International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(2): 20-24

Received: 11-01-2018
Accepted: 12-02-2018

M Bharathi Raja
Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

S Parthiban
Grapes Research Station, Kumbum, Tamil Nadu, India

M Anandhan
Horticulture Research Station, Thadiyankudisai, Tamil Nadu, India

E Venkadeswaran
Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

V Karthik Pandi
Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

S Suganthi
Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

M Siva Prakash
Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Correspondence
M Bharathi Raja
Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Rooting and sprouting performance of nodal cutting of cultivated and wild inter specific *Piper* rootstocks

M Bharathi Raja, S Parthiban, M Anandhan, E Venkadeswaran, V Karthik Pandi, S Suganthi and M Siva Prakash

Abstract
The effect of propagation by nodal cutting on six different *Piper* species and their performance were studied at Horticultural College and Research Institute, Periyakulam. The six *Piper* spp. namely *Piper colubrinum, Piper hymenophyllum, Piper longum, Piper attenuatum, Piper nigrum* and *Piper betle*, were utilized for this study and was laid out in a completely randomized design with 4 replications. The results of this experiment are revealed that the performance of *Piper colubrinum* superior on number of sprouts (1.36) and length of sprouts per cuttings (1.42 cm) as compared to other *Piper* species. The higher rooting percentage (82.24 per cent) also recorded in the species *Piper colubrinum.* Hence, the species (*Piper colubrinum)* can be effectively propagated through stem cuttings and thereby the faster multiplication rate can also be obtained.

Keywords: *Piper* species, Mass multiplication, Nodal cutting, rooting and sprouting

Introduction
Pepper belongs to the family Piperaceae and genus *Piper*. Apart from black peppe (*Piper nigrum*), the genus also includes economically important species like *P. longum* (long pepper) and *P. betle* (betel leaf). Other closely related indigenous species are *P. colubrinum, P. hymenophyllum, P. attenuatum.* Betelvine popularly known for its leaves and the origin of betelvine is Malaysia (Chattopadhyay and Maity, 1967). [3] The vine is a dioecious (male and female plants are different), shade loving perennial root climber. There are about 100 varieties of betelvine in the world, of which about 40 are found in India and 30 in West Bengal (Maiti, 1989; Samanta, 1994; Guha, 1997). [17] The deep, green and heart shaped leaves of betelvine are popularly known as Paan in India. It is also known as Nagaballi, Nagurvel, Saptaseera, Sompatra, Tamalapaku, Tambuli, Vakshapatra, Vettilai, Voojangalata etc., in different parts of the country (CSIR, 1969; Guha and Jain, 1997) [5, 11]. The betelvines (usually the male plants) are cultivated throughout the India except in the dry North Western parts. Further, the female plants also rarely produce many flowers or fruits in Indian climate (CSIR, 1969) [5]. In spite of that the vines are cultivated for harvesting the heart shaped green leaves. It grows best under the shaded, tropical forest ecological condition.

Betelvine is cultivated in India traditionally in an area of 55,000 ha with an annual production worth about Rs. 900 million. On an average, about 66 per cent of the production is contributed by the state of West Bengal where it is cultivated in 20,000 ha encompassing 4-5 lakh Boroj employing about the same number of agricultural families. Betel leaf is an excellent mouth freshener and mild vitalizer, routinely served on the social, cultural and religious occasions. However, there is a huge wastage of leaves during storage, transportation and during glut season is a great menance. The leaves are nutritive and contain anticarcinogens showing promise for manufacturing of a blood cancer drug. Betel leaf is traditionally known to be useful for the treatment of various diseases like bad breath, boils and bscesses, conjunctivitis, constipation, headache, hysteria, itches, mastitis, mastioditis, leucorrhea, otorrhoea, ringworm, swelling of gum, rheumatism, brasion, cuts, and injuries etc. as folk medicine while the root is known for it's female contraceptive effect (Chopra *et al.,* 1956; Khanra, 1997) [4, 15].

