

## Response of interspecies hybrids of the genus *Prunus* to the main economically important diseases of plum

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**Content:** The object of study were properties of the progeny from the combination Sloe (*Prunus spinosa*) x Yellow Ablanska Plum (*Prunus domestica*) and their susceptibility to sharka (*Plum pox virus*), red leaf spots (*Polistigma rubrum* Person DC), rust (*Puccinia pruni spinosae* Pers.), shot hole (*Stigmia carpophila*) and brown rot of fruits (*Monilinia fructigena* Ader & Ruhl Honey ex Whetz). The cropping of trees was registered. Morphological description of the fruits was made determining their qualities. Breeding evaluation was performed and forms were selected that will be of interest from immune-biological point of view.

**Key words:** Plum, interspecies hybrids, fungal diseases.

### Introduction

Disease infection in orchards occurs on systematic basis. The control of the situation is achieved both by conventional plant protection measures, and by utilization of low susceptible and/or tolerant cultivars and hybrids (Trifonov, 1979; Stoyanova and Minev, 2002).

In instances of high infestation rate with red leaf spots the leaves curl along the mid-rib, turn necrosed and drop down, which affects the setting of fruit buds for the following year and the chances for successful overwintering of the plants (Stancheva, 2001).

High infestation of rust might results in complete leaf fall in late summer, that is often the cause of recurrent putting forth of leaves and flowering (Stoyanova and Minev, 2003).

A key factor inducing severe infestation of fruits with brown rot is the high atmospheric relative humidity (Stancheva, 2001).

When leaves are severely infected with shot hole disease, they turn yellow and drop down. Following prolonged spells of rainfall there is high infestation rate. This disease will develop not only in spring and summer, but in autumn as well. It is widely spread and occurs annually, causing severe damages in some years (Mihaylova, 1962).

The practical implementation of plum cultivars and hybrids that are resistant, or tolerant to fungal diseases will bring about considerable alleviation of plant protection as well as lower costs for it. In turn, this will result in high quality fruit production of low cost price.

A view that is gaining wider recognition is that regarding the problem of disease control the possibilities of intraspecies hybridization are restricted and exhausted (Eremin and Vitkovskiy, 1980). Even Michourin considered the intraspecies hybridization as the best way to utilize wild plant forms and especially their disease hardness (Michourin, 1948).

In this connection, research of our intraspecies hybrids was held with the aim of forms choice, having mostly sustainability or tolerance of some fungal diseases for further selection of plum.

## Material and methods

The study focused on the progeny of the intraspecies combination of Sloe (*Prunus spinosa*) x Yellow Ablanshka plum (*Prunus domestica*). The main morphological traits of the fruits and their characteristics were examined. The chemical composition was assayed. Dry matter (refractometrically), sugars (after the methods of Shorol and Regenboggen), acids (titrimetrically), tannins and colouring matter (after Leventhal – Neubauer) were examined, also.

The research was held in selection plantations in full fruit-bearing. The trees were with completed forming of the tree crown.

In the center of attention was the attitude of the hybrids examined to the economically important fungal diseases in plum, such as red leaf spots (*Polistigma rubrum* Person DC), leaf rust (*Puccinia pruni spinosae* Pers.), shot hole (*Stigmia carpophila*) and brown rot of fruits (*Monilinia fructigena* Ader. Ruhl. Honey ex Whetz). The disease susceptibility rates were assessed visually, in July and August, following the cease of growing, on a mean sample of 200 leaves per tree. The index of infestation was calculated by the formula of Mc Kenney (1923). The standard plum cultivars Kyustendilska plum and Stanley were used as control.

The trees were own-rooted, planted in light grey forest soil, with grassed down surface and without implementation of plant protection measures. The studies used the approved methods of studying plant resources of fruit species (Nedev *et al.*, 1979).

The seedlings were derived by Sr. Res. Assoc. Micho Balev. During the hybridization the *Prunus spinosa* from the local plant resource was used as a mother and the Yellow Ablanshka plum sloe plum – local cultivar of *Prunus domestica*, as a father.

## Results and discussion

The interspecific hybrids studied have rather small fruits (Tab. 1). Their mass ranged from 7.32 g in N<sup>o</sup> 10/1 to 13.88 g in N<sup>o</sup> 39. The prevalent part was fruits of about 10 to 14 g mass. In different trees the fruits were not uniform and the values for mass varied within wide range. Their shape was oval or ovaly elongated, slightly flattened on the sides. The colour of the skin was blue in various hues. In nine of the hybrids the stone was separable, while the rest had no free stone. The latter was medium large (Tab. 1). In most cases fruits ripened in late August – early September. (August, 25<sup>th</sup> – September, 12<sup>th</sup>) (Tab. 1). They stayed on the tree long after ripening. Their taste was sourly tart. The well-ripen fruits were very tasteful for consumption. In fresh fruits the tannins ranged from 0.188 to 0.376%, and of acids from 1.34 to 2.35%. As for total sugars, the main share fell to invert sugar, while sucrose was present in negligible quantities or missing (Tab. 2).

