International Journal of Economic Plants

https://ojs.pphouse.org/index.php/IJEP

IJEP January 2025, 12(1): 01-06

Crossref

Article IJEP5716b

Full Research

Natural Resource Management

Doi: HTTPS://DOI.ORG/10.23910/2/2025.5716b

Performance of Lac Insect *Kerria lacca* Kerr on Bushy Host *Flemingia semialata* (Roxb.)

P. Bhagyapriya[1*], S. R. Koteswara Rao[1], Sanyasidhurua[2] and D. Ramesh[3]

[1]Dept. of Entomology, Agricultural College, ANGRAU, Bapatla, Andhra Pradesh (522 101), India
[2]Dept. of Entomology, Agricultural College, ANGRAU, Naira, Andhra Pradesh (532 185), India
[3]Dept. of Statistics and Computer Applications, Agricultural College, ANGRAU, Bapatla, Andhra Pradesh (522 101), India

Corresponding Author

P. Bhagyapriya
e-mail: bhagyapriyapaidi@gmail.com

Article History

Received on 18th August, 2024
Received in revised form on 25th November, 2024
Accepted in final form on 22nd December, 2024
Published on 08th January 2025

Abstract

The study was carried out to assess the potential of *Flemingia semialata* as host of lac insect at Agriculture College, Bapatla, Andhra Pradesh (522101) India during January to June, 2023 to investigate the potential of *F. semialata* under coastal conditions of Andhra Pradesh. Among different productivity parameters, initial density of settlement (Number per square cm), final density of settlement (Number per square cm)., sex ratio (% of male insects), density at crop maturity (Number per square cm) were recorded high at lower stem portion of the host plant *F. semialata* compared to upper and middle stem portions. Initial mortality (%) was recorded high at upper portion of host plant compared to middle and lower portions. Mean fecundity (Number of young ones produced by the female insect) recorded was 389.60. Mean yield (kg) of brood lac obtained was 0.76 kg and mean yield (kg) of scrapped lac obtained was 0.35 kg. Mean female size was recorded as 1.85mm. Mean broodlac-scraped lac ratio recorded was 2.17. Among the life cycle parameters of Lac insect mean sex ratio varied from 22.66 to 25.29. The life period of female was recorded as 156 days. The mean fecundity of female was 380.96 crawlers. There was a positive non-significant correlation recorded between female lac cell size and fecundity and also between female lac cell size and female cell weightand concluded that *F. semialata* can be used as a potential host for lac cultivation in the state of Andhra Pradesh

Keywords: *Kerria lacca*, *Flemingia semialata* Roxb, *Kusmi*, production parameters

1. Introduction

India is the world's highest lac producer and has the greatest diversity of commercially significant lac insects Rangeeni and kusmi are the two strains of lac insect which are classified based on preference of the insect for specific host plants. Raw lac is the source of three valuable products i.e. resin, dye and wax. (Yogi et al., 2021.) On the basis of survey in the local weekly markets of different lac producing districts, the estimated national production of sticklac during 2018–19 was approximately 18,537 tons comprising rangeeni (5691 tons) and kusmi (12846 tons) sticklac (Yogi et al., 2021.). Lac insects are members of the family Kerriidae (Hemiptera), also known as scale insects, which produce a resinous material that forms a hard scale test over their bodies (Gullan et al., 2007, Rajgopal et al., 2021). Lac insect has gained importance in areas like coating, adhesive, electric and electronic, food leather, pharmaceutical and cosmetic industries. They are phytosuccivorous and prefer certain species of hosts viz., palas, *Butea monosperma*; ber, *Ziziphus mauritiana*; kusum, *Schleichera oleosa*; *Flemingia semialata*; *Ficus spp*; *Conocarpus lancifolius*. etc. The number of host trees spread various Agroforestry systems in all over the country which was three per cent of total number of available trees to investigate the potential of *F. semialata* under coastal conditions of Andhra Pradesh. Current lac production estimates revealed that only less than ten per cent lac host being utilized for lac cultivation as various operations of lac cultivation on host trees is difficult. Lac insects survive on more than 400 plant species (Kapur, 1954; Varshney and Teotia, 1967; Rao et al., 2023; Sharma et al., 1997). They are characterized by the presence of a special type of mouthparts, intended for sucking plant sap from tender branches. Lac cultivation has been traditionally carried out on naturally occurring tree-hosts. Due to the climbing nature of lac culture operations, theft of the lac crop, difficulties in lac culture operations due to dispersed trees, etc., a significant portion of the population of tree-hosts remain unutilized. But farmers are interested in lac cultivation for their livelihood. Under these

