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Studies on the population dynamics and host range of Lac insect in different agro-climatic zones of Punjab (India)

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Abstract

A study was conducted for a period of three years from 2014-2017 to check the status of Lac insect along with its associated host plants in five agro-climatic zones (Central plain, Western, Western plain, Sub-mountainous undulating and Sub-mountainous undulating plain) of Punjab. During the study period, lac infestation was found to be predominant in dry areas of western and western plain zone followed by central zone and was recorded to be least in the sub mountainous zone (undulating and undulating plain). Ber (*Ziziphus mauritiana*), Peepal (*Ficus religiosa*), Kikar (*Acacia nilotica*) and Sirin (*Albizia spp*) were recorded as major host plants of lac insect. Out of these four, high infestation of lac insect was recorded on *Ziziphus mauritiana* > *Ficus religiosa* > *Acacia nilotica* and *Albizia spp*. Another host plant i.e. Litchi (*Litchi chinensis*) was found to be heavily infested with lac insect at only one site (Ludhiana) in central zone of Punjab.

Keywords: acacia nilotica, ficus religiosa, litchi chinensis, ziziphus mauritiana and lac infestation

1. Introduction

Lac-insects are the crowning glory of India's rich insect fauna. Out of nine genera and 99 species of lac-insects reported from all over the world; two genera and 26 species are found in India, representing 26.3% of the known lac-insect species diversity [1]. These insects are exploited for their products of commerce viz., resin, dye and wax. Besides Indian lac insect, *Kerria lacca* which is the most exploited lac insect (Family Kerriidae, Super family Coccoidea, Order Hemiptera); *K. chinensis* and *K. sharda* are two other important lac producing insects [8]. They thrive on more than 400 plant species. Lac insects are restricted to tropical and sub-tropical regions of the world, between the latitudes 40°N and 40°S in its distribution [4]. Lac is the major source of livelihood of millions of backward population especially tribes in many states of India. Though lac-insects are still found in nature all over the country, its commercial cultivation is now restricted only to Jharkhand and Chhattisgarh, and certain pockets of Madhya Pradesh, Maharashtra and West Bengal. As a result, many species of lac insects have either become extinct or are in the 'waiting list' of extinction. Lac cultivation has been stopped by the traditional cultivators in the central Indian states and the unutilized lac-hosts are being cut for timber and fuel wood purposes. Biodiversity of lac insect and its associated fauna has been eroded over the years as it the direct target of pest management practices being used by the farmers. Economically important plants viz. Litchi (*Litchi chinensis*), Mango (*Mangifera indica*), Ber (*Ziziphus mauritiana*), Sandal (*Santalum album*) etc. are infested by the lac insect in India [9].

Therefore there is strong need to undertake extensive and comprehensive surveys to know the present status of lac-insects and their host plants bio-diversity. Thus, the present study was conducted to collect the information regarding lac insect and their associated host plants from different agro-climatic zones of Punjab.

2. Materials and Methods

Regular surveys were conducted for collecting the information on lac insect and its associated host plant diversity for a period of three years (2014-2017) from different agro-climatic zones of Punjab. In Central zone, out of seven districts (Ludhiana, Jalandhar, Kapurthala, Amritsar, Patiala, Tarntarn and Fatehgarh Sahib), 30 sites from 23 blocks were surveyed. Similarly a

total of 35 locations from 15 blocks of western and 8 blocks including 19 locations of western plain zone having nine districts (Moga, Sri Muktsar Sahib, Bathinda, Barnala, Mansa, Sangrur, Faridkot, Ferozpur and Fazilka) were covered. In sub-mountainous undulating and sub-mountainous undulating plain zone, 8 locations from 5 blocks and 3 locations from 3 different blocks from six districts (Pathankot, Gurdaspur,

Hoshiarpur, Roopnagar, SBS Nagar and SAS Nagar) were investigated to check the population status of lac insect and their host plants respectively (Fig. 1). GPS co-ordinates of each location were recorded by using instrument named "GARMIN MONTANA 650". Lac samples were also collected for their identification and ex-situ conservation.



