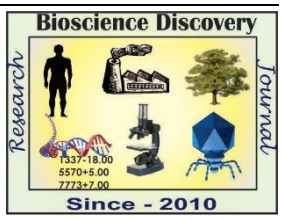
Open Access, Peer Reviewed, Referred Research Journal

Print & Online available on https://jbsd.in
ISSN: 2229-3469 (Print); ISSN: 2231-024X (Online)
Research Article



Exploration of Infestation Dynamics of *Kerria lacca* on Indigenous Lac Host Plants in Nanded Region, Maharashtra

Raut M. H.[1] and M. Y. Kulkarni[2]

[1]Department of Zoology, N. E. S., Science College, Nanded, Maharashtra, India
[2]Department of Zoology N. S. B, College, Nanded, Maharashtra, India
Email: aniruddhbansode@gmail.com

Article Info

Received: 18-05-2025,
Revised: 26-06-2025,
Accepted: 30-06-2025

Keywords: kerria lacca, Infestation, lac

Abstract

India stands as the world's leading producer and exporter of lac, contributing nearly 65% to global lac trade and playing a vital role in the nation's agro-based economy. Lac, a natural, eco-friendly, and biodegradable resin, is secreted by the tiny insect *Kerria lacca* and cultivated on various host plants. Prominent lac host species in India include *Butea monosperma* (Palas), *Zizyphus mauritiana* (Ber), *Schleichera oleosa* (Kusum), *Samanea saman* (Rain tree), *Annona squamosa* (Custard apple) *Ficus benghalensis* (Banyan) , and *Ficus racemosa* (Umber). The Nanded district, located in the Marathwada region of Maharashtra, exhibits significant potential for lac cultivation owing to its favorable climatic conditions and host plant diversity. Promoting lac culture in this region can substantially enhance rural livelihoods, farmer income, and employment opportunities, contributing to sustainable regional development.

To explore this potential, a field survey was conducted across multiple sites in Nanded to assess *Kerria lacca* infestation levels on prevalent host plants. Results revealed that Palas and Samanea (Rain tree) showed the highest infestation rates, followed by Ber, Banyan, Umber, and Khair, indicating their relative suitability for commercial lac cultivation. These findings highlight the importance of strategic host selection and region-specific management for optimizing lac production in the Nanded region.

INTRODUCTION

Lac, a natural resin secreted by the insect *Kerria lacca Kerr*, is a biodegradable, non-toxic material with diverse industrial applications in dyes, varnishes, waxes, cosmetics, pharmaceuticals, and electrical insulation. As the only commercially viable animal resin, it holds immense value in the bioeconomy for sustainable uses such as eco-friendly coatings and drug delivery systems. Lac cultivation provides a supplementary income for smallholder and tribal farmers, promoting rural development and biodiversity conservation through non-destructive forest use.

India dominates global lac production, contributing 50–60% of the world's output (over 20,000 metric tons annually). Major producing states include Jharkhand, Chhattisgarh, and Madhya Pradesh, while Maharashtra accounts for about 4.5%, largely through rangeeni strains on *Butea monosperma* (Palas) and *Ziziphus mauritiana* (Ber). Lac exports—over 6,700 tons worth ₹12 crores—contribute significantly to India's economy and align with sustainable practices described in *Science and Practice in Lac Culture* and *A Practical Manual of Lac Cultivation*. The rangeeni strain yields six to eight times more than kusmi, though the latter produces superior-quality resin (*J. Mohanta et al., 2014*).

Situated in the Marathwada region of Maharashtra, Nanded district (10,528 km²) is largely agrarian and economically underdeveloped, with limited industrialization. Given its rich biodiversity and favorable agroclimatic conditions, lac cultivation presents a low-input, high-value opportunity for local farmers and tribal populations.

Key host plants *Palas, Ber, Pipal, Samanea saman, Ficus racemosa, and Ficus benghalensis* are abundant across sites like Nanded region, Shitakhandi, Warkwadi near Tamsa, Limboti near Kandar and Patnurghat near Lahan.

