Seasonal effect of different food plants on cocoon characteristics of Tasar Silk moth *Antheraea mylitta Drury*

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Abstract:

Tasar silk moth is commercially bivoltine reared twice in the year in Uttar Pradesh, once during the rainy season (July-August) and second during the autumn (September-October). Sericulture is practiced in Uttar Pradesh for both Tasar and mulberry, but Tasar silk rearing in comparison to mulberry rearing is very low due to environmental conditions, still in some districts of the state, such as; Hardoi, Jhansi, Mirzapur, Sonbhadra, and some other districts, Tasar sericulture has developed. In the present study, available primary and secondary host plants from the Mirzapur area of eastern and Southern Uttar Pradesh were used for the study of *Antheraea mylitta* and recorded the cocoon characters like single shell weight, absolute silk, cocoon weight, peduncle length, cocoon length, and cocoon width were varied from first rearing crop and second rearing crop in different months and related to the host plants fed to larvae.

Key words; *Antheraea mylitta, cocoon, peduncle length, bivoltine*

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Introduction:

In the world, silk is mainly comprised of two different sectors; non-mulberry and mulberry. Sericulture of mulberry refers to the silkworm *Bombyx mori L*. (Lepidoptera: Bombycidae), a monophagous native insect that feeds on mulberry leaves and is nurtured under indoor conditions. The non-mulberry silk area involves tropical Tasar (*Antheraea mylitta Drury)*, temperate Tasar (*Antheraea proylei)*, Eri (*Philosomia ricini hutt*.), and Muga (*Antheraea assamensis* Ww.), all belonging to the Saturniidae family. India is the only country producing all five kinds of silk. Tropical Tasar culture, also known as "wild silks," is one of India's richest tribal cultures (Allam *et al.*, 2018). India is the world's second largest producer of silk, accounting for more than 18% of total raw silk production (Singh *et al.,* 2020). Tasar silk also displays the heavy mortality of larvae due to pests, predators, and climatic hazards (Samhita & Purushotham, 2005). The tropical Tasar silkworm, *Antheraea mylitta Drury*, is a profitable species that occurs in various forms in 44 ecological places in different topographical areas of our country and depends on food plants and ecological conditions. Tasar silk was widely available in Europe and Asian countries at the turn of the nineteenth century (Srivastava *et al.,* 2016). The tropical Tasar silk worm is widely distributed in our country and elsewhere. There are good quality food plants available in India for Tasar rearing. Only 5%, however, use

plants for Tasar culture. Tasar silk worms were found in Sikkim, Meghalaya, West Bengal, Odisha, Bihar, Madhya Pradesh, Jharkhand, Chhattisgarh, Tamil Nadu, and Himanchal Pradesh, and some places were discovered in Uttar Pradesh (Sinha & Prasad 2011). The Tasar silk worms produced Tasar silk (Insecta: Lepidoptera: Saturniidae), which has several eco-races largely controlled by prevailing environmental conditions. In India, Tasar silkworm comes in two varieties: tropical and temperate. In India, *Antheraea mylitta Drury* is commercially exploited for the production of wild silk, and a large number of poor families depend on Tasar culture for their livelihood. Tasar silk shows a higher value of air permeability as compared to mulberry silk. A curtain made of Tasar silk fabric outperforms one made of mulberry silk textile. (Bamhaniya *et al.,* 2017). *Shorea Robusta* accounts for 80% of the Tasar flora range in India, with *Terminalia* species and other multitude trees accounting for the remainder. Only 5% of the Tasar food plant is used for Tasar rearing (Singh and Mishra 2003). Food plant variety and nutritional value have a significant impact on Tasar silk cocoon quality (Jadhav *et al.,* 2014). *Antheraea mylitta,* which feeds primary food plants like *Terminalia arjuna*, *Shorea Robusta* (Sal), and *Terminalia tomentosa,* and secondary food plants *Ziziphus mauritiana, Anogcissus latifolia*, *Syzigium cumini, Hardwickia* binate, and Lareya arborea (Reddy *et al.,* 2010). Large-scale production of Tasar silk is very difficult because *Antheraea mylitta* is a Vanya species. However, if raised outdoors under systematic and scientific conditions, they can produce higher quality cocoons. Before rearing Tasar silk larvae, it is critical to understand their feeding habits and which food plants are suitable for *Antheraea mylitta* in specific environmental conditions. By observing the larval mortality, larval growth, and percentage of egg richness, the best food plants are determined.

