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Adoptability Limitation and Commercial Feasibility of Silkworm Rearing Technologies of Indian Tropical Tasarculture

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ABSTRACT

Tropical tasarculture is an agro forestry activity of growing *Antheraea mylitta* Drury (wild silk insect) for unique vanya silk, which provides livelihood and employment to two and half lakh rural aboriginal families of the country. The outdoor tropical tasar silkworm rearing with tentative cocoon yield requires technology intervention for assured cocoon crop and sustainable returns. The critical areas of silkworm rearing from egg incubation to spinning of cocoon needs appropriate handling to convert maximum number of viable silkworm eggs to quality silk cocoons. Though, the technologies for tasar silkworm rearing are available, their adoptability and commercial feasibility among rearing groups and operational areas require fine-tuning and the field functionaries need updation on such modifications, thus to result into feasible cost-benefit proposition. The fine-tuned adoptable technologies for higher egg hatching and healthy larval population, control of diseases and larval mortality and minimizing the cocoon yield loss with pests and predators, requires wider publicity among end users, appropriate advocation of specified methodology and in-time adoption for attainable productivity, quality and economic success in tropical tasar silkworm rearing.

Key words: *Antheraea mylitta,* rearing technologies, Tribals, tropical tasarculture, Vanya silk

INTRODUCTION

The tropical tasarculture is a traditional agro forestry practice to produce unique tasar vanya silk by applying wild silk insect, *Antheraea mylitta* Drury (Lepidoptera: Saturniidae), which provides livelihood, employment and economic support to several aboriginal families of Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Orissa, Maharashtra, Madhya Pradesh, Uttar Pradesh and West Bengal states of the country. This polyphagous silk insect feeds primarily on *Terminalia tomentosa* (Asan), *Terminalia arjuna* (Arjun) and *Shorea robusta* (Sal), besides a variety of secondary and tertiary food plants (Suryanarayana and Srivastava, 2005; Suryanarayana *et al*., 2005; Mahapatra, 2009; Reddy, 2010b). The sericigenous species with continuous generations have adapted to different eco-geographic niches and formed in to forty-four ecoraces with varied phenotypic traits and behavioral characters. In spite of vast availability of tropical tasar flora and fauna, its sustainable utilization is yet to get momentum, for want of information on the ecological behaviour of reported tasar ecoraces and their interaction with majority of food plants (Suryanarayana and Srivastava, 2005; Suryanarayana *et al*., 2005; Hansda *et al*., 2008; Ojha *et al*., 2009; Reddy *et al*., 2010). The tasar silkworm is an eco-insect and its low performance in captivity against potential both during silkworm rearing (cocoon production) and grainage activity (seed production), denote its intricate behaviour (Thangavelu, 2002; Srivastava *et al*., 2004; Reddy *et al.*, 2009a). Though, several tribals even today traditionally believes on the collection of only nature grown tasar cocoons, the actual reason behind is their cultural heritage and belief of allowing the economic silk insect with sustainable population levels (Suryanarayana and Srivastava, 2005; Ashfaq and Aslam, 2006; Unni *et al.*, 2009). However, the commercial sustenance of this forest based activity needs practical and potential utilization of biodiversity to meet the fast changing human needs besides, conserving the environment and ecological integrity (Mahapatra, 2009; Reddy, 2009, 2010a). For the maintenance of such equilibrium among biodiversity and sustainability, the intervention of technology is the solution, for simultaneous conservation as well as sustainable utilization (Dolli, 1993; Sethi and Singh, 2001; Hansda *et al.*, 2008; Reddy, 2010a; Reddy and Prasad, 2010). In general, the commercial rearing of tasar silkworm aims for higher cocoon yields, which has overall impact on the success of the industry, as this leads to the tasar silk and seed cycle and employment generation (Shetty *et al.*, 2007). However, the technologies related to the rearing of any economic insect must be flexible, adoptable and economically viable under variable ecological conditions prevail over its practicing areas of the country (Barrett *et al.*, 2001; Thangavelu, 2002; Basavaraja *et al.*, 2005; Reddy *et al.*, 2009b; Unni and Murthy, 2009).

