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Effect of Tree Size, Topography and Shoot age

on Pest Infestation and Tree Growth of Palas (*Butea monosperma*)

A bench mark survey was conducted in March, 2017 to generate information about health status of palas trees (Butea monosperma), the most important host tree of rangeeni lac insect (Kerria lacca Kerr.). The principal objective of the study was to identify factors responsible for poor growth of this important tree. Infestation of termite and trunk borer is perennial problem for palas trees. Therefore, information was generated under three different conditions (i) tree size i.e. small and big (mean trunk girth 74.3 cm and 151 cm) (ii) land topography i.e. upland/ lowland and (iii) tree with old/ new shoots i.e. trees having shoots of > 2 year or one year old. Land topography was found to have effect on termite infestation. In upland condition, termite galleries covered 50 per cent of the tree length, while the same value was merely 5.8 per cent in case of lowland. Smaller trees were 43 per cent less infested in comparison to big ones. Similarly, upland trees were 2.5 times more infested than lowland. Number of live shoot and additive shoot diameter per prune point were also found to be higher in case of relatively smaller trees. Number of live shoot per prune point was recorded to be 3.6 and 3.1 in small and big sized trees, respectively and additive live shoot diameter was 52.4 and 43.2 mm per prune point on small and big trees. But, in contrast, average number of dead shoots were found higher in big sized trees. Only variation was observed in case of trees with old and new shoots, where 19.2 per cent increase in average diameter was observed in newly emerged shoots i.e. pruned one year back. Better performance of smaller sized trees in terms of growth and pest resistance could be attributed to better rejuvenation power and vitality for being younger in age. Similarly, higher attack of pest in upland soils could be attributed to maintenance of poor health on relatively less fertile uplands.

Key words: Palas, *Butea monosperma,* Termites, Borer, Growth

Termite and borer infestation remain higher in upland condition, and shoot growth is better in pruned trees i.e. on trees with new shoots.

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Introduction

Lac is a natural resin of insect origin. Lac insect, *Kerria lacca* secrete this resin to protect itself from the natural enemies. *Rangeeni* strain of the insect is cultured on *palas* trees. This tree is distributed in abundance on all the lac growing areas in Jarkhand, Chhattisgarh, Madhya Pradesh, Odisha, Maharashtra and West Bengal. *Rangeeni* lac has two life cycles in a year with variable crop duration- 4 months during rainy season (Jun/ July to Oct/Nov); and 8 months during summer (Oct/Nov to Jun/ July). Total lac production of the country is almost static *i.e.* 18-20 thousand tons since pretty long time (Yogi *et al.,* 2018). This quantum of production through the years has witnessed a rise in *kusmi* lac production in comparison to *rangeeni*. The main reason for decrease in *rangeeni* lac production is crop failure or very less production of summer crop.

There could be various reasons for this low production of summer crop. These include, global climate change resulting in behavioural changes in predator and parasites activities on lac crop. The other reason, which is coming under the limelight these days, the nutritional factor affecting tree health which is thought to be the root cause for poor health and insect pest attack on the host plant. Infestation by termite

(*Odontotermis* spp.), bark borer (*Indarbela* spp.) and trunk borers (*Cossus* spp.) is of frequent occurrence in *palas* plantations. For satisfactory lac production, texture of shoot is a very important factor to address. Texture of shoot is affected by many factors *e.g.* nutritional status of soil, age of shoot, size of tree *etc*. Ghosal (2017) reported that shoot age has some role in lac production. Similarly, nutritional factors like application of potassium fertilizers increases lac production significantly. These attributes are governed by overall tree health. Topography of land *i.e.,* upland and lowland can affect tree growth significantly, since lowland soil is normally rich in soil fertility. Health status of tree is supposed to be better if it is pruned less frequently. Similarly, big trees are supposed to have much more stored energy than smaller one. Therefore, an analysis based on different growth parameters is very much pertinent to know how these factors contribute to produce good tree health.

Material and Methods

Two locations of land *i.e.* upland and lowland were selected in Institute Research Farm of ICAR-Indian Institute of Natural Resins and Gums, Ranchi. The second factor, tree size was accommodated by taking big and small sized trees (mean trunk girth 74.3 cm and 151 cm respectively). Similarly, third factor, pruning was accommodated by taking two levels of pruning *i.e.* trees pruned every year and trees pruned more than two years back. Thus recorded data was arranged as per Randomized Block Design in factorial mode and calculated in four replications.

