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SHORT COMMUNICATION

ROOTING AND GROWTH RESPONSE OF RHIZOME CUTTINGS OF *PICRORHIZA KURROOA* TO NAA, IBA AND ROOTEX

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The present study was conducted to standardize the propagation protocol for *Picrorhiza kurrooa* Royle ex-Benth during the year 2005-06 in completely randomized design with 8 treatments and 3 replications. Rhizome cuttings of 3-4 cm length were treated with three concentrations each of NAA and IBA (1000, 2000 and 3000 ppm) and a commercial rooting powder, "rootex" following the quick dip method. In general, response of treatments was of the order: IBA > NAA > rootex > control. IBA 1000 ppm resulted in minimum number of days taken to root emergence (29.33 day) as well as emergence of leaves (32.80 day). Days taken to root and leaf emergence (40.66 and 37.33 day) in rootex treated cuttings were statistically at par with control (42.33 and 39.66 day). IBA 1000 ppm also produced maximum rooted cuttings (81.3%), number (8.21) and length of roots (8.5 cm) and number of leaves (9.20) with maximum field survival (70.5%) of rooted cuttings as against the minimum rooted cuttings (50.25%), number (3.1) and length of roots (3.3 cm) and number of leaves (4.8) with minimum field survival (40.83%) under untreated cuttings.

***Key words*: IBA, NAA, *Picrorhiza kurrooa*, rootex, rooting.**

Medicinal and aromatic plants are the emerging crops of future because of the resurgence of interest in their curative and aromatic properties. Even today 80 per cent of the world population is directly or indirectly dependant on plant based drugs for their healthcare. In India, nearly 5-8 thousand plant species are known for their medicinal value and a large number of them are used in different indigenous medicine systems (Kirtikar and Basu 2001). However, due to the non-judicious exploitation of resources from natural habitats and near absence of commercial cultivation, many medicinal and aromatic plants have reached the brink of extinction. Thus there is an urgent need to domesticate such species so that they can be introduced into regular farming systems. The domestication process presages propagation of the germplasm as the initial step. Medicinal and aromatic plants await commercialization owing to non-availability of propagation protocols.

Picrorhiza kurrooa Royle ex-Benth is a high altitude medicinal plant of herbaceous perennial nature belongs to family Scrophulariaceae (Fig. 1). It contains alkaloid picrorlive, cucurbitacin and glycoside in its rhizomes (Bhattacharjee and De 2005). The drug has been found to be hepatocytoprotective. It is also effective against asthma, hepatitis, vitilago, hay fever and rheumatoid arthritis. It is a bitter tonic and a useful antiseptic. It improves appetite and stimulates gastric secretions, with mild laxative properties. However, there is no scientific technique available for its propagation/

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cultivation. Hence the present study was undertaken to standardize the propagation protocol for *Picrorhiza kurrooa* Royle ex-Benth for its cultivation.

Fig. 1. *Picrorhiza kurrooa* in flowering condition

Present investigation was carried out during 2005-2006 at research farm of Division of Floriculture, Medicinal and Aromatic Plants, SKUAST-K, Shalimar, Srinagar. Rhizomes of *Picrorhiza kurrooa* were made into divisions of 3-4 cm each having atleast one bud by using a sharp knife. Cuttings were treated with NAA (1000 ppm, 2000 ppm and 3000 ppm), IBA (1000 ppm, 2000 ppm and 3000 ppm) and rootex (3000 ppm), a commercial formulation of IBA. Treatments were given as quick dip technique (Hartmann *et al.* 2002) wherein basal portion of the cuttings (1.0 cm) were given quick dip of 5 seconds. For rootex treatment basal portion of cuttings were placed in the powder for 5 seconds. Dipping of cuttings in distilled water was served as control. There were thus eight treatments of three replications with a sample size of 20 cuttings. Treated cuttings were immediately transferred to the rooting trays of 2ft x 1.5ft x 4inches size filled with washed coarse sand. The cuttings were dibbled in holes already made for the purpose in the medium to a depth of 1.5 cm with a distance of 3 cm between cuttings. The rooting medium was kept moist by intermittent water sprays with the help of a hand sprayer. After a period of 60 days, the plantlets produced in trays were transplanted to the field. Data recorded on various parameters of root/shoot growth and field survival per cent were subjected to statistical analysis under the completely randomized design (CRD) following the standard methodology (Gomez and Gomez 1984).

