4	Meghalaya	23,000	500	*Q.serrata* 600-1800 mASL *L.dealbata* 600-750 mASL
5	Mizoram	15,000	5000	*Q.serrata* 600-1800 mASL *Q.acutissima* 600-1800 mASL *Q.griffithii* 900-1800 mASL
6	Nagaland	15,000 -20,000	5,000	*Q.serrata* 600-1800 mASL *Q.acutissima* 600-1800 mASL *Q.griffithii* 900-1800 mASL *Q.semiserrata* 600-900 mASL *L.dealdata* 600-750 mASL
7	Jammu and Kashmir	55,000		*Q. leucotrichophora* 1200-2000 mASL *Q.floribunda* 2100-2700 mASL *Q.semecarpifolia* 2000-3500 mASL
8	Uttara-Khand	3,05,000	500	*Q.glance* 1200-1600 mASL *Q.leucotrichophora* 1200-2000 mASL *Q.floribunda* 1900-2200 mASL *Q.semecarpifolia* 2000-3500 mASL
9	Himachal Pradesh	1,39,500	3,000	*Q.leucotrichophora* 1200-1600 mASL *Q.semecarpiflolia* 2000-3500 mASL

Source: Technical Bulletin of Regional Tasar Research Station, Central Silk Board, Ministry of Textiles, Government of India, 2007-2008.

Table 2: State-wise Oak tasar raw silk production in India (MetricTone).

Year State	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-2014	2014-15
Arunachal Pradesh	0.03	0.1	0.1	0.1	0.34	-	-	-
Manipur	3.00	3.00	3.5	2.0	2.45	2.80	4.00	4.00
Mizoram	0.02	0.10	0.02	0.40	0.93	0.72	0.70	0.02
Nagaland	0.16	0.50	0.50	0.30	0.06	0.21	0.21	0.10
Jammu and Kashmir	0.01	0.50	0.10	-	-	-	-	0.02
Uttarakhand	0.50	0.50	0.10	-	-	-	0.10	0.02
Total(MT)	3.71	4.21	5.30	3.00	3.78	3.73	5.00	4.14

Source**:** Regional Tasar Research Station; Central Silk Board Ministry of Textile Govt. of India.

In Assam 24,000 hectares area are under Oak flora and exploitable area 2,000 hectares, in Karbialong and Dima Hasao District. The Oak tasar silkworm rearing conducted during March-April as Spring crop and September-October as Autumn crop.

In the year 1969 crossing between *Antheraea pernyi* from China and its male counter *Antheraea roylei* of Indian wild silk moth gave birth to fertile hybrid *Antheraea proylei* **Jolly.** The commercial rearing of silkworm *A.proylei* was established in 1973-74 in India. *Antheraea proylei* is the source of Indian Oak tasar silk, a rough, course and nubby silk usually with natural shade of beige. Origin of the Oak-based tasar silk production is documented in China at least to the Han Dynasty (206 BC–AD220). Since then, this culture is so far the exclusive monopoly of the People Republic of China. The rearing of silkworm has been rationalized and year old occupation by the Chinese people. Oak tasar industry is a new culture in India. Dr M.S. Jolly was then Director of Central Tasar Research and Training Institute, Ranchi had been awarded Central Silk Board's prestigious "Seth Baldeodas Shah" award in recognition for the discovery of a hybrid *Antheraea proylei* and development of the new field of tasar culture on Oaks in Manipur, and afterwards in other states of North East India. This activity is a kind of livelihood and provides gainful employment to several communities in rural areas in North Western and North- Eastern Himalayans states of India especially weaker section of the society, which will be help for the economic upliftment of hilly people.

More than 90-95% of Oak tasar silk and seed production is generated from the Spring crop. The seed cocoons are obtained from the rearing of Spring crop rearing is preserved for at least 8 months (May to January next year) in semi dark seed cocoons preservation halls under properly ventilated condition. During the long period preservation of seed cocoons high loss of silk moth biomass is observed. To sustain the production and also to make a profitable venture second crop (Autumn crop) rearing is indispensable for sericulturist.

