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## **Fruit characteristics of some traditional pear varieties in the Prespa region**

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**Abstract:** The aim of this study was the evaluation of phenological, fruit and chemical characteristics of 6 traditional pear varieties ('Mustabej', 'Patliganka', 'Ljubichica', 'Tatlikuti', 'Shaldanka' and 'Ekshikuti') typical of the Prespa region in Macedonia. These varieties flowered in the second half of April up until the end of April. 'Shaldanka' and 'Ekshikuti' flowered the earliest. According to ripening time, 'Mustabej' was characterized as a summer variety, 'Patliganka' and 'Ljubichica' as autumn varieties, 'Tatlikuti' and 'Shaldanka' as late-autumn varieties, and 'Ekshikuti' as a winter variety. These varieties had a medium-long fruit stalk except 'Tatlikuti'. All varieties contained a low quantity of seeds in the fruit. The biggest fruits, with the longest fruit stalk and the highest value of stone cells were characteristic of 'Shaldanka'. 'Mustabej' had the highest value for fruit firmness. 'Tatlikuti' formed fruits with the best flavor.

**Key words:** pear, traditional variety, fruit characteristics, Prespa region, Macedonia.

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## Introduction

The pear has a long history on the Balkan Peninsula (Niketic, 1951; Stankovic and Mishic, 1978; *Milutinovic* et al., 1998, 2005 and Mratinic, 2000) as well as in Macedonia (Dimitrovski, 1974; Avramovski et al., 2005 and Selamovska et al., 2013). The introduction of new varieties and the substitution of local varieties with new varieties from abroad had negative effects on genetic diversity. Today, traditional pear varieties are very rare in Macedonia, and they are found in abandoned regions where extensive agriculture takes place. Therefore, it is necessary to evaluate these varieties.

These varieties are suitable for organic production due to their vitality, long-lasting, and the fact that they exist in a purely natural environment free from any pesticides and chemical pollutants. The high-quality characteristics of these fruits are very important for breeding.

## Materials and methods

Six traditional pear varieties ('Mustabej', 'Patliganka', 'Ljubichica', 'Tatlikuti', 'Shaldanka' and 'Ekshikuti') existing only in the Prespa region, near the villages Jankovets and Kozjak, were evaluated (Figures 1 and 2).

The aim of the research was to evaluate fruit characteristics of 30 fruits per variety (fruit mass, fruit width, fruit firmness, length of fruit stalk and number of seeds per fruit); characteristics of fruit mesocarp (color, taste, presence of stone cells); phenological characteristics (flowering and ripening time) and chemical characteristics of fruits (total sugar, total acids and soluble solids). The descriptor developed by the IBPGR was used (Thibault et al., 1983). Fruit classification was made according to Rubcov's classification (Mratinic, 2000). Five trees per variety were evaluated. The collected data were statistically processed using analysis of variance and LSD test (Table 1).

The Prespa region belongs to the cold continental climate-vegetation-soil area, and it is located at an altitude of 900 – 1.100 m. The average annual rainfall is 800-900 mm. The drought index is 25 - 40.8. Humid climate is dominant. According to the active temperature sum under 10°C, the Prespa region belongs to moderately hot areas. In this region, two types of soil dominate (chromic luvisol on saprolite and chromic luvisol on saprolite – leached reached with humus) (Filipovski et al., 1996).

