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# DETERMINATION OF OPTIMUM TIME FOR MASS MOUNTING OF MULTIVOLTINE SILKWORM, *BOMBYX MORI* (L.) [LEPIDOPTERA : BOMBYCIDAE] UNDER TROPICAL CONDITIONS OF WEST BENGAL.

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## INTRODUCTION

Towards the end of final larval instar, the silkworm starts cleaning its alimentary canal. When the alimentary canal is empty, the worm looks translucent and called mature. Such mature larvae normally crawl towards the periphery of the rearing trays in search of suitable support for building their cocoons. The process of picking the ripe worms and putting them on suitable mountages for the spinning of cocoons is called mounting of worms.

In usual sericultural practices of West Bengal, a farmer rears about 100-200 dfls. of multivoltine silkworm race nistari of *Bombyx mori* (L.) in each commercial crop season. All the worms of a lot do not ripen simultaneously. It is observed that it takes about 24-48 hours for maturation of the entire lot. During this period, the mature worms are picked-up intermittently and mounted for spinning, which involves a great deal of labour and time. Therefore, the present study was undertaken to determine an optimum time for mass mounting of the worms after first appearance of maturation in the lot in order to save labour and time.

## MATERIALS and METHODS

The experiment was conducted with 50 dfls. of popular multivoltine race nistari of *Bombyx mori* (L.) reared on S1 variety of mulberry leaves at room temperature and humidity. In 5th larval instar 10,000 worms were taken at random from the mass to initiate the experiment. After the first appearance of maturation in the lot, these worms

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were picked up and put on a separate bamboo mountage. The picking commenced at 6 A. M. and continued at an interval of four hours until the experimental material exhausted. The cocoons were harvested on the 5th day of spinning; subsequently, cocooning percentage, single cocoon weight, single shell weight and silk ratio were recorded. Data of mature worms during each mounting time were taken together for calculating the mean mature value of the concerned parameters. Deviation of premature value from the mean mature one under each parameter at every mounting time is presented in parenthesis. The mean cocooning percentage for mature worms is calculated from the ratio of total number of cocoons resulted from mature worms and total number of mature worms mounted.

The mean values of single cocoon weight and single shell weight for mature worms are actually the mean figures weighted, weight in each case being the ratio of harvest cocoons at different times of mounting and total number of cocoons harvested from mature worms.

The mean of silk ratio is the figure of total shell weight and total cocoon weight expressed in percentage for mature worms. The experiment was conducted in all four commercial seasons, viz., Falgooni (February-March), Jaistha (May), Bhaduri (August-September) and Agrahayani (November) of the year 1984.

## Results and Discussion

The data regarding mean performance of mature and premature worms on cocooning percentage, single cocoon weight, single shell weight and silk ratio during the foregone commercial seasons are presented in Tables 1, 2, 3, 4. During the seasons of February-March (Table-1) and November (Table-4). the mounting commenced at 6 A. M. and ended at 10 A. M., whereas in May (Table-2) and August-September Seasons (Table-3), the Mounting started at 6 A. M. and ceased at 6 A. M. of the following day.

During February-March (Table-1) there was no marked difference in cocooning percentage for mature and premature worms at different intervals. However, at 2 P. M. single cocoon weight, single shell weight and shell ratio of premature worms showed no reduction of their mean mature values, as evident by the positive deviation in parenthesis.

In May (Table-2) at 6 P. M. the deiviation of the cocooning percentage of premature larvae was found to be minimum (2·37) as compared to that of their mean mature value except 6 A. M. of the following day. Single shell weight and silk ratio of premature larvae at 6 P. M. showed higher grade than their mean mature values, as evident by positive deviation in parenthesis.

