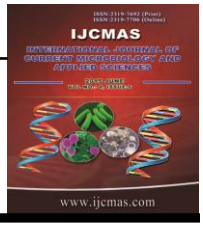
Int.J.Curr.Microbiol.App.Sci (2015) 4(6): 660-665

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 4 Number 6 (2015) pp. 660-665**
http://www.ijcmas.com



Original Research Article

Vegetative propagation of an endangered medicinal plant of Himalayan region, Paris polyphylla Smith

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Keywords

Paris polyphylla, Conservation, Medicinal herb, Treatments, Vegetative propagation

A B S T R A C T

Vegetative propagation of *Paris polyphylla* Sm. an important medicinal plant of Himalayan region needs an urgent attention for conservation which overcomes the pressure on its natural habitat. Propagation of this species was carried out at Pithoragarh (1700 m asl) a part of Western Himalaya, Uttarakhand, India. The present study investigates the potential of producing sprouting and rooting percentage of *Paris polyphylla* Smith. and using various soil composition with different concentration and combination of IBA and GA_3 hormones (50, 100 and 150 mg/l) treatments. Combination of 100mg/l GA_3 and 100 mg/l IBA showed highest sprouting and rooting percentage along best composition of soil:loam:sand (3:2:1).

Introduction

Indian Himalayan region has rich biodiversity of biotic resources in the world. Indian Over 1748 species of medicinal and aromatic plants (MAPs) reported from IHR are used in different systems of medicine (Samant and Joshi, 2005).

Medicinal plants are the nature gift to mankind, containing active compounds used to alleviate illness. More than 90% of plant species used by pharmaceutical industry, however the supply of raw material is mostly met from the wild habitat, thus putting them to severe exploitation (Gupta *et al.*, 1998, and Ved *et al.*, 1998).

Paris polyphylla Smith.is an endangered medicinal herb (CAMP and Kumari *et al*., 2011) commonly known as satuwa of family liliacea, this perennial medicinal herb , known for its high medicinal value and facing over-exploitation from its place of occurrence and possibly may become extinct. It is distributive from China to Nepal. In India, it is reported in Manipur, Himachal Pradesh and Uttarakhand (Tiwari *et al*., 2010),in an altitudinal ranges of 2000-4000 m.Its rhizomes are used for injuries from falls, fractures, convulsions and strains (Liang 2000). Whole plant can be used as febrifuge, while roots can be used as

analgesic, antiphlogistic (removes heat), antipyretic, antitussive and depurative (Yung 1985, Duke and Ayensu 1985). A root is used in the treatment of poisonous snake bites, ulcers, appendicitis, tonsillitis, rheumatism, alleviates pain, relieves boils, sore throat and traumatic pain (Vassilopoulos 2009). Polyphyllin D, a steroidal saponin of *P.polyphylla* has also been observed in inhibitory effects of human breast cancer cells (Lee *et al*., 2005).

Rapid reduction of natural resources of medicinal plant accompanied with exponential rise in demands of the market for a continuous and uniform supply of raw material in pharmaceutical industries, over and illegal exploitation, deforestation and habitat loss of this species have been assigned as endangered for Himalayan region. However, the germination of seeds seems low or negligible in the wild (Madhu *et al.*, 2010). Vegetative propagation recognized as conservation of those species which are economically important and difficult to grow through seed and other means. Efforts have been made to develop protocol of propagation by using rhizome cutting and will be further beneficial for other important medicinal plants.

Material and Methods

P. polyphylla rhizomes were collected from natural habitat of Munsiyari (30.0674° N Lat. and 80.2386° E Long.) in an altitudinal range of 2000-4000m in a place known as Khaliyatop, Milam and Johar Valley in the month of October 2014. The rhizomes were thoroughly washed with running tap water to remove soil particles. Each rhizome was cut into small pieces as there were apical buds present on the rhizome. Cuttings without any hormonal treatment were maintained as control (0). The cuttings were treated with GA_3 and IBA at different hormonal concentrations of 0, 50, 100, 150 mg/l by dipping them for 24 hrs. (Vashistha *et al.*, 2009). For individual treatment three replicates with ten cuttings each were used. Subsequently, all segments were planted in the soil as well as in mixture of soil, loam and sand (3:2:1) in October 2014 at Departmental garden of botany, Govt P.G.College Pithoragarh (29.5800^0N Lat. and 80.2200^0E Long.), Uttarakhand, India. After 120 days, number of sprouted segments and rooting were recorded in each treatment.

