

## *Plum pox virus* sanitary status in Plovdiv region of Bulgaria

Snezhana Milusheva<sup>1</sup>, Ivanka Kamenova<sup>2</sup>

<sup>1</sup>Fruit Growing Institute, Plovdiv, Bulgaria

E-mail: jane\_m@abv.bg

<sup>2</sup>AgroBioInstitute, Sofia, Bulgaria

**Content:** A study on *Plum pox virus* distribution (PPV) in Plovdiv region, one of the main fruit-growing regions of Bulgaria was conducted during 2000–2004. Field inspections and collection of samples included 339 plum trees, 270 apricot trees and 208 peach trees. Virus identification was based on double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA). Plum (*Prunus domestica*) was the most infected – 26.54%, followed by peach (*P. persica*) – 21.15% and apricot (*P. armeniaca*) – 15.55%. The highest incidence of PPV on plum was recorded in cv Tuleu Timpuriu (80%). Two plum cultivars, Pacific and Opal were PPV free. Peach cultivar Summerset was the most infected (32.26%), while cv. Petrichka showed the lowest infection level (4.17%). The most affected apricot cultivar was Modesto (26.32%). No PPV infection was found in cv Early red French.

**Key words:** Stone fruits, sharka, distribution.

### Introduction

*Plum pox virus* (PPV), the causal agent of sharka disease (Atanasov, 1932), is the most economically important worldwide pathogen of *Prunus* stone fruit trees. Sharka disease cause great damages in the Balkan countries, including Bulgaria, where for many years it remained the most destructive and serious virus disease, despite all the control measures applied. A recent survey made in several regions of Bulgaria has shown the plum (*Prunus domestica* L.) as the most sharka infected stone fruit species (62.2%), followed by apricot (*P. armeniaca*) (23.4%) and peach (*P. persica*) (19.5%) (Kamenova et al., 2002).

Plovdiv region is the main plum productive and second (after Sliven region) peach productive region of Bulgaria (MAF-Annual Report, 2000). Since detailed information concerning PPV distribution and its infection level in the different stone fruit species in Plovdiv region is still limited, we aimed to estimate PPV sanitary status in the region.

## Material and methods

The survey was carried out in stone fruit collection and commercial orchards in Plovdiv region during 2000–2004. Symptom observations included 339 plum trees from 10 cultivars, 208 peach trees from 13 cultivars and 270 apricot trees from 10 cultivars.

Samples of leaves, collected from both, symptomatic and symptomless trees were tested by double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA) (Clark and Adams, 1977), using a polyclonal antisera for PPV (Kamenova and Peters, 1999) and Bioreba kit specific for PPV.

## Results and discussion

PPV was common and sharka symptoms were observed on the leaves and the fruits, as well as on the stones in all types of visited orchards of plum, peach and apricot (Tab. 1, 2, 3).

Tab. 1. PPV symptoms observed on plum cultivars  
*Simptomi zaraženosti virusom šarke na sortama šljive*

Cultivar <i>Sorta</i>	The highest degree of the symptoms on leaves <i>Stepen izraženosti simptoma na lišću</i>	The highest degree of the symptoms on fruits <i>Stepen izraženosti simptoma na plodovima</i>	Symptoms on stones <i>Simptomi na koštici</i>
Stanley	severe/ <i>jaki</i>	mild/ <i>blagi</i>	reddish spots/ <i>crvenkaste pege</i>
Bluefre	severe/ <i>jaki</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Čačanska Rana	severe/ <i>jaki</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Čačanska Najbolja	severe/ <i>jaki</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Čačanska Rodna	medium/ <i>srednji</i>	no symptoms <i>bez simptoma</i>	no symptoms <i>bez simptoma</i>
Čačanska Lepotica	severe/ <i>visoka</i>	mild/ <i>blagi</i>	light rings <i>blago izraženi prstenovi</i>
Tuleu Timpuriu	severe/ <i>jaki</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Pacific	no symptoms <i>bez simptoma</i>	no symptoms <i>bez simptoma</i>	no symptoms <i>bez simptoma</i>
Althan's Gage	severe/ <i>jaki</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Opal	no symptoms <i>bez simptoma</i>	no symptoms <i>bez simptoma</i>	no symptoms <i>bez simptoma</i>

Leaves: mild – up to five little spots; medium – spots cover up to ½ of the leaf; severe – spots cover more than ½ of the leaf.

