

## **CLASSIFICATION OF SILKWORMS BASED ON VOLTINISM**

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Voltinism is a term used in biology to indicate the number of broods or generations of an organism in a year. Or Number of generations per year under natural environmental conditions. Based on voltinism *Bombyx mori* is divided in to 3 types, namely

1. UNIVOLTINES,
2. BIVOLTINES and
3. MULTIVOLTINES.

### **1. UNIVOLTINE RACES:**

They produce only one generation per year. The larval weight is comparatively higher and cocoons are heavy. Denier of the silk filament is above 2.3. They are not suitable for summer & winter rearings, since the larvae are weak against unfavourable conditions especially to higher temperature. They lay only diapausing eggs. All European races are univoltines *eg.*, E16

### **2. BIVOLTINE RACES:**

They produce only two generations per year. The length of the larval stage is short. The leaf consumption to cocoon production (cocoon ration) is less, and the quality of the cocoons inferior to that of univoltine races. Further, cocoon weight, shell weight, silk % & filament length are lesser than uni/mono voltines. Most of the temperate races are bivoltines and lays both non hibernating and non-hibernating eggs. *eg.*, NB<sub>4</sub>D<sub>2</sub>, NB<sub>18</sub>, KA, NB<sub>7</sub> *etc.*,

### **3. MULTIVOLTINE RACES:**

They produce more than 5-6 generations per year. The length of the larval duration is short. In most of the polyvoltine races the leaf cocoon ratio is high, cocoons are compact grained and cocoon layer is soft. The length of the filament is short (approximately 400 meters). However, the cocoon filament is fine and clean with little lousiness; but with more lustrous. The larvae are robust and can tolerate fluctuating environmental conditions and hence best suited for tropical climates. They lay only non-diapausing eggs. *Eg.*, Pure Mysore, C. nichii, Hosa Mysore.

## **CLASSIFICATION BASED ON MOULTINISM**

Moulting - Moulting or molting, also known as shedding, or ecdysis, is the manner in which an animal routinely casts off an outer layer or covering at specific points in its

life cycle. Based on this character silkworms can be classified in to tri moulters, tetra moulters, penta moulters and hexa moulters (very rare)

### **1. TRIMOULTERS:**

This group includes silkworms which moult three times during larval period. The larval growth is limited, the larval duration short ranging from 15-18 days. Pupae & moths are small, cocoon weight is less, cocoon filament is fine & denier of the silk filament ranges from 1.6 to 1.7.

### **2. TETRAMOULTERS:**

This group moults four times during their larval stage. The length of the larval stage is medium ranging from 23-28 days. The larval growth and cocoon weight is medium. Denier is 2-2.5. Tetra moulters are cosmopolitan in their distribution.

### **3. PENTAMOULTERS:**

The silkworms of this group moults five times during their larval stage. The length of the larval stage is long, larval weight is high and cocoons are heavy, filament length is more. Denier of the silk filament denier is very high.

## **CLASSIFICATION BASED ON GEOGRAPHIC DISTRIBUTION**

### **1. JAPANESE RACE (ABORIGINAL IN JAPAN)**

Fecundity is higher ranging from 600-700. The larvae are very active & leaf cocoon ratio is less. Larval body size is smaller for long larval duration & is around 26 days and the larvae are marked. The shape of the cocoon is strangulated giving the appearance of pea nut shape. Almost all races produce white cocoons. Further, Per cent age of double cocoons is more & quality of silk is better. Larvae are susceptible to grasserie and flacherrie. There are Uni and Bivoltines races in this group.

### **2. CHINESE RACE (ABORIGINAL IN CHINA):**

In Chinese races the fecundity rate is higher ranging from 600- 650 eggs. The progress of the larval growth is quick & as a result of which the leaf cocoon ratio is less. Most of the Chinese races are plain without any markings. The shape of the cocoon is round/elliptical/few of them are spindle shaped. The Cocoon colour is white, golden yellow, flesh or red. The Silk filament is fine & reelability is good. The Chinese races are resistant to high temperature & humidity. Uni, Bi, Multivoltines falls under this group and even trimoulters are noticed.

### 3. EUROPEAN RACES (ABORIGINAL IN EUROPE AND CENTRAL ASIA):

The fecundity rate is medium ranging from 550- 600 & size of the eggs is large. The larval stage is long, the moulting period reduced by 1-2 h. The larvae are plain without any markings. The cocoons are big, long elliptical. Cocoons are either white/flesh coloured. The per cent age of double cocoons is less. The filament length is long with good reelability. European races are weak against high temperature & humidity. All are Univoltines.

