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SCREENING OF TASAR FOOD PLANT GENE BANK AGAINST MAJOR INSECT PESTS AT RANCHI

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ABSTRACT

Tasar silk is produced by wild silkworm belonging to genus *Antheraea mylitta* D. Tasar silkworm rearing is a traditional activity of tribals inhabiting the central – southern plateau region including the dense humid forest area of Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa and West Bengal extending to the fringes of Uttar Pradesh and Maharashtra. Tasar silkworm is extremely polyphagous and differs in its adaption to different food plants. The genus *Terminalia* belongs to family Combretaceae and consists of trees, shrubs and woody climbers, some species (*Lagerstroemia*) belongs to family Lythraceae. Importance of *T. arjuna* and *T. tomentosa* has been well recognized in tropical Tasar industry as these are important primary food plants. Keeping in view the importance of the genus, Central Tasar Research and Training Institute, Ranchi (Jharkhand) is maintaining a Gene Bank of *Terminalia* where 300 accessions of seven species collected from different parts of the country are being maintained. In recent time, the improved production practices along with the climate change (delayed monsoon and prolonged dry spells) have drastically escalated the insect-pests problem on host plants of tasar-silkworm in a subtle and oblivious fashion. A large number of pests are reported to attack the tasar food plants causing loss to the tune of 15–90%. The major pests are gall insect (*Trioza fletcheri minor*), Vapourer tussock moths, May-June beetle (*Anomala blanchardi*), ash weevils (*Myllocerus viridanus, M. Undecim-pustulatus, M. transmarinus*) and Red beetles (*Tricliona picea, T. variables*), stem borers (*Psiloptera fatuosa, Sphenoptera koenbierensi, Aeolesthes holosercea*) and *Bark* eating caterpillars, *Indarbella sp.* Besides these insect pests like thrips, *Rhiphiphorothrips cruentatus* Hood (Thysanoptera: Thripidae), spittlebug, *Clovia* sp. (Hemiptera: Aphrophoridae) and leaf hoppers (LH), *Hishimonus indicus* (Sohi) and *H. viraktamathi* Knight (Hemiptera: Cicadellidae) are also observed infested tasar host plants. To assess the susceptibility of tasar food plant gene bank to major insect pests (stem borer, bark eater, gall fly and termites) at Ranchi, an assessment of the tasar food plants in the Gene Bank of CTR&TI, Ranchi was done. From the observations, it was found that highest infestation of gall fly was seen in *Terminalia arjuna*; stem borer in *L. parviflora*; bark eater in *Terminalia arjuna* and termites in *L. parviflora* accessions and showed that there is variability in infestation of different insect pests of tasar host plants. This variability of infestation of insect pests may be exploited to develop tolerant hybrids (host plants) against major insect pests under the plant breeding programes of the institute.

***Keywords*:** Screening, Tasar Food Plants, Gene Bank, Insect Pests.

Introduction

The tasar culture is largely confined to the forests due to the existence of a fairly large amount of forest flora to required for the culture. There is need to systematic plantation of good varities of non mulberry food plants due to lack of systematic plantation in North-eastern India has restricted the muga culture to a limited pocket only and same is the case of eri culture. Through abundant flora is available, in the region, non-mulberry sector has proved non-productive due to the above reasons.

Tasar silk is produced by wild silkworm belonging to genus Antheraea. There are as many as 61 species of *Antheraea* known to produce silk (Jolly *et al*., 1979), but all of them are not commercial importance. Tasar silkworm rearing is a traditional activity of tribals inhabiting the central – southern plateau region including the dense humid forest area of Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa and West Bengal extending to the fringes of Uttar Pradesh and Maharashtra. An estimated 11.6 million hectares of forest harbor Tasar food plants. Tasar silkworm is extremely polyphagous and differs in its adaption to different food plants. The genus *Terminalia* belongs to family Combretaceae and consists of trees, shrubs and woody climbers, some species (Lagerstroemia) belongs to family Lythraceae. *Terminalia* derives its name from Latin word 'terminus' which means the position of the leaves borne in tufts at the end of the branches. The genus is of immense economic importance in various industries like sericulture, pharmaceutical, timber, paper, soap, match industries, food, fodder, fuel etc.

