International Journal of Bio-resource and Stress Management 2014, 5(2):228-233
DOI: 10.5958/0976-4038.2014.00560.0

Full Research Article

Nutrient Status of Oocytes and Eggs of Muga Silkmoth *Antheraea Assama* as Influenced by Food Plant and Season in *Terai* Region of West Bengal, India

N. Chaudhuri*, R. Ghorai and S. K. Senapati

Department of Agricultural Entomology, RRS, UBKV, Pundibari, Cooch Behar, W.B. (736 165), India

Article History

Manuscript No. cn242
Received in 6th November, 2013
Received in revised form 16th April, 2014
Accepted in final form 5th June, 2014

Correspondence to

**E-mail*: nc_ubkv@rediffmail.com

Keywords

Antheraea assama, oocytes, eggs, nutrient, hatching

Abstract

The nutrient status of oocytes and eggs (laid in different days) of *Antheraea assama* Ww. varied in successive five generations with the food over seasons in Terai region of West Bengal. The nutrient contents in oocyte were found relatively lower as compared to the eggs. The concentration of protein, carbohydrate and lipid in oocytes were higher when the larvae fed on soalu (*Litsaea polyantha* Juss.) leaves but the FAA content was found higher in som fed one. The concentration of protein, FAA and lipid were the maximum in the eggs when the food plant was som (*Machilus bombycina* King. syn. *Persea bombycina* Kost.) but for carbohydrate it was soalu. Among the generations, the concentration of protein was the maximum in September-October (*Bhodia*) followed by March-April (*Chotua*) and being minimum in May-June (*Jethua*) crop. The carbohydrate concentration was the maximum in October-November (*Katia*) and being the minimum in May-June (*Jethua*) crop. The FAA concentration was higher during December-February (*Jarua*) in 1st day eggs and oocytes and the level was lowest in September-October (*Bhodia*) crop. The lipid concentration was the maximum in December-February (*Jarua*) crop and the minimum in March-April (*Chotua*) crop. The hatching % was also recorded higher in September-October (*Bhodia*), October-November (*Katia*) and March-April (*Chotua*) crop. During May-June, the hatching % was found to be the lowest. Therefore, it can be said that the nutrient content in oocytes and eggs and its impact on hatching was maximum in first two generations completed during September to November and decrease gradually with a peak during March-April and the lowest being found in fifth generation completed during May-June, the commercial season.

1. Introduction

The muga silkworm (*Antheraea assama*) is polyphagous and multivoltine insect and endemic to Northeastern region of India. The terai region of West Bengal mainly Cooch Behar and Jalpaiguri districts are congenial to the agro-ecological condition to that of lower Assam and posses innumerable scope for muga culture. Seed production is considered as the backbone of sericulture industry. Egg is the primary and basic component of muga culture so production of quality eggs is the need for the day (Das, 2005). In Terai region of West Bengal traditionally, the farmers use to collect seed cocoons and produce eggs for commercial rearing during *Katia* (October-November) and *Jethua* (May-June). With the adoption of new technologies, creation of infrastructure and awareness towards advantages of quality egg production, the muga industry has been passing through a transitional phase. Quality egg means disease free laying with higher hatchability and fertility to obtain higher effective rate of rearing (ERR) determining productivity of cocoon. However, low hatchability of eggs due to ecological and physiological stress is the principal cause of lower productivity of cocoon, even total crop failure. This constraint has built the programme of present investigation to identify the reason for production of quality eggs to achieve more ERR.

2. Materials and Methods

The experiments were conducted during 2003-2005 in the research laboratory and instructional farm, Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India.

2.1. Rearing of the insect

Eggs (disease free layings) were collected from the REC, RMRS, Central Silk Board, Khagrabari, Cooch Behar during September and the rearing was continued for consecutive five generations during September-October, October-November, December-February, March-April, and May-June in two food plants namely som (S_1) (*Machilus bombycina*) and soalu (S_2) (*Litsea polyantha*). The adults emerged from som and soalu fed stock in each season were allowed to couple and after 6-8 hours of coupling they were decoupled and tied on kharika (made up of straw) for egg laying. The hatching % of eggs laid on different days was recorded. The oocytes were collected from the unmated females.

