

EFFECTS OF FOOD FROM MULBERRY TREATED WITH UREA “N” ON LARVAL DEVELOPMENT AND COCOON WEIGHT OF SILKWORM *BOMBYX MORI* L.

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Abstract: Silkworm larvae fed on leaves, from mulberry (*Morus laevigata* L.) tree, given soil treatment with 0.2%N concentration, consumed significant more food, gained more weight and produced heavier cocoons, as compared to those fed on leaves from trees treated with 0.1%N, 0.3%N, 0.4 %N concentrations.

Keywords: *Morus laevigata* L., Nitrogen, *Bombyx mori* L., Food consumption, Larval weight, Cocoon weight.

INTRODUCTION

Silkworm (*Bombyx mori* L.) is a monophagous insect and feeds on mulberry leaves. Mulberry leaves have been supplemented with various nutrients for silkworm feeding to promote silk quality and quantity. Mahmood *et al.* [2002] found that silkworm larvae, when fed on mulberry leaves treated with 2Kg FYM+0.2%N concentration solution significantly consumed more food, gained more larval weight and produced heavier cocoons as compared with those fed on untreated or other treated leaves. Ashfaq *et al.* [1998a] was found that silkworm larvae when fed on mulberry leaves treated with 0.2%N + 0.05%Cu concentrations solution consumed more food, gained more larval weight and produced heavier cocoons as compared to untreated. Rasool [1995] reported that silkworm larvae, when fed on leaves treated with 0.2%N+0.5%Mn concentrations solution consumed more food, gained more larval weight and produced heavier cocoons as compared with those fed on untreated leaves. Haq and Saleem [1985], and Mahmood *et al.* [1989] concluded that larvae fed on leaves treated with 0.2%N concentration solutions consumed more food, gained significantly more weight and produced heavier cocoons as compared to those fed on leaves treated with 0.1%, 0.3% and 0.4%N concentrations. Anonymous [1973-74] found that “N” has a greater effect on feeding and growth of the mulberry plants. Krishnaswami *et al.* [1971] reported that Soil application of “N” to mulberry tree increased the yield of foliage of mulberry tree significantly improved cocoon weight of silkworm larvae fed on leaves from such trees.

Besides being a precious fiber, silk is also used for making parachutes, tyrelinings, electrical insulation materials, artificial blood vessels and surgical sutures. Silkworm pupae have been used for the preparation of oil from which soap, plasticizers, hydrolysed protein, amino acids and vitamin B₁₂ can be obtained. The present studies were aimed for studying the effect of different “N” application to mulberry trees on silkworm

feeding and cocoon weight, with an ultimate aim of producing more and better quality/quantity of silk.

MATERIALS AND METHODS

The Eggs of Korean strain, F₁ Hybrid (JAM 108 X JAM 107) of silkworm, *Bombyx mori* L., procured from Punjab Forest Department, Lahore were incubated during the last week of February in the growth chamber at 28±2° C and 70-80% relative humidity. Urea (46%N) in different 0.1%, 0.2%, 0.3% and 0.4% concentrations was applied four time at ten days interval through roots with irrigation to four sprouted mulberry trees of two years age growing in the Entomological Experimental Area, University of Agriculture, Faisalabad. The treatments were as follows:

T1	=	0.1% N	Applied in soil to mulberry tree
T2	=	0.2% N	Applied in soil to mulberry tree
T3	=	0.3% N	Applied in soil to mulberry tree
T4	=	0.4% N	Applied in soil to mulberry tree
T5	=	Check	

The silkworm larvae pass through five instars (1st instar six days, 2nd instar five days, 3rd instar seven days, 4th instar nine days and 5th instar completed after nine to ten days). In the beginning of every instar, they stop feeding and keep $\frac{1}{3}$ of anterior body raised up and withdraw thoracic legs. The 1st and 2nd instar larvae were fed on chopped green leaves while the remaining three instars were fed on whole green leaves plucked from trees which received different treatments. Food was supplied to larvae at 8.00 am and 8.00 pm daily till the larvae were fulfed and ready for pupation. The newly hatched, silkworm larvae were divided into five groups including check, following Randomized Complete Block Design with three replications and each replication had thirty larvae. Thirty larvae of each group were separately reared in 10X10 cm sized fifteen cardboard trays up to 3rd instar, while 4th and 5th instar larvae were reared in 10X20 cm cardboard trays. The larval weight was recorded on the last day of each instar using electronic balance. The residual leaves and feces were collected separately and dried in the oven at 100° C for 24 hours. The food consumption was measured by subtracting the dry weight of residual leaves directly from the determined total dry weight of leaves offered to silkworm at the end of each instar. Cocoon weight with and without pupae was also recorded after two to three day of pupation for different treatments. The data were analyzed statistically and Duncan's multiple range (DMR) test at 5% probability [1981] was applied to test the significance of results.

