

Studies on Vegetative Propagation of *Costus speciosus* (Thebu), as Affected by Cutting Type and Potting Mixture

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Abstract

Costus speciosus is a herb belongs to order Zingiberales, Family Costaceae, with a pseudostem and convolute leaf-sheaths. Conventional vegetative propagation of *Costus speciosus* is carried out through stem cuttings, division of clumps and rhizomes. The study was carried out to select suitable cutting type and potting mixture for propagation of *Costus speciosus*. Three different cutting types (soft wood, semi hard wood and hard wood) and four different potting mixtures (top soil, top soil:sand (1:1), sand:Compost (1:1) and top soil: sand: compost (1:1:1)) were used. The experiment was conducted using Completely Randomized Design with factorial structure and 10 replicates were used for each treatment. Two nodal cuttings were planted in black polythene bags filled with different potting mixtures assigned in different treatments. Data were collected weekly intervals up to four weeks. Number of suckers arising from cuttings and their height, stem circumference and number of leaves per sucker were measured. Cutting type was highly influenced for the success of the propagation. According to the results of analysis of variance, interaction effect of cutting type and potting mixture was significant only on stem thickness ($P=0.004$). Significantly higher number of suckers was arisen in softwood cuttings ($P=0.0011$). Height of suckers ($P<0.0001$) and number of leaves per sucker ($P<0.001$) also significantly higher in softwood cuttings than other cutting types. But the effect of potting mixture was only significant on height of suckers and significantly higher sucker height was observed in top soil medium ($P=0.0084$). Results revealed that the best cutting type for propagation of *Costus speciosus* is soft wood cutting irrespective of different potting mixtures which were not significantly influenced for the propagation.

Keywords: *Costus speciosus*, Vegetative propagation, Cutting type, Potting mixture

INTRODUCTION

Most of the pharmaceutical industry is highly dependent on wild populations for the supply of raw materials for extraction of medicinally important compounds. Meeting the demand of plant raw drugs through cultivation reduces pressure on natural population and is recognized as one of the most effective ways of conservation. Therefore, developing cost effective propagation techniques for medicinal plants are essential requirement in the medicinal plant industry.

Costus speciosus is a herb belongs to order Zingiberales, family Costaceae. *Costus speciosus* is an erect plant found to grow up to a height of 2.7 m. The root stock is tuberous and the stem is sub woody at the base. Its leaves are large, dorsally silky and are sub sessile, oblong and spirally arranged. The plant is reported to have shell shaped flowers. The white flowers are clustered in very dense spikes with a short corolla tube and are characterized by large and shiny brown or red bracts. The fruits of *Costus speciosus* are globose or ovoid capsules with obovoid or sub globose seeds (Khanna *et al.*, 1977).

It is an important medicinal plant widely used in several indigenous systems of medicine for the treatment of various ailments. Its rhizome decoction is taken as a diuretic to relieve complaints of the bladder and urethra and to expel kidney stones. Discovery of diosgenin, a natural source of steroids from the rhizome of *Costus speciosus*, which is generally used to control diabetes (Rani *et al.*, 2012), made the plant more popular in the drug industry (Raghu *et al.*, 2006).

Order Zingiberales consisting flowering, aromatic perennial herbs with creeping horizontal or tuberous rhizomes, generally propagated by rhizomes (Kress *et al.*, 2002). *Costus speciosus* can be propagated from seeds, stem cuttings and rhizomes but commercially, it is being propagated only through rhizome cuttings (Pandey *et al.*, 2011) and mass scale propagate through micro propagation (Robinson *et al.*, 2009).

Costaceae are the only gingers that can be propagated by stem cuttings (www.floridata.com, 2012). Therefore this study was performed to find out the possibility of propagation of *Costus speciosus* by stem cuttings and to select suitable cutting type and potting mixture for propagation.

MATERIALS AND METHODS

The research was carried out at the Faculty of Agriculture, University of Ruhuna, Sri Lanka. Three different cutting types and four different potting mixtures were used. Soft wood, Semi hard wood and Hard wood cuttings were used as cutting types with Top soil, Top soil : Sand (1:1), Sand : Compost (1:1) and Top soil : Sand : Compost (1:1:1) potting mixtures.

