

**INFLUENCE OF HORMONAL TREATMENTS ON STEM CUTTINGS THROUGH
MULTIPLICATION IN THERAPEUTICALLY WORTHWHILE PLANT
*TINOSPORA CORDIFOLIA***

Abstract

Tinospora cordifolia (Willd.) Miers ~~is a~~ members of the Menispermaceae family and go by a variety of popular names, including "Guduchi," "Gulvel," and "Giloy." The plants in this genus, particularly their stem, provides a wide range of health advantages that have been mentioned in ancient texts and conventional medical practises. Over 68 Ayurveda formulations contain the medicine Guduchi as one of its main constituents, and need for this medication has climbed ~~from~~ to 3000 (year) to 6000 MT (year) with a 9.1% yearly increase. Unfortunately, uncontrolled harvesting is causing the natural populations of ~~the~~ **both types** to decline – THREE AND THEN ONE TYPE IS ABOVE, WHICH TWO TYPES ARE YOU REFERRING TO? There is plenty of room to expand the commercial production of these plants given the enormous increase in demand. For the purpose of creating a technique for rapid multiplication, propagation by stem cuttings was examined in the current experiment. For ~~these specie~~ this species, the impact of various GA3 concentrations on stem cuttings during 30 DAP and 45 DAP was investigated using the RBD design with four replications. The 200 ppm GA3-treated stem cuttings of *T. cordifolia* (T1) showed a considerable rooting (~~percentage of~~ 85.75%). The highest shoot lengths NEW SHOOTS? AFTER HOW LONG? were measured for treatments T1 (average 106.15 cm). Maximum root numbers were measured for treatments T1 (6.25cm) and treatment T1 had slightly longer roots (17.42 cm), but there were no ~~discernible~~ statistical differences in mean values. WAS STATISTICS DONE? Throughout the course of the experiment, *T. cordifolia* cuttings' average lowest and maximum growth rates ranged from 4.33 cm/day to 7.1 cm/day.

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Keywords: *Tinospora cordifolia*, Cuttings, propagation, GA3

Introduction

India is a leader in the usage of the ancient ayurveda system and is blessed with a vast richness of medicinal herbs. The Menispermaceae family member *Tinospora cordifolia* (Willd.) Miers ex Hook. F and Thoms (giloy) is a glabrous, deciduous climbing shrub. This plant species ~~The shrub~~ may be found world-wide? ~~all over~~, especially in tropical regions, and can be found in India climbing to an altitude of 300 m as well as in some regions of Sri

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Lanka, Bangladesh, and China (Mittal et al. 2014). A desire to balance the crisis situation?? has been made possible by the rapid loss of natural resources of medicinal plants in general, and in particular giloy??, together with an exponential spike in demand (Sinha and Sharma, 2015). SENTENCE IS NOT CLEAR – WHAT BALANCE? For collectors, forests are currently their main supply of plant material unprocessed drugs.

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The resource value of this important medicinal plant has recently been recklessly depleted due to widespread, unrestricted anthropogenic exploitation, insufficient natural regeneration, rising demand from the pharmaceutical industry, conflicting with constrained cultivation, and insufficient efforts to replace the plantstock-# (Veeraiah and Reddy, 2012). Increased availability with correct farming techniques to easily and sustainably fulfil the rising demand is needed. This is only achievable by mMeeting the huge demand in the ayurvedic pharmaceutical sectors is only achievable by providing enough high-quality planting material at a lower-viable cost for agricultural purposes. The medicine Tinospora has a wide range of therapeutic action, which contributes to its rising demand on both the domestic and global markets (REF). TINOSPORA is the only medicine made from this plant?

