Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(5): 420-425
Received: 25-07-2019
Accepted: 27-08-2019

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Host preference studies in *Rangeeni* strain of lac insect (*Kerria lacca* Kerr)

Shivani Sharma, Jayshree Jhala and Chandra Bhan

Abstract
The investigations on host preference of *Rangeeni* strain of lac insect on beer, pigeonpea and flemingia were carried out at the lac insect gene bank and lac laboratory, situated at Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur during *Katki* season, 2017 with an aim to study the parameters of host preference *viz.*, initial density of settlement of first instar crawlers on host plants varied in different parts of plants which ranged from 32-114, 23-120 and 30-110 crawlers per sq.cm with the mean initial per cent mortality 10.30, 9.70 and 7.97; 12.49, 11.83 and 11.49 and 14.54, 14.43 and 13.17 per cent on upper, middle and lower parts of beer, flemingia and pigeonpea respectively during *Katki* season, 2017. The final density of settlement first instar crawlers ranged from 37-112, 20-110 and 20-100 crawlers per sq.cm on upper, middle and lower portion of ber, flemingia and pigeonpea respectively. The density of female cells at maturity ranged from 2-9, 1-8 and 1-7 cells per sq.cm on ber, pigeonpea and flemingia. The broodlac ratio 0.186, 0.15 and 0.19; 0.05, 0.06 and 0.07; 0.010, 0.011and 0.009 was recorded in three sets of experiments each of beer, pigeonpea and flemingia. The mean female cell size, weight of female cell, resin weight and sticklac yield were recorded as 2.13, 1.81 and 1.47 mm; 22.54, 19.39 and 17.15 mg; 20.92, 17.82 and 15.57 mg and 3.69, 1.08 and 1.73 kg in ber, flemingia and pigeonpea respectively during *Katki* season, 2017.

Keywords: *Kerria lacca* Kerr, *Rangeeni* strain, *Ziziphus mauritiana*, *Cajanus cajan*, *Flemingia macrophylla*

Introduction
Lac is one of nature's gift of immense economic importance to man. It is the only resin of animal origin, being actually the secretion of a tiny scale insect, *Kerria lacca* Kerr belonging to the family Tachardiidae (Kerriidae), super family Coccoidea of the order Hemiptera [1]. The life cycle of lac insect starts with first instar larval stage, generally known as crawlers; and is the only mobile stage that settles and feeds on phloem sap by piercing its proboscis into phloem region of shoot and secrets the resin over the body. The crawlers after settlement undergo three successive moultings to become the adult. Lac insect basically yields three useful materials viz., resin, dye and wax [2]. The major constituent of lac is the resin (68%), dye (1.2%), wax (6%), others (25%) like sugar, proteins, soluble salts, sand, woody matter, and insect body debris. Its derived products are biodegradable, nontoxic, environment friendly and have versatile uses and tremendous export potential [2]. In addition to this, the lac insect-host association contributes to the conservation of biodiversity viz., soil flora, fauna and soil microorganisms [3].
India is the major producer of lac, accounting for more than 50 per cent of the total world production. On the basis of survey of the markets of different lac producing districts and states, the national production of sticklac during 2012-2013 was 19577 tons. In India, Jharkhand state with 50.83 percent of total production, ranks 1st in lac production followed by Chhattisgarh (14.58 %), Madhya Pradesh (14.41 %), Maharashtra (8.98 %), Orissa (4.21 %), West Bengal (2.66 %) and Assam (1.68 %). Total export of lac and its value added products in 2012-2013 is 543620.51 tons (IINRG Statistics, 2014-15).
In the Rajasthan state, as many as 14 species of plants have been reported under the survey conducted by NP-CLIGR, of which being available in abundance, the Ber, palas, arhar, sitafal, have been found suitable for its commercial cultivation in the state. Ber (*Ziziphus mauritiana*) is a good host of *Rangeeni* strain of lac insect found throughout the state of Rajasthan. The state which being semi-arid in climatic condition can be better for the cultivation of lac in the region. Baishaki crop of Rangeeni lac is the major crop, mainly produced on *Z. mauritiana*. It is also a host of Kusmi lac strain, crop of *Kusmi* strain performs well on *Z. mauritiana* during crop period of July to January (Ghosal, 2009) [4]. Pigeonpea (*Cajanus cajan*) is a new lac host and strains of lac insects are being investigated to enhance its production. In 1950s pigeonpea was identified as a favorite host for lac insect in Yunnan province of South West

