REZULTATE CU PRIVIRE LA INMULTIREA UNOR BIOTIPURI DE *LYCIUM* SP. PRIN BUTĂȘIRE

RESULTS ON HARDWOOD CUTTINGS PROPAGATION OF SOME *LYCIUM* SP. GENOTYPES

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Abstract:

The increasing interest of consumers for goji fruits and plants and the opportunity seized for growers to deliver valuable and profitable products on the local market raise the need of producing new plants of *Lycium* sp. In this respect, the present work reveals some particularities in hardwood cuttings propagation for two genotypes of *Lycium barbarum* L. (B1 and B2) and one of *Lycium chinense* Mill. (410). Several factors have been included in the experiment: genotype, cutting thickness, composition of substrate (peat, sand and perlite) and hormonal treatment (IBA 500 ppm, IBA 1000 ppm, IBA 1500 ppm, Razormin and Rhizopan). Higher rooting percentages of cuttings were recorded for B1 and B2 genotypes and the positive influence of thick cutting was remarked in the shoots length and roots volume of all *Lycium* genotypes. Presence of peat in the rooting substrate also demonstrated a good influence on the rooted cuttings quality. From the hormonal products Razormin and IBA 1500 ppm showed better results.

Cuvinte cheie: goji, grosime butas, hormoni de inradacinare, substrat de inradacinare, volum radicular
Keywords: wolfberry, cutting thickness, hormonal treatment, rooting substrate, roots volume

1. Introduction

Wolfberry (*Lycium* sp.) is becoming day by day more popular in Romania and worldwide due to its value and benefits for consumption (Asanica et al., 2016). The main production is provided by China and exported as dried fruits. In the last decade, European countries start testing wolfberry genotypes in different conditions and fresh products arrive on the market from own production. This is the case of Romania too, where *Lycium barbarum* L. and/or *Lycium chinense* Mill. proved by now to be adapted to our climate, and growers are therefore encouraged to set up more and more plantations. Unfortunately, only few scientific researches have been conducted in this regard and especially concerning the antioxidant and nutraceutical traits of fruits (Ionică et al., 2012; Mocan et al., 2014, Tarko et al., 2013).

The great diversity of the biological material makes the fruits obtained differ from biotype to biotype in terms of size, shape, color, taste and biochemical content. In Romania, currently there is no variety of goji in the official catalog of cultivated plants and a cultural technology for this specie has not yet been developed. Furthermore, only few studies on plant biology, phenology and propagation have been developed (Mencinicopshi and Balan., 2013). Recent works focused on non-conventional propagation of *Lycium* using *in vitro* multiplication by direct organogenesis (Danaila-Guidea et al., 2015), rooting and acclimatization (Fira., 2013), microcuttings culture (Maseda et al., 2004) and even ex-vitro rooting using float hydroculture (Clapa et al., 2013).

But instead of these modern techniques of multiplication, a lot of farmers still use seeds and cuttings in order to expand or establish new wolfberry orchards. In this regard, the current research aims to contribute to the traditional way of propagate this species by cuttings, finding the best method to obtain vegetative biological material fast, easy, cheap and with high percentage of rooting.

2. Material and methods

The experiment was established in the Vegetation House of the University of Agronomic Sciences and Veterinary Medicine of Bucharest and carried out during the first 6 months of 2016.

The biological material consists of three genotypes of wolfberry:

- B1-genotype (*Lycium barbarum* L.)
- B2-genotype (*Lycium barbarum* L.)
- 410-genotype of (*Lycium chinense* Mill).

The cuttings were made using annual branches harvested from mother plants located in the experimental field of the Faculty of Horticulture, Bucharest.

Two categories of cuttings were executed (figure 1):

- thin cuttings (0.1-0.35 mm) and

- thick cuttings (0.36-0.85 mm)

The length of the cuttings was of 15 cm with minimum 3 nodes.