### 4. SOUTH EAST ASIAN RACES (TROPICAL):

The fecundity rate is lower ranging from 400-500. Eggs are small. The larval length is short with few exceptions where the tropical races of India exhibit longer larval duration. The larval markings are not common in these races. Leaf cocoon ratio is high. The size of the larvae is small. The shape of the cocoon is spindle, flossy with less filament. The common cocoon colour is green/pink/yellow/white. Denier of the silk filament is fine. These races are resistant to varied environmental conditions especially high temperature & humidity. Multivoltines/polyvoltine breeds are very common.





**Popular silkworm breeds of Karnataka & their economic traits**

In Karnataka, a multi X bi (Pure Mysore X CSR<sub>2</sub>, earlier it was Pure Mysore X NB<sub>4</sub>D<sub>2</sub>) hybrid is very popular and used for the production of commercial silk in the areas where irrigation facility is available for mulberry garden. But, in the traditional belt, with rainfed mulberry gardens, still a multi X multi (Pure Mysore X C. nichi) hybrid is used for the production of commercial silk. Further, Nandi, a Bi X Bi between KA X NB<sub>4</sub>D<sub>2</sub> is also reared by some of the rearers to produce commercial silk.

Traits > Breed	Fecundity	Hatching %	LD	Cocoon shape & color	Cocoon wt.	Shell Wt.	Shell %	Denier
PM	473	96.13	689.22	Greenish yellow / oval	0.942	0.130	13.79	1.7
C.nichi	454	96.64	505.11	Dumb bell / white	1.077	0.121	11.32	1.6
NB <sub>4</sub> D <sub>2</sub>	558	95.34	609.55	Dumb bell / white	1.817	0.398	21.89	2.2
KA	540	94.9	600.00	Oval / white	1.62	0.3	18.63	2.1
CSR <sub>2</sub>	550	97	600	Round / oval	1.8	0.36	20	2.1

The brief description of the economic traits and methods used as stated above are as follows:

- a) *Fecundity*: This character represents the number of eggs laid by a female moth after mating.

- b) *Hatching percentage* : This character indicates the number of larvae hatched from disease free layings. The hatching percentage was calculated after deducting the number of unfertilized, unhatched and dead eggs from the total number of eggs laid. The formula for calculation is

$$\text{Hatching percentage} = \frac{\text{No. of eggs hatched in a laying}}{\text{Total no. of eggs per laying}} \times 100$$

- c) *Weight of ten larvae of fifth instar*: It represents the weight of 10 randomly selected healthy and robust larvae weighed one day earlier to spinning.

- d) *Larval Duration*: Represents the total duration in hours of rearing period of silkworm from the time of hatching to that of spinning.

- e) *Yield of cocoons by number*: This character represents the survival rate of larvae that spin cocoons. The 10,000 larvae brushed is taken as a standard unit. The formula for calculation is

$$\text{Yield of cocoons by number} = \frac{\text{Total no. of cocoons harvested}}{\text{Total no. of larvae brushed}} \times 10,000$$

- f) *Yield of cocoons by weight*: It is the total quantity of good cocoons in kilograms obtained for a standard unit of 10,000 larvae brushed. The formula for calculation is

$$\text{Yield of cocoons by weight} = \frac{\text{Total wt. of cocoons}}{\text{Total no. of cocoons harvested}} \times \text{yield of cocoons by number}$$

- g) *Single cocoon weight*: This represents the average weight of randomly selected twenty five cocoons in grams.

h) *Single shell weight*: This indicates the total quantity of silk in grams from twenty five cocoons selected randomly.

i) *Shell ratio*: It is the ratio between shell weight and cocoon weight. It is may be expressed in percentage using the following formula

$$\text{Shell percentage} = \frac{\text{Total weight of shell}}{\text{Total weight of cocoon}} \times 100$$

j) *Filament length*: Total length of filament of single cocoon reeled using eprouvette (a reeling device for monococoon reeling). Mean values of such twenty five observations.

k) *Denier*: Denier is the thickness of the filament and can be calculated using the following formula.

$$\text{Denier} = \frac{\text{Weight of the reeled silk}}{\text{Length of the reeled silk}} \times 9000$$

l) *Effective rate of rearing*: This character represents the ratio of the number of larvae brushed and the number of cocoons harvested from them which is expressed in percentage, the ERR may be was calculated using the following formula.

$$\text{ERR} = \frac{\text{No. of cocoons harvested}}{\text{No. of larvae kept after 3}^{\text{rd}} \text{ moult}} \times 100$$

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