Middle Eastern and Russian Journal of Plant Science and Biotechnology ©2008 Global Science Books

Influence of IBA and Cutting Length on Rooting Rate of Wild Caper (*Capparis spinosa* var. Parviflora) Stem Cuttings

Mohammad Jafar Bahrani • Mehdi Remazani Gask • Akhtar Shekafandeh*

Department of Horticulture, College of Agriculture, Shiraz University, Shiraz, 71444, I.R. Iran

***Corresponding author*: * shekafan@shirazu.ac.ir**

ABSTRACT

The rooting potential of wild caper plant (*Capparis spinosa* var. Pariflora) leafy and leafless cuttings of different lengths (10, 15 and 20 cm) and cutting source [from growing season (softwood) and one year old stems (semi-hardwood)] was determined under different conditions. Bases of cuttings were treated with indole-3-butyric acid (IBA) at different concentrations and planted in an enclosed mist propagation system. Softwood cuttings did not root while only a small percentage (16.1%) of semi-hardwood cuttings rooted. IBA induced rooting poorly in all cuttings but, irrespective of the concentration, it improved the rooting capacity relative to the control. The highest rooting percentage (16.1%) was obtained when leafy 15 cm semi-hardwood cuttings were treated with 2 g l^{-1} IBA. Possible reasons for poor rooting ability of this species by IBA are discussed.

Keywords: leafy cutting, rooting percentage, semi-hard wood, soft-wood

INTRODUCTION

Caper (*Capparis spinosa* L.) plants are perennial, thorny, short deciduous shrubs of the family *Capparaceae* with numerous branches, and a deep and extensive root system (Barbera and Di Lorenzo 1984; Francis 2004). However, uncultivated caper plants are more often seen hanging, draped and sprawling as they scramble over soil and rocks. The plant is native to the Mediterranean regions where it is grown commercially as a condiment, used for cosmetics and also used as an ornamental plant (Orphanos 1983; Ozcan 1998). Caper is widely distributed in many parts of Iran, particularly in the south (Sabety 1994). Caper plants are grown from seed and by vegetative cuttings. Plants grown from cuttings have an advantage over seed propagated ones; they are genetically identical with their mother plant and this practice avoids high variability in terms of production and quality. The preferred methods of caper propagation are cuttings, simply because of the variability found in seed propagated plants (http://www.americanembassy.org.cy/EmbatWork/Capers.pdf).

Caper is difficult to root compared to woody species, Successful propagation requires careful consideration of genotypes as well as seasonal and environmental factors (Sozzi 2001). Dipping the cutting basal end into 1500-3000 ppm indole-3-butyric acid (IBA) solution may enhance rooting, but results depend on the type of cutting (http://www.americanembassy.org.cy/EmbatWork/Capers.pdf).

High and low auxin: cytokinin ratios, generally, favour adventitious root and shoot formation, respectively. Plant species with plenty of cytokinin root with more difficulty than those with low cytokinin (Okoro and Grace 1978). IBA has been used to induce root formation in cuttings of a wide range of species (e.g. Rosier *et al*. 2004). The objective of this research was to determine the rooting ability of different caper stem cuttings under varying IBA concentrations.

MATERIALS AND METHODS

Cuttings were prepared from wild mother plants in the early morning of early May 2005 from Frashband (52° 5′ E, 28° 52′ N, altitude: 750 m), a semi-desert area, 172 km southwest of Shiraz, Iran. The region is characterized by a dry and warm climate with annual rainfall of 275 mm and mean temperatures above 25°C (Bahrani *et al*. 2008). The experiment was factorial arranged in a completely randomized design with seven replications. Cuttings were in two groups (softwood and semi-hardwood), leafy and leafless of different lengths (10, 15, 20 cm). Shoots which had been growing in spring were considered as softwood cuttings and one year old stems were selected as semi-hardwood cuttings. Cuttings were selected with uniform diameter (0.5 and 1.0 cm for softwood and semi-hardwood cuttings, respectively).

