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Effect of wounding and growing media on rooting of Barberry shrub (*Berberis* vulgaris) hard wood cuttings

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Abstract

The experiment was conducted in the plastic house of the Horticulture Department Nursery/Technical College of Akre / Duhok Polytechnic University, during the period from 20 February to 1 July 2018. This experiment include a study of the effect wounding (wounding and without wounding) and different growing media (sand + peatmoss (1:1), loam + peat moss (1:1) and alone peat moss) in the rooting of Barberry shrubs (*Berberis* vulgaris) hard wood cuttings. The factorial experiment conducted by using Randomized Complete Block Design (RCBD) with three blocks and 10 cuttings for each treatment. The important results indicated the following: although the wounding of cuttings had no significant increase in the rooting percentage (51.11%), while significantly increase roots, shoots and leaves number/cutting, and dry weight of roots and vegetative growth. And the best results of rooting percentage (56.67%), root length, shoots length and dry weight of shoots characters obtained when cuttings planted in medium consist of loam and peat moss while the other characters was best when planted in sand with peat moss and in alone peat moss media. For the dual interaction noticed that the non-wounded cuttings which planted in loam with peat moss medium gave the highest rooting percentage 60.00% while the planting of wounded cuttings in mixed of sand or loam with peat moss medium significantly improve all of the studied characters.

Key world: wounding, growing media, Barberry (Berberis vulgaris) hard wood cuttings.

تأثير التجريح واوساط اكثار في تجذير العقل الخشبية لنبات البربريس *Berberis* vulgaris

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الخلاصة

اجريت التجربة في البيت البلاستكي التابع الى مشتل قسم البستنة /كلية عقرة التقنية / جامعة دهوك التقنية، للفترة من 20 شباط ولغاية 1 تموز 2018 وتضمنت التجربة دراسة تأثير التجريح (تجريح وبدون تجريح) واوساط اكثار مختلفة (رمل بناء + بيتموس (1:1) حجما ، زميج نهري + بيتموس (1:1) حجما و بيتموس لوحده) في تجذير العقل الخشبية لنبات شجيرة البربريس ***Berberis vulgaris*** واستخدم في تنفيذ التجربة تصميم القطاعات العشوائية الكاملة (RCBD) وبثلاث قطاعات (مكررات) وكل مكرر تحوي 10 عقل ، واهم النتائج كانت كالاتي: ادت معاملة التجريح الى احداث زيادةغير معنوية في نسبة التجذير(51.11%) مقارنة بتلك غير المجرحة بينما ادى الى احداث تحسين معنوي في عدد الجذور والاوراق والافرع / عقلة واوزن الجاف للجذور والمجموع الخضري. وان افضل النتائج لصفات نسبة التجذير (56.67%) ، طول الجذور، طول النموات الخضرية والوزن الجاف للنمو الخضري كانت عند الزراعة في الوسط المكون من الزميج نهري والبيتموس بينما بقية الصفات كانت جيدة عند الزراعة في الوسط المكون من رمل بناء وبيتموس او البتموس لوحده. اما بالنسبة للتداخل الثنائي لوحظ بانه عند عدم تجريح العقل وزراعته في الوسط المكون من الزميج والبيتموس اعطى اعلى نسبة للتجذير (60.00%) بينما بقية الصفات كانت افضل عند زراعة العقل المجرحة في الوسط المكون من رمل البناء او الزميج النهري مخلوطا مع البيتموس.

Introduction

Barberry *(Berberis vulgaris*) (family Berberidaceae) is deciduous shrubs, winter-hardy with 1–5 m tall, found throughout temperate and subtropical regions of the world, native to central and southern Europe, northwest Africa and western Asia. It grows in a variety of soil, though is primarily cultivated in cooler regions. They are often planted in gardens and used as hedges (Harden, 2000; Tomżyńska and Muras, 2006 and Arayne, *et al.*, 2007). The fruit rich in vitamin C. Barberry is mainly used as a food is cooked with rice (seedless or red), also referred to as black barberry and wild barberry, are used mainly for juice extraction in food industries and as medication (Ardestani *et al*., 2013 and Rahimi-Madiseh *et al.*, 2016).