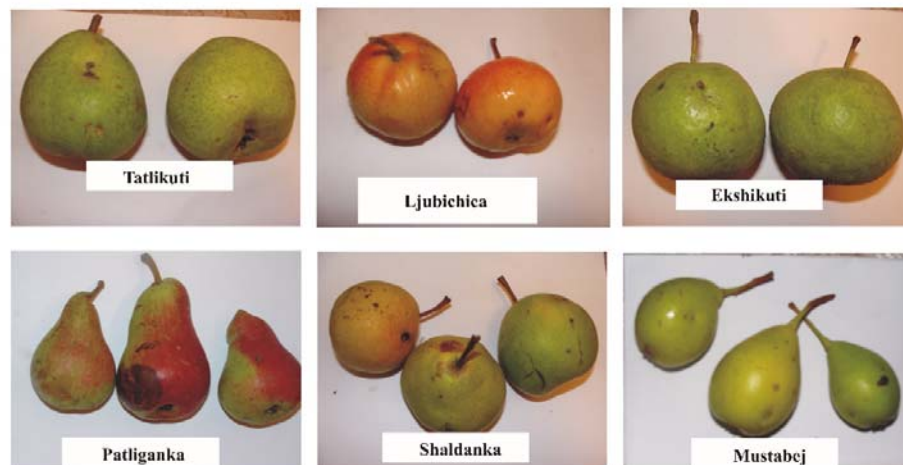


Figure 1. Traditional pear varieties in the Prespa region

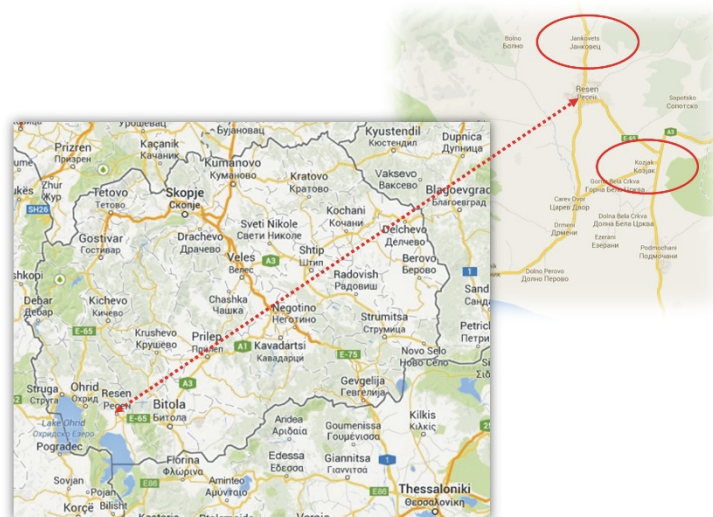


Figure 2. Map of Macedonia (Prespa region with villages Jankovets and Kozjak)

Table 1. Fruit characteristic of some traditional pear varieties in the Prespa region

Variety	Fruit characteristics			Chemical content			
	Fruit mass (g)	Length of stalk (cm)	Number of seeds per fruit	Fruit firmness (g/cm <sup>2</sup> )	Soluble solids (%)	Total acids (%)	Total sugar (%)
'Mustabej'	60.8	3.3	0.9	2235	14.2	0.09	13.5
'Patliganka'	107.3	2.3	3.3	1183	15.3	0.11	14.5
'Ljubichica'	63.6	3.1	0.5	1440	15.6	0.12	14
'Tatlikuti'	152.7	1.6	2	1428	14.5	0.24	14.5
'Shaldanka'	165.4	3.5	0.6	1475	14.3	0.15	13
Average	109.4	2.6	2.3	1503	14.7	0.16	13.7
F	83.21794 ***	76.60145 ***	133.4579059 ***	97.71891841 ***	250.0692308 ***	278.612195 ***	1033.125 ***
LSD <sub>0.001</sub>	9.429	1.688	0.407	75.379	0.077	0.008	0.042

## Results and Discussion

In this study, phenological, pomological and chemical characteristics of fruits of 6 traditional pear varieties, typical only of the Prespa region, were investigated. These varieties are not present in other parts of Macedonia.

All analyzed pear trees are solitary and very old, more than 100 years of age. Local inhabitants stress that they are long-lasting. These pear trees are not treated with chemicals for pest and disease control. Also, no cultural and tree management practices are applied. These pear trees exist without watering. Their fruits are harvested by the local inhabitants for their needs or for local markets.