Tasar silk is commercially bivoltine reared twice a year in Uttar Pradesh, once during the rainy season (July-August) and once during the autumn (September-October) (deka 2016) In Uttar Pradesh, only a small percentage of the population is familiar with Tasar and silk production. (Sathe and Jadhav, 2011). Sericulture is practiced in Uttar Pradesh for both Tasar and mulberry, but Tasar silk rearing in comparison to mulberry rearing is very low due to environmental conditions, but in some districts of the state, such as Hardoi, Jhansi, Mirzapur, Sonbhadra, and some other districts, Tasar rearing has developed. In the present study, available primary and secondary host plants from the Mirzapur area of eastern and Southern Uttar Pradesh were used for the study of *Antheraea mylitta*. Eastern Uttar Pradesh, particularly Mirzapur and Sonbhadra, is a biodiversity hotspot with a high level of floral and faunal diversity, with 5–6 host plants and a large population of *Antheraea mylitta*. In these regions, the usual breeding of *Antheraea mylitta* is also observed, whereas better conditions, some human outlay, social awareness, and the use of advanced techniques will be helpful to the growth of the Tasar production in eastern Uttar Pradesh. Tasar culture is good for biodiversity conservation and improving the economic condition of tribal people. The area of Sonbhadra districts is 6,788 km2, and the covered forest area is 2436.75 km^2 which is protected forest. Sonbhadra district forests are divided into two types: semitropical evergreen forests and dry deciduous forests. *Antheraea mylitta* rearing conditions in district Sonbhadra regions are favorable for the growth of flora and fauna. The temperature in this region in the summer rises to 41.40 ^{0}C in April–May (the summer season) and comes down to 9.10 ^{0}C during the winter season. In Sonbhadra rainy season lasts from June to September, with most of the rain falling during the south-west monsoon. An average rainfall of 136.6 mm and an average humidity of 65% is observed in the district (Indian Climate).

Materials and Methods

Study area:

The experiment caried out at chaki Resam form Parasi Panday Sonbhadra (Uttar Pradesh), India. Sonbhadra is situated on 24^0 11’18” North Latitude and 82^{0}46’20” East Longitude. The average annual rainfall mean is about 1115 mm. The mean daily maximum

temperature varies from 15 ^{0}C in December to 42^{0}C in May. The minimum temperature varies from 11 ^{0}C in winter and 28-42^{0}C in summer. The relative humidity ranges from 45-90 %, as it is observed during study period 2021-2022.

Materials used:

Seed Stock: Fresh, disease-free laying larvae of *Antheraea mylitta* were obtained from the State Tasar seed culture of Parasi Panday, District Sonbhadra, India. In outdoor conditions, 200 larvae of *Antheraea mylitta* were reared up to the second instar stage equally on three different food plants, viz *Terminalia tomentosa*, *terminalia arjuna*, and *Ziziphus mauritiana*, in rearing trees (size 4x2 feet L x W and 5-feet height) (Jadhav *et al.,* 2014). Later, newly hatched larvae were released on various food plants. In this period, protected from predators and pests with the help of nylon nets, bamboo sticks, and borax powder to clean the area.

Method of recording and observations:

The observations on the following parameters, such as peduncle length, cocoon weight, shell weight, cocoon length, cocoon width, Larval length, and Larval width, recorded, and growth parameters were also recorded (Waldbauer, 1968). Cocoon length, width, and peduncle length were measured with a Vernier calliper and ten randomly selected Tasar silk worm cocoons were selected for this analysis.

Single cocoon weight (g):

Ten cocoons were selected and average cocoon weight (g)was taken. Using electronic balance 10 randomly selected cocoons were taken and weighed. The weight was expressed in grams (Rath, 2010).

Cocoon weight(g) =Weight of cocoon (g)**/**Total number of cocoons

Single cocoon shell weight (g):

Calculated the shell weight (g)of each of 10 cocoons, after removing floss and pupa was weighed using an electronic balance. Taken randomly ten cocoon shells for each replication (Arun *et al.,* 2018).

Precautions taken during rearing silkworms:

The Tasar silk worm larvae are prone to various diseases so various precautions were taken during rearing of silkworm larvae. Some important measures are as following:

Cleaning and Disinfectant was used to sanitise the rearing site surroundings and rearing tree to prevent an outbreak of disease at newly hatched larvae and each instar larvae in sericulture.