situations *Flemingia semialata* Roxb.of family Fabaceae, is a most suitable quick growing lac host plant even in plains on plantation basis. *F. semialata* is little less woody and legumins, deep rooted shrub grows up to 2 m height. Due to succulence of the twigs the preference for lac insect is more. Shivaleela and Javaregowda (2018) *F. semialata* requires well drained soil and partially sloppy land. Being a leguminous plant, it fixes nitrogen in the soil and improves fertility and productivity of soil. Flowering starts in the month of October–November and fruit matures from the month of February–March Once *Flemingia* plant is established, the lac cultivation can be done continually up to 6–8 years. *Flemingia semialata* can be easily propagated through seeds and its suitability for intensive lac cultivational cultivation is a boon to the farmers who do not have lac host trees but are interested in cultivation of lac. Various operations of lac cultivation are easy as all activities can be carried out from ground itself, so women folk may be involved actively. It is a potential lac host as it responds highly to coppicing. Therefore, recent study was carried out to assess the potential of *F. semialata* under coastal conditions of Andhra Pradesh.

2. Materials and Methods

The brood lac of *kusmi* strain of *Kerria lacca* was collected from the farmer's fields during the month of December–January and was inoculated in the month of January on *Flemingia semialata* host plants grown at Agricultural College, Bapatla. After inoculation on to the host plants the following observations were recorded from inoculated host plants (Mohanasundaram et al., 2016)

2.1. Initial density of settlement (Number per square cm)

One square cm area was selected at random and numbers of lac crawlers settled was counted. Three such sites were selected (Lower, middle and upper portions of stem of host plant) from the same host plant and average was taken as density of settlement.

2.2. Initial mortality (%)

The used-up brood lac was removed and the above process was repeated at 21-days after inoculation of brood lac. Under field conditions, process of larval emergence continues up to two weeks. The larvae, which are not able to find suitable sites for settlement die due to starvation. Observation at this stage is the true indication of the number of larvae actually settled and which have started feeding.

Initial mortality=(Initial density-Density after 21 days of settlement/Initial density)×100

2.3. Sex ratio (% of male insects)

At the time of emergence, larvae were not differentiated into males or females. After a certain period of growth, larvae could be differentiated into male and female lac insects based on their morphological differences (Male are elongated and females are round shaped). The process (as in initial density of settlement) was repeated for recording male and female insects.

Percentage of males=(Number of male insects/ Total number of insects)×100

2.4. Density at crop maturity (Number per square cm)

Surviving female lac insects (After initial mortality and emergence of male lac insects) was counted as above at crop maturity (Appearance of yellow spot)

2.5. Life period of the female cell (Days)

Time elapsed between date of inoculation and crop harvesting was counted (in days) as life duration of the female lac insect.

2.6. Female cell size (mm)

The size of the individual female cell (mm) was recorded for randomly selected ten cells from five tagged host plants. The female cells were collected at harvest for each host and cell size was measured by the vernier caliper. Observations were recorded on mean size of female cells (mm).

2.7. Weight (mg) of the female cell and resin output

Weight of individual female lac insect was recorded after larval emergence has completed using electronic balance. The resin produced by an individual female cell was recorded after removing the dead insect body from the cell.

