.

Muga silkworm – *Antheraea assama* Ww (lep.): habitat, climate change effects and performance in new climate zones

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Introduction

Muga silk is one of the four natural silk fibres produced and commercially exploited in the world. Produced exclusively in India, muga silk is unique in its fibre properties-strong and durable- with natural golden luster. Known to world from centuries as Royal fabric of North East India, muga silk is produced in limited quantity and production has never matched the demand and is around 100 mt/yr seeing ups and downs. Recent findings on its usage for human scaffoldings in tissue culture and tissue regeneration has added more value and kimonos with muga silk are now preferred. Livelihood activity for more than 30000 poor families at cocoon producing level and more than double of the same for post cocoon activities ,muga silk is produced by one of the least probed insect: Muga silkworm- *ANTHEREA ASSAMA Ww. Lep.)* belongs to family saturnidae and endemic to North Eastern States of India. Mainly produced in Assam the population has been slowly expanded to North Eastern states and Part of West Bengal Unlike other sericigenous insects, efforts to rear and produce muga elsewhere failed to give result. Restricted and localized population, unique genome (n=15) and sensitive nature have all contributed to limited production and recent urbanization, deforestation,pollution and climate changes have all pushed muga silkworm to the danger of declined production and to the very sustenance.

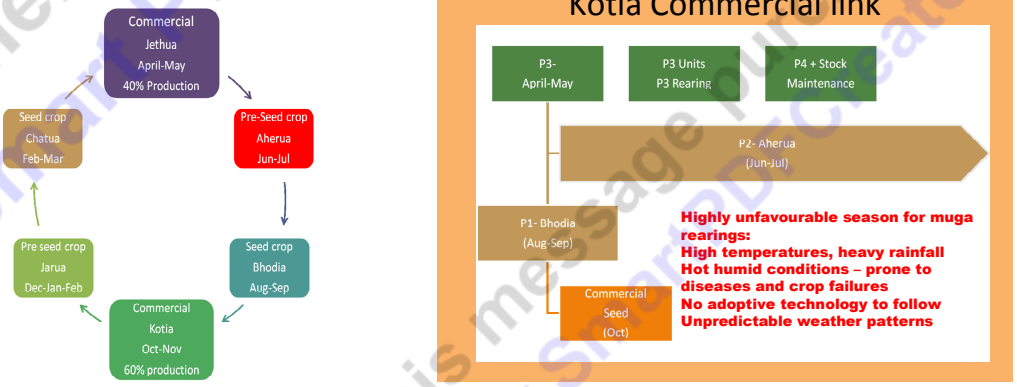
Habitat

Muga silkworm *ANTHEREA ASSAMA*(Ww. Lep.) belongs to family saturnidae and endemic to North Eastern States of India. Polyphagus in nature muga silkworm feeds mainly on two Lauracae plant species:- 'Som';*Persea bombycina* and 'soalu' *Litsea polyantha*. Several secondary and tertiary food plants have been reported but limited success achieved to exploit the same. Typical of any Lepidopteran insect, it passes from egg to larvae, pupa(cocoon) and moth stages (Fig.1) with 45 to 110 days based on season. Even though wild in nature, muga silkworm is highly sensitive and choosy in its sustenance, life cycle and selection for multiplication. Available in wild in Meghalaya and few pockets of Assam in dense forests.As the weather changes , for conducive multiplication, the lower elevations and plain areas are preferred.

Fig.1.Life cycle of Muga silkworm

In a three generation multiplication cycle, two most favourable season:-October (Kotia) and April (Jethua) seasons as commercial cocoon generation is back linked to seed crops (fig.2).

Fig.2 :Year round Multiplication cycle of muga silkworm and summer seed crop



Most vital being the summer seed crops which are crucial and which are now being severely affected due to climate changes in NE region. The results are there to see in reduced muga silk production due to severe shortage of commercial seed and also massive failures in commercial areas .

Climate Change effects

Climate change with global warming effect has been reported and analysed both at International & National forums and visible effects of global warming on biodiversity in North Eastern zone has been welldocumented. Climate change over decades has contributed to global warming as endangered fauna and flora in the one of the hot spots of world.i.e. North Eastern India with highest biodiversity species congregated**.**

Rapid changes in climate happening, the Climate models predict 2.0 to 3.5 C increase in temperature and 250 - 500mm increase in precipitation in the North Eastern region with more threats of crop failures thus on survivability itself of the species. Analysis of climatic changes in key locations testifies the changing environment not conducive for success of muga silkworm lifecycle.

Table 1.
Production of commercial cocoons over years in the distrcit of North Lakimpur,Assam, India **(in crore nos)**

Year	Jetua	Kotia	Total	Potential
2001	5.5	2.3	7.8	54
2002	4.5	2.2	6.7	54
2003	4.6	3.8	8.4	54
2004	5.0	3.9	8.9	54
2005	4.5	3.3	7.8	54
2007	4.3	2.9	7.2	54
2008	4.7	1.6	6.3	54
2009	4.5	1.4	5.9	54
2010	2.7	1.2	3.9	54

Emissions of carbon dioxide, the principal greenhouse gas, from energy use in Asian countries now exceed those from the European Union or **North** America. Three of the top five emitters-China, **India**, and Japan, are Asian countries. (Siddiqi TA).