The National Medicinal Plant Board (NMPB) of India has lately undertaken a concentrated effort to resolve these problems and selected this significant species for mass multiplication due to Tinospora's significance in India (Handique, 2014). The aforementioned medicine ranks 29th in terms of volume utilised for the creation of various Ayurveda formulations based on market demand. *T. cordifolia* demand increased annually by 9.1% and ranged from 2000 to 5000 MT IN WHAT YEAR? (NMPB, 2012). In this context, many techniques are seen as necessary to promote the commercial production of this species (Handique, 2014). The primary issues in Giloy IS THIS A VARIETY OF THIS SPECIES? are the extremely low viability of seeds, poor seed set, and poor seed germination (Mittal et al. 2014). Thus, propagation by cuttings is a simple and affordable process. Similar to this, semi-hard wood cutting was the most popular cutting style for commercial multiplication (ref). HOW SUCCESSFUL WERE PREVIOUS ATTEMPTS AT PROPAGATION OF THIS SPECIES USSING CUTTUINGS? It is evident that the demand for the narcotic "Guduchi" cannot be satisfied entirely by wild sources today, hence increased and targeted agricultural activities are essential. For the Tinospora species YOU MEAN GENUS?, it is crucial to develop reproduction and agricultural techniques in order to close the supply-demand imbalance. Nevertheless, there is no scientific method for growing or propagating the *Tinospora* species (IF MORE THAN ONE SPECIES, MENTION THEM) medication. So,

the goal of the current study was to standardise the ~~hormonal therapy~~ propagation of this plant using cuttings for mass multiplication.

MATERIALS AND METHODS

Collection

~~The~~ stem samples of *T. cordifolia* were gathered in January 2022 from the campus of Tamil Nadu Agricultural University in Coimbatore. WHAT TIME OF YEAR? HOW LONG WERE THE STEMS? HOW OLD WERE THE PLANTS? PROVIDE A PICTURE OF THE PLANTS. PROVIDE A HERBARIUM VOUCHER NUMBER. The field studies were carried out at a medicinal plant garden that was constructed on the grounds of the medical school (18° 33' 22.5" N, 73° 49' 17.5" E).

Preparation

By making a vertical cut at the top and a sloping downward cut at the base, healthy cuttings with 2-3 nodes and a length of 10-15 cm were created. The positioning and orientation of the cup-like nodes was deliberately taken into account when creating the cuts. IIS THERE A PICTURE FOR THIS?

Treatments

The clippings were then treated for five minutes with a 1% (w/v) solution of the broad-spectrum fungicide Bavistin. WERE THEY SUBMERGED? To determine a quick and effective pretreatment for growth, cuttings' farther distal parts (2–3 cm) were deep-soaked in GA₃ solutions at various concentrations for 30 minutes as detailed below: control (T0), 200 ppm (T1), 400 ppm (T2), 600 ppm (T3), 800 ppm (T4), and 1000 ppm (T5). Cuttings only without being dipped were another are seen as a kind of control (T6).

Plantation of cuttings and data collection

~~Cuttings were placed vertically. Assessments of vegetative propagation were conducted~~ in a sunken bed of 5 x 20 feet filled with that included nursery polythene bags containing filled with soil material WHAT TYPE OF SOIL? SANDY-LOAM? DESCRIBE SOIL MIX IN MORE DETAIL measuring 6 x 9" in size. WAS ANY SHADE PROVIDED? Both species' ONLY ONE SPECIES IS MENTIONED ABOVE UNDER COLLECTION. IF MORE THAN ONE, LIST ALL SPECIES TESTED IN THAT SECTION. One treated cuttings were inserted into each nursery bags at a depth of three to four centimetres. To

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prevent water from evaporating before planting, the top section of each cut was coated with a single coating of wax. Each nursery bag included one stem clipping. For each treatment experimental procedure, 20 cuttings were employed in four random blocks. Eighty cuttings in total were assessed for each treatment. WAS THE WHOLE EXPERIMENT REPEATED OR ONLY CARRIED OUT ONCE?

For the duration of the trial, common organic procedures including watering, weeding, disease, and pest management were carried out used. The plants were given meticulous organic maintenance. WHAT DOES THIS MEAN? OThe observations were made for both species at 30 and 45 days following planting. The total days required for the initial sprouting and re-rooting of cuttings were recorded kept track of. HOW DID YOU CHECK FOR ROOTING WITHOUT DISTURBING THE CUTTINGS? The morphological information, which included the amount of new shoots produced, stem length, leaf, roots, and root-to-shoot ratio, as well as the thickness of the stems, petiole length, leaf length, and leaf breadth, was noted. The Gupta et al. (1998) approach was used to calculate the biomass yield (1998).