2.8. Fecundity (Number of young ones produced by the female insect)

The collected mature female cells were stored individually into glass vials and were plugged with cotton for about a month and the emerged larvae were counted. The cells were then broken and larvae, which could not emerge, were counted. Total count was taken as fecundity of the female lac insect.

2.9. Total yield (kg)

Total yield per plant was recorded after harvesting.

2.10. Broodlac output ratio

Ratio of quantity of broodlac obtained at crop harvest to broodlac used at inoculation is broodlac output ratio.

2.11. Broodlac and scrapped lac ratio

Ratio between broodlac and scrapped lac obtained after harvesting lac.

2.12. Occurrence of natural enemies of lac insects

The collected lac encrustations consisting of matured females were kept in a glass jar covered with muslin cloth for 45 days and observed at weekly intervals for the emergence of natural enemies. All the data were subjected to statistical analysis by adopting appropriate statistical tools as described in Panse and Sukhatme (1985).

3. Results and Discussion

During the survey the brood lac of *kusmi* strain collected from the farmer's fields was inoculated in the month of January on *F. semialata* host plants grown at Agricultural College, Bapatla. To

evaluate the lac insect performance on *F. semialata* different parameters like initial density of settlement, initial mortality per cent, final density of settlement, density of female cells at crop maturity, broodlac ratio, female cell size, weight of female cell, weight of resin and broodlac yield of *kusmi* strain of lac insect *Kerria lacca* were recorded during 2023.

3.1. Initial density of settlement (Number per square cm)

The observations recorded on initial density of settlement of first instar crawlers (number per sq. cm) after the emergence on upper, middle and lower stem portions of host plants were presented in Table 1. The results revealed that the mean initial density of crawlers varied from 70.04 crawlers on upper stem portion to 90.08 crawlers on lower stem portion. The mean initial density of settlement of 70.04, 79.48 and 90.08 crawlers were recorded on upper, middle and lower stem portions, respectively. High mean initial density of settlement of crawlers at lower stem portion of host plant may be attributed to site of broodlac inoculation *i.e.,* at lower stem portion nearly 15 cm above the ground so the crawlers which emerged immediately from broodlac preferred to settle at lower stem portions and also suitability of thickness of the stem for more colonization of crawlers at lower stem portion of the host plants. The mean initial density of crawlers ranged from 64.80–73.20, 76.80–82.60 and 87.80–92.20 crawlers per sq. cm on upper, middle and lower stem portions, respectively. The results of present investigations are in alignment with the findings of Mohanta et al. (2014) who reported that initial density of settlement of crawlers ranged between 92.58–126.74 crawlers per sq. cm of *kusmi* strain on kusum.

The results were analysed by non-parametric statistical test, Kruskal-Walli's test revealed that there was a significant difference of initial density of settlement of crawlers on host plant with respect to portion of settlement and there is highest initial density of settlement of crawlers per sq. cm on lower stem portion of host plant.

Table 1: Initial density of settlement (per sq. cm) of first instar crawlers of *kusmi* strain of lac insect on *F. semialata*

Descriptive statistics	Stem portion of host plant		
	Upper	Middle	Lower
Mean	70.04	79.48	90.08
SD (σ)	3.28	2.46	1.93
SE	1.47	1.10	0.86
Range (R)	8.40	5.80	4.40
CV%	4.69	3.09	2.14

3.2. Initial mortality (%)

The observations on mean per cent initial mortality (Per sq. cm) recorded at 21-days after inoculation of brood lac of *kusmi* strain of lac insect were presented in Table 2. The data indicated that the first instar crawlers of the lac insect died since they were unable to find adequate locations for settlement, and the residual population at this stage represented the genuine number of crawlers actually established. The observations on mean per cent initial mortality varied from 10.91 per sq. cm on lower stem portion to 12.98 per sq. cm on upper stem portion. The results of mean per cent of initial mortality (Per sq. cm) were 12.98, 11.35 and 10.91% on upper, middle and lower stem portions, respectively. The per cent initial mortality ranged from 12.50–13.50, 10.59–12.11 and 10.26–11.38% at upper, middle and lower stem portions, respectively.