The Oak tasar silkworm rearing is carried out with the dfls (Disease free layings) prepared from erratically emerged mother moths or by inducing photoperiodic treatment of the silk cocoons. *Antheraea proylei* being weak voltinism, the diapausing behaviour is easily broken by fluctuating meteorological factors and observed loss of more than 20-30% during seed cocoon preservation due to stray emergence of mother moths. Loss is also contributed due to pupal mortality during the long period of seed cocoon preservation. To compensate the loss and also to meet the demand of seed requirement for commercial/seed crop rearing of first crop (Spring crop) during the next crop. So it is very much important to conduct second crop rearing during Autumn season. The second crop rearing is conducted on the plantations where Spring crop rearing was not done, and light pruning/clipping were done for sprouting of new foliages. Due to minimized stray emergence of moths during the seed cocoon preservation from Autumn to next Spring crop. During the period pupal mortality is low due to short period of seed cocoons preservation. The performance of Autumn to Spring season preservation with respect to grainage behaviour such as emergence, coupling, fecundity and cocoon dfls ratio are better than Spring to Spring preservation lot.

For every terrestrial ecosystem fungi are most important ecosystem for the success and health and very must essential to the sustainability of biodiversity. Fungi are present everywhere and colonize, multiply and survive habitats performing a wide variety of various activities and play a very important role in nutrient cycling and plant health development (Bridge and Spooner, 2001, Thorn, 1997). Some of fungi are known to cause of plant diseases others are known to antagonize plant pathogens, decompose plant residues, provide nutrient to plants and stimulate plant growth. Approximates 1.5 million fungal species are present on the earth of which only about 70,000 have been described till-date (Hawksworth and Rossman, 1997). The number of fungi recorded in India about 27,000 species, the largest biotic community after insects (Sarbhoy *et al.*, 1996).It is become gradually evident that a good number of fungi do not exist in nature individually, but numbers of micro-organisms are present in the rhizosphere, rhizoplane, phyllosphere, phylloplane and in other habitants in the host or in close proximity of the host.

The term “Rhizosphere” was introduced in (1904) by the L. Hiltner, (Campbell and Greaves, 1990) to denote that region of the soil which is subject to the influence of the plant root. The word rhizosphere is derived from the Greek word “rhiza” meaning root and shere meaning field of influence, rhizosphere effect indicates the overall influence of plant roots on soil micro-organisms. It is now clearly established that Greater of bacteria, fungi and actinomycetes are present in the rhizosphere soil than in non-rhizosphere soil.

The Rhizosphere as the zone of soil immediately adjacent to legume roots that support high levels bacterial activity (Morgan *et al.*, 2005, Egambardiyeva, 2006). According to Rovira (1965) rhizosphere represents a poorly defined zone of the soil with a microbiological gradient in which maximum changes to the microflora, which is occur in soil adjacent to the root and decline with distance away from it. Snell and Dick (1971) considered that rhizosphere as “the region in the vicinity of the root in connection with the mycorrhizae”, (Davennport, 1976).The term has now been broadening to include the volume of soil influenced by the root tissues colonized by micro-organisms (Pinton *et al.,* 2001).

The region of soil surrounding and including the plant root is of crucial and very importance for the plant health and nutrition (Marschner,1995).The rhizosphere is characterized by the increased microbial activity stimulated by the leakage and exudation of organic substances from the root (Graystone *et al.*, 1996). Plant roots exude simple sugars, amino acids, many other compounds in the rhizosphere region which are available for the microorganisms (Campbell 1989; Klein, 1992). The Rhizosphere studies are fascinating and interesting leading to many beneficial consequences though some microbes have harmful effects. The biotic interactions in the rhizosphere are very complex and variable, and the rhizosphere study has got very special attention of microbiologists, molecular biologists and biochemists all over the world.

The relationship between plants micro-organisms are very clearly defined so far as diseases and symbiotic nature are concerned. The interactions between plants and saprophytic rhizosphere organisms are somewhat intricate. The significance of these microorganisms to the plant may range from the competition and amensalism to mutualism depending on the environmental conditions (Trolldenier,1979). Many of the micro organisms of the root zone are probably harmless commensals without any significance for the plant. The plant rhizosphere is a very dynamic environment in which many other factors may be affect the structure and species composition of the microbial communities that colonize the roots (Yang and Crowley, 2000). The Microbial communities treated with the rhizosphere vary depending on the plant species (Graystor *et al.*, 1998), the soil type (Campbell *et al.*, 1997) and cultural practices (Lupwayi *et al*., 1998). The root exudates of the plants have stimulatory effects on the growth and sporulation of different types of micro-organisms, which is help on the development of the phylloplane of the host plant by providing special type of nutrition.

The micro-habitat has been recognized and has been defined as the "rhizoplane or the root surface. The term "rhizoplane" proposed by Clark in 1949, is the external surface of plant roots together with tightly adhering soil particles or debris (Sharma and Sinha, 1974). The rhizoplane is often regarded as a part of the rhizosphere (Alexandar, 1977; Lawrence 2000). As the roots grow they cast off dead cells and navigate around soil particles making the rhizoplane highly irregular. The rhizoplane is the site of water and nutrient uptake which is released of exudates into soil.