Rooting substrate was represented by equal share of the following parts:

- Peat + Perlite = 1:1
- Peat + Sand = 1:1
- Perlite + Sand = 1:1

Cuttings were afterwards treated with different rooting hormones and concentrations as follows:

- IBA 500 ppm (solution)
- IBA 1000 pm (solution)
- IBA 1500 ppm (solution)
- Razormin (solution)
- Rhizopon AA1% (powder)

Except the control, all the cuttings were submerged in the hormonal solutions for 5 minutes with the basal part or covered with powder in the situation of Rhizopon product.

At the end, 1080 cuttings resulted: 360 of B1, 360 of B2 and 360 of Genotype 410. Half of them (540 cuttings) were in the first thickness category and the other half in the second one.

A number of 108 pots with the capacity of 3 liter each were filled in with specific substrates and the cuttings were assigned according to the experimental model (figure 2).

On 7th of June, 2016, all the cuttings were removed from the pots and several determinations and observations were performed:

- Rooting percentage
- Vegetative growth of the rooted cuttings
- Root Volume

All data were processed by analyze of variance and Duncan's multiple range test at confidence level of 95% ($P \leq 0.05$) using XLSTAT and InfoStat software.

3. Results and discussions

Five months after the experiment start, the entire plot was disassembled, taking each variant one by one in careful observation and gathering data related to the rooting success and overall cuttings quality. Counting the rooted cuttings for each genotype, it was obvious that the two *L. barbarum* L. genotypes recorded better multiplication rate than Genotype 410 (*L. chinense* Mill.). More than 60% of genotypes B1 and B2 cuttings formed roots and only 13.61% in the case of genotype 410 (table 1). Close percentages of rooted cuttings were recorded regardless the cutting thickness. Better results showed thinner cuttings in Genotype 410.

The substrate mix was not as influent as it was expected, in terms of rooting rate, each of the mixture assuring good results in this regard. For instance, for thin cuttings of B1, B2 and 410 genotypes, peat with sand and perlite with sand gave a few more percentages of rooted cuttings comparing with the substrate composed by peat and perlite in equal parts. At the thicker cuttings of B1 genotype, the composition of peat and perlite assured better results (68.33 %). High rate of roots formed by thick cuttings (78.33%) were noticed in B2 genotype in perlite and sand substrate.

The hormonal effect on the rooting emphasizes a good influence of IBA 500 ppm for B1 genotype and IBA 1000 ppm for B2 genotype. At *L. chinense* Mill. (genotype 410), Razormin demonstrated a positive effect upon the rooting rate of cuttings, in line with research made by Feng et al (2000).

From the rooted cuttings of *Lycium* sp., we could discriminate one category that formed only few leaves (rosette type) and another one that developed shoots of different lengths. As it could be seen in the figure 3 and figure 4, thicker cuttings improved the number of shoots regardless the genotype. It is also remarkable the balance of shoots and rosettes in case of B1 genotype for thinner cuttings. A huge rate of cuttings (42.97%) even that developed roots in the substrates, issued only rosettes from the upper buds. One particular observation is that in the situation of *Lycium chinense* Mill., the genotype 410 formed only shoots (no rosette) without considering any other experimental factor.

The length of the rooted cuttings shoots was direct influenced by all the experimental factors. For the Genotype 410, it was remarked that thick cuttings developed an average growth of the shoots of 50.94 cm, i.e. 2.24 times significantly longer than those obtained from the thinner cuttings (figure 5). Smaller differences between shoots length were noticed in *Lycium barbarum* L. genotypes B1 and B2.

Substrate composition strongly affected the growth of the cuttings shoots. For all genotypes peat and sand mixture gave best average results (figure 6 and 7). Thus, the most vigorous shoots were present in B2 (53.06 cm) and 410 genotype (53 cm). In addition to this average values recorded by B2 and 410 genotypes we like to emphasize the growth power of the genotype 410 which produced shoots of 113 cm height (thick cuttings treated with Rhizopon in peat and sand substrate).

From the substances utilized to stimulate rooting of cuttings, Razormin and IBA 1500 ppm showed a positive effect also on the shoots vigor for genotype 410 (figure 8). Similarly, Razormin in the case of B1 genotype proved a slight influence on shoots length (shoots longer with 27.67% more than of control).