LIMITATION OF TECHNOLOGY ADOPTION

The adoption of technology depends either on the need or on economic advantage, but demand of fine-tuning for its wider suitability will be raised if it gets adopted by many consumers over more and geographically different locations (Reddy and Prasad, 2010). The results of any new technology experienced by its users in the fields other than agro based industries can easily decide either to continue or discard technology application. But, the adoption of a rearing technology in tropical tasarculture is complex, cumbersome, time-taking and expensive, as factors influencing the result are many and consumers are dissimilar as much of them being illiterates, women groups and with conventional backdrop from different ecozones of the country. Therefore, the success limitation and economic gain assured of technology should be clear to the tasar rearer, along with the factors responsible and the modifications required based on the rearing area and situation, for its optimal impact (Reddy *et al.*, 2009b). Though, the general perception on tasar silkworm rearing is that, it starts with egg hatching, but it actually starts from the maintenance of food plants, hygiene of rearing field and handling of silkworm seed from the day of its production (Reddy *et al.*, 2009c). The tasar rearing technologies and their economic feasibility are interdependent among status of food plants, hygiene of rearing field, quality of seed (egg) and its handling, young and late age rearing, incidence of diseases, pests and predators, type of spinning care and time of cocoon harvesting (Thangavelu, 2002; Reddy *et al.*, 2009b; Unni and Murthy, 2009). The other vital aspect is outdoor rearing environment, which changes unpredictably tilting the impact and improvement of the applied technology. The technologies related to egg handling and incubation can be applied effectively as they can be done indoor (Reddy *et al.*, 2009c; Reddy and Prasad, 2010). While the technologies related to food plant maintenance, fertilizer application, controlling of plant and insect diseases and rearing field hygiene through the chemical formulations of time-bound schedules are difficult with unpredictable and fluctuating outdoor rearing environmental conditions. Further, the technology related to indoor rearing up to late age and spinning are not cost-effective and are against the logic of tasarculture of utilizing the vastly available nature grown tasar flora as part time avocation for the economic support of forest based tribal populace. Also, the tasarculture being seasonal, monsoon dependent and with tentative crop returns, the investment for its rearing infrastructural facilities will reverse the cost-benefit and commercial equation. However, the simple technologies for larval brushing and chawki rearing under nylon net can be adoptable to contain the larval loss and to save time and labour. The control of diseases, pests and predators can only be done with precautionary and physical management rather than the chemical means, because of the difficulty in dosage assessment, application methodology, labour requirement and efficacy potential (Pande *et al*., 2002; Thangavelu, 2002; Basavaraja *et al*., 2005; Reddy *et al*., 2009b; Kumar *et al*., 2010; Reddy and Prasad, 2010).

FEASIBILITY OF MODIFICATION

The technology modification is to contain production loss and to attain success in quantity or quality, which finally reflects in terms of added value as higher crop yield and end product excellence. The value addition though indicates the suitability and adoptability of the rearing technology; it may also require modification with the changing rearing environment, eco-geographical zone, contemporary status and non availability of similar area and same type of end users continuously. The tropical tasar silkworm rearings are being practiced under varied eco-geographical conditions applying different flora and fauna during uncertain crop rearing seasons; the modifications in the rearing technology are essential for optimal impact for sustainable yield output and crop returns. Further, such modifications may not be uniform all through the seasons, silkworm rearing areas and corresponding periods of yester seasons, because such prevailed climatic conditions are rarely coincide under the current trend of rapid climate change and global warming. The non synchronization of silkworm seed and suitable leaf availability in the food plant are becoming common phenomena of current day, which needs an appropriate technology or modification in the existing one, either to reschedule the egg hatching or to resort for indoor rearing to overcome the situation, to minimize the loss of biological material and to maintain the brushing time schedule for attaining better cocoon yield. Also, during adverse conditions like heavy cyclonic rain and gale winds, the silkworm larval brushing can be done under indoor method for the best utilization of hatched larvae. Further, the maintenance of optimal larval density on its food plant can minimize the burden of larval transfer, human handling and labour requirement; thus results to successful harvest of cocoon crop as the tasar silk insect being semi domesticated, or rather wild, which doesn’t perform optimally with frequent human interference. This approach also avoids the overcrowding of larvae, competition for feed, probability of disease incidence, spreading of diseases, either with contamination or due to larval disturbance during moulting and spinning, so to yield more cocoons with better silk content and quality.

HUMAN RESOURCE INTERVENTION

The performance of human resource in the tropical tasar rearing field are largely depends on their professional competency, acquired experience and exposure to resource training for the latest technology developments taking place in the research institutions. The intervention of trained human power, either the producing group or supervising, will be one of the critical input requirements for the proper implementation of the evolved rearing technologies and to attain the cocoon yield gain and crop return appreciation. The mid-term corrections, time-bound modifications and fine-tuning of technologies are specific many a time for a given field situation and for the site of rearing technology application. Such requirements can be efficiently attended by the group who evolved the technology or the field staff who trained for technology implementation; which also can enhance the pace in transfer of technology with minimal gap in the efficiency of technology from lab to land. The field demand and technology development are continuous and for such situation, the updation, refreshment and operational know-how must reach the extension and field personnel for their practical knowledge and skill to scientifically execute the evolved or improved technology in the rearing field. Further, such competent technical service to the targeted rearer group must be provided like a tailor-made at their door steps in right time to meet the specific needs of each rearing field problem or individual.

EPILOGUE

Commercially sustainable tasarculture can only provide assured economic support and optimal employment to the tribal populace, which in-turn depends on the adoptability and feasibility of silkworm rearing technologies. The developed technologies must be need based, less expensive, easy to operate, enduring and environment friendly and must have consistency for economic advantage. Though, the silkworm rearing technologies have to overcome the field problems, all such requirements expected and unexpected to encounter with forest and outdoor based tasarculture can not be addressed and only those which are of vital in nature can be thought of to contain the major yield loss and to sustain the crop economics of tasar rearers. As on day, no technology has found totally pool-proof in the field dealing with biological material and however, the adoptability and feasibility advantage must be at break even level, for the technologies to continue with field application and this holds good even for the outdoor tropical tasar silkworm rearing to keep its expansion further on.

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