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Viruses on Table Vine Varietie

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Abstract:
In Herzegovina table grapes have been grown on smaller private areas. One of the most important factors that affect the yield and quality of vines, grapes and the profit of production are the viruses. The aim of this work is to monitor the occurrence of 4 viruses (GLRaV-1, GLRaV-3, ArMV and GFLV) on 6 table grape varieties: Prima, Black Magic, Cardinal,Demir-kapija, Victoria, Alphonse Lavallée. The research was conducted in the period from November 2019 to September 2020 on one of the larger plantations north of Mostar.Studies have shown different susceptibility of different varieties to these viruses. Of the 60 samples examined, the presence of ArMV virus was not recorded. The presence of GLRaV-1, GLRaV-3 and GFLV viruses was proven by ELISA. The variety Victoria is most susceptible to infection with the GLRaV- 3 virus, in which each sample of this variety is infected. The second variety that is most susceptible is Demir kapija with 80% of infected samples, followed by Cardinal with 70% and Alfonso with 50%. The most resistant varieties according to this research are Prima with 30% of infected samples and Black Magic with 10% of infected samples.

Keywords: grapevine, viruses, table varieties, ELISA, symptoms.

1. Introduction

The grapevine is one of the oldest and most important cultivated plants. Due to the value of its fruits, today it is present and economically important in almost all countries of the world, where climatic factors allow its cultivation.

Vine cultivation is found on almost all continents (except Antarctica), in areas located within a temperate climate zone with clearly separated four seasons. According to data from the International Organization for Vine and Wine (OIV), in 2017, there were 7,534,000 ha under vines, and world grape production amounted to 73,000,000 tons, with a share of 37% in Europe.

In Bosnia and Herzegovina, more than 95% of the area under vines is located in the southern regions of Herzegovina, mostly in private ownership. However, viticulture in BiH is developing more and more quickly and is becoming, apart from the traditional, also in the economic sense, a very important branch of the economy.That is why it is important to understand and investigate all the factors that can disrupt the process of growing vines and the production of grapes and wine.

One of the most important factors that affect the yield and quality of vines and grapes, as well as the profits of agricultural farms, are viruses that are the subject of research.

Diseases caused by phytopathogenic viruses are a limiting factor in the profitable production of grapevines. Grapevine is the crop parasitized by the largest number of plant viruses, more than 70 of them, specific or non-specific for grapevine, which have been investigated in the past 60 years (Meng et al., 2017). In addition to reducing the yield in the quantity and quality of grapes, the negative impact of viral diseases can also be reflected in the reduction of the vitality of the vines, which directly affects their resistance to adverse external conditions, primarily low temperatures, and shortens the exploitation life of the vineyard. Great difficulties can also be caused in the production of reproductive material through a reduced rooting ability of vine grafts, as wellas weaker fusion or incompatibility of podolog and scion (Ristić et al., 2018).

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Although vine viruses can be transmitted via vectors, the main and most dangerous way of transmission is through infected planting material. For this reason, in countries with a developed viticulture and wine industry, great attention is paid to the production of virus-free planting material as the most important measure in the fightagainst viral diseases. Improving the health status of the planting material through individual clonal and sanitaryselection is an initial precautionary measure in the fight against vine viruses.

All grapevine viruses belong to 27 described genera from 17 different families, and many of them can be simultaneously present in one plant without a clear pathogenic role. While some do not pose a threat to profitable grape production, others are economically and economically very important. They are widespread andcause a whole series of symptoms on the basis of which we are talking about disease complexes, such as: infectious degeneration, curling of the leaves, wrinkling of the wood and incompatibility of the substrate and thecrown. All these diseases in an advanced stage have a great impact on the yield (Jagunić, 2019).

Infectious degeneration caused by vine leaf spot viruses; it is the virus of infectious degeneration of the grapevine (Grapevine fanleaf virus, GFLV) and other European Nepoviruses;

Grapevine leafroll caused by a complex of viruses (Grapevine leafroll-associated viruses, GLRaVs);

Holey, furrowed, corky and spongy texture of vine wood caused by a virus complex (Rugose wood complex);

Grapevine fleck virus (Grapevine fleck virus, GFkV).