The wounding as a process encouraging roots emergence is not new, but that many of the old reports had touched it, he found that the emergence of adventitious roots on the stem cutting can be stimulated by wound of cuttings, in many of evergreen ornamental trees and shrubs and some fruit trees. In general, the wounding conducted for several reasons, including speediest of rooting, increase the average number of adventitious roots on cuttings, increased power of communication the roots with cuttings (Well, 1962). Sultan (1974) minted that the wounding of cutting bases for a number of ornamental plants accelerate rooting and increase the number of roots on cuttings as well as it increases the power of root cohesion with the cuttings. Pontikis *et al.* (1979) commented on the wounding process of apple M27stock cutting which is a cut of sclerenchyma tissue for phloem, and anatomically stimulates rooting of woody cuttings, which has a thick collar of sclerenchyma. Al- Al-Atrakchii and Saleh (2008) found that wounding the base of *Gardenia thunbergia* L.F. cuttings resulted in increasing rooting percentage 51.11 %, number of roots 3.44, length of root 8.12 cm, number of shoots 1.71 and length of shoots 1.10 cm in comparison with non-wounded cuttings which provided 39.99 %, 1.99, 3.43 cm, 1.01 and 0.60 cm respectively.

Growing media is an important factor in plant propagation; the selection and preparation of the medium is extremely important in terms of plant growth and quality because rooting performance depends on the type of medium used in propagation (Raviv, 2011). This is especially important in our country where the different growth media used in the developed countries are not available, accessible and affordable hence most of the peasant gardeners still use, tops and mainly for their planting operations though it is bulky and heavy, very inconsistent in quality and environmentally unfriendly. It is necessary to find many media consisted of a number of components in order to achieve this purpose. It can be said that sand, loam, and peat moss are the basic components of the special medium of seed planting (Salman, 1988). Tawajin (1987) said that adding organic manures to the growth medium leads to improving the plant growth and that using clay or silt in the growth medium will limit the growth unless large amounts of organic materials, for about half of the size of the medium or even more, are added to it. Pontton *et a*l (1990) concluded that the use peat moss medium is more appropriate for the growth of *Nephrolepis exaltata* and the best growth of roots is when the brown peat moss is used. Singh *et al* (2002) found that there are no significant differences in plant height of some pots plants when planted in four different planting media (sand, sand and peat moss (1:1), peat moss and fermented leaves (1:1), and alone peat moss) but the plants planted in alone peat moss or in the mixture of peat moss and fermented leaves giving the highest number of stems, branches and roots. (Hartmann *et al*., 2002) refers that the cuttings of many plants is easily rooted in many types of growing media, but the difficult or hard rooting of cuttings influenced by certain type of medium.

This research aimed to determine the effect of wounding on the rooting and identify the best medium for propagation of Barberry shrubs (*Berberis* vulgaris) hard wood cuttings to obtain the best percentage of rooting and the highest quality of the roots and vegetative growth.

Material and methods

The experiment was conducted from 20 February to 1 July 2018, in the plastic house of the Horticulture Department / Technical College Akre / Dohuk polytechnic University. The cuttings taken from mother plants of Barberry shrub (*Berberis vulgaris*) with age 8 -10 years that

grown in gardens of agriculture college– Duhok university- summel, and have a length of 15-20 cm contains 4-5 buds, the hard wood cuttings were divided in to two groups, the first group was wounded longitudinal 2 cm at the base while the second group was left without wounding then cultured in pots with diameter 22.5 cm filled with three different growing media (sand + peat moss (1:1), loam + peat moss (1:1) as equal volume and alone peat moss). The cuttings and media were sterilized by Benomyl fungicide (2 g L^{-1}). The cuttings removed after 12 weeks of planting in 20 may 2019 for recorded the experimental measurements (parameters) which include:

1- Rooting percentage (%).
2- Roots number per cutting.
3- Length of the longest roots (cm).
4- Dry weight of roots (g).
5- Shoots numbers per cutting.
6- Leaves number per cutting.
7- Length of the longest shoots (cm).
8- Dry weight of shoots (g).

The experiment was applied by using Randomized Complete Block Design (RCBD) with two factors in three blocks. Each one included 3 pots planted with 10 cuttings. The results analyzed statistically by using SAS program, Means comparison was done by Duncan's Multiple Ranges Test under 5% (SAS, 2006).

Results and Discussions

1- Rooting percentage (%).

It is appeared from the data in Table (1) that the wounding of cuttings bases led to no significant increase in the rooting percentage 51.11% as compared with un-wounded cuttings 46.67%, the root percentage differed with vary growing media, the significant higher rooting percentage were 56.67 and 53.33 % when cuttings planted in medium consist of loam and peat moss and alone peat moss respectively, while the lowest values was 36.67 % when planted in sand mixed with peat moss, the data of interaction between wounding and media indicated that the wounded cuttings which planted in loam with peat moss gives significant higher values of rooting percentage 60.00 % only as compared with some other interactions.