Fruits: mild – discoloured spots on the skin; medium – 1 pox on the fruit; severe – poxes and internal fruit damages.

*Lišće: blagi – do 5 malih pega; srednji – pege koje pokrivaju do ½ površine lista; jaki – pege koje pokrivaju više od ½ površine lista.*

*Plodovi: blagi – obojane pege na pokožici; srednji – 1 ulegnuće na plodu; jaki – ulegnuća i unutrašnja oštećenja ploda.*

Tab. 2. PPV symptoms observed on peach cultivars  
*Simptomi zaraženosti virusom šarke na sortama breskve*

Cultivar <i>Sorta</i>	The highest degree of the symptoms on leaves <i>Stepen izraženosti simptoma na lišću</i>	The highest degree of the symptoms on fruits <i>Stepen izraženosti simptoma na plodovima</i>	Symptoms on stones <i>Simptomi na koštici</i>
<i>Peach/Breskva</i>			
Cardinal	severe/ <i>jaki</i>	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>
Colins	severe/ <i>jaki</i>	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>
Redhaven	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
Glohaven	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
J. H. Hale	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
Petrichka	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
Aheloy	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
Summerset	severe/ <i>jaki</i>	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>
<i>Clingstone/Industrijska breskva</i>			
Andross	severe/ <i>jaki</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Golden Queen	medium/ <i>srednji</i>	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>
Tundzha 1	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
Tebana	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
<i>Nectarine/Nektarina</i>			
Fantasia	severe/ <i>jaki</i>	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>
Hew Jersey 59	medium/ <i>srednji</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>

Leaves: mild – few small chlorotic blotches and bands; medium – veins cleared and chlorotic blotches, rings and bands surrounding veins cover up to ½ of the leaf; severe – veins cleared and chlorotic blotches, rings and bands surrounding veins cover more than ½ of the leaf. Narrowing and distortion of the leaf surface.

Fruits: mild – discoloured spots and rings cover up to ½ of the skin; medium – discoloured spots and rings cover more than ½ of the skin or slight sunken rings; severe – fruit deformation and internal fruit damages.

*Lišće: blagi – nekoliko hlorotičnih pega i linija; srednji – prosvetljavanje nerava i hlorotične pege, prstenovi i linije koji pokrivaju do ½ površine lista oko nerava; jaki – prosvetljenje nerava i hlorotične pege, prstenovi i linije koje pokrivaju preko ½ površine lista oko nerava. Sužavanje i deformacija liske.*

*Plodovi: blagi – obezbojene pege i prstenovi koji porivaju do ½ površine pokožice; srednji – obezbojene pege i prstenovi koji pokrivaju više od ½ površine pokožice i blago ugnuti prstenovi; jaki – deformacija i unutrašnja oštećenja ploda.*

Tab. 3. PPV symptoms observed on apricot cultivars  
*Simptomi zaraženosti virusom šarke na sortama kajsije*

