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BEHAVIOR OF PLUM VARIETIES GROWN IN DRYANOVO EXPERIMENTAL STATION TO ECONOMICALLY IMPORTANT DISEASES

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Abstract

The behavior of plum varieties grown in Dryanovo Experimental Station for the period 2018-2020 to the economically important diseases of the plum (Polystigma; Monilinia fructigena; Stigmina carpophila, Tranzschelia-pruni spinosae) was studied.
Sensitive to red leaf spots were the plum varieties Yoyo, Chachanska lepotitsa, Chachanska najbolie and Nevena, according to the Stanley standard (slightly sensitive). With regard to late brown rot and powdery mildew, a high degree of sensitivity manifested variety Tegera. Nevena and Balvanska Slava proved to be practically resistant to these diseases. Plum rust tolerant plums (Tranzschelia-pruni spinosae) include the varieties Yoyo, Balvanska Slava, Nevena, Gabrovska, Tegera and Hanita. From the study on the conditions of Dryanovo, Bulgarian varieties show low to medium susceptibility to economically important diseases.

Key words: *Plum, economical important diseases, Polystigm, Monilinia fructigena, Stigmina carpophila, Tranzschelia-pruni spinosae.*

INTRODUCTION

The plum is an economically valuable fruit species with traditions in our country. The biological and economic qualities of plum allow it to take a leading place in our country. It is a traditional fruit crop, widespread at 300-700 m in the foothills and mountainous regions of the Central Stara Planina, in the region of Troyan, Dryanovo, Gabrovo. This is due to the favorable soil and climatic conditions that the plum orchard finds in foothill and mountain conditions (Anzin, 1956; Enikeev, 1960) (Djouvinov and Vitanova, 2002). Plum (*Prunus domestica* L.) is characterized by high productivity opportunities varieties with different ripening periods and relatively low production costs. Valuable nutritional, medicinal and dietary qualities make it a desirable fruit, both in the domestic and foreign markets. (Mladenova et al., 2017).
In the recent past, the most widespread varieties were Kyustendil Blue Plum and Stanley. Plum varieties selected in a number of European countries have become widespread in the recent years. The most common diseases in plum culture are early and late brown rot, red leaf spots, fungal powdery mildew, plum rust (Iliev and Stoev, 2008; Iliev et al., 2011). The selection of varieties for the creation of a new orchard is an important moment in the preparation for a profitable fruit growing agribusiness. Choosing the right variety reduces the cost of growing fruit trees, reduces the risk of disease and allows for rhythmic annual harvesting. In addition, the breeder can more flexibly meet the requirements of the variety set market (Stoev et al., 2017).
The present study aims to trace the attitude of some varieties grown in the Dryanovo region to the studied economically important diseases.

MATERIALS AND METHODS

In the period 2018-2020, a study was conducted covering 13 plum varieties with different agrobiological characteristics and their relationship to economically important fungal diseases. The data on temperatures and precipitation, which are essential for the

development of the studied diseases, were used by the Meteorological Station in OSS-Dryanovo (Table 1), (experimental station for plum culture), which is a branch of RIMSA-Troyan, Bulgaria.

Humidity during the growing season is one of the main factors in the development of fungal diseases. Regarding the amount of precipitation, the region of Dryanovo is within the average amount of rain for the country, which varies around 410 l/m² for the period from March to August. The only exception is 2020, when the amount of precipitation for Dryanovo for the months from March to August was 343 l/m^2. The obtained results are averaged by the statistical methods of Lidanski (1988).

Table 1. Degree of infestation of introduced and our plum varieties to the diseases: powdery mildew, *Plum rust* red leaf spots, late brown rot (%)

Сорт	***Polystigma Rubrum (%)***		***Tranzschelia-pruni spinosae***		***Stigmina carpophila***		**Monilia fructigena**	
	x	± S x	x	± S x	x	± S x	x	± S x
Altanova renkloda	7.41	0.52	11.00	10.92	13.87	3.52	19.60	11.76
Balvan's glory	8.60	3.89	3.20	1.60	9.33	0.58	1.80	0.85
Gabrovska	11.07	4.69	5.07	0.99	16.80	7.79	8.27	5.67
Yo Yo	9.73	3.87	3.93	0.70	11.73	3.04	13.40	11.43
Nevena	13.47	2.12	6.67	3.43	9.60	0.20	14.10	0.14
Pacific	13.87	2.14	7.33	5.46	11.53	0.42	14.27	10.43
Stanley	3.07	0.90	11.27	4.11	10.60	1.64	16.80	13.22
Strinava	8.40	2.42	3.87	0.12	8.07	0.42	15.33	12.47
Tegera	16.20	7.45	4.00	2.23	8.47	2.14	13.50	11.74
Hanita	13.13	3.64	4.33	0.70	16.00	2.65	12.40	7.16
Chachanska lepotica	23.23	10.14	10.73	8.73	19.20	6.42	7.47	4.06
Chachanska najbolia	17.73	3.21	8.33	5.61	10.40	0.87	5.00	4.16
Chachanska rodna	11.67	1.89	10.27	8.81	10.93	3.13	5.73	4.09

