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# *LYCIUM BARBARUM* L. – A NEW SPECIES WITH ADAPTABILITY POTENTIAL IN BUCHAREST'S AREA

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***Abstract***

*The adaptability potential of Lycium barbarum L., a species with significant health-promoting properties, in Bucharest's area hasn't been studied until now. This paper aims to present the evolution of the elements belonging to the juvenile plant's architecture (number and length of shoots) and the stages of fructification (first floral buds and flowering sightings, number of flowers on shoots, fructification period, fruit quality) during the first two years from planting (2011-2012). Two phenotypes ($V_1$ and $V_2$) were planted and observed in the research field at U.Ş.A.M.V.'s Campus in Bucharest. At the end of 2011, newly-grown shoots per plant were between 10 and 40 for $V_1$ and between 18 and 33 for $V_2$. Their maximum number was 69 for $V_1$ and 81 for $V_2$. 2012's values are 20 to 60 for $V_1$, and 20 to 70 for $V_2$. The maximum value for $V_1$ is 108 and 85 for $V_2$. At the end of 2011, the average length of the shoots was 10 to 50 cm for $V_1$, with a maximum of 62 cm. For $V_2$, these values were 20-80 cm, with a maximum of 99 cm. In 2012, $V_1$'s new sprouts are 5 to 30 cm and $V_2$'s are 9-40 cm long. In 2011, for $V_1$, flower buds first appeared at the middle of June and flowering occurred at the end of the same month. $V_2$ plants flowered in august, and bore far less flowers. Both phenotypes flowered until late November. The average number of flowers per shoot was between 5 and 40. Fruits set in at the end of June, less than a year's time from cultivation. Production peaked in August and September. Fructification continued, for both phenotypes, until the end of November. $V_2$ shrubs had fewer but bigger fruit, fructification started later and was less frequent. The average results at the quality tests were 16-20% dry substance per berry. The minimum value was 11%, the maximum 24%. Quality was slightly better for $V_2$ fruit. In 2012, the first floral buds appeared on a $V_2$ plant at the beginning of May and in a few days they were also seen on $V_1$ plants. Days later, the first flowers appeared and in a week's time, fruits also set in although they had not ripened yet. The average number of flowers and buds, per branch, is 5 to 50, with a maximum of 70. The significance of these results is that the studied phenotypes belonging to the Lycium barbarum L. species have shown a strong adaptability potential in Bucharest's area.*

***Key words*****:** *adaptability, fructification, juvenile, Lycium barbarum L. (Goji), plant architecture.*

## INTRODUCTION

*Lycium barbarum* L., commercially known as Goji, is a deciduous shrub belonging to the Solanaceae family. It is native to Asia and south-eastern Europe having been introduced, over the years, to many regions of the world. Different parts of the plant have been used in Asian countries as traditional herbal medicine and functional food [7, 9]. The species' popularity has been constantly growing in the last years, especially in western countries, due to marketing claims that call Goji a "super-fruit". Though there have been some exaggerations in these claims, scientific research has shown that the fruit's nutritional value and health-promoting properties are quite remarkable [1, 3].

Some of Goji's beneficial effects on the human body are: anti-ageing properties, anti-diabetic effects, anti-oxidant activity, cardiovascular benefits, eye health promoter and immuno-modulatory functions [2, 5, 6].

In Romania, *L. barbarum* hasn't been thoroughly studied yet, though given its growing popularity in our country, cultivating this shrub could prove to be a profitable investment. Moreover, in order to benefit from the fruit's full health-promoting properties, the consumer is advised to eat Goji fruit in their fresh, unprocessed form. Unfortunately, this is impossible at present time as most of the fruit reaching our country is imported from China, in a dried or processed state. This is why this paper aims to study the adaptability potential of the species in Bucharest's area by presenting

the evolution of the elements belonging to the juvenile plant's architecture (number and length of shoots) and the stages of fructification (first floral buds and flowering sightings, number of flowers on shoots, fructification period, fruit quality) during the first two years from planting (2011-2012).

## MATERIAL AND METHOD

In order to study *L. barbarum's* adaptability potential in Bucharest's area, two phenotypes ($V_1$ and $V_2$) were planted, in a non-random block experiment with 6 repetitions (3 for $V_1$ and 3 for $V_2$), within the research field at USAMV's Campus in Bucharest.

The plants were regularly measured and the fructification stages were closely observed. The fruit were measured, weighed and tested. Both sensorial and chemical properties were analyzed. Some of the tools that were used are: WAA analytical balance/scales, portable refractometer and binocular eyeglass.

The collected data was processed using Microsoft Office Excel™, according to Pena A. [8] and Cociu V., Oprea S. [4] research methods, in order to illustrate the Goji plants' growing and development stages.