Cultivar <i>Sorta</i>	The highest degree of the symp- toms on leaves <i>Stepen izraženosti simptoma na lišću</i>	The highest degree of the symptoms on fruits <i>Stepen izraženosti simptoma na plodovima</i>	Symptoms on stones <i>Simptomi na koštici</i>
Kishinevskij rannij	mild/ <i>blagi</i> *	no symptoms/ <i>bez simptoma</i>	rings/ <i>prstenovi</i>
Early red	no symptoms**	no symptoms	no symptoms
French	<i>bez simptoma</i>	<i>bez simptoma</i>	<i>bez simptoma</i>
Ijantarnij	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>	no symptoms/ <i>bez simptoma</i>
Magyar kajszi	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>	rings/ <i>prstenovi</i>
Modesto	medium/ <i>srednji</i> ***	mild/ <i>blagi</i>	rings/ <i>prstenovi</i>
Albena	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>	rings/ <i>prstenovi</i>
Kostyuzhenskij	medium/ <i>srednji</i>	mild/ <i>blagi</i>	rings/ <i>prstenovi</i>
Rouge Tardif	medium/ <i>srednji</i>	mild/ <i>blagi</i>	rings/ <i>prstenovi</i>
Delbard			
Roxana	mild/ <i>blagi</i>	no symptoms/ <i>bez simptoma</i>	rings/ <i>prstenovi</i>
Silistrenska kompotna	medium/ <i>srednji</i>	mild/ <i>blagi</i>	rings/ <i>prstenovi</i>

Leaves: mild – up to five little spots; medium – spots cover up to ½ of the leaf; severe – spots cover more than ½ of the leaf.

Fruits: mild – discoloured rings and bands on the skin; medium – sight sunken rings; severe – brown sunken rings or bumps on the fruits and internal fruit damages.

*Lišće: blagi – do 5 malih pega; srednji – pege koje pokrivaju do ½ površine lista; jaki – pege koje pokrivaju preko ½ površine lista.*

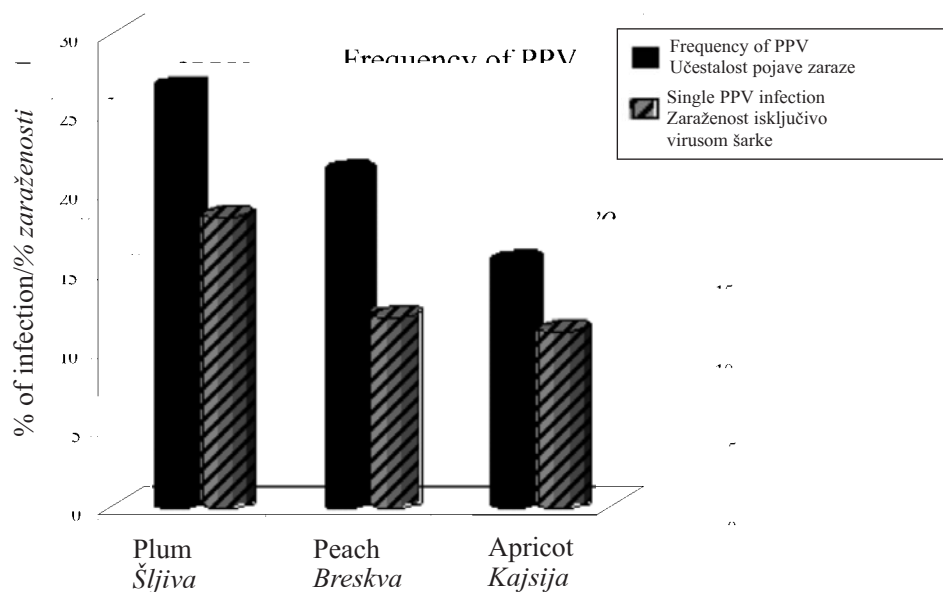
*Plodovi: blagi – obezbojeni prstenovi i linije na površini pokožice; srednji – blago ugnuti prstenovi; jaki – mrki, ugnuti prstenovi i neravnine na plodu, kao i unutrašnja oštećenja ploda.*

\*The data showed in tables 1, 2, 3 present the highest symptom degrees which were read on the pants infected only by PPV.