Roots volume is a useful indicator of rooted cutting quality. In this respect, we observed that thicker cuttings improved the total roots volume for all genotypes of *Lycium* sp. (table 2). Almost a double volume of roots were measured for B1 genotype when we used thick cuttings (an average of 1.54 mm^3) comparing with thin cuttings (0.87 mm^3).

Presence of peat in the substrate helped roots grow efficiently (figure 8). Peat blended with sand reacted better for B2 and 410 genotypes and mixed with perlite better for B1 genotype. No evident influence of hormonal treatment could be underlined in terms of roots volume at the entire level of rooted cuttings. Razormin and IBA 1500 ppm slightly increased the roots volume for cuttings treated with these hormones. The type of cutting (thick or thin) and the substrate composition influenced the root volume more than the hormone treatment.

4. Conclusions

Lycium barbarum L. genotypes (B1 and B2) recorded higher rooting rates than genotype 410 (*Lycium chinense* Mill.).

The thicker cuttings did not substantially affect the rooting percentage of the B1 and B2 genotypes but improved the shoots length and the roots volume for all genotypes.

The peat used as a half share in substrates had a positive influence in the shoots length and the roots volume of the *Lycium* sp. cuttings.

Horrmonal treatment of the cuttings proved not so efficient in terms of rooting percentages; for genotype 410, Razormin and IBA 1500 ppm highlighted with a stimulant effect for shoots vigor and roots volume

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Tables and figures

Table 1. Rooting percentage of *Lycium* sp. cuttings depending on genotype, thickness of cutting, substrate and hormone applied

B1 genotype		Hormone					Untreated	Mean
Cutting	**Substrate**	**IBA 500**	**IBA 1000**	**IBA 1500**	**Razormin**	**Rhizopon**	**Control**	
Thin	Peat + Perlite	60	50	70	40	70	60	**58.33a**
	Peat + Sand	90	70	60	40	70	60	**61.67a**
	Perlite + Sand	30	70	80	70	50	70	**61.67a**
	Average	**60.00**	**63.33**	**70.00**	**50.00**	**63.33**	**63.33**	**60.56**
Thick	Peat + Perlite	80	80	40	70	60	80	**68.33a**
	Peat + Sand	40	60	50	60	40	60	**51.67a**
	Perlite + Sand	60	90	70	50	40	60	**61.67a**
	Average	**60.00**	**76.67**	**53.33**	**60.00**	**46.67**	**66.67**	**60.56**
	Overall Average	*60.00a*	*70.00a*	*61.67a*	*55.00a*	*55.00a*	*65.00a*	*60.56*
B2 Genotype								
Thin	Peat + Perlite	70	50	60	70	60	50	**60.00a**
	Peat + Sand	60	30	90	80	50	60	**61.67a**
	Perlite + Sand	90	90	70	80	40	80	**75.00a**
	Average	**73.33**	**56.67**	**73.33**	**76.67**	**50.00**	**63.33**	**65.56**
Thick	Peat + Perlite	80	50	80	50	60	30	**58.33a**
	Peat + Sand	90	50	30	60	60	70	**60.00a**
	Perlite + Sand	100	90	70	60	60	90	**78.33a**
	Average	**90.00**	**63.33**	**60.00**	**56.67**	**60.00**	**63.33**	**65.56**
	Overall Average	*81.67a*	*60.00ab*	*66.67ab*	*66.67ab*	*55.00b*	*63.33ab*	*67.78*
410 Genotype								
Thin	Peat + Perlite	10	30	10	10	0	0	**10.00b**
	Peat + Sand	30	30	30	40	10	30	**28.33a**
	Perlite + Sand	0	20	30	30	30	30	**23.33ab**
	Average	**13.33**	**26.67**	**23.33**	**26.67**	**13.33**	**20.00**	**20.55**
Thick	Peat + Perlite	0	10	0	20	10	0	**6.67a**
	Peat + Sand	0	10	10	10	10	10	**8.33a**
	Perlite + Sand	0	0	10	10	10	0	**5.00a**
	Average	**0.00**	**6.67**	**6.67**	**13.33**	**10.00**	**3.33**	**6.67**
	Overall Average	*6.67a*	*16.67a*	*15.00a*	*20.00a*	*11.67a*	*11.67a*	*13.61*