## TABLE : 1

Mean performance of mature and pre-mature worms mounted at different times on cocooning, single cocoon weight, single shell weight and silk ratio

Season : February-March, 1984. Temperature : 25°C±1°C
Relative humidity : 63%±2%

| Time of mounting | Mature (M) Pre-mature (PM) | No of M and PM worms mounted at the time out of10,000 worms | Cocoons harvested (No.) | Cocooning (%) | Single cocoon weight (g.) | Single shell weight (g.) | Silk Ratio (%) |
|---|---|---|---|---|---|---|---|
| 6 A. M. | M | 971 | 968 | 99·69 | 0·880 | 0·109 | 12·38 |
| | PM | 971 | 955 | 98·35(−1·23) | 0·831(−0·065) | 0·100(−0·012) | 12·03(−0·44) |
| 10 A. M. | M | 2280 | 2267 | 99·42 | 0·887 | 0·110 | 12·40 |
| | PM | 2280 | 2253 | 99·81(−0·77) | 0·836(−0·060) | 0·101(−0·011) | 12·80(−0·39) |
| 2 P. M. | M | 386 | 384 | 99·48 | 0·918 | 0·115 | 12·52 |
| | PM | 386 | 382 | 98·96(−0·62) | 0·904(+0·008) | 0·113(+0·001) | 12·50(+0·03) |
| 6 P. M. | M | 799 | 798 | 99·87 | 0·917 | 0·116 | 12·64 |
| | PM | 799 | 796 | 99·62(+0·04) | 0·905(+0·009) | 0·114(+0·002) | 12·59(+0·12) |
| 10 P. M. | M | 822 | 819 | 99·63 | 0·910 | 0·114 | 12·52 |
| | PM | 306 | 305 | 99·67(+0·09) | 0·906(+0·010) | 0·114(+0·002) | 12·58(+0·11) |
| | | | | M* = 99·58 | M* = 0·896 | M* = 0·112 | M* = 12·47 |

M* = Mean Value of the concerned parameter of worms.

Figures in Paranthesis denotes deviation from mean value of mature worms.

TABLE : 2

Mean performance of mature and pre-mature worms mounted at different times on cocooning, single cocoon weight, single shell weight and silk ratio

Season : May, 1984

Temperature : 31°C±1°C
Relative humidity : 80%±2%

| Time of Mounting | Mature (M) Pre-nature (PM) | No. of M and PM works mounted at the time out of 10,000 worms | Cocoons harvested (No) | Cocooning (%) | Single cocoon weight (g.) | Single shell weight (g.) | Silk Ratio (%) |
|---|---|---|---|---|---|---|---|
| 6 A. M. | M | 702 | 658 | 93·73 | 0·724 | 0·036 | 11·89 |
| | PM | 702 | 607 | 86·46(−8·46) | 0·703(−0·029) | 0·076(−0·016) | 10·81(−1·73) |
| 10 A. M. | M | 1214 | 1129 | 92·99 | 0·728 | 0·090 | 12·36 |
| | PM | 1214 | 1109 | 91·35(−3·57) | 0·721(−0·012) | 0·082(−0·010) | 11·37(−1·17) |
| 2 P. M. | M | 268 | 252 | 94·02 | 0.732 | 0.091 | 12·43 |
| | PM | 268 | 246 | 91·79(−3·13) | 0·730(−0·002) | 0·090(−0·002) | 12·32(−0·22) |
| 6 P. M. | M | 94 | 89 | 94·68 | 0·735 | 0·094 | 12·78 |
| | PM | 94 | 87 | 92·55(−2·37) | 0·732(+0·000) | 0·093(+0·001) | 12·70(+0·16) |
| 10 P. M. | M | 214 | 201 | 93·92 | 0·736 | 0·095 | 12·90 |
| | PM | 214 | 198 | 92·52(−2·40) | 0·732(−0·001) | 0·094(+0·002) | 12·84(+0·30) |
| 6 P. M. | M | 4558 | 4363 | 95·72 | 0·734 | 0·093 | 12·67 |
| (Next day) | PM | 458 | 430 | 93·88 (−1·04) | 0·733(+0·001) | 0·092 (+0·000) | 12·55(+0·01) |
| | | | | M*=94·92 | M*=0·732 | M*=0·092 | M*=12·54 |

M*=Mean value of the concerned parameter of worms

Figures in Paranthesis denotes deviation from mean value of mature worms,

## TABLE : 3

Mean performance of mature & pre-mature worms mounted at different times on cocooning, Single cocoon weight, Single shell weight and silk ratio.