\* *Podaci prikazani u tabelama 1, 2, 3, predstavljaju najveći stepen izraženosti simptoma uočenih na biljkama inficiranim samo sa PPV.*

DAS-ELISA results revealed that the most affected *Prunus* spp. was plum, with 26.54% of the tested trees, followed by peach (21.15%) and apricot (15.55%) (Graph 1). Besides, the plants included in this survey, were analyzed for *Prunus necrotic ring spot virus* (PNRSV), *Prune dwarf virus* (PDV) and *Apple chlorotic leaf spot virus* (ACLSV) by DAS-ELISA. The highest rate of PNRSV was recorded in plum – 20%, followed by peach – 18.7% and apricot – 13% (Milusheva and Borisova, 2005). The data obtained about frequency of PDV showed that 14% from plum trees, 11.2% from peach trees and 14.2% from apricot trees were infected by this virus (Milusheva and Borisova, 2005). The most affected by ACLSV was peach 20%, followed by plum 15% and apricot 11% (Milusheva, 2005). The frequencies of PPV and the others detected viruses, may be summarized by the following scales: in plum PPV>PNRSV>ACLSV>PDV; in peach PPV>ACLSV>PNRSV>PDV; in apricot PPV>PDV>PNRSV>ACLSV.

According to the data obtained, PPV infection was prevalent in tested plum, peach and apricot trees. Approximately 18% from the plums, 12% from the peaches and 11% from the apricots, respectively were infected only by PPV (single PPV infection) (Graph 1, Tab. 4, 5, 6).



Graph 1. Infection level of PPV in plum, peach and apricot  
 Graf. 1. Stepen zaraženosti virusom šarke kod šljive, breskve i kajsije

The results obtained in this survey demonstrate, that for a period less than 10 years PPV infection level in plum (26.54%) and apricot (15.55%) in Plovdiv region has increased slowly, compared to that of 24.5% and 11.7% for plum and apricot, respectively reported by Topchiiska (1997). For the same period, however, the infection level of PPV in tested peach cultivars (21.15%) has increased much more to that (15.7%) reported by Topchiiska (1997). The results obtained showed also that PPV occurrence particularly in plum in Plovdiv region is the lowest one, compared with PPV infection levels of 76.6%, 73.0% and 63.2% in some other plum-growing regions in Bulgaria, as Sofia, Drjanovo and Kyustendil, respectively as reported by Kamenova and Borisova (2002).

The data from serological detection of PPV by DAS-ELISA method in plum, peach and apricot cultivars are shown in tables 4, 5 and 6, respectively. Two plum cultivars, Tuleu Timpurio and Stanley are the cultivars with the highest PPV infection, 80%, and 46.57%, respectively, while Pacific and Opal cultivars were PPV free (Tab. 4).

Tab. 4. Presence of PPV infection in plum cultivars  
*Prisustvo zaraženosti virusom šarke kod sorti breskve*

Cultivar <i>Sorta</i>	Level of PPV infection based on DAS-ELISA <i>Stepen zaraženosti virusom šarke na osnovu DAS-ELISA testova</i>				
	Total number of tested trees <i>Ukupan broj testiranih stabala</i>	Number of PPV positive samples <i>Broj PPV pozitivnih uzoraka</i>	Level of PPV infection (%) <i>Stepen zaraženosti virusom šarke</i>	Number of trees infected only by PPV <i>Broj stabala zaraženih samo virusom šarke</i>	Level of single PPV infection (%) <i>Stepen zaraženosti virusom šarke kod stabala koja su obolela samo od PPV-a</i>
Stanley	73	34	46.57	25	34.25
Bluefre	15	4	26.66	3	20.00
Čačanska Ranna	31	4	12.90	3	9.67
Čačanska Najbolja	52	13	25.00	7	13.46
Čačanska Rodna	40	5	12.50	3	7.50
Čačanska Lepotica	55	11	20.00	6	10.90
Tuleu Timpuriu	15	12	80.00	9	60.00
Pacific	20	0	0.00	0	0.00
Althan's Gage	23	7	30.43	6	26.08
Opal	15	0	0.00	0	0.00
Total number <i>Ukupan broj</i>	339	90		62	
Frequency in % <i>Frekvencija u %</i>			26.54		18.29