Black pepper (*Piper nigrum* L.) is an important spice crop, which originated in Western Ghats of India. India once considered as a major producer and exporter of black pepper is now pushed backed to second position by Vietnam which is emerging as the world's largest

Producer of black pepper. The reasons for Vietnam to excel traditionally black pepper growing country like India are due to use of clean planting materials, relatively disease free fields and use of orthotropic branches as planting materials which are precocious as compared to runners in India. Black pepper is commercially propagated by cuttings taken from runners in India while orthotropic shoots as source of planting material is used in Indonesia, Malaysia, Vietnam, Cambodia and Brazil where farmers adopt pure crop system and invariably use orthotropic shoots, as a source of planting material. Orthotropic shoots will be totally free from soil contamination compared to runner shoots which are often contaminated with soil that might lead to *Phytophthora* infection. Flowering is early and starts by second year of planting. In India, there are hardly any reports on the use of orthotropic shoots as planting material (Sarma *et al*., 2013). [24]

Long pepper (*Piper longum* L.) is a unisexual perennial climber with woody roots. Almost all parts of it, namely roots, stems and fruits are medicinally important and used especially in the treatment of diseases of respiratory tract like bronchitis, asthma, cough *etc.* (Sivarajan and Balachandran, 1994). The principal pharmacological constituents are piperine and piplartine. The crude extract of *P. longum* contains 3-8% of piperine (James, 1999). [14] Vegetative propagation through leaf cutting can be a suitable way to develop plants economically and in a controlled manner. The advantage of this type of propagation is that, with this technique plants can be raised throughout the year and the mother plant is less disturbed unlike the stem cutting method.

Piper attenuatum is an important *Piper* species which is much used in the Ayurvedic system of medicine. It is a rare *Piper* species which is found in the tropical and sub-tropical region and mainly found in southern part of India. Plant having important phytochemical constituents like Alkaloids, amides, steroids, saponins, glycosides, tannins, which are responsible for its therapeutic efficacy. Piperine and Piperlonguminine are the main Alkaloids/amides present in *Piper attenuatum.* Various parts of plant like seeds, root, leaves, and stem are used in different indications. Roots of Plant show excellent diuretic activity. Different part of Plant is used as drug, Preservatives, Insecticidal and larvicidal control agents. Biologically *Piper attenuatum* is very important spice. The biological role of this spice is explained in different experiments like anti-pyretic, anti-malarial, anti-microbial, anti-cancer & anti- trypanosomal. Seeds of plant having anti-oxidant property.

Piper colubrinum Like is a shade loving plant growing in marshy habitats and the stem puts forth numerous aerial roots that go and penetrate into the soil. Water stagnation is not detrimental as long as the shoot is above water. With this background, an attempt has been made in this study utilize the orthotropic shoots as planting material. As its availability is limited *viz.*, runners, the feasibility of type of orthotropic cuttings *viz.*, terminal, and semi-hardwood and hardwood cuttings as planting material need to be explored. The limited availability of propagating material *i.e.*, runner shoots, the feasible utilization of orthotropic cuttings *viz*., terminal, semi-hard wood and hardwood cuttings has been attempted. The performance and success rate of species were studied.

Materials and Methods

Description of the study area

This experiment was conducted in Periyakulam, Horticultural College and Research Institute at shade house. The site is located within 10.07°N 77.33°E. It has an average elevation of 356 meters above mean sea level. The climate is dry and hot, with North East monsoon rains during October - December. Temperatures during summer reach a maximum of 40 and a minimum of 26.3 °C, though temperatures over 43 °C are not uncommon. Winter temperatures range between 29.6 and 18 °C. The average annual rainfall is about 135 cm.

Experimental materials and growth media

This experiment was taken up with **s**ix wild species of *Piper viz., Piper colubrinum, Piper hymenophyllum, Piper longum, Piper attenuatum, Piper nigrum* and *Piper betle*. The Cuttings were taken from the healthy mother plants and uniform shoots were selected as propagating materials. The two nodal cuttings were planted in the respective growth media consisted of sand, soil and well decomposed FYM in the ratio of 1:2:1 and followed by watering. After planting, the necessary nursery management practices such as watering and weeding were applied as per the recommendation of Grima *et al*. (2011). [9]

Experimental design and treatments

The study was conducted in a factorial experiment (6 rootstocks and 2 nodal cuttings) in a Completely Randomized Designs (CRD) with four replications. Each treatment consisted of sixty cuttings and a total 360 cuttings were used in the study.