Data analysis

Data was analyzed statistically (SPSS version 19) using one way analysis of variance (ANOVA). The significances of difference among means were carried out using Duncan's multiple range test (DMRT) at (P=0.05). The results are expressed as a mean ± SE.

Results and Discussion

Effect of growth hormones in vegetative propagation

Result of vegetative propagation of *P. polyphylla* shown in table (1&2). Cutting rhizome subjected under different hormonal concentrations, the highest number of sprouting and rooting was observed together in applications of hormones 100 mg/l GA_3 and 100mg/l IBA (83.33% and 73.33 %) as compared to control(46.66 % and 36.66 %). According to data stated in table 2, results indicate combination of GA_3 100 mg/l and IBA 100mg/l treatment had maximum influence over treatments with respect to avg. shoot length (9.73±0.12), avg.leaf number (10.00±0.57), avg. root number (12.33± 0.33), avg. root length (7.10± 0.05), avg. rhizome length (5.66 ±0.08) and avg. rhizome diameter (2.23±

0.14) while these data recorded least in control namely, avg. shoot length (4.93±0.17), avg. leaf number (4.33±0.33), avg. root number (4.33± 0.33), avg. root length (1.40± 0.23), avg. rhizome length (1.93 ±0.12) and avg. rhizome diameter (0.70± 0.10).

Effect of soil texture in vegetative propagation

Effect of soil texture on the sprouting and rooting percentage of rhizome cutting of *P.polyphylla* shown in table 3. soil:loam:sand had the maximum sprouting and rooting (76.66% and 73.33%) while comparison to soil alone had less sprouting and rooting (66.66% and 60.00%).

The use of *P.polyphylla* rhizome sections seems to be satisfactory technique for vegetative propagation. The present study results revealed that the *P.polyphylla* rhizome segments can be successfully propagated (Figure 1). Combination treatment of 100 mg/l GA_3 and 100 mg/l IBA produced maximum sprouting and rooting (83.33% and 73.33 %), as compared to control with 46.66% sprouting and 36.66% rooting while higher concentrations of GA_3 and IBA (150mg/l) were found less effective. According to Yu *et al.*, 2009 stated that rhizome yield and quality (saponin content) of *P. polyphylla* improved by using apical buds, annual parts and other parts of rhizome in 100 mg/l of GA_3 -induced retardation of senescence increased green leaf area and prolonged the duration of photosynthesis. Medicinally important species of tuberous roots of *Aconitum atrox*, can be utilized for mass propagation by vegetative propagation otherwise this species in an alpine region fails to propagate through seeds under natural condition (Kuniyal, 1999). Kuniyal et al., 2003 reported that the *Aconitum atrox* propagated through tuber segment at lower altitude (1900m asl) in Garhwal Himalaya. Apical segments produced single shoot where as sub-apical, middle and basal were produced numerous shoots.

Table.1 Effect of different growth hormones on vegetative propagation of *P.polyphylla* using rhizome segment

Treatments (mg/l)	Sprouting %	Rooting%
Control	46.667±3.333^{ab}	36.667±3.333^{a}
GA 50	63.333±3.333^{cde}	56.667±3.337^{cd}
GA 100	76.667±3.333$^{e\ f}$	70.000±5.774^{e}
GA 150	56.667±3.333^{bcd}	53.333±3.333^{bc}
IBA 50	50.000±5.774^{abc}	43.333±3.333^{ab}
IBA100	66.667±3.333^{de}	56.667±3.333^{cd}
IBA 150	40.000±5.774^{a}	33.333±3.333^{a}
GA + IBA 50	70.000±5.774^{de}	66.667±3.333^{de}
GA + IBA 100	**83.333±3.333^{f}**	**73.333±3.333^{e}**
GA + IBA150	56.667±3.333^{bcd}	53.333±3.333^{bc}

Note: Values are represented as mean of triplicate ± standard error significant value at p=0.05 was calculated according Duncan's multiple range- Posthoc test by using the statistical package SPSS. Value followed by same letter in a column is not significantly different. Control- free of hormonal concentrations. Each treatment consisted of ten rhizome segments, the experiments were repeated three times and data were recorded after 120 days.

