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Role of lace bug *Tingis beesoni* and control measures in top dying of *Gmelina arborea* plantations

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Abstract
Plantation of *Gmelina arborea* is facing the great problem of major insect pest i.e. sap sucker / lace bug *Tingis beesoni* (Drake) resulting in top dying of shoots in tropical forest of Madhya Pradesh. The nymphs and adults of bug feed entirely at the base of leaf blade on the under surface and the leaf axils. The leaf becomes spotted and brownish near the base. The affected leaves wither, dry, fall and plant become completely defoliated throughout the season. The shoot dry up, turn black and sooty mould grows all over plants leading to the top dying. Such plant does not give economic returns at the time of harvesting. The results revealed that lace bug; *T. beesoni* was responsible for causing the top dying of *G. arborea*. For protection of economically important forest tree species, monocrotophos 0.05% + ridomil 0.2% followed by decis 0.005%+ ridomil 0.2% was proved to be most effective.

Keywords: Lace bug, top dying, plantations, control measures

1. Introduction
Gmelina arborea (Linn.) is a fast growing deciduous tree species of tropical and subtropical regions of India. It provides one of the most durable timbers after teak in India (Tewari, 1995) [13]. It is a suitable tree for reclamation of wasteland, marginal land, fallow land and also for the different programmes under social and community forestry, afforestation / reforestation programmes. It provides raw materials for paper and matchwood industry. The wood is used in construction, furniture etc. Leaves are good fodder for cattle and all plant parts have immense value (Anonymous, 1952 and 1995) [1, 2]. In Madhya Pradesh, plantations of *G. arborea* is a recent approach in plantation strategy. To encourage its plantation, Madhya Pradesh Forest Department declared it transport permit (TP) free. The plantations of this local forest tree species is damaged by various insect pests, diseases and animals (Chaudhury,1925; Mathur& Singh,1961; Kumar & Kadam,1993; Wingfield & Robison, 2004; Dey, 2016) [6, 10, 9, 14, 7]. Browne (1968) [5] provides a general review of the insect pests of *G. arborea* and other plantation species. Insect pest incidence and its relationship with soil nutrients and girth classes in plantations of *Gmelina arborea* at Thane and Nasik, western Maharashtra was studied (Meshram *et al.*, 2001) [11]. However, this plantation is facing the great problem of major insect pest i.e. sap sucker/lace bug *Tingis beesoni* Drake (Hemiptera: Tingitidae). The nymphs and adults of this bug feed entirely at the base of leaf blade on the under surface and at the leaf axils. The leaf becomes spotted and brownish near the base. Affected leaves wither, fall and plant completely defoliated. The shoot dry up, turn black and a sooty mould grows all over the plants leading to top dying and mortality (Beeson 1941; Browne 1968; Harsh *et al.*,1992 and Meshram *et al.*, 2001) [3, 5, 8, 11]. A problem of top dying was brought to the notice in plantations in state forest department of Madhya Pradesh. Hence, the present study was undertaken to describe the role of lace bug and management in top dying of *G. arborea* plantation ecosystem.

2. Material and Methods
2.1 Incidence of top dying of *G. arborea* plantations and role of lace bug, *T. beesoni* in top dying of *G. arborea*
G. arborea plantations were surveyed at Poama / Chhindwara, Sonaghati / Betul, campus of Tropical Forest Research Institute (TFRI), Jabalpur and Ghughari (Gangai / Charganva), Jabalpur Madhya Pradesh. The nymphs, adult bugs of *T. beesoni* (Fig. 2-3) and damaged specimens (Fig.4) were collected for examination in the laboratory. Top dying or damaged and healthy plants were recorded. For study the top dying of *G. arborea*, regular survey was conducted in the campus of TFRI, Jabalpur and the detail observations were recorded.

2.2 Control measures

To workout the evaluation of some insecticides, a field trial was laid out in plantation of *G. arborea* in the campus of Centre for Forestry Research & Human Resource development (CFRHRD), at Poama, Chhindwara in 0.54 ha area during August 2016. The trial was performed in randomized complete block design (RCBD) with four replications. In all six treatments viz. Larvin 75 W.P. 0.1% + Ridomil 0.2%; Caldon 50 S.P. 0.1% + Ridomil 0.2%; Decis 2.8 E.C. 0.005% + Ridomil 0.2%; Monocrotophos 36 E.C. 0.05% + Ridomil 0.2%; Neem based pesticides-bioneesh and untreated control were used. Pretreatment observations in respect of bug population in all plants were recorded. The different concentrations of insecticides (Table-1) were prepared by diluting them with water on the basis of their active ingredients. Ten liter solution of the insecticides were uniformly sprayed up to run off stage per replication. Post treatment observations were recorded after 7 and 15 days of interval. Incidence of bug population was recorded randomly on 4 plants by numerical counts on both sides of leaves. Ten leaves were randomly selected from each direction. The data obtained on percentage of reduction in population were compiled and subjected to pooled analysis after transformation as given by (Snedecor, 1950) [12].