*Duncan's multiple range test (P≤0.05)

Fig. 1. Cuttings of *Lycium* sp. with different thickness

Fig. 2. Experimental module of *Lycium* sp. cuttings grouped by substrate, thickness and hormonal treatment (4.04.2016)

Fig. 3. The dominant number of shoots formed at B2 genotype (10.05.2016)

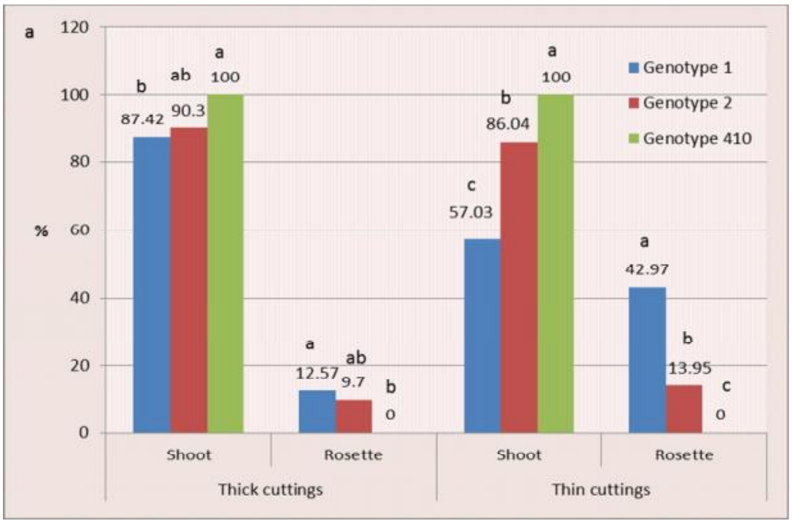

Fig. 4. The share of shoots and rossettes depending on thickness and Lycium genotype

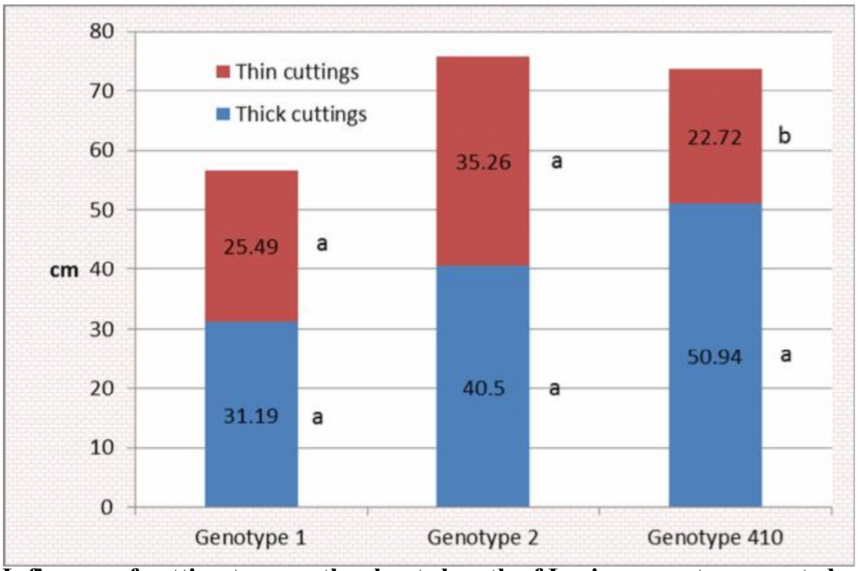

Fig. 5. Influence of cutting type on the shoots length of Lycium genotypes rooted cuttings