Fig I: Different Agro-climatic zones of Punjab

3. Results and Discussion

During the present study period, in Central plain zone (30°07.139'N-32°26.524'N and 74°45.410'E-76°38.6'E), out of 30 sites visited from 23 blocks, no lac infestation was observed in 14 sites, three sites were recorded with low population of lac insect, five with moderate population whereas heavy infestation of lac insects was recorded in 8 blocks viz. Ludhiana district (Jagraon, Halwara, Amargarh and City I) on *Ziziphus mauritiana*. The lac population on *Litchi chinensis* was recorded from Ludhiana city for the first

time; however, other lac hosts have earlier been reported during previous surveys conducted. *Ziziphus mauritiana* and *Ficus religiosa* were major host plants with heavy infestation of lac insects in Patiala (City and Ghagga). Similarly at Fatehgarh Sahib, two sites (NauLakha and Rurki) were found to be highly infested with lac insects. No infestation was reported from *A. nilotica* from central zone of Punjab except for 3 sites at Jalandhar (1) and Kapurthla (2) as shown in Table 1, fig 2.

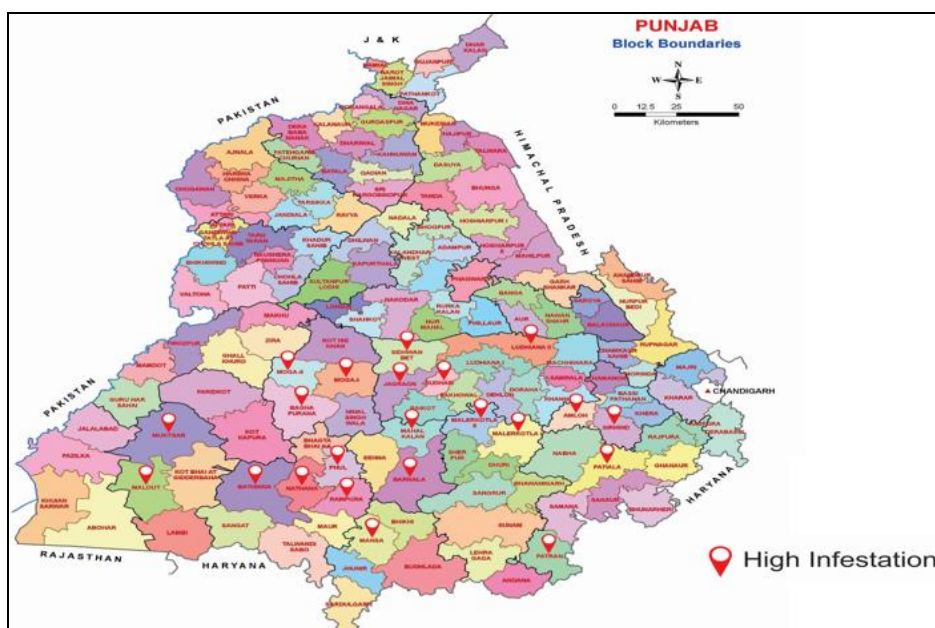


Fig II: Different blocks with high infestation of lac insect (Punjab)