Rearing equipment and devices were sterilized from 2 % formalin and cleaned to maintain the appropriate rearing environment and sanitary conditions.

These applications first sprayed with 2% formalin and then kept in the sun for drying.

Washing of hands and changing shoes, were done before entering the rearing space to prevent introduction of disease-causing bacteria.

The rearing site was free from rat tunnels, ant mounds and water logging ditches by thorough cleaning, removing of weed and debris etc, and apply bleaching powder 10g/bush to maintain hygiene.

Do not disturb the larva settled under moult till they come out completely from the old skin.

When the worms are mature transfer them in a plant having at least 70% leaves for hammock formation and spinning cocoons.

Do not disturb the spinning worms. And protect from pests and predators.

Result:

The recorded cocoon characteristics of *Antheraea mylitta* is presented in table I. The cocoon characteristics, like single shell weight, absolute silk, cocoon weight, peduncle length, cocoon length, and cocoon width, varied in different months and were related to the host plants fed to larvae. The table shows that *Antheraea mylitta* produced the most cocoons (12.83 gm) when their larvae were fed *Terminalia tomentosa* as a food plant in September-October, when compared to another host plant. The growth of *Terminalia arjuna*'s cocoon weight (9.55 gm) and development were comparatively better than *Ziziphus mauritiana. Antheraea mylitta's* life cycle is longest in September-October and best compared to the rest of the first rearing

crop, though the life cycle is shortest during the rainy season. Growth of *Ziziphus mauritiana* cocoon weight (8.42 gm) larger in July -August rearing crop, but Shell weight (1.161gm) peduncle length (22 mm), cocoon length (48.73 mm), cocoon width (29.53 mm) was reduced comparatively. In comparison to September to October their cocoon weight (7.203 gm) was less, but shell weight (1.184 gm) peduncle length (32 mm), cocoon length (46.14 mm), and cocoon width (27.85 mm) were larger in second rearing crop. The Presentation of longer (48 mm) peduncle lengths in *Terminalia tomentosa* host plants during (September-October) rearing crop and shorter (22 mm) peduncle lengths in *Ziziphus mauritiana* during (July-August) rearing crop.

Table 1: Cocoon Characteristics of *Antheraea mylitta* on various food plants in different months

Food plants	Rearing Month	Cocoon Weight (gm) Mean value	Shell Weight (gm) Mean value	Peduncle length (mm) Mean value	Cocoon Length in (mm) mean value	Cocoon width in (mm) mean value
Terminalia	July-August	9.914	1.45	47	50.09	30.84
tomentosa	September-October	12.83	1.50	48	53.46	32.6
Terminalia	July-August	8.47	1.417	45	49.69	29.74
Arjuna	September-October	9.55	1.55	46	50.59	30.17
Ziziphus	July-August	8.42	1.161	22	48.73	29.53
mauritiana	September-October	7.203	1.184	32	46.14	27.85

ANOVA Analysis:

Rearing month	Cocoon wt.(g) (F-value)	Shell wt. (g) (F-value)	Peduncle length (mm) (F-value)	Cocoon length(mm) (F-value)	Cocoon Width (mm) (F-value)
Jul-Aug Sept-Oct	2.818 29.140	.907 2.044	602.567 131.640	24.114 24.114	1.252 24.123

Table-2: **Climatic condition at Parasi Panday district of Sonbhadra (2021-2022**).

Months	**Temperature (0C)**		**Humidity (%)**		**Rainfall (mm)**	
	Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**maximum**
July–August	**28.7**	**37.25**	**60**	**84**	**200**	**1100**
September-October	**26.5**	**34.5**	**57**	**82**	**150**	**850**

A-Crop performance of Tasar Silkworm *Antheraea mylitta Drury* by using different food plants from Parasi Panday district Sonbhadra of Uttar Pradesh.