Table 2: Initial per cent mortality (per sq. cm) of first instar crawlers of *kusmi* strain of lac insect on *F. semialata*

Descriptive statistics	Stem portion of host plant		
	Upper	Middle	Lower
Mean	12.98	11.35	10.91
SD (σ)	0.44	0.56	0.41
SE	0.20	0.25	0.18
Range (R)	1.00	1.52	1.12
CV%	3.43	4.93	3.78

High initial mortality per cent at upper stem portion of host plant may be attributed to the factor that soft new apical growth of host plants cannot tolerate continuous sap sucking mode of feeding by lac insects and that led to mortality of lac insects. The similar results were observed by Divakara (2013) who recorded minimum per cent mortality of *rangeeni* strain of lac insects in *Calliandra calothyrsus* (12.48%) and *Dalbergia assamica* (22.36%).

The results were analysed by non-parametric statistical test, Kruskal-Walli's test revealed that there was a significant difference of initial mortality per cent of crawlers per sq. cm on host plant with respect to portion of settlement and there is highest initial mortality per cent of crawlers per sq. cm on upper stem portion of host plant.

2.1. Final density of settlement (Number per sq. cm)

The observations on mean final density of settlement of crawlers recorded on upper, middle, lower stem portions of host plants were presented in Table 3. The observations on mean final density of crawlers varied from 60.92 crawlers per sq. cm on upper portion to 80.36 crawlers per sq. cm on lower portion. The mean final density of settlement of crawlers

Table 3: Final density of settlement (per sq. cm) of first instar crawlers of *kusmi* strain of lac insect on *F. semialata*

Descriptive statistics	Stem portion of host plant		
	Upper	Middle	Lower
Mean	60.92	70.46	80.36
SD (σ)	2.74	2.52	2.12
SE	1.22	1.12	0.95
Range (R)	7.00	5.90	4.80
CV%	4.50	3.60	2.64

were recorded as 60.92, 70.46 and 80.36 crawlers per sq. cm on upper, middle and lower stem portions, respectively. High mean final density of settlement of crawlers at lower stem portions of host plants may be attributed to the factor of favourable stem thickness at lower portion compared to upper portion of stem.

The final density of crawlers ranged from 56.70–63.60, 67.50–73.40 and 77.80–82.60 crawlers per sq.cm on upper, middle and lower stem portions, respectively.Kalahal et al. (2017) also reported that the mean final density of settlement of first instar crawlers were 85.50, 78.20, 53.10; 80.20, 85.90, 65.00 and 61.90, 57.30, 54.60 crawlers per sq. cm on lower, middle and upper portion of plant in three plots, respectively, in *rangeeni* strain of lac insect in pigeon pea crop in *katki* season, which was also in alignment with the findings of present investigation. The results were analysed by non-parametric statistical test, Kruskal-Walli's test revealed that there was a significant difference of final density of settlement of crawlers on host plant with respect to portion of settlement and there was highest final density of settlement of crawlers per sq. cm on lower stem portion of host plant

3.2. Ratio (% of male insects)

The observations on sex ratio recorded as per cent male lac insects, were calculated by counting the male and female cells per sq. cm area in upper, middle, lower stem portions of host plants and mean per cent male lac insects were presented in Table 4. The results show that mean per cent male lac insects 22.66, 23.78 and 25.29 per sq. cm were recorded on upper, middle and lower stem portions, respectively. The results of present investigation are in conformity with observations by Divakara (2013) who recorded highest per cent of male lac insects on *ber* (26.86%) followed by *F. semialata* (24.84%) and kusum (17.82%). The results were analysed by non-parametric statistical test, Kruskal-Walli's test revealed that there was a significant difference of sex ratio on host plant with respect to portion of settlement and there is highest mean sex ratio per sq. cm on lower stem portion of host plant.