Most of the pear varieties are found in the villages of Jankovec and Kozjak, located at an altitude of 860 – 900 m. In Jankovec, these pear trees are found in gardens, most of them belonging to the 'Uspenie na Presveta Bogorodica' (Assumption of the Mother of God) Monastery. As a result of diligence for these pear trees, today, the preserved traditional pear varieties in the Prespa region, such as 'Mustabej', 'Patliganka' and 'Ljubichica' are not present in other parts of

Macedonia. The pear varieties 'Shaldanka', 'Ekshikuti' and 'Tatlikuti' exist in the village of Kozjak.

Low luxuriant tree is typical of 'Ekshikuti'. The pears 'Shaldanka' and 'Tiranka' have a medium luxuriant tree, and the rest pear varieties ('Mustabej', 'Ljubichica' and 'Tatlikuti') are characterized by luxuriant, vigorous and branchy trees.

In the Prespa region, these pear varieties flower from the second half of April to the end of April. The earliest time of flowering is characteristic of pears 'Shaldanka' and 'Ekshikuti' (the second ten days of April). 'Mustabej' flowers a few days later. The pears 'Patliganka', 'Ljubichica' and 'Tatlikuti' flower the latest (the end of April).

'Mustabej' ripens the earliest (beginning of August), followed by 'Patliganka' (beginning of September), 'Ljubichica' (beginning of September until the second ten days of September), 'Tatlikuti' (from the second half to the end of September), 'Shaldanka' (from the end of September to the first ten days of October) and 'Ekshikuti', whose fruits are harvested at the end of October.

The largest fruits are formed by 'Shaldanka' (165.4 g), and the smallest by 'Mustabej' and 'Ljubichica' (around 60 g). According to the average length of the fruit stalk (2.6 cm), the studied varieties have a medium-long stalk (Table 1). 'Ekshikuti' has a high quantity of seeds in the fruits (6.7).

The color of the fruit mesocarp ranges from whitish ('Patliganka', 'Tatlikuti' and 'Shaldanka'), yellowish ('Mustabej' and 'Ekshikuti') to orange ('Ljubichica'). The pear 'Tatlikuti' tastes fine to excellent, while the rest varieties taste medium-fine to fine.

'Mustabej' and 'Tatlikuti' have a juicy mesocarp. The highest value of stone cells is contained in 'Shaldanka' fruits. The other varieties except 'Mustabej' have a low value of stone cells in the fruits. When the fruits ripen, the mesocarp rots. As shown in Table 1, a higher value for fruit firmness was measured in the fruits of 'Mustabej' (2235 g/cm<sup>2</sup>) and the smallest value in the fruits of 'Patliganka' (1183 g/cm<sup>2</sup>).

The average content of soluble solids in the fruits of the analyzed varieties was 14.7%. The highest content of soluble solids was measured in 'Ljubichica' and 'Patliganka'. The average value of total sugar in these varieties was 13.7%. The highest value of total sugar was detected in 'Patliganka' and 'Tatlikuti', while the lowest in 'Shaldanka' and 'Ekshikuti'. The content of total acids is in the range of 0.09 to 0.24%. The smallest amount of total acids was measured in 'Mustabej' (Table 1).

In the region of Prespa, 17 pear cultivars are preserved, which makes this region a treasury of traditional pear varieties (Selamovska and Nikolic, 2012; Selamovska et al., 2012 and Selamovska, 2013). All analyzed trees are solitary and very old, (more than 100 years of age), and no cultural or tree management practices are used.

Low luxuriant tree was typical of 'Ekshikuti', medium luxuriant trees were characteristic of 'Shaldanka' and 'Tiranka' and the rest of pear varieties were characterized by luxuriant, vigorous and branchy trees. Also, according to Stancevic (1983), 'Tatlikuti' had a luxuriant tree, and was a super-high-yielding variety. 'Tiranka' had very luxuriant trees, and was a super-high-yielding variety.

In the Prespa region, these pear varieties flowered in the second half of April, and 'Shaldanka' and 'Ekshikuti' were early-flowering varieties. According to Gjurgjevic and Shoshkic (1968), 'Tatlikuti' and 'Tiranka' were early-flowering varieties in the continental area. 'Tiranka' was characterized as an intermediate flowering variety (Dimitrovski, 1974).

