IMPACT OF DIFFERENT TREATMENTS IN GENTIANA KURROO AND CYRTOMIUM CARYOTIDEUM RHIZOME MACROPROLIFERATION

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ABSTRACT

In the present study, an attempt was made to evaluate the impact of different hormones i.e. Indole -3 butyric acid (IBA) and Indole -3 acetic acid (IAA) for the root induction in *Gentiana kurroo,* a small perennial herb and *Cyrtomium caryotideum,* a fish-tail holly fern. Both population is fast depleting in their natural habitats due to their high medicinal uses. For the present study growing tip of rhizome was split into 2, 3 and 4 longitudinal parts. Each split contained ½, ⅓ or ¼ of longitudinal section of mother rhizome and above ground part with growing buds. *G. kurroo* and *C. caryotideum* two piece rhizome exhibited significantly higher survival percentage than three and four pieces. *G. kurroo* two and three pieces IBA treated cuttings showed better results than IAA treatments. *C. caryotideum*'s two and three piece cuttings provided best survival under controlled conditions, four piece cuttings thrived better under IAA 300 ppm treatment. Impact of hormones in rhizome-cutting of *G. kurroo* and *C. caryotideum* is a new, simple, easy and effective technique for multiplication and conservation of these endangered herb and fern for production of more number of plants for future conservation.

Keywords: hormones, herb, fern, rhizome, multiplication, endangered, conservation.

I. INTRODUCTION

Gentiana kurroo Royle [family: Gentianaceae] is an endangered [1] medicinal plant. It is a small perennial herb, with a stout rhizome bearing decumbent flowering stems, found in North–Western Himalayas, at altitudes of 5,000–11,000 ft. The dried rhizome and roots of *G. kurroo*, described under the name Indian Gentian are exported from the hills. The plant does not seem to have been cultivated on a large scale anywhere in India.

Cyrtomium caryotideum Presl. [Family: Dryopteridaceae] also known as '*fish tail holly*

fern', is a medium sized fern with ascending or erect rhizomes. It grows well under medium light in moist dry garden soil. This fern is native of Southeast Asia, China, northern India, and islands of South Pacific. Fishtail holly fern as the most used common name for *C. caryotideum* on the premise that the three-pronged leaf ends look like the tails of fishes. It is also called dwarf holly fern because it is usually only one foot tall

The plants at higher altitudes of Himalayas generally, propagated by rhizomes [2]. The propagation by rhizome and stem cuttings has emerged as efficient methods of multiplication and conservation of such species. Therefore, present study was conducted to macro-proliferate *Gentiana kurroo* and *Cyrtomium caryotideum* through rhizome cuttings.

II. MATERIALS AND METHODS

The plants of *Gentiana kurroo* and *Cyrtomium caryotideum* were collected during March, 2008 from Chakrata forest division. The site is situated between the latitude 30º 26 N and 31° 02 N and longitude 77° 38 E and 78° 04 E, and at an elevation range of 1800 m to 2750 m above mean sea level.

The ball of earth was removed carefully and soil loosened, so as to expose the rhizome of *G. kurroo* and *C. caryotideum*. The entire plant, along with rhizome, was washed in a bucket of water. Rhizomes of *G.kurroo* and *C. caryotideum*, about 5-8 cm in diameter, were then divided into 2, 3 and 4 equal longitudinal pieces. Each split contained ½, ⅓ or ¼ of longitudinal section of mother rhizome and above ground part with growing buds. These rhizome cuttings were dipped in different hormone solutions for 12 hours at ambient temperature. The hormonal treatments include Indole -3 butyric acid (IBA) (100 ppm, 200 ppm, and 300 ppm), Indole -3 acetic acid (IAA) (100 ppm, 200 ppm, and 300 ppm) and control prepared for comparison. Twenty five plantlets per replicate were planted in raised nursery beds at temperate forest nursery under natural conditions. The plantlets were

watered regularly, and planted at equal distance of about 15 cm. The experiment was laid in a randomized block design with four replicates for each treatment. Survival per cent at the end of three months was calculated as (number of plantlets survived/total number of plantlets planted) x 100.

Statistical tools used in the study were analysis of variance (ANOVA) and Fisher's LSD. Fisher's LSD was applied to test the best treatment when ANOVA was significant at $P < 0.05$. All the per cent values were transformed as described by [3]. Data was analyzed using computer programs SPSS 1997 and Microsoft Excel.

III. RESULTS

When comparision between three longitudinal pieces in *G.kurroo*, two pieces cuttings exhibited significantly (ANOVA, $P < 0.01$) higher (97.5%) survival under control conditions followed by three piece (90%) and four pieces (22.5%) cuttings (Table 1). Other then this, two piece cuttings also had the maximum survival percentage under T_0 to T_6. Two and three pieces IBA treated cuttings showed better results than IAA treatments and enhanced the emergence percentage.