Tab. 1. Results of morphological measurements of plum fruits, ripening time and cropping potential of the interspecies hybrids Sloe (*Prunus spinosa*) x Yellow Ablanshka plum (*Prunus domestica*)  
*Rezultati morfoloških merenja plodova šljive, vremena sazrevanja i potencijala rodnosti interspecies hibrida (Prunus spinosa) x Yellow Ablanshka plum (Prunus domestica)*

Hybrid N <sup>o</sup> Hibrid, broj	Fruit mass (g) Masa ploda	Fruit size (mm) Dimenzije ploda			Stalk length (mm) Dužina peteljke	Stone mass (g) Masa koštice	Stone separability Odvajanje koštice	Ripening time Vreme zrenja	Yield (kg/tree) Prinos u kg/stablo
		Height Visina	Width Širina	Thickness Debljina					
16/11	11.38	25.08	26.38	26.42	7.88	0.53	no/ne	25. 08.	9
7	7.33	24.25	21.88	21.46	4.82	0.47	no/ne	28. 08.	14
36	9.59	27.92	23.98	23.78	8.61	0.49	yes/da	12. 09.	12
15/6	9.82	28.72	23.98	22.35	10.42	0.89	yes/da	02. 09.	7
26	11.05	27.63	25.38	25.08	10.34	0.78	no/ne	30. 08.	9
14/9	10.52	29.72	23.75	23.92	9.28	0.45	yes/da	12. 09.	12
14/7	8.88	29.15	24.85	23.82	6.21	0.49	yes/da	03. 09.	15
43	11.35	30.42	25.00	24.72	9.56	0.55	yes/da	12. 09.	14
14/1	13.25	27.38	28.21	27.10	10.02	0.85	no/ne	28. 08.	3
31	8.27	25.78	22.89	23.35	6.80	0.79	yes/da	28. 08.	32
13	10.59	26.32	24.83	24.72	6.90	0.73	yes/da	08. 09.	25
53	8.53	26.39	24.58	24.15	7.90	0.58	yes/da	30. 08.	24
38	13.82	29.32	27.81	25.37	8.42	0.81	no/ne	26. 08.	6
39	13.88	28.32	28.45	27.58	10.07	0.68	no/ne	12. 09.	11
33	12.28	28.56	26.32	25.92	11.87	0.55	no/ne	28. 08.	9
10/4	13.58	30.25	25.42	27.32	8.95	0.73	yes/da	28. 08.	2
10/1	7.32	25.45	20.73	22.34	9.92	0.31	no/ne	30. 08.	11

Tab. 2. Chemical composition of fresh plum fruit from interspecies hybrids  
*Hemijski sastav svežih plodova interspecies hibrida šljive*

Hybrid N <sup>0</sup> <i>Hibrid br.</i>	Dry matter <i>Suva materija</i> (%)	Total sugars <i>Ukupni šećeri</i> (%)	Invert sugar <i>Invertni šećeri</i> (%)	Sucrose <i>Saharoza</i> (%)	Acids <i>Kiseline</i> (%)	Tanins <i>Tanini</i> (%)
15/6	19.5	9.83	9.83	–	2.35	0.316
26	15.8	9.48	9.48	–	2.28	0.316
14/1	16.1	9.83	9.83	–	1.74	0.297
31	16.5	8.60	8.60	–	2.08	0.178
13	19.00	10.35	10.25	0.09	2.35	0.218
53	15.0	7.93	7.83	0.03	2.28	0.198
33	17.5	8.70	8.70	–	1.47	0.198
10/4	18.00	12.63	12.63	–	1.34	0.356
10/1	14.00	9.38	9.13	0.23	1.74	0.376

As is evident from table 3, none of the interspecies hybrids studied was fully resistant to brown rot of fruits (*Monilinia fructigena*). The conidiospores spread by wind, rain or insects early in spring is generally most successful in rainy or moist weather. More susceptible to this disease showed the hybrids N<sup>o</sup>s 41, 38, 10/4, 9 and the control cv Stanley. Five of the hybrids studied were found to be slightly susceptible. The cultivar Kyustendilska plum, also used as a control, proved resistant to brown rot.

However, cv Kyustendilska plum was susceptible to red leaf spots (*Polystigma rubrum*) given the favourable conditions for this disease development. Nevertheless, none of the hybrids were infested by it. Single small spots were observed only in N<sup>o</sup> 39.

Concerning shot hole (*Stigmia carpophila*), the greater part of the hybrids studied proved susceptible to it (N<sup>o</sup>s 31, 38, 13, 43, 10/4, 53, 7). The most severe infestation was read on the leaves of N<sup>o</sup> 15/6. This disease was able to develop not only in spring and summer, but in autumn as well. No infection was registered in N<sup>o</sup>s 14/7, 41, as well as in the control cultivars Stanley and Kyustendilska plum. Low susceptibility was recorded for N<sup>o</sup>s 16/11, 10/1, 26 and 9.

