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Effect of Synthetic Vitamin 'C' Supplimentation on Dietary Water Utilization in NB_4D_2 Race of Silkworm *Bombyxmori* L.

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Abstract:
SyntheticVitamin'C' is also called as L-ascorbic acid or simply ascorbate vitamins which is an water soluble nutrient and essential for both humans and certain plants, and functions as a anti-oxidant and reducing agent. Dietary supplementation of synthetic vitamin 'C' with different concentrations ranging from 0.5%, 1.0%, 1.5% and 2.0% fed ad libitum mulberry leaves Morus albain Silkworm NB_4D_2 race from hatching to pupation at $26^0 \pm 2^0$ c with 80±10% Relative Humidity, resulted in a significant increase in the water intake, water absorption, water retention and water transpiration compared to control group. The water utilization parameters like water transpiration rate, water intake rate, water absorption rate, water loss rate, water retention efficiency and absorption efficiency were also studied, and the data were analysed by using Mean, Standard deviation. It has been observed that the 0.5% vitamin 'C' treated group plays a significant role with a increase in water intake rate and a better water absorption efficiency compared to control group and other vitamin 'C' treated groups.

Keywords: *Ascorbate, Bombyxmori L., Micronutrient, Morusalba, transpiration*

1. Introduction

Synthetic Vitamin C is an essential water soluble micronutrient, which act as a cofactor and involves in several enzymatic reactions. Water is the most important component of life of living organisms. It is the largest ingredient required for the maintenance of both animal and plant life. In insects, as in other organisms, water is the fundamental basis of metabolic processes and is a very important item of insect diet (Ross 1956). Water is the medium for the movement of various dissolved substances like gases, minerals, organic substances, etc. in the conducting tissues of the plants like xylem and phloem. It also takes part in the metabolic reactions that occur in the cell. Water is an important factor which controls the limits of distribution of terrestrial animals (Allee et al., 1949).

Majority of the insects are known to drink water, but others, especially the leaf feeders like *Bombyxmori* and other pests meet most of their water requirements from the food (Waldbauer 1968; Pandian et al., 1978 Delvi, 1983). Perhaps *Bombyxmori* meets major fraction of required water from the ingested leaf of *Morusalba* (Delvi 1983). Some insects are known to obtain atmospheric water through the integument (Bodine 1921; Ludwig 1937; Beament1964) and in a few cases via cloacals end(Beament 1961) or via the spiracles (Buxton 1932). The energy budget of a number of terrestrial insects from hatching to death have been reported (Delvi and Pandian 1971; Hiratsuka 1920; Schroeder 1971; Scriber and Slansky 1981).

The quantitative aspects of water gain and water loss during ingestion and digestion of food and mechanisms regulating have not been studied adequately in economically important insects of *Bombyxmori*. There is a paucity of information on the effect of water utilization budget in the silkworm *Bombyxmori* L. The present investigation was undertaken to study the effect of synthetic vitamin C on dietary water utilization of silkworm *Bombyxmori*L. NB_4D_2 race from hatching to pupation.

1.1. Materials and Methods

Disease free layings of *Bombyxmori* L.(NB_4D_2 race) were obtained from Central SericultureTraning and Research institution, Mysore. After the incubation period of 10 days, the freshly hatched larvae were transferred to enamel trays (36x 26 x4 cm) covered with paraffin paper to prevent loss of water from the leaf bed. The experiment was conducted in triplicate with 50 larvae in each group and the larvae from first to fifth instar was fed with *ad libitum* mulberry leaves *Morus alba* with the different concentrations of synthetic vitamin c i.e.(0.5%, 1.0%, 1.5% and 2.0% concentrations) at $26^0 \pm 2^0$ c and RH 80±10%. The larvae of the experimental group were fed with mulberry leaves treated with different vitamin C concentration four times at 6.A.M, 11.A.M, 3.P.M and 8.P.M. Simultaneously, the larvae were reared under control at $26^0 \pm 2^0$ c and R.H. 80±10%. Its effect on vitamin C concentration an water consumption and utilization was studied by using IBP formula C=F+P+R. The data were analysed by using Mean, Standard deviation.