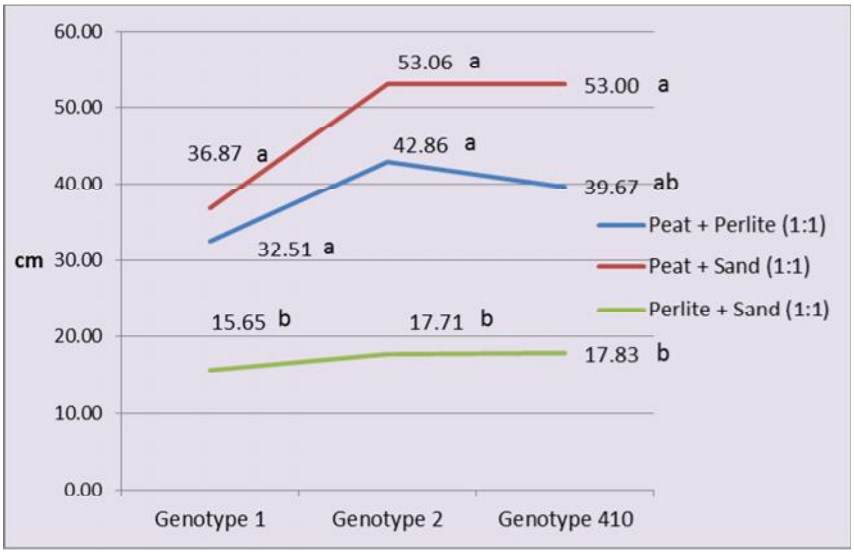

Fig. 6. Influence of substrate composition on the shoots length of Lycium genotypes rooted cuttings

Fig. 7. The shoots growth of genotype B2 in peat + sand (1:1) substrate

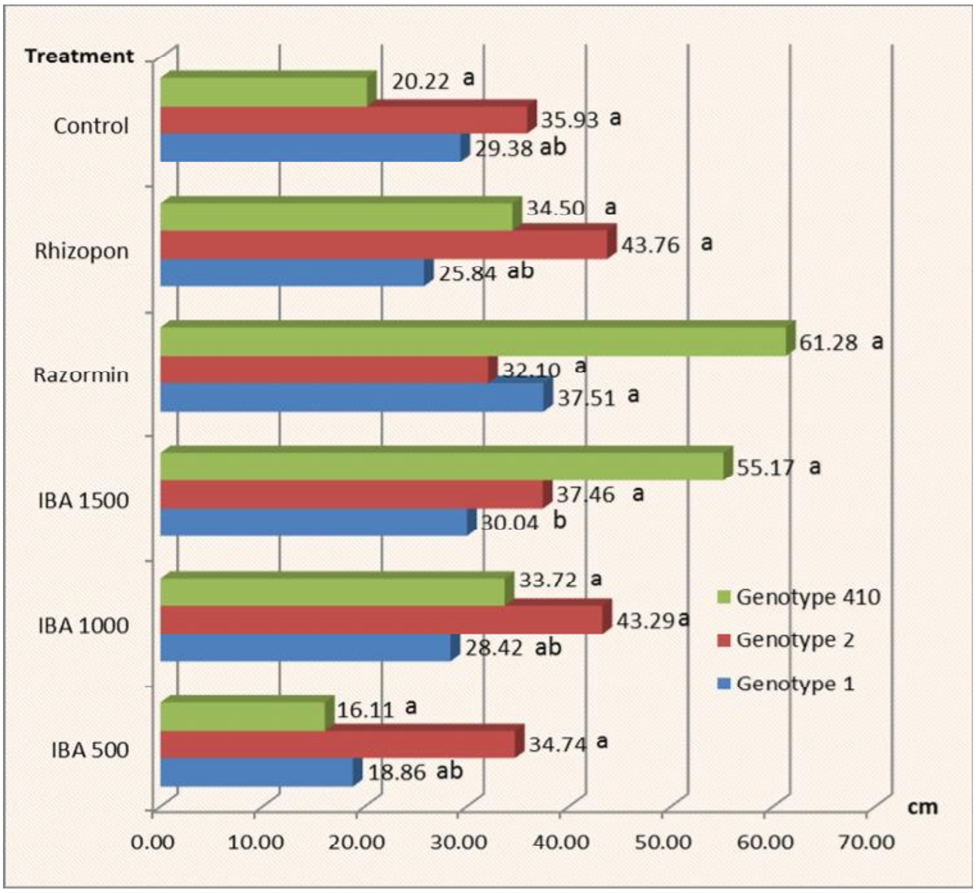

Fig. 8. Influence of hormonal treatment on the shoots length of *Lycium* genotypes rooted cuttings

