

Effect of wounding and different concentrations of indole butyric acid (IBA) on rooting of hard wood cuttings of *Plumbago capensis* plant

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Abstract

This study was carried out in a greenhouse of Horticulture Department, Plant production school, Faculty of Agriculture and Forestry / Duhok University from 15th Feb. to 1st June 2008. It aims the study to investigate the effect of wounding and indole butyric acid (IBA) concentrations (0, 500, 1000, 1500 and 2000 mg l⁻¹) on rooting ability of hard wood cuttings of *Plumbago capensis* plant. The results indicated that rooting percentage significantly increased by wounding the cuttings 60.79% as compared with unwounded cuttings 45.84% and farther more enhanced good of roots and vegetative growth characters. And best results of rooting and vegetative growth characters were obtained when cuttings treated with 1500 and 2000 mg l⁻¹ of IBA. While the interaction treatments between wounded cuttings and 1500 and 2000 mg l⁻¹ of IBA improved all characteristics of roots and shoots under the study.

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تأثير التجريح وتركيز مختلفة من حامض الاندول بيوتيريك (IBA) في تجذير العقل الخشبية لنبات الياسمين الماوي *Plumbago capensis*

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الكلمات الدالة : الخلاصة

أجريت الدراسة للفترة من 15 شباط لغاية 1 حزيران 2008 في البيت الزجاجي التابع لقسم البستنة، سكول الانتاج النباتي، فاكولتية الزراعة والغابات/ جامعة دهوك. تضمنت دراسة تأثير التجريح (تجريح وبدون تجريح) وتركيز مختلفة من حامض الاندول بيوتيريك IBA وهي (0 ، 500 ، 1000 ، 1500 و 2000 ملغم / لتر) في تجذير العقل الخشبية لنبات الياسمين الماوي *Plumbago capensis*. تشير أهم النتائج الى ان تجريح قواعد العقل أدت الى حصول زيادة معنوية لنسبة تجذير العقل (60.79 %) مقارنة مع العقل بدون تجريح (45.84 %) وقد حسن من صفات النمو الجذري والخضري، وأدى استعمال IBA وبالتركيزين (1500 و 2000 ملغم / لتر) الى احداث زيادة معنوية في القيم المتحصلة عليها للصفات المدروسة، وبالنسبة لمعاملات التداخل فقد أعطت معاملة العقل المجروحة بالتركيزين (1500 و 2000 ملغم / لتر) أفضل النتائج لتجذير العقل وكذلك لجميع صفات النمو الجذري والخضري.

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Introduction

Plumbago capensis plant belongs to Plumbaginaceae family is evergreen plant which grows as shrub, climber or semi-climber, which climbs to wrap for height more than 3-5 meter in old plants, the leaves are full egg prolonged; spoon shaped and narrow at the base, flowers are beautiful show on the terminal of branches in clusters of large dense; which appear from the late of spring until winter and gave plant attractive beauty, the flowers in this plant are like to Phlox flower with shiny blue (Al-Ba'aly, 1967). Pumbago plant uses for planting in the large pots or in ground at meadows aspects for climbing on balconies, props, vines, or on tall trees. They propagated by seeds and cuttings that taken from wooden branches is not promotable (Al-Ba'aly, 1967 and Sultan *et al.*, 1992).

Wounding is a tactics which encourage roots emergence not only in new shots, but also in old once. Sultan (1974) reported that the wounding of cutting bases for a number of ornamental plants accelerate rooting and increased the number of roots on cuttings as well as it increased the power of root cohesion with the cuttings. Pontikis (1979) commented on the wounding process of apple M27 stock cuttings which is a cut of sclerenchyma tissue for phloem and anatomically stimulated rooting of woody cuttings, which has a thick collar of sclerenchyma tissue.

On the other hand, Struve *et al.*, (1984) explained that treatment of some difficult rooting plants such as *Quercus occinen*, *Juglans nigra*, *Liriodendron tulipifera* with IBA before planting increased the number of new roots formation. Singh *et al.*, (1986 - A) showed that IBA at 1500 mg l⁻¹ concentration improved the rooting and plant growth in stem cuttings of *Citrus limettioides* plant. In the same direction, Sultan and Al-atraqchi (1993) showed that the use of IBA at concentration between (2000 - 3000 mg l⁻¹) significantly increased rooting percentage in *Jasminum sambac* soland cuttings as well as roots number. Also Anonymous (1999) noticed that cuttings of *Lagerstroemia indica* var. Acoma and Natchez rooted easily when treated with 1000-3000 mg.l⁻¹ IBA. Salih and Abdulrahman (2001) found that *Cotoneaster racemiflorous* cuttings gave the highest rooting percentage 57.95% when treated with IBA at 1000 mg.l⁻¹. While treated cuttings with 500 mg.l⁻¹ IBA gave the highest number of roots/cutting 8.22.