2.2. Biochemical analysis

The eggs laid on different days were collected within 12 hours of laying and stored in frozen condition in a homeovial for immediate use for several biochemical tests.

The protein was estimated following Lowry et al. (1951) method. The total carbohydrate concentration was estimated by Anthrone method (Plummer, 1979). The total free amino acid was estimated following Sadasivam and Manickam (1997). The concentration of total lipid was estimated by following the Bligh and Dyer method (Jayaraman, 1981).

The data so collected were subjected to appropriate statistical analysis using INDOSTAT for interpretation.

3. Results and Discussion

The nutrient contents in gonad (oocyte) namely protein, carbohydrate, free amino acid and lipid ware found relatively lower as compared to the eggs but the trend was recorded reverse in lipid concentration (Table 1,2,3,4 and 5). The seasonal influence was found to have significant impact on the nutrient content of food plants as well as on oocytes and eggs.

*3.1. Concentration of protein (*mg g^{-1}*)*

The protein concentration (Table 1) was recorded higher during September-October (12.15 mg g^{-1} in 2nd; 10.82 mg g^{-1} in 3rd and 10.12 mg g^{-1} in 1st day eggs). The minimum concentration was recorded during December-February for 1st and 2nd day eggs (6.88 mg g^{-1} and 6.68 mg g^{-1}) while during May-June in 3rd day eggs (6.27 mg g^{-1}). In relation to food it was higher on S_1 fed stock in 1st day and 3rd day eggs (9.31 and 8.52, respectively) and on S_2 fed stock in 2nd day (9.32 mg g^{-1}).

Irrespective of seasons, the protein concentration in the oocytes was recorded higher on S_1 (8.19 mg g^{-1}) than S_2 fed stock (7.31 mg g^{-1}). Among the seasons maximum protein concentration was recorded in September-October (9.48 mg g^{-1}) and being lowest in May-June (4.84 mg g^{-1}). Seasonal influence on the food plant revealed that higher concentration of protein was found from S_1 fed stock (9.15 mg g^{-1}) in September-October and from S_2 it was (10.24 mg g^{-1}) in March-April; the minimum being recorded in May-June (5.35 and 4.33 mg g^{-1} on som and soalu respectively).

*3.2. Concentration of carbohydrate (*mg g^{-1}*)*

The carbohydrate concentration in the eggs (Table 2) was comparatively higher in 1st day and 2nd day eggs (27.06 mg g^{-1} and 32.34 mg g^{-1}, respectively) from S_2 fed stock, while it was higher on S_1 in 3rd day eggs (20.98 mg g^{-1}). In 1st day and 2nd day eggs the level was maximum in October-November (38.74 mg g^{-1} in and 54.18 mg g^{-1} respectively) and being lowest in

Table 1: Protein concentration (mg g^{-1}) in eggs laid on different day of oviposition and oocytes as influenced by food plants over seasons