Lac insect population was found to be predominant in dry areas i.e. western and western plain areas of Punjab (30°5.456'N - 30°93.3'N and 74°02.8'E-75°76.947'E). Thirteen blocks of western and western plain zone were found to be highly infested with lac insect (Fig 2). Out of 54 sites in nine districts, 9 sites were found with no lac infestation, 5 sites having low population, 12 sites were recorded with medium population of lac insect and 28 sites having heavy infestation of lac insect was recorded in Barnala (Mehal Kalan, WajidKe, Tappa, Dhaula, BhadalWadh, Nihalewal, Dhanuala), Ferozepur (Mudki, Lakohke, Behram, Cantt, Karin Kalan, Sadar Din Wala, AlamKe), Faridkot (Tehna, Sandhwa, Kotakpura, Baja Khana), Bathinda (RampuraPhool, Lehra Bega, Gonian Khurd, City), Muktsar (City II, Malout, SaraiNagha), Moga (Demru, City, Daddahor) and Sangrur (Kupkalan, City, Sanghera). High infestation was reported on *Ziziphus mauritiana* followed by *Ficus religiosa* and *Acacia nilotica* (Table 2, 3).

There was no report of lac insect infestation from sub mountainous undulating and plain zone, (30°05.864'N-32°81.86'N and 75°20.28'E-76°38.00'E) of Punjab as very few host trees were found in the districts of Gurdaspur, Pathankot and Rupnagar. However, at Hoshiarpur (Mukerian) moderate population was reported from *Ziziphus mauritiana* (Table 4, 5).

During survey period, a total of ninety samples were collected from different zones of Punjab. Maximum samples were collected from western and western plain zone (60) followed by Central zone (29) and only one sample was collected from Sub-mountainous undulating zone (Fig 4). Population density was observed high on *Ziziphus mauritiana* followed by *Acacia nilotica*, *Ficus religiosa*, *Litchi chinensis* and *Albizia* species (Fig 5).

Lac insects are restricted to tropical and sub-tropical regions of the world [4], between the latitudes 40°N and 40°S in its distribution. However, lac production varies from host to host and season to season [5]. The combination of temperature and relative humidity has been identified as the principal factors limiting geographic distribution of *Kerria yunnanensis*, which is also related with the distribution of its host plants [10].

Most of the lac insect infestation was found on wild *Ziziphus mauritiana*. Highest survivability of *Kerria lacca* on the *Ziziphus mauritiana* may be due to more succulence and also

the availability of phloem sap [7]. In India, *Ziziphus mauritiana* Lam. occupies large area (22,000 ha) and it is popular fruit crop for arid and semi-arid regions of India [3] and most of the cultivated areas are confined to Rajasthan, Haryana, Punjab, Gujarat, Maharashtra and Uttar Pradesh. The crop is gaining popularity among the growers because it thrives well under adverse climatic condition and gives good return [2]. During the present study, lac infestation was not observed on cultivated ber orchards as they are regularly pruned and protected against insects by spraying insecticides. The other host plants of lac insect recorded are peepal (*Ficus religiosa*), kikar (*Acacia nilotica*), sirin (*Albizia* spp) and *Litchi chinensis*. The lac insect infesting economically important plants viz. litchi (*Litchi chinensis*), mango (*M indica*), ber (*Ziziphus mauritiana*), sandal (*S album*) [8]. In Rajasthan, 13 host plants of lac insect in southern Rajasthan among which ber and palash trees were dominant in numbers [5]. Although more than 250 host plant species of *K. lacca* have been identified so far, the first category, i.e., common or major hosts include fourteen species in which three, namely Palash (*Butea monosperma*), Kusum (*Schleichera oleosa*) and Ber (*Ziziphus mauritiana*) are of all Indian importance and contribute 95 per cent of commercial production of lac [6].

4. Conclusion

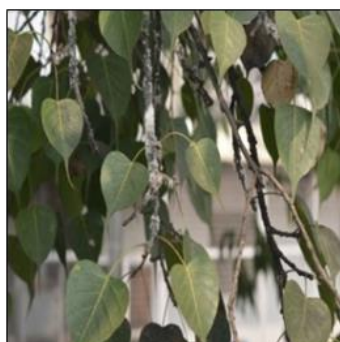
It can be concluded that wild Indian ber tree serves as major host plant of lac insects in all different agro-climatic zones of Punjab. As there is lack of awareness about lac production much attention is not given by the growers also. Thus, future investigations on study of biology of lac insects, productivity linked parameters and their integration with other agricultural crops in Punjab is the need of hour to promote and encourage lac culture which will not only conserve associated fauna and flora but also helps in fetching more income to the farmers.