Data collection and analysis

Data were collected three months from the date of planting by gently uprooting the node cuttings as recommended by Yeboan *et al*. (2009).[31] The parameters evaluated were number of sprouts, length of sprouts and rooting percentage. The collected data on different growth parameter**s** were statistically analyzed by adopting the procedures suggested Panse and Sukhatme (1995). [19] Simple correlation between the percentage of success and some of the factors responsible were worked out as the method outlined by Snedecor and Cochran (1967). [30]

Results and Discussion

Effect of nodal cuttings of *Piper* species on number of sprouts

In the present study the number of sprouts per cutting was observed on 30, 60 and 90 days after planting did not exhibit any statistical difference between the species (Table 1 & Fig.1). However, among the *Piper* species, *P. colubrinum* exhibited 1.35, 1.36 and 1.36 as number of sprouts per cutting at 30, 60 and 90 days after planting, respectively and it was

Table 1: Effect of nodal cuttings of *Piper* species on number of sprouts

S. No.	*Piper* species	30 DAP	60 DAP	90 DAP	Mean
1.	P. colubrinum	1.35	1.36	1.36	1.36
2.	P. hymenophyllum	1.20	1.25	1.31	1.25
3.	P. longum	1.31	1.34	1.36	1.34
4.	P. nigrum	1.28	1.30	1.32	1.30
5.	P. attenuatum	1.19	1.21	1.24	1.21
6.	P. betle	1.17	1.21	1.24	1.21
Mean		1.25	1.28	1.31	
SED		NS	NS	NS	
CD (P=0.5)		NS	NS	NS	

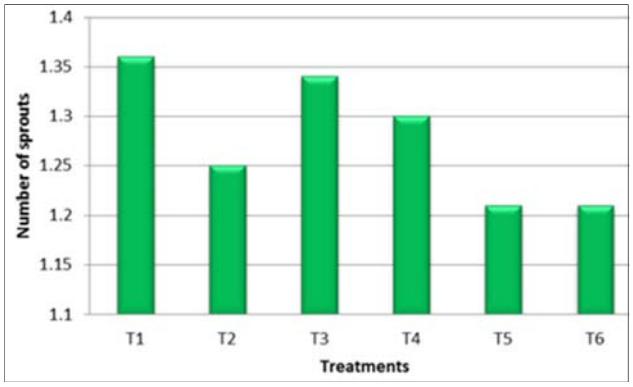

Fig 1: Effect of stem cuttings of *Piper* species on number of sprouts

Followed by the species *P. longum* which recorded 1.31, 1.34 and 1.36 as number of sprouts per cutting at 30, 60 and 90 days after planting. Cuttings from plants high C/N ratio produce more roots but feeble shoots as against those containing ample carbohydrate and higher nitrogen that produce fewer roots but strong shoots. Cuttings from succulent stems with very low carbohydrate and high nitrogen do not succeed by Singh (2000) [25] in pepper.

The covering cuttings with transparent polythene sheets or bags created a micro climate and this might have helped reduce dehydration, breakdown of cell content and also to re-activate the growth of dormant buds as reported by Hartmann and Kesater (1983). The relatively higher temperature within the polythene sheet coupled with the higher humidity might have re-active the biochemical processes that initiate sprouting and root formation as observed in rooting in chrysanthemums by Fischer and Hansen (1977). [7] The stored photosynthate in the cuttings might have also encouraged more sprouting and rooting as experienced by Samish and Spiegel (1957). [23]