Rearing season	1st day eggs			2nd day eggs			3rd day eggs			Oocytes		
	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean
Sep-Oct	10.93	9.31	10.12	13.29	11.01	12.15	11.37	10.27	10.82	9.15	9.80	9.48
	(3.38)	(3.13)	(3.26)	(3.66)	(3.39)	(3.53)	(3.45)	(3.28)	(3.37)	(3.11)	(3.21)	(3.16)
Oct-Nov	10.21	6.98	8.60	7.18	8.04	7.61	7.12	7.09	7.11	7.64	9.04	8.34
	(3.27)	(2.73)	(3.00)	(2.77)	(2.92)	(2.84)	(2.76)	(2.75)	(2.76)	(2.85)	(3.09)	(2.97)
Dec-Feb.	5.86	7.90	6.88	6.09	7.26	6.68	6.92	6.53	6.73	7.48	7.54	7.51
	(2.52)	(2.88)	(2.71)	(2.57)	(2.79)	(2.68)	(272)	(2.65)	(2.69)	(2.82)	(2.84)	(2.83)
Mar-Apr	10.32	8.31	9.32	9.00	12.96	10.98	10.76	9.76	10.26	6.92	10.24	8.58
	(3.29)	(2.97)	(3.13)	(3.08)	(3.67)	(3.37)	(3.36)	(3.20)	(3.28)	(2.72)	(3.28)	(3.00)
May-Jun	9.25	7.54	8.40	7.19	7.35	7.27	6.45	6.09	6.27	5.35	4.33	4.84
	(3.12)	(2.89)	(2.98)	(2.77)	(2.80)	(2.79)	(2.64)	(2.57)	(2.60)	(2.42)	(2.20)	(2.31)
Mean	9.31	8.01		8.55	9.32		8.52	7.95		7.31	8.19	
	(3.12)	(2.91)		(2.97)	(3.11)		(2.98)	(2.89)		(2.78)	(2.92)	
	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S
SEd	0.028	0.045	0.063	0.040	0.063	0.089	0.024	0.037	0.053	0.023	0.036	0.051
CD (p=0.05)	NS	0.093	0.013	NS	0.132	0.187	NS	0.078	NS	0.048	0.076	0.107

Figure in parenthesis indicate square root transformed value

March-April (12.09 mg g^{-1} and 12.03 mg g^{-1} respectively). However in 3rd day laid eggs the concentration was higher in September-November (27.13-28.46 mg g^{-1}) and being the minimum in March-June (10.01-11.82 mg g^{-1}).

Higher carbohydrate content was recorded in oocytes of S_2 fed stock (20.12 mg g^{-1}) than S_1 (17.18 mg g^{-1}). During October-November the content was higher (41.49 mg g^{-1}) and lowest being recorded in May-June (9.79 mg g^{-1}). The carbohydrate level was higher in October-November (34.42 mg g^{-1} on S_1 and 48.55 mg g^{-1} on S_2 fed stock); the lowest being recorded during May-June (8.24 mg g^{-1}) in S_1 and in September-October (9.68 mg g^{-1}) in S_2 fed one.

3.3. Concentration of free amino acid (FAA) (mg g^{-1})

The free amino acid concentration (Table 3) was recorded

Table 2: Carbohydrate concentration (mg g^{-1}) of eggs laid on different day of oviposition and oocytes as influenced by food plants over seasons

Rearing season	1st day eggs			2nd day eggs			3rd day eggs			Oocytes		
	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean
Sep-Oct	35.64 (5.99)	27.21 (5.26)	31.43 (5.63)	41.17 (6.45)	25.17 (5.06)	33.17 (5.75)	33.13 (5.80)	23.79 (4.92)	28.46 (5.36)	10.61 (3.33)	9.68 (3.19)	10.15 (3.26)
Oct-Nov	23.97 (4.94)	53.50 (7.34)	38.74 (6.14)	29.19 (5.44)	79.17 (8.93)	54.18 (7.18)	23.11 (4.85)	31.15 (5.61)	27.13 (5.23)	34.42 (5.90)	48.55 (7.00)	41.49 (6.45)
Dec-Feb.	35.11 (5.96)	31.31 (5.62)	33.21 (5.79)	27.01 (5.23)	26.00 (5.14)	26.51 (5.19)	24.19 (4.95)	21.13 (4.65)	22.66 (4.80)	17.13 (4.18)	19.13 (4.43)	18.13 (4.31)
Mar-Apr	13.49 (3.74)	10.68 (3.33)	12.09 (3.53)	12.62 (3.62)	11.44 (3.45)	12.03 (3.54)	14.42 (3.86)	9.22 (3.12)	11.82 (3.49)	15.52 (4.00)	11.92 (3.52)	13.72 (3.76)
May-Jun	15.52 (3.98)	12.62 (3.62)	14.07 (3.80)	13.98 (3.80)	19.92 (4.52)	16.95 (4.16)	10.03 (3.24)	9.99 (3.24)	10.01 (3.24)	8.24 (2.96)	11.33 (3.42)	9.79 (3.19)
Mean	24.75 (4.92)	27.06 (5.03)		24.79 (4.91)	32.34 (5.42)		20.98 (4.54)	19.06 (4.31)		17.18 (4.07)	20.12 (4.31)	
	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S
SEd	0.150	0.236	0.334	0.096	0.151	0.214	0.099	0.156	0.221	0.086	0.135	0.191
CD (p=0.05)	NS	0.493	0.697	0.199	0.315	0.446	0.206	0.326	0.461	0.178	0.282	0.400