MATERIALS AND METHODS

Study Area and Period

The study was conducted during the agricultural year 2015–18 across multiple locations in Nanded district, Maharashtra, India. Nanded district, located in the Marathwada region, spans a geographical area of 10,528 km², representing approximately 3.41% of Maharashtra's total area. According to the 2011 Census of India, the district has a population of 3,361,292, with 27.19% residing in urban areas and the remainder predominantly engaged in rural agrarian activities. The district lies between 18°16' to 19°55' North latitude and 76°55' to 78°19' East longitude, characterized by a semi-arid climate conducive to lac cultivation (Mohanta et al., 2014).

Survey and Methodology

A systematic survey was undertaken to assess the infestation of the lac insect, *Kerria lacca (Kerr)*, on various host plants across the district. The study aimed to identify the distribution, prevalence, and suitability of host plants for lac cultivation. Sampling sites were selected to represent both rural and urban areas, including sites like Nanded region, Shitakhandi, Warkwadi near Tamsa, Limboti near Kandhar and Patnurghat near Lahan.

Host Plant Identification

Fig. Palas (*Butea monosperma*) and its Infestation

Host plants were identified based on their morphological characteristics, following standard taxonomic keys outlined in botanical references such as Flora of Maharashtra . The primary host species surveyed included:

Butea monosperma (Palas) *Ziziphus mauritiana* (Ber) *Samanea saman* (Rain tree) *Annona squamosa* (Custard apple) *Ficus racemosa* (Umber) *Ficus benghalensis* (Banyan) These species were selected due to their documented suitability for *Kerria lacca* infestation and their abundance in the Nanded region (Sharma et al., 2006).

Data Collection and Analysis

The field surveys were performed during the peak seasons for lac insect activity. At each site, host plants were examined for lac insect presence, with data recorded on infestation levels, host plant species, and ecological conditions.

Data on lac infestation were analyzed qualitatively to determine the prevalence and distribution of *Kerria lacca* across host species and locations. Morphological characteristics of infested plants were cross-referenced with uninfested ones to assess host suitability. The findings were contextualized with regional agricultural and ecological data to evaluate the potential for lac cultivation as a sustainable income source for farmers and tribal communities in Nanded, aligning with methodologies in Science and Practice in Lac Culture (Srivastava, 2023). This methodology ensured a comprehensive assessment of lac insect infestation patterns, providing a foundation for promoting lac cultivation as an economically viable and environmentally sustainable practice in Nanded district.

RESULTS AND DISCUSSION

A survey was conducted across five selected sites in Nanded district, Maharashtra, India. That sites are Nanded region, Shitakhandi, Warkwadi near Tamsa, Limboti near Kandar and Patnurghat near Lahan, to evaluate the presence and infestation levels of lac host plants by the lac insect, *Kerria lacca* (Kerr).

The selected sites represented diverse ecological settings—urban fringes, rural farmlands, and semi-forested zones reflecting the overall potential of Nanded district for lac cultivation. The survey recorded a rich distribution of natural host plants, notably *Butea monosperma* (Palas), *Ziziphus mauritiana* (Ber), *Samanea saman* (Rain tree), *Annona squamosa* (Custard apple), *Ficus racemosa* (Umber), and *Ficus benghalensis* (Banyan), exhibiting varying degrees of *Kerria lacca* infestation, with the highest occurrence on Palas and Ber (*Virendra K. et al., 2025*). Infestation intensity was greater in rural habitats, where higher host density and limited human disturbance promoted favorable conditions for larval settlement (*Mohana Sundaram et al., 2018*). These observations highlight the untapped potential of Nanded's agroforestry systems for expanding lac production, contributing to biodiversity enhancement and sustainable livelihood opportunities in semi-arid regions. *Kumar K. K. (2002)* further emphasized the employment potential and economic significance of lac cultivation in rural economies.

From a socioeconomic standpoint, lac cultivation in the Nanded district presents substantial potential for employment generation and livelihood improvement, particularly among rural farmers and tribal communities who form the majority of the population. As a low-input, high-return enterprise compatible with existing agricultural systems, lac farming creates seasonal employment opportunities in activities such as host plant pruning, inoculation, harvesting, and resin processing. Nationwide, it benefits over one million tribal households through supplemental income (*Sudhir Kumar & Rajendra Singh, 2015*). Recent studies demonstrate that scientific interventions—including training in broodlac management, pest control, and host maintenance—have yielded significant economic benefits for tribal farmers in regions like Chhattisgarh, with improved yields translating into higher household incomes and reduced reliance on subsistence agriculture. In forest-based economies, lac cultivation enhances both farmer viability and national export potential, supporting millions of rural livelihoods, particularly in underdeveloped regions such as Marathwada. For Nanded, where industrialization remains limited and agriculture predominates, promoting lac as a commercial cash crop could strengthen economic resilience and diversify rural income sources, as evidenced by similar viability assessments in other states.