RESULTS AND DISCUSSION

FOOD CONSUMPTION

In Table 1 there is no significance difference in food consumption up to first three instar *Bombyx mori* larvae when fed on mulberry leaves from

trees received 0.1%, 0.2%, 0.3% and 0.4%N concentration soil application. The work tally with Mahmood *et al.* [2002], Shafiq and Haq [1993] and Mahmood *et al.* [1989] who found that when larvae fed on mulberry leaves treated with different concentrations there is no significance difference in 1st three instar regarding food consumption. The maximum average quantity of food consumed in the 4th and 5th instars was 688.89 and 4371.91 mg/larva when larvae fed on leaves plucked from tree treated with 0.2%N concentration soil application (T2), Whereas minimum average food 445.61 and 2808.23 mg/larva when fed on leaves from tree receiving no treatment (T5). Therefore, (T2) was the best treatment. Thus, the research findings are in agreement with the work of Mahmood *et al.* [1989], Shafiq and Haq [1993], and Mahmood *et al.* [2002] who found that when larvae fed on leaves treated with 0.2%N concentration consumed more food as compared to untreated or other treated leaves. Ashfaq *et al.* [1998a] found that silkworm larvae when fed on mulberry leaves treated with 0.2%N + 0.05%Cu solution consumed more food as compared to untreated leaves. Min and Kim [1980] found that urease activity increased with increasing concentration of urea. Urease activity decreased gradually with increasing concentrations of urea.

Table1: Average food consumption by silkworm on leaves from mulberry trees receiving different "N" concentrations.

Treatments	Average Food Consumption (mg)/larvae				
	1 st instar	2 nd instar	3 rd instar	4 th instar	5 th instar
0.1%N	13.67 a	24.05 a	83.60 a	673.66 ab	4335.99 ab
0.2%N	14.10 a	25.09 a	83.69 a	688.89 a	4371.91 a
0.3%N	13.65 a	22.24 a	81.13 a	644.12 c	4330.42 abc
0.4%N	13.51 a	21.01 a	79.30 a	606.96 d	4311.10 bcd
Check	13.41 a	14.39 b	68.98 b	445.61 e	2808.23 e

Values followed by same letters do not differ significantly at 5% level of probability.

LARVAL WEIGHT

First instar larvae gained maximum weight when fed on mulberry leaves plucked from tree treated with 0.2%N concentration. Similarly larvae gained average weight of 3.79, 3.70, 3.66 and 3.35 mg/larva when fed on leaves from trees received 0.1%, 0.3% and 0.4%N concentration and untreated respectively. The maximum weight gained in the 2nd, 3rd, 4th and 5th instars was 13.25, 55.90, 312.90 and 1140.12 mg/larva when larvae were fed on mulberry leaves plucked from tree treated with 0.2%N (T2) concentration respectively as against minimum larvae gained in average weight 12.03, 45.20, 254.72 and 718.22 mg/larva when fed on leaves plucked from untreated tree (T5). The gained in average weight trend in all other treatments in all rest of four instars were similar to 1st instar (Table 2). Therefore, T2 was the best treatment. The present findings are similar as of Mahmood *et al.* [2002] silkworm larvae, when fed on mulberry leaves treated with 2Kg FYM+0.2%N concentration significantly

gained more larval weight as compared with those fed on untreated or other treated leaves. Ashfaq *et al.* [1998a] and Javaid [1991] found that silkworm larvae when fed on mulberry leaves treated with 0.2%N concentration solution gained significantly more weight as compared to that fed on untreated leaves. Ashfaq *et al.* [1998b, c], Rasool [1995], Zaman [1995], Tariq [1993] and Ishtiaq and Akhtar [1992] also concluded that when larvae were fed on leaves treated with different nutrients gained significantly more weight as compared to those fed on untreated leaves. The results are similar to that of Mahmood *et al.* [1989] and Haq and Saleem [1985] who found that with 0.2%N concentration treatment *Bombyx mori* larvae gained significantly more weight as compared to the larvae fed on leaves treated with 0.1%, 0.3% and 0.4%N concentrations. Similar studies were also carried out by Askari and Sharan [1982], and Liaw and Shikata [1980] who reported that feeding silkworm larvae on top, young and tender leaves which are usually rich in "N" resulted in better larval development than those fed on leaves low in "N". Horie [1978] found that the effect of additional supplementation of 0.2%N treated mulberry leaves to the larvae significantly increase the weight of larvae. Simple correlation between food consumed and larval weight was also found to be significant and positive.

