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FIRST RESULTS OF TESTING GOJI BERRY (*LYCIUM BARBARUM* L.) IN PLOVDIV REGION, BULGARIA

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Abstract

The study was conducted during the period 2013 - 2014 at the experimental field of the Department of Fruit Growing at Agricultural University – Plovdiv, Bulgaria. In vitro propagated plants of two Bulgarian cultivars ('JB 1' and 'JB 2') were planted in 20 June 2013 at distances of 3 x 2 m. The plants were grown under drip irrigation. The plants were formed as trees with 40 cm trunk height. Despite of late planting in the permanent place the plants of both cultivars started to bloom and bear fruits (although single fruits) in the same year. During the second vegetation flowering of tested cultivars started in the beginning of June and finished in the end of November. Better productivity was recorded in cultivar 'JB 1' with 0,56 kg/tree and theoretical yield per decare – 93,52 kg whereas the yield of cultivar 'JB 2' was 0,31 kg/tree and 51,77 kg respectively. The cultivar 'JB 2' was more susceptible to powdery mildew than 'JB 1'.

Key words*: cultivar, fruit bearing, growth, Lycium barbarum* L.

INTRODUCTION

An increasing interest to growing untraditional crops especially those with high nutritional value has been observed recently. *Lycium barbarum* L. is a frutescent plant which belongs to *Solanaceae.* The fruits of this plant are also known as goji berry and together with other parts of the plant have been used for a long time in traditional chinese medicine (Institute of Chinese Materia Medica, 1997). The place of origin of *L. barbarum* is not definitively determined. Probably it can be found in the Mediterranean Basin (Genaust, 1996). The plant is widely distributed in the Mediterranean area, Southwest and Central Asia. It is also cultivated in North America and Australia (Hänsel et al., 1993). Niculescu M. et al. (2011) reported presence of *Lycium barbarum* L. (*L. halimifolium* Miller.) in the Bistrita - Varatic Valley and Jiu Valley.

Fruits with optimum quality can be obtained in hot summer conditions. Rains during ripening cause cracking of the fruit. There is relationship between the environmental conditions and the yield.

Liu Jing et al. (2004) reported that for good growth and fruit bearing effective temperature of 3450^0 C and light for 1640 h are required. Other factors such altitude, temperature and sunshine are important for the quality of the fruits. As a result of a study Lin et al. (2013) defined the most suitable regions for growing goji berry in their province.

Nutritionists describe goji berry as "exotic super food" because of its high content of polysaccharides, vitamins and carotenoids. Cultivation of goji berry plants recently increases due to high demand of fresh or dried organic fruits. In the past new plantations have been established using seedlings whereas nowadays vegetative propagated plants of certain cultivars are mostly used.

In Ningxia-China goji berry plants were formed as a shrub or a small tree and were planted at density 1,5 x 1m (Hummer et al., 2012).

Diploid and triploid cultivars were studied in China. The authors reported that triploid cultivars were more vigorous and there were differences in terms of beginning and finish of certain phenophases (Ann et al., 1998).

Wang et al. (2011) had compared the cultivar Ningqi 6 with the standard Ningqi 1. The authors pointed out cultivar Ningqi 6 as more vigorous, better feathered and higher productive. The fruit of this cultivar were bigger, with smaller seeds and higher quality than the standard.

In different study the cultivar Ningqi 1 were compared with two new cultivars of *Lycium barbarum* L. - Ningqi 6 and Ningqi 8. It was found out that the new cultivars have thicker leaves, which explains their vigorous vegetative growth and large size of the fruits (Yan et al., 2014).

Different cultivars were studied at arid and semi arid conditions of Gansu and Ningxia province in China. It was established that cultivars Ningqi 5, Mengqi 1 and Bianguogouqi were the most vigorous during first few years after planning. Therefore, the authors define them as most suitable for growing under such conditions (Zhang et al., 2013).

Five new goji berry strains were studied in three regions of Ningxia province, China. As a result it was established that the environmental conditions influence the growth of different strains (An et al., 2009). Investigating the possibilities for growing goji berry is done in other countries in Asia. The suitability of growing goji berry in typical steppe in Inner Mongolia was investigated and it was reported that *Lycium barbarum* L. can be successfuly grown under such conditions (Liu, 1999).

Two cultivars of *Lycium barbarum* L. were studied near by North Bucharest, Romania (Mencinicopschi et al., 2012). It was established that the cultivars are suitable for growing in this region. The authors reported the differences concerning vegetative and reproductive characteristics of the studied cultivars. Mencinicopschi and Balan (2013) established differences between two cultivars goji berry in terms of beginning of phenophases and pointed out the importance of weather conditions for the beginning of phenophases flowering and fruit bearing. The authors inform that one of the cultivars was more vigorous and less productive but its fruits were of higher quality.

