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Impact of Diseases on the Biochemical Contents of Tropical Tasar Silkworm Antheraea Mylitta D

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Abstract:
The present communication accounts for the biochemical variation in percent ; carbohydrate, protein, lipid, moisture and ash contents in relation to different diseases, viz; sporozoasis, bacteriosis, virosis and mycosis of tropical tasar silkworm Antheraea mylitta. The results obtained are indicative of the fact that the estimated biochemical contents at larval, pupal and adult stages are significantly lesser in diseased tasar silkworms in comparison to control (non diseased), during the seed crop (July - Aug) and commercial crop (Sep - Oct) season. Further the biochemical concentrations are comparatively better in a commercial crop season than the seed crop season. The significant decrease in the percent biochemical contents among the infected stages of tasar silkworm is presumed due to the adverse effects of different pathogens causing different diseases with different mode of actions, since the pathogens have different physio-genetic makeup as they belong to different species with different nature manifestations.

Key words*: Microsporidiosis, Sporozoasis, Bacteriosis, Virosis, Polyhedrosis, Mycosis, Seed crop, commercial crop*

1. Introduction

As a matter of fact the “Queen of Textiles” is constituted of mulberry, non-mulberry and other animal products. Which are known as mulberry, tasar, muga, eri, anaphe, mussel, spider and coan silk. It is interesting that the climatic and environmental condition of India make their homeland of various silk producing insects and food plants. However, India enjoys the unique distinction being the only country in the world which produces all the four important varieties of natural silks, namely mulberry, tasar, eri and muga under domesticated and wild condition on the foliages of host plants during the seed crop and commercial crop seasons.

A distinct belt of humid and dense tropical forest sprawling over the central plateau is the home of tasar. It covers the principal states of Jharkhand, Bihar, M.P., Orissa, Chattisgarh, West Bengal, Assam, fingers of Andhra Pradesh and Karnataka.The famous tasar producing species such as *Antheraea mylitta, Antheraea pernyi, Antheraea roylei, Antheraea frithi* and *Antheraea proylei*.

Indian tasar silkworm, *Antheraea mylitta* D; which is of great commercial interest suffers great loss of crop (70 to 80%) due to diseases like sporozoasis, bacteriosis, virosis and mycosis. The estimated crop loss due to Sporozoasis alone in case of *Antheraea mylitta* is reported to be in the tune of 40% (Sen and Jolly, 1972). The adverse effects of different diseases on the technological characters of different cocoons of tasar silkworm have been studied (Sen et al. 1973; Choudhary etal. 1974; Sharan and Sharma, 1989). The investigations in relation to the relative effect of different pathogens causing different diseases in sericigenous insects have been carried out. The evident biochemical variations in relation to free amino acids among diseased and non diseased tasar silkworm have been reported by Agarwal et. al. (1974). The serious nature of nosema infection causing microsporiodosis (sporozoasis) has been investigated in potato tube worm by Alien and Brunsen (1949). Griyaghey et.al. (1975) has reported that microsporidiosis in *Antheraea mylitta* has assumed a menacing proportion in the major tasar tracts of Bihar, Jharkhand. The disease, which is transovarially transmitted, effects emergence, reproductive potentials, viability and quantitative cocoon character of the tasar insect. He has further mentioned about the thermic control of microsporidiosis up to desired extent. The harmful effects of polyhedrosis caused by viral infection in Alfalafa caterpillar has been extensively worked out by Steinhouse (1948). Likewise, polyhedrosis in the tropical tasar silkworm, A. mylitta is responsible for 20-25% of crop loss (Sharma and Pandey 1990). Sharma and pandey (1990) have further investigated the useful effects of some egg surface sterliants in minimising the polyhedral disease in tasar silkworm. The pathological nature of bacteriosis due to bacterial infection has been carried out in tasar silkworm in relation to deterioration in the quantitative and qualitative characters of tasar (Griyaghey and Gupta, 1978). Pandey (1989) has found significant behavioural and