Most harmful viruses belong to the following genera: Closterovirus, Ampelovirus, Maculavirus, Vitivirus, Foveavirus and Nepovirus (Fauquet et al., 2005). So far, 25 viral and virus-like diseases of grapevines (Vitis and Muscadinia spp.) have been recorded. According to Karačić (2015), the most important are: Grapevine fanleaf virus (GFLV), Arabis mosaic virus (ArMV), grapevine leaf roll associated viruses 1-9 (Grapevine leafroll associated -1 to -9 , GLRaV-1 to -9), grapevine fleck virus (GFkV), grapevine A-virus (Grapevine virus A, GVA) and grapevine B-virus (Grapevine virus B, GVB).

Through this research, we will get an overview of the current health status of table grape varieties on one of the largest plantations in the Mostar winegrowing region.

2. Material and Methods

The subject of the research are table grape varieties: Prima, Black Magic, Cardinal, Demir-kapija, Victoria, Alphonse Lavallée, which were analyzed for the presence of 4 viruses: GLRaV-1, GLRaV-3, ArMV and GFLV. Samples for testing were taken on May 20, 2020. year with 10 vines randomly, from symptomatic and asymptomatic vines selected from all varieties (60 samples in total). Each sample contained three shoots. When choosing the shoot that was used as a sample, care was taken to ensure that it was a one-year, semi-woody growth, and that it grew from the old, or basal, perennial part of the vine, or branch. Each sampled shoot had three buds on it. During sampling, hygienic conditions were taken into account, so the vineyard shears were disinfected with 70% alcohol after each sampling. All collected samples were stored in cooling chambers at a temperature of 4°C, in order to preserve the collected material until laboratory testing. Laboratory research was carried out at the Faculty of Agriculture and the Agro-Mediterranean Institute in Buna using the ELISA test method. Detection and identification of the virus with the DAS-ELISA test was performed according to the recommended protocol of the manufacturer of the BIOREBA commercial kit.

3. Results and Discussion

Tests have shown different sensitivity of varieties to the tested viruses. The presence of ArMV virus was not recorded in 60 tested samples, while GFLV was detected in only one sample of the Victoria variety. GLRaV-1 was detected in 2 samples of the Alfonso variety. GLRaV-3 is the only virus that was detected on all tested varieties. From the obtained results, it can be concluded that the Victoria variety is the most susceptible to infection with the GLRaV-3 virus, 100% infection. The above data indicate a great need for the production of certified planting material of this variety. The second most susceptible variety is Demir-kapija with 80% of

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infected samples, followed by Kardinal with 70% and Alfonso with 50%. In this analysis, the varieties Prima and Black Magic had 30% and 10% of the infected samples, respectively (Table 1).

Table 1. Representation of the virus in the tested grapevine samples

Ordinal number	Viruses	Number of positive samples	Variety	%
1st	ArMV	0/60	-	-
2nd	GFLV	1/60	Victoria	1.66
3rd	GLRaV-1	2/60	Alfonso	3.33
4th	GLRaV-3	7/10 3/10 8/10 5/10 1/10 10/10	Kardinal Prima Demir-kapija Affonso Black magic Victoria	56.66

Research by Delić et al. (2007) present the first report on the presence of GLRaV-1 and 3 on autochthonous grape varieties in BiH. ELISA tests showed that 76.31% of the tested samples were positive for the presence of viruses from the Closteroviridae family, Grapevine leafroll-associated 1 and 3.