Figure in parenthesis indicate square root transformed value

Table 3: Free amino concentration (mg g^{-1}) of eggs laid on different day of oviposition and oocytes as influenced by food plants over seasons

Rearing Season	1st day eggs			2nd day eggs			3rd day eggs			Oocytes		
	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean
Sep-Oct	33.71 (5.84)	31.07 (5.62)	32.39 (5.73)	29.17 (5.44)	41.35 (6.46)	35.26 (5.95)	29.07 (5.42)	27.31 (5.27)	28.19 (5.35)	23.73 (4.88)	22.03 (4.75)	22.88 (4.81)
Oct-Nov	27.75 (5.32)	29.06 (5.43)	28.41 (5.37)	21.12 (4.64)	21.14 (4.63)	21.13 (4.64)	20.19 (4.54)	21.07 (4.64)	20.63 (4.59)	21.14 (4.64)	15.89 (4.05)	18.52 (4.35)
Dec-Feb.	55.48 (7.48)	43.29 (6.61)	49.39 (7.04)	31.71 (5.68)	29.07 (5.43)	30.39 (5.56)	27.1 (5.25)	25.11 (5.04)	26.14 (5.15)	51.40 (7.19)	19.82 (4.49)	35.61 (5.84)
Mar-Apr	44.92 (6.74)	27.74 (5.30)	36.33 (6.02)	21.14 (4.64)	43.60 (6.63)	32.37 (5.64)	22.44 (4.92)	29.31 (5.43)	25.88 (5.18)	26.42 (5.17)	15.85 (4.04)	21.14 (4.60)
May-Jun	31.03 (5.61)	27.13 (5.25)	29.08 (5.43)	27.03 (5.34)	23.71 (5.24)	25.37 (5.29)	25.19 (5.05)	20.71 (4.60)	22.95 (4.83)	31.17 (5.63)	26.31 (5.17)	28.74 (5.40)
Mean	38.58 (6.20)	31.66 (5.64)		26.03 (5.15)	31.77 (5.68)		24.81 (5.04)	24.70 (5.00)		30.77 (5.50)	19.98 (4.50)	
	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S
SEd	0.093	0.147	0.208	0.143	0.227	0.321	0.080	0.126	0.178	0.146	0.230	0.326
CD (p=0.05)	0.194	0.307	0.435	0.299	0.473	0.669	NS	0.260	0.371	0.304	0.480	0.680

Figure in parenthesis indicate square root transformed value maximum during December-February in 1st day eggs (49.39 mg g^{-1}) and during September-October in 2nd and 3rd day eggs (35.26 mg g^{-1} and 28.19 mg g^{-1}). The level was the minimum in October-November (28.41 mg g^{-1}, 21.13 mg g^{-1} and 20.63 mg g^{-1} in 1st, 2nd and 3rd day eggs). In som fed stock the free amino acid concentration was higher in 1st and 3rd day laid eggs (38.58 mg g^{-1} and 24.81 mg g^{-1} respectively) while in the 2nd day laid eggs it was higher in S_2 fed stock (31.77 mg g^{-1}).

In the oocytes the concentration was higher on S_1 (30.77 mg g^{-1}) than S_2 (19.98 mg g^{-1}). The highest concentration was observed during December-February (35.61 mg g^{-1} g^{-1}) and being lowest in October-November (18.52 mg g^{-1}) irrespective of food plant. It was higher on S_1 (51.40 mg g^{-1}) in December-February and on S_2 (26.31 mg g^{-1}) in May-June and the minimum being recorded in October-November on S_1 (21.14 mg g^{-1}) and on S_2 in March-April (15.85 mg g^{-1}).

