

THE INFLUENCE OF GENOTYPE ON RIBWORT-PLANTAIN (*Plantago lanceolata*) YIELD AND QUALITY

R. Jevdjović, Radojka Maletić and Jasmina Jevdjović*

Abstract: The preliminary results of a two-year comparative investigation of two genotypes of ribwort-plantain in the agroecological conditions of west Serbia (Gorobilje), south Banat (Pančevo) are given. Genotype originating from the international exchange (marked with "D") was compared with "domestic" genotype which has been raised at the Medicinal Plants Research Institute "Dr Josif Pančić", Belgrade, for more than ten years. Both genotypes have been monitored during two years of the research – 1998 and 1999. "D" genotype is more early growing than "domestic" genotype. That earliness is about one month in both years of the research. This genotype has broader leaves but is more susceptible to plant diseases.

"Domestic" genotype is higher yielding and its yield is less influenced by growing conditions. The differences in dry leaf yield range up to 50% in favour of "domestic" genotype. This genotype has much higher content of basic active matter aucubin.

Key words: ribwort-plantain, genotype, dry leaves, aucubin.

Introduction

Plantain grows worldwide, especially in moderately hot and cold regions. Three genera with about 250 species belong to *Plantaginaceae* family. Of this number, only *Plantago* genus with about 15 species is growing in our country.

* Radosav Jevdjović, B.Sc., Medicinal Plants Research Institute "Dr Josif Pančić", Tadeuša Koščuška 1, 11000 Belgrade, FR Yugoslavia

Dr Radojka Maletić, Assistant Professor and Jasmina Jevdjović, Student, Faculty of Agriculture, 11081 Belgrade-Zemun, Nemanjina 6, FR Yugoslavia

Two species of this genus have been studied and these are *Plantago major* – broad leaved -plantain and *Plantago lanceolata* – ribwort-plantain. Both of the species are widespread in nature, but are increasingly raised on plantations in order to obtain higher and more certain yields as well as plants of better quality.

Ribwort-plantain is a perennial plant with 10-20 cm long lancet leaves gradually narrowing into a short stem and assembled into a low rosette. Young leaves may be used for salad or cooked in a soup. As a healthy vegetable, plantain leaf was mentioned even by Plinius and Diskorid.

In pharmacy, the aerial part of the plant is used (*Plantaginis lanceolatae herba*) or just its leaves (*Plantaginis folium*). Because of its antimicrobial properties, it is used as tea, syrup and pastille for curing asthma, cough and other respiratory diseases as well as oral inflammation and pharyngitis and liver diseases. Young leaves contain lots of vitamin C, carotene, iridoid glycoside aucubin, tannin, silicic acid, potassium,...

Materials and Methods

A two-year research has been carried out in the agroecological conditions of west Serbia (locality of Gorobilje) and south Banat (locality of Pančevo). The aim of the research was to show the influence of genotype on the yield and quality of ribwort-plantain leaf.

The locality of Gorobilje is characterised by brown soil type of low acid reaction (pH nKCl = 5.9) with humus content 4.4%, phosphorus content 12.5 mg/100 g and potassium 25.8 mg/100 g (Jevdjović et al., (1), 2000). The altitude is 420 m. The first crop was wheat. In the vegetative period in 1998 average daily temperature was 17.5°C and precipitation 432 mm, while in 1999 average daily temperature was 18°C and precipitation 570 mm.

The locality of Pančevo has swampy humus soil type. It is of low acid reaction (pH nKCl = 5.7) moderately supplied with humus (3.5%) and phosphorus (12 mg/100 g) and rich in potassium (38 mg/100 g). The altitude is 70 m. The first crop was wheat. In the vegetative period in 1998 average daily temperature was 18.9°C and precipitation 288 mm, and in the next year (1999) average daily temperature was 19.1°C and precipitation 617 mm.

The tested genotype "D" was compared with standard "domestic" genotype, which has been grown and multiplied on the experimental field of the Medicinal Plants Research Institute, Belgrade, for more than ten years. The nursery plants of both genotypes for this research were produced at the same Institute. Seeding was done on a well prepared soil with the spacing of 50 x 30 cm (Jevdjović et al., (1), 2000). Nursery plants were transplanted on the locality Pančevo on March 16 and on locality Gorobilje on March 17, 1998. The size of the experimental plot was 10 m². The trial was performed in three replicates (Maletić et al.,

2000) Agrotechnical measures applied during plant growth, such as crust breaking of and killing of weeds, mechanically without herbicides use, were identical for both genotypes during two study years and on both localities (Pavlović et al., 1998). Also, phenological observations during the vegetative period were monitored and recorded. Leaf picking (harvest) was carried out manually during the period of plant blooming. In case of genotype "D", picking (harvest) was carried out on July 7 in the first study year (1998) on the locality Pančevo, and on locality Gorobilje on June 9. In case of genotype "domestic", picking (harvest) was carried out on July 7 in the first study year (1998) on the locality Pančevo, and on locality Gorobilje on July 10. In the second study year, in case of the genotype "D", picking of leaves was carried out on June 14 on the locality Pančevo and on June 20 on locality Gorobilje, and in case of "domestic" genotype on locality Pančevo on July 7 and on locality Gorobilje on July 12, 1999.