Among the six treatments, both two and three piece cuttings recorded significantly higher survival percentage under controlled conditions (T_0). While two piece cuttings recorded least survival percentage under T_5 (70.0%) treatment. Three piece cutting recorded least survival under T_6 (55.0 %) treatments. Four piece cutting showed lowest under T6 (12.5%) treatment (Table 1).

Table 1. Impact of IBA & IAA in rhizome cuttings of *Gentiana kurroo*

Treatments	Survival (%)		
	2 piece	3 piece	4 piece
Control (T_0)	$97.5^{a,a} \pm 0.50$	$90.0^{a,b} \pm 0.82$	$22.5^{c,c} \pm 0.50$
IBA 100 ppm(T_1)	$80.0^{c,a} \pm 0.82$	$75.0^{b,a} \pm 1.00$	$35.0^{b,b} \pm 0.48$
IBA 200 ppm(T_2)	$85.0^{b,a} \pm 0.58$	$70.0^{c,b} \pm 0.82$	$45.0^{a,c} \pm 0.52$
IBA 300 ppm(T_3)	$80.0^{c,a} \pm 0.82$	$75.0^{b,b} \pm 0.58$	$35.0^{b,c} \pm 0.58$
IAA 100 ppm(T_4)	$77.5^{c,a} \pm 0.50$	$62.5^{d,b} \pm 0.50$	$32.5^{b,c} \pm 0.50$
IAA 200 ppm(T_5)	$70.0^{d,a} \pm 0.82$	$57.5^{e,b} \pm 0.96$	$35.0^{b,c} \pm 0.43$
IAA 300 ppm(T_6)	$72.5^{d,a} \pm 0.50$	$55.0^{e,b} \pm 1.00$	$12.5^{d,c} \pm 0.50$

The values refer to mean and S.D. ($n = 25 \times 4$). Mean followed by the different superscripted letter are significantly different at $p < 0.01$ (Fisher's LSD). First letter represents variation among treatments ($T_0 - T_6$) and second between rhizome cuttings (2, 3 and 4 pieces). Values followed by are standard deviation

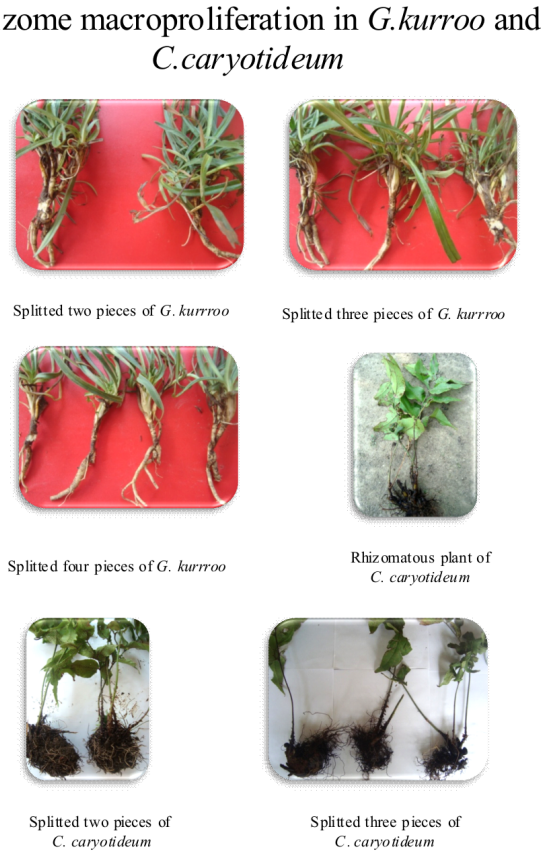
When comparision between three longitudinal pieces in *C.caryotideum*, two pieces cuttings exhibited significantly (ANOVA, $P < 0.01$) higher (95.0%) survival under control conditions followed by three piece (85.0%) and four pieces (55.0%) cuttings [Table 2]. Other then this, two piece cuttings also had the maximum survival percentage under T_2 (75.0%), T_4 (77.5%) and T_5 (70.0%) treatments. Three piece cutting had significantly higher survival percentage in T_3 (75.0%) and T_4 (77.5%) and four piece under T_5 (70.0%) and T_6 (72.5%).