China. On-farm lac production with pigeonpea has recently emerged and spread in the Northern part of The Lao Peoples' Democratic Republic (Lao PDR) as a result of increasing demand of lac in China. This host has also been reported as promising host in North-East India (Ghosh *et al*., 2014) [5]. In different parts of Rajasthan, it is widely cultivated pulse crop which could be utilized for encouraging lac cultivation in the region. The wild leguminous species *Flemingia semiliata* and *F. macrophylla* have been found best suited for the commercial cultivation of lac insect in various parts of the country, of which *F. macrophylla* is better suited for the cultivation of *Rangeeni* strain of lac insect (Kaushik *et al*., 2012) [8]. It has an added advantage to overcome the problems of long gestation period, scattered distribution and high crown of the traditional hosts. Efforts were made to explore suitable non-traditional hosts of short gestation period and low crown. In this context, *F. macrophylla* was found as one of the promising non-traditional host species which has been explored for lac cultivation (Divakara, 2013) [1].

Materials and Method

The various facts of the present studies on the "Host preference studies in *Rangeeni* strain of lac insect *Kerria lacca* Kerr" were studied on three hosts *viz.,* Ber (*Ziziphus mauritiana*), Pigeonpea (*Cajanus cajan*) and *Flemingia macrophylla* in *Katki* season during 2017 at the lac insect gene bank and lac laboratory under NP-CLIGR, Department of Entomology, RCA, Udaipur. To study the host preference of the *Rangeeni* strain of lac insect during *Katki* season, 2017 the various parameters attributing host preference of lac insect on host were studied on ten tagged plants in three set of experiments of three hosts, respectively. The three host *viz.*, Ber, Pigeonpea, *F. macrophylla* were inoculated with brood lac of *Rangeeni* lac bearing fully matured females at proper sites on host plants, so as to provide succulent stem for emerging crawlers to settle. Brood lac sticks were tied in 60 mesh nylon cage which allow only crawlers to move out not the natural enemies. The nymphs were allowed to hatch from mature females within 7-10 days and after completion of emergence the *phunki* lac sticks were removed from host plants.

The different parameters attributing the lac insect host preference *viz.*, initial and final density of settlement, density at maturity (per sq. cm), broodlac ratio, female cell size (mm), weight of cell (mg), weight of resin (mg), sticklac yield (kg) were recorded on tagged host plants of ber, pigeonpea, *F. macrophylla* in three sets as per the standard procedure prescribed by Mohansundaram *et al.* (2016) as follows:

Observations

Initial density of settlement (number per sq. cm)

The observations on the initial density of settlement of the lac insect were recorded on completion of emergence of first instar crawlers from mature females of broodlac by placing a graph paper with a cut window of one square cm on the stem of three host plants under study. One square cm area was randomly selected on plant stem and numbers of nymphs settled after 7 days of inoculation were counted visually or with the help of magnifying glass. The observations at three such sites, the upper, lower and middle portion of plant were recorded on the ten plants in each three sets of experiments of three hosts and mean were recorded as density of initial settlement.

Initial natural mortality (%)

The observation on initial natural mortality was recorded by repeating the above procedure at 21days after inoculation of broodlac for three hosts. Under field conditions, the process of larval emergence continues up to two - three weeks. The larvae, which are not able to find suitable sites for settlement, die due to starvation. The observation at this stage is the true indication of the number of larvae actually settled and which have started feeding.

$$\text{Initial natural mortality (\%)} = \frac{\text{Initial density} - \text{Density after 21 days of settlement}}{\text{Initial density}} \text{X } 100$$

Final density of settlement (number per sq. cm):

The observations on final density of settlement on (no. per sq.cm) were recorded twenty one days after inoculation at the completion of emergence of crawlers from mature females, and were recorded following the same procedure as described for initial density of settlement.

Final density of settlement = Initial density of settlement – Initial natural mortality

Density at crop maturity (number per sq. cm)

To study the density at crop maturity the number of surviving female lac insects remained after initial mortality and emergence of male lac insects were counted per sq. cm by placing graph paper with a cut window of one sq. cm on the stem of three host plants at crop maturity on the appearance of yellow spot on the female cells.

