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MAPPING OF THE OCCURRENCE OF GRAPEVINE VIRUSES: GFLV AND ArMV IN VINEYARDS OF THE GRAPEVINE BREEDING STATION POLEŠOVICE

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Abstract

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Due to their worldwide distribution and also detrimental potential virus diseases of grapevine are economically very important. In grapevine plants Grapevine fanleaf virus (GFLV) and Arabis mosaic virus (ArMV) is one of the most harmful virus pathogens. The aim of this study was evaluate the occurrence of GFLV and ArMV in vineyards of the Grapevine Breeding Station Polešovice (Czech Republic) using the ELISA test and visual symptoms. In every year from 2001–2004 altogether 225 grapevine plants were tested for the occurrence of GFLV and ArMV. In case of GFLV positive results were obtained in 43 plants, i. e. in 19.11% of all samples. In case of ArMV there were 51 positive tests, i.e. 22.66%. Our results demonstrated a occurrence of GFLV and ArMV in propagation vineyards, which was comparable with results obtained abroad. It was also demonstrated that a professional visual selection could provide a good basis for the identification of virus diseases and their subsequent tests.

grape variety, grapevine virus disease, GFLV, ArMV, ELISA method, visual symptoms

Grapevine virus diseases are of a high economic importance because they occur worldwide and can cause great damages in vineyards. The most important virus diseases of grapevine plants can be classified into two major genera: Nepoviruses and Closteroviruses.

The *Arabis mosaic virus* (ArMV) and the *Grapevine fanleaf virus* (GFLV), two nepoviruses, are both causative agents of the fanleaf disease of grapevine, one of most damaging virus diseases affecting grapevines (Wetzel et al., 2002).

Grapevine fanleaf virus (GFLV), is degeneration, which causes poor berry set and a yield loss, which exceed 80% in some grapevine varieties. Grapevine viruses can cause severe losses by substantially reducing yield, affecting fruit quality and shortening the lifespan of infected plants in vineyard. (Rakhshandehroo et al., 2005).

GFLV is transmitted from grapevine to grapevine by ectoparasitic nematode *Xiphinema index* (Andret-Link et al., 2004).

Grafting of cuttings on infected rootstocks may result in a reduced yield of graftings. In Germany for example, the yield of Riesling grafting on healthy and GFLV-infected SO 4 rootstocks was 30–45% and 6–10%, resp. (Brückbauer, 1962).

As compared with healthy vineyards, yield losses obtained in GFLV-infected stands may be as much as 80% (Rüdel, 1983).

ELISA has been as a reference method for routine virus diagnosis of grapevine (Anfoka et al., 2004).

GFLV can be detected routinely by enzyme-linked immunosorbent assay of various grapevines extracts (leaves collected during spring, rootlets, cortical scrapings from mature canes, petioles) (Andret-Link, et al., 2004).

The control of these infections is based on the production of „virus-free“ plant material, clone selection and application of nematocides into the soil prior to planting of young plants (Bouquet et al., 2003).

Recently, Komínek and Holleinová (2003) evaluated the health condition of grapevine varieties in the Czech Republic.

Martin et al. (2005), tested the occurrence of GFLV and ArMV in the Oregon´s and Washington´s vineyards. They found zero occurrence of GFLV and ArMV.

Poljuha et al. (2004) evaluated the occurence of 6 grapevine virus, and too GFLV and ArMV with ELISA method.

The aim of this research was to evaluate the occurrence of GFLV and ArMV in vineyards of the Grapevine Breeding Station Polešovice.

MATERIAL AND METHODS

The evaluation and testing of grapevine samples for the presence of GFLV and ArMV by ELISA method was carried out in the period of 2001–2004.

Samples of grapevine varieties and clones were obtained in vineyards of the Grapevine Breeding Station Polešovice. Varieties and clones under study are presented in Tab. II. altogether 225 plants were followed in each experimental year.

Viruses were detected using ELISA method. Commercial antisera (Bioreba, Switzerland) against GFLV and ArMV were used in this method ELISA.

The ELISA tests were performed according to the methodology described by Komínek (2001).

A visual evaluation of symptoms of GFLV and ArMV infection was performed on the base of known symptoms of these two viruses show in Tab. I.

I: *Visual symptoms of viral diseases as observed in grapevine varieties cultivated under field conditions in the Breeding Station ŠSV Polešovice*

Virus disease	Symptoms
Grapevine fanleaf virus (GFLV)	- Sharply and markedly cogged leaf margins - Opened petiole nervatures - Fan-like nervature - Short internodes - Fasciation
Arabis mosaic virus (ArMV)	- Fan-like, markedly cogged leaves - Missing variety-typical shape of leaves. - Thin shoots and shorter internodes

RESULTS AND DISCUSSION

Production and propagation of „virus-free“ planting material is of cardinal importance in all wine-growing regions because it is well-known healthy stocks grow better and produce grapes of a higher quality than the infected ones (Woodham et al., 1984).