The experiment was conducted using completely randomized design with factorial structure and 10 replicates were used for each treatment. Two nodal stem cuttings were planted in black polythene bags filled with different potting mixtures as assigned in different treatments and kept inside a shade house (60% shade). Watering was done daily. Data were collected weekly interval up to four weeks. Number of suckers arising from cuttings and their heights, stem circumference and number of leaves per suckers were measured. Stem thickness was derived by using following formulae.

$$\text{Stem thickness} = \frac{\text{Stem circumference}}{3.14}$$

Data were statistically analyzed. The means of all treatments were compared using analysis of variance in order to define whether the differences were significant. When significant main effects existed, means were separated by Duncan Multiple Range Test at $P \leq 0.05$.

RESULTS AND DISCUSSION

Costus speciosus conventionally propagate by rhizome cuttings (Robinson *et al.*, 2009). Due to indiscriminate collection of its medicinal rhizomes cause disappearance of this medicinal plant from its natural habitat (Malabadi *et al.*, 2005) and according to Robinson *et al.* (2009) rhizome pieces of *Costus speciosus* showed low multiplication rate. *Costus speciosus* successfully propagate by tissue culture techniques by using rhizome sections (Robinson *et al.*, 2009), nodal segments and axillary buds (Punyarani and Sharma, 2010). But micro propagation techniques are sophisticated and only practicable in mass scale propagation.

Results of the present study revealed that *Costus speciosus* can also successfully propagate through stem cuttings. Success of propagation through cuttings mainly depends on the cutting type, cutting-propagation medium. According to the results on analysis of variance, effect of cutting type was highly influenced on the success of the propagation. Significantly higher number of suckers was arisen in softwood cuttings ($P = 0.0011$) than semi hard wood and hard wood cuttings (Figure: 1A). When considering the arisen suckers from different cutting types, height ($P < .0001$) and number of leaves ($P < .001$) also significantly higher in softwood cuttings than other cutting types (Figure: 1B and C). Soft wood cuttings exhibit significantly better performances compared with semi hard wood and hard wood cuttings.

But the effect of potting mixture was only significant on height of newly arisen suckers. With regards to the different potting mixtures used, top soil showed significantly higher sucker height ($P = 0.0084$) than other potting mixtures (Figure: 1D).

Interaction effect between cutting type and potting mixture was significant only on stem thickness ($P=0.004$). In P2, P3 and P4 potting mixtures, soft wood cuttings showed higher stem thickness of newly arisen suckers but in contrast, semi hard wood cuttings showed better performances in P1 potting mixture (Figure 2).

Stem cuttings (vegetative plants) are classified based on physiological age of the stem from which they are hard wood, semi hard wood and soft wood cuttings. Hard wood cuttings are taken from dormant matured stems of more than one year old. Semi-hard wood cuttings are usually prepared from partially mature wood of the current season's growth while soft wood cuttings are prepared from soft, succulent new growth (Agbo and Obi, 2007). Physiological stage of the cuttings has significant influence on rooting and propagation of cuttings (Aminul-Islam *et al.*, 2010). Many internal factors have been shown to influence root initiation and shoot development in stem cuttings. Such factors are auxins, rooting co-factors, carbohydrate and nitrogen levels in the rooting stock (Agbo and Obi, 2007). In this experiment soft wood cuttings showed significantly better performances than other cutting types may be due to higher concentration of rooting hormones and rooting co factors present in soft wood cuttings. Similar results observed in Agbo and Obi, (2007) in stem cutting propagation trial of *Gongronema latifolia* Benth softwood stem cuttings had lower days to opening of apical bud and shooting as well as higher percentage of rooted cuttings observed in soft wood cuttings than semi hard wood and hard wood cuttings. *Costus igneus* also successfully propagate by soft wood cuttings (Devi and Urooj, 2008). According to Geof Nicholos, (2005) most plants with soft, herbaceous growth habit can easy to propagate using soft tip cuttings.