Table 4: Sex ratio (per sq. cm) of first instar crawlers of *kusmi* strain of lac insect on *F. semialata*

Descriptive statistics	Stem portion of host plant		
	Upper	Middle	Lower
Mean	22.66	23.78	25.29
SD (σ)	0.83	0.72	1.24
SE	0.37	0.32	0.55
Range (R)	2.10	1.93	3.14
CV%	3.69	3.06	4.92

2.3. Density at crop maturity (Number per square cm)

The data on mean density of mature female cells (per sq. cm) of *kusmi* strain of lac insect recorded on upper, middle, lower stem portions during *jethwi* season, 2023 were presented in Table 5. The results revealed that the mean density of female cells varied from 4.72, 4.80 and 5.44 female cells per sq. cm on upper, middle and lower stem portions, respectively.

Table 5: Density at crop maturity (per sq. cm) of *kusmi* strain of lac insect on *F. semialata*

Descriptive statistics	Stem portion of host plant		
	Upper	Middle	Lower
Mean	4.72	4.80	5.44
SD (σ)	0.22	0.20	0.26
SE	0.10	0.08	0.12
Range (R)	0.60	0.40	0.60
CV%	4.83	4.16	4.80

The results of present investigation were in full alignment with the findings of Mohanta et al. (2014) who also recorded average higher density of living female cells at crop maturity as 3.38–12.67 cells per sq. cm on *palas* plant for *rangeeni* strain of lac insect. Similarly, Kalahal et al. (2017) reported that the density of female cells of *rangeeni* strain of lac insect at maturity on pigeon pea ranged from 01-11 cells per sq. cm during *katki* season. The substantial fall in female settlement density when compared to the initial density of settlement may be related to mortality owing to non-feeding at the beginning phases, existing biotic/abiotic conditions, and the death of male insects that die shortly after fertilizing the females.

The results were analysed by non-parametric statistical test, Kruskal-Walli's test revealed that there was a significant difference of density of female cells at crop maturity on host plant with respect to portion of settlement and there is highest density of female cells per sq. cm on lower stem portion of host plant.

3.4. Life period of the female cells (Days)

Life period of the female cells was recorded by calculating the time period between the date of inoculation and date of harvesting and it was observed as 156 days. On contrary Sharma et al. (2019) recorded the life period of the female cells (Days) of *rangeeni* strain of lac insect on *F. Semialata* during *katki* season, 2017 in field conditions as 118 days.

3.5. Total yield (kg) plant^{-1}

The data on mean broodlac yield and scrapped lac yield of *kusmi* strain of lac insect were recorded from host plants during *jethwi* season, 2023 and were presented in Table 6. The observations on mean broodlac yield and scrapped lac yield recorded were 0.76 kg and 0.35 kg plant^{-1}, respectively.

The results are in conformity to the findings of Sharma et al. (2019) who recorded 1.08 kg, 1.73 kg and 3.70 kg of mean broodlac yield in *rangeeni* strain of lac insect on Flemingia, pigeon pea and ber, respectively, in *katki* season during 2017 and 0.22 kg, 0.35 kg and 0.74 kg of mean scrapped lac yield in *rangeeni* strain of lac insect on Flemingia, pigeon pea and ber, respectively, in *katki* season during 2017.