Season : August-September, 1984.

Temperature : 31°C±1°C
Relative humidity : 91%±2%

| Time of Mounting | Matural (M) Pre-mature (PM) | No. of M and PM worms mounted at the time out of 10,000 worms | Cocoons harvested (No.) | Cocoonig (%) | Single cocoon weight (g.) | Single shell weight (g.) | Silk Ratio (%) |
|---|---|---|---|---|---|---|---|
| 6 A. M. | M | 1388 | 1289 | 92·86 | 0·787 | 0·085 | 10·80 |
| | PM | 1388 | 1256 | 90·48(−3·35) | 0·758(−0·044) | 0·080(−0·007) | 10·55(−0·33) |
| 10 A. M. | M | 1749 | 1629 | 93·13 | 0·797 | 0·086 | 10·79 |
| | PM | 1749 | 1605 | 91·76(−2·07) | 0·774(−0·028) | 0·083(−0·004) | 10·72(−0·16) |
| 2 P. M. | M | 177 | 169 | 95·48 | 0·812 | 0·083 | 10·83 |
| | PM | 177 | 167 | 94·35(+0·52) | 0·787(−0·015) | 0·085(−0·002) | 10·80(−0·08) |
| 6 P. M. | M | 131 | 125 | 95·41 | 0·819 | 0·090 | 10·98 |
| | PM | 131 | 124 | 94·65(+0·82) | 0·815(+0·013) | 0·089(+0·002) | 10·92(+0·04) |
| 10 P. M. | M | 116 | 112 | 96·55 | 0·818 | 0·090 | 11·00 |
| | PM | 116 | 111 | 95·68(+1·85) | 0·811(+0·009) | 0·089(+0·002) | 10·97(+0·09) |
| 6 P. M. | M | 2739 | 2287 | 94·45 | 0·811 | 0·089 | 10·97 |
| (Next day | PM | 139 | 134 | 96·40(+2·57) | 0·810(+0·008) | 0·089(+0·002) | 10·98(+0·10) |
| | | | | M*=93·83 | M*=0·802 | M*=0·087 | M*=10·88 |

M*=Mean value of the concerned parameters of worms.

Figures in Paranthesis denote deviation from mean value of mature worms.

TABLE : 4

Mean performance of mature and pre-mature worms mounted at different times on cocooning, single cocoon weight, single shell weight and silk ratio

Season : November, 1984

Temperature : 24°C±1°C
Relative humidity : 72%±2%

| Time of Mounting | Mature (M) pre-mature (PM) | No. of M and PM works mounted at the time out of 10,000 worms | Cocoons harvested (No.) | Cocooning (%) | Single cocoon weight (g.) | Single Shell weight (g.) | Silk Ratio (%) |
|---|---|---|---|---|---|---|---|
| 6 A. M. | M | 766 | 754 | 98·43 | 0·835 | 0·091 | 10·89 |
| | PM | 766 | 741 | 96·73(−2·17) | 0·768(−0·084) | 0·081(−0·014) | 10·54(−0·56) |
| 10 A. M. | M | 2426 | 2391 | 98·55 | 0·847 | 0·093 | 10·97 |
| | PM | 2426 | 2367 | 97·56(−1·34) | 0·792(−0·060) | 0·085(−0·010) | 10·73(−0·37) |
| 2 P. M. | M | 205 | 203 | 99·02 | 0·868 | 0·098 | 11·29 |
| | PM | 205 | 200 | 97·56(+1·43) | 0·858(+0·006) | 0·096(+0·001) | 11·18(+0·08) |
| 6 P. M. | M | 113 | 112 | 99·11 | 0·881 | 0·099 | 11·23 |
| | PM | 113 | 110 | 97·34(−1·56) | 0·859(+0·007) | 0·096(+0·001) | 11·17(+0·07) |
| 10 P. M. | M | 2137 | 2122 | 99·43 | 0·860 | 0·097 | 11·27 |
| | PM | 843 | 332 | 98·69(−0·21) | 0·859(+0·007) | 0·097(+0·002) | 11·29(+0·19) |
| | | | | M*=98·90 | M*=0·852 | M*=0·095 | M*=11·10 |

M*=Mean value of the concerned parameter of worms.