CONCLUSION

Costus speciosus can be successfully propagated through stem cuttings and soft wood cuttings exhibit better performances than semi hard wood cuttings and hard wood cuttings irrespective of potting mixtures used.

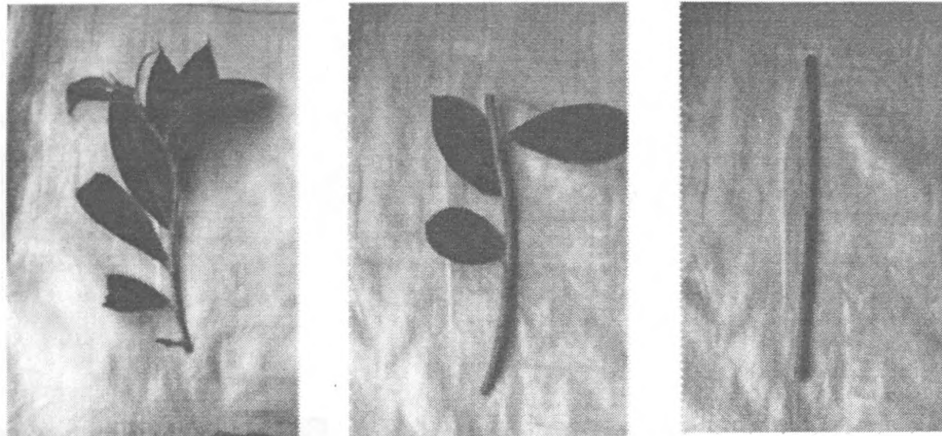
REFERENCES

- Agbo CU and Obi IU (2007) Variability in Propagation Potentials of Stem Cuttings of Different Physiological Ages of *Gongronema latifolia* Benth, *World Journal of Agricultural Sciences* 3 (5): 576-581
- Aminul-Islam AKM, Zahira Y, Nurina A and Mohammed O (2010) Propagation potentials of genotypes and different physiological ages of Stem Cuttings in *Jatropha curcas* L. *Journal of Agricultural Science*, 2(4): 75-82
- Costus speciosus* (2012) Retrived from http://www.floridata.com/ref/c/cost_spe.cfm on 11 November 2013
- Devi VD and Urooj A (2008) Hypoglycemic potential of *Morus indica*. L and *Costus igneus*. Nak.—A preliminary study. *Indian J. Exp. Biol.* 46 (8): 614–616.
- Khanna P, Sharma PGL, Rathore AL and Manot SK (1977) Effect of cholesterol on in vitro suspension tissue cultures of *Costus speciosus* (Keon.) *Dioscorea floribunda*, *Solanum aviculare* and *solanum xanthocarpum*. *Ind.J. Exptl.Biol.* 15:1025-1027
- Kress WJ, Prince LM and William KJ (2002) The phylogeny and a new classification of the gingers (Zingiberaceae): evidence from molecular data 1
- Nicholos G (2005) Growing rare plants. *A practical handbook on propagating the threatened plants of southern Africa*
- Pandey A, Gupta S and Yadav KR (2011) Agro Techniques of *Costus speciosus* :An Important Endangered Medicinal Plant, *Forest Biodiversity : Earth's Living Treasure* : 125-128
- Punyarani K and Sharma GJ (2010) Micro propagation of *Costus speciosus* (Koem.ex.retz) Sm by using nodal segment culture, *Notulac Scientia Biologycae* 2(1) : 58
- Raghu AV, Geetha SP, Gerald M and Indira B (2006) Micropropagation of *Costus speciosus* Sm. *Journal of Tropical Medicinal Plant*

Rani S, Sulakshana G and Patnaik S (2012) *Costus speciosus* an antidiabetic plant (2009) Micropropagation of *Costus speciosus* Botany Research Semi hard wood Hard wood Stem cutting types - Review 1(3): 52

Robinson JP, Britto SB and Balakrishnsn V (Kocm.ex.rctz) Sm., an Antidiabetic Plant by Using Explants of Pseudostems, International 2 (3): 182