The infestation rate with rust (*Puccinia pruni spinosae*) was very strong in the hybrid N<sup>o</sup>s 10/1, 15/6, 13, 43, 10/4, 39, 9 and the control cv Kyustendilska. The index of infestation ranged between 11.92 and 27.54%. The peak of infestation with this disease was observed in late summer, especially in August, when the translocation of large amounts of uredosores took place in humid and moderately warm weather. Thus, only in July and August in 2004 the rainfall amount was 137 l/m<sup>2</sup>. The hybrids N<sup>o</sup>s 38, 14/7 and 7 were slightly susceptible, with infestation index 2.14–6.18%.

All the hybrids studied had field resistance to sharka (*Plum pox virus*). Although they had been grown for a long time – 30 years – in a region with intensive sharka disease spread, no fruit or leaf symptoms were observed in them.

Tab. 3. Infestation rate of the main fungal diseases on the interspecies plum hybrids examined  
*Stepen zastupljenosti najznačajnijih gljivičnih oboljenja ispitanih interspecies hibrida šljive*

Interspecies hybrid <i>Interspecies hibrid</i>	Brown rot <i>Monilinia fructigena</i> Ader. Ruhl. Honey ex Whetz	Red leaf spots <i>Polistigma rubrum</i> Person DC	Shot hole <i>Stigmia carpophila</i> Pers.	Rust <i>Puccinia pruni spinorzae</i> Pers.
N <sup>o</sup> 7	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 13	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>
N <sup>o</sup> 26	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Low susceptibility <i>Slabo osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 31	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 33	Low susceptibility <i>Slabo osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 36	Low susceptibility <i>Slabo osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 38	Susceptible <i>Osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 39	Low susceptibility <i>Slabo osetljiva</i>	Single spots <i>Pojedinačne pege</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>
N <sup>o</sup> 41	Susceptible <i>Osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Low susceptibility <i>Slabo osetljiva</i>
N <sup>o</sup> 43	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>

Interspecies hybrid <i>Interspecies hibrid</i>	Brown rot		Red leaf spots		Shot hole		Rust	
	<i>Monilinia fructigena</i> Ader. Ruhl. Honey ex Whetz		<i>Polistigma rubrum</i> Person DC		<i>Stigmata carpophila</i>	<i>Puccinia pruni-spinorzae</i> Pers.		
N° 53	Low susceptibility <i>Slabo osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>	Susceptible <i>Osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>		
N° 10/1	Low susceptibility <i>Slabo osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Low susceptibility <i>Slabo osetljiva</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>		
N° 10/4	Susceptible <i>Osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>		
N° 14/7	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Low susceptibility <i>Slabo osetljiva</i>		
N° 15/6	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Highly susceptible <i>Veoma osetljiva</i>	Highly susceptible <i>Veoma osetljiva</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>		
N° 9	Susceptible <i>Osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Low susceptibility <i>Slabo osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>		
N° 16/11	Medium susceptibility <i>Srednje osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Low susceptibility <i>Slabo osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>	Low susceptibility <i>Slabo osetljiva</i>		
Kyustendilska plum	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Susceptible <i>Osetljiva</i>	Susceptible <i>Osetljiva</i>		
Stanley	Susceptible <i>Osetljiva</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Nil infestation <i>Nema zaraženosti</i>	Medium susceptibility <i>Srednje osetljiva</i>	Medium susceptibility <i>Srednje osetljiva</i>		

## Conclusion

In individual hybrids of the progeny great diversity was found regarding the fruits morphological traits and their quality. Differences were also found concerning the susceptibility to the economically important diseases. Conversely to reports in literature of barrenness or low fruit yields in interspecific hybrids, in the studied progeny no barren forms were found. Regardless of the rather small size of fruits in hybrid N<sup>o</sup>s 31, 53, 13, 7 considerably high yields were obtained.

The results for susceptibility to the diseases investigated allowed us to select N<sup>o</sup>s 31, 7, 53, 14/7, that will be used in further breeding activities as donors of disease resistance.

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REAKCIJA INTERSPECIES HIBRIDA RODA *PRUNUS* NA EKONOMSKI  
NAJZNAČAJNIJE BOLESTI ŠLJIVE

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Rezime

Proučavane su osobine potomstava dobijenih ukrštanjem sorte Sloe (*Prunus spinosa*) x Yellow Ablanska plum (*Prunus domestica*), kao i njihova osetljivost na virus šarke (PPV), *Polystigma rubrum* Person DC, *Puccinia pruni spinosae* Pers., *Stigma carpophila* i *Monilinia fructigena* Ader. & Ruhl. Honey ex Whetz. Praćena je rodnost stabala, a kvalitet plodova je utvrđivan na osnovu morfološkog opisa plodova. Ispitivano je oplemenjivanje, a izdvojene su selekcije koje mogu biti interesantne sa imuno-biološkog stanovišta.

**Ključne reči:** Šljiva, interspecies hibridi, gljivična oboljenja.

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