INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
VOLUME-2, ISSUE-2 APRIL-JUNE-2012 ISSN 2231-4490

Coden : IJPAES www.ijpaes.com

Received: 09th Mar-2012 *Revised: 16th Mar-2012* *Accepted: 21st Mar-2012*

Research Article

ROOTING IN *HIBISCUS ROSA*- SINENSIS (YELLOW DOUBLE HYBRID') BY INDOLE BUTYRIC ACID AND ROOTING SUBSTRATES

Ali Mohammadi Torkashvand[a] and Vahid Shadparvar [b*]

[a]Department of Horticulture, Rasht Branch, Islamic Azad Univercity, Rasht, Iran
[b]Young Researchers Club, Bandar Anzali Branch, Islamic Azad Univercity, Bandar Anzali, Iran
*Corresponding Author, email: Shadparvar@gmail.com

ABSTRACT: Hibiscus belongs to Malvaceae family. Conventionally, it is cultivated by stem cutting. for study on effect of IBA and different Substrates on *Hibiscus rosa- sinensis*, a factorial experiment arranged based on RCB design with two factors: 1. four levels of Indole Butyric Acid (IBA) (0, 1000, 2000 and 4000 mg l^{-1}) and 2- four substrates as growth media (Sand, Coco peat, Sand-perlit and peat-perlit) in three replications. Root diameter, root length, root number, rooting, green cuttings, number of buds, root beginning and callus induction. Results showed that the effect of Indole Butyric Acid and substrates were significant on all of traits ($p \leq 0.01$ and 0.05) and interaction effects of IBA and substrates were significant on root length, root number, rooting, number of buds, root beginning and callus induction. The highest root diameter (2.13 mm), the highest number of root (4.33) but the highest buds numbers obtain in sand-perlit substrate and same concentration of 4000mg l^{-1} IBA and peat-perlit substrate. The lowest root beginning (45 days) and the lowest callus induction (28 days) were observed in same concentration of IBA and peat-perlit substrate.
Key words: *Hibiscus rosa-sinensis*, IBA, Rooting Substrates, Rooting,

INTRODUCTION

Hibiscus rosa- sinensis belongs to Malvaceae family. Conventionally, it is cultivated by stem cutting. This plant is native to tropical and southeastern Asia (China). this plant is commonly found throughout the tropics and as a house plant throughout the world. Most ornamental varieties are hybrids [3]. This plant useful in landscape with medium-textured.the characteristic of this plant are glossy dark green leaves with 4-6 inch wide and up to 8 inch long, showy flowers that produced throughout the year and grows up to 7-12 feet [6, 7].this plant have medicinal and industrial application and has a resistance to fungal pathogens [12].

Specific concentrations of IBA are required to start production in rooting cutting of plant. There are many differences between plant species and cultivars in rooting potential of cuttings and it is very difficult to forecast easy and hard to rooting of cuttings in the plants. Bhatt and Tomar (2010) examined different levels of IBA (viz., 500, 1000, 1500 ppm) on rooting of Citrus auriantifolia Swingle (Kagzi-lime). They found that treatment of 500 ppm IBA performed the best in all aspects, as root formation, length of root, thickening of root and leaf sprouting in shoot [2]. Owais (2010) examined different levels of IBA (3000, 6000, 9000, 12000 ppm) and quick dip (10 sec) on five Jordanian pomegranate varieties. He concluded that increasing dose of IBA can be useful in increasing rooting potential and other root characteristics [11]. Kumari et al (2010) with effect of IBA on rooting in Cuttings of *Jatropha Curcus* L Strain DARL-2 found that applied of IBA is useful for improved rooting for vegetative propagation of Jatropha [9].The results of Sulusoglu and Cavusoglu showed that maximum rooting rates were obtained with 2 or 4 g/l IBA for most of the types of cherry. 1 or 2 g/l IBA obtained the maximum root length and increased the rooting length and root quality in compared with control. The average number of roots increased in 2 g/l IBA [15]. Pandey et al. (2001), [13] examined the effects of auxins including ABA and NAA on root of cuttings of *Ginkgo biloba* L. they found that the treatment of IBA have morphologically healthy in terms of their shoot height, diameter of shoot, number of nodes per cutting, number of leaves/node and number of branches per cutting than the control plants and this treatment improve the subsequent growth and survival rate of the plantlets of G. biloba [13].