Table 6: Yield (kg) of brood lac and scrapped lac of *kusmi* strain of lac insect on *Flemingia semialata*

Descriptive statistics	Yield (kg) of broodlac	Yield (kg) of scrapped lac
Mean	0.76	0.35
SD (σ)	0.03	0.02
SE	0.01	0.01
Range (R)	0.07	0.04
CV (%)	3.60	4.51

3.6. Weight (mg) of the female cell and resin output

The weight of ten female cells and the resin produced by female cells of *kusmi* strain of lac insect was recorded from host plants. The female cells were kept in glass vials for the emergence of crawlers. The weight of female cells after the emergence of crawlers was recorded by using electronic balance. The resin produced by female cells of lac insect was recorded after removing the dead insect body from the cells. The average of ten cells weight and resin output was considered as mean weight of cells in mg and mean weight of resin in mg. The observations recorded on mean weight of female cells (mg) and mean weight of resin (mg) were presented in Table 7. The mean female cell weight and mean weight of resin recorded were 21.47 mg and 20.08 mg respectively. The results of present investigation are in full alignment with the findings of Sharma et al. (2019) who also recorded mean female cell weight from ber*, F. semialata* and pigeon pea were 22.54, 19.39 and 17.15 mg, respectively and mean weight of resin recorded from ber, *Flemingia* and pigeon pea were 20.92, 17.82 and 15.57 mg, respectively during *katki* season, 2017

Table 7: Female cell weight (mg), female cell size (mm) and resin weight (mg) of *kusumi* strain of lac insect on *Flemingia semialata*

Descriptive statistics	Female cell weight (mg)	Female cell size (mm)	Resin weight (mg)	Mean fecundity per female cell
Mean	21.47	1.85	20.08	389.60
SD (σ)	0.67	0.02	0.30	4.39
SE	0.30	0.01	0.13	1.96
Range (R)	1.77	0.06	0.80	10.20
CV (%)	3.15	1.21	1.51	1.12

3.7. Female cell size (mm)

The size of ten randomly selected individual female cells (mm) of lac insect was measured by the vernier caliper from host plants and mean female size was recorded as 1.85 mm. The observations recorded on female cell size were presented in Table 7. The results of present investigation are in full alignment with the findings of Sharma et al. (2019) who also recorded mean female cell size on *F. semialata* during *katki* season, 2017in field conditions as 1.81 mm.

3.8. *Fecundity (Number of young ones produced by the female lac insect)*

The mature ten female cells from host plants were stored separately in separate glass vials sealed with cotton for one month, and emerged crawlers were counted visually. The observations recorded on fecundity of female cells were presented in Table 7. The results revealed that the average number of crawlers emerged from ten female cells was 389.60 crawlers.

The findings of Mishra et al. (1999) support the results of the present investigation who evaluated the productivity of Indian lac insect (*Kerria lacca*) on *F. semialata* and *F. macrophylla* in terms of fecundity and found that the fecundity varied from 253–565 and 297–477 crawlers per female cell on the two hosts under study, respectively.

3.9. Broodlac and scrapped lac ratio

The results are in conformity with Netam et al. (2019) who recorded mean fresh weight of 30 cm broodlac of *kusmi* strain lac insect on *F. semialata* during 2015–2016 and 2016 –2017 as 42.76 g and mean weight of scrapped lac from that 30 cm lac stick as 17.94 g and the mean broodlac-scrapped lac ratio was 2.38.

4. Conclusion

F. semialata was found suitable for the inoculation, management and harvesting of lac. *F. semialata* might be be used as a suitable host of Lac insect for Lac cultivation in the state of Andhra Pradesh.

5. References

Divakara, B.N., 2013. Exploration of lac cultivation on non-traditional host *Flemingia macrophylla* (Willd.) Kuntze Ex Merr and its possibility in understorey plantations of *Dalbergia sisso* Roxb. International Journal of Forest, Soil and Erosion 3, 129–133. https://www.semanticscholar.org/paper/Exploration-of-Lac-Cultivation-on-Non-Traditional-Divakara/56797f8ae90e2f85357186e20d1963a18a443ea6.

Gullan, P.J., Kondo, T., 2007. The morphology of lac insects (Hemiptera: Coccoidea: Kerriidae); Proceedings of the XI International Symposium of Scale Insect Studies; Oeiras, Portugal 10(24–27), 63–70.