Data analysis using statistics

RBD (Randomized Block Design) was used to conduct the experiment with four blocks and 10 replicates for each treatment (n = 204). Analysis of variance (ANOVA) was used to evaluate the data in order to find significant mean differences. Using the statistical analysis programme SPSS 16.0, the means that differed substantially were examined utilizing Duncan's (1955) multi-ranges test (DMRT) just at 5% probability value. The mean and standard error were used to describe data variability.

Results

a) GA₃'s impact on 30-day-old *T. cordifolia* stems

REPORT RESULTS AS PER SIGNIFICANCE NOT AS GREATEST AND WHAT HAPPENED TO THOSE THAT WERE NOT DIPPED WITH IS THE SECOND CONTROL (T6?)

The greatest rooting percent (69.50) was seen in *T. cordifolia* stem cuttings treated with 200 ppm GA₃ (T1), followed by T2 (48.25). REPORT ON EACH PARAMETER ONE BY ONE.

On 11 DAP, the first sprouting was noted – FROM WHICH TREATMENT? Nevertheless, Treatment T4 had thea larger number of sprouting shoots (3.45).

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Treatment T1 reached the longest shoot length possible (30.92cm), however there were no measurable variations in mean shoot length.

~~T~~Moreover, treatment T1 ~~also produced new shoots with the largest~~had a larger sprouting shoot diameter (4.54mm). Was this significantly wider than the other treatments? If so, say so.

Treatment T1 ~~produced new shoots with~~had somewhat more leaves, longer petioles, wider leaves, and longer leaves overall, but there were no significant differences ~~appreciable variations in the mean values of in~~ any of these metrics (Table 1).I CANNOT VERIFY THIS AS I SEE NO LETTERS SHOWING SIGNIFICANCE

Table 1. Effect of pre-treatment of *T. cordifolia* stem cuttings ~~Pre-treatment with varying concentrations of GA₃ on eight parameters of growth~~has an impact on stem cuttings at 30 DAP

Parameters	Treatments					
	T 0	T 1	T 2	T 3	T 4	T 5
RP	39.5	69.5	48.25	44.5	37.00	44.50
NS	3.16	3.25	3.20	3.40	3.45	3.25
SL	14.31	30.92	22.77	25.55	25.27	19.85
DS	4.09	4.54	4.02	4.03	4.06	4.16
NL	5.30	5.85	5.00	5.50	5.45	5.10
PL	5.71	7.58	6.38	7.36	7.57	6.98
LL	6.49	8.52	8.04	8.30	8.85	7.10
LW	5.97	7.99	7.27	7.46	7.49	6.06

(RP- Rootingpercentage, NS-NumberofShoots, SL- ShootLength(cm.), DS- Diameterofstem(mm.)(Sproutedshoot), NL- Numberofleaves, PL- Petiolelength(cm.), LL- Leaflength(cm.), LW- Leafwidth(cm.).The numbers in this table represent the mean and standard error (SE) based on four replications ONLY MEANS ARE GIVEN IN THIS TABLE. At the 5% level, there is no discernible difference between the means that are followed by identical letters within rows (DMRT). NO LETTERS ARE SEEN THE materials and methods section said the data would be given as means ± SD but that is not the case in this table

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b) GA₃'s impact on 45-day-old *T. cordifolia* stems

The highest rooting rate, or 85.75%, was seen in *T. cordifolia* stems supplied with 200 ppm GA₃ (T1). At 30 DAP to 45 DAP, there were reports of enhanced rooting (18.25%).

WHAT DOES ENHANCED ROOTING MEAN AND WHO REPORTED IT? Although treatment T1 had somewhat more roots overall (6.25 cm) and longer roots (17.42cm), there were no observable variations in mean values that were statistically significant.

PUT ROOT REPORTING TOGETHER

106.15cm and 50.159 cm were the greatest and shortest shoot lengths measured in treatments T1 and T0, respectively. At 97% confidence intervals, the mean value of shoot length for treatments T2, T3, and T5 was shown to be significantly different than WHAT?.