Samples for analysis and aucubin detection were taken from fresh leaves in three replicates. Harvested leaf mass was dried naturally and subsequently the yield was determined.

Obtained experimental results were analysed statistically (Hadživuković, 1991).

Results and Discussion

After two years of investigation, it can be concluded that genotype "D" is more early - growing compared to "domestic" genotype. Early growing is expressed in both study years and on both localities. This is probably the result of better use of heat sums.

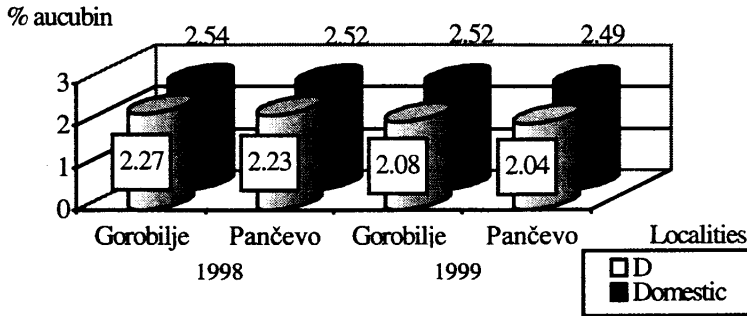
The effect of genotype on aucubin content in ribwort-plantain leaves

Aucubin content is higher in leaves of "domestic" genotype in both study years and on both localities (Tab. 1). Also, growing conditions within the same genotype had no significant effect on the content of this active substance ($Cv < 1\%$).

Tab. 1. - Aucubin content in fresh ribwort-plantain leaves, %

Genotype	Gorobilje		Pančevo		\bar{x}	Cv(%)
	1998	1999	1998	1999		
"domestic"	2.54	2.52	2.52	2.49	2.52	0.81
"D"	2.27	2.08	2.23	2.04	2.16	5.19
\bar{x}	2.40	2.30	2.38	2.26		
Cv(%)	7.95	13.53	8.62	14.08		

In case of genotype “D”, aucubin content expressed higher variability with regard to the study year ($Cv = 8-14\%$) and localities ($Cv = 5\%$).



Graph.1. – Aucubin content in fresh leaves

The effect of genotype on the yield of dry ribwort-plantain leaves

Yield of dry ribwort-plantain leaves is considerably higher in case of genotype “domestic” in both study years and both localities, without oscillating considerably with the change in growing conditions ($Cv < 3\%$), table 2. Average yield of dry leaves of the same genotype is nearly by 50% higher compared to the yield of dry leaf of genotype “D”.

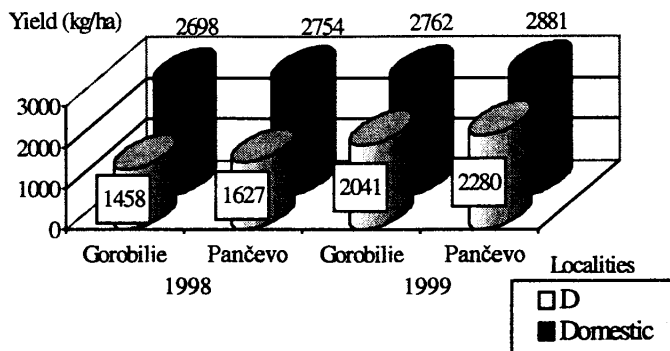
T a b. 2. - Yield of dry ribwort-plantain leaves

Genotype	Gorobilje		Pančevo		\bar{x}	Cv(%)
	1998	1999	1998	1999		
“domestic”	2698	2762	2754	2881	2774	2.77
“D”	1458	2041	1627	2280	1852	20.32
\bar{x}	2078	2402	2191	2581		
Cv(%)	42.20	21.22	36.37	16.46		

Genotype “D” expresses significant oscillations in yield with regard to the study year ($Cv = 16-42\%$) and localities ($Cv = 20\%$), Graph. 2. The same genotype had, on average, by 40% higher yield of dry ribwort-plantain leaves in 1999 compared to the preceding year, 1998. Considerably lower leaf yield of genotype “D” in the first study year was probably the result of great droughts recorded during that year.