Importance of *T. arjuna* and *T. tomentosa* has been well recognized in tropical Tasar industry as these are important primary food plants. Keeping in view the importance of the genus, Central Tasar Research and Training Institute, Ranchi (Jharkhand) is maintaining a field gene bank of *Terminalia* where 300 accessions of seven species collected from different parts of the country are being maintained.

Propagation of the genus is mainly through seeds. The seeds are winged which help in easy dispersal over a large area. Plantation is done mainly through seedlings raised in nursery beds. Most of the species in this genus are not amenable for propagation through cuttings as most of them fall under difficult to root category. Recently a limited success in vegetative propagation has been reported in *T. arjuna* & *T. tomentosa*. Young seedlings / saplings are susceptible to frost and regeneration is affected badly.

Insects are diversified creatures on the earth. Their innate and acquired mechanisms improve their fitness (either individual or population) against the man-made challenges like insecticide molecules, transgenic plants, microorganisms & their toxins, pollutants, climate change, production practices and fragmented landscapes (Chakravarthy, 2015). Due to these reasons the risk of pest-outbreak is increasing regularly in agriculture, veterinary and medical fields. Since, tasar silkworm is reared on host plants which are raised under in-situ condition; the success in terms of productivity is highly influenced by both biotic and abiotic factors. In recent time, the improved production practices along with the climate change (delayed monsoon and prolonged dry spells) have drastically escalated the insect-pests problem on host plants of tasar-silkworm in a subtle and oblivious fashion.

A large number of pests are reported to attack the tasar food plants causing loss to the tune of 15-90%. The major pests are gall insect (*Trioza fletcheri minor*), Vapourer tussock moths, May-June beetle (*Anomala blanchardi*), ash weevils (*Myllocerus viridanus, M. Undecim-pustulatus, M. transmarinus*) and Red beetles (*Tricliona picea, T. variables*), stem borers (*Psiloptera fatuosa, Sphenoptera koenbierensi, Aeolesthes holosercea*) and *Bark* eating caterpillars, *Indarbella sp.* Besides these insect pests like thrips, *Rhiphiphorothrips cruentatus* Hood (Thysanoptera: Thripidae), spittlebug, *Clovia* sp. (Hemiptera: Aphrophoridae) and leaf hoppers (LH), *Hishimonus indicus* (Sohi) and *H. viraktamathi* Knight (Hemiptera: Cicadellidae) are also observed infested tasar host plants. (Jolly *et al.*, 1974; Singh *et al.,* 1992, Thangavelu and Singh, 1991, Thangavelu, 2000; Chandrashekharaiah *et al.*, 2018 and Preeti Tirkey *et al.*, 2019).

To assess the susceptibility of tasar food plant gene bank to Major Insect Pests (stem borer, bark eater, gall and termites) at Ranchi an assessment was done in the Tasar food plant gene bank of CTR&TI, Ranchi.

Materials and Methods

An experiment was conducted during the years 2020-2021 at Central Tasar Research and Training Institute, Ranchi in order to "screening of gene bank". The details of various material and method for achieving the objectives of this experiment are described in this chapter.

Description of the experiment site

The field experiment was conducted at "Gene Bank" of Central Tasar Research and Training Institute, Piska-Nagri, Ranchi, Jharkhand state. In which host plants are collected from A.P, Assam, Bihar, C.G, Jharkhand, M.P, Maharashtra, Manipur, Uttarakhand, U.P and Odisha. This area falls under central and north eastern plateau. Ranchi is located at 23.35ºN latitude, 85.33ºE longitude and an altitude of 651m/2140 feet above mean sea level. The experiment site has been rated as humid sub tropical climate.