5. Acknowledgment

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Ziziphus mauritiana



Ficus religiosa



Albizia sp.

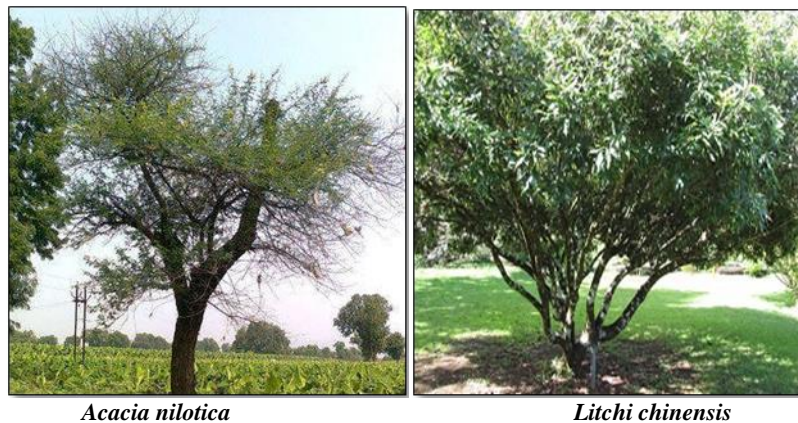


Fig III: Major host plants of lac insects

Table I: Status of lac insect and their host plants from central plain zone of Punjab during 2014-2017

Districts	Locations	GPS Coordinates		Host Plants	Population Size			
		Latitude	Longitude		Nil	Low	Moderate	High
Ludhiana	Mullanpur	30°84.765'N	75°67.655'E	<i>Ziziphus mauritiana</i>	√			
	Jagraon	30°48.687'N	75°28.564'E	<i>Z. mauritiana</i>				√
	Halwara	30°43.321'N	75°38.667'E	<i>Z. mauritiana</i>				√
	Jalal diwal	30°36.127'N	75°35.012'E	<i>Z. mauritiana</i>	√			
	Amargarh	31°12.79'N	76°07.18'E	<i>Z. mauritiana</i>				√
	Lehra	30°42.089'N	75°50.909'E	<i>Z. mauritiana</i>	√			
	Daheru	30°36.127'N	75°35.01'E	<i>Z. mauritiana</i>	√			
	MandialaKalan	30°45.463'N	76°05.730'E	<i>Z. mauritiana</i>	√			
	City I	32°26.524'N	75°42.826'E	<i>Litchi chinensis</i>			√	
Jalandhar	CityII	30°90.01'N	75°85.253'E	<i>Z. mauritiana</i>				√
	Mehatpur	31°45.2'N	75°28.9'E	<i>Z. mauritiana</i> and <i>Acacia nilotica</i>	√			
Kapurthala	Shahkot	31°11.66'N	75°35.00'E	<i>Z. mauritiana</i>		√		
	Dhliwan	31°52.00'N	75°35.00'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
Amritsar	SaraiJattan	31°25.85'N	75°19.04'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
	City	31°38.232'N	74°52.201'E	<i>Z. mauritiana</i>			√	
	Beas	31°51.66'N	75°28.90'E	<i>Z. mauritiana</i>	√			
	Tangra	31°33.659'N	75°06.752'E	<i>Z. mauritiana</i>	√			
Patiala	Sathaiala	31°34.697'N	75°17.303'E	<i>Z. mauritiana</i>	√			
	City	30°33.9'N	76°38.6'E	<i>Z. mauritiana</i>				√
	Ghagga	30°07.139'N	76°05.024'E	<i>Z. mauritiana</i> and <i>F. religiosa</i>				√
	Nabha	30°37.960'N	76°16.423'E	<i>Z. mauritiana</i>		√		
	DuggalKalan	29°59.058'N	76°01.035'E	<i>Z. mauritiana</i>			√	
Tarnarn	Rajpura	30°32.055'N	76°30.757'E	<i>Z. mauritiana</i>	√			
	City	31°27.4'N	74°85.6'E	<i>Z. mauritiana</i>		√		
	Bhikiwind	31°20.549'N	74°41.754'E	<i>Z. mauritiana</i>			√	
	HarikePattan	31°10.343'N	74°56.131'E	<i>Z. mauritiana</i>	√			
Fatehgarh Sahib	Dialpura (Patti)	31°17.942'N	74°45.410'E	<i>Z. mauritiana</i>	√			
	MugalMajra	30°40.503'N	76°16.400'E	<i>Z. mauritiana</i>			√	
	NauLakha	30°30.097'N	76°24.304'E	<i>Z. mauritiana</i>				√
	Rurki (Amlah)	30°31.162'N	76°24.278'E	<i>Z. mauritiana</i>				√