Most varieties of Hibiscus are easy to root, but variety of *Hibiscus rosa- sinensis* 'yellow double hybrid' is hard to root. Rooting of cuttings is an active process and the root formation of cutting differentiates for every cutting. The rooting rate and root quality of cuttings changes pay attention to type of plant. Therefore, studying for achieve methods and skills such as the use of hormones and Co-factors of rooting of cuttings, control of environmental conditions, select the appropriate planting media and etc for increase rooting of cuttings in these variety are necessary. The results of this study cause to speed, quality and production performance. Consequently, it has greater economic efficiency for producers and more satisfaction for consumer.

MATERIALS AND METHODS

Hardwood dormant cuttings of *Hibiscus rosa-* sinensis 'yellow double hybrid' were prepared from vigorous shoots of this plant.All sizes of cuttings were 12-10 cm and they had 8-6 buds. After sterile and hormonal treatment (quick dip, 5 seconds), cuttings planted in the depth of 3 cm on different rooting substrates. Environment temperature of cuttings in the greenhouse was 24- 27 °C and substrates temperature was usually 24-22 °C. Light intensity in the environment of cuttings was 5000 luxe. Greenhouse and environment humidity was maintained in the range of 95-85 percent.

Growth medium was sand and coco peat that usually are used for rooting of semi hardwood and hardwood cuttings in the greenhouses in north of Iran. Three concentrations of IBA hormone (1000, 2000, 4000 mg l^{-1}) with control (without ABA) and four rooting substrates (Sand, Coco peat, Sand-perlit and peat-perlit) were used in this experiment. This experiment including 16 treatments, each of treatment in three replicates, each replication consisted of five cuttings and totally, 48 experimental units.

At the end of experiment, traits such as root diameter, root length, number of root, percentage of rooting, percentage of green cuttings, number of buds, root beginning, callus induction were investigated. All cuttings were excluded from medium at the end of experiment after (70 days) and sampling was completed. Variance analysis of data was carried out and from Least Significant Difference was used in the comparison of mean data at 5% and 1% probability level.

RESULTS AND DISCUSSION

The overall results of the effects of IBA and different substrates on root diameter, root length, root number, rooting, green cuttings, number of buds, root beginning and callus induction are summarized in Table 2. Based on analysis of variance (Table 1), the effect of IBA and different substrates on the root diameter, also the interaction effect of IBA and different substrates on the root diameter was significant at 0.05 level of probability. Both IBA concentrations and different substrates significantly affected root number ($p<0.05$). Cuttings in coco peat-perlite substrate and 4000 mg l^{-1} IBA had highest root number. IBA treated cuttings gave highest roots than control cuttings in all substrate types (Table 2). Rooting substrates and IBA concentrations statistically affected number of buds per cuttings (Table 1 and 2). More personage of rooting were produced by cuttings in coco peat-perlite than the other Rooting substrates ($p<0.05$). All IBA treated cuttings gave more percentage green cutting than the controls ($p<0.05$). 4000 ppm IBA has the best treatment in root beginning and callus induction for all of substrates (Table 2). There were differences between rooting substrates and IBA concentrations in root diameter, but this different is not significant (Table 1 and 2).

Table 1: Analysis of variance of different concentrations of IBA and different Substrates on evaluated traits.

S.O.V	df	MS							
		Root Diameter	Root Length	Root Number	Rooting	Green Cuttings	Number Of Buds	Root Beginning	Callus Induction
IBA (I)	3	6.57*	18.16*	19.13*	5230.55*	6075*	8.11*	777.24*	976.58**
Substrate (S)	3	1.27*	8.85*	6.13*	1875*	2252.77*	2.5**	452.41*	613.25*
I × S	9	0.209ns	1.51*	0.97*	341.66*	67.59ns	0.09*	43.03*	28.19**
Error	30	0.21	0.419	0.77	206.11	262.77	0.394	17.52	45.31

**: significant level at 1%
*: significant level at 5%
ns: no significant

Table 2. Mean comparison of different concentrations of IBA and different Substrates on evaluated traits.