3.4. Concentration of lipid (%)

In the eggs laid in different days the lipid level was recorded higher during October-February (13.98-15.75% in 1st, 12.21-13.21% in 2nd and 11.44-12.66% in 3rd day eggs) and lower in March-April (7.01% in 1st, 6.93% in 2nd, and 6.12% in 3rd day eggs). The concentration was higher in S_1 fed stock, (10.25% and 10.10% on 2nd and 3rd day eggs respectively) and it was higher on S_2 fed one (11.47% in 1st day eggs) (Table 4).

In the oocytes higher lipid content was recorded on S_2 (10.02%) than S_2 (9.95%). During December-February the content was higher (12.60%) and lowest being recorded 4.86% in March-April. Interaction between food plants and seasons revealed that it was higher during December-February (13.02 %) on S_1 and 12.17% on S_2. The lowest being recorded during March-April (4.76%) on S_1 and (4.96%) on S_2 fed one.

3.5. Effect of nutrient content on hatching %

The hatching was found higher in on S_1 (81.02%) than S_2 (77.57%) fed stock in 1st day eggs. Interplay of food and season showed that the concentration was maximum in October-November (98.38% on S_1 and 98.95% on S_2) in 1st day eggs, (96.36% on S_1 and 96.31% on S_2) in 2nd days eggs and (92.17% on S_1 and 98.31% on S_2). The value was lowest in May-June (24.33% on S_1 and 18.56% on S_2) in 1st, (3.77% on S_1 and 5.33% on S_2) in 2nd and only 5.56% on S_2 in 3rd day eggs (Table 5).

The overall hatching was higher on S_1 fed stock (75.55%) than S_2 (74.01%). During October-November, the hatching was the maximum on both S_1 (95.26%) and S_2 (95.44%). In May-June, it was lowest 19.36% and 14.66% on S_1 and S_2 respectively. With regard to season, the highest hatching was observed 95.35% during October-November and the lowest in May-June (17.01%)

The protein, carbohydrate and lipid content in the oocytes significantly increased the respective content in eggs laid in different days (Table 6). Sinha and Sinha (1991) also reported that the level of biochemical constituents likes lipid, amino acids, proteins; carbohydrates and phosphorus compounds in the moth improve the quality and quantity of eggs. This might be due to absorption of protein, lipid, sugar by females from the ejaculate of male (Thornhill, 1976; Boggs and

Table 4: Lipid concentration (%) of eggs laid on different day of oviposition and oocytes as influenced by food plants over seasons

Rearing Season	1st day eggs			2nd day eggs			3rd day eggs			Oocytes		
	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean
Sep-Oct	10.15 (18.44)	10.10 (18.43)	10.13 (18.44)	9.21 (17.66)	7.29 (15.66)	8.25 (16.66)	10.21 (18.59)	5.31 (13.30)	7.76 (15.95)	11.21 (19.55)	10.27 (18.67)	10.74 (19.11)
Oct-Nov	13.25 (21.35)	14.70 (21.97)	13.98 (21.66)	11.21 (19.55)	13.21 (21.20)	12.21 (20.37)	12.11 (20.31)	13.21 (21.30)	12.66 (20.81)	10.76 (19.07)	10.71 (19.08)	10.74 (19.08)
Dec-Feb.	16.21 (23.48)	15.25 (22.95)	15.75 (23.22)	13.17 (21.44)	13.24 (21.33)	13.21 (21.28)	12.17 (20.27)	10.71 (18.74)	11.44 (19.51)	13.02 (21.12)	12.17 (20.24)	12.60 (20.68)
Mar-Apr	6.71 (14.97)	7.31 (15.48)	7.01 (15.23)	5.65 (13.67)	8.21 (16.60)	6.93 (15.14)	6.02 (13.30)	6.21 (14.35)	6.12 (13.84)	4.76 (12.55)	4.96 (12.83)	4.86 (12.69)
May-Jun	4.67 (12.03)	10.00 (18.19)	7.34 (15.11)	12.00 (19.85)	5.00 (12.49)	8.50 (16.17)	10.00 (17.85)	7.00 (15.32)	8.50 (16.58)	10.00 (18.38)	12.00 (20.25)	11.00 (19.31)
Mean	10.20 (18.06)	11.47 (19.41)		10.25 (18.39)	9.39 (17.46)		10.10 (18.07)	8.49 (16.60)		9.95 (18.13)	10.02 (18.21)	
	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S
SEd	0.278	0.440	0.623	0.235	0.372	0.526	0.219	0.346	0.489	0.161	0.255	0.360
CD (p=0.05)	0.581	0.918	1.298	0.491	0.776	1.097	0.456	0.721	1.020	NS	0.531	0.751