Population size : Low: <100, Moderate: 100-1000 and High: >1000

Table II: Status of lac insect and their host plants from western zone of Punjab during 2014-2017

Districts	Locations	GPS Coordinates		Host Plants	Population size			
		Latitude	Longitude		Nil	Low	Moderate	High
Moga	Mehna	30°50.440'N	74°55.250'E	<i>Z. mauritiana</i>			√	
	Matwani	30°81.199'N	75°30.243'E	<i>Z. mauritiana</i> and <i>A.nilotica</i>			√	
	Demru	-	-	<i>Z. mauritiana</i>				√
	City I	30°49.164'N	75°12.389'E	<i>AlbiziaSp.</i>				√
	Samalsar	30°38.523'N	75°00.155'E	<i>A. nilotica</i>	√			
	Daddahor	30°35.515'N	75°34.077'E	<i>Z. mauritiana</i>				√
	Ajitwal	30°48.714'N	75°19.824'E	<i>Z. mauritiana</i>			√	
	Mandi complex	30°49.576'N	75°09.428'E	<i>Z. mauritiana</i>			√	
Sri Muktsar Sahib	Jalalabad	30°5.456'N	75°15.064'E	<i>Z. mauritiana</i>	√			
	City I	30°46.196'N	74°52.8254'E	<i>Z. mauritiana</i>			√	
	City II	30°28.932'N	74°32.490'E	<i>Z. mauritiana</i>				√
	Malout City	30°11.929'N	74°29.612'E	<i>Z. mauritiana</i>		√		√

Districts	Locations	GPS Coordinates		Host Plants	Population size			
		Latitude	Longitude		Nil	Low	Moderate	High
	Sarai Nagha	30°31.054'N	74°40.031'E	<i>Z. mauritiana</i>				√
	Mehrajwala	30°20.950'N	74°31.161'E	<i>Z. mauritiana</i>	√			
Bathinda	Rampuraphool	30°28.19'N	75°23.73'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>				√
	Lehrabega	30°14.47'N	75°71.1'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>				√
	Bucho	30°22.33'N	75°10.17'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
	GonianKhurd	30°20.102'N	74°56.145'E	<i>Z. mauritiana</i>				√
	City	30°14.132'N	74°56.115'E	<i>Z. mauritiana</i>				√
	Nehianwala	30°18.415'N	74°54.345'E	<i>Z. mauritiana</i>			√	
Barnala	MehalKalan	30°61.79'N	75°76.947'E	<i>Z. mauritiana</i>				√
	WajidKe	30°27.24'N	75°34.21'E	<i>Z. mauritiana</i>				√
	Tappa	30°29.81'N	75°36.89'E	<i>A. nilotica</i>				√
	Dhaura	30°17.55'N	75°29.40'E	<i>A. nilotica</i>				√
	Bhadalwadh	-	-	<i>Z. mauritiana</i>				√
	City	30°21.445'N	75°33.493'E	<i>Z. mauritiana</i>			√	
	Nihalewala	30°34.122'N	75°34.940'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>				√
	Dhanaula	30°18.323'N	75°29.568'E	<i>Z. mauritiana</i>				√
Mansa	Tamkot	30°06.5678'N	75°404.854'E	<i>A. nilotica</i>				√
	Ubha	30°03.424'N	75°24.794'E	<i>Z. mauritiana</i>	√			
	KupKalan	30°36.791'N	75°52.654'E	<i>Z. mauritiana</i>				√
	Malerkotla	30°32.452'N	75°52.852'E	<i>Z. mauritiana</i>	√			
	City	30°14.258'N	75°50.327'E	<i>Z. mauritiana</i>				√
	Mehlan	30°09.309'N	75°53.741'E	<i>Z. mauritiana</i> and <i>F. religiosa</i>		√	√	
	Sanghera	30°25.77'N	75°34.002'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>				√