	Root diameter (mm)	Root length (mm)	Number of root	Rooting (%)	Green cuttings (%)	Number of buds	Root Beginning (days)	Callus induction (days)
I_1 (0 mg l^{-1})	00.08 c	0.11 c	0.17 c	01.67 c	23.33 c	00.42 b	71.67 a	57.08 a
I_2 (1000 mg l^{-1})	00.98 b	1.35 b	1.42 b	18.33 b	38.33 b	00.92 b	67.83 b	49.50 b
I_3 (2000 mg l^{-1})	01.74 a	2.61 a	2.83 a	45.00 a	68.33 a	01.75 a	58 c	39 c
I_4 (4000 mg l^{-1})	01.54 a	2.73 a	2.75 a	43.33 a	68.33 a	02.25 a	54.58 c	38.25 c
S_1 (sand)	00.68 c	0.87 c	0.92 c	13.33 b	35.00 b	00.83 c	68.92 a	54 a
S_2 (Sand-Perlite)	1.00 bc	1.28 c	1.75 b	20.00 b	41.67 b	1.17 bc	66.25 a	49.08 a
S_3 (Coco peat)	1.22 ab	1.83 b	1.83 b	35.00 a	56.67 a	1.42 ab	62.08 b	43.25 b
S_4(Coco peat- perlite)	1.45 a	2.82 a	2.67 a	40.00 a	65.00 a	01.92 a	58.83 c	37.50 c
I_1S_1	0.00 a	0.00 g	0 e	0 d	13.33 a	0 f	75 a	64 a
I_1S_2	0.00 a	0.00 g	0 e	0 d	20 a	0.33 ef	71.67 ab	60.33 ab
I_1S_3	0.35 a	0.45 g	0.67 e	6.67 cd	26.67 a	0.33 ef	71.67 ab	54 abc
I_1S_4	0.35 a	0.47 g	0.67 e	6.67 cd	25.00 a	022 ef	70.65 ab	54 abc
I_2S_1	0.10 a	1 fg	1.1 de	8.7 cd	26.01 a	060 ef	70.65 ab	51 bcd
I_2S_2	1.03 a	1.27 def	1.67 cde	13.33 cd	26.67 a	0.66 ef	70.33 abc	50 bcd
I_2S_3	0.99 a	1.23 def	1.33 cde	20 cd	55.33 a	1 cdef	69.33 abc	49 bcd
I_2S_4	1.57 a	2.45 cde	2.33 c	26.67 cd	55.33 a	1.67 abcd	60 d	43 cde
I_3S_1	1.50 a	1.95 cdf	2 cd	20 cd	55.33 a	1.33 bcde	64 bcd	45 cd
I_3S_2	1.76 a	1.99 cdf	2.67 bc	33.33 cd	60 a	1.67 abcd	63 cd	43 cde
I_3S_3	1.77 a	2.54 cd	2.67 bc	60 a	73.33 a	1.67 abcd	59 d	39 def
I_3S_4	2.09 a	3.98 ab	4 ba	66.67 a	86.67 a	2.33 ab	46 e	29 f
I_4S_1	0.88 a	1.06 fgh	1.33 cde	20 cd	53.33 a	1.67 abcd	65 bcd	51 bcd
I_4S_2	1.38 a	3.87 def	2.67 bc	33.33 bc	60 a	2 abc	60 d	43 cde
I_4S_3	1.76 a	3.13 bc	2.67 bc	55.33 ab	73.33 a	2.67 a	48.33 e	31 ef
I_4S_4	2.13 a	4.87 a	4.33 a	66.67 a	86.67 a	2.67 a	45 e	28 f

* Values in each row followed by the same letter are not significantly different by LSD

The results obtained in this study indicated that root length, root number, rooting, number of buds, root beginning and callus induction were significantly affected by rooting substrates and IBA concentrations. Auxins plays main role in the process of root formation. For successful rootting induction, plants should be contained a certain quantity of IBA [15]. According to results, callus induction days and start rooting decreased with increase in IBA concentrations in all rooting substrates. Similar results have been reported by Kumari et al. (2010). They believed that auxins can control cell enlargement, bud formation and root initiation and also promote the production of other hormones [9].

Habibi Kotenaei (2010) reported that the increase of auxin concentrations tend to increase in oleander plant rooting (*Nerium oleander* L.) and subsequent increase in IBA decreased plant rooting. This result was also obtained in all rooting substrates. In all rooting substrates, with increasing concentrations of IBA, root length increased. About root length our results in sand substrates are similar with results of Habibi Kotenaei (2010), but in other substrates can be observed difference between these results. The increase in length of cuttings and increase in diameter seemed to be due to the use dry matter for the shoot growth that auxinmakes it [4]. Kesari et al. (2010) investigative effect of auxin on rooting of *Pongamia pinnata* and concluded that auxin concentrations affects the beginning rooting, umber of roots and length of roots. The application of IBA may have an indirect influence by enhancing the speed of transformation and movement of sugar to the base of cuttings and consequently rooting. Obtained Results had a conforming to the results of Pandey et al. (2011). Govinde- Soulange et al. (2009) reported that IBA increased the number of root in every cutting, but it decreased root number at the higher amounts. They concluded that IBA has a positive effect on the cutting number of *H. sabdariffa*, significantly. At present study, IBA had the same effect on root number.