Table 2. Impact of IBA & IAA in rhizome cuttings of *Cyrtomium caryotideum*

Treatments	Survival (%)		
	2 piece	3 piece	4 piece
Control (T_0)	$95.0^{a,a} \pm 0.58$	$85.0^{a,b} \pm 0.58$	$55.0^{d,c} \pm 1.29$
IBA 100 ppm(T_1)	$55.0^{f,a} \pm 0.58$	$47.5^{f,b} \pm 0.96$	$45.0^{f,c} \pm 1.29$
IBA 200 ppm(T_2)	$75.0^{c,a} \pm 0.58$	$67.5^{d,b} \pm 0.50$	$50.0^{e,c} \pm 1.41$
IBA 300 ppm(T_3)	$50.0^{g,b} \pm 0.82$	$75.0^{c,a} \pm 0.58$	$50.0^{e,b} \pm 1.63$
IAA 100 ppm(T_4)	$77.5^{b,a} \pm 0.50$	$77.5^{b,a} \pm 0.50$	$57.5^{c,b} \pm 0.96$
IAA 200 ppm(T_5)	$70.0^{d,a} \pm 0.82$	$47.5^{f,b} \pm 0.50$	$70.0^{b,a} \pm 1.15$
IAA 300 ppm(T_6)	$62.5^{e,b} \pm 1.50$	$55.0^{e,c} \pm 0.58$	$72.5^{a,a} \pm 0.96$

The values refer to mean and S.D. ($n = 25 \times 4$). Mean followed by the different superscripted letter are significantly different at $p < 0.01$ (Fisher's LSD). First letter represents variation among treatments ($T_0 - T_6$) and second between rhizome cuttings (2, 3 and 4 pieces). Values followed by are standard deviation.

Among the six treatments, both two and three piece cuttings recorded significantly higher survival percentage under controlled conditions (T_0). While two piece cuttings recorded least survival percentage under T_3 (50.0%) treatment. Three piece cutting recorded least survival (47.5 %) under T_1 and T_5 treatments.



Rhizome macroproliferation in *G.kurroo* and *C.caryotideum*

Four piece cutting showed lowest under T_1 (45.0%) treatment [Table 2].

IV DISCUSSION

The macropropagation study on various species have also indicated that IBA is more frequently used for rooting experiments. The superiority of IBA over other natural auxins (e.g IAA) may be because of high stability, as it is well known that IAA is oxidized by light as well as by enzymes such as IAA Oxidase. Splitting method reduced the vegetative growth period in comparison to seed raised plantlet; it even helped in establishing the plantlet in field. Thus, rhizome splitting appears to be better mode of multiplying these species. Similar results were also observed by [4] in *Nardostachys jatamansi.* [5] reported that the youngest top portion of the rhizomes bearing leafy buds gave the best survival results in case of *Cyrtomium caryotideum* but also observed that the rhizome without fronds gave poor results. They also reported that two to three rhizome bulge with leaves gives better result in *Cyrtomium carytotideum*. Similarly [6] found that larger the rhizome or clump taken, the better the chances of a successful division in *Podophyllum hexandrum.*

Thus, it can be convincingly stated that the propagation of *G.kurroo* and *C.caryotideum* can be successfully done by splitting a rhizome into two pieces which is an easy and effective technique for multiplication and conservation of these endangered herb and fern for production of more number of plants.

Due to beautiful and peculiar appearance of *G.kurroo* and *C.caryotideum* both can be multiplied for botanical as well as ornamental purposes which can be a good choice for containers, rock gardens, or to cover rocky patches in Himalayas. Moreover medicinal value needs much more study to find out commercial exploitation by local people. Considering the medicinal value of these species, *in-situ* as well as *ex-situ* conservation is needed at this juncture.

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REFERENCES

[1] R. Raina, M.C. Behera, R. Chand and Y. Sharma. Reproductive biology of *Gentiana kurroo* Royle. *Current Science*, 2003; 85 (5): 667-670.

[2] R.N. Chopra, I.C. Chopra, K.C. Handa and L.D. Kapur. In: *Chopra's Indigenous drugs of India*. U.N. Dhur and Sons Pvt. Ltd. Calcutta, 1958.

[3] K.A. Gomez and A.A. Gomez. *Statistical Procedures for Agricultural Research*, 2nd edition. John Wiley and Sons, New York, 1984, pp 680.

[4] G.R. Gargya. *Phytosociological Ecological and Propagation Studies on Nardostachys jatamansi* DC. in Garhwal Himalayas. Ph.D. Thesis, Forest Research Institute University, Dehra Dun. India. 2001.

[5] A. Tomar and R.K. Srivastava. Vegetative propagation of less known fern-*Cyrtomium caryotideum*- a new approach. *Indian Forester*, 2007.133 (2): pp 261-262.

[6] R.L. Badhwar and B.K. Sharma. A note on the germination of *Podophyllum hexandrum* Seeds In : *Medicinal and Aromatic Plants* (Eds. S.S. Negi, R.K. Srivastava and N.S. Bisht). *Indian Forester,* Dehradun. 2007 pp. 407-409.