biochemical differences in relation to diseased and non diseased conditions in indigenous tasar silkworms. It is reported that the bacterial (bacteriosis) and fungal (mycosis) infections retard the growth and development of tasar worms and seriously impairs the tissue resulting in the physiological disturbance. However, biochemical studies in respect of diseases of tasar silkworm are quite fragmentary, as a result a comprehensive picture concerning relative variations in respect of different diseases has not yet emerged.(Griyeghey et al., 1974; Jolly 1974; Ahsan, 1975;Akai, Hiromu 1998; Akai, 2005;Arora, S. 2006;Bhattachrya, 2005;Bhatia, 2010;Chakravorty, 2007; Chaudhury, M. 2008; Dikshit, 2007; Pandey, 1989;Pandey, 2012; Prasad, 2011;Mandar et al., 1990; Qadri, 2010). The present communication accounts for the relative effect of four different diseases on the biochemical contents of tropical tasar silkworm, *Antheraea mylitta*D.

2. Material and Method

The haemolymph of larva, pupa and adult tropical tasar silkworm (*Antheraea mylitta*) infected by the diseases like microsporidiosis, polyhedrosis, bacteriosis and mycosis were carefully collected and thereafter estimated for different bio-chemical contents as per the standard method.

2.1. Estimation of Protein

For the estimation of protein the amount of nitrogen was determined by Dumas method as suggested by Gernad (1954) and it was later multiplied by 6.25 to calculate the actual amount of protein contents in the bodies of tasar silk worm. The data in relation to the protein contents in tasar silk worm were tabulated carefully at different stages of the relative evaluation of protein contents. The data were analysed correlated and finally presented in the tables.

2.2. Estimation of Lipid

The samples of *Antheraea mylitta* in relation to their stages were collected and prepared within 24 hours, before the laboratory estimation. The samples were washed in distilled water and homogenised in a blender with the vol. of chloroform: Methanol (2 v/v).The different larvae cultured on food plants under laboratory condition were taken for the estimation of the lipid contents. In order to minimise fatty acid contamination from the gut contents, the fresh larvae were considered for the analysis. The biochemical analysis for the lipid contents were made only after the excretion of the meconium as per the suggestion of Choudhary, (1974). In this method the dried samples were weight and placed in a heating mantle, 250 ml. capacity and for lipid extraction, petroleum ether was used as solvent. The extraction period was arranged between 24 to 30 hrs. The insoluble residues were dried on oven (regulated at 65^0C) for 2 to 3 days till the constant weight were obtained. The difference in weight before and after lipid extraction gave the amount of the lipid in body. The data so collected were presented in the table.

2.3. Estimation of Moisture

To study the moisture content the tasar silkworm was weighed separately and dried in a vacuum dessicator at 66°C +1· till constant weight was obtained. The differences between wet weight and dry weight were considered to represent the amount of moisture converted into percentage.

In order to examine the impact of sporozoasis, bacteriosis, virosis and mycosis on the boichemical moieties of tasar silkworm, the biochemical analysis of different infected non-mulberry tropical tasar silkworm (*Antheraea mylitta*) at larval, pupal and adult stages of the life cycle in respect of total percentage of protein, lipid, carbohydrate, moisture and ash was carried out as per the standard methods. Likewise controls were also maintained in order to compare the biochemical make up of tasar silkworms under the diseased and non-diseased conditions. The experiments were carried out during the seed crop and commercial crop seasons.

3. Results and Discussion

Data concerning biochemical variations due to four popular diseases of A. mylitta are given in Table-1.

From the perusal of the table it is evident that the percentage of carbohydrate at larval (9.32 : 11.16), pupal (10.13 : 12.14) and adult (8.14 : 10.12), protein at larval (44.16 : 53.21), pupal (45.25 : 54.10), adult (42.16 : 52.10), lipid at larval (11.34 : 15.25), pupal (12.16 : 16.28), adult (9.31 : 14.16), moisture at larval (58.16 : 60.16), pupal (60.18 : 61.42), adult (56.15 : 59.17) and Ash at larval (09.12 : 11.14), pupal (11.25 : 12.31) and adult (10.12 : 10.19) in respect of Nosema infected and non-infected lots (control) present significant variation among the non-mulberry tasar silkworm during the seed crop season.