Data on prune point diameter, emerged shoot from prune point and its length, trunk borer infestation level *etc*., were recorded treatment wise. Level of termite infestation was recorded by per cent coverage of trees with termite gallaries, and infestation by trunk borer was recorded by counting bored holes on tree trunk up to 6 feet height. All measurements were done manually, through Verneer and meter scale. Significance of levels of each factor was compared through ANOVA allowing 5% error only.

Results and Discussion

Data presented in Table 1 reveal that tree size and pruning frequency do not have any significant role in termite infestation. per cent coverage ranged between 26.4 to 29.4. The same value ranged between 27 to 28.8 per cent in case of trees having more than two year old and one year old respectively. Land topography was found to effect on termite infestation. In upland condition, termite gallaries covered 50 per cent of the tree length, while the same value was merely 5.8 per cent in case of lowland. Hemachandra *et al*. (2014) reported that both abundance and richness of termite is met in dry forests. They also emphasized that key factors favouring presence of termite are dryer areas with undecomposed litter/ branches that suits for the food habit of the termite species. Wet dampy soils supplied with woody dead branches riddled with beetles are not suitable to termites. Similar observations were reported by Ayukea *et al.* (2011). That could be the reason behind more infestation of termites in upland conditions.

Data on number of borers upto 6 feet height visualized that big sized trees were much infested as compared to small sized trees. Small trees were 43 per cent less infested. Similarly, upland trees were 2.5 times more infested than lowland. Number of borers was found high in number on trees which were pruned annually, while trees which were lesser pruned were lesser infested, though the difference did not touch the level of significance.

Four prune points per tree were selected at random for recording other growth attributes. Diameter did not vary significantly in different sizes of trees and also in different topography. But trees with new shoots were found to have prune points with higher diameter (32.8 mm) compared to that in trees with old shoots (27 mm).

Number of live shoot and additive shoot diameter per prune point were also found to be higher in case of relatively small trees. But in contrast, average number of dead shoots were found higher on big sized trees. Smaller sized trees are empowered with greater

Table 1: Palas tree growth and pest infestation affected by tree size, topography and pruning status

	Prune Point diameter (mm)	No. live shoot	Live additive diameter per prune point (mm)	Average dead shoot per prune point	Average live shoot diameter (mm)	Average total shoot length (cm)	Average shoot length	Percent coverage by Termite	No borers up to 6' height	Number of inoculable shoots per tree	Shoots with flower per tree
Small	29.8	3.6	52.4	0.7	14.4	218.7	60.4	29.4	2.9	30.7	2.8
Big	30.1	3.1 *	43.2 *	1.1 *	14.0	190.7	61.8	26.4	5.1 *	46.2 *	52.5 *
Upland	31.4	3.5	50.4	0.9	14.3	209.4	60.0	50.0	5.8	35.4	28.0
Lowland	28.5	3.2	45.2	0.9	14.1	200.0	62.2	5.8 *	2.3 *	41.5	27.3
Old	27.0	3.5	45.8	0.9	13.0	204.7	59.0	27.0	3.5	30.4	40.0
New	32.8	3.2	49.8	0.9	15.5 *	204.7	63.2	28.8	4.6	46.5 *	15.3 *
CD	3.6	0.4	6.2	0.3	1.2	25.7	5.2	14.3	1.8	11.1	16.0

vegetative growth. In other words, relatively smaller sized trees are younger in age; therefore, have higher rejuvenation power. The same reason can be cited for higher shoot mortality in big sized trees. Interestingly, difference between average live shoot diameter of small and big sized trees narrowed down. It indicates that palas shoot diameter tend to remain within a reasonable range. It is a very important characteristic of palas trees. The same phenomena has been observed in other conditions like upland/ lowland also. Only variation was observed in case of trees with old and new shoots, where 19.2% increase in average diameter was observed in trees of new shoots *i.e.* pruned trees. The result indicated tendency of *palas* trees to produce shoot length in a restricted range. It implies that under normal pruning, emerged shoots do not vary much in diameter. This tendency restricts to bring a difference among trees even after imposition of factors like tree size, topography and pruning interval. The same is true for average shoot length also. Higher number of inoculable shoots observed in big sized trees is merely due to higher tree volume/ number of prune points only. Similarly, higher number of prune points observed on newly pruned trees is due to higher emergence of new shoots due to pruning effect. Higher number of flowering shoots were observed on big sized trees and on unpruned trees.