Weather and climate

Ranchi district experiences subtropical climate, which is characterized by hot summer from March to May and well distributed rainfall during southwest monsoon from June to October. Winter season in the area is marked by dry and cold weather during the month of November to February. The normal annual rainfall data indicate that average rainfall is 1394 mm. Maximum rainfall has been observed from June to October months.

Characteristic properties of soil

The typical soil of the district is red sedentary. This is an inferior soil and can be used for cultivation of crops like maize, kurthi, kodo etc. In northern portion of the district grey soil is found. This is of alluvial origin and is of heavier texture.

Data collection of the experiment

The data was collected from tasar food plant gene bank of CTRTI, Ranchi to assess the susceptibility of tasar food plant gene bank to Major Insect Pests (stem borer, bark eater, gall and termites). The data was recorded on three plants of each accession and percent infestation was calculated.

$$\text{Number of infested plants}\,(\%) = \frac{\text{Number of infested plants}}{\text{Total number of plants}} \times 100$$

Results and Discussion

The data on the infestation was collected from tasar food plant gene bank of CTRTI, Ranchi to assess the screening of tasar food plant gene bank against Major Insect Pests (stem borer, bark eater, gall and termites) Table-1. The infestation was observed differ in different months. The gall infestation was high in the month of November and low in the month of February from the above experiment and stem borer and bark eater also found to be high in February, but termites are the only pest that attack throughout the year. It damages the bark of the host plants and maximum are infested by termites from the observation conducted at the gene bank. The data recorded on percent infestation of gall fly, bark eater, stem borer and termites are presented in Table-2.

Table 1 : Field gene bank of tropical tasar silkworm host plants:

Species	Family	Common Name	Accessions
Anogeissus latifolia	Combretaceae	Dhavda	01
Terminalia arjuna	Combretaceae	Arjun	190
Terminalia tomentosa	Combretaceae	Asan	94
Terminalia belerica	Combretaceae	Bahera	22
Terminalia chebula	Combretaceae	Harra	17
Terminalia myriocarpa	Combretaceae	Hollok	04
Lagerstroemia indica	Lythraceae	Saoni	03
Lagerstroemia parviflora	Lythraceae	Siddha	04
Lagerstroemia speciosa	Lythraceae	Jarul	06

Table 2 : Percent infestation of Gall fly, Bark eater, Stem Borer & Termite in gene bank of tropical tasar silkworm host plants.

Sl.No	Plant Species	Total no of plants	Gall fly	Bark eater	Stem Borer	Termite
			% infestation	% infestation	% infestation	% infestation
1	*Terminalia arjuna*	190	49	35.8	3.1	14.7
2	*Terminalia tomentosa*	79	68.8	24	5	36.7
3	*Terminalia chebula*	19	0	26.6	6.6	26.6
4	*Terminalia belerica*	15	10.5	5.2	5.2	57.9
5	*Lagerstroemia indica*	1	0	0	16.6	83.3
6	*Lagerstroemia speciosa*	6	0	0	50	50
7	*Lagerstroemia parviflora*	2	0	50	0	0
8	*Anogeissus latifolia*	1	0	0	0	0

Percent infestation of Gall fly in gene bank of tropical tasar silkworm host plants: The data in Table-2 showed that *Terminalia tomentosa* (68.8%) accessions were infested highest by gall fly followed by *Terminalia arjuna* (49%) and *Terminalia belerica* (10.5%) no infestation was recorded in *Terminalia chebula,, Lagerstroemia speciosa and Lagerstroemia parviflora* accessions. The data showed that the accessions of *Terminalia arjuna, Terminalia tomentosa, and Terminalia belerica* were infested with gall fly, the maximum infestation was found in *Terminalia arjuna* (93 access.), followed by *Terminalia tomentosa* (48 access.) and then *Terminalia belerica* (2 access).