All peach cultivars tested were affected by PPV in single or mixed infection (Tab. 5). The most infected peach cultivar was Summerset (32.26%). This is in contrast to the results reported by Topchiiska (1996), for PPV presence in Summerset cultivar grown in Plovdiv region. Relative high PPV level was recorded in three cultivars, Cardinal (30%), Colins (30%) and Andross (30%). The lowest infection rate (4.17%) was detected in cultivar Petrichka. Besides cv Petrichka, a low percentage of PPV infection was found also in J. H. Hale (6.25%), Redhaven (6.67%), Glohaven (9.52%), Aheloy (10.00%) and Fantasia (13.33%).

In apricot, the highest PPV infection level of 26.32% was noted in cultivar Modesto (Tab. 6). Higher percentage of sharka virus infection was found in Albena (25%), Kostyuzhenskij (25%) and Silistrenska kompotna (23.81%) in comparison with Roxana (3.85%), Ijantarnij (8.33%), Tardiv Rouge Delbard (10.71%) and Kishinevskij rannij (11.47%). The trees of Early red French gave a negative response to the

Tab. 5. Presence of PPV infection in peach cultivars  
*Prisustvo zaraženosti virusom šarke kod sorti breskve*

Cultivar <i>Sorta</i>	Level of PPV infection based on DAS-ELISA <i>Stepen zaraženosti virusom šarke na osnovu DAS-ELISA testova</i>				
	Total number of tested trees  <i>Ukupan broj testi- ranih stabala</i>	Number of PPV positive samples  <i>Broj PPV pozitivnih uzoraka</i>	Level of PPV infection (%) <i>Stepen zastu- pljenosti infekcije virusom šarke</i>	Number of trees infected only by PPV <i>Broj stabala zaraženih samo virusom šarke</i>	Level of single PPV infection (%) <i>Stepen zastu- pljenosti infekcije viru- som šarke kod stabala koja su obolela samo od PPV-a</i>
<i>Peach/Breskva</i>					
Cardinal	10	3	30.00	2	20.00
Colins	10	3	30.00	1	10.00
Redhaven	15	1	6.67	1	6.67
Glohaven	21	2	9.52	2	9.52
J. H. Hale	16	1	6.25	1	6.25
Petrichka	24	1	4.17	1	4.17
Aheloy	10	1	10.00	1	10.00
Summerset	31	10	32.26	8	25.81
<i>Clingstone/Industrijska breskva</i>					
Andross	10	3	30.00	2	20
Golden Queen	14	3	21.43	2	14.29
Tundzha 1	12	2	16.67	1	8.33
Tebana	10	2	20	1	10.00
<i>Nectarine/Nektarina</i>					
Fantasia	15	2	13.33	1	6.67
Hew Jersey 59	10	2	20.00	1	10.00
Total number	208	44		25	
<i>Ukupan broj</i>					
<i>Frequency in %</i>			21.15		12.01
<i>Frekvencija u %</i>					

virus. The results obtained about Early red French are very interesting, because all tested trees from this cultivar were ten years old and they are grown in the immediate vicinity of Modesto, Albena, Kostyuzhenskij, Ijantarnij, Kishinevskij rannij and Magyar kajszi, in one and the same apricot orchard.

Sharka disease has a status of obligatory controlled plant pathogen in Plovdiv region and the results presented here document the current situation about PPV sanitary status in that part of the country. The results obtained clearly show that more attention has to be paid on the increased PPV incidence in peach and apricot species with further surveys and testing of larger number of cultivars and trees. In that aspect the investigation has to be enlarged in the main peach- and apricot-growing regions,

Tab. 6. Presence of PPV infection in apricot cultivars  
*Prisustvo zaraženosti virusom šarke kod sorti kajsije*