~~Although treatment T1 had somewhat more roots overall (6.25 cm) and longer roots (17.42cm), there were no observable variations in mean values that were statistically significant.~~ A sprouting shoot's diameter was likewise larger in treatment T1 (4.71mm). T1 reported the highest fresh shoot biomass (16.57 g), followed by T3 (16.05g). Treatment T1 also had larger levels of new root biomass, maximum fresh biomass, shoot dry biomass, root dry biomass, and dry matter biomass (Table 2). During the current experiment, *T. cordifolia* cuttings' average lowest and highest growth rates were found to be 4.33 cm/day and 7.1 cm/day, respectively.

NEEDS TIDYING UP AS SUGGESTED ABOVE

REPORT ONE DECIMAL POINTS FOR ALL MEANS AND TWO DECIMAL POINTS FOR SE OR SD – AND PUT IN MATERIAL AND METHODS AND AT THE BASE OF THE TABLES WHICH ONE YOU ARE USING.

Table 2. *T. cordifolia* Pre-treatment with GA₃ has an impact on stem cuttings at 45DAP.

Parameters	Pre-treatments					
	T 0	T 1	T 2	T 3	T 4	T 5
RP	49.5	85.75	57	54.5	48.25	57.00
NS	3.16	3.30	3.30	3.60	3.50	3.30
SL	50.16	106.15	86.7	105.35	81.6	92.63
DS	5.75	6.25	5.75	5.50	6.00	6.00
NL	15.02	17.42	16.75	15.72	14.02	16.82
PL	2.43	2.15	2.17	2.14	2.15	2.18
LL	4.03	4.71	4.09	4.06	4.29	4.39
LW	10.75	14.35	8.8	14.10	10.35	10.8

RP	9.33	13.74	12.09	13.23	12.66	12.46
NS	9.85	13.97	13.69	14.00	14.07	13.41
SL	9.17	13.54	12.24	12.84	12.74	12.92
FSB	8.42	16.57	13.35	16.05	12.5	13.9
FRB	2.55	2.73	2.71	2.59	2.54	2.42
TFB	8.97	17.3	14.06	16.64	13.03	14.32
DSB	2.95	4.19	3.67	4.11	3.54	3.75
DRB	2.19	2.24	2.25	2.20	2.18	2.14
TDB	3.13	4.44	3.93	4.31	3.72	3.90

(RP- Rootingpercentage, NS-NumberofShoots, SL- ShootLength(cm.), DS- Diameterofstem(mm.)(Sproutedshoot), NL- Numberofleaves, PL- Petiolelength(cm.), LL- Leaflength(cm.), LW- Leafwidth(cm.), FreshShootBiomass(gm.), FreshRootBiomass(gm.), TotalFreshBiomass(gm.), DryShootBiomass(gm.), DryRootBiomass(gm.), TotalDryBiomass(gm.). The numbers in this table represent the mean and standard error (SE) based on four replications. At the 5% level, there is no discernible difference between the means that are followed by identical letters within rows (DMRT).

[SIGNIFICANCE LEVELS ARE NEEDED IN TABLES, ONLY MEANS ARE REPORTED WHICH IS INSUFFICIENT.](#)

Discussion

It has become clear that auxin has a role in a variety of physiological processes, including cell elongation and differentiation in plant tissue. Several agricultural plant species have benefited from the exogenous administration of auxin as a potent technique to promote adventitious roots (Hartmann et al. 1997). Some plant species induce roots because of the abundance of natural auxin (IAA), however the application of a synthetic analogue like GA₃ was more successful than IAA. [YOUR EXPERIMENT DID NOT INCLUDE AUXIN TREATMENTS SO YOU CANNOT REACH THIS CONCLUSION.](#) Its increased stability inside tissue and during storage were discovered to be the cause of its significant effect on roots and growth performance in many types of plants (Blythe et al. 2007, Ling et al. 2013). [TWO REFERENCES ONLY? AUXIN HAS BEEN USED TO ROOT PLANTS FOR A LONG TIME. I HOPE THESE TWO REFERENCES HAD TREATMENTS OF AUXIN AND GA3 IN THE SAME EXPT TO REACH THIS CONCLUSION.](#)

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WHY DID YOU TRY GA3 AND NOT AUXIN? WERE THERE PREVIOUS ATTEMPTS TO ROOT THIS SPECIES WITH ROOTING POWDER (WHICH CONTAINS AUXIN) THAT FAILED?