Data reveal variation in the response of cuttings to applied growth regulators in terms of days taken to new leaf emergence (Table 1). Growth regulators hastened the new leaf emergence and cuttings treated with IBA at 1000 ppm took lesser days (32.80 day) for new leaf emergence followed by IBA 2000 ppm (33.33 day) and IBA 3000 ppm (35.03 day). NAA also speeded up the new leaf emergence but showed relatively less

Table 1. Influence of growth regulators on root and shoot development in rhizome cuttings of *Picrorhiza kurrooa*

Treatment	Days taken to new leaf emergence	No. of leaves per cutting	Days taken to root emergence	No. of roots per cutting	Length of primary roots per cutting (cm)
NAA 1000 ppm (T_1)	39.99	7.20	36.33	4.55	4.40
NAA 2000 ppm (T_2)	39.33	7.40	35.99	4.66	5.00
NAA 3000 ppm (T_3)	38.33	8.40	34.33	6.44	5.80
IBA 1000 ppm (T_4)	32.80	9.20	29.33	8.21	8.50
IBA 2000 ppm (T_5)	33.33	8.80	31.33	6.55	6.30
IBA 3000 ppm (T_6)	35.03	8.70	33.66	5.20	5.60
Rootex (3g IBA/kg of rootex) (T_7)	40.66	6.70	37.33	3.99	3.60
Control (Distilled water) (T_8)	42.33	4.80	39.66	3.10	3.30
CD (P=0.05)	2.14	0.62	2.22	0.78	0.71

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proficiency than IBA and taken 39.99, 39.33 and 38.33 days, respectively with 1000, 2000 and 3000 ppm. Rootex again could not manipulate any noticeable change on days taken to leaf emergence (40.66 day) and stayed behind with control (42.33 day). Similar findings have been reported in *Rosa hybrida* (Van de Pol and Breuklear 1982) and in *Prunus glandulosa* and *Aloysia triphylla* (Banday 2003). The lesser effect of rootex than IBA and NAA lends support from the findings of Chong *et al.* (1992). The decrease in time taken to emergence of new leaves as a result of these treatments may be due to the stimulatory effect on overall growth of cuttings. Auxins play an important role in the metabolic activities and cell process, which further result in increased growth (Edmond *et al.* 1997).

All the treatments including rootex significantly alter the number of leaves produced per cuttings and maximum leaf number (9.20) was recorded with IBA at 1000 ppm as against the minimum of 4.80 leaves in control. The maximum number of leaves was followed in decreasing order by IBA 2000 ppm (8.80), IBA 3000 ppm (8.70), NAA 3000 ppm (8.40), NAA 2000 ppm (7.40), NAA 1000 ppm (7.20) and rootex (6.70). These results are in conformity with those obtained by Jhon *et al.* (2000) in rose. Increased foliage as a result of IBA application may be attributed to the stimulatory influence of the auxin on metabolic activities and cell division processes and also to its effect on rhizogenesis.

The cuttings took as many as 39.66 days for root emergence under control conditions which was reduced by use of growth regulators with minimum of 29.33 days under IBA 1000 ppm followed by 31.33 and 33.66 days, respectively in IBA 2000 and 3000 ppm. NAA treatments also produced significant effects in reducing the days taken to root emergence but were relatively less effective than IBA. However, unlike IBA higher doses of NAA were found more beneficial in hastening the root emergence as compared to lower doses. Commercial formulation of IBA, i.e. rootex was not as much effective as IBA or NAA and remained at par with control (Table 1). The dominance of IBA over NAA in rhizogenesis and shoot growth is quite in agreement with the observation of Jaya *et al.*(2003) in *Coleus forskohlii*, Masoodi *et al.*(1994) in *Glycyrrhia glabra* Linn and Nag *et al.*(1999) in mungbean. The improved rooting performance under IBA treatment may be attributed to its higher concentration near the base as IBA is translocated poorly and retain near the site of application thus, seems to be a superior root stimulator. A slower rate of IBA degradation due to oxidative enzymes might also be the reason of its superiority in root induction. The lesser effect of rootex than IBA or NAA indicates that solution form was more effective than powder form. As evident from data, rhizome cuttings of *Picrorhiza kurrooa* also responded significantly to various growth regulators in terms of per cent cuttings rooted. In general IBA was found most effective followed by NAA, rootex and control (Fig. 2). Maximum rooting per cent (81.30%) was recorded with IBA 1000 ppm followed by IBA 2000 ppm (78.20%) and IBA 3000 ppm (76.80%) while NAA responded better at its higher level 3000 ppm (75.20%) followed by 2000 ppm (65.53%) and 1000 ppm (63.63%). Rootex also showed a significant increase in per cent rooting (60.33%) over control (50.25%).