Figure in parentheses indicate the angular transformed value

Table 5: Hatching (%) of eggs laid on different day of oviposition as influenced by food plants over seasons.

Rearing season	1st day eggs			2nd day eggs			3rd day eggs			Over all		
	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean	Som	Soalu	Mean
Sep-Oct	98.18	86.79	92.48	72.27	58.85	65.56	48.83	33.98	41.41	83.64	71.21	77.43
	(82.67)	(69.52)	(76.09)	(58.23)	(50.19)	(54.21)	(44.32)	(35.62)	(39.97)	(66.46)	(58.71)	(62.58)
Oct-Nov	98.38	98.95	98.59	96.36	96.31	96.34	92.17	98.31	95.24	95.26	95.44	95.35
	(83.39)	(85.51)	(84.45)	(81.00)	(82.54)	(81.77)	(76.88)	(84.09)	(80.48)	(77.85)	(77.98)	(77.91)
Dec-Feb.	92.22	86.64	89.43	75.11	95.95	85.53	71.23	82.10	76.67	89.53	94.50	92.02
	(74.29)	(74.92)	(74.61)	(60.42)	(81.80)	(71.11)	(57.72)	(65.54)	(61.63)	(72.02)	(78.60)	(75.31)
Mar-Apr	91.99	96.92	94.45	80.07	89.99	85.03	45.51	46.87	46.19	89.96	94.24	92.10
	(74.38)	(81.15)	(77.76)	(64.84)	(71.72)	(68.28)	(55.75	(43.25)	(49.50)	(71.79)	(78.60)	(73.97)
May-Jun	24.33	18.56	21.45	3.77	5.33	4.55	0.00	5.56	2.78	19.36	14.66	17.01
	(29.55)	(25.51)	(27.53)	(11.19)	(13.35)	(12.27)	(0.30)	(13.63)	(6.97)	(26.09)	(76.14)	(24.29)
Mean	81.02	77.57		65.52	69.29		51.55	53.36		75.55	74.01	
	(68.86)	(67.32)		(55.14)	(59.92)		(46.99)	(48.43)		(62.84)	(62.50)	
	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S	Food	Season	F×S
SEd	1.054	1.666	2.357	2.685	4.246	6.004	2.734	4.323	6.114	0.983	1.554	2.198
CD (p=0.05)	2.854	3.256	4.562	NS	8.856	12.524	NS	9.018	12.754	NS	3.219	4.585

Figure in parentheses indicate the angular transformed value

Table 6: Correlation of nutrient content of oocytes with the nutrient content of eggs laid in different days of oviposition

Nutrient in oocytes	Host plants	1st day egg	2nd day egg	3rd day egg
Protein	Som	0.059	0.693**	0.574*
(mg g^{-1})	Soalu	0.410	0.732**	0.773**
Carbohydrate	Som	0.014	0.247	0.209
(mg g^{-1})	Soalu	0.873**	0.963**	0.714**
Free amino	Som	0.707**	0.562*	0.159
acid (mg g^{-1})	Soalu	-0.093	-0.099	-0.003
Lipid %	Som	0.380	0.662**	0.622**
	Soalu	0.543*	0.170	0.281

*Significant at p=0.05; **Significant at p=0.01

Gilbert, 1979) and their use in the egg production as reported by Boggs and Watt (1981), Marshall (1985) and Watanabe (1988). The carbohydrate content was found minimum in May-June that confirmed the findings of Jyothirmayala and Bharathi (1993).