Cuttings dipped in groups of 10 into 0, 1, 2, or 3 g l^{-1} powdered IBA (Sigma) for 5 sec. IBA was dissolved in ethanol (the most amount that can dissolve without precipitation), distilled water was added (pH of the solution was 7.5 ± 0.1). Cuttings were planted in a sterile seedbed composed of 1: 1: 1 peat: field soil: sand and grown in greenhouse conditions: temperature 24 ± 2°C, light intensity 32 μE/cm^2/s, irrigation a mist system operating each tree hour for 15 sec. Data were analyzed by M STAT C (version 1.42 Michigan state University) software and means were compared by Duncan's multiple range test at 1% probability.

RESULTS AND DISCUSSION

Softwood cuttings did not root at all compared to semi-hardwood cuttings, which contradicts the findings of other researchers (Black 1972; Ferahmand and Khosh-Khui 2001) who showed a decrease in rooting ability of stem cuttings with an increase in plant age. The main effect of IBA on rooting ability of stem cuttings, regardless of other factors (length of cuttings, leafy and leafless cutting) showed that the highest rooting percentage occurred with 3 g l^{-1} IBA compared to control (**Table 1**). Cutting stems 15 cm in length, regardless of other factors, produced the highest rooting percentage (**Table 2**).

The interaction between stem length, leafy and leafless cuttings and different IBA concentrations showed that leafy semi-hardwood cuttings were more suitable for rooting than leafless ones (**Table 3**). Cuttings 15 cm in length had the highest rooting percentage for both leafy and leafless cut-

Received: 18 October, 2008. Accepted: 13 November, 2008.

Research Note

Table 1 Effect of IBA on rooting percentage of caper stem cuttings regardless of other factors.

IBA (mg l^{-1})	Rooting (%)
0	4.5 e
1000	6.7 c
2000	8.0 b
3000	8.4 a
powder	6.1 d

Means with similar letters are not significantly different (Duncan 1%).

Table 2 Effect of caper stem cutting length on rooting percentage regardless of other factors.

Length of cutting (cm)	Rooting (%)
10	4.6 c
15	9.1 a
20	6.5 b

Means with similar letters are not significantly different (Duncan 1%).

Table 3 Interactions of IBA, leafy and leafless semi-hardwood caper cuttings on rooting percentage.

IBA (mg l^{-1})	Length of leafy cutting (cm)			Length of leafless cutting (cm)		
	10	15	20	10	15	20
0	4.7 g	7.1 e	6.4 f	1.0 i	4.4 g	3.7 g
1000	6.8 f	11.8 c	7.1 e	3.4 h	6.8 f	4.1 g
2000	7.5 e	16.1 a	9.2 d	3.6 h	7.7 e	4.1 g
3000	7.2 e	14.0 b	11.2 c	4.4 g	7.1 e	6.5 f
powder	6.1 f	9.5 d	6.1 f	1.7 i	6.4 f	6.8 f

Means of each parameter in each treatment with similar letters are not significantly different (Duncan 1%).

tings. Enhanced rooting occurred with increased IBA concentration and the highest rooting percentage (16.1%) was obtained when leafy 15 cm semi-hardwood cuttings were dipped into 2 g l^{-1} IBA. IBA stimulated adventitious root formation of cuttings of different species (e.g. Weisman and Lavee 1995; Sing and Attri 2000; Aminah *et al*. 2006). Another reason for low rooting percentage may be due to little or lack of naturally occurring substances that appear to act synergistically with indoleacetic acid in promoting rooting. Hess termed these nonauxin rooting stimuli rooting cofactors (Hess 1962). It has been suggest that phenolic compounds act as cofactors to be in protecting indoleacetic acid (IAA) from destruction by the enzyme IAA oxidase (Fadl *et al.* 1979). Easy-to root cuttings have higher rooting cofactors compared to difficult-to root cuttings (Hess 1962; Hartman *et al.* 1997). Rooting ability can differ with nutritional conditions of the mother plant and consequently optimal stem food storage (carbohydrates). In this research, the stem cuttings were collected from wild plants without controlling their nutritional status. Andres *et al*. (1999) reported the *Colutea arborescens* apical cuttings, which had high total carbohydrate content, had greater rooting capacity. Softwood cuttings did not initiate adventitious roots, probably due to poor carbohydrate content compared to semi-hardwood cuttings, while leafy stem cuttings increased the rooting percentage versus leafless cuttings probably due to photosynthetic activity and production of more carbohydrates and probably cofactors (Hartman *et al* 1997). In this research, IBA influenced rooting ability of caper plants poorly, similar to the findings of Ferahmand and Khosh-Khui (2001) who found a low rooting rate of hardwood and semi-hardwood cuttings of judas tree (*Cercis siliquastrum* L.) with 1.6 g l^{-1} IBA while Caglar *et al.* (2005) reported increased rooting ability of caper cuttings with 5.4 mg l^{-1} IBA for 10 min.