Table 2: Effect of different "N" concentrations on average weight gain of silkworm

Treatments	Average Larval Weight (mg)				
	1 st instar	2 nd instar	3 rd instar	4 th instar	5 th instar
0.1%N	3.79 b	13.00 b	55.10 b	300.00 b	1120.56 b
0.2%N	4.10 a	13.25 a	55.90 a	312.90 a	1140.12 a
0.3%N	3.70 c	12.80 c	55.05 bc	290.05 c	1095.90 c
0.4%N	3.66 cd	12.73 cd	54.95 cd	280.09 d	1070.90 d
Check	3.35 e	12.03 e	45.20 e	254.72 e	718.22 e

Values followed by same letters do not differ significantly at 5% level of probability.

COCOON WEIGHT

The average maximum cocoon weight with pupa was 410.39 mg and without pupa was 210.26 mg when fed on leaves obtained from 0.2%N concentration treated as against 348.33, 381.44, 380.05 and 267.36 mg with pupa; 200.22, 196.90, 185.37 and 137.75 mg without pupa in case of 0.1%, 0.3% and 0.4%N concentrations and leaves from untreated tree, respectively. The weight of cocoon in 0.2%N concentration (T2) was higher than all other treatments (Table 3). Present findings are in the line of Mahmood *et al.* [2002] silkworm larvae, when fed on mulberry leaves treated with 2Kg FYM+0.2%N concentration produced heavier cocoons as compared to untreated or other treated leaves. Ashfaq *et al.* [1998a] and Javaid [1991] who found that silkworm larvae when fed on mulberry leaves treated with 0.2%N concentration solution produced heavier cocoons as compared to untreated leaves. Similar studies were also carried out by Ashfaq *et al.* [1998b,c], Rasool [1995], Zaman [1995], Tariq [1993], and Ishtiaq and Akhtar [1992] who concluded that larvae when fed

on nutrient treated leaves produced heavier cocoon as compared to those fed on untreated. Similarly Shafiq and Haq [1993] found cocoon weight directly proportional to the "N" content of the leaves. Mahmood *et al.* [1989], and Haq and Saleem [1985] found that 0.2%N concentration produced heavier cocoons as compared to the larvae fed on leaves treated with 0.1%, 0.3% and 0.4%N concentrations. Askari and Sharan [1982], and Liaw and Shikata [1980] reported that feeding silkworm larvae on top, young and tender leaves, which are usually rich in "N" resulted in more cocoon weight than when fed on leaves which are low in "N". Min and Kim [1980] found that urease activity increased with increasing concentration of urea. Urease activity decreased gradually with increasing concentrations of urea. Horie [1978] found that the effect of additional supplementation of 0.2%N treated mulberry leaves to the larvae significantly increase the weight of cocoon. Krishnaswami *et al.* [1971] reported that soil application of "N" to mulberry leaves significantly improved cocoon weight of silkworm fed on leaves of treated trees.

All the Scientists were of view that mineral supplementation has a profound effect on the cocoon weight. 0.2%N, which has been tested by a number of Scientists, mentioned earlier in the context as the most suitable dose. Simple correlation between food consumed and cocoon weight (with and without pupae) was also found to be significant and positive.

Table 3: Effect of different "N" concentrations on average cocoon weight of silkworm.

Weight (mg)	0.1% N	0.2% N	0.3%N	0.4% N	Check
Cocoon with pupa	384.33 b	410.39 a	381.44 c	380.05 d	267.36 e
Cocoon without pupa	200.22 b	210.26 a	196.90 c	185.37 d	137.75 e

Values followed by same letters do not differ significantly at 5% level of probability.

On overall basis 0.2%N concentration was found to be the optimum concentration affecting the parameters studied in the present study. It has also been found that food with high "N" i.e.0.3% and 0.4% adversely affected on food consumption, larval weight and cocoon weight as also observed by Haq and Saleem [1985].

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