Effect of nodal cuttings of *Piper* species on length of sprouts

The results showed significant difference between the wild *Piper* species for the trait sprout length. Higher length of sprouts per cutting (0.44 cm) was observed in *P. longum* at 30 days after planting and it was followed by *P. colubrinum* and *P. nigrum*, which recorded 0.43cm each as sprout length at 30 days after planting, whereas at 60 days after planting the highest value of 1.43cm sprout length was recorded in *P. nigrum* followed by *P. betle* which recorded 1.38 cm and 1.36 cm, respectively (Table 2 & Fig. 2). *P. colubrinum* registered higher sprout length of 2.48cm when compared to other treatments at 90 days after planting. Similar findings were also reported by Husen and Mishra (2001) [26] in *Vitex negundo*, Singh *et al.* (2003) [28] in *Piper longum* and Singh (1979) [28] working with *Jasminum sambac.* Similarly, cuttings treated with growth regulators have recorded higher fresh and dry weights of sprouts compared with control. The fresh weight was related to number of sprouts and length of longest sprouts per cutting in *J. Sambac* (Singh, 2001). [26]

Rooting percentage of wild species of Piper

The rooting percentage of wild species of *Piper* was observed at 30, 60 and 90 days after planting. From the results it was noticed that the rooting per cent at 30 days after planting and 60 days after planting showed significant difference between wild *piper* species (Table 3 & Fig. 3). Among the different wild species of *Piper*, *P. colubrinum* recorded the highest rooting per cent of 70.70 at 30 days after planting, 86.07 per cent at 60 days after planting, and 89.96 per cent at 90 days after planting. It was followed by the treatment (*P. longum*) with 58.54, 83.15 and 86.55 per cent of rooting at 30, 60 and 90 days after planting, respectively. The presence of leaves on the cuttings might have exerted some stimulating influence on root initiation as reported by Rappaport

Table 2: Effect of stem cuttings of *Piper* species on length of sprouts (cm)

Treatments	*Piper* species	30 DAP	60 DAP	90 DAP	Mean
T_1	*P. colubrinum*	0.43	1.36	2.48	1.42
T_2	*P. hymenophyllum*	0.40	1.12	1.65	1.05
T_3	*P. longum*	0.44	1.32	2.43	1.39
T_4	*P. nigrum*	0.43	1.43	1.85	1.23
T_5	*P. attenuatum*	0.36	1.19	1.75	1.10
T_6	*P. betle*	0.37	1.38	1.73	1.16
Mean		0.40	1.30	1.98	
SED		0.027	0.087	0.134	
CD (P=0.5)		0.057	0.183	0.282	

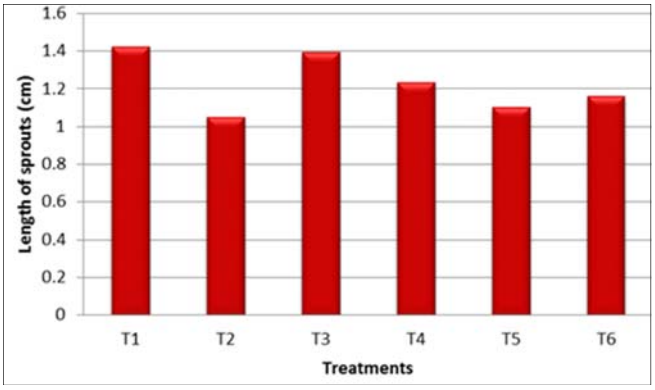

Fig 2: Effect of stem cuttings of *Piper* species on length of sprouts (cm)

Table 3: Effect of nodal cuttings of *Piper* species on rooting percentage (%)

S. No.	*Piper* species	30 DAP	60 DAP	90 DAP	Mean
1	*P. colubrinum*	70.70	86.07	89.96	82.24
2	*P. hymenophyllum*	38.90	68.32	80.72	62.65
3	*P. longum*	58.54	83.15	86.55	76.08
4	*P. nigrum*	44.25	70.02	82.66	65.64
5	*P. attenuatum*	42.06	70.02	81.93	64.67
6	*P. betle*	43.02	63.46	77.80	61.43
Mean		49.58	73.50	83.27	
SED		3.394	4.936	NS	
CD (P=0.5)		7.131	10.370		