Table 1: Effect of wounding and growing media on rooting percentage (%) of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	40.00 ab	60.00 a	53.33 ab	51.11 a
wounding	33.33 b	53.33 ab	53.33 ab	46.67 a
Wounding mean	36.67 b	56.67 a	53.33 a	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

2- Roots number per cutting.

The data in Table (2) show that wounding cuttings gave the significant largest number of root / cutting 4.79, while the lowest number was 3.06 roots / cutting for the non-wounded cuttings. The growing cuttings in media consist of sand and peat moss led to a significant increase in the average number of roots formed on the cuttings 4.83 roots / cutting compared to when growing in alone peat moss and mixed with loam 3.00 and 3.93 roots respectively. As for interaction between wounding and media, wounded cuttings and growing in media consist of

sand and peat moss gave higher significant values of roots / cuttings 6.33 roots, but these values decreased to 2.67 roots for non-wounded cuttings planted in alone peat moss medium.

Table 2: Effect of wounding and growing media on roots number per cutting of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	3.33 c	3.17 c	2.67 c	3.06 b
wounding	6.33 a	4.70 b	3.33 c	4.79 a
Wounding mean	4.83 a	3.93 b	3.00 c	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

3- Length of the longest roots (cm).

The data in the Table (3) refers that wounding no had significant effect on the root length of barberries shrub cuttings; the wounded cuttings gives highest long of roots 12.20 cm which as compared with un-wounded cuttings 11.33 cm. The cuttings planted in medium consist of loam and peat moss gives a significant high length of roots 15.37 cm. The interaction between wounded cuttings and medium consist of loam and peat moss gave the significant highest length of roots 16.03 cm.

Table 3: Effect of wounding and growing media on length of longest roots (cm) of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	7.37 c	14.70 ab	11.93 b	11.33 a
wounding	8.13 c	16.03 a	12.43 b	12.20 a
Wounding mean	7.75 c	15.37 a	12.18 b	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

4- Dry weight of roots (g).

The results in Table (4) declared that the wounding had significant effects on the dry weight of roots for barberries cuttings; the highest significant dry weight was obtained in wounded cuttings 1.29 g which differed from the non-wounded cuttings 0.99 g. It is clear that the planting cuttings in alone peat moss media and mixed it with sand give the significant higher dry weight of roots formed on the cuttings 1.18 and 1.21 g respectively. The interaction between wounded cuttings and medium consist of sand and peat moss has recorded the significant highest dry weight of roots 1.56 g.

5- Shoots number per cutting.

From the data in Table (5) noticed that wounding cuttings gave the significant largest number of shoots 5.02 shoots per cutting, while the lowest number was 4.18 shoots for the non-wounded cuttings. Media had non-significant effect on shoots number per cuttings. As for interaction between wounding and media, where the wounded cuttings planted in sand mixed with peat moss gave significant higher shoots per cuttings 5.53, but these values decreased to 3.67 shoots for non-wounded cuttings in loam with peat moss medium.

Table 4: Effect of wounding and growing media on dry weight of roots (g) of barberries plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	0.87 d	0.95 cd	1.16 bc	0.99 b
wounding	1.56 a	1.13 bc	1.19 b	1.29 a
Wounding mean	1.21 a	1.04 b	1.18 ab	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

Table 5: Effect of wounding and growing media on shoots number per cutting of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	4.33 ab	3.67 b	4.53 ab	4.18 b
wounding	5.53 a	4.53 ab	5.00 a	5.02 a
Wounding mean	4.93 a	4.10 a	4.77 a	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

6- Leaves number per cutting .

The data in the Table (6) refers that the wounding had a significant effects on the number of leaves; the highest number was 34.67 leaves in wounded cuttings which differed from un-wounded cuttings 28.51 leaves. The significant highest leaves number founded in cuttings planted in media consists of sand and peat moss 35.87 leaves. The data of interaction indicated that wounded cuttings planted in above medium formed significant large number 39.67 leaves.

Table 6: Effect of wounding and growing media on leaves number per cutting of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	32.07 b	20.73 c	32.73 b	28.51 b
wounding	39.67 a	33.60 b	30.73 b	34.67 a
Wounding mean	35.87 a	27.17 c	31.73 b	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

7- Length of the longest shoots (cm).