Conclusion

The study concludes that palas health is affected by both biotic and abiotic factors. Pest attack was high in the upland areas is attributed to low moisture and less vigor of the tress and in big sized trees it is due to dead bark in case of termite attack and high rate of assimilated stored foods for stem borer in comparison with small sized trees. The small sized trees were taken upper hand in number of live shoot and additive shoots per prune point and additive live shoot diameter is probably due to active growing stage of the trees. The conditions can be normalized by adopting the good agronomic and pest management practices.

पलास (*ब्यूटीया मोनोस्पर्मा*) वृक्ष की वृद्धि और नाशी जीव उत्पीड़न पर वृक्ष आकार, स्थलाकृति और प्ररोह आयु का प्रभाव

एस. घोषाल और एन.एन. राजगोपाल

सरांश

रंगीनी लाख कीट (*केरिया लाका* केर.) का सबसे महत्वपूर्ण परपोषी वृक्ष, पलास (*ब्यूटीया मोनोस्पर्मा*) के स्वास्थ्य स्तर के बारे में सूचना का सृजन करने के लिए मार्च, 2017 में एक बेंच मार्क सर्वेक्षण किया गया। अध्ययन का प्रधान उद्देश्य इस महत्वपूर्ण वृक्ष की कमजोर वृद्धि के लिए उत्तरदायी कारकों की पहचान करना था। दीमक और तना छेदक का उत्पीड़न पलास वृक्षों की बारहमासी समस्या है। अत: तीन विभिन्न अवस्थाओं के अन्तर्गत सूचना का सृजन किया गया (i) वृक्ष आकार यथा छोटा और बड़ा (औसत तना घेरा 74.3 से.मी. और 151 से.मी.) (ii) भूमि स्थलाकृति यथा उच्चभूमि एवं निम्न भूमि और (iii) पुराने एवं नए प्ररोहों के साथ वृक्ष, यथा 2 साल अथवा एक साल के प्ररोह वाले वृक्ष। भूमि स्थलाकृति का दीमक उत्पीड़न का प्रभाव देखा गया। उच्च भूमि अवस्था में, दीमक गैलरियों ने 50 प्रतिशत वृक्ष लम्बाई को कवर किया जबकि यही मान निम्नभूमि के मामले में 5.8 प्रतिशत था। बड़े वृक्षों की तुलना में छोटे वृक्ष 43 प्रतिशत कम उत्पीड़ित थे। इसी प्रकार, उच्चभूमि वृक्ष निम्नभूमि की अपेक्षा 2.5 गुना ज्यादा पीड़ित थे। प्रति प्रून प्वांइट अनेकों सजीव प्ररोह और योज्य प्ररोह व्यास भी अपेक्षाकृत छोटे वृक्ष के मामले में उच्च पाए गए। प्रति प्रून प्वांइट अनेकों प्ररोह क्रमश: छोटे और बड़े आकार के वृक्षों में 3.6 और 3.1 अभिलिखित किया गया तथा छोटे और बड़े वृक्षों पर प्रति प्रून प्वांइट योज्य सजीव प्ररोह व्यास 52.4 और 43.2mm था। किन्तु इसके विपरीत बड़े आकार के वृक्षों में मृत प्ररोह की औसत संख्या उच्च पाई गई। पुराने और नए प्ररोहों वाले वृक्षों के मामले में केवल विभिन्नता प्रेक्षित की गई, जहां नए उद्गामी प्ररोहों, यथा एक साल पहले छांटे गए, औसत व्यास में 19.2 प्रतिशत की वृद्धि प्रेक्षित की गई। वृद्धि और नाशी जीव प्रतिरोध के संदर्भ में छोटे आकार के वृक्षों के बेहतर प्रदर्शन को, आयु में युवा होने के लिए बेहतर पुनरूज्जीवन शक्ति और ओजस्विता के लिए, श्रेय दिया जा सकता है। इसी प्रकार, उच्चभूमि मृदाओं में नाशीजीव के उच्च आक्रमण के लिए अपेक्षाकृत निम्न उर्वरक उच्चभूमियों में कमजोर स्वास्थ्य के अनुरक्षण को माना जा सकता है।

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