1.1.1. Results and Discussion

Water utilization in NB_4D_2 race of silkworm *Bombyxmori* L. varies as a function of life stage. The larvae consumes highest amount of water which is averaged to 13565.15 mg at 0.5% vitamin C treated group compared to control group, which is averaged to 8055.132 mg. such increase was also observed in remaining three concentrated groups i.e (1.0% 1.5% and 2.0%).The water loss through faeces increased with an increase in life stage. It was observed that in control group larvae 1509.25 mg of water loss through faeces takes place which was minimum and started increasing from 2.0%, 1.5%,1.0% and 0.5% concentration of vitamin C. [Table 1,2 and 3]. The transpiration of water was also observed to be increased at 0.5% concentration group and started decreasing from 1.0%, 1.5% and 2.0% concentration and was minimum in the control group. The results found differs depending on the concentration of vitamin C used [figure 1,2 and 3]. The total rates and efficiencies registered a slight increase over the control feeding at $26^0 \pm 2^0$ c and RH 80±10 %.

From the data, it is evident that vitamin C plays a key role in silkworm physiology. The change in quality of food affects the water balance of the insects which in turn directly deteriorates the quality of silk (Delvi 1983, Pandian et al.,1978, Hanumappa and Delvi 1989, Delvi and Naik 1984, Radhakrishna and Delvi 1987, Radhakrishnan 1992, AsiyaNuzhat 1993, and Nuzhat and Delvi 1998). Higher absorption efficiency results in lower water retention efficiency observed in all the tested groups and control groups. Delviet al., (1988) reported that with the decreasing ration level, the amount of water retained in the body by the *Bombyxmori* and EriSilkworm *Pilosamiaricini* also decreased and also exhibited decreased rate of water loss through faeces with the increasing ration level. Information is also available on the total water intake which was highest in *Poiceloceruspictus* then in other lepidopteran insects (Delvi, 1983).

2. Acknowledgement

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	Concentrations				
	Control	**0.5%**	**1.0%**	**1.50%**	**2.00%**
Life Span(Days)	25	19	19	19	21.5
Water intake	8055.132 ±655.40	13565.15 ±862.67	10813.74 ±305.32	10249.34 ±225.27	10026.75 ±155.24
Water loss	1509.25 ±64.709	2016.27 ±118.18	1733.32 ±38.118	1699.80 ±43.756	1680.455 ±34.62
Water absorbed	6545.85 ±704.68	11548.89 ±800.29	9080.40 ±304.05	8549.52 ±195.65	8350.29 ±158.90
Water retained	8055.12 ±655.40	13565.15 ±862.67	10813.74 ±305.32	10249.34 ±225.27	10026.75 ±155.244
Transpiration	5473.69 ±520.95	9260.15 ±811.27	7314.74 ±240.118	6882.16 ±240.118	6732.66 ±156.49

Table 1: Effect of synthetic vitamin C on total water intake, water loss, water absorption, water retained and water transpiration from hatching to pupation in silkworm Bombyxmori L. (NB4D2 race) fed ad libitum Morusalba at $26^0 \pm 2^0$ c and the 80±10% RH. at different concentrations. The control worms were maintained at room temperature. All the values are expressed as mg of insect per day