Table2. Effect of hormonal treatments after 120 days on vegetative propagation of *P.polyphylla*

Treatments (mg/l)	Avg. shoot length/segment	Avg. leaf no./segment	Avg. root no./explant	Avg. root length/explant	Avg. rhizome length/explant	Avg. rhizome diameter/explant
Control	4.933±0.176 [a]	4.333±0.333 [a]	4.333±0.333 [a]	1.400±0.231 [a]	1.933±0.120 [a]	0.700±0.100 [a]
GA 50	8.033±0.260 [e]	5.000±0.577 [bc]	4.333±0.333 [a]	3.367±0.186 [c]	2.600±0.153 [b]	1.233±0.145 [bc]
GA 100	9.067±0.176 [f]	6.667±0.333 [c]	6.333±0.333 [b]	4.267±0.145 [d]	2.500±0.058 [b]	1.400±0.058 [bcd]
GA 150	6.033±0.088 [b]	5.000±0.577 [bc]	5.333±0.333 [ab]	2.133±0.088 [b]	3.133±0.088 [c]	1.500±0.058 [cde]
IBA 50	6.967±0.088 [c]	4.667±0.333 [a]	9.333±0.333 [c]	6.200±0.115 [f]	3.400±0.115 [c]	1.167±0.088 [b]
IBA100	7.467±0.088 [d]	5.667±0.333 [abc]	10.667±0.882 [d]	7.100±0.058 [g]	4.200±0.058 [e]	1.567±0.088 [def]
IBA 150	5.267±0.120 [a]	4.667±0.667 [a]	8.333±0.333 [c]	5.000±0.058 [e]	3.900±0.058 [d]	1.500±0.058 [cde]
GA + IBA 50	9.200±0.115 [f]	6.333±0.333 [bc]	10.667±0.333 [d]	6.100±0.058 [f]	5.100±0.058 [f]	1.800±0.058 [f]
GA + IBA 100	**9.733±0.120 [g]**	**10.000±0.577 [d]**	**12.333±0.333 [e]**	**7.233±0.145 [g]**	**5.667±0.088 [g]**	**2.233±0.145 [g]**
GA + IBA150	8.333±0.145 [e]	6.667±0.333 [c]	8.667±0.333 [c]	4.533±0.120 [d]	4.367±0.088 [e]	1.767±0.033 [ef]

Note: Values are represented as mean of triplicate ± standard errorsignificant value at p=0.05 was calculated according Duncan's multiple range- Posthoc test by using the statistical package SPSS. Value followed by same letter in a column is not significantly different. . Control- free of hormonal concentrations. Each treatment consisted of ten rhizome segments, the experiments were repeated three times and data were recorded after 120 days.

Table 3: Effect of soil texture on sprouting of rhizome segment of *P.polyphylla*

Treatments	Sprouting%	Rooting%
soil	66.667±3.333	60.000±5.774
soil:loam:sand	76.667±3.333	73.333±3.333

Figure.1 Vegetative propagation of *P.polyphylla* through rhizomes **a.** Rhizome segments ; **b&c.** Vegetatively propagated plant

Banday *et al.*, 2014 reported that maximum sprouting of *Jurinea dolomiaea* was recorded in soil: sand in 2:1 whereas in *Acorus calamus* highest sprouting percentage and rooting percentage was recorded in litter (Bisht and Bhatt, 2014). The results revealed that the rhizome of *P.polyphylla* showed better sprouting and rooting (76.66% and 73.33%) in soil texture having soil:loam:sand in 3:2:1. Both the regulators GA_3 and IBA play important role in sprouting and rooting.

The result, illustrate that the rhizome segments of *P. polyphylla* is responsive to vegetative propagation and opening the window of opportunities for commercial purpose by local cultivars and supplying to pharmaceutical industries. Also open the opportunity for researchers and farmers in future genetic improvement and large scale cultivation of *Paris polyphylla* using vegetative propagation technique.

Acknowledgement

The authors are grateful to Uttarakhand State Biotechnology Department (USBD), Govt. of Uttarakhand for providing financial assistance.

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