Cultivar Sorta	Level of PPV infection based on DAS-ELISA <i>Stepen zaraženosti virusom šarke na osnovu DAS-ELISA testova</i>				
	Total number of tested trees  <i>Ukupan broj testi- ranih stabala</i>	Number of PPV positive samples  <i>Broj PPV pozitivnih uzoraka</i>	Level of PPV infection (%) <i>Stepen zastu- pljenosti infekcije virusom šarke</i>	Number of trees infected only by PPV  <i>Broj stabala zaraženih samo virusom šarke</i>	Level of single PPV infection (%) <i>Stepen zastu- pljenosti infekcije viru- som šarke kod stabala koja su obolela samo od PPV-a</i>
Kishinevskij rannij	61	7	11.47	4	6.56
Early red French	8	0	0.00	0	0.00
Ijantarnij	24	2	8.33	1	4.17
Magyar kajszi	14	2	14.28	2	14.28
Modesto	19	5	26.32	4	21.05
Albena	28	7	25.00	5	17.86
Kostyuzhenskij	20	5	25.00	3	15.00
Rouge Tardif Delbard	28	3	10.71	1	3.57
Roxana	26	1	3.85	1	3.85
Silistrenska kompotna	42	10	23.81	9	21.43
Total number <i>Ukupan broj</i>	270	42		30	
Frequency in % <i>Frekvencije u %</i>			15.55		11.11

as Sliven, Black Sea district and Silistra. Further and detailed investigations, concerning PPV strain status are also greatly desirable. Since PPV is transmitted by infected propagating material and nursery grafts and by aphids in non-persistent way, its incidence in some ornamental and wild *Prunus* species has to be taken in mind, too because they can be involved as virus sources of aphids. The annual inspection and testing of the susceptible ornamental *Prunus* species are important for further development an efficient programme for managing of the disease. It is recognized that the efforts of Fruit Growing Institute, Plovdiv to control the spread of the disease and reduce the



losses have to continue for phytosanitary improvement of fruit-growing industry in the region.

## Conclusion

The slow increase of PPV infection level in plum and apricot, and the higher one in peach in the last several years of Plovdiv region shows the potential risk of further PPV spread in these fruit species. The result presented here stress the importance of establishing a certification programme, aimed at preventing the introduction of viruses, especially PPV and the production, distribution and the use of certified material. To this aim, a joint project supported from Germany is being established between Fruit-Growing Institute, Plovdiv and FAMAD Project (Fruit-Cultivation and Mountain Agriculture Development Project).

Two plum cultivars, Opal and Pacific and the apricot cultivar Early red French which were PPV free under field conditions could be used in future breeding programs for establishing stone fruit cultivars resistant to PPV.

The presence of PNRSV, PDV and ACLSV in tested plum, peach and apricot cultivars has to be greatly considered having in mind that the first two viruses are pollen and seed transmissible.

## References

- Annual Report of Ministry of Agriculture and Forestry (2000): Peaches, Sofia, p. 40.
- Atanasov, D. (1932): Yearbook. University of Sofia, Faculty of Agriculture, 11: 49.
- Clark, M.F., Adams, A.N. (1977): Characteristics of microplate method of enzyme-linked immunosorbent assay for the detection of plant viruses. *J. Gen. Virol.*, 34: 475-483.
- Kamenova, I., Peters, D. (1999): The differential reactivity of two polyclonal antisera to *Plum pox virus* isolates at different stages after immunization. *Biotechnologies & Biotechnological Equipment*, 1: 33-39.
- Kamenova, I., Borisova, A. (2002): Sanitary status of plum varieties at the Kyustendil region of Bulgaria. *Acta Horticulturae*, 577: 275-279.
- Kamenova, I., Milusheva, S., Borisova, A., Stoev, A., Myrta, A. (2002): Typing of *Plum pox virus* isolates in Bulgaria: Preliminary results. *Biotechnologies & Biotechnological Equipment*, 16, 2: 10-13.
- Milusheva, S. (2005). *Apple chlorotic leaf spot virus* – current status in peach, plum and apricot for Plovdiv region. *Ecology and Future*, 2-3: 106-108.
- Milusheva, S.A., Borisova, A.Z. (2005): The incidence of *Prunus necrotic ring spot* and *Prune dwarf viruses* in *Prunus* species in South Bulgaria. *Biotechnologies & Biotechnological Equipment*, 19, 2: 42-45.
- Topchiiska, M. (1996): PPV infection degree in peach: Sap transmissible viruses on stone and nut species in Bulgaria – etiology, diagnostics, distribution and control. Research work for qualifying for an academic degree. FGI, Plovdiv, pp. 306–307.
- Topchiiska, M. (1997): *Plum pox* (Sharka) *virus* in some *Prunus* spp. in Bulgaria. *Proceedings. Middle European Meeting '96 on Plum Pox*, Budapest, pp. 94-98.