Broodlac ratio

To measure the brood lac ratio, the amount of brood lac utilized for the inoculation of each plant were weighed and the weight of the lac sticks bearing fully mature females at harvest were weighed for each ten tagged plants in three sets of experiments of three hosts. The ratio of broodlac used at inoculation to the quantity of broodlac obtained at crop harvest was calculated as broodlac output ratio.

Female cell size (mm)

The size of the individual female cell (mm) was recorded for randomly selected ten cells from ten tagged plants in each three sets of experiments of three hosts. The female cells were collected at harvest for each host and cell size was measured by the veneer caliper.

Weight of cell (mg)

The weight of individual female cell (in mg) was recorded on randomly selected ten cells from ten tagged plants in each three sets of experiments of three hosts after larval emergence has completed using electronic balance.

Weight of resin (mg)

The resin produced by individual female cell was recorded after removing the dead insect body from the cell. The resin weight of ten cells from ten tagged plants in each three sets of experiments of three hosts was recorded.

Weight of sticklac (kg)

The lac sticks were separated by scantier from the twigs of host plants and were weighed (in kg) respectively for each three host plants to record sticklac yield.

Result and discussion

Initial density of settlement (Number per sq.cm)

The gravid female lays eggs inside encrustation and first instar larvae hatch out which crawls and settle at suitable sites on succulent stem of host plant. The settlement of the first

instar crawlers takes place within a period of a week or two of the hatching.

The observations of mean initial density of settlement of crawlers were recorded seven days after the inoculation of broodlac and are presented in Table 1.The results reveal that there was a difference in mean initial density of settlement of first instar crawlers on upper, middle and lower portion of different host plants. The initial density of settlement of first instar crawlers of *Rangeeni* strain of lac insect on ber, pigeonpea and flemingia during *Katki* season, 2017 ranged from 32-107, 34-92 and 78-114; 25-112, 23-120 and 31-118 and 30-89, 32-107 and 30-110 crawlers per sq.cm on upper, middle and lower portion of three host plants, respectively. The results of present investigations are in alignment with the findings of Mohanta *et al*. (2014) [12], who reported that initial density of settlement of crawlers ranged between 92.58-126.74 crawlers per sq.cm and 93.12-109.62 crawlers per sq.cm of *Kusmi* strain on Kusum and Ber trees respectively. Similarly Kalahal *et al*. (2017) [7]. Also reported that the initial density of settlement of first instar crawlers on host pigeonpea varied in different parts of plant and ranged from 20-121 crawlers per sq.cm of *Rangeeni* strain of lac insect in pigeonpea crop in *Katki* season. A higher mean initial density of settlement of first instar crawlers on upper, middle and lower portion of ber plant may be attributed to different layer structure of periderm cortex and secondary phloem in bark having simple column rays which have an effect on adhesion density of lac insect larvae. (Chen *et al*. 2003) [1].

Table 1: Mean initial density of settlement per sq. cm of first instar crawlers of *Rangeeni* strain of lac insect on different host during *Katki* season

Initial density of settlement per sq. cm				
		Upper portion of plant	**Middle portion of plant**	**Lower portion of plant**
Ber	Mean ($\bar{x}$)	77.83	77.40	93.93
	SD(σ)	4.51	3.55	4.16
	SE	2.60	2.05	2.40
	Range (R)	32-107	34-92	78-114
Pigeonpea	Mean ($\bar{x}$)	64.20	66.63	68.60
	SD(σ)	2.79	5.27	7.37
	SE	1.61	3.04	4.25
	Range (R)	30-89	32-107	30-110
Flemingia	Mean ($\bar{x}$)	67.98	72.89	73.47
	SD(σ)	7.33	4.29	7.86
	SE	4.23	2.48	4.54
	Range (R)	25-112	23-120	31-118

Initial natural mortality (%)