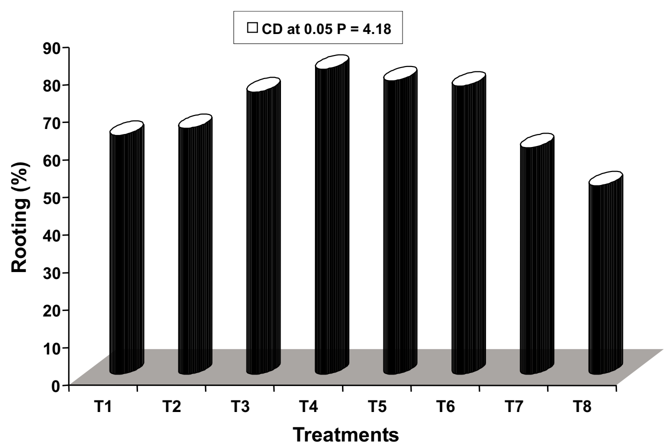

Fig. 2. Effect of growth regulators on rooting in rhizome cuttings *Picrirhiza kurrooa* Royle ex Benth. Details of treatment (T1-T8) are same given in table 1.

Our observations confirm the findings of Chauhan and Reddy (1974) in plum and Venugopal *et al*. (2005) in Patchouli (*Pogostemon cablin*), wherein IBA at 1000 ppm produced maximum rooting. Bhuse *et al.* (2003) also reported beneficial effect of IBA than NAA, on rooting percentage in *Pelargonium graveolens*. Similar observations were made by Bhuwan *et al.* (2006) in *Picrorhiza kurrooa*. The increased percentage of rooting might be due to the beneficial effect of auxins in the stimulation of nutritional reserves and their mobilization to the region of root formation (Doak 1941) as auxin enhance the activities of hydrolysing enzymes.

Number of roots per cutting ranged from 3.10 (control) to 8.21 (IBA 1000 ppm), which, indicates a clear-cut influence of growth regulators and rootex (Table 1 and Fig. 3a-d). NAA treatment in general was less effective than IBA treatments, followed by rootex. However, number of roots increased with increasing levels of NAA from 1000 ppm to 3000 ppm whereas increased levels of IBA was found to have dropping off effect in inducing the number of roots per cutting. Cuttings treated with rootex powder also showed a significant increase in root number (3.60) as compared with control, however, it was less effective than other growth regulator treatments. These results are in conformity with the findings of Chauhan and Reddy (1974) in plum, wherein IBA (1000 ppm) induced maximum number of roots per cutting, and Bharmal *et al.* (2005), wherein highest root number per cutting was produced by IBA treatments compared to NAA and control. The exogenous application of auxins might have supplemented endogenous auxin levels and brought about certain anatomical and physiological changes that resulted in increase in numerical strength of primary roots.

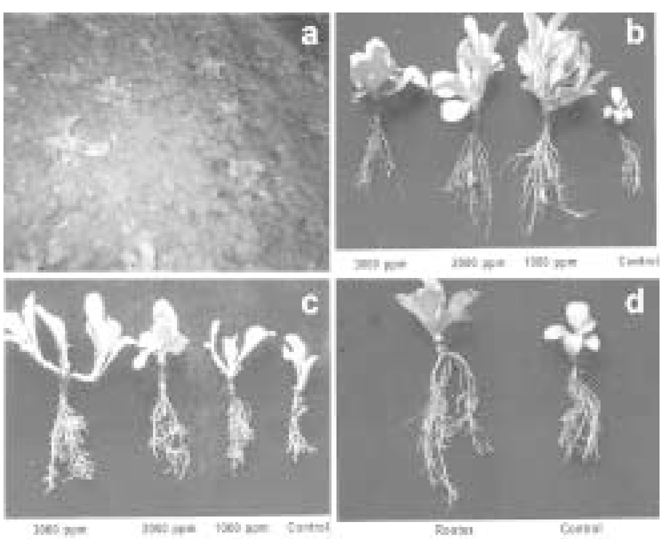

Fig. 3. Plantlets of *Picrorhiza currooa* transplanted in field after a period of 60 days in trays (a), rooting performance with different conc. of IBA (b), NAA (c) and rootex (d).