By wounding the terminal cuttings of *Cotoneaster prostrate* treated with a mixture of IBA and NAA at concentration 1000 mg.l⁻¹ for both by quick-dip method gave the best result for rooting percentage 100%, higher number of roots/cutting 12.08 – 23.05, in addition to enhancing vegetative growth (Al-Noaimy, 1999).

Accordingly, this study aims to determine the response of hard wood cuttings of *Plumbago* plant to wounding and different concentrations of IBA in terms of rooting improvement and also to find the best vegetative growth as response to the factors under this investigation.

Materials and methods

The study was carried out in greenhouse of Horticulture Department, School of plant production, Faculty of Agriculture and Forestry, Duhok University during 15 February to 1 June 2008. The hard wood cuttings of Pumbago plant were taken in 18/2/2008 from mother plants (8-10 years old) with a length of 15-20 cm containing 4-5 buds. The cuttings were divided into two groups. The bases of first group wounded longitudinally with the length of 2 cm; two opposite wounds for each cutting and the second left without wounding. The bases of cuttings were treated with five concentrations of IBA (0, 500, 1000, 1500 and 2000 mg l⁻¹) for 10 s. The cuttings were sterilized by Benomyl fungicide (2g l⁻¹) and then planted in pots with diameter 22.5 cm filled with sand and peat moss medium (1:1) which were washed 48 hours before planting to prevent fungal disease and sterilized by Radomil G-5% fungicide with a rate of 40 g/m². Pots were covered by porcelain with lifting for 1-2 hours a day for ventilation.

The cuttings were removed after 12 weeks of planting bed and the experimental measurements were recorded as following:

1. Rooting percentage (%).
2. Roots number/ cutting.
3. Length of the longest roots/ cutting (cm).
4. Dry weight of roots (g).
5. Number of shoots / cutting.
6. Length of the longest shoots (cm).
7. Leaves number / cutting.
8. Dry weight of vegetative growth (g).

The experiment was applied by using Randomized Complete Block Design (RCBD) with two factors in three replicates. Each replicate included 8 cuttings. The angular conversion for the results of rooting percentage then they have been analyzed statistically by using SAS

program, means values were compared by Duncan test at 0.05 level (SAS, 2001).

Results and Discussion

1. Effect of wounding

Data in Table (1) clear that the wounding of cutting bases significantly increased the rooting percentage (60.79%) as compared with non wounded

cuttings (45.84%), also the wounded cuttings significantly gave a high values of roots number, roots length, root dry weight, shoots number, shoots length, leaves number and shoots dry weight as compared with non wounded cuttings which gave the lowest values in all studied features.

Table (1). Effect of wounding on rooting and vegetative characteristics of hard wood cuttings of *Plumbago capensis* plant.

Treatments	Rooting percentage %	Roots numbers	roots Length (cm)	Root dry weight (g)	Shoots number	Shoots Length (cm)	Leaves number	Shoots dry weight (g)
Wounded cuttings	60.79	4.79	6.71	0.26	1.13	37.47	8.16	0.46
	a	a	a	a	a	a	a	a
Non wounded cuttings	45.84	2.98	4.66	0.17	0.65	34.07	5.98	0.34
	b	b	b	b	b	b	b	b

Notes: 1. Each number represents a mean of 3 replicates and 8 cuttings for each replicate.

2. Numbers carrying the same letter has no significant differences according to Duncan test under probability level of 0.05.

The results of this study obviously show that wounding the base of cuttings significantly led to obtaining the best results for rooting percentage 60.79% and also wounding resulted significantly increased in number, length and dry weight of roots per cutting and also improved the vegetative growth characters (shoots number, number of leaves, length of shoots and dry weight of vegetative growth) as compared with non wounded cuttings. The interpretation of these results can be attributed to that the plants have bundles of cells with thick walls to the outside of the roots formation region and those roots are not able to penetrate those bundles (Sultan, 1974 and Pontikis, 1979). Therefore, the wounding easily removes the obstacle that led to development of roots. Also, wounding may increase the absorb surface area to take externally added auxin by the base tissues of cuttings and starts up-taking auxin which increasing the division, thus encouraging the emergence adventitious root (Hartmman *et al.*, 2002 and Howard *et al.*, 1984).

The wounding stimulates cells division as response to wounded tissues, increased the permeability of oxygen to interior tissues in cuttings and increase the amount of water absorbed from the base of cuttings, in addition to increasing the amount of ethylene formation in the cutting bases and that stimulate the formation of roots (Hartmman *et al.*, 2002).