It can be observed from the Table (7) that the wounding had non-significant effect on the longest length of shoots. Planting of the cuttings in loam with peat moss gave the significant longest length of shoots 16.08 cm formed on cuttings compared to the sand and peat moss medium. The significant longest shoots length 17.23 cm was obtained when planting wounded cuttings in medium consist of loam and peat moss.

Table 7: Effect of wounding and growing media on length of longest shoots (cm) of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	12.27 c	14.93 ab	16.73 a	14.64 a
wounding	14.63 a-c	17.23 a	13.47 bc	15.11 a
Wounding mean	13.45 b	16.08 a	15.10 ab	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

8- Dry weight of shoots (g).

The data in Table (8) show that that the wounding had significant effect on the dry weight of shoots for barberries cuttings; the highest dry weight was obtained in wounded cuttings 3.32 g which differed from the unwounded cuttings 1.78 g. As well as, the significant dry weight of shoots was 2.78 g for cuttings planted in loam with peat moss medium. The data of interaction indicated that the significant highest dry weight was 3.81 g when wounded cuttings planted in loam with peat moss medium.

Table 8: effect of wounding and growing media on dry weight of shoots (g) of barberries shrub plant hard wood cuttings.

Wounding treatments	Growing media			Growing media mean
	Sand + peat moss	Loam + peat moss	Peat moss	
Non wounding	1.59 d	1.75 cd	2.00 bc	1.78 b
wounding	3.50 a	3.81 a	2.64 b	3.32 a
Wounding mean	2.54 ab	2.78 a	2.32 b	

Values followed by different letters are significantly different at P□0.05 level according to Duncken test.

Seen from the results that the un-wounded gave the best results of the rooting percentage where the rooting percentage reached to 51.10% as compared with wounding of base cuttings, while the wounding increased resulted of number and dry weight of roots and improvement of the vegetative growth characters included shoots number, number of leaves and dry weight of vegetative growth. That the interpretation of the results can be attributed to the many of plants have bundles of cells with thick walls to the outside of the roots formation region and those roots aren't able to penetrate those bundles (Pontikis *et al.*, 1979). wounded cuttings slightly better than without wound. These results were in agreement with Rosier (2003) on Fraser fir and with Ucler *et al.* (2004) on *Actinidia deliciosa*. Basal wounding is beneficial for improve the characters of roots and vegetative growth of several cuttings species especially when cuttings are collected from older material (Hartmann *et al.* 2002). As Sultan (1974) and Hartmann *et al.* (2002) mentioned that the wounding that could lead to starting a private hormones (Wounding hormones) except growth hormones and thus stimulate the formation of roots, in addition to the wounding stimulates cells to divide in response to wounded tissues, and increases the permeability of oxygen to the interior tissues in cuttings, and increase the amount of water absorbed from the base of cuttings, in addition to increasing the amount of ethylene formed in the cutting bases and that stimulate the formation of roots and thus positively opposite in improving the vegetative growth characters.

Using of different growth media can effect on rooting of cuttings and improving plant growth, the source of used substance in the medium and its composition limits the strength of media and its ability to keep water, air, and nutrients rather than thermal balance and pH which effects either positively or negatively on growth and development of different plant organs subsequently in the whole plant life cycle (El-Sallami and Mahros, 1997).

The media contained peat moss led to obtain the highest value or all studied features. The improvement of cuttings growth may be due to many probable reasons which have been mentioned by many authors like the porosity of the medium which leads to a good ventilation, which prevent CO_2 accumulation in the resulted from roots and microorganisms respiration in the medium and the analysis of its components which deceased respiration and as a result the growth (Al-Anny, 1980 and Nelson, 1991).

The use of medium consists of peat moss with sand or loam cause an improvement in all studied features that can be due to the high fertility which leads to increasing nutrients absorption especially nitrogen which has a great role in activating many enzymes and plant growth hormones that can be attractive centers for nutrient materials, this interacts in many biological processes (Mohammed, *et al*. 1985 and Al-Sahaff, 1989).

Conclusions

The experimental results lead us to the conclusion that wounding improved, the most root and vegetative growth characteristics except rooting percentage, length of longest roots and shoots characters. As for media noted that medium consist of loam or sand mixed with peat moss considerably lead to increase in rooting percentage, length of longest roots and shoots, dry weight of shoots while the medium consist of sand and peat moss led to increase of roots number, dry weight of roots, shoots (branch) number and leaves number. Also as for interaction between both factors noted that the planting of cuttings in sand or loam mixed with peat moss led to increase the most of studied characters in this experiment.

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