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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

The Incidence of Pests and Diseases on Teak Plantation, Grown from Tissue Culture in Kendal Forest, District Central Java

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Abstract: Damages caused by pests and diseases were observed in 2-year-old teak plantation in Kendal Forest district, Central Java. The plantation was established using containerized plantlets produced from tissue culture technique and planted through taungya system with corn and groundnut as intercrops in two compartments. Results showed that some less important pests commonly observed in direct seeding of teak plantation turned out to become prevalent damage in both compartments. Bee hole borer, commonly present sporadically in teak plantation, infested up to 12.6% of the total sample trees. Pink disease caused by *Corticium salmonicolor* affected the young trees up to 8.50%, and root wilt disease at the average of 7.65% in both compartments. It might be true that the significant damage of young plant caused by pests in the compartment was still beyond tolerable threat, but since all the damages were concentrated on the main stem of the young plant, they could result in dying up or broken the stem above the point of attack. These problems appeared to be associated with the higher input of planting management, involving close cultivation of taungya crops and intensive work of soil. Cultivation of crops especially corn increases humidity and favouring incidence of pink disease. Intensive work of soil prior to and during the taungya period may cause root injury facilitating invasion of root pathogen. Additional watering for a short time in early dry season will bring along the samples to sudden water stress during the rest of the dry period.

Key words: Teak plantation, pests and diseases, plantlets

Introduction

Teak forest, which dominates plantation forestry in Java, has been managed for more than a century. It produces fine timber and supplies a significant proportion of timber in world trade. Plantation of teak has been raised since 1870s and at present time more than a million hectares of stands have been established, making up about 55% of all forest plantation in Java. According to the statistics of Perum Perhutani, a State own Forest Company (Perum Perhutani, 1995), most teak populations present in East Java (about 570 ha) and the rest are distributed in Central Java (312 ha) and West Java (185 ha). Teak forest is managed using a 60-year rotation and plantation is mostly raised by direct seeding in taungya system. Recently rooted cuttings and tissue culture plantlets from selected clones, have been used as plant materials for plantation. Selected clones are those performing better growth rate and performance. With adequate initial growth start, it is possible for the plantlets to compete crops planted in taungya system. A small extent of plantation has been established using the materials. Some well-known pests of direct seeding teak plantation in Java have been recognized, notably caterpillar *Hyblaea puera*, leaf skeletoniser *Eutectona machaeralis* and termite *Neotermes tectonae* (Nair and Sumardi, 2000). Pests and diseases of less importance include ambrosia beetle *Xyleborus destruence* and bee hole borer *Xyleutes ceremica*. It is possible that young plantation raised using tissue culture plantlets as the planting materials performed abnormal growth pattern, especially in response to environmental stress, pest and disease. This study was an attempt to evaluate growth performance and incidence of pest and disease of young plantation raised from selected clone tissue culture plantlets.

Materials and Methods

Observation was made in two compartments of 2-year-old teak plantations located in two forest districts, Boja (compartment 82a) and Subah (compartment 13a); both are in Central Java. In both

compartments, plantations were established using containerized plantlets of selected clone produced from tissue culture technique, following basic taungya system. Plantlets were grown in well prepared sites 3 x 3 m² apart, and at the same time the peasants, people who are establishing plantation, are allowed to grow crop plants in between teak rows. Some additional treatments were applied to the basic planting technique, including intensive site preparation, pre-planting compost application and some watering during dry season. Groundnut and corn were inter planted in between the teak rows. Table 1 summarizes the conditions of site and growth as well as planting system of plantation being studied. Growth performance of young plant raised from tissue culture plantlets in both compartments were evaluated and compared relative to the same age young teak planted, using the same planting system but raised from direct seeding in adjacent compartments.

Rows of young teak were selected as the observation units and the incidence of pests and diseases was recorded on individual tree basis based on the visible symptoms and signs observed on young plants. Pests and disease damage intensity was assessed based on the proportion of trees infested. The identity of disease causal agents were examined in pure culture using Koch's postulate and the insects causing pest were observed microscopically in the laboratory of Forest Protection.

Results and Discussion

Growth performance: The 2 years old teak plantation raised from tissue culture plantlets in both compartments showed vigorous growth with the average height of 3 m and diameter (BDH) ranging from 3 to 8 cm. Growth uniformity is another significant performance, exhibited by plantation. Factors like site quality, which is sufficient for teak, composted organic matter application prior to planting and site preparation might contribute to the growth performance. Except for site quality, the last two factors are those that have never been applied in common teak plantation practices. The use of plantlets as plant materials, which have

Table 1: The general condition of young teak plantation in compartment 82a and 13a

Compartment	Planted area(ha)	Site quality	Age (month)	Planting system	Intercrop species
82a	20	4	18	Taungya/3 x 3 m	Ground nut/corn
13a	11	3,5	18	Taungya/3 x 3 m	Ground nut/corn

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Table 2: The incidence of pest and disease of young teak plantation raised from tissue culture

Compartment	The incidence of injuries (%)		
	<i>Corticium salmonicolor</i>	Root-rot diseases	<i>Zeuzera coffeae</i>
82a (Boja)	8.50	5.90	7.90
13a (Subah)	1.80	9.50	2.50
Average	5.05	7.70	5.20

Table 3: Detailed observation of pest and disease incidence of young plantation in compartment 82a, Boja.

Number of trees	The incidence of injuries		
	<i>Corticium salmonicolor</i>	Root-rot diseases	<i>Zeuzera coffeae</i>
240	20 (8.33%)	14 (5.80%)	19 (7.90%)
240	26 (10.80%)	18 (7.50%)	33 (13.70%)
155	10 (6.40%)	7 (4.50%)	35 (22.50%)
Average	8.50%	5.90%	12.80%

Table 4: Detailed observation of pest and disease incidence of young plantation in compartment 13a, Subah.