In the current study, it was shown that *T. cordifolia* stem clippings supplemented with 200 ppm GA₃ (T1) showed a significantly higher ~~considerable~~ rooting percentage than...... Within 45 Minutes or DAYS?, the entire roots and sprouting process was finished. No other reports of rooting followed ??. The overall findings demonstrated that although *T. cordifolia* sprouting time was significantly longer, shoot elongation was significantly improved following sprouting. RESULTS SECTION NEEDS TO SUBSTANTIATE THIS CLAIM. The findings of the current study on *T. cordifolia* were in agreement with those published by Mishra et al. (2010). THIS STUDY NEEDS TO BE IN THE INTRODUCTION SECTION. WHAT DID THEY TEST? WHAT RESULTS DID THEY GET? IS THIS THE ONLY OTHER STUDY ON MAKING CUTTINGS FROM THIS PLANT? AND WHY IS ONLY ONE PLANT VARIETY REPORTED WHE ON OCCASION 'BOTH SPECIES' IS MENTIONED? When compared to other auxins and the control, old vine clippings of *T. cordifolia* treated with 200 ppm of GA₃ dramatically improved sprouting, rooting, and root length. During three months of planting, the highest plant growth (364.73 cm) and branch count (3.42) in the identical GA₃ treatments were noted (Mishra 2010). The investigation on *T. cordifolia* macro-propagation was also conducted by Rao et al. (2000). According to the study, GA₃ pre-treatment of *T. cordifolia* cuttings produced the best rooting responses (86%) at 200 and 300 ppm doses. SO WHAT MAKES YOUR REPORT DIFFERENT FROM THESE REPORTS? DID YOU TRY A DIFFERENT VARIETY? *T. cordifolia*, however, had the highest rooting effectiveness (96%) without the use of growth regulator hormone, according to a research by Warriar et al. (2007). WHY DO YOU THINK THAT IS? As a result, the current study deviated from the previous findings. FOR WARRIER BUT WERE THE SAME AS MISHRA AND RAO FOUND.

To obtain high-quality seedlings that lower the danger of plant damage, nursery techniques included several observations along with growing performance. NOT CLEAR Based on Further recorded observations, findings, and a few recommendations are offered. In polythene bags, care was made to avoid water logging and soil compaction. It was shown that stem cuttings of *Tinospora* were sensitive to rotting when exposed to too much water. As a result, cuttingsseedlings received water every 4-5 days. This discovery led to the recommendation that seedlings that were grown from seeds should be monitored for heavy

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Spodoptera and thrips damage to delicate leaves and stems. So, the fastest, safest, and cheapest method of proliferation was by cuttings.

THIS LAST SECTION SHOULD BE REPORTED IN MATERIALS AND METHODS AND RESULTS. THEN THE RESULTS SHOULD BE DISCUSSED HERE IN LIGHT OF ANY OTHER REPORTS ON SEEDLING PRODUCTION FROM THIS PLANT.

Conclusion

The 200 ppm GA3-treated stem cutting of *T. cordifolia* showed ~~sufficient~~ notable sprouting, rooting percentage, total fresh biomass, and dry biomass. *Tinospora cordifolia* planting material through the use of cuttings is ~~are~~ now ~~un~~able to produce enough biomass for commercial use, which opens the door to large-scale growth with little upfront costs. For large-scale plantations, ~~the~~ qualified planting material (QPMs) of these plants may be easily generated year-round. The government just established the "All India Institute of Ayurveda" to promote research relevant to our ancient culture, therefore this study has major ramifications. Under the Start-up India programme, young entrepreneurs can also create commercial *Tinospora* plantations.

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