The first instar crawlers which could not find suitable sites for settlement on host plant could not survive and dies due to starvation within a week or two of its emergence. The observations on per cent initial mortality of first instar crawlers recorded at 21 days after inoculation of broodlac of *Rangeeni* strain of lac insect on ber, pigeonpea and flemingia during *Katki* season, 2017 are presented in Table 2. The data shows that mean per cent initial mortality of first instar crawlers varied from 7.97 per cent per sq. cm on lower portion of ber to 14.54 per cent per sq. cm on upper portion of pigeonpea which confers with the findings of Kalahal *et al*. (2017) [7]. Who reported that the per cent mortality ranged from 6.46-12.57 per cent *Rangeeni* strain of lac insect in pigeonpea crop in *Katki* season? The results of present investigations reveal that the minimum mean initial mortality of 10.30, 9.70 and 7.97 per cent were recorded from upper middle and lower portion of ber followed by 12.49, 11.83, 11.49 and 14.54, 14.43 and 13.17 per cent mean mortality were recorded from upper, middle and lower portion of flemingia and pigeonpea respectively. The similar results were observed by Divakara (2013) [1] who recorded minimum per cent mortality of *Rangeeni* strain of lac insect in *Calliandra calothyrsus* (12.48%) and *Dalbergia assamica* (22.36%), the maximum per cent mortality of Kusmi strain in Jethwi season were observed in *F. semialata* (27.88%) followed by ber (24.91%) and kusum (18.75%). The minimum mortality (%) recorded on lower, middle and upper portion of ber is in agreement with the findings of Chen *et al*. (2003) [1]. Who revealed bark anatomy of host as important parameters responsible for the mortality of lac insect?

Table 2: Mean initial percent mortality per sq cm of first instar crawlers of *Rangeeni* strain of lac insect on different host during *Katki* season

Initial percent mortality per sq. cm				
		Upper portion of plant	**Middle portion of plant**	**Lower portion of plant**
Ber	Mean ($\bar{x}$)	10.30	9.70	7.97
	SD(σ)	2.22	0.64	1.35
	SE	0.12	0.37	0.78
	Range (R)	5-12	4-13	3-12
Pigeonpea	Mean ($\bar{x}$)	14.54	14.43	13.17
	SD(σ)	1.71	2.89	2.77
	SE	0.98	1.67	1.59
	Range (R)	3-22	2-19	1-17
Flemingia	Mean ($\bar{x}$)	12.49	11.83	11.49
	SD(σ)	0.60	1.13	0.64
	SE	0.34	0.65	0.37
	Range (R)	2-20	3-13	4-13

Final density of settlement (Number per sq.cm)

The first instar crawlers after finding a suitable site on host plant settle down and starts feeding by inserting the proboscis in the stem and the remaining crawlers which could not find sites for settlement die due to starvation within a fortnight of the emergence from the female cells. The true population of lac insect which finds on plant for lac secretion which is recorded by subtracting the density of crawlers in initial and initial mortality (number). The data presented in Table 3. reveal that maximum final density of settlement of crawlers observed were 112, 100 and 110 crawlers per sq.cm while minimum final density of settlement of crawlers of *Rangeeni* strain of lac insect were 37, 20 and 20 crawlers per sq.cm on ber, pigeonpea and flemingia respectively during *Katki* season, 2017. The findings of Divakara (2013) [2]. supports the results of present investigation who recorded maximum density (77.8 crawlers/cm^2) of insect settlement in *F. macrophylla* as intercrop in under storey of *Dalbergia sisso* 21 days after of inoculation of broodlac. Similarly Kalahal *et al*. (2017) [7]. Have also reported that the mean final density of settlement first instar crawlers ranged from 17-114 crawlers per sq.cm with mean of 85.50, 78.20, 53.10; 80.20, 85.90, 65.00 and 61.90, 57.30, 54.60 crawlers sq.cm on lower, middle and upper portion of plant in three plots, respectively in *Rangeeni* strain of lac insect in pigeonpea crop in *Katki* season.

Table 3: Mean final density of settlement per sq cm of first instar crawlers of *Rangeeni* strain of lac insect on different host during *Katki* season

Final density of settlement per sq. cm				
		Upper portion of plant	**Middle portion of plant**	**Lower portion of plant**
Ber	Mean (×)	65.37	69.93	86.50
	SD(σ)	4.12	3.59	4.66
	SE	2.38	2.07	2.69
	Range (R)	41-97	37-92	70-112
Pigeonpea	Mean (×)	55.10	57.67	60.00
	SD(σ)	3.34	5.84	7.64
	SE	1.93	3.37	4.41
	Range (R)	32-80	22-100	20-98
Flemingia	Mean (×)	59.87	64.97	66.00
	SD(σ)	6.96	4.15	7.73
	SE	4.02	2.40	4.47
	Range (R)	27-110	20-110	24-110

Density at crop maturity (number of cells per sq.cm)

The lac cells are exposed to several biotic and abiotic stresses during life period on the host hence also affect the density of female cells at crop maturity and vary widely from initial density of settlement. The female cell during their growth period increases in size and density at maturity determines the yield of lac insect at harvest and the potential of broodlac for next generation therefore can be considered as an important parameter of host preference of lac insect.