## RESULTS AND DISCUSSIONS

*The evolution dynamics of the Lycium plants' architecture*

**Plant height.** The average height of the potted plants, at the date of their planting (19.11.2010), varied between 17.86 cm and 44.25 cm. The highest plants were those in the first and third repetitions. When comparing the two phenotypes ($V_1$ and $V_2$), the average heights of the first three repetitions were greater than those of the other three. This means that the $V_1$ phenotype had taller plants than $V_2$. For $V_1$, the average height was between 36.86 cm and 44.25 cm, while for $V_2$ the average values were between 17.86 and 21.57 cm (Fig.1).

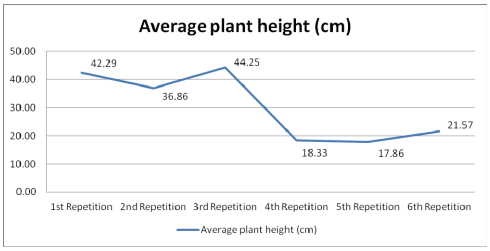


Fig. 1. The average heights of the *Lycium* plants at planting time

After 12 months from planting, the interpretation of the histograms corresponding to repetitions 1-3 ($V_1$) and to repetitions 1-3 ($V_2$) have shown significant differences, regarding growth and survival rates, between the two phenotypes. $V_1$ plants had a greater survival rate, but the average heights, at the end of the first year, did not exceed 64.2 – 73 cm for $R_1$, 78.4 – 92 cm for $R_2$ and 61.8 – 73 cm for $R_3$ (Fig.2). The $V_2$ plants had a more luxuriant growth, but lower survivability levels. The average heights of the second phenotype were: 178.2 – 198 cm for $R_1$, 105.5 – 127 cm for $R_2$ and 194.4 – 216 cm for $R_3$ (Fig.3).

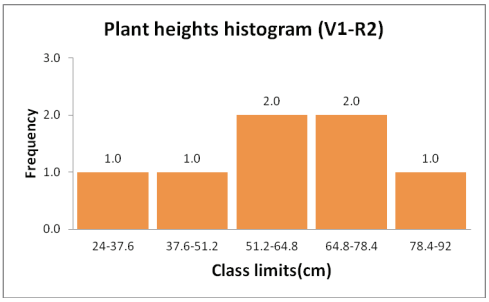


Fig. 2. Histogram of the average heights of the *Lycium* plants in $V_1$'s 2nd repetition, 12 months from planting

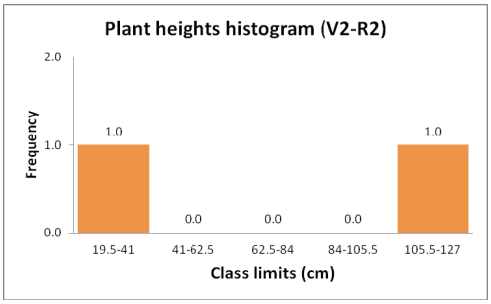


Fig. 3. Histogram of the average heights of the *Lycium* plants in $V_2$'s 2nd repetition, 12 months from planting

**Number of shoots.** Shoot growth is a phenotypic trait of a given cultivar, but it is also influenced by environmental factors, just like any other quantitative trait. The dynamics of this characteristic have been studied for every phenotype, repetition and plant in the research field. Three major stages were observed in the first year from planting. May represented the growth debut, June-August represented the months with the most intensive growth rate and November marked the end of the shoots' growth.

In May 2011, the histograms' and frequency polygons' analysis, pointed out a series of interesting facts. The distribution of the newly-grown shoots' numbers amongst the class limits and centres, were different from one phenotype to the other and also between repetitions. For example, in $R_1$, 43% of the plants had grown between 7 and 10 new shoots, with a peak in class centres around 9. In $R_2$, 57% of the individuals had grown 3 to 4 new shoots, though there were plants that had up to 10 new shoots and the class centre of the frequency polygon reached 9.3 for almost 29% of the plants. $R_3$ individuals were evenly distributed between 4 of the 5 variation classes. The class limits were between a minimum of 1-2 and a maximum of 8-10 new shoots. $V_2$'s repartitions had fewer individuals with new shoots and also the number of newly-grown shoots per plant reached a maximum value of only 6.

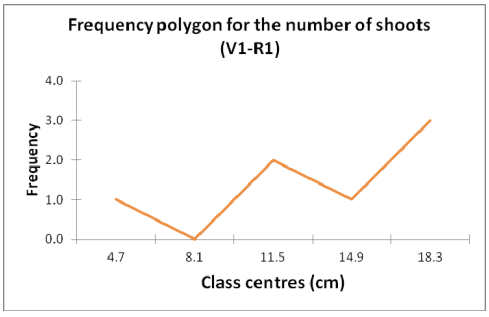


Fig. 4. The frequency polygon for the number of shoots in $V_1$'s 1st repetition, 12 months from planting

At the end of 2011, newly-grown shoots per plant were between 10 and 40 for $V_1$ (Fig. 4) and between 18 and 33 for $V_2$ (Fig. 5). Their maximum number was 69 for $V_1$ and 81 for $V_2$. May 2012's values are 20 to 60 for $V_1$, and 20 to 70 for $V_2$. The maximum value for $V_1$ is 108 and 85 for $V_2$.