Figures



Soft wood

Semi hard wood

Hard wood

Plate 1: Stem cutting types

Tables

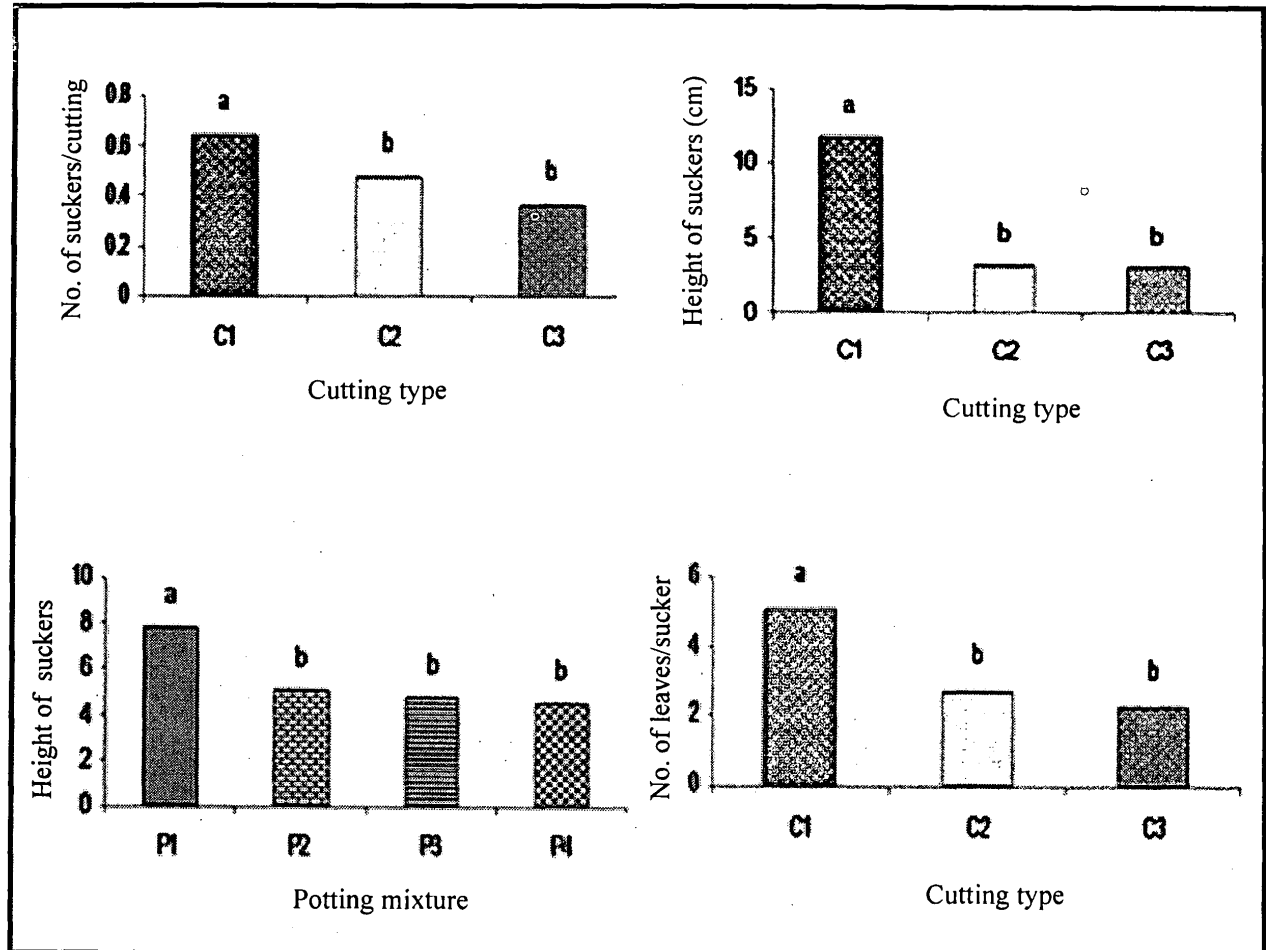


Figure 1: Effect of cutting type on no. of suckers/cutting (A), Effect of cutting type on height of suckers (B), Effect of cutting type on no. of leaves/sucker (C), Effect of potting mixture on height of suckers (D). P1 - Top soil; P2 - Top soil:Sand (1:1); P3 - Sand:Compost (1:1); C1 - Soft wood cutting, Top soil : Sand (1:1); C2 - Semi hard wood cutting; C3 - Hard wood cutting, Means on the bars represent the same letters are not significantly different at $P \leq 0.05$.