3. Results and Discussion

3.1 Incidence of top dying of *G. arborea* plantations

Per cent incidence of top dying of *G. arborea* is summarized in Table 1. The highest per cent i.e. 27% followed by 25% recorded at Chhindwara and Betul respectively. The lowest per cent of top dying was recorded in TFRI, campus and near Jabalpur area.

3.2 Role of lace bug, *T. beesoni* in top dying of *G. arborea*

Dark brown lace bug *T. beesoni*, which assembles in crowded on the leaves and soft tissues (Figs.2-3). The nymphs and adults suck the sap at the base of the leaf axils, which results in discoloration of leaf in the form of patches on both the sides of lamina (Fig.4). The infested leaves become blotched brown near the base, which ultimately wither and fall down. Due to the heavy infection, the leaf fall starts from the months of July-August and completely defoliated in the months of November-February (Figs, 5-8). The young plants completely defoliate their shoot dry apically and turn to black like most fungal infection. *Hendersonula toruloidea* (Nattras) has been found associated with the stem and twig cankers. The fungus is known to attack the bark and cambium region of the plants followed by defoliation. It finally remains covered with sooty moulds. The plants remain leafless for several months up to next following year. The details of top dying shown in schematic presentation (Fig.1). As a result not only retardation in growth but sometimes completely death of plants may occur. Since the *T. beesoni* attack the plants after onset of monsoon, *H. toruloidea* finds most susceptible conditions of the host plants during the monsoon and establish the infection. The high humidity and moderate temperature favored the infection and developed infection preferably in the crown and branch tips. Once the fungus established, its spores are disseminated downward. The active inoculums were capable of invading and killing the plants within one or more years.

3.3 Control Measures

The pooled mean bug population recorded after 7 and 15 days from application (Table 2) revealed that the results of all treatments were significantly superior to those of the control in reducing the population of bug *T. beesoni.* Monocrotophos 0.05% + Ridomil 0.2% and Decis 0.005% + Ridomil 0.2% proved highly effective by reducing 96.00 and 94.35 per cent population of bug compared with 23.98 per cent in the untreated control. Among others Caldon 0.1% + ridomil 0.2% and Larvin 0.15% + Ridomil 0.2% gave minimum bug population up to 86.33 and 83.28 respectively. Neem based-bioneesh was moderately effective recording 40.75% reduction in bug population.

The top dying problem in G. *arborea* plantations seems to be due to insect disease- complex. Initially the insect pest *T. beesoni* attacks the leaves and young shoots causing leaf fall and drying of shoots. The insect injury to the trees and ultimate loss of vigor makes the way for the infection of fungus *H. toluroidea*. Similar study is reported by Beeson (1941) [3] mentioned the possibility of association between bronze disease with *T. beesoni* and the association between insect-disease causing top dying and mortality is also supported by the findings made by Beeson (1941) [3]. Browne (1968) [5] reported to occur usually of the host. A review of literature (Bilgrami *et al*., (1981) [4] revealed that such and insect-disease complex have not been reported on *G. arborea.* Harsh *et al.*, 1992 [8] also studied the top dying and mortality in provenances of *G. arborea* and only suggested the control measures i.e. spraying of 0.02% monocrotophos + 0.1% bavistin without any trial. The infection vary in different provenances of *G. arborea.*

Table 1: Incidence of top dying of *G. arborea* plantations

S. No.	Location	Year	Total plants	Top dying plants	Incidence (%)
1	Poama, Chhindwara	2003	600	160	27.00
2	Sonaghati, Betul	1999	1000	250	25.00
3	TFRI, campus, Jabalpur	2012	150	08	5.33
4	Ghughari(Gangai/ Charganva), Jabalpur	2012	6500	780	12.00

Table 2: Bug population reduction (%) after treatment

Treatment	% Reduction bug population after		% mean reduction in population
	7 days	15 days	
T1.Larvin 0.1% + Ridomil 0.2%	83.60	82.96	83.28
T2. Caldon 0.1% + Ridomil 0.2%	89.00	83.67	86.33
T3. Monocrotophos 0.05% + Ridomil 0.2%	94.22	97.80	96.01
T4. Decis 0.005% + Ridomil 0.2%	93.77	94.93	94.35
T5. Neem based (Bioneesh)10%	38.01	43.50	40.75
T6. Control (untreated)	26.20	21.76	23.98
SE m±	3.80	2.35	3.17
C D at 5%	13.79	6.11	7.84