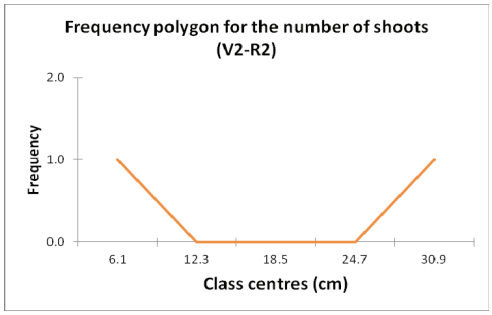


Fig. 5. The frequency polygon for the number of shoots in $V_2$'s 2nd repetition, 12 months from planting

**Length of shoots.** At the end of 2011, the average length of the shoots was 10 to 50 cm for $V_1$, with a maximum of 62 cm. For $V_2$, these values were 20-80 cm, with a maximum of 99 cm. In May 2012, $V_1$'s new sprouts were 5 to 30 cm and $V_2$'s were 9-40 cm long.

*Evolution of fructification stages for the two Lycium barbarum phenotypes*

**Flowering.** In the first year from planting, on $V_1$ individuals, flower buds first appeared at the middle of June and flowering occurred at the end of the same month. $V_2$ plants flowered in august, and bore far less flowers. Both phenotypes flowered until late November. The average number of flowers per shoot was between 5 and 40.

In 2012, the first floral buds appeared on a $V_2$ plant at the beginning of May and in a few days they were also seen on $V_1$ plants. Days later, the first flowers appeared. The average number of flowers and buds, per branch, was 5 to 50, with a maximum of 70.

**Fructification.** Fruits first appeared at the end of June 2011. Production peaked in August and September. Fructification continued, for both phenotypes, until the end of November. $V_2$ shrubs had fewer but bigger fruit; fructification started later and was less frequent.

In 2012, fruiting started earlier than the first year, towards the middle of May. At that time, fruits appeared on a $V_2$ individual, although

they had not ripened yet. The most important aspect regarding *Lycium barbarum's* fructification is the fact that the shrubs bore fruit in less than a year's time from their planting. This revealed a precocity trait in the new species' fructification in Romania's pedo-climatic conditions. The average fruit yield per plant, in the first year from planting, was around 64 g for the $V_1$ phenotype (Fig. 6). If planting distance is 2x2 $m^2$, the plant's nutrition area is 4 $m^2$, so the approximate number of plants per ha would be 2500. Therefore, the estimated fruit yield per ha of Goji-cultivated land, would be 160 kg, just on the first year from planting.

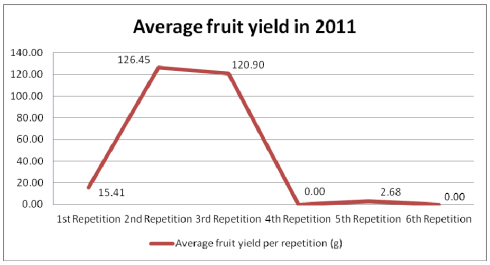


Fig. 6. The average fruit yield per repetition, 12 months from planting

The first year, average results at the quality tests were 16-20% dry substance per berry. The minimum value was 11%, the maximum 24%. Quality was slightly better for $V_2$ fruit. This year, the minimum value in the quality tests for $V_1$ fruit were 7.6 % dry substance, while the maximum value for this phenotype was 17.4 % dry substance. For $V_2$ individuals, values spanned between 13.6% and 32.4 %. It is important to mention that the fruits were harvested at different maturation stages.

## CONCLUSIONS

The plants belonging to both studied phenotypes presented a discontinuous variability of their architectural elements. While $V_1$ individuals showed higher survival rates, $V_2$ individuals presented a more luxuriant growth. $V_1$ plants had a larger number of newly-grown shoots and $V_2$ plants had a greater length of their shoots.

Both phenotypes manifested precocity in fructification, having born fruit the first year from planting. $V_1$'s fruits were smaller, more elliptical but greater in number than those of $V_2$ who were fewer and more round.

The quality of the fruit also revealed differences between size, taste and dry substance levels. $V_2$ fruit were bigger, sweeter and had a higher level of dry substance than those of $V_1$. All in all, the two studied phenotypes, belonging to the *Lycium barbarum L.* species, have shown a strong adaptability potential in Bucharest's area.

## ACKNOWLEDGEMENTS

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