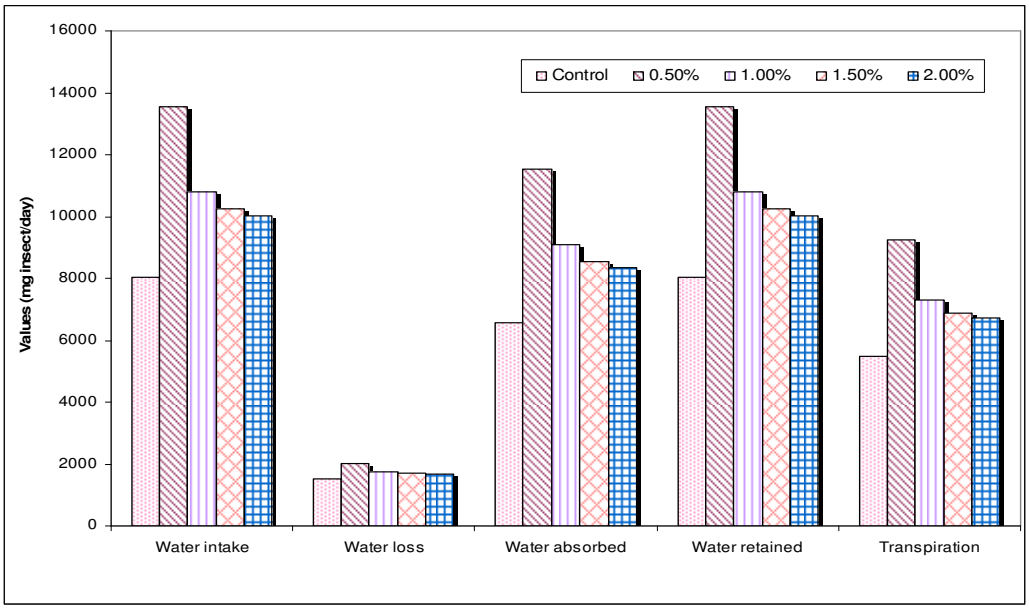

Figure 1: Total Water intake, Water loss, Water absorption, Water retained and Water transpiration in the silkworm Bombyxmori L. at different vitamin C concentrations.

Rates	Concentration				
	Control	**0.5%**	**1.0%**	**1.5%**	**2.0%**
Transpiration rate	2.4807 ±0.2448	4.0597 ±0.3632	3.6751 ±0.2734	3.3091 ±0.3065	2.9607 ±0.2253
Water intake rate	2.6996 ±0.2512	4.3472 ±2.006	3.9536 ±0.2776	3.5758 ±0.3062	3.2038 ±0.2253
Water loss through faeces rate	0.09718 ±0.0107	0.11623 ±0.00469	0.16828 ±0.0823	0.1127 ±0.00564	0.09817 ±0.00722
Absorption rate	2.6035 ±0.2498	4.2309 ±0.360	3.8369 ±0.2757	3.4617 ±0.3045	3.10602 ±0.2236

Table 2: Effect of synthetic vitamin C on total Transpiration rate, Water intake rate, Water loss through faeces rate and Absorption rate from hatching to pupation in silkworm Bombyxmori L. (NB4D2 race) fed ad libitum Morusalba at $26^0 \pm 2^0$ c and the 80±10% RH. at different concentrations. The control worms were maintained at room temperature. All the values are expressed as mg of insect per day.