Likewise the percentage of carbohydrate at larval (9.54 : 12.13), pupal (10.92 : 13.32), adult (9.12 : 11.12), protein at larval (44.12 : 54.19), pupal (45.90 : 55.31), adult (44.92 : 53.90), lipid at larval (12.18 : 16.40), pupal (13.14 : 17.28), adult (11.65 : 15.25), moisture at larval (59.12 : 61.12), pupal (61.14 : 62.14) and adult (58.16 : 60.15), and Ash at larval (09.80 : 12.21), pupal (11.50 : 13.38), adult (10.40 : 11.12) also account for the significant variations in respect of Nosema infected and non-infected lots among the non-mulberry tasar silkworm during the commercial crop seasons.

The biochemical contents are relatively lesser due to microsporidiosis (Nosema infection) in comparison to bacteriosis (bacterial infection), polyhedrosis (viral infection) and mycosis at larval, pupal and adult stages of tasar silkworm. The significant decrease in the concentrations of carbohydrate, protein, lipid, moisture and ash contents in relation to different diseases of tasar silkworm has been observed to follow the relative order as Microsporidiosis > Bacteriosis > Polyhedrosis > Mycosis. However, the percent concentrations of carbohydrate, protein, lipid, moisture and ash contents in all the four diseased conditions of tasar silkworm are significantly lower as compared to normal and healthy tasar silkworm (control). The percent protein (60.62, 57.42. 59.45) lipid (24.42,

18.32, 19.61) and carbohydrate (10.72, 14.92 and 10.53) contents at larval, pupal and adult stages of Antheraea mylitta under non-diseased (control) condition clearly reveal the marked differences among diseased and non-diseased conditions. No significant variations in the percent ash content in respect of diseases have been recorded which is indicative of the fact that different diseases of tasar silkworm do not affect the percent ash content. The aforesaid results have led us to believe that the diseases of tasar silkworm lessen the biochemical concentrations at different stages of life cycle and retard, the growth and development. It is further presumed that the evident decrease in the biochemical concentrations in tasar silkworm is an index for the various diseases. It appears that the various pathogens responsible for the diseases are instrumental in lessening the biochemical contents and metabolic disturbances. The present findings are in conformities with the earlier works of Griyaghey et al. (1978, 1975) Agrawal et al. (1974), Jolly and Sen (1972), Pandey (1989) and Sharma et al. (1990). The present communication thus accounts for the fact that the said diseases evidently affect the productivity and quality of tasar silk yarn by imparting the biochemical makeup of larva, pupa and adult stages of tropical tasar silkworm owing to its subsequent effects on the growth and development of tasar silkworm.

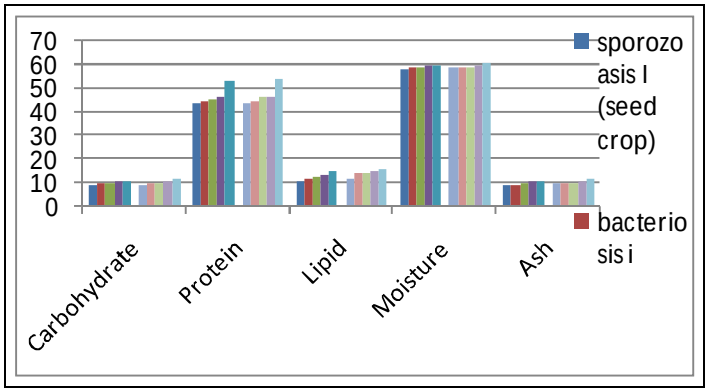

Figure 1: Relative impacts of diseases on the larva of tasar silkworm Antheraea mylitta on the biochemical contents during the seed crop and commercial crop season

