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Canopy Structure of Ber (*Zizyphus mauritiana*) Trees Influencing Lac Yield

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Abstract

Ber (*Z. mauritiana*) is a popular lac-host among the farmers. Both strains of lac insect i.e. *kusmi* and *rangeeni* of *Kerria lacca* (Homoptera : Tachardiidae) are being grown on ber Intra-specific variation is found on the host for which canopy of the tree has got various shapes. Four types of ber tree i.e. erect, semi-erect, roof and bushy types were identified based on canopy structure in the Institute Research Farm, Namkum. These trees were characterized based on vegetative characters and subsequently lac yield performance. The roof type trees performed the best giving a yield ratio (brood yield : brood used ratio) of 13.01 while the bushy type showed the lowest yield ratio (0.99). Thin shoot percent (basal diameter<1.0 cm) and length/diameter ratio were highest in bushy type trees. Values for light transmission ratio under bushy tree canopy (27.3%) was less as compared to erect (45%) and semi-erect types (36.9%). It appears that these factors coupled together might have led to poor lac yield performance in bushy types and comparatively better in other types of trees.

Key words : ***Zizyphus mauritiana*, Ber, Canopy structure, Lac yield, *Kerria lacca.***

Ber is considered to be a fruit of minor importance. It is mainly cultivated for fruit in Punjab, Haryana, Rajasthan, Gujarat, Tamilnadu and Karnataka though it is adapted to grow in a wide range of soils across the country. Due to its adaptable nature, it is able to perform in acidic, alkaline and in drought stress conditions (1). Besides yielding fruits, ber tree is also a good host for culturing economically important lac insect, *Kerria lacca* (Kerr.) (Homoptera : Tachardiidae) which is the source of natural resin, wax and dye. *K. lacca* has two strains, *kusmi* and *rangeeni*, each giving two crops in a year. Ber is suitable for culturing both *kusmi* and *rangeeni* lac insects. The summer crop of *rangeeni* commonly known as *baisakhi* and the winter crop of *kusmi* known as *aghani* are normally cultured on this host. Winter lac crop period of *kusmi* strain is between June-July and January-February. Intra-specific variation for canopy has been reported for the species and the trees were grouped into three types based on canopy (2). A specific type of tree canopy may be characterized by the physical characteristics of its shoot and its influence in changing micro-climate within the canopy. Due to canopy structure, light interception is markedly affected, which in turn influences the incidence of many pests and fungal diseases. High light intensity was found to reduce disease severity significantly (3,4). Sporulation of many *Alternaria* spp. was found to be influenced by light intensity and duration (5). Besides, some fungus produce non-selective toxic substance e. g. zinicol which is attributed to production of large number of plant diseases in less light intensity (6—9). Tagetes leaf lessons increased with darkness and decreased with light intensity (10). Higher susceptibility of older leaves in *Alternaria* leaf spot of mustard is another example of disease incidence in shade (11, 12). In view of the variation of the canopy structure and its influence on micro-climatic condition, its relation with lac yield performance has been studied.

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Methods

To ascertain the degree of influence of canopy structure on lac yield, 71 trees of wild ber in the Institute Research Farm, IINRG, Namkum were categorized into groups as per canopy structure based on development of shoots after pruning and examined whether

Table 1. Plant characteristics of different types of ber trees.

Type of trees	Thin shoot (%)	Length/ dia ratio	Trans- mission ratio (%)	Canopy area (sq m)
Erect	22.7	135.6	45.5	12.9
Semi erect	29.9	126.9	36.9	18.7
Flat/roof	36.7	148.2	18.2	25.1
Bushy	42.1	163.8	27.3	22.0
Significance (0.05)	*	*	*	NS

Table 2. Lac yield (winter crop of kusmi) attributes of ber trees in relation to canopy types.

Type of trees	Brood yield ratio		Lac yield per shoot (g)		
	Values	CV	Brood lac	Stick- lac	Rejected- lac
Erect	6.64	28.4	207	142	82
Semi erect	6.21	45.5	179	124	77
Roof	13.01	31	639	390	40
Bushy	0.99	80.8	10	23	86
Significance (0.05)	*		*	*	NS

some variation in lac yield is explained of these parameters. Based on canopy size, ber trees were classified in four groups viz. erect type with upright branches and small canopy spread (5–15 sq m), sem-ierect type with higher canopy spread (10—35 sq m) than erect but branches are laterally placed,roof type with branching from base, wider and horizontal canopy (10—35 sq m) with more than one tree trunk, and bushy type with drooping, thin and crowdy branches also having same canopy spread as in semi-erect and roof type tree. Canopy related parameters like thin shoot per cent and length/initial basal diameter ratio were worked out by random sampling (with various sample size) from each tree, while light transmission ratio (light intensity at ground level divided by the same at above canopy) and canopy area were estimated for each tree. Relative proportion of erect, semi-erect, roof and bushy plant types in the study was 6, 15, 72 and 7% respectively. All the trees under the study were pruned in February 7 and inoculated with *kusmi* brood lac (propagating material) in July 7 for raising winter season crop (*aghani*). Recommended crop protection measures were adopted i. e. application of 0.05% endosulfan and 0.01% carbendazim at 30 DAI (days after inoculation) and 0.03% DDVP along with 0.01% carbendazim at 60 DAI. Experiment was conducted in completely randomized design.

Results and Discussion

Table 1 indicates that significant difference exists among four types of trees with regard to per cent thin shoot, shoot length/diameter ratio, light transmission ratio. But differences were not significant in canopy area. As illustrated erect type of trees have only 22% thin shoots (basal diameter <1.0 cm), while the figure is higher with umbrella or bushy type (42%). The highest ratio of shoot length/initial basal diameter showing lankiness of shoot was found associated with bushy trees. Highest light transmission ratio was found in erect type (45.5%) as against 27.3% in bushy and 18.2% in roof type trees.

Among the four types, lac yield performance was best with roof type tree with brood/brood ratio (13.01) followed by erect (6.64) and semi erect (6.21) types ; bushy type proved to be the poorest performer with brood yield/brood used ratio 0.99 (Table 2). The erect type performed more consistently as CV of yield ratio was low . High lac mortality was observed on thin shoots predominantly found on bushy type trees. As a consequence production of lac was lesss on such trees. Shoots of higher diameter might have fulfilled the need of lac insect in a better way in erect type and roof type than that in bushy type for which lac production in former was significantly higher than the later.

Higher light transmission ratio in erect and semi-erect type trees signifies penetration of more light through the canopy. Due to much horizontal and vertical spread in case of bushy type and only horizontal spread in case of roof type, light penetration is pretty low. By virtue of higher canopy spread, roof type trees are vigorous possessing more number of healthy and thick shoots. Higher level of ventilation in roof type trees due to lesser vertical thickness and higher number of thick shoots might have resulted in lesser lac mortality and subsequently higher yield. Light, being an important factor influences fungal disease intensity (3—6). Even light therapy in combination with anti-fungal drug treatments, in human pathogen *Cryptococcus neoformans* can combat fungal infections (13). The finding suggests that not only the plant but also the animal invading fungus are influenced by light. Therefore, low light intensity inside the canopy, shoot diameter and canopy structure of trees was found to play important role in governing lac yield. Since erect types occupies less space, it is also advisable to grow such genotypes with much higher population per hectare, as consistency of broodlac production of such type is high due to low CV.

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