Population size : Low: <100, Moderate: 100-1000 and High: >1000

Table III: Status of lac insect and their host plants from western plain region of Punjab during 2014-2017

Districts	Locations	GPS Coordinates		Host Plants	Population size			
		Latitude	Longitude		Nil	Low	Moderate	High
Faridkot	BirSikhanWala	30°61.7'N	74°91.7'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>		√		
	PanjgrainKalan	30°36.771'N	74°55.020'E	<i>Z. mauritiana</i>			√	
	Tehna	30°41.578'N	74°47.689'E	<i>Z. mauritiana</i>				√
	Sandhwa	30°38.122'N	74°46.974'E	<i>Z. mauritiana</i>				√
	Kotakpura	30°34.002'N	74°49.409'E	<i>Z. mauritiana</i>				√
	Bajakhana	30°27.475'N	74°57.011'E	<i>Z. mauritiana</i>				√
Firozpur	TalwandiBhai	30°50.440'N	74°55.250'E	<i>Z. mauritiana</i>		√	√	
	City I	30°93.3'N	74°62.25'E	<i>Z. mauritiana</i>			√	
	City II	30°55.682'N	74°37.777'E	<i>Z. mauritiana</i>		√	√	
	Zira	30°59.544'N	75°05.858'E	<i>Z. mauritiana</i>	√			
	Mudki	30°47.040'N	74°53.327'E	<i>Z. mauritiana</i>				√
	LakohkeBehram	30°47.403'N	74°26.925'E	<i>Z. mauritiana</i>				√
	Cantt.	30°55.817'N	74°37.433'E	<i>Z. mauritiana</i>				√
	Karin Kalan	30°50.256'N	74°27.712'E	<i>Z. mauritiana</i>				√
	Sadar din wala	30°52.828'N	74°30.920'E	<i>Z. mauritiana</i>				√
	AlamKe	30°48.368'N	74°25.788'E	<i>F. religiosa</i>				√
Fazilka	KarniKhera	30°87.564'N	74°25.864'E	<i>A. nilotica</i>	√			
	Jalalabad	30°62.00'N	74°25.00'E	<i>A. nilotica</i>	√			
	City	30°40.3'N	74°02.8'E	<i>Z. mauritiana</i>				√

Population size : Low: <100, Moderate: 100-1000 and High: >1000

Table IV: Status of lac insect and their host plants from sub-mountainous undulating zone of Punjab during 2014-2017

Districts	Locations	GPS Coordinates		Host Plants	Population size			
		Latitude	Longitude		Nil	Low	Moderate	High
Pathankot	City	32°26.68'N	75°60.00'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
	ChakkMadho	32°05.49'N	75°37.822'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
	KotliMughlan	32°26.542'N	75°55.548'E	<i>Litchi chinensis</i>	√			
Gurdaspur	RanjitSagarBagh	32°23.363'N	75°48.265'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
	Batala	32°81.86'N	75°20.28'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
	City	32°04.1'N	75°40.5'E	<i>Z. mauritiana</i>	√			
Hoshiarpur	Ghar Shankar	30°05.864'N	75°41.409'E	<i>A. nilotica</i>	√			
	Mukerian	31°57.130'N	75°36.724'E	<i>Z. mauritiana</i>			√	