Kalahal, C., Hemanth, S., Lekha., 2017. Productivity-linked parameters of the *rangeeni* strain lac insect, *Kerria lacca* (Kerr) on pigeon pea, *Cajanus cajan* Linn. at Rajasthan. Journal of Entomology and Zoology Studies 5(3), 1745–1751.

Kapur, A.P., 1954. Some unrecorded host plants of the lac insect, *Laccifer lacca* (Kerr) (Homoptera: Lacciferidae).

Journal of Bombay Natural History Society 52, 645–647.

Mishra, Y.D., Sushil, S.N., Bhattacharya, A., Kumar, S., Mallick., A., Sharma, K.K., 1999. Intra specific variation in host–plants affecting productivity of Indian lac insect, *K. lacca* (Kerr). Journal of Non-Timber Forest Product 6(3/4), 114–117.

Mohanasundaram, A., Monobrullah, M., Sharma, K.K., Meena, S.C., Ramani, R., 2016. Lac insect and associated fauna - A Practical Manual. ICAR-Indian Institute of Natural Resins and Gums, Ranchi (Jharkhand), India. Bulletin (Tech.) No.14/2016, 01–42.

Mohanta, J., Dey, D.G., Mohanty, N., 2014. Studies on lac insect (*Kerria lacca*) for conservation of biodiversity in Similipal Biosphere Reserve, Odisha. Indian Journal of Entomology and Zoology Studies 2(1), 1–5.

Netam, P.K., Chandrakar, H.K., Katlam, B.P., 2019. Comparative performance of different host plants of lac insect *Kerria lacca* (Kerr). at Kanker district of Chattisgarh.Journal of Entomology and Zoology Studies 7(6), 265–270.

Panse, V.G., Sukhatme, P.V., 1985. Statistical methods for agricultural workers. ICAR, New Delhi, 187–202.

Rajgopal, N.N., Mohanasundaram, A., Sharma, K.K., 2021. A new species of lac insect in the genus Kerria Targioni Tozzetti (Hemiptera: Coccomorpha: Tachardiidae) on Samanea saman (Fabaceae) from India. Zootaxa. 4938, 60–68. Doi, 10.11646/zootaxa.4938.1.2.

Rao, S.R.K., Naresh, T., Mohanasundaram, A., Panduranga, G.S., Dhurua, S., Jyothula, D.P.B., Rao, T.S., 2023. New host plant record for lac insect *Kerria spp*. from Andhra Pradesh. Indian Journal of Entomology 85 (Special Issue), 130–131.

Sharma, K.K., Ramani, R., Mishra, Y. D., 1997. An additional list of the host plants of lac insects, *Kerria* spp. (Tachardiidae: Homoptera). Journal of Non-Timber Forest Products 4(3/4), 151–155. Available at: http://indianmedicine.eldoc.ub.rug.nl/id/eprint/48795.

Sharma, S., Jhala, J., Bhan, C., 2019. Host preference studies in *rangeeni* strain of lac insect (*Kerria lacca* Kerr). Journal of Pharmacognosy and Phytochemistry 8(5), 420–425.

Shivaleela, I.U., Javaregowda, 2018. Cultivation of lac *Kerria lacca* (Kerr) on its potential host plant Flemingia semialata. Journal of Experimental Zoology India 21(1), 515–519.

Varshney, R.K., Teotia T.P.S., 1967. A supplementary list of the host plants of lac insects. Journal of Bombay Natural History Society 64(3), 488–511.

Yogi, R.K., Kumar, N., Sharma, K.K., 2021. Lac, plant resins and gums statistics 2019. At a Glance. ICAR-Indian Institute of Natural Resins and Gums, Ranchi (Jharkhand), India. Bulletin (Technical) No. 3/2021, 01–82.