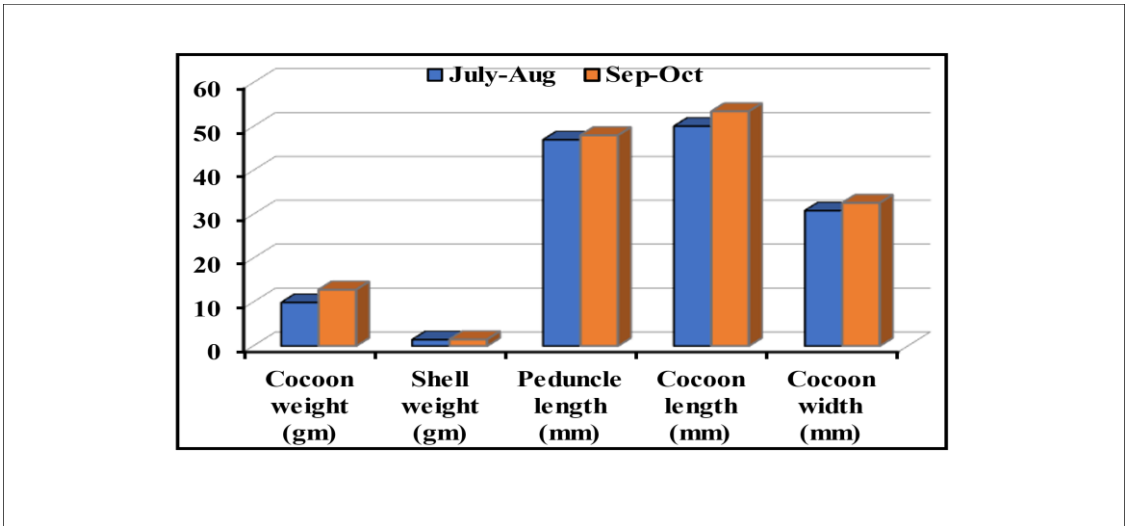

Figure 1. Cocoon parameters from *Terminalia tomentosa* as a food plant

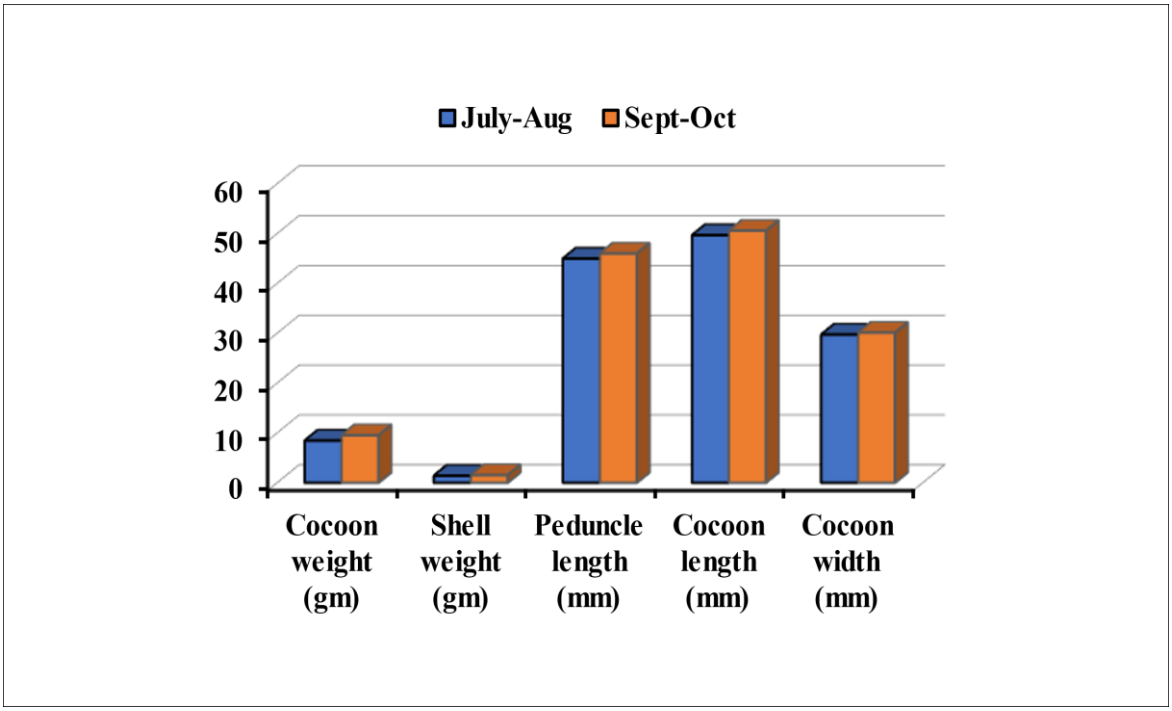

Figure 2. Cocoon parameters from *Terminalia. arjuna* as a food plant