Number of trees	The incidence of injuries		
	<i>Corticium salmonicolor</i>	Root-rot diseases	<i>Zeuzera coffeae</i>
120	3 (2.50%)	16 (13.30%)	4 (3.30%)
110	2 (1.80%)	10 (9.00%)	2 (1.80%)
80	4 (0.50%)	5 (6.20%)	2 (2.50%)
Average	1.80 %	9.50 %	2.50 %



Fig. 1: Non-pathological damages of young teak raised from tissue culture plantlet a). crooked growth of internodes, b) atrophic growth of internodes c) swelling of main stem caused by red borer and d) the larva and its resulting channels in the inner stem.



Fig. 2: Pathological symptoms of young teak raised from tissue culture plantlets. (a) Dying up of plant above the point of disease infestation, (b). Pink-coloration of stem by *Corticium salmonicolor*, (c) Leaf chlorosis as secondary symptom of root-rot disease, (d) rhizomorf.

excellent growth start, is another factor facilitating vigorous growth performance of young plants.

Young teak plantation in both compartments experienced defoliation in response to drought during dry season. Such growth response has been the common characteristic to teak growing in areas with monsoon type of climate. The stem of young plants, particularly of those in compartment 13a, showed significant crooked growth on 6th and 7th internodes from ground surface (Fig. 1a). No such growth deviation was found in young teak plantation in compartment 82a where some additional watering was applied. This malformation might correlate to the sudden water stress when watering was stopped in dry season. Observation of same age young teak planted in the same planting system but raised from direct seeding in adjacent compartment showed atrophic growth of internodes at the same position in response to dry season (Fig. 1b), though the internodes did not get bent. No further information could be obtained to derive conclusion whether young teak raised from tissue culture plantlets failed to develop growth mechanism to adapt dry condition. However it might be possible that additional watering only for a short time in early dry season will bring along the young teak to sudden water stress upon watering termination and during the

rest of the dry season.

Pest and disease status: Young teak plantation raised from tissue culture suffered from some common teak pests like leave defoliator caused by *Hyblaea puer* (Lepidoptera, Hyblaeidae), that had been outlined by Kalshoven (1955). Pink disease caused by *Corticium salmonicolor*, root rot and red borer by *Zeuzera coffeae*, were the prevalent pests and disease found in teak plantations. Table 2 summarizes the extent of pest and disease damage based on the proportion of trees infested.

More detailed observation of pest and disease status on teak plantation in both compartments are presented in Tables 3 and 4. Less important pests and diseases are commonly observed in teak plantation raised in taungya using direct seeding and these are the prevalent pests and diseases in teak plantation grown in the same system but using tissue cultured plantlets.

The pest noted was red borer *Zeuzera coffeae*, which is uncommon to ordinary teak plantation raised from direct seeding. It infested young teak plantation in Boja and Subah at an intensity of 7.90 and 2.50% respectively. Red borer has been known to infest some industrial estate plantations. The insect drilled the inner portion of stem, manifested by swelling of stem at the point

of infestation (Fig. 1c). Upward channel above point of infestation was found in longitudinal section of stem, where the larva continuously boring the inner stem (Fig. 1d). Young plant suffers from red borer will develop wood with lesser quality. In addition, the infested plant particularly parts of the tree above point of infestation, is susceptible to wind damage.

Stem cancer caused by *Corticium salmonicolor* (pink disease) was a significant disease that affected the teak plantation grown in compartment 82a and 13a with an intensity of 8.50 and 1.60% respectively. Pink disease has also been noticed in young plantation of *Agathis dammara* (Suharti, 1983). Lee (1996) reported pink disease infestation in *Acacia mangium* planted for industrial plantation in Sumatra. In young teak, pink disease attacked the main stem and serious attack resulted in dying up and breakage of stem above the point of disease attack (Fig. 2a and 2b). This will develop into multi branched plant with low stem quality. Young teak with such growth form could not maintain better start for the main component of high value timber. Pink disease in both compartments appeared to be associated with higher input of planting management, involving taungya crops, additional watering and intensive work on soil. Cultivation of intercrops especially corn, when planted in high density, increases the humidity and favouring the incidence of diseases.

Root-rot disease affected the young teak in compartments 82a and 13a, with intensity of 5.90 and 9.50% respectively (Table 2). Like root disease in common, the first visible symptom of the disease was gradual yellowing of the leaves, followed by death of the leaves (Fig. 2c and 2d), and at this stage most of root system is decayed. White rhizomorph of the causal pathogen ramify the root surface. Intensive work of soil prior to and during the taungya period may cause root injury facilitating the invasion of root pathogen.

It was concluded that young teak plantation raised from tissue culture performed specific response to environmental stress (i.e. water stress) differ from that established by direct seeding. Less

important pests and diseases commonly observed in direct seeding of teak plantation, turned out to become prevalent pests and disease in two compartment of teak plantation grown from tissue culture, including red borer, pink disease and root wilt. Higher input of planting management such as close cultivation of intercrop, compost application, intensive work on soil were the factors favouring pest and disease infestation.

Acknowledgment

The authors would like to thank Perhutani, the State own forest company, with the special appreciation to Pusbanghut Cepu for giving the opportunity to visit the plantation area and other facilities. They are grateful to all of colleagues of the laboratory Forest Protection, Faculty of Forestry, Gadjah Mada University, in particular Mr. Harjono for technical support.

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