Priljeno: 12. 01. 2005.  
Prihvaćeno: 02.02. 2006.

## STEPEN ZARAŽENOSTI STABALA VIRUSOM ŠARKE (PPV) U REGIONU PLOVDIVA U BUGARSKOJ

Snezhana Milusheva<sup>1</sup>, Ivanka Kamenova<sup>2</sup>

<sup>1</sup>*Institut za voćarstvo, Plovdiv, Bugarska*

*E-mail: jane\_m@abv.bg*

<sup>2</sup>*Agrobioinstitut, Sofija, Bugarska*

### Rezime

Tokom poslednjih nekoliko godina (2000 – 2004) vršena su obimna ispitivanja u cilju utvrđivanja kako rasprostranjenosti virusa šarke (PPV), tako i stepena zastupljenosti ovog virusa kod koštičavih voćnih vrsta u nekoliko oblasti Bugarske. U radu su predstavljeni rezultati jednog dela proučavanja, posebno za oblast Plovdiva, jednu od glavnih voćarskih regija. Ispitivanje je vršeno u okviru kolekcionog zasada koštičavih voćnih vrsta, kao i u komercijalnim zasadima. Ispitivanja u polju kao i u kolekcionim zasadima obuhvatala su 339 stabala šljive, 270 stabala kajsije i 208 stabala breskve. Identifikacija virusa izvršena je direktnom imunoenzimskom metodom (DAS-ELISA).

Najveći stepen zaraženosti utvrđen je kod šljive (*Prunus domestica*), – 26,54%, zatim kod breskve (*P. persica*) – 21,15%, a najmanji kod kajsije (*Prunus armenica*), – 15,55%. Izraženo u procentima, oko 18% šljive, 12% breskve i 11% kajsije bilo je zaraženo virusom šarke (PPV). Dobijeni rezultati ukazuju i na to da je stepen zastupljenosti virusa šarke (PPV) u oblasti Plovdiva najniži, u poređenju sa drugim oblastima gajenja šljive u Bugarskoj, kao što su Sofija (76,6%), Drjanovo (73,0%) i Čustendil (63,2%).

Prisustvo virusa šarke (PPV) je bilo najizraženije kod sorte Tuleu Timpuriu (80%). Kod dve sorte šljive, Pacific i Opal, nije utvrđeno prisustvo PPV. Sorta breskve Summerset je bila najzaraženija virusom šarke (32,26%), dok je kod sorte Petrichka utvrđen najmanji stepen zaraženosti (4,17%). Kod sorte kajsije Modesto ustanovljen je najviši stepen zaraženosti virusom šarke (26,32%). Kod sorte Early Red French nije konstatovano prisustvo PPV.

Dve sorte šljive, Opal i Pacific, kao i sorta kajsije Early Red French, kod kojih u poljskim uslovima nije utvrđeno prisustvo zaraze, mogu se preporučiti za buduće programe oplemenjivanja koji imaju za cilj utvrđivanje sorti koje su otporne, ili tolerantne prema virusu šarke.

**Ključne reči:** Koštičavo voće, šarka, rasprostranjenost.

Author's address:  
Dr Snezhana Milusheva  
Fruit Growing Institute  
12 Ostromila str.  
4004 Plovdiv  
Bulgaria