Akinyele (2010) concluded that auxine and substrate are effective on characteristics such as root length, number of root, percentage of survivability of plants [1]. In plant roots, auxin is critical for patterning and morphogenesis. It regulates cell elongation and division, the development and maintenance of root apical and other processes [10]. In an experiment, increase concentration in IBA increased the root length, number of root, root fresh weight and root dry weight in cuttings that seems to be due to the effect of this regulator on stimulation of rooting [14]. Bhatt and Tomar (2010) believe that with increased auxin levels, root diameter also increased. This phenomenon might be attributed due to greater metabolic activity and maximum utilization of sugar and starch after hydrolysis from stem [2].

CONCLUSION AND RECOMMENDATION

This research showed that the choosing an appropriate concentration of IBA and rooting substrates was effective on balanced increasing of rooting traits by 4000 mg l^{-1} IBA and Coco peat- perlite substrate. Increasing IBA levels caused to decrease in root beginning and callus induction. The best treatment for this study is I_4S_4 (with 4000 mg l^{-1} IBA and Coco peat- perlite substrate)

REFERENCES

[1] Akinyele AO. 2010. Effects of growth hormones, rooting media and leaf size on juvenile stem cuttings of Buchholzia coriacea Engler. Annals of Forest Research. 53(2): 127-133.

[2] Bhatt BB, Tomar YK. 2010. Effects of IBA on rooting performance of Citrus auriantifolia Swingle (Kagzi-lime) in different growing conditions. Nature and science, 8(7): 8-11.

[3] Das R. 2010. Conservation of medicinal plant Hibiscus rosa sinensis through allium fistulosum plantation. Der Pharmacia Sinica. 1(1): 166-172.

[4] Govinden-Soulange J, Boodia N, Dussooa C, Gunowa R, Deensah S, Facknath S, Rajkomar B. 2009. Vegetative propagation and tissue culture regeneration of Hibiscus sabdariffa L. (Roselle). World Journal of Agricultural Sciences, 5 (5): 651-661.

[5] Habibi Kotenaei Sh. 2010. Effect of auxin different concentrations on rooting of the semi-hardwood cutting in oleander plant. Journal on Plant Science Researches, 18(2): 36-46.

[6] Hindustan AA, Chitta SK, Kishore KRB, Ravindra B V, Sasidhar CGS, Abhilash C, Sagar NRV. 2010. Designing and evaluation of diclofenac sodium ustained release matrix tablets using Hibiscus rosa-Sinensis leaves mucilage. International Journal of Pharmaceutical Sciences Review and Research. 1(2): 29-31

[7] Hindustan AA, Chitta S K, Pilli Y, Sandhya R P, Chandra S A, and Sivaramakrishna GV. 2010. Fabrication and characterization of diclofenac sodium Hibiscus rosa-sinensis leaves mucilage sustained release matrix tablets. Der Pharmacia Lettre: 2 (1): 452-456.

[8] Kesari V, Das A, Rangan L. 2010. Effect of genotype and auxin treatments on rooting response in stem cuttings of CPTs of Pongamia pinnata a potential biodiesel legume crop. Current Science, 98 (9): 1234- 1237.

[9] Kumari M, Patade VY, Arif M, Ahmed Z. 2010. Effect of iba on seed germination, sprouting and rooting in cuttings for mass propagation of Jatropha Curcus L strain DARL-2. INSInet Publication. Research Journal of Agriculture and Biological Sciences. 6(6): 691-696.

[10] Mironova1 VV, Omelyanchuk1 NA, Yosiphon G, Fadeev SI, Kolchanov NA, Mjolsness E, Likhoshvai1 VA. 2010. A plausible mechanism for auxin patterning along the developing root. BMC Systems Biology, 4:98. 1-19.

[11] Owais SJ. 2010. Rooting Response of Five Pomegranate Varieties to Indole Butyric Acid Concentration and Cutting Age. Pakistan Journal of Biological Sciences, 13 (2): 51-58.

[12] Ozmen A. 2010. Cytotoxicity of Hibiscus rosa sinensis flower extract. Caryologia, 63 (2): 157-161.

[13] Pandey A, Tamta S, Giri D. 2011. Role of auxin on adventitious root formation and subsequent growth of cutting raised plantlets of Ginkgo biloba L. Internationals Journal of Biodiversity and Conservation Vol. 3(4): 142-146.

[14] Rahdari P, Mohana M, Asadi M. 2010. The effect of zinc sulphate on the naa and iba hormones on rooting of semi-hardwood cuttings of Aralia Elegantissima. Journal of Sciences and Techniques in Natural Resources. 5(1):95-103.

[15] Sulusoglu M, Cavusoglu A. 2010. Vegetative propagation of Cherry laurel (Prunus laurocerasus L.) using semi-hardwood cuttings. African Journal of Agricultural Research. 5(23): 3196-3202.