According to ripening time, 'Mustabej' was characterized as a summer variety, 'Patliganka' and 'Ljubichica' as autumn varieties, 'Tatlikuti' and 'Shaldanka' as late-autumn varieties, and 'Ekshikuti' as a winter pear variety. According to Stancevic, (1983) 'Shaldanka' was a late-autumn to winter variety depending on climatic conditions, and 'Mustabej' ripens in the second half of July (Dimitrovski, 1974).

Significant differences were found in fruit mass among the analyzed varieties. All varieties had medium-large fruits except 'Mustabej'. Fruit size is a varietal characteristic although it depends on ecological conditions, type of pollination, etc. (Vujanic-Varga, 1985).

The detected differences in the length of the fruit stalk among the evaluated varieties were statistically significant. 'Tatlikuti' had a short fruit stalk, and the other varieties had medium-long fruit stalks. The long length of the fruit stalk is an important characteristic of varieties growing in windy and unsuitable conditions (Dimitrovski, 1974).

These varieties contained a low quantity of seeds in the fruit. This indicates triploidy of the varieties and a tendency to parthenocarpy (Dimitrovski, 1974 and Nyeki et al., 1998). Significant differences were found in the number of seeds and fruit firmness among the varieties.

The color of the fruit mesocarp in the varieties varied from whitish ('Patliganka', 'Tatlikuti' and 'Shaldanka') to yellowish ('Mustabej' and 'Ekshikuti') to orange ('Ljubichica'). 'Tatlikuti' tasted fine to excellent, while the other varieties tasted medium-fine to fine. 'Mustabej' and 'Tatlikuti' had a juicy mesocarp. The fruits from 'Shaldanka' contained the highest value of stone cells. The mesocarp became overripe when the fruits ripened. The highest value for fruit firmness was measured in 'Mustabej'.

## Conclusions

All pear varieties analyzed in this study occur only in the Prespa region of Macedonia. They are healthy organic food and as such they deserve a place in organic agricultural production.

Statistically significant differences were found in soluble solids, total sugar and total acids among the varieties. The highest sugar sweet index was characteristic of 'Mustabej'. Even though 'Tatlikuti' had a medium sugar sweet index, it had the best flavor.

These pear varieties with their quality characteristics provide a diverse gene fund important in the process of developing new varieties and improving some disadvantages (low resistance to pests and diseases, fruit mass, fruit firmness, ripening time) in the existing ones.

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## KARAKTERISTIKE PLODA NEKIH TRADICIONALNIH SORTI KRUŠKE NA PODRUČJU PRESPE

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### Rezime

Cilj ovog istraživanja jeste ispitivanje fenologije, plodova i hemijskih karakteristika 6 sorti kruške ('Mustabej', 'Patliganka', 'Ljubichica', 'Tatlikuti', 'Shaldanka' i 'Ekshikuti') koje su karakteristične za područje Prespe u Makedoniji. Sorte su cvetale od druge polovine do kraja aprila. 'Shaldanka' i 'Ekshikuti' su najranije cvetale. S obzirom na vreme zrenja, 'Mustabej' je okarakterisan kao letnja sorta, 'Patliganka' i 'Ljubichica' kao jesenje, 'Tatlikuti' i 'Shaldanka' kao kasno jesenje, a 'Ekshikuti' kao zimsko sorta. Sve sorte osim 'Tatlikuti' su imale srednje dugu peteljku ploda. Sve sorte su imale malu količinu semenki u plodu. Najkrupniji plodovi, sa najdužom peteljkom i sa najviše kamenih ćelija imala je sorta 'Shaldanka'. 'Mustabej' je imao najčvršće plodove. 'Tatlikuti' je imao najbolju obojenost plodova.

**Ključne reči:** kruška, tradicionalne sorte, plod.

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