The field experiments were carried out in the Experimental Station in the town of Dryanovo. The region is 300 m above sea level and belongs to the Pre-Balkan climatic region of Bulgaria. The plantations are established on pseudo-podzolic gray forest soil at a planting distance of 5x5 m. being grown according to the adopted technology for plum culture under non-irrigated conditions. The climat conditions have a significant impact on the growth and fruiting of the plum crop. The plantation is maintained in accordance with the methodology for the study of plant resources by Yoncheva et al., (1979). The degree of sensitivity to red leaf spots, fungal powdery mildew, plum rust and late brown rot was reported on 200 annual and short twigs on a scale (Yoncheva et al., 1979).

The observed trees were not treated with insecticides and fungicides. Excluding pesticide use facilitates the accumulation of infection in the orchard and the attack of trees by *Polystigma rubrum, Tranzschelia-pruni spinosae Stigmina carpophila Monilia fructigena*. The following indicators were taken into account in the study: Indicators of resistance to these diseases are: the condition of the fruit in the presence of measles and brown rot, as well as signs on the leaves of the observed diseases (Yoncheva et al., 1979).

The obtained results were subjected to mathematical and The obtained results are averaged by the statistical methods of Lidanski (1988) analysis using the software products used during the study was “MS Excel Analysis ToolPak Add-Ins”.

RESULTS AND DISCUSSIONS

During 2018 the meteorological conditions in the region of Dryanovo were favorable for the development of red leaf spots. This is due to the higher temperatures in April (16.7 ºC) and May, compared to the base period. Most of the varieties have over 10% attack of red leaf spots. The highest degree was reported for the variety Chachanska lepotitsa (21.3%), followed by Chachanska najbole and Hanita, and the lowest grade was Stanley - 2.2%.

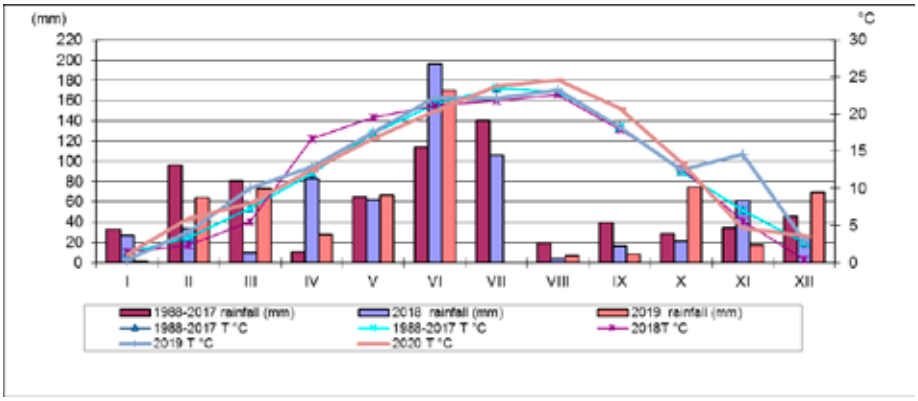

Figure 1. Climatic factors: temperature (°C), precipitation (mm), humidity (g/m^3).

In 2019, the amount of precipitation in April (83.0 l/m^2) is higher compared to 2018 (10.6 l/m^2) and 2020 (27.3 l/m^2) and are a prerequisite for a stronger attack by *Polystigma rubrum* (Figure 1). This pathogen inflicted the greatest damage on the Chachanska Lepotitsa variety - 34.8%. In most varieties the percentage is from 10 to 14.4%. Values below 10% were reported for the cultivars Altanova Renkloda, Balvanska Slava, Gabrovska, Yoyo, Strinava, and the lowest was in the cultivar Stanley - 3%. In 2020, lower temperatures in late March and early April affect the development of pathogens, especially those that appear at the beginning of the growing season. One of these pathogens is *Polystigma rubrum*, whose development coincides with the phases of flowering and the appearance of leaves in plums. During this period, the conditions for infection are not suitable as there are days with temperatures below 10ºC, which stops the flight of ascospores. The unusually high degree of infestation by *Polystigma rubrum* has been reported in low-susceptibility varieties, probably due to the later appearance of the leaves. The biggest damages were inflicted on the varieties Tegera - 24.8% and Chachanskaya najbloya - 20.8%. In most varieties the percentage varies from 10.2 to 16.2%. The lowest values were reported for the varieties Altanova Renkloda - 7.2% and the variety Stanley - 4% (Figure 2).