2. Effect of IBA concentrations

Table (2) showed that IBA had a significant effect on the rooting percentage; the highest percent obtained from cuttings treated with 1500 mg l⁻¹ (68.75 %) which significantly differs from the other concentrations in addition to highest number of roots (6.18), roots length 9.17 cm and shoots length (9.84 cm). While 1500 and 2000 mg l⁻¹ of IBA gave the best vegetative growth features of *Plumbago* cuttings in terms of shoots number (1.53 and 1.37), leaves number (49.33 and 47.33), dry weight of shoots (0.52 and 0.50 g) and also dry weight roots (0.30 and 0.27 g) respectively as compared with the other concentrations.

Table (2). Effect of IBA on rooting and vegetative characteristics of hard wood cuttings of *Plumbago capensis* plant.

IBA concentrations mg.l ⁻¹	Rooting percentage %	Roots numbers	roots Length (cm)	Roots dry weight (g)	Shoots number	Leaves number	Shoots Length (cm)	Shoots dry weight (g)
control	38.80 e	1.64 e	2.25 e	0.08 d	0.35 c	23.17 d	4.69 d	0.27 c
500	43.25 d	2.50 d	3.45 d	0.18 c	0.52 bc	27.17 c	4.96 d	0.31 c
1000	51.05 c	4.00 c	5.77 c	0.22 b	0.68 b	31.83 b	6.52 c	0.40 b
1500	68.75 a	6.18 a	9.17 a	0.30 a	1.53 a	49.33 a	9.84 a	0.52 a
2000	64.73 b	5.10 b	7.80 b	0.27 a	1.37 a	47.33 a	9.35 b	0.50 a

Notes: 1. Each number represents a mean of 3 replicates and 8 cuttings for each replicate.

2. Numbers carrying the same letter has no significant differences according to Duncan test under probability level of 0.05.

The effect of IBA can be explained to the light plants or cuttings content of the interior auxins that helpful for activating the cell division process, enlarging its size and formation of roots primordial, in addition to their indirect role in converting starch into carbohydrates process (Monlar and Lacroix 1972). In the same direction, Hartmann *et al.* (2002) reported that there are types of cuttings for some plants contain sufficient quantities of vehicles to help rooting, but lack the appropriate level of auxins. Therefore, adding auxins to these cuttings will improve rooting. Salih (1991) demonstrated that the root lengths at the use of certain concentrations of IBA increased as the auxins stimulated and regulated roots elongation by organizing the cell elongation process and by controlling the synthesis of specific types of RNA, which in turn bear the code synthesis of enzymes specific and the function of locking cell specialized to the process of elongation.

It can be concluded that 1500 and 2000 mg l⁻¹ concentrations of IBA significantly affected and were superior for giving the highest average dry weight of roots formed on the cuttings of plumbago plant. These results can be interpreted that the use of different concentrations of IBA caused increasing the number and length of roots; this increase leads to increase the efficiency of roots to absorb water and nutrients. On the other hand, the high concentrations of IBA significantly increased the rooting percentage (Table 1) which reduced the distance between rooted cuttings and eventually the effect of light was non-homogeneous and thus caused obvious differences in the growth of longitudinal. Moreover, under rooting conditions the auxins play an

important role in both division and elongation process of cells for branches and stems (Hopkins and Huner, 2004). The results also can attributed to the significant increases for the rate lengths of shoots and number of leaves by IBA concentrations, which reflect differences in the rates of vegetative growth and dry weight of cuttings, and this mean that the dry weight of vegetative growth associated in most cases with the number and length of shoots and leaves number of cutting.

3. Effect of interaction between wounding and IBA concentrations

The data in Table (3) for interaction treatments between wounding and IBA concentrations indicated that treatments of wounded cuttings with 1500 and 2000 mg l⁻¹ of IBA gave the best results of root percentage 77.73 and 73.70%, root dry weight 0.36 and 0.35 g , shoots number 1.90 and 1.80, shoots length 11.90 and 11.55 cm, leaves number 54.33 and 51.67 and shoot dry weight 0.61 and 0.58 gm respectively as compared with other interactions except numbers and length of roots characters which significantly superior when wounded cuttings treated with 1500 mg l⁻¹ of IBA alone from the other interactions. The minimum values of roots and shoots were recorded for interaction between non wounded cuttings and control treatment. These results can be interpreted as mentioned in the discussion of wounding and IBA concentrations separately.

Table (3). Effect of the interaction treatments between wounding and IBA on rooting and vegetative characteristics of hard wood cuttings of *Plumbago capensis* plant.

