stage *i.e.* 7–10 days, the effect on vitellogenesis is negligible. In any case, egg laying does not take place in such females. Thus cautery of mNSC does not stop but delays previtellogenic growth; however it stops vitellogenesis and mature oocyte production (Figure 2). It has also been observed histochemically the mNSC cautentered females have very little deposition of proteins in the fat body.

By implantation of CA in mNSC cauterised females previtellogenic growth as well as vitellogenesis is accelerated. However vitellogenesis is slower than that in normal females. In these females also elongated terminal oocytes are resorbed and there is no egg laying (Figure 2). It is clear that both the CA and mNSC are necessary for successful oocyte development and egg laying (Figure 2). It is clear that both the CA and mNSC are necessary for successful oocyte development and egg laying in *P. pictus* just as in the case of *Schistocera*[5,6] and *Locusta*[7,9,17]. The NSC hormone affects previtellogenic growth of oocytes, general protein synthesis in the fat body and oviposition whereas the CA affects vitellogenic protein synthesis in the fat body and yolk deposition in the oocyte. Egg laying of mature oocytes is assisted by NSC although the CA is also necessary for this phenomenon. In allatectomised females vitellogenesis does not occur and the oocytes after maximum previtellogenic growth are resorbed (Figure 2). It is presumed that a factor from CA maintains the activity of mNSC. On the other hand, failure to produce mature oocytes after CA implantation in mNSC cauterised females show that a factor from mNSC might control and maintain the activity of CA.

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AUXIN INDUCED REGENERATION OF FOREST TREE — *DALBERGIA SISSOO* ROXB. THROUGH TISSUE CULTURE

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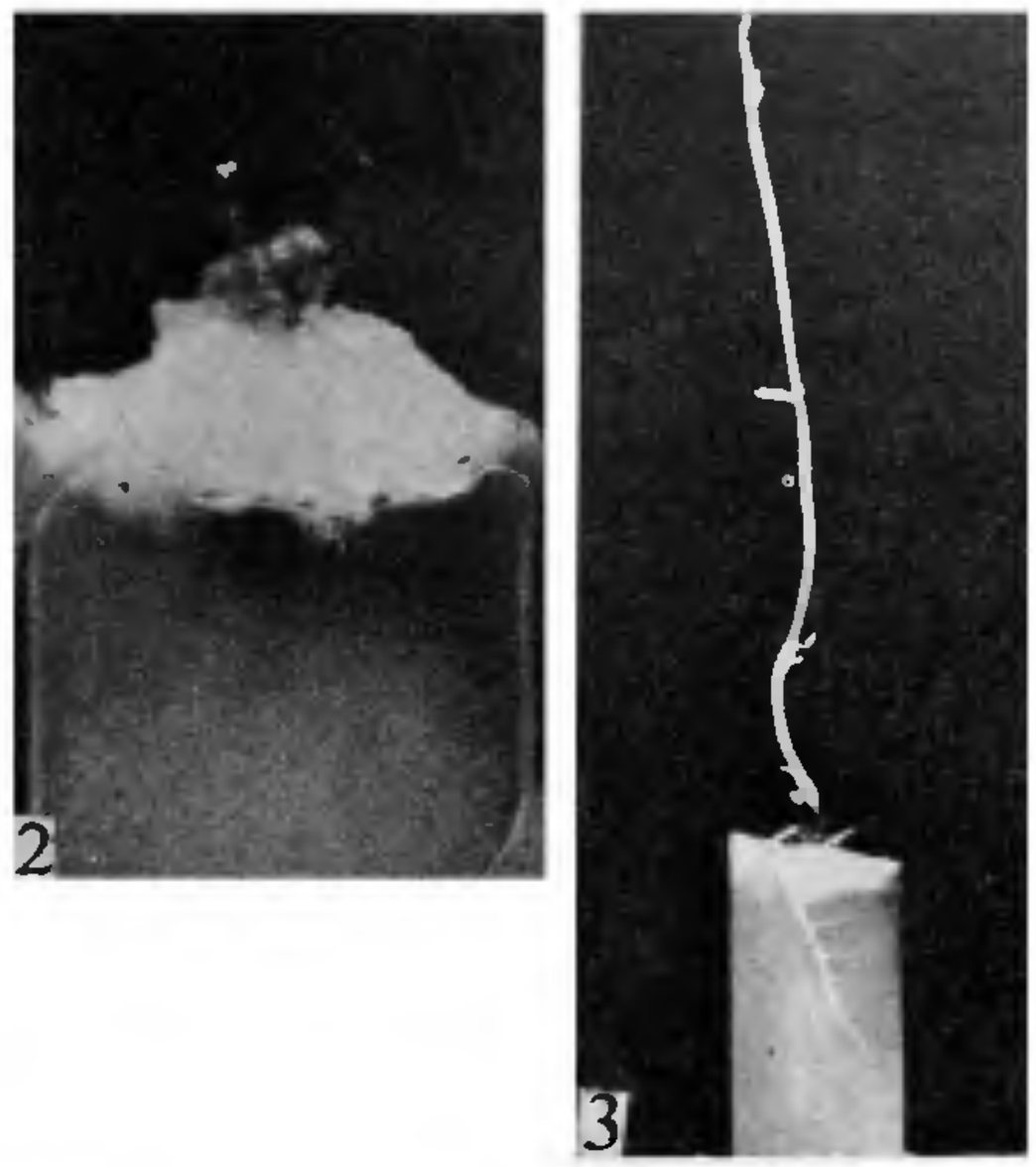
TISSUE culture techniques are becoming useful tools for rapid clonal multiplication of plants. The commercial feasibility of this technique has been demonstrated in many diversed genera including a few forest trees[1-11]. The advantage of tissue culture cloning over conventional propagation technique is in the reduction in the time needed to achieve large scale propagation. It is well established that auxin-cytokinin balance in the medium promotes the organogenesis[3,10,11]. Multiple shoots of *Dalbergia sissoo* were obtained in MS_1 medium (MS, Murashige and Skoog medium[12] + vitamins of Gamborg B_5 medium[13]). In the present paper it has been demonstrated that auxin induces rhizogenesis as well as rooted shoots in the MS_1 medium.