Figures in Paranthesis denote deviation from mean value of mature worms.

During the season of August-September (Table-3), it was observed that at 6 P. M. cocooning percentage, single cocoon weight, single shell weight and silk ratio of premature larvae registered a positive deviation from their mean mature values.

During the season of November (Table-4), there was no marked variation in cocooning percentage of mature and premature worms at different intervals. However, single cocoon weight, single shell weight and silk ratio of premature larvae at 2 P. M. showed positive deviation from their mean mature values.

The above results indicate that if all the premature and mature multivoltine sikworms are mounted intermittently for 8 hours (during February-March and November) to 12 hours (during May and August-September) after their first appearance of maturation in the lot, the premature worms result in the formation of normal cocoons without any adverse effect on cocooning and quality of cocoons. Sukcharoen and Akapanathu (1987) reported that in silkworm race $K_1 \times K_{13}$ the mature worms collected after 24 hours of discharging green faeces, were better in cocoon weight and shell weight.

The long duration of ripening of silkworms may be due to many factors, one of which is the formation of egg-cells that do not proceed uniformly within the ovariole (Tazima, 1964). There is conspicuous difference in the rate of growth among egg-cells depending on their location in distal and proximal portions of the ovariole. In general, about seventy eggs are deposited from each tubule. The difference in the growth-rate of egg-cells might reflect in the uneven maturation of the silkworms as well as the hatchability of silkworms, as their hatching usually begins in early morning and ends at about 8-10 A. M. (Tanaka, 1964).

Moulting is a very critical factor in silkworm rearing. The worms normally settle in about 6-8 hours from the time first signs of moulting are noticed. Most of the worms (over 90 %) also come out of moult within 6-8 hours from the time the early moulted worms appear in the bed (Krishnaswami, 1986). This 6-8 hours difference during settling in moult or comming out of moult in a rearing bed is continued till ripenning time of the worms, which are then intermittently mounted.

It is well known that temperature and humidity play a vital role in the uniform development of silkworms. Krishnaswami *et al.*, (1971) observed that there is a high degree of climatic fluctuations in West Bengal. Such a condition may lead to variation in maturation of the silkworms. Generally, worms during the ripening time require a temperature around 24°C and 60% to 70% relative humidity (Ullal and Narsimhanna, 1978). High humidity lengthens the ripening period ; this is evident from the fact that during the season of May (Jaistha) and August and Septemper (Bhaduri), total ripening period

required 24 hours, whereas during the seasons of February-March (Falgooni) and November (Agrahayani), ripening ended within 18 hours.

The supply of adequate food and proper spacing is necessary for the uniform growth of silkworm (Sengupta and Yusuf, 1974). However, the difference in the assessibility of food among the individuals may lead to uneven growth of the silkworms.

All these factors, viz., gradual maturation of egg-cells, hatching duration, irregular moulting, high degree of fluctuations of temperature and relative humidity and difference in the assessibility of food, may collectively operate to prolong the ripening period (24-48 hours) of the multivoltine silkworms. During this ripening period, the appetite of silkworms is gradually reduced leading to cessation of feeding at about 8-12 hours after the initiation of ripening, when most of the worms remain busy with cleaning their intestine and prepare themselves for spinning. So, if all the worms are mounted about 8-12 hours after the initiation of ripening, there will be no adverse effect on cocooning economic importance of cocoons. It is useful to reduce labour, cost and time during spinning.

## Summary

It was experimentally observed on multivoltine silkworm, *Bombyx mori* (L.) that by intermittent picking and mounting of mature larvae done for 8-12 hours from their first appearance followed by that of all the other mature and premature larvae in the lot mounted at a time, the premature larvae resulted in the formation of normal cocoons without any adverse effect both on the yield and quality of cocoons. Performances of mature and premature larvae, picked-up at different intervals, on cocooning and qualitative characters of cocoons are discussed.

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