Longest length of primary root per cutting (8.50 cm) was obtained with IBA 1000 ppm while increase in IBA concentration to 2000 to 3000 ppm reduced root length to 6.30 cm and 5.60 cm, respectively. On the other hand, increasing levels of NAA brought about encouraging effect on this trait and produced 4.40, 5.0 and 5.8 cm roots with 1000, 2000 and 3000 ppm, respectively. However, rootex treatment could not exert any significant influence on length of primary roots and remained at par (3.60 cm) with control (3.30 cm). These findings get support from results of Thimmappa and Bhattacharjee (1990), in scented geranium. IBA performed better, since it is more stable auxin. It is well known that auxins (naturally occurring or exogenously applied) are a requirement for initiation of adventitious roots or stems. It appears that the success of IBA may be due to its slow activity and its slow degradation by auxin destroying enzyme (IAA-oxidase). IBA is quite a strong auxin while NAA and IAA are readily destroyed. Higher IBA levels (2000 and 3000 ppm), resulted in reduced root elongation. This may be credited to the auxin induced ethylene production, which further prevents auxin transport. There are a number of studies indicating that auxins have a promotive effect or an inhibitory effect on root elongation, at higher concentrations (Hartmann *et al.* 2002). IBA may enhance rooting via increased internal free IBA or may synergistically modify the action of IAA or endogenous synthesis of IAA. IBA can also enhance tissue sensitivity for IAA and increase rooting (Vander *et al.* 1993). Also, IBA may rapidly metabolise to form IBA conjugates which are reported to be superior to free IBA in serving as an auxin source during later stage of rooting (Wiesman *et al.* 1989).

It is evident from the data that all the treatments showed significant impact on field survival of rooted cuttings and it is interesting to note that unlike other attributes field survival increased (62.20% < 66.10% < 70.50%) with increasing levels of IBA from 1000 to 3000 ppm (Fig. 4). NAA also boosted the field survival per cent which become more obvious with elevated levels from 1000 to 3000 ppm (50.06% < 53.20% < 59.30%). Field survival under rootex treatments was recorded as 46.76% which was significantly higher than 42.75% survival in control. Similar results have also been reported in *Glycyrrhia glabra* Linn (Masoodi *et al*. 1994). Better survival may be a result of better growth and root production, which helped cuttings to absorb more nutrients and moisture from rooting medium and resulted in better growth than other treatments, which inturn increased their survival.

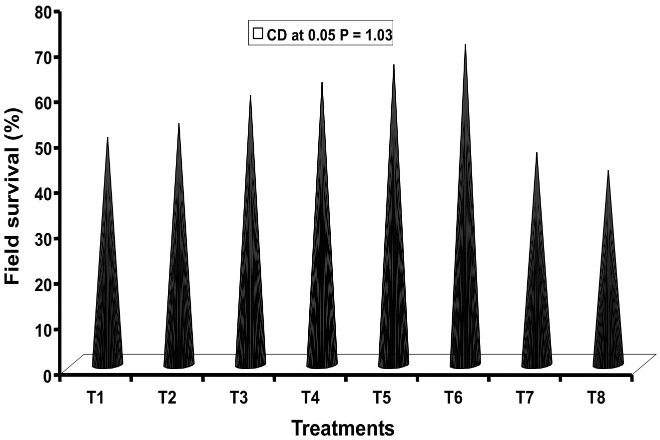

Fig. 4. Effect of growth regulators on field survival in rhizome cuttings of *Picirhiza kurrooa* Royle ex Benth. Details of treatment (T1-T8) are same given in table 1.

Thus, it can be convincingly stated that the propagation of *Picrorhiza kurrooa* can successfully be done by a quick dipping of rhizome cuttings in IBA 1000 ppm which not only resulted in a better rooting and shoot growth but also ensured an improved survival of rooted cuttings under field.

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