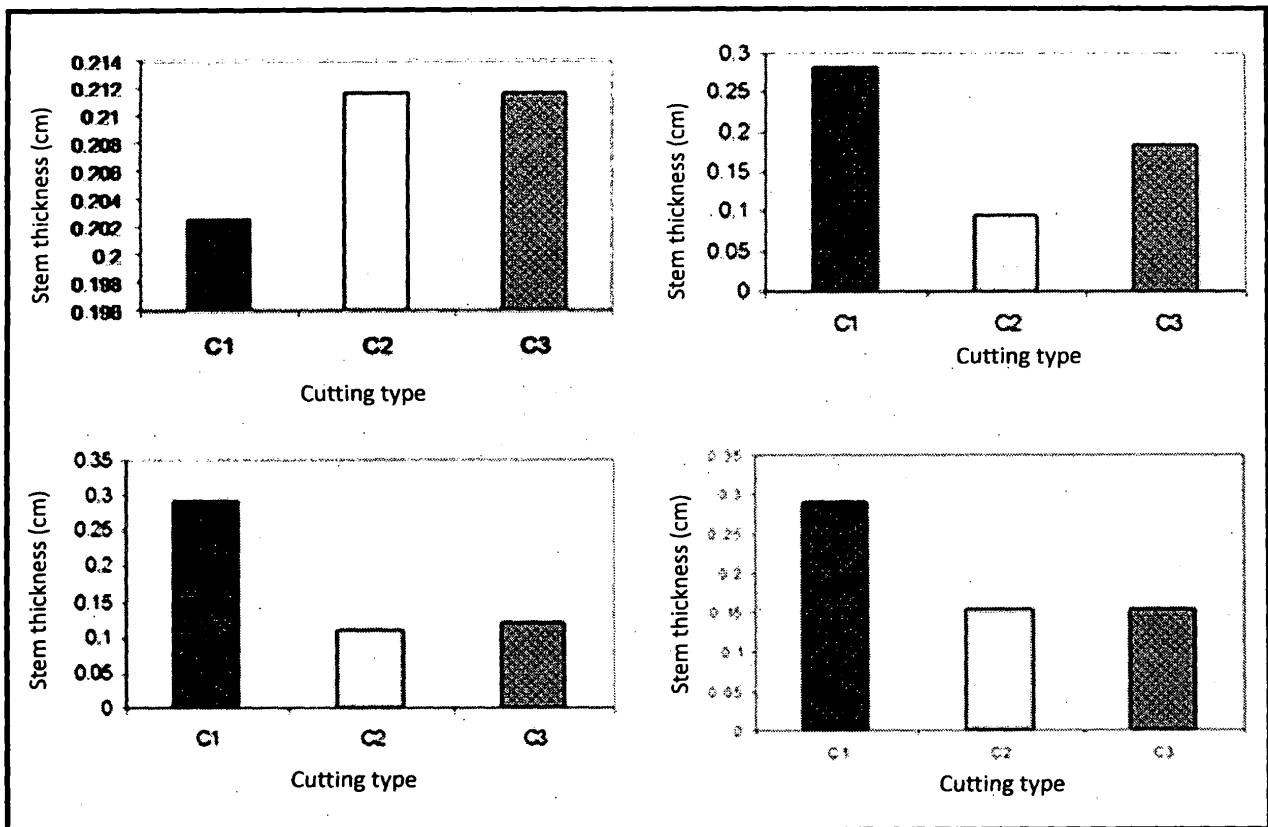


Figure 2: Stem thickness of suckers arisen from different cutting types in different potting mixtures.