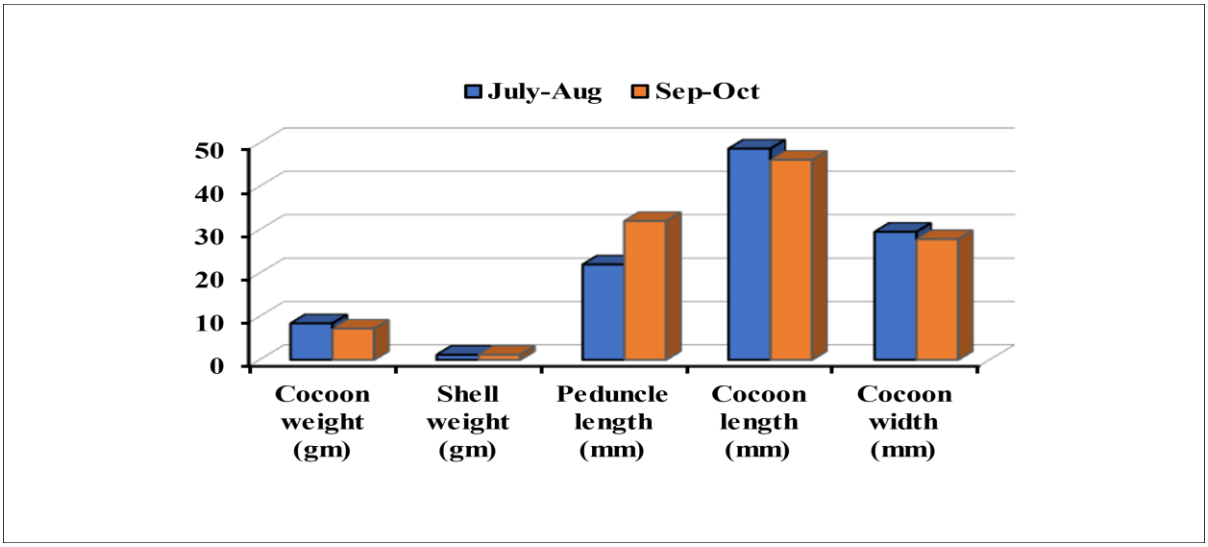

Figure 3. Cocoon parameters from *Ziziphus mauritiana* as a food plant.

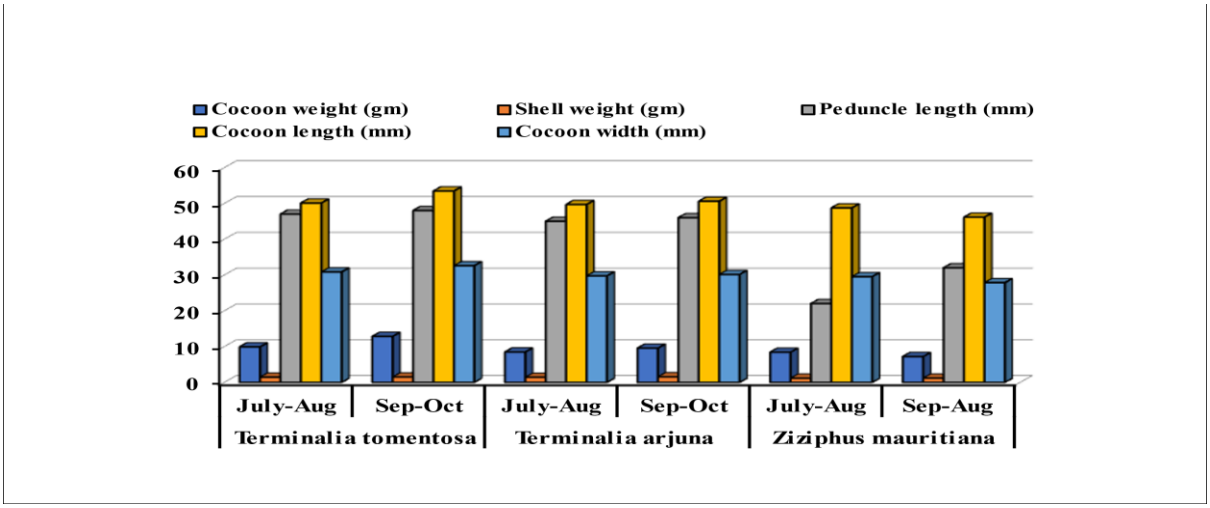

Figure 4. Performance of cocoon different food plants.