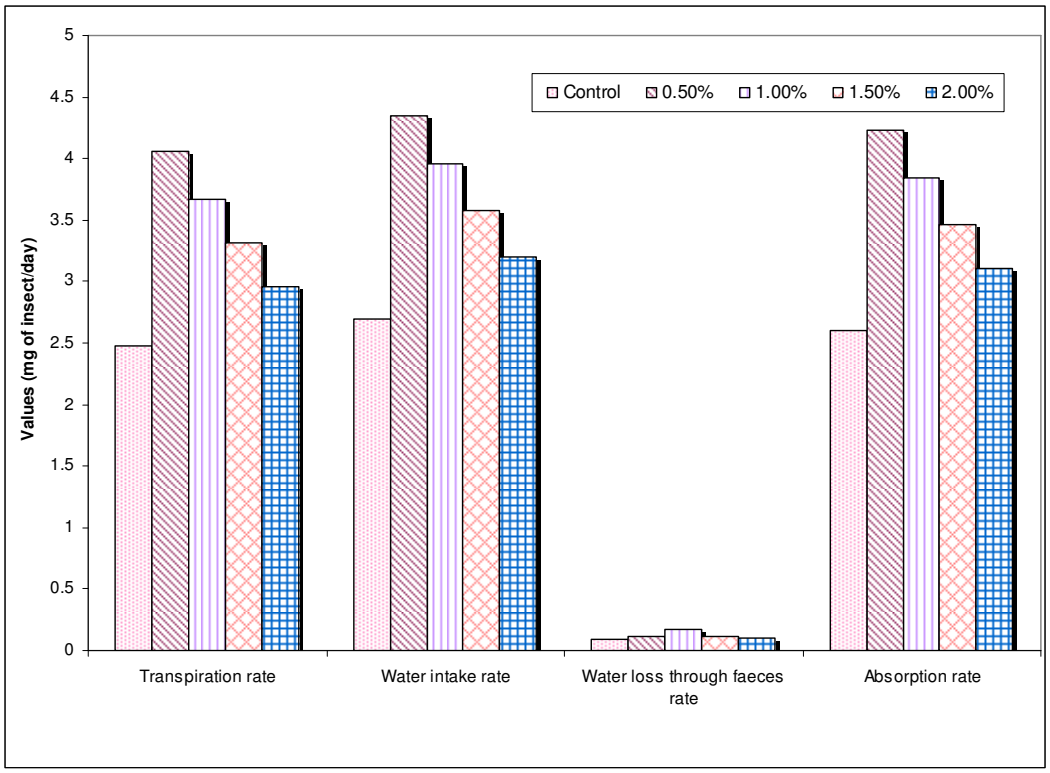

Figure 2: Total Transpiration rate, Water intake rate, Water loss through faeces rate and Absorption rate in the silkworm Bombyxmori L. at different vitamin C concentrations

Efficiencies	Concentration				
	Control	**0.5%**	**1.0%**	**1.5%**	**2.0%**
Water retention efficiency	9.94 ±1.782	13.42 ±1.1315	13.56 ±0.4198	13.43 ±0.48934	13.15 ±0.4931
Absorption efficiency	85.38 ±1.122	91.25 ±0.4345	90.16 ±0.3807	90.09 ±0.3364	90.44 ±0.3964

Table 1: Effect of synthetic vitamin C on total Water retention efficiency and Absorption efficiency from hatching to pupation in silkworm Bombyxmori L. (NB4D2 race), fed ad libitum Morus alba at $26^0 \pm 2^0$ c and the 80±10% RH. at different concentrations. The control worms were maintained at room temperature. All the values are expressed as percent.

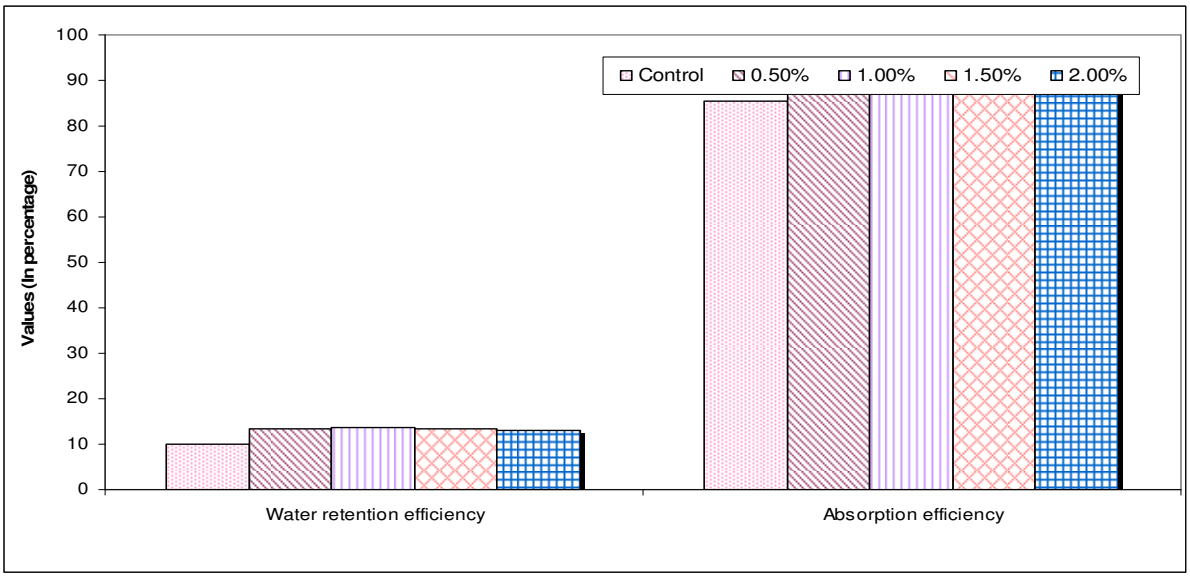

Figure 3: Total Water retention efficiency and Absorption efficiency in the silkworm Bombyxmori L. at different vitamin C concentrations.