The highest values were reported in 2018 and 2019 for the Chachanska Lepotitsa variety - 21.3% and 34.2%. In 2020, the same variety reported only 14.2% attack rate. This is probably due to the biological peculiarities of the variety, as the beginning of the vegetation begins 2-3 days earlier than that of the varieties Tegera and Chachanska naibolya. In all other varieties the infestation rate is below 20%.

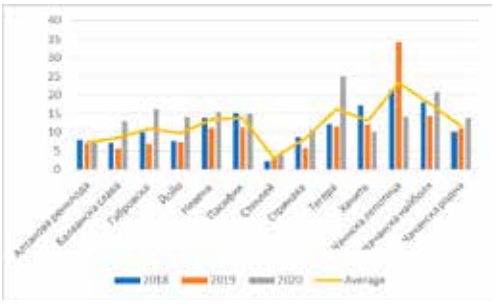

Figure 2. Infection rate (%) of *Polystigma rubrum*

The varieties Stanley, Strinava and Altanova Renkloda are defined as weakly sensitive, as their damage index does not exceed 11% throughout the study period. In the varieties Balvanska Slava, Gabrovska and Yoyo the degree varies widely and in 2018 and 2019 values below 11% were reported and we can define them as weakly sensitive. But in 2020, the same values were reported - Gabrovska variety 16.2%, Yoyo - 14.2% and Balvanska slava - 13%. This shows that these varieties in some years may show a medium sensitivity to red leaf spots. The strength of the attack by the pathogen depends very much on the meteorological conditions that affect its development and spread.

During the summer months of June and July 2018, large amounts of precipitation were measured - 114.51 l/m^2 and 140.51 l/m^2. High humidity and soil are beneficial for the

development of the fungus (Figures 1 and 3). Plum rust was manifested with a high degree of infestation in varieties - Altanova Renkloda (23.6%), Chachanska native (20.4%) and Chachanska lepotitsa is 20%. The varieties Balvanska Slava, Yoyo and Hanita have the lowest level of infestation below 5%. For other varieties, the percentage varies from 6 to 18%. This year is indicative of varieties that show moderate sensitivity.

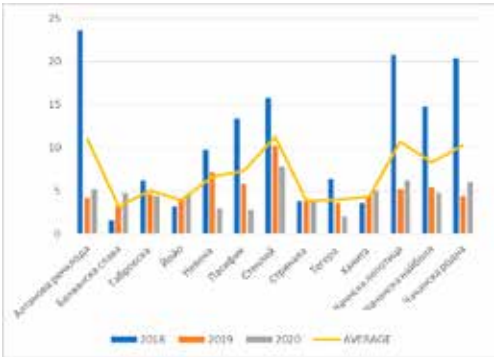

Figure 3. Infection rate (%) of *Tranzschelia-pruni spinosae*

In 2019, the months of August and September there was a drought and retention of higher temperatures, especially in September, which affected the spread of rust. The highest value is in the sensitive Stanley variety - 10.2%, and in other varieties the percentage is between 7 and 3%. Degree of attack below 5% was reported in the varieties Strinava, Tegera, Hanita, Yoyo, Gabrovo and Altanova Renkloda, and the lowest degree in Balvanska Slava - 3.2%.

In 2020, the months of July (0 l/m^2), August and early September, there was atmospheric drought and retention of higher temperatures, which affected the spread of rust. The highest value is for the sensitive Stanley variety - 7.8%, and for other varieties the percentage is between 2% and 6%. A degree of infestation below 5% was reported for the varieties Strinava, Balvanska Slava, Hanita, Yoyo, Gabrovska, Nevena, Pacific, Chachanska naibolya and Altanova renkloda, and the lowest degree in Tegera - 2%.