Globally, more than 400 host species of lac insects have been identified, while in India approximately 113 species are known, with only a few commercially exploited. Major hosts, contributing about 95% of India's lac production, include *Butea monosperma* (Palas), *Schleichera oleosa* (Kusum), and *Ziziphus mauritiana* (Ber) due to their abundance and adaptability for both rangeeni and kusmi strains. Biodiversity surveys in districts such as Gondia confirm the dominance of these species in supporting lac insect propagation and ecological balance. Occasional hosts like *Ficus spp.* and *Samanea saman* are regionally utilized, while rare hosts exhibit lower infestation success. Enhanced management of major hosts particularly *B. monosperma* through improved pruning and inoculation techniques has been shown to significantly increase lac yield and quality.

The inoculation process, whereby host trees are infested with lac insects, involves tying broodlac (lac sticks laden with mature females) to suitable branches, allowing swarming larvae (crawlers) to emerge and settle on tender shoots. Studies indicate that larval density typically ranges from 150–300 per square inch (or approximately 23–47 per square cm) on optimal twigs, with higher settlements observed at lower stem portions due to proximity to inoculation sites. (Sharma K.K. et.al 2002). Effective broodlac management, including pre- and post-inoculation care against predators, is crucial to prevent crop failures, as emphasized in recent reviews. (Mohana Sundaram, A. et. Al. 2021) Population density directly influences growth and survival, with densities at level III (moderate to high) or above potentially damaging host plants if unmanaged, while optimal levels (e.g., 33–67 per cm^2 at 45 days post-inoculation) maximize resin yield. Factors like irrigation and plant spacing further modulate survival rates on hosts such as pigeon pea.

Lac insects exhibit selective preference for host plants based on nutritional quality, phloem sap composition, and morphological traits, which influence settlement behavior and resin productivity. Higher infestation levels or lac encrustation correlate with increased abundance of lac-associated fauna, including predators, parasitoids, and hyperparasitoids, which can comprise over 30 primary parasitoids, 20 predators, and 40 secondary parasitoids. Healthy lac encrustation and insect density are notably higher on ber, palas, *semialata (Flemingia semialata*), and *kusum* during specific crop seasons *katki* and *baisakhi for rangeeni*, and aghani and jethwi for kusmi—leading to greater faunal diversity in these periods.[Bhagyapriya, P. et.al 2025] Seasonal abundance of associated insects varies across sites, with predators

like Eublemma amabilis and parasitoids such as Tachardiaephagus tachycardia peaking in rainy crops, necessitating integrated management to sustain yields.The growth and development of lac insects are profoundly influenced by host plant species and seasonal variations, with rangeeni strains showing more pronounced responses to environmental cues than kusmi On hosts like ber and palas, survival rates and cell weights are optimized during katki (rainy) and baisakhi (summer) seasons, while kusum supports superior kusmi growth in aghani (winter). In Nanded, observations mirrored these patterns for the rangeeni strain, with robust infestation on palas and ber during katki and baisakhi, attributed to the region's semi-arid climate and host availability, suggesting high suitability for commercial expansion. (Bhatnagar, P et.al.2022)

Conclusion

The Nanded region of Maharashtra holds immense untapped potential for lac cultivation and production, positioning it as a promising agroforestry-based enterprise capable of transforming rural livelihoods and fostering sustainable economic growth. The district's semi-arid climate, rich host plant diversity, and agrarian population make it particularly suitable for large-scale expansion of lac farming, especially using the rangeeni strain on major hosts such as *Butea monosperma* (Palas) and *Ziziphus mauritiana* (Ber).

Field surveys conducted across Nanded, Shitakhandi, Warkwadi (Tamsa), Limboti (Kandhar), and Patnurghat (Lahan) revealed extensive natural infestations of *Kerria lacca*, with Palas, Ber, and Rain tree (*Samanea saman*) exhibiting the highest infestation levels. These naturally infested trees represent valuable sources of broodlac, which can be utilized to inoculate underexploited or newly established host plants, thereby enhancing production without necessitating large-scale deforestation. Such strategies align with sustainable lac cultivation practices, including habitat modeling for optimal host distribution and biodiversity conservation.