Discussions:

The current study estimated that the result effect on *Terminalia tomentosa* food plants was more significant (cocoon weight 12.83 g) in September-October month and less significant (cocoon weight 7.203 g) on *Ziziphus mauritiana* food plants. *Antheraea mylitta*'s life cycle in *Terminalia arjuna* food plants was longer than that of another food plant during (July-August). Higher shell weight of (1.55 g) was recorded in the months of (September – October) on fed *Terminalia arjuna* food plants, whereas lower shell weight (1.16 g) was noted in (July–August) months on *Ziziphus mauritiana* food plants.The peduncle length higher showed length (53.46 mm) food plant of *Terminalia tomentosa* in September-October months and lowest length (22 mm) food plants of *Ziziphus mauritiana* in July-August months, and the largest width of cocoon (32 mm) of *Terminalia tomentosa* in September-October and lowest width (27.85 mm) of *Ziziphus mauritiana* in September-October months.

This study showed the comparative rearing results of the Daba ecoraces reared on *Terminalia tomentosa* and *L. parviflora* host plants and the measure of statistical significance. The larval life span, rate of rearing, cocoon weight, shell weight, cocoon production, and melt cocoon percentage were all significantly different

between larvae fed on two different host plants, but the weight of the larvae was not (Reddy *et al.,* 2010).

Kumar *et al*., (2013) discovered that the average outdoor rearing weight of a cocoon was (12.568 ± 0.448 gm). whereas the current study estimated that the mean cocoon weight in outdoor cultures on the *Terminalia arjuna* food plant was (8.47 gm) in July-August and (9.55 gm) in September-October.

Jadhav *et al.,* (2014) reported that for four different food plants, cocoon length and cocoon width in outdoor conditions were (4.3, 4.7, and 5.1 cm) and (9.3, 9.7, and 10.2 cm) food plants on *Terminalia tomentosa* in different seasons (rainy, winter, and autumn), respectively. whereas cocoon length and cocoon width were (4.1, 4.8, and 4.8 cm) and (9.3, 9.4, and 9.7 cm) for host plant on *Terminalia arjuna* in the mentioned seasons (rainy, winter, and autumn) respectively. But cocoon length and cocoon width in the outside area were (4.0, 4.3, and 4.7 cm) and (9.1, 9.2, and 9.7 cm) almond plants on *Terminalia catappa* in rearing various seasons (rainy, winter, and autumn) separately. the length and width of the cocoon (4.1, 4.4, and 4.3 cm) and (9.2, 9.4, and 9.6 cm) on the host plant *Ziziphus jujube* during specific seasons (rainy, winter, and autumn). In our research, we discovered that the length and width of cocoons varied across three different food plants and seasons. The plant *Terminalia tomentosa* affects cocoon length and cocoon width in outdoor conditions (50.09 and 30.84 mm) in July –August and (53.46 and 32.6 mm in September – October. Whereas *Terminalia arjuna* showed results for cocoon length and cocoon width of (49.69 and 29.74 mm) in July–August and (50.59 and 30.17 mm) in September–October. The cocoon length and cocoon width of *Ziziphus mauritiana* were found in July–August (48.73 and 29.53 mm) and in September-October (46.14 and 27.85 mm).

Reddy *et al.,* (2009) documented the rearing performances of *Antheraea mylitta* Daba places on *Terminalia arjuna* under Ranchi climatic conditions, monitoring on various parameters such as Peduncle length (3.5–6.83 cm); cocoon width (2.95–3.17 cm); length of cocoon (4.85–5.21 cm); shell weight (1.2–2.36 gm); silk ratio (14.13–16.28%); silk production/1000 cocoons (812–1417 gm); recovery of silk (52–71%); length of silk filament (475–1240 m); durable length of filament (79-475 m)and weight of cocoon (09.20-12.83 gm).The maximum peduncle length (48 mm) was found on the *Terminalia tomentosa* food plant in the months of September-October, but not in the months of July-August (47 mm) in the current study. The minimum peduncle length on food plants *Ziziphus mauritiana* was (22 mm) in July-August but (32 mm) in September-October. Whereas peduncle length (45 mm) in July–August and (46 mm) in food plants of *Terminalia arjuna*.

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