Tested genotype “D” had considerably broader leaf (from 16 x 3 cm – 22 x 3,7 cm) compared to genotype “domestic” (from 12 x 2 cm – 16 x 2,2 cm), however, rosetta is significantly dispersed. Genotype “D” expressed greater

susceptibility to plant diseases. This was manifested mostly during the second year of investigation (1999), when considerably higher precipitation was recorded as well as numerous plants of genotype "D" with fungal diseases. On the other hand, plants of genotype "domestic" were completely healthy. Also, considerable damage of leaves in genotype "D", caused by insects, was observed but not on the leaves of genotype "domestic".



Graph. 2. – Yield of dry leaves (kg/ha)

Conclusion

Based on two year investigations and analysis of results, the following can be concluded:

- Genotype "domestic" has considerably higher yield of dry leaves as well as higher aucubin content regardless of agroecological growing conditions;
- Genotype "domestic" is better adaptable to drought, since no oscillations of yield during dry season were recorded;
- Genotype "D" is more early growing compared to the "domestic";
- Genotype "D" is more susceptible to plant diseases caused by parasitic fungus;
- In case of genotype "D" damage of leaves caused by insects was registered, but not in case of "domestic" ribwort-plantain;
- In order to further improve the production of ribwort-plantain in our country, it is necessary to continue research to find new genotypes more suitable for growing in the existing ecological conditions. It would be interesting to cross these two genotypes in order to obtain an early growing genotype with broader leaves and fuller rosette, more resistant to plant diseases.

REFERENCES

1. Hadživuković, S. (1991): Statistički metodi. Drugo prošireno izdanje. Poljoprivredni fakultet, Novi Sad.
2. Jevdjović R., Maletić Radojka, Jevdjović Jasmina (2000): Possibility of raising Thyme in different regions of Serbia. Second Balkan botanical congress, Istanbul, Turkey, May 14-18, abstracts, p. p.132.
3. Jevdjović, R., Pavlović, R., Jevdjović Jasmina (2000): Effect of environmental factors on the leaf quality and yield in great plantain. Proceedings of the First Conference on Medicinal and aromatic Plants of Southeast European Countries, Arandelovac, Yugoslavia, May 29-june 3, p.p. 299-302.
4. Maletić Radojka, Jevdjović, R., Pavlović, R., (2000): The investigation of the effect of genotype on the quality traits of lemon balm. XXVIII, Óvári Tudományos napok az élelmiszergazdaság fejlesztésének lehetőségei, Agrárökonómiai szekció, Mosonmagyaróvár, október 5-6, Hungary, pp. 211-216.
5. Pavlović, R., Jevdjović, R., Bjelić, V., Maletić Radojka (1998): Mogućnosti proizvodnje peršuna lišćara u brdsko planinskom području Srbije. "Savremena poljoprivreda", Vol. 46, vanr. broj, str. 329-332, Novi Sad.

Received December 8, 2000

Accepted March 27, 2001

UTICAJ GENOTIPA NA PRINOS I KVALITET USKOLISNE BOKVICE
(*Plantago lanceolata*)

R. Jevdjović, Radojka Maletić i Jasmina Jevdjović *

Rezi me

Dati su preliminarni rezultati dvogodišnjeg uporednog ispitivanja (1998. i 1999. godine) dva genotipa uskolisne bokvice u agroekološkim uslovima zapadne Srbije (Gorobilje) i južnog Banata (Pančevo). Genotip koji potiče iz međunarodne razmene (označen šifrom "D") upoređivan je sa genotipom "domaća" koji se više od deset godina gaji u Institutu za proučavanje lekovitog bilja "Dr Josif Pančić", Beograd. Genotip "D" je znatno ranostasniji od genotipa

* Radosav Jevdjović, dipl. ing., Institut za proučavanje lekovitog bilja "Dr Josif Pančić", Tadeuša Koščuška 1, 11000 Beograd, SR Jugoslavija

Dr Radojka Maletić, docent i Jasmina Jevdjović, student, Poljoprivredni fakultet, 11081 Beograd-Zemun, Nemanjina 6, SR Jugoslavija

“domaća”. Ta ranostasnost kreće se oko mesec dana u obe godine istraživanja. Ovaj genotip ima krupnije listove ali i veću sklonost oboljenju od biljnih bolesti.

Genotip “domaća” je znatno prinostniji i kod njega na visinu prinosa manje utiču uslovi gajenja. Razlike u visini prinosa suvih listova kreću se i do 50% u korist genotipa “domaća”. Ovaj genotip ima i znatno veći sadržaj osnovne aktivne materije aukubina.

Genotip “D” je ispoljio velike oscilacije sadržaja aukubina i prinosa suvih listova i po godinama i po lokalitetima.

Primljeno 8. decembra 2000.

Odobreno 27. marta 2001.