Population size : Low: <100, Moderate: 100-1000 and High: >1000

Table V: Status of lac insect and their host plants from sub-mountainous undulating plain zone of Punjab during 2014-2017

Districts	Locations	GPS Coordinates		Host Plants	Population size			
		Latitude	Longitude		Nil	Low	Moderate	High
Roopnagar	Nangal	31°37.00'N	76°38.00'E	<i>A. nilotica</i>	√			
SBS Nagar	City	31°13.903'N	76°11.219'E	<i>Z. mauritiana</i> and <i>A. nilotica</i>	√			
SAS Nagar	City	30°41.672'N	76°39.770'E	<i>Z. mauritiana</i> , <i>A. nilotica</i> and <i>F. religiosa</i>	√			

Population size: Low: <100, Moderate: 100-1000 and High: >1000

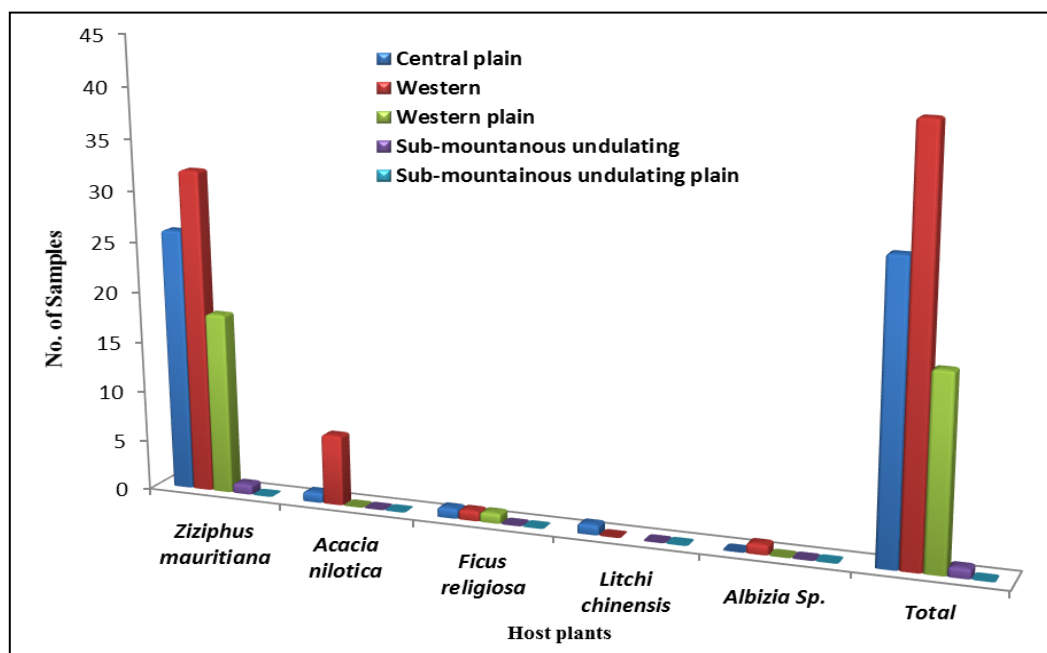


Fig IV: No. of lac samples collected from different agro-climatic zones of Punjab during 2014-2017