In 2018, the most serious damage from shotgun is in the variety Chachanska lepotitsa - 26.6%. In five varieties over 10% were reported, and in the other varieties a lower percentage was reported and respectively the Tegera variety had the lowest - 6.6% (Figure 4). This is a year with heavy rainfall, especially in June and July, when it is a prerequisite for a longer period of infection with powdery mildew. The lesions of fungal powdery mildew in 2019 are weak compared to the previous one. In all varieties the degree of infestation is similar and the values are between 8% for Tegera variety (lowest) and 17% for Hanita (highest). The damage from fungal powdery mildew in 2020 was less pronounced, probably due to the atmospheric drought in July. In most varieties the degree of infestation is similar and the values are from 7.6% for the variety Chachanska rodna, as the lowest, to 12.4% for Stanley. For another year, the highest damage was inflicted on the Hanita variety by 18%, and Chachanska lepotitsa with a close value of 15.8%. In 2018, the sensitive varieties Gabrovska and Chachanska lepotitsa showed the disease with values over 25%. Over the next two years, the damage index ranged from 12.4% for Gabrovo to 15.8% for Chachanska Lepotitsa. The varieties Yoyo, Pacific, Hanita and Altanova Renkloda are of medium sensitivity. The other varieties show low sensitivity and in the indicative year (2018) the lowest values were measured at Tegera - 6.6% and Strinava - 7.6%.

Figure 4. Infection rate of *Stigmina carpophila* (%)

Significant rainfall in June and July (2019) provoked the development of the fungus *Monilinia frutigena*. The largest lesions are in the varieties Altanova Renkloda, Pacific, Strinava and Tegera, as they reported values between 20% and 28.2% fruit rot. Only in the two varieties Yoyo and Chachanska the value below 10% were reported. The Altanova Renkloda and Pacific varieties have very low

yields and have also been severely affected by late brown rot. Significant rainfall in June provoked the development of the fungus *Monilinia frutigena.*

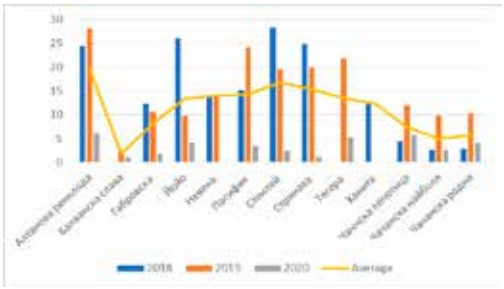

Figure 5. Infection rate (%) of *Monilia fructigena*

In July, a drought was observed, which affected the spread of brown rot spores. The largest lesions are in the varieties Altanova Renkloda, Chachanska Lepotitsa, and Tegera, with values between 6.2% and 4.8% of fruit rot reported. Values below 15% were reported for all other varieties. In the varieties Nevena and Hanita there is a very low yield (single number of fruits), due to which no damage index is reported.

CONCLUSIONS

Global climate change requires a new concept in the selection and selection of varieties and the study of their susceptibility to disease.

Opal is sensitive to red leaf spot, while Nevena, Pacific, Gabrovo, Hanita, Chachanska Lepotitsa and Chachanska Rodna are moderately sensitive. The varieties Altanova Renkloda, Balvanska Slava, Yoyo, Tegera, Strinava, Chachanska Naibolya and Stanley are defined as weakly sensitive.

The group of tolerant and insensitive varieties to rust on plums includes Yoyo, Altanova Rencolada, Balvanska Slava, Nevena, Opal, Gabrovska, Tegera and Hanita. The Stanley variety is very sensitive.

Compared to the powdery mildew, the varieties Chachanska lepotitsa and Gabrovska belong to the sensitive ones. The varieties Yoyo, Hanita and Altanova Renkloda sensitivity have medium sensitivity, and Stanley, Chachanska native, Chachanska naibolya, Balvanska slava, Nevena and Strinava are tolerant.

The Stanley, Yoyo and Altanova Rencloda varieties have the disadvantage that their fruits can be affected by late brown rot. The varieties Stanley, Altanova Renkloda, Yoyo and Strinava were very sensitive to late brown rot, and in some years the damage was over 25%. These varieties fall into the group for fresh consumption, which requires the application of a modern sustainable plant protection system to obtain quality attractive fruits and high sustainable regular yields.

With the best results in terms of tolerance or low sensitivity to the studied pathogens, were found in Yoyo, Pacific, Tegera, Hanita and Chachanska best. The Stanley, Chachnska Naibolya, Pacific and Altanova Renkloda varieties bear fruit regularly and have good fruit qualities. The varieties Nevena, Gabrovska and Strinava selected in Experimental station of plum-Dryanovo are characterized by complex resistance to economically

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