3. References

i. AsiyaNuzhat, F.B. (1993). Effect of photoperiod on food and water utilization in the silkworm *Bombyxmori* L. Ph.D thesis, Bangalore university, Bangalore.
ii. Allee, W.C, Emerson,A.E, Park, T and Schmidt, K.P (1949) . Principles of animal ecology (Philadelphia: Saunders,W.B) pp. 837
iii. Beament, J.W.L (1961) The water reaction of insect cuticle Bio,Rev. 36: 281-320
iv. Beament, J.W.L (1964) Active transport of water in insects in philosamia advance in insect physiology (EDS) J.W.L beament, J.W Treherence and W.B Wiggles worth (New york), Academic press, 2: 67-120
v. Bodine (1921). Factors influencing the water content and rate of metabolism of certain orthoptera. J. Exp. Zoo 32: 137-164
vi. Buxton (1932). Terrestrial insects and humidity of the environmental Biol. Rev. 7: 275-320
vii. Delvi M.R. and Pandian T.J. (1971) Ecophysiological studies on the utilization of food in paddy field grasshopper *oxyavelox*. Oecologia (Berien) 8: 267-273
viii. DelviM.R andPandian T.J (1972). Rates of feeding and assimilation in the grasshopper *poiceloceruspictus*.J Insect physiol. 18: 1829-1843
ix. Delvi M.R. (1983). Dietary water balance in a tropical insect. Proc. Indian Acad.sci. (animal. Sci) 92: 135-145
x. Delvi,M.R and Naik, P.R (1984). Effect of permethrin on dietary water budget in silkworm *Bombyxmori*, sericolgia 24: 501-511
xi. Delvi,M.R, P.G. Radhakrishna and Noor Pasha (1988). Effect of leaf ration on dietary water budget of the larvae of silkworm *Bombyxmori* and eri silkworm *Philosamiaricini.* Proc. Indian Acad. Sci.(Anim. Sci.), vol.97, No.3 pp. 197-202
xii. Hanumappa,T.V and Delvi, M.R (1989). Effect of temperature on food utilization in different races of the silkworm *Bombyxmori* L. (Lepidoptera : Bombycidae). Sericologia : 27 : 347-354
xiii. Hiratsuka, E (1920) Research on the nutrition of the silkworm. Bull. Sericol. Enp. Sta (Japan) 1 : 257-315
xiv. Ludwig, D. (1937). The effect of different relative humidities on respiratory metabolism and survival of grass hopper *Chortophagecirdifasciate* De ger. Physiol. Zool. 10: 342-351
xv. Nuzhat,F.B. Asiya and Delvi, M.R. (1998). Effect of photoperiod on growth in the silkworm *Bombyxmori* L. (Lepidoptera: Bombycidae) IN. J. Exptl. Zool. India vol,1, No.2, pp. 125-129
xvi. Pandian, T.J., Patchairaj, R., Mathavan,S. and Palanichamy, R (1978). Effect of temperature and leaf ration on the water budget of the final instar larvae of *pqnauschrysippus*.L. (Lepidoptera : Donidae) Monit. Zool. Ital. 12 : 17-28
xvii. Radhakrishna, P.G and Delvi, M.R (1987). Effect of ration level on food utilization in the silkworm *Bombyxmori* L. (Lepidoptera : Bombycidae). Sericologia : 27 : 347-354
xviii. Radhakrishnan,K.(1992) Effect of synthetic pyrethroid and organophosphrus insecticides on food and water budgets in Different races of *Bombyxmori* L. Bangalore University, Ph.D thesis pp. 146
xix. Ross,H.H (1956). In a text book of Entomology (New York : JhonWiley) 124-125
xx. Schroedar, L.A (1971). Energy budget of larvae of *HyalophoraCecropia* fed lilac leaves . Ann. Entomol Soc. AM. 65 : 367-372
xxi. Scriber, J.M and Slansky, F. Jr.,(1981). The nutritional ecology of immature insects. Ann. Rev. Entomolgy 26: 183-211
xxii. Waldbauer, G.P (1968). The consumption and utilization of food by insects in advances in insect physiology (Eds) :J.W.L BeamentJ.W.Treherne, V.B. Wigglesworth (Newyork: Academic press) 5: 229-288