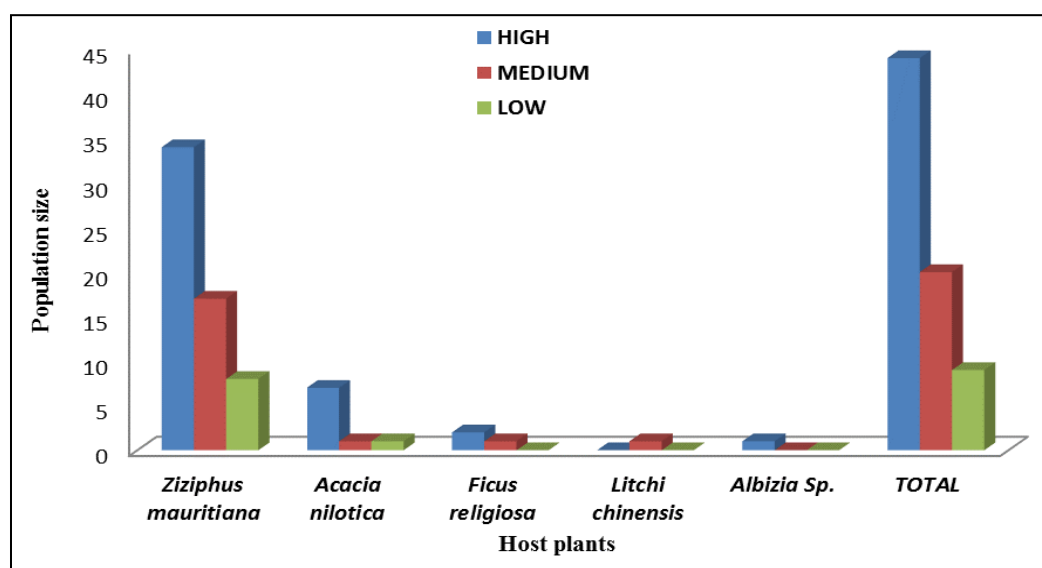


Fig V: No. of lac samples based on population size collected from different agro-climatic zones during 2014-2017

6. References

1. Anonymous. Indian Institute of Natural Resins and Gums, Namkum, Ranchi, 2014, 1-135.
2. Haldhar SM, Deshwal HL, Jat GC, Berwal MK, Singh D. Pest scenario of ber (*Ziziphus mauritiana* Lam.) in arid regions of Rajasthan: a review. Journal of Agriculture and Ecology. 2016; 1:10-21.
3. Jamadar MM, Balikai RA, Sataraddi AR. Status of Diseases on Ber (*Ziziphus mauritiana* Lamarck) in India and their Management Options. Acta Horticulture. 2009; 840:383-390.
4. Kapur AP. The lac insect. In: A Monograph on Lac. Mukhopadhyay B, Muthana MS (Eds.), ILRI, Namkum, Ranchi, 1962, 59-89.
5. Kumar A, Kumawat MM, Lekha, Meena NK. Lac hostplants recorded from southern Rajasthan and their relative performance. Entomology. 2007; 32(2):129-132.
6. Mohanta J, Dey DG, Mohanty N. Studies on lac insect (*Kerria lacca*) for conservation of biodiversity in Similipal Biosphere Reserve, Odisha, India. Journal of Entomology and Zoology Studies. 2014; 2(1):1-5.
7. Shah TH, Thomas M, Bhandari R. Impact of nutrient management in *Z. mauritiana* (Lamb.) on the survivability of lac insect and the yield of *Aghani* crop of

Kusmi lac. Journal of Entomology and Zoology Studies. 2014; 2(5):160-163.

8. Sharma KK, Ramani S. Lac insect systematics and geographical distribution. *In* Sharma, K.K. and Ramani, R. (eds) Recent advances in lac culture. 2011; 27-36 pp.
9. Sharma KK, Jaiswal AK, Kumar K. Role of lac culture in biodiversity conservation: Issues at stake and conservation strategy. *Current Science*. 2006; 91(7):894-898.
10. You-Qing C, Shao-Yun W. Natural Distribution, Diffusion and Geographic origin of the genus (Hemiptera: Kerriidae). *Entomotaxonomia*. 2007; 2:107-115.