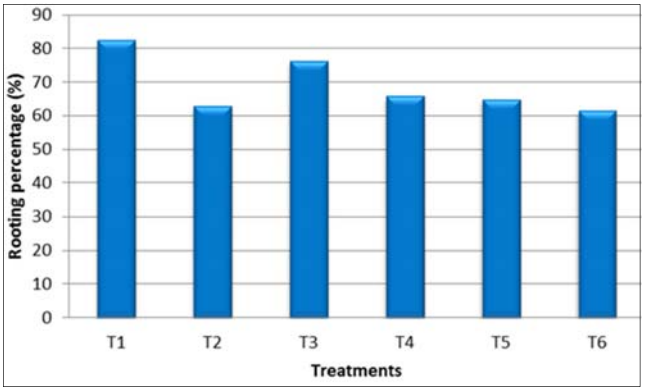

Fig 3: Effect of stem cuttings of *Piper* species on rooting percentage (%)

(1940).[21] Carbohydrates, which are vital for root formation, might have been translocated from the leaves to the base of cuttings as reported by Evans (1951). [6] Leaves left attached to the cuttings served as source of auxins, Breen and Muraoka (1974) [2] and photosynthates, therefore normal plant life results in earlier rooting.

Higher rooting percentage observed from the cuttings could be linked to better initial carbohydrate reserves stored of stem cuttings by Ky-Dembele *et al.* (2011). [16] A well aerated medium enhances greater root penetration and favours metabolic activities for root initiation, which leads to formation of longer roots and high root growth rate (Gopale and Zunjarrao, 2011). [8] This difference in rooting percentage is also associated with their variation in genetic makeup which influence the amount of root promoting substances and interaction between genetic and environmental factors as reported earlier (Amissah and Bassuk, 2007; Gopale and Zunjarrao, 2011; Pijut *et al.*, 2011) [1,8]

In the present study it was observed that the species *P. colubrinum* cuttings produced more number of sprouts, sprout length and higher rooting percentage than other species of *Piper*. Thus *P. colubrinum* is an ideal rootstock as it has strong root system that favours the ability of the plant to withstand several biotic and abiotic stress conditions (Mathew and Rema, 2000). [18]

Acknowledgement

Author is thankful to Department of Spices and Plantation Crops, Horticultural College and Research Institute, Periyakulam, Tamil Nadu for the assistance during the research programme.