Till now in the available scientific literature we have not found data concerning testing goji berry plants grown on the field in Bulgaria. The aim of the study was to evaluate some of the growth and reproductive characteristics of two bulgarian goji berry cultivars under conditions of Plovdiv region, Southern Bulgaria.

MATERIALS AND METHODS

The study was conducted during the period 2013 - 2014 at the experimental field of the Department of Fruit growing at Agricultural University–Plovdiv, Bulgaria. For that purpose in vitro propagated plants of two Bulgarian cultivars (JB 1 and JB 2) were planted in 20 June 2013 at distance 3 x 2 m. The thickness at the root neck was 2-3 mm and the plant height was 20-30 cm. The plants were formed as trees with 40 cm trunk height, supporting sticks were used and drip irrigation was applied. The experiment was set up in a randomized block design. Six replications and one plant per plot were included in each variant. The data were statistically processed by the method of analysis of variance. The following parameters were evaluated: height of the plants, total growth, trunk thickness, crown diameter and crown volume and yield per tree. Phenological observations concerning the beginning and end of phenophases flowering and fruit bearing also were determinated.

The climate in Plovdiv region is typical of temperate climate zone. The average year active temperature sum is 3900º C, mean annual rainfall is 515 mm and pH of the soil is 7,2 – 7,4 (Angelov, 2006).

RESULTS AND DISCUSSIONS

Growth characteristics of tested cultivars are presented in (Table 1). The differences between the two studied cultivars concerning height of the plants in the year of planting (2013) are insignificant. In the end of the second vegetation the plants of cultivar JB 2 are significantly higher than these of JB1. Other authors (Zhang et al., 2013; Mencinicopschi and Balan, 2013; Wang et al., 2011) also reported for differences in terms of vigor of tested cultivars.

For the period 2013 – 2014 the differences between tested cultivars in terms of vegetative growth are significant and the cultivar JB 2 surpasses JB 1.

Table 1. Growth characteristics of two goji berry cultivars.

Cultivar	Height of the plants, cm		Total growth, cm		
	2013	2014	2013	2014	∑ 2013-2014
JB 1	42.0	103.50	86.00	761.50	847.50
JB 2	48.50	238.67	130.00	1061.17	1191.17
LSD 5%	19.92	56.51	69.69	202.63	184.81

Data about other parameters concerning the growth characteristics of the tested goji berry cultivars at the end of the second vegetation (2014) are presented in Table 2. Concerning the trunk thickness there is no significant difference between tested cultivars. In terms of crown diameter and crown volume cultivar JB 2 surpasses JB 1.

Table 2. Other parameters characterizing the growth characteristics of two cultivars goji berry at the end of the second vegetation (2014).

Cultivar	Trunk thickness, mm	Crown diameter, cm	Crown volume, m^3
JB 1	8.99	66.25	0.09
JB 2	8.91	110.00	0.63
LSD 5%	2.14	13.04	0.20

Despite of relatively late planting (20 June) the plants started to bloom and bear fruits in the same vegetation - the cultivar JB 1 produced approximately 16 fruits per plant as long as the cultivar JB 2 produced 1-2 fruits per plant.

In the second year after planting the flowering of the cultivars began in the beginning of June. Start of flowering was recorded in JB 1 cultivar as well as JB 2 cultivar started flowering 2-3 days later. End of flowering for both cultivars was recorded in the end of November. Mencinicopschi and Balan (2013) reported for long period of flowering of the tested goji berry cultivars in Romania.

In the second vegetation fruit bearing of JB 1 cultivar was higher in comparison with JB 2 cultivar (Table 3). Other authors (Wang et al., 2011; Mencinicopschi and Balan, 2013) also reported about differences concerning the obtained yield in different tested cultivars.

Table 3. Reproductive characteristics of two goji berry cultivars in second vegetation (2014).

Cultivar	Yield, kg/tree	Theoretical yield, kg/decare
JB 1	0.56	93.52
JB 2	0.31	51.77
LSD 5%	0.28	45.32

In 2014 the first harvest of both cultivars was conducted in late August and the last in mid-November.

In another study in Bulgaria, Stoykov (2012) in laboratory analysis of samples of *Lycium barbarum* L. was discovered the causative agent of powdery mildew on goji berry plants. The author defined it as *Arthrocladiella mougeotii* (Lev.) Vassilkov. Monitoring for attack by pests and diseases was conducted in our experimental plantation. The results confirmed the presence of powdery mildew. Among the two cultivars JB 2 is visibly more susceptible to this disease than JB 1.