Plant parts specially leaves are exposed to dust and air currents resulting in establishment of a typical flora on their surface aid by the cuticle, waves and appendages which help in the anchorage of microorganisms. These microorganisms may die or survive or proliferate on one leaf depending on the extent of influence of the materials in leaf diffusates or exudates. Leaf diffusates or leachates have been analysed for their chemical constituents. The principal nutritive factors are amino acids, glucose, fructose and sucrose. If the catchment areas on the leaves or leaf sheaths are significantly substantial, such specialized habitats may provide niches for nitrogen fixation and secretion of substances capable of promoting the growth of plants (Rao, 2008).

The leaf surface has been term phylloplane and the zone on leave inhabited by microorganisms as phyllosphere and the inhabitants are called epiphytes (Lindow and Brandl, 2003). Epiphytic communities are dynamic and non-uniformly distributed in time and space of leaf surfaces (Thomson *et al.,* 1993; Hirano and Upper, 1991). The term "phyllosphere" was proposed independently by Last (1955) and Ruinen (1961) and subsequently by Dickinson (1965) who used the "Phylloplane" for the study of leaf surface microflora. The phylloplane studies of various plant species attracted the attention of the many different workers (Dickinson 1967, 1971, 1976; Lamb and Brown 1970; Sinha 1971; Mishra and Srivastava 1971b, 1974; Mishra and Tiwari 1976b; Sharma and Mukerjii 1976; Rajkumar and Gupta 1980; Mishra and Dickinson 1981; Breeze and Dix 1981; Cabral 1985; Sahu and Tiwari 1985, 1988; Vardavakis 1988; Adhikari 1990; Thompson *et al.,* 1993; Barua and Bora 1995; Inacio *et al.,* 2002; Osono *et al.,* 2004; Singh and Shukla 2005).

Plant parts, especially leave surface carries a heterogenous population of the microbes which grow, reproduce and multiply on the leaf surface in dynamic equilibrium with the existing micro and macro environment (Devi *et al*., 2003). The leaves constitute a very large microbial habitat, and it is also estimated that, the terrestrial leaf surface area that might be colonized by microbes is about $6.4x10^8$ Km^2 (Morris and Kinkel 2002). The Microbial populations on the leaf surface vary in size and diversity depending on the influence of several biotic and abiotic factors which affect their growth and survival (Bakker *et al*., 2002). These factors include leaf age, external nutrients, the interactions between populations of different micro-organisms (Blakeman 1985), temperature, relative humidity, duration at leaf wetness, light intensity, wind speed and presence of air pollutants and pesticides (Dix and Webster 1995). Due to these factors, the phylloplane microhabitat is in a state of continuous flux (De Jager *et al.*, 2001). The study of qualitative and quantitative composition of epiphytic micro-organisms occurring on the leaf surface as well as the investigation of their activities consist a very important problem concerning the interrelation between plants and microorganisms. The leaf surface is well known to all that to harbor a definite microbial community by virtue of the presence of leachates (Godfrey 1976; Irvine *et al*., 1978). The leaf leachates or exudates which are greatly influence by the quality and quantity of micro-organisms occurring on the leaf surfaces (Tukey 1971; Tyagi and Chauhan 1982). The different microbial populations in such a community interact with one another by competing for the space and nutrients by production of secondary metabolites and also antibiotics (Fokkema 1973; Hudson 1978). This is an important aspect of phylloplane is the production of self inhibitory and self stimulatory compounds as leaf exudates or by the micro-organisms Further, a large number of nitrogen fixing organisms are present on the leaves of plants growing on plants growing on nitrogen deficient soil (Pillai and Sen, 1966).The supplied with moisture from the atmosphere and nutrients in the form of leaf exudates, such organisms may be fix considerable amount of nitrogen. Many workers have studied on this aspect and are try to find out different micro-organisms which might play a very important role in the growth and nitrogen nutrition of the host plants and in turn may be increase the yield of plants (Blasco and Jordon 1976; Remacle 1977; Banarjee and Chandra 1978; Nandi and Sen 1981; 1982; Sadykov 1981; Sengupta *et al*., 1981).