Wounding	IBA concentrations mg.l ⁻¹	Rooting percentage %	Roots numbers	Roots length (cm)	Roots dry weight (g)	Shoots number	Shoots Length (cm)	Leaves number	Shoots dry weight (g)
Wounded cuttings	control	42.00	2.25	2.57	0.09	0.47	5.19	25.33	0.29
		d	fg	fg	ef	d-f	e	de	cd
	500	51.03	3.45	4.13	0.23	0.67	5.14	26.33	0.34
		c	de	e	bc	cd	e	de	c
	1000	59.50	5.02	7.60	0.27	0.83	7.02	29.67	0.48
		b	bc	c	b	c	c	cd	b
	1500	77.73	7.38	10.40	0.36	1.90	11.90	54.33	0.61
		a	a	a	a	a	a	a	a
	2000	73.70	5.87	8.87	0.35	1.80	11.55	51.67	0.58
		a	b	b	a	a	a	a	a
	control	35.60	1.02	1.93	0.07	0.23	4.19	21.00	0.24
		e	h	g	f	f	f	e	d
Non wounded cuttings	500	35.47	1.54	2.77	0.12	0.37	4.78	28.00	0.26
		e	gh	f	e	ef	ef	d	d
	1000	42.60	3.00	3.93	0.17	0.53	6.01	34.00	0.32
		d	ef	e	d	de	d	c	c
	1500	59.77	4.98	7.93	0.23	1.17	7.79	44.33	0.43
		b	bc	c	bc	b	b	b	b
	2000	55.77	4.34	6.73	0.19	0.93	7.14	43.00	0.43
		bc	cd	d	cd	bc	c	b	b

Notes: 1. Each number represents a mean of 3 replicates and 8 cuttings for each replicate.

2. Numbers carrying the same letter has no significant differences according to Duncan test under probability level of 0.05.

References

- Al-Ba'aly, S.A. (1967). The gardens. The printing press of local administration. Baghdad, Iraq. (in Arabic).
- Al-Noaimy, G. Y. Q. (1999). Study on propagation of *Cotoneaster prostrata* shrubs by terminal cuttings M.Sc. Thesis, College of Agriculture and Forestry, Mosul University. (In Arabic)
- Anonymous (1999). *Lagerstroemia* 'Acoma' and 'Natchez'. U. S. National Arboretum Plant Introduction. Floral and Nursery Plant Research Unit. www.ars-grin.gov
- Hartmann, H. T., D. E. Kester, F. T. Davis, Jr., and R. L. Geneve (2002). Plant Propagation: Principles and Practices. 7th ed. Prentice Hall, Upper Saddle River, N.J.
- Hopkins, W. G. and N. P. A. Huner (2004). Plant Physiology 3rd Edition, John Wiley and Sons, Inc., USA.
- Howard, B. H.; T. J. Banko and D. C. Milbocker (1984). Rooting response of Jojoba cuttings to stem wounding, nodal propagation and IBA treatment. The plant propagator 30 (4): 12-14.
- Monlar, J. M. and L. J. Lacroix (1972). Studies of the rooting of cuttings of *Hydrangea macrophylla*: enzyme change. Canadian J. of botany Vol. 50. 315-322.
- Mukherjee, T. P.; T. Roy and T. K. Bose (1976). Standarization of propagation from cutting under mist. II-Effect of rooting media on root formation in cutting of ornamental plants. Punjab Hort. Jour., 16 (3/4): 153-156.
- Pontikis, C. A.; K. A. D. Mackenzie and B. H. Howard (1979). Establishment of initially unrooted stool shoots of M. 27 apple root stock. Journal of Horticultural science. 54(1): 79-85.
- Salih, M. M. S. (1991). Physiology of plant growth regulators. Ministry of Higher Education and Scientific Research, University of Salahuddin.
- Salih, M. M. S. and Y. A. Abdulrahman (2001). Effect of planting media and concentrations of indole butyric acid (IBA) on rooting hardwood cuttings of *Cotoneaster racemiflorous*. J. Duhok Univ., 4(2): 86-92. (In Arabic)
- SAS. (2001). Statistical Analysis System. SAS Institute Inc., Cary, Nc. USA.
- Singh, A. R.; N. C. Pande and A. K. Pandey (1986). Studies on the regeneration of *citrus limettioides* Tanak by stem cuttings with the aid of IBA and NAA. Haryana Jour. of Hort. Sci., 15 (1/2): 25-28. (plant growth regulator abstract, 1987, 13 (8) Abst. 1458).
- Struve, D.K.; R.D. Kelly and B. C. Moser (1984). Promotion of root regeneration in difficult-to-transplant species. Comb. Proc. Intern. Plant propagators soc., (33): 433-434. (plant growth regulator abstract, 1985, 11(7) Abst. 793).
- Sultan, S. M. (1974). Studies on vegetative propagation of some nursery stocks. Ph. D. Thesis, Wye college. Univ. of London.
- Sultan, S. M.; T. M. Chalabi and M. D. Al-Sawaf (1992). The ornamental plants. Ministry of Higher Education and Scientific Research, University of Mosul.
- Sultan, S. M. and A. O. Atrachchi (1993). Vegetative propagation of *Jasminum sambac* shrubs by stem cutting. Journal of Mesopotamia Agriculture. vol. 25 (4): 45-51.