Percent infestation of Bark eater in gene bank of tropical tasar silkworm host plants: The data in Table-2 showed that *L. parviflora* (50%) accessions were infested highest by bark eater followed by *Terminalia arjuna* (35.8%), *Terminalia chebula* (26.6%), *Terminalia tomentosa* (24%) & *Terminalia belerica* (5.2%) however no infestation was recorded in *Lagerstroemia speciosa* and accessions. The data showed that the accessions of *Terminalia arjuna, Terminalia tomentosa, Terminalia chebula, Terminalia belerica,* and *Lagerstroemia parviflora,* plant were infested with bark eater in which maximum infestation was found in *Terminalia arjuna* (68 access.) followed by *Terminalia tomentosa* (19 access.) and then *Terminalia chebula* (4 access.), *Terminalia belerica*, and *Lagerstroemia parviflora.*

Percent infestation of Stem borer in gene bank of tropical tasar silkworm host plants: The data in Table-2 showed that *Lagerstroemis parviflora* (50%) accessions were infested highest by stem borer followed by *Lagerstroemia parviflora* (16.6 %), *Terminalia chebula* (6.6%), *Terminalia belerica* (5.2%), *Terminalia tomentosa* (5%), & *Terminalia arjuna* (3.1%). The data showed that the accessions of *Terminalia arjuna, Terminalia tomentosa, Terminalia belerica, Terminalia chebula, L. speciosa & L. parviflora* plants were infested with stem borer, in which maximum infestation was found in *L. parviflora* (1 access.) followed by *Terminalia arjuna* (6 access.) and then *Terminalia tomentosa* (4 access.) then *Terminalia chebula*, *Terminalia belerica* and then *L. speciosa.*

Percent infestation of Termite in gene bank of tropical tasar silkworm host plants: The data in Table-2 showed that all the accessions of *Terminalia chebula, Terminalia belerica, Lagerstroemia speciosa, Lagerstroemia parviflora,* were infested by termites as compare to accessions of *Terminalia tomentosa* (36.7%) & *Terminalia arjuna* (14.7%). High infestation was found in *L. speciosa* (83.3). The data showed that the accessions of *Terminalia arjuna, Terminalia tomentosa, Terminalia belerica, Terminalia chebula, L. parviflora & L. speciosa* plants were infested with termites, in which maximum infestation was found in *L. speciosa* (5 access.) followed by *L. speciosa* (1 access.) then *Terminalia belerica, Terminalia tomentosa, Terminalia arjuna, Terminalia chebula* accessions.

Srivastav *et al.* (1997; 1999) studied that 130 accessions of *Terminalia* species complexes and their hybrids exhibited continuous variation. Maintenance of their genetic resources through *ex situ* conservation at various stations and their systematic characterization and evaluation and yield and quality trials have been discussed In detail, Strategies for effective utilization and conservation of germplasm and superior varieties of Pentaptera have also been remarked.

Suryanarayana *et al*. (2005) have worked at the gene bank and collected many data related to the food plants of *Antheraea mylitta* and published a monograph on Indian tropical tasar silkworm food plants (*Terminalia* spp.). This monograph contains valuable information on distribution and morphology, silvicutltre and management, anatomy and wood properties, diseases and pests, conservation, characterization, documentation, breeding and utilization.

Kumar *et al.* (2002) have generated and compiled the information in the form of Catalogue on *Terminalia* with a view to facilitate *Terminalia* breeders. The information has been gathered from different sources and works carried out at this institute on various aspects like classification, morphology, silviculture and management, diseases and pest, conservation and utilization.

Conclusions

The present study indicated that there is variability in infestation of different insect pests of tasar host plants. From the observation in accessions it was found that highest infestation of gall fly was seen in *Terminalia arjuna;* stem borer in *L. parviflora*; bark eater in *Terminalia arjuna* and termites in *L. parviflora* In the gene bank of CTR&TI–Ranchi. This variability of infestation of insect pests may be exploited to generate many hybrids plants to get desired superior plants in the breeding programmes of the institute.

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