REFERENCES

Aminah H, Hasinta RMN, Hamzah M (2006) Effects of indole butyric acid concentrations and media on rooting of leafy stem cuttings of *Shorea parvifolia* and *Shorea macroptera*. *Journal of Tropical Forest Science* **18**, 1-7

Andres EFDE, Alegere J, Tenorio JL, Manzanares M, Sanchez FJ, Ayerbe L (1999) Vegetative propagation of *Colutea arborescens* L., a multipurpose leguminous shrub of semiarid climates. *Agroforestry Systems* **46**, 113-121

Bahrani MJ, Remazani Gask M, Shekafandeh A, Taghvae M (2008) Seed germination of wild caper (*Capparis spinosa* L., var. *parviflora*) as affected by dormancy breaking treatments and salinity levels. *Seed Science and Technology* **36**, 776-780

Barbera G (1991) Le caprier (*Capparis spp*) Serie Agriculture: Programme de recherché Agrimed, Commission des Communautes Europeennes, 63 pp

Black DK (1972) The influence shoot origin on the rooting of Douglas-fir stem cuttings. *Proceedings of the International Plant Propagators Society* **22**, 142-157

Calgar G, Culgar S, Ergin O, Yarim O (2005) The influence of growth regulators on shoot proliferation and rooting of *in vitro* propagated caper. *Journal of Environmental Biology* **26**, 479-485

Fadl MS, El-Deen AS, El-Mahady MA (1979) Physiological and chemical factors controlling adventitious root initiation in carob (*Ceratonia siliqua*) stem cutting. *Egyptian Journal of Horticulture* **6**, 55-68

Ferahmand H, Khosh-Khui M (2001) Investigation on improvement of sexual and vegetative propagation of Judas tree (*Cercis siliquastrum* L.). *Iranian Journal of Horticultural Science and Technology* **2**, 25-38 (In Farsi with English Summary)

Francis JK (2004) *Capparaceae*. Available online: www.fs.fed.us/global/iitf/pdf

Hartman HT, Kester DE, Davies FT, Geneve RL (Eds) (1997) *Plant Propagation: Principles and Practice* (6th Edn), Prentice Hall Publishers, Englewood Cliff, NJ, USA, 770 pp

Hess CE (1962) Characterization of the rooting cofactors extracted from *Hedera helix* L. and *Hibiscus rosa-sinensis* L. *Proceedings of the 16th International Horticultural Congress*, pp 382-388

Okoro OO, Grace J (1978) The physiology of rooting *Populus* cuttings. II. Cytokinin activity in leafless hardwood cuttings. *Physiologia Plantarum* **44**, 167-170

Orphanos PI (1983) Germination of caper (*Capparis spinosa* L.) seeds. *Horticultural Science* **58**, 267-270

Ozcan M (1998) The physical and chemical properties and fatty acid composition of raw and brined capper berries (*Capparis* spp.). *Turkish Journal of Agriculture and Forestry* **23**, 771-776

Rosier CL, Frampton J, Goldfarb B, Wise FC, Blazich FA (2004) Growth stage, auxin type and concentration influence on rooting of Virginia pine stem cuttings. *HortScience* **39**, 1392-1396

Sabety H (1994) *Forests, Trees and Shrubs of Iran*, Yazd University Press, Yazd, Iran, 810 pp

Singh DB, Attri BL (2000) Effect of IBA on rooting in West Indian cherry (*Malpighia glabra* L.) cuttings. *Journal of Applied Horticulture* **2**, 134-135

Sozzi GO (2001) Caper, bush: botany and horticulture. In: Janick J (Ed), *Horticultural Reviews* (Vol 27), Wiley, New York, pp 125-173

Weisman Z, Lavee S (1995) Enhancement of IBA stimulatory effect on rooting of olive cultivar stem cuttings. *Scientia Horticulturae* **62**, 189-198