Economically, lac cultivation presents multiple advantages for Nanded's predominantly rural and tribal communities. As a low-input, high-value cash crop, it provides seasonal employment and supplementary income through activities such as host plant management, inoculation, harvesting, and processing. Evidence from Gondia district and other lac-growing regions indicates that systematic lac farming significantly improves household income, livelihood security, and resource sustainability. Rangeeni lac production, even on non-traditional hosts like pigeon pea, has demonstrated favorable cost-benefit ratios, underscoring its potential for poverty alleviation and ecological stability. In Nanded, where industrial development remains limited, integrating lac into existing agricultural systems could stimulate bioeconomic growth, expanding its applications in pharmaceuticals, cosmetics, and eco-friendly industries, while reinforcing India's global leadership in lac exports.

Realizing this potential requires targeted policy interventions and farmer capacity-building initiatives. Organizing scientific training programs on improved lac cultivation practices—such as superior insect strains, optimized host rotation, and integrated pest management—can significantly enhance productivity and adoption rates. Successful models from Ranchi (Jharkhand) demonstrate that community-based lac initiatives can uplift economically disadvantaged farmers and promote long-term rural resilience. The Government of Maharashtra should therefore support this sector through financial assistance schemes, training and research centers, and low-interest loans for host plant propagation and processing infrastructure.

Establishing a dedicated Lac Culture and Training Center in Nanded city would serve as a regional hub for knowledge dissemination, technological innovation, and farmer empowerment. With sustained institutional support and scientific guidance, lac cultivation can evolve into a pillar of sustainable rural development enhancing tribal welfare, economic resilience, and ecological preservation across the Nanded region and beyond.

REFERENCES

Kumar KK. 2002. Scope of lac cultivation in employment and income generation. Recent advances in lac culture (ILRI,Ranchi pp 254-262).

J Mohanta. 2014 Studies on lac insect for conservation of biodiversity in Similipal Biosphere Reserve ,Odisa India.

KK Sharma, AK Jaiswal and KK Kumar, 2006, *Current Science , 91 , No. 7* role of lac culture in biodiversity conservation: issues at stake and conservation strategy Lac Wikipedia , the free encyclopedia A monograph on Lac (book , 1962) Ranchi , Indian Lac Reseach Institute (B Mukhopadhyay, M.S. Muthana)

Sharma KK, Jaiswal AK. 2002. Biotic factors affecting productivity of lac insect. In recent advances in lac culture . Kumar K.K. , Ramani R , Sharma K.K. (Eds), ILRI , Namkum ,Ranchi , , 59-63. Kumar KK

Sudhir Kumar & Rajendra Singh. 2015. In Bundelkhand, Lac Cultivation has high production potential. *Indian Farming,* **63**(11):11

Mohana Sundaram A, Sharma KK, Verma S, Anees K, & Rashmi M. 2021. *Broodlac Quality Assessment and Forecasting of Crawler Emergence in*

Indian LAC Insect Kerria lacca. *Indian Journal of Entomology*, 84(1), 24-28.

Mohana Sundaram, Meena SC, Monobrullah Md, Sharma KK, Anees K, Verma Sweta. 2018. Variations in infestation / host density / associated fauna "*Variations in population of lac associated fauna in relation to different lac host plants, lac insect strains and seasons of cultivation."* [ICAR data repository].

Bhatnagar P, Lodhi B, Prajapati S & Aarmo B. 2022. *Occurrence Of Lac Insect And Its Host Plants In Madhya Pradesh*. *Indian Journal of Entomology*,

Virendra K Sangode & Sandipkumar Gahane 2025. "Biodiversity of Host Plants for Laccifer lacca in Gondia District, Maharashtra, India". *Uttar Pradesh Journal of Zoology,* **46**(12):117-123.

Mohanta J, Dey DG, & Mohanty N. 2012. *Performance of lac insect Kerria lacca in conventional and non-conventional cultivation.* Bioscan (regional cultivation/performance study).

Yogi RK, Jaiswal AK, Sharma KK & Ramani R. 2018. *Studies on lac insect (Kerria lacca Kerr) infestation on different host plants under varying ecological conditions. Journal of Entomology and Zoology Studi*es, **6**(2):1600–1605.