The fungal populations on the leaf surface make a very interesting study. The living leaf can act as a landing stage for fungal spores and other propagules in the air, whether they deposited by gravity, boundary layer exchange, and the impactation or water splash. Once on the leaf, unless they are washed off by rain, they derive benefit by diffusion of nutrients from leaf, and from algae and pollen grains which are present on the leaf surface. When leaves are infested with aphids, the honey dew forms an abundant source of food (Pugh and Buckley 1971). There are two group of phylloplane fungi, they are residents and casuals (Norse, 1972) The resident can multiply on the healthy leaves surface without noticeably affecting the host tissues, whereas the casuals land on the leaf surface but unable to grow (Leben 1965). The occurrence of many fungi on the aerial surface may be directly related to inoculations from the atmosphere, which in turn is related to the production of deciduous propagules elsewhere, to their successful release into the atmosphere and to their survival and dispersal in this environment. The rain may also play a very significant role in dispersal and in some instances fungi may move from plant to plant in splash droplets (Dickinson 1976).

The phylloplane studies have been concerned mostly with pathogens or non-pathogenic fungi of crops or economically important trees (e.g Dickinson 1967, 1973; Pugh and Willams 1968; Mishra and Srivastava 1971b, 1974; Bainbridge and Dickinson 1972; Godfrey 1974; Mishra and Tiwari 1976b; Mishra and Dickinson 1981; Cabral 1985; Vardavakis1988; Carries 1992; Barua and Bora 1995; De Jager *et al*., 2001; Sharma 2004; Singh and Shukla 2005; McGrath and Andrew 2006).

So far as study of the fungal population associated with of *Quercus* sp is concerned, very a little works has been reported so far. Oak plants have an added aspect to it, since, the Oak tasar silkworm *i.e.* temperate tasar (*Antheraea proylei* **Jolly.**) feed on its leaves and, the growth and development of Oak tasar silkworm largely depends on the quality of leaves they feed upon. A few reports on the study of phylloplane of *Quercus* sp may be mentioned. Adhikari and Tiwari (1991) some experimental studies of phylloplane and litter fungi of *Quercus semecarpiflolia.* Gupta and Khuble (1991) studies on decomposition of Oak leaf litter by fungi in the forest of Almora Hills. Such study has not been reported from Umrangso in Dima Hasao District of Assam. Further, a study on both rhizoplane and phylloplane myco-fungi of *Quercus serrata* plants during different Oak tasar silkworm rearing seasons are the lacking *i.e.* on Spring and Autumn season considering the crucial role played by the micro-organisms in nutrient cycling and there by supporting plant growth, as well as the aspect that the Oak tasar silkworm (*Antheraea proylei* **Jolly.**) while feeding on the leaves of *Quercus serrata* probably consume all the micro-organisms and their metabolic by products present on the leaves. The present investigation was undertaken to study the fungal population of the rhizoplane and phylloplane associated with *Quercus serrata* plants during different seasons related to various crop seasons rearing (Spring and Autumn) crop. This study has been carried out to find out, the qualitative and quantitative nature of the fungal population of rhizosphere and phylloplane, An attempt has been made to investigate the fungal population of air and soil during different season in order to find the cyclic pattern of occurrence of fungal population over Oak (*Quercus serrata*) plantation at Umrangso in Dima-Hasao District in Assam, and has also been made to study the co-relation between the performance of the temperate tasar crops, climatic conditions and the micro-fungal association, as some fungi are known to be pathogenic to Oak plants; while others cause disease in Oak tasar silkworm. Study of some microbial secretion of Oak leaves (*Quercus serrata*) has also been estimated through biochemical assay in two different rearing seasons *i.e.* Spring and Autumn crop. It is also made effort to study reeling parameter of Oak tasar cocoons which is very important for Oak tasar industry to generated employment in rural sector.

The present effort has also been made to study the effect of rearing *Antheraea proylei* **Jolly.** its impact on, their growth and development. This may boost up the Oak tasar industry in India by evolved superior breed of Oak tasar silkworm as well as superior varieties of *Quercus serrata*.

The aim of the present investigation is to study of qualitative and quantitative nature of Air, Soil, Rhizosphere and Phylloplane myco-flora with special reference to various Fungi along with their seasonal variation from Oak Tasar food plant and their effects on the growth and development of Oak Tasar silkworm (*Antheraea proylei* **Jolly**.) in Dima Hasao district of Assam for the production of oak tasar raw silk .

- It encompasses the following objectives.
- To isolate and identify different myco-flora from Phylloplane, Rhizosphere, Rhizoplane of soil and Air from oak tasar plantation..
- To study rearing performance of oak tasar silk worm *Antheraea proylei* **Jolly.** in different seasons.
- To study biochemical constituents of *Quercus serrata* leaf in different seasons.
- To study reeling parameter of *Antheraea proylei* **Jolly**. cocoons.