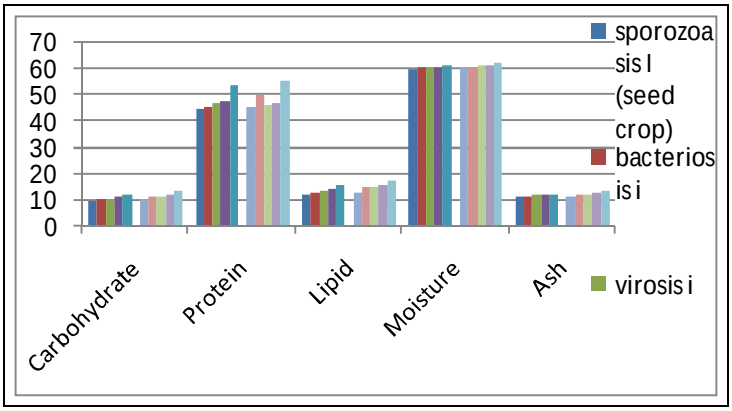

Figure 2: Relative impacts of diseases on the pupa of tasar silkworm Antheraea mylitta on the biochemical contents during the seed crop and commercial crop season

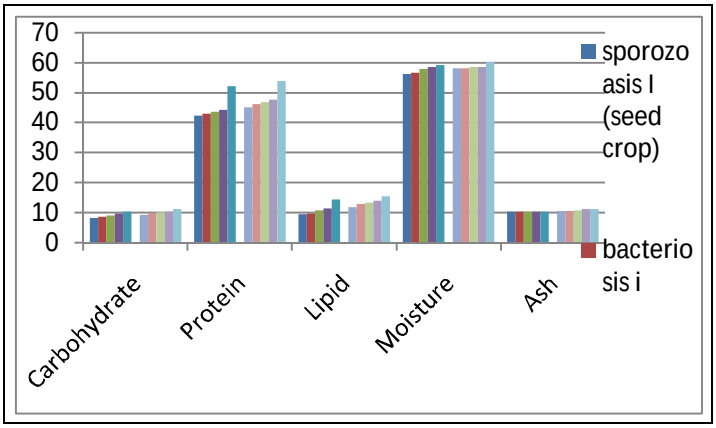

Figure 3: Relative impacts of diseases on the adult tasar silkworm Antheraea mylitta on the biochemical contents during the seed crop and commercial crop season

Sl no.	Diseases of tasar silkworm	Season	Percent carbohydrate			Percent protein			Percent lipid			Percent moisture			Percent ash			C.D. at 5% level
			Larva	Pupae	Adult	Larva	Pupae	Adult	Larva	Pupae	Adult	Larvae	Pupae	Adult	Larva	Pupae	Adult	***
1	Sporozoasis	i ii	9.32 9.54	10.13 10.92	814 912	44.16 42.16 44.12 44.92	45.25 45.90		11.34 09.31 12.18 11.65	12.16 13.14		58.16 56.15 59.12 58.16	60.18 61.14		09.12 10.12 09.80 10.40	11.25 11.50		
2	Bacteriosis	i ii	09.98 08.59 10.01 09.79	10.52 11.30		44.90 42.70 45.12 45.90	45.81 49.98		11.51 09.48 13.98 12.82	12.70 14.93		58.72 56.63 59.20 58.19	60.73 61.21		09.50 10.14 10.10 10.51	11.50 11.82		**
3	Virosis	i ii	10.10 08.92 10.50 10.01	10.98 11.56		45.90 43.30 45.98 46.78	46.82 46.70		12.98 10.60 14.20 13.20	13.60 14.99		59.10 57.92 59.40 58.41	60.80 61.98		10.30 10.16 10.29 10.67	11.80 12.12		**
4	Mycosis	i ii	10.90 09.60 10.90 10.20	11.10 12.30		46.02 44.00 46.20 47.60	47.80 47.50		13.60 11.30 14.90 13.80	14.20 15.80		59.50 58.60 59.86 58.60	60.98 62.00		10.90 10.17 10.90 10.98	12.01 12.90		NS
5	Control	i ii	11.16 10.12 12.13 11.12	12.14 13.32		53.21 52.10 54.19 53.90	54.10 55.31		15.25 14.16 16.40 15.25	16.28 17.28		60.16 59.17 61.12 60.15	61.42 62.14		11.14 10.19 12.21 11.12	12.31 13.38		

Table 1: showing relative impacts of diseases on the biochemical moieties of tasar silkworm Antheraea mylitta D

- *** :- Highly significant
- i:- seed crop
- ** :- significant
- ii:- commercial crop
- NS :- Not significant

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