The data on mean number of female cells per sq.cm of *Rangeeni* strain of lac insect in *Katki* crop season during, 2017 are presented in Table 4. The observations on that mean density of female cell recorded at crop maturity reveal that there were 5.23, 6.00 and 5.90; 4.77, 5.10 and 4.27; 4.80, 4.77 and 5.17 female cells per sq.cm on upper, middle and lower portion of ber, pigeonpea and flemingia respectively. The maximum density of cells at maturity recorded was 9.00 female cells per sq.cm on ber where as the minimum density recorded was 1.00 female cell per sq.cm in pigeonpea and flemingia of *Rangeeni* strain of lac insect during *Katki* season, 2017. The results of present investigation are in full alignment with the findings of Mohanta *et al*. (2014) [12], who also recorded average higher density of living female cells at crop maturity as 3.38-12.67 cells per sq.cm on pales plant for *Rangeeni* strain of lac insect. Similarly Kalahal *et al*. (2017) [17]. Reported that the density of female cells of *Rangeeni* strain of lac insect at maturity on pigeonpea ranged from 01-11 cells per sq.cm during *Katki* season.

Table 4: Mean density at crop maturity per sq cm of first instar crawlers of *Rangeeni* strain of lac insect on different host during *Katki* season.

Density at crop maturity per sq. cm				
		Upper portion of plant	**Middle portion of plant**	**Lower portion of plant**
Ber	Mean (×)	5.23	6.00	5.90
	SD(σ)	0.80	0.44	0.10
	SE	0.46	0.25	0.06
	Range (R)	2-8	3-9	2-8
Pigeonpea	Mean (×)	4.77	5.10	4.27
	SD(σ)	0.40	0.46	0.15
	SE	0.23	0.26	0.09
	Range (R)	1-8	1-8	2-7
Flemingia	Mean (×)	4.80	4.77	5.17
	SD(σ)	0.10	0.91	0.51
	SE	0.06	0.52	0.30
	Range (R)	2-7	1-6	2-7

Broodlac ratio

The ratio of weight of broodlac used at inoculation to the weight of broodlac obtained at the time of crop harvest were recorded for three hosts *viz*., ber, flemingia and pigeonpea during *Katki* season, 2017 as broodlac output ratio. The data on mean broodlac ratio of *Rangeeni* strain of lac insect in *Katki* season during 2017 recorded on upper, middle, lower sites on ten plants in three set of experiment on each three hosts are presented in Table 5. The mean broodlac ratio of 0.186, 0.15 and 0.19; 0.05, 0.06 and 0.07; 0.010, 0.011 and

0.009 was observed in three sets of experiments of ber, pigeonpea and flemingia respectively. The findings of the present study are in the alignment with Ferdousee *et al*. (2010) who reported *Z. mauritiana* as most preferred host on the basis of lac production as compared to other hosts. The results of the present investigation confer the findings of Divakara (2013) [2]. who recorded broodlac yield 448.76 gm and 622.64 gm of *Rangeeni* and *Kusmi* strain of lac insect in *F. macrophylla* as intercrop in under story of *Dalbergia sisso*.

Table 5: Mean broodlac ratio of *Rangeeni* strain of lac insect on different host during *Katki* season

Brood lac ratio				
		R1	**R2**	**R3**
Ber	Mean ($\bar{x}$)	0.186	0.15	0.19
	SD(σ)	0.15	0.06	0.09
	SE	0.05	0.02	0.03
	Range (R)	0.077 -0.50	0.08-0.28	0.09-0.40
Pigeonpea	Mean ($\bar{x}$)	0.05	0.06	0.07
	SD(σ)	0.008	0.016	0.017
	SE	0.002	0.005	0.005
	Range (R)	0.043-0.067	0.043-0.10	0.053-0.10
Flemingia	Mean ($\bar{x}$)	0.010	0.011	0.009
	SD(σ)	0.0028	0.0037	0.0012
	SE	0.0009	0.00012	0.0004
	Range (R)	0.0056-0.014	0.0083-0.012	0.0056-0.010

Female cell size (mm)

The size of the individual female cell (mm) was recorded for randomly selected ten cells from ten tagged plants in each three sets of experiments of three hosts. The female cells were collected at harvest from each hosts and cell size was measured by the veneer caliper. The observations recorded on mean size of female cells (mm) are presented in Table 6. The observation recorded on mean female cell size (mm) of *Rangeeni* strain of lac insect during *Katki* season, 2017 reveal that maximum mean cell size of 2.13 mm was recorded from female cells of the host ber which was followed by the mean female cell size recorded for flemingia and pigeonpea were 1.81 and 1.47 mm respectively during *Katki* season, 2017. Though not much study on female cell size aspect of *Rangeeni* strain have been revealed by the researchers but the findings of the present investigations are in line with the observations of Mishra *et al*. (2000) [11]. who studied inter trait relationship and found highly significant positive correlation was observed between all weight, fecundity and life period with the diameter of cells.