The protein concentration had positive effect on carbohydrate and lipid in oocytes, 1st, 2nd and 3rd day eggs, while it increases FAA in 2nd and 3rd days eggs but decrease FAA in oocytes and 1st day eggs. The carbohydrate level increased the level of lipid in oocytes and different days eggs. On the other hand it increases the FAA for 1st day eggs and decreased the level of FAA for oocytes, 2nd and 3rd day eggs. FAA concentration found to have positive and significant relation with lipid in oocytes and 1st day eggs but it was negative in 2nd and 3rd day eggs. The concentration of protein, carbohydrate and lipid of 1st, 2nd and 3rd day eggs showed positive and significant relation with hatching while the FAA concentration of oocytes, 1st, 2nd and 3rd day eggs and the lipid level of oocytes found to have negative impact on hatching (Table 7a&b).

Table 7a: Correlation of nutrient content of eggs among themselves and with hatchability (oocytes)

Nutrient content	Host plant	Carbo-hydrate	FAA	Lipid	Hatching
Protein	Som	0.138	-0.318	0.051	0.554*
	Soalu	0.265	-0.354	0.02	0.457
Carbohy-drate	Som	1.000	-0.249	0.064	0.630**
	Soalu	1.000	-0.498	0.219	0.451
FAA	Som		1.000	0.364	-0.115
	Soalu		1.000	0.536*	-0.610*
Lipid	Som			1.000	-0.028
	Soalu			1.000	-0.306
			1st day eggs		
Protein	Som	0.325	-0.431	0.074	0.031
	Soalu	-0.106	-0.091	-0.085	0.017
Carbohy-drate	Som		0.239	0.778**	0.505*
	Soalu		0.306	0.795**	0.515*
FAA	Som		1.000	0.354	0.126
	Soalu		1.000	0.597*	0.26
Lipid	Som			1.000	0.711**
	Soalu			1.000	0.248

*Significant at p=0.05, **Significant at p=0.01

Table 7b: Correlation of nutrient content of eggs among themselves and with hatchability (2nd day eggs)

Nutrient content	Host plant	Carbo-hydrate	FAA	Lipid	Hatching
Protein	Som	0.734**	0.482	0.28	0.139
	Soalu	-0.006	0.031	0.386	0.296
Carbohy-drate	Som	1.000	-0.312	0.341	0.446
	Soalu	1.000	-0.763**	0.572*	0.368
FAA	Som		1.000	0.523*	-0.415
	Soalu		1.000	-0.402	-0.06
Lipid	Som			1.000	0.161
	Soalu			1.000	0.878**
			3rd day eggs		
Protein	Som	0.697**	0.651**	0.332	0.264
	Soalu	0.41	0.204	-0.087	0.227
Carbohy-drate	Som	1.000	-0.244	0.504*	0.541*
	Soalu	1.000	-0.216	0.606*	0.655*
FAA	Som		1.000	-0.017	-0.225
	Soalu		1.000	-0.546*	-0.089
Lipid	Som			1.000	0.307
	Soalu			1.000	0.659**

*Significant at p=0.05, **Significant at p=0.01

The metabolism of carbohydrate increases the FAA concentration while the metabolism of lipid and or protein caused the fall of total FAA pool. Since the primary energy reserve and an organism's dietary source may shift during the year (Bayne, 1973), so it is very much common that the total FAA fluctuate seasonally in *A. assama.* In the developing embryos the protein concentration changes frequently during embryogenesis, while the carbohydrate decreases gradually from 1st day of embryogenesis till hatching of the larvae (Sinha et al., 1994) corroborate present findings.

4. Conclusion

The reproductive efficiencies in the non-feeding adult stage are built-up from the nutritional level of developing larvae as the nutrient in the food plant get assimilated in the insect tissue that subsequently passed on into the oocyte and sperm which in turn influences the nutrient content in the eggs and thereby the hatchability i.e. quality of egg.

Therefore, production of quality egg based on the critical nutritional status of host plant and insect physiological activities is the prime need for muga culture in Teari region of West Bengal.

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