Nodal explants (1-1.5 cm) were excised from healthy growing mature tree of *D. sissoo*, growing in the University garden. The explants were cultured in the MS_1 medium following the procedure mentioned earlier[14,15]. MS medium was supplemented with vitamins of B_5 medium with sucrose 20 g^{-1}, agar 0.90%, AA 5 mg, l (ascorbic acid) and various concentrations of auxins (IAA, Indole acetic acid; IPA, indole propionic acid; NAA napthaleneacetic acid; 2,4-D, 2,4-dichlorophenoxyacetic acid). The cultures were main-

Figure 1. Callus initiation from nodal explants of *D. sissoo* MS; medium containing NAA and IAA (both 0.5 mg/l).

tained at 28±2° C under 1600 Lux for 16 hr per day. Subculturing was done at every 20 day intervals.

Response of auxins on nodal explants (table 1) shows that IAA (1 mg/l) alone and IAA (1 mg/l)+NAA (0.5 mg/l) (figure 3) were found suitable in regenerating rooted shoots followed by NAA (variable concentrations). Of all the auxins used, IAA responded best and IPA, 2,4-D did not respond at all. All the auxins except IPA responded in callus initiation, the best was obtained in the combination of NAA+IAA (0.5 mg/l) (figure 1) and IAA (1 mg/l) (figure 2). It is significant to



Figures 2 & 3. 2. Healthy callus growth in MS; medium containing IAA (1 mg/l). **3.** Regenerated plants in MS; containing IAA, 1 mg/l and NAA 0.5 mg/l.

TABLE 1

Auxin induced callus formation, rhizogenesis and rooted shoot formation in Dalbergia sisoo[a]

Growth media[b] MS_1	Callus initiation		% of root formation	% shoot formation	% of regenerated plants
	30 days	60 days	60 days	60 days	60 days
MS_1+0.1 IAA	+	+	10	15	10
MS_1+0.5 IAA	+	++	45	80	50
MS_1+1.0 IAA	+	+++	20	40	15
MS_1+2.0 IAA	+	+	–	–	5
MS_1+0.5 NAA	+	+	30	10	5
MS_1+0.5 NAA	+	+	30	10	5
MS_1+1.0 NAA	–	–	–	–	
MS_1+0.5 IPA	–	–	–	–	–
MS_1+1.0 IPA	–	–	20	–	–
MS_1+2.0 IPA	–	–	–	–	–
MS_1+0.5 2,4-D	–	+	–	–	–
MS_1+1.0 2,4-D	–	+	–	–	–
MS_1+1.0 IAA+0.5 NAA	+	++	60	80	60

[a] data scored at the end of 30/60 days of interval; 20 explants/treatment

[b] concentrations of growth substances are expressed as mg/l

note that nodal explant responded to plantlet and callus formation in the same combinations of auxins or IAA (table 1).

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SPODOPTERA LITURA—A VORACIOUS FEEDER OF *MARSILEA* WEED

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SEVERAL noctuid larvae were found feeding on the common weed, *Marsilea quadrifolia* (L.), so voraciously that within 2-3 days they completely defoliated the weed plants in quarter of a hectare rice field at the All India Coordinated Rice Improvement Project farm in Hyderabad during wet season. The population of this insect was high and more than ten larvae at times were seen even on rice plant but with no obvious symptoms of damage. This observation prompted the following investigations.

The larvae collected from the field were reared on *Marsilea* at $30 \pm 5°$ C under glasshouse conditions. The Commonwealth Institute of Entomology, London, identified the adults as *Spodoptera litura* F. The life cycle of *S. litura* on *Marsilea* was studied. A female moth laid 300 to 400 eggs in 3 to 4 batches covered by yellowish-brown scales. Eggs hatched after 4–5 days into green bodied black headed larvae that tended to aggregate and feed on the same leaf on which eggs were laid. Five larval instars lasted for 4–5, 3–4, 2–3, 3–4 and 3–4 days, respectively. Full grown larvae measured 60 mm in length and fed voraciously on the weed foliage (figure 1). Pupal period ranged from 9–11 days and the adults lived for 5–6 days. The entire life cycle was completed in 29–37 days.

Figure 1. Full grown larva of *S. litura* F. feeding on *M. quadrifolia* leaves.

Host-range was studied by releasing 10 first instar larvae in suitable cages on six weeds collected from rice fields and also on a rice variety, T(N)1 (table 1). Results, presented in table 1, revealed cent per cent larval survival on *Marsilea quadrifolia*, *Ammania bacifera* and *Eclipta alba*. However, limited survival (20 to 40%) on the 4th day of caging and no survival on 10th day on the three other weeds studied and on the rice plant was observed.

Though *S. litura* is on record as a pest of rice, no detailed study on life cycle in relation to rice crop is available. In our investigation, although larvae nibbled the rice leaves initially, they tended to be weak and sluggish and died ultimately. In addition, larvae reared on artificial diet, obtained from other Agricultural Research Institutes, gave similar results.