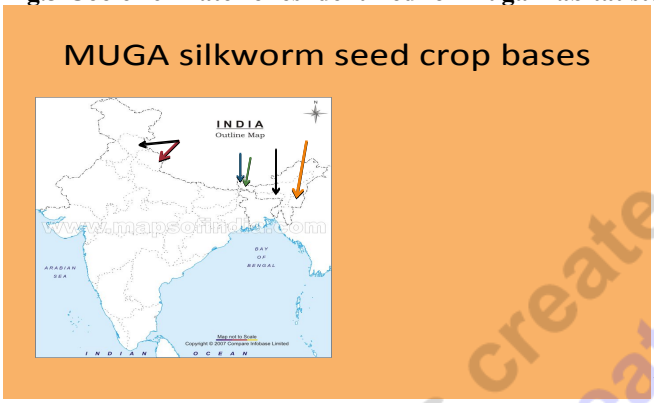
This plus Industrialisation, pollutants from Oil refiniaries has effected the muga cocoon production in commercial hub:- North Lakimpur which has about 9000 farmers.

Even though there is potential for 54 crore cocoons/yr , productivity has never crossed 10 crores and that too is being severely effected from last five years. To reach to 3.9 crores in 2010.Muga seed supply plays a major role in productivity and critical parental seed production in summer months needs to be addressed more seriously.The need for the relocation of seed crops was felt seriously in recent years and Central Silk Board through Muga Silkworm Seed Organisation made new attempts that were relevant in the climate change scenario. Basic Seed production in these cooler zones can provide the much needed link for large scale multiplication

Performance in a new habitat

To overcome the decline in production, efforts were made to identify new areas both with in and outside North Eastern states of India- especially in sub –Himalyan hill ranges with altitude of 1000 to 2500 MASL for season specific favourable conditions focusing on Summer related problems and identified few locations in Meghalaya, Sikkim, Manipur in NE and Kalimpong/ Dargeeling of West Bengal ,Uttarakhand and Himachal Pradesh out side NE states.

Fig.3 Cooler climate zones identified for muga habitat study



Naturally grown food plant pockets located for trail/introductory rearings and plan of action to introduce muga silkworm rearing in completely new habitat done. Performance under predator protected conditions analysed, cocoon and seed quality compared in comparison to original habitat which showed significant improvement in new locations especially in Sikkim, Uttarkhand and Meghalaya pockets. New problems in introduction to new habitat in Uttarkhand and Manipur discussed. A new home in these pockets for declining wild insect population found for relocation in adverse climate conditions to sustained silk production.While □erformance in most of the new zones are linked with various problems, One location i.e. Bageshwar in Uttarakhand is worth mention .

Bageshwar in Uttarakhand is in the foot hills of western Himalayas and just 40 km far away from Pindari glacier with the varied topography of the region occupies a distinct diversified ecosystem. Localized and scattered naturally distributed primary host plants in the region, conducive weather and promising preliminary trials tempted to go in for a large scale trials of muga seed crops in the region during early 2010.

Fig 4:-Temperature and Precipitation in Bageshwer, Uttarnachal,India

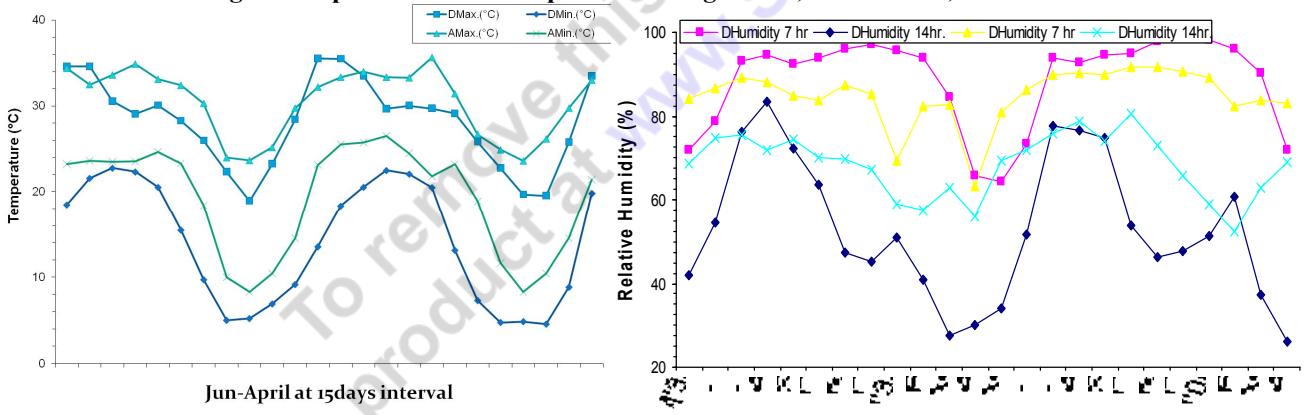


Fig.:5 Natural food plants of 'Som' Persea bombycina in Bageshwer, Uttranchal

Table 2 Performance of Muga crops in Bageshwer, Uttarnchal

	Season	Dfls	Cocoons	Next Gen Dfls	Remarks
1	March,2010	100	500	135	Predators
2	May,2010	500	failed		storms
3	Jun,2010	125	1011	200	
4	Aug,2010	100	2600	500	Standardised practice

The results though not to the boosting, provided the much needed basic seed for north-eastern region which lacked the required favorable conditions for seed crop rearing. The seed produced thus was far superior in qualitative characters over the same produced in traditional seed zones of north-eastern part of India.

Best part of this effort is identification of new locations where muga silkworm can acclimatise and sustain in the changed environment due to global warming effects.A new habitat cabn be awelcome step towards passing most critical and vital Further, based on these vital inputs, suggestions are put forth herewith for establishment of an alternate seed zone for muga with systematic and organized seed production and multiplication plan linked to north-eastern part of India needs for stabilized muga seed supply.

The plan on implementation shall enhance the job opportunity to the people of the region with muga silk production as subsidiary occupation