Fig. 9. Roots volume and distribution
genotype 2 – thin cuttings in peat + sand (1:1) substrate treated with IBA 1500 ppm (left)
genotype 410 – thin cuttings in peat + perlite (1:1) substrate treated with IBA 1000 ppm (right)

Table 2. Roots volume of *Lycium* sp. cuttings depending on genotype, thickness of cutting, substrate and hormone applied (mm^3)

B1 genotype		Hormone					Untreated	Mean
Cutting	**Substrate**	**IBA 500**	**IBA 1000**	**IBA 1500**	**Razormin**	**Rhizopon**	**Control**	
Thin	Peat + Perlite	1.10	1.60	3.00	1.67	1.71	2.00	*1.85a*
	Peat + Sand	1.33	1.43	2.33	2.80	2.00	2.50	*2.07a*
	Perlite + Sand	0.67	0.57	0.50	0.88	1.00	0.67	*0.71b*
	Average	**1.03**	**1.20**	**1.94**	**1.78**	**1.57**	**1.72**	***1.54***
Thick	Peat + Perlite	0.57	0.63	1.00	0.86	1.00	0.63	*0.78b*
	Peat + Sand	1.00	0.67	2.25	2.33	1.00	1.50	*1.46a*
	Perlite + Sand	0.33	0.71	0.25	0.33	0.50	0.17	*0.38b*
	Average	**0.63**	**0.67**	**1.17**	**1.17**	**0.83**	**0.76**	***0.87***
	Overall Average	*0.83a*	*0.93a*	*1.56a*	*1.48a*	*1.20a*	*1.24a*	*1.21*
B2 Genotype								
Thin	Peat + Perlite	2.86	1.75	2.50	2.17	2.25	1.00	*2.09a*
	Peat + Sand	0.80	0.33	0.33	0.75	0.88	0.38	*0.58b*
	Perlite + Sand	0.63	2.40	2.43	1.83	2.00	1.25	*1.76a*
	Average	**1.43**	**1.49**	**1.75**	**1.58**	**1.71**	**0.88**	**1.47**
Thick	Peat + Perlite	2.14	2.00	3.33	2.20	0.83	0.71	*1.87a*
	Peat + Sand	0.22	1.20	0.57	0.29	0.50	0.22	*0.50b*
	Perlite + Sand	0.00	0.00	0.00	0.00	0.00	0.00	*0.00b*
	Average	**0.79**	**1.07**	**1.30**	**0.83**	**0.44**	**0.31**	**0.79**
	Overall Average	*1.11a*	*1.28a*	*1.53a*	*1.21a*	*1.08a*	*0.59a*	*1.13*
410 Genotype								
Thin	Peat + Perlite	1.33	1.50	1.00	4.67	1.00	1.67	*1.86a*
	Peat + Sand	1.00	0.33	1.00	0.25	0.50	1.50	*0.76a*
	Perlite + Sand	-	1.50	1.00	-	2.00	-	*1.50a*
	Average	**1.17**	**1.11**	**1.00**	**2.46**	**1.17**	**1.58**	**1.38**
Thick	Peat + Perlite	-	1.00	0.50	2.00	2.00	-	*1.38a*
	Peat + Sand	-	-	-	0.50	1.00	0.50	*0.67a*
	Perlite + Sand	-	-	0.50	0.50	0.50	-	*0.50a*
	Average	**-**	**1.00**	**0.50**	**1.00**	**1.17**	**0.50**	**0.85**
	Overall Average	*0.58a*	*1.06a*	*0.75a*	*1.73a*	*1.17a*	*1.04a*	*1.11*

*Duncan's multiple range test (P≤0.05)