The most comprehensive data on the presence of viruses on grapevines in Herzegovina, currently available, are in the research of Karačić (2015). The results of testing nine viruses (ArMV, GFLV, GFkV, GLRaV -1, GLRaV -2, GLRaV -3, GLRaV -4-9, GVA, GVB) in 20 vineyards on six economically important autochthonous cultivars are presented. Serological methods detected: Grapevine leafroll-associated virus-3 (GLRaV-3) in 884 vines (66.3%), Grapevine fanleaf virus (GFLV) in 500 vines (37.5%), Grapevine leafroll-associated virus-1 (GLRaV-1) in 293 vines (22.0%), Grapevine fleck virus (GFkV) in 197 vines (14.7%), Grapevine leafroll- associated virus-4-9 (GLRaV-4-9) in 90 vines (6, 7%), Arabis mosaic virus (ArMV) in 17 vines (1, 2%), Grapevine leafroll-associated virus-2 (GLRaV-2) in 3 vines (0, 2%), while viruses: Grapevine virus A (GVA) and Grapevine virus B (GVB) were not detected. Of all tested vines, 1153 (86.5%) samples carried at least one virus, while 179 (13.4%) samples were healthy, without the presence of tested viruses. According to the available knowledge, the conducted research represents the first finding of GLRaV-2, GLRaV-5 and GLRaV-9 in Bosnia and Herzegovina confirmed by molecular methods, while GFkV, GLRaV-2 and the GLRaV-4-9 virus group is the first confirmed finding in Bosnia and Herzegovina serological methods.

Research conducted in five vineyards in Serbia determined the presence of GLRV-1, -2, -3 on 18 grape varieties, with GLRaV-3 being the most abundant (Starović et al., 2008). Similar results were shown by our research, which determined the presence of GLRaV-1, -3 and GFLV viruses, of which GLRaV-3 proved to be the most abundant virus, as 34 samples out of 60 tested were positive for this virus.

Grapevine leafroll-associated virus (GLRaV) is widespread in wine-growing areas around the world, and GLRaV-1, GLRaV-2, GLRaV-3, GLRaV-4 and GLRaV-6 have been identified in Slovenia (Rusjan et al., 2018).

Vončina et al. (2008) investigated the presence of five economically important viruses in Croatia on the variety Plavac mali and found a very high degree of infection. In terms of representation, GVA predominates (present in 6% of analyzed samples), followed by GLRaV-3 (99%), GLRaV-1 (76%), GFLV (53%), and ArMV (95%). In 19% of the samples, the presence of none of the tested viruses was detected. Also, a very high degree of simultaneous infection with 3 or more viruses was found (89%), while 92% of samples were found to be infected with only one or 2 viruses.

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4. Conclusion

The vine is susceptible to attack by a large number of pests and pathogens, among which viruses play a significant role, causing losses that are reflected, among other things, in the reduction of fertility and the shortening of the vineyard's lifespan.

The most important viruses on grapevines: Grapevine fanleaf virus (GFLV), Arabis mosaic virus (ArMV), grapevine leafroll associated viruses 1-9 (Grapevine leafroll associated -1 to -9, acronym GLRaV-1 of -9), grapevine fleck virus (Grapevine fleck virus, acronym GFkV), grapevine A-virus (Grapevine virus A, acronym GVA) and grapevine B-virus (Eng. Grapevine virus B, acronym GVB).

The research was conducted on table grape varieties: Prima, Black Magic, Cardinal, Demir-kapija, Victoria and Alphonse Lavallée, on a private plantation near Mostar, in the period from November 2019 to September 2020. The presence of 4 viruses was analyzed: GLRaV-1, GLRaV-3, ArMV and GFLV.

Laboratory research was carried out at the Faculty of Agriculture and the Federal Agro-Mediterranean Institute on Buna using the ELISA test method.

The presence of the GLRaV-1, GLRaV-3 and GFLV viruses was determined, while the ArMV virus was not detected.

Out of 60 samples, 57% of them were infected with GLRaV-3, 3.33% with GLRaV-1 and only 1.66% with GFLV. Through this research, it was determined that out of the 6 examined varieties of grapevine, the most susceptible to infection with the GLRaV-3 virus was the Victoria variety, all samples of which were positive. The second most susceptible variety is Demir-kapija with 80% of infected samples, followed by Kardinal with 70% and Alfonso with 50%. Varieties Prima and Black Magic had 30% and 10% of infected samples, respectively.

The investigation of grapevine viruses present on the plantation provided an overview of the sanitary condition of table grapevine varieties. By describing the symptoms of viruses on vines, it is possible to monitor the state of health and control the spread of proven viruses, which is the subject of another research paper.

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A Brief Author Biography

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