CONCLUSIONS

The first results (till the end of the second vegetation) of testing two goji berry cultivars allow the following conclusions:

1. The Bulgarian goji berry cultivars JB 1 and JB 2 can be successfully grown under environmental conditions of Plovdiv region (Southern Bulgaria).
2. Cultivar JB 2 is more vigorous in terms of height of plants, diameter and volume of the crown than JB 1 cultivar.
3. When planting in the permanent place the plants of both cultivars started to bloom and bear fruits (although single fruits) in the same year. During the second vegetation flowering of tested cultivars started in the beginning of June and finished in the end of November. Better productivity was recorded in cultivar JB 1 with 0,56 kg/tree and theoretical yield per decare – 93,52 kg whereas the yield of cultivar JB 2 was 0,31 kg/tree and 51,77 kg respectively.

REFERENCES

Angelov, L., 2006. A study of vegetative and reprudoktive habits of Tempranillo cultivar during the process of formation and initial bearing. Dissertation, Plovdiv.

Ann L., Yoon H., Wei L., Yunxiang J. N., 1998. Breeding new varieties of triploid seedless wolfberry. Journal of Ningxia Agricultural Colege, Vol. 19 (3), 41-43.

An W.,Wang Y. J., Shi Z. G., Zhao J.H., 2009. Growth Characteristics of five new Wolfberry Strains in different Regions. Nortern Horticulture, 1, 5.

Genaust H.,1996.Wörterbuch der botanischen Pflanzennamen,Auflage. Basel: Birkhäuser Verlag.

Hänsel R., Keller K., Rimpler H., Schneider G., 1993. Hagers Handbuch der pharmazeutischen Praxis, Vol. 5, Drogen Berlin, Heidelberg, New York, Springer Verlag.

Hummer K., Pomper K., Postman J., Graham C., Stover E., Mercure E., Aradhya M., Crisosto C., Ferguson L., Thomson M., Byers P., Zee F., 2012. Emerging fruit crops. In fruit breeding. Badens, Springer, New York, USA, Vol. 8, 188-195.

Lin N., Yang Z. X., Lin H. M., Zhang J.G., 2013. Evaluation of the Quality of *Lycium barbarum* from different production areas. Journal of Gansu Agricultural University, 4, 34-39.

Liu J., Zhang X. Y., Yang Y. L., Ma L.W., Zhang X. Y., Ye D., 2004. Research in relationship of yield and it's meteorological conditions of (*Lycium barbarum* L). National climate center of China River, 22–25.

Liu T., 1999. Development of drygrassland area wolfberry resources.InnerPrataculture, 3, 10.

Mencinicopschi I. C., Balan V., 2013. Growth and development characteristics of plant individuals from two *Lycium barbarum* L. Varieties. Scientific Papers, Series A. Agronomy, Vol. LVI, 490-497.

Mencinicopschi I. C., Balan V., Manole C., 2012. *Lycium barbarum* L. - A new spices with adaptability potencial in Bucharest area. Scientific Papers. Series A. Agronomy, Vol. 2, №1, 95-101.

Niculescu M., Luminita B. D., Podeanu L.Nuta I . S., Novu I., 2011. Contributions regarding invasive alien plants in the Valcan mountains. Analele Universitai din Craiova, vol. XLI, 200-204.

Qin K., Dai C. L., Cao Y. L., Tang H. F., Yan Y. M., He J., Li R., 2012. A New Wolfberry Cultivar "Ningqi 7". Acta Horticulturae sinica, vol. 39, 1(11), 2331-2332.

Stoykov D., 2012.Ecological interactions between invasive alien vascular plants, and essential saprophytic and parasitic fungi in Bulgaria. Phytologia balcanica, 18 (2), 113–116.

Yan Y., Wang H., Wang J., 2014. Comperative anatomical studies of 2 new kinds LB. Xian Nong Ye Keji, № 5, 29.

Wang J. X., Wang Y. L., Chang H.Yu., Xiong X., Tian Y., 2011. Report on Superior Characteristics of Ningxia Woolfberry New Variety Ningqi № 6. Modern Agricultural Science and Technology, 23, 150–155.

Zhang B., Cai G., Wang S., Zhang G., Zhong L., Wu L., Hu B., 2013. Vegetative Growth Evaluation and Selection of Different Varieties of Lycium for Dry Sand Land. Chinese Agricultural Science Bulletin, 29 (13), 40-43.

***The Institute of Chinese Materia Medica, China Academy of Traditional Chinese Medicine, (1997).Medicinal Plants in China – A selection of 150 commonly used species, WHO Regional Publications,Western Pacific Series 2, 169.