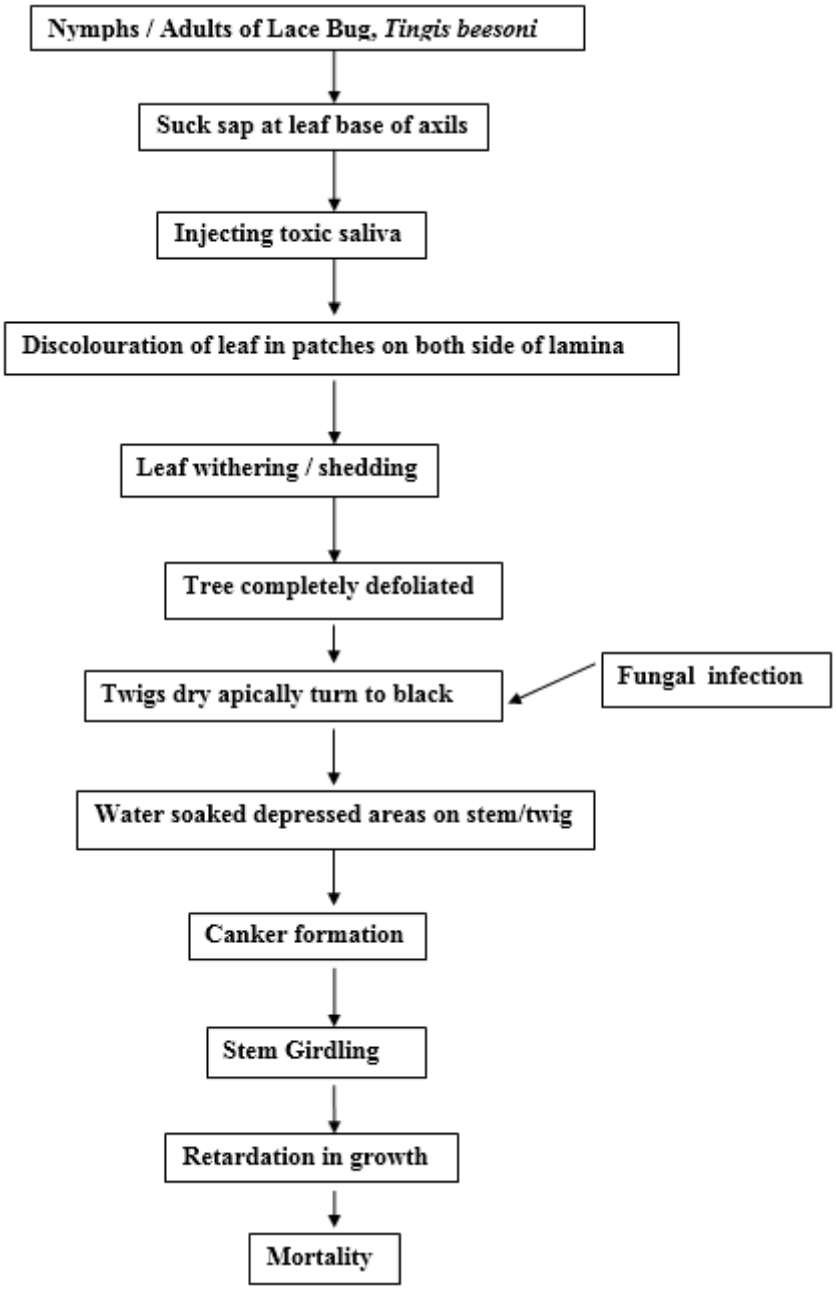
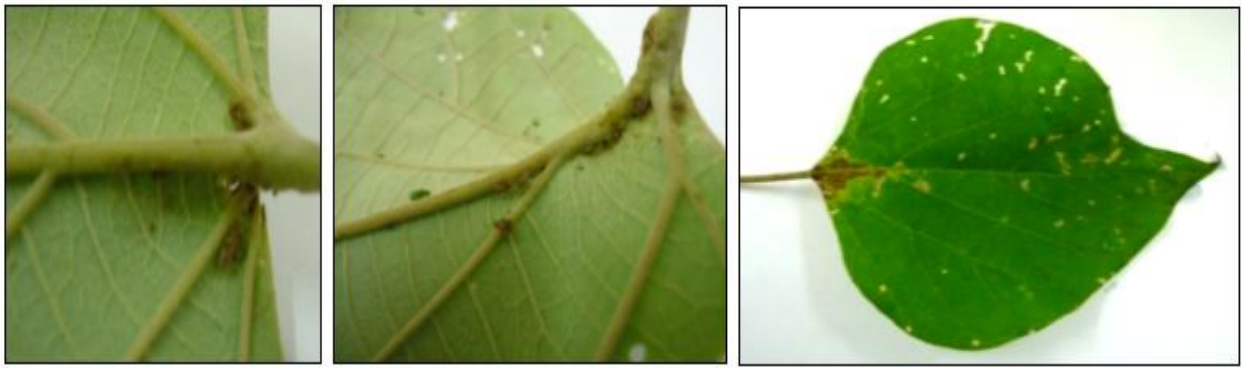


Fig 1: Role of Lace Bug in Top Dying of *Gmelina arborea*



1 2 3

Fig 2-4: Lace bug *Tingis beesoni* feed on leaves; 3. Patches / blotch on lamina


5 6

Fig 5-6: Leaf fall start due to infection in July-August; 6. Status in September-October


7 8

Fig 7-8: Defoliated tree in November-December; Tree completely defoliated in Jan-Feb.

4. Conclusion

The present study concluded that lace bug, *T. beesoni* is responsible for causing the top dying of *G. arborea*. For protection of this economically important forest tree species, the only highly effective insecticide proved best are monocrotophos 0.05% + ridomil 0.2% followed by decis 0.005%+ ridomil 0.2%.

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