References

1. Amissah J, Bassuk N. Effect of light and cutting age on rooting in *Quercus bicolor*, *Quercus robur* and *Quercus macrocarpa* cuttings. Comb. Proc. Intern. Plant propagators, Soc. 2007; 57:286-292.
2. Breen PJ, Muraoka J. Effects of leaves and carbohydrate content and movement of 14C-assimilate in plum cuttings. J. American Society Hort. Sci. 1974; 99:326-332.
3. Chattopadhyay SB, Maity S. Diseases of betelvine and spices. ICAR, New Delhi. 1967, 45.
4. Chopra RN, Nayar SL, Chopra LC. Glossary of Indian Medicinal Plants, CSIR, New Delhi. 1956, 194.
5. CSIR (Council of Scientific and Industrial Research). New Delhi. The wealth of India. 1969; 8:84-94.
6. Evans H. Investigation on the propagation of cuttings Tropical Agriculture, Trinidad. 1951; 28:147-203.
7. Fischer P, Hansen J. Rooting of chrysanthemum cuttings: Influence of irradiance during stock plant growth and of decapitation and disbudding of cuttings. *Sci.* Hort. 1977; **7**:171-178.
8. Gopale KD, Zunjarrao RS. Effect of auxin, length of stem cuttings, substrate and seasonal variations on *Jatropha curas* L. A biodiesel plant. *Biosci. Discov*. 2011; 2(1):76-81.
9. Grima H, Digafie T, Habtewold K, Haimanot M. Effect of node number on the nursery performance of vanilla (several biotic and abiotic stress conditions vanilla fragrances) cutting in South Western Ethiopia. Proceeding of the third biennial Ethiopian Horticultural Science Society (EHSS) conference on Improving Quality Production Horticultural Crops for Sustainable Development, Jimma, Ethiopia. Jimma University college of Agriculture and Veterinary Medicine. 2011.
10. Guha P. Paan Theke Kutir Silpa Sambhabana (In Bengali). Exploring betel leaves for cottage industry, In: Krishi, Khadya-o-Gramin Bikash Mela. A Booklet published by the Agricultural and Food Engineering Department, IIT, Kharagpur, India. 15-19
11. Guha P, Jain RK. Status report on production, processing and marketing of betel leaf (*Piper betle* L.). Agricultural and Food Engineering Department, IIT, Kharagpur, India. 1997.
12. Hartmann HT, Kester DE. Plant propagation: Principles and practices, prentice. Hall Inc., Eagle-wood cliffs, New Jersey. 1983, 721.
13. Husen, Mishra VK. Effect of IBA and NAA on vegetative propagation of *Vitex negundo* L. through leafy stem cuttings from hedged shoots during rainy season. Indian Perf. 2001; 45(2):83-87.
14. James V. Piperine: the treasured alkaloid in *Piper nigrum*. Spice India. 1999; 12:9-12.
15. Khanra S. PaanVittikSilpakendra (In Bengali). Betel leaf based industry. Nanbana Bharati, 1997; 30(2):169.
16. Ky Dembele CK, Tigabu M, Bayala J, savadogo P, Boussim IJ, Oden PC. Clonal propagation of *Khaya senegalenss*. The effect of stem length, leaf area, auxins, smoke solution and stock plant. Age. Int. J. Forest Res. 2011; 20(11):269-281.
17. Maiti S. Extension bulletin: The betelvine. All India Coordinated Research Project on Betelvine, Indian Institute of Horticultural Research, Hessarghatta, Bangalore, India. 1989.
18. Mathew PA, Rema J. Grafting black pepper to control foot rot. Spice India. 2000; 7:7-10.
19. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. I.C.A.R., New Delhi. 1995.
20. Pijut PM, Woeste KE, Michler CH. Promotion of adventitious root formation of difficult to root hardwood trees species. Horti. Rev. 2011; 8:214-250.
21. Rappaport J. The influence of leaves and growth substance on the rooting responses of cutting. *Naturals Tijdschr*. 1940; 21:356-359.
22. Samant C. (In Bengali): A report on the problems and solution of betelvine cultivation. A booklet published by Mr. H.R. Adhikari, C-2/16, Karunamoyee, Salt Lake City, Kolkata-64(WB), India. 1994.
23. Samish RM, Spiegel P. The influence of the nutrition of the mother vine on the rating of cuttings Ktavim. 1957; 8:93-100.
24. Sarma YR, Dyah Manohara, Premkumar T, Vikraman Nair R. Orthotropic shoots as source of planting material in black pepper. Spices India. 2013; 26(8):4-9.
25. Singh A. Fruit Physiology and Production. Kalyani Publishers, New Delhi. 2000, 564.
26. Singh AK. Effect of auxins on rooting and survival of Jasmine (*Jasminum sambac*) stem cuttings. Prog. Hort. 2001; 33(2):174-177.
27. Singh AK, Rajesh Mittal AK, Singh YP, Jauhari Shiva.Effect of plant growth regulators on survival rooting and growth characters in long pepper (*Piper longum* L.). *Prog. Hort.* 2003; 35:208-211.
28. Singh SP. Effect of rooting media and indole-3-butyric acid on root formation in *Jasminum sambac* cv. Motia semi hardwood cuttings under intermittent mist. *Prog. Hort.* 1979; 11:49-51.

29. Sivarajan VV, Balachandran I. Ayurvedic Drugs and their Plant Sources Oxford and IBH Publishing Co. Pvt. Ltd. 1994, 374-376.
30. Snedecor CW, Cochran WG. Statistical methods. Sixth Ed. Oxford and IBH Publishing Co., New Delhi. 1967.
31. Yeboan J, Lowors ST, Amoah FM. The rooting performance of shea (*Vitellaria paradoxa* C.F. Gaertn). Cutting leached in water and application of rooting. *J. Plant. Sci*. 2009; 4(1):10-14.