Table 6: Mean female cell size, weight of female cells and weight of resin of *Rangeeni* strain of lac insect on different host during *Katki* season

Hosts	Mean female cell size (mm)	Mean female cell weight (mg)	Mean resin weight (mg)
Ber	2.13	22.54	20.92
Pigeonpea	1.47	17.15	15.57
Flemingia	1.81	19.39	17.82

Weight of cell (mg)

The weight of ten randomly selected female cells of *Rangeeni* strain of lac insect on ber, pigeonpea and flemingia during *Katki* season, 2017 were recorded by electronic balance. The results presented in Table 6. Reveal that the mean female cell weight recorded for ber, pigeonpea and flemingia were 22.54, 17.15 and 19.39 mg respectively during *Katki* season, 2017. The results of present study are in full alignment with the findings of Mishra *et al*. (1999) [10] who also evaluated the productivity of Indian lac insect (*Kerria lacca* Kerr) on *F. semialata* and *F. macrophylla* in terms of dry cell weight and recorded 8-19 mg and 9-18.83 mg cell weight on two hosts respectively. The present results are in conformity with the findings Kumar *et al*. (2007) who evaluated 7 host plants of lac insect with reference to the cell weight and found that it ranged from 10.12-14.21 mg in ber and 9.40-13.60 mg in pigeonpea in Baisakhi season. Similarly Kalahal *et al*. (2017) [7]. Also reported that the female cell weight was 6-24 mg per cell in *Rangeeni* strain of lac insect in pigeonpea crop in *Katki* season. A significant positive correlation was also observed between cell diameter and cell weight by Mishra *et al*. (2000) [11].

Table 7: Mean weight of stick lac of *Rangeeni* strain of lac insect on different host during *Katki* season

Mean weight of stick lac(kg)				
	R1	**R2**	**R3**	**Mean weight**
Ber	4.08	3.83	3.18	3.70
Pigeonpea	1.95	1.75	1.50	1.73
Flemingia	1.05	1.00	1.20	1.08

Resin weight (mg)

The results presented in Table 6. Reveal that the mean resin weight recorded in *Rangeeni* strain of lac insect on ber, flemingia and pigeonpea in *Katki* season during 2017 were 20.92, 17.82 and 15.57 mg per cell respectively. The results are in conformity to the findings of Sharma *et al*. (2007) who studied the resin producing efficiency of *Rangeeni* strain of *Kerria lacca* on different hosts and recorded highest resin weight on *Acacia auriculiformis* (9.09 mg), followed by *Butea monosperma* (8.76 mg), *F. macrophylla* (7.49 mg) and *Cucurbita moschata* fruits (6.00 mg). Similarly Kalahal *et al*. (2017) [7]. Also reported 4-19 mg resin weight per cell in *Rangeeni* strain of lac insect in pigeonpea crop in *Katki* season.

Weight of sticklac (kg)

The results presented in Table 7 reveal that the mean weight of sticklac recorded in *Rangeeni* strain of lac insect on ber, pigeonpea and flemingia in *Katki* season during 2017 were 3.69, 1.73 and 1.08 kg respectively. The results are in conformity to the findings of the findings of Divakara (2013) [2]. who recorded 342.74 g and 219.02 g sticklac yield in *Flemengia spp.* in winter and rainy season respectively per plant. Patel (2013) who studied weight of sticklac of *Rangeeni* and *Kusmi* strain of lac insect on ber and recorded the mean weight (gm) of sticklac per 30 cm was highest in *Kusmi* 53.09 gm followed by *Rangeeni* 47.36 gm. Similarly Kalahal *et al*. (2017) [7]. Reported that the weight of sticklac was 235 gm per plant in *Rangeeni* strain of lac insect in pigeonpea crop in *Katki* season.

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