A regular control of propagated grapevine material is very important from the viewpoints of the health conditon of plants and the possible process of their sanitation.

Regarding these facts we tried to map the occurrence of GFLV and ArMV in some varieties grown in propagation plantations of the Grapevine Breeding Station Polešovice.

Selected plants were evaluated by means of the ELISA test and on the base of visual symptoms.

Numbers of all evaluated plants, positively tested plants with ELISA and plants showing visual symptoms of GFLV are presented in Tab. II.

Within the period of 2001–2004, altogether 225 grapevine plants were tested by the serological method ELISA for the occurrence of GFLV. Positive results were obtained in 43 cases, i. e. in 19.11% of the total number of plant samples. In plantations of Pinot Gris and Lemberger very low percentages of positively tested plants were recorded as well. As one can see in Tab. II., nearly all positively ELISA-tested plants showed also visual symptoms of virus infection.

Numbers of all evaluated plants, positively tested plants with ELISA and plants showing visual symptoms of ArMV are presented in Tab. III.

II: *Numbers of all evaluated plants, positively tested plants and plants showing visual symptoms of GFLV*

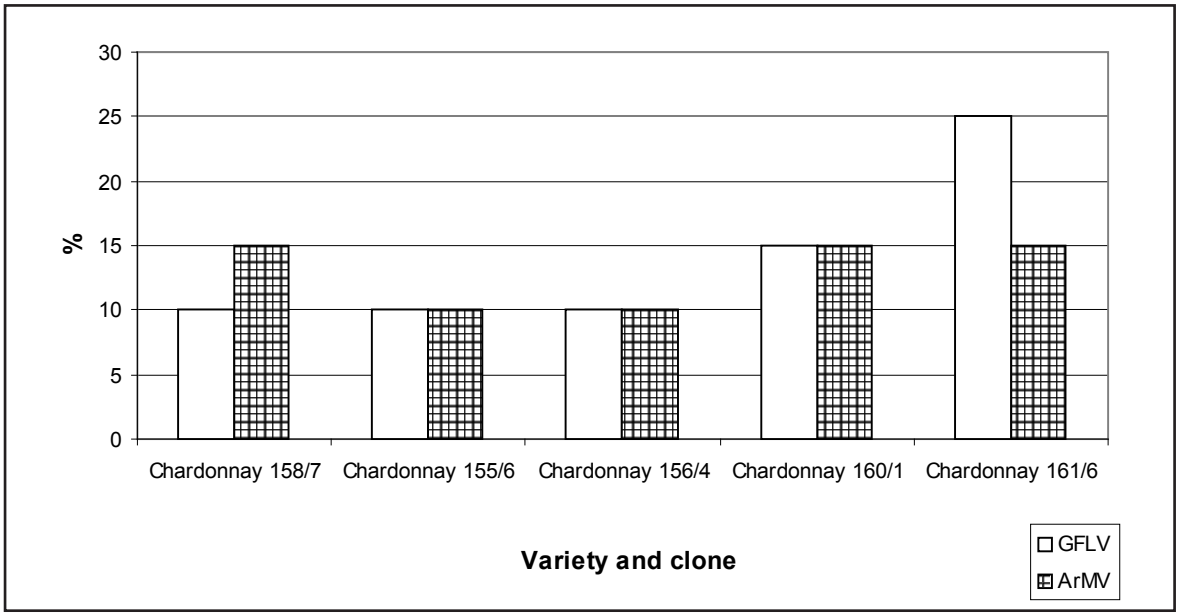
Variety	Total number of tested plants	Number of positively tested plants	Number of plants showing visual symptoms
Cabernet Sauvignon	10	2	2
Pola	10	3	2
Vitra	10	3	3
Olsava	10	6	5
Muscat moravsky	20	4	4
Chardonnay 158/7	20	2	2
Chardonnay 155/6	20	2	2
Chardonnay 156/4	20	2	2
Chardonnay 160/1	20	3	3
Chardonnay 161/6	20	5	4
Zweigeltrebe	25	6	3
Pinot Gris	20	3	3
Lemberger	20	2	2

III: *Numbers of all evaluated plants, positively tested plants and plants showing visual symptoms of ArMV*

Varietal	Total number of tested plants	Number of positively tested plants	Number of plants showing visual symptoms
Cabernet Sauvignon	10	8	7
Pola	10	4	3
Vitra	10	2	2
Olsava	10	7	7
Muscat moravsky	20	5	4
Chardonnay 158/7	20	3	3
Chardonnay 155/6	20	2	2
Chardonnay 156/4	20	2	2
Chardonnay 160/1	20	3	3
Chardonnay 161/6	20	3	2
Zweigeltrebe	25	8	4
Pinot Gris	20	4	4
Lemberger	20	0	0

Within the period of 2001–2004, altogether 225 grapevine plants were tested by the serological method ELISA for the occurrence of ArMV. Positive results were obtained in 51 cases, i. e. in 22.66%. A very positive result was obtained also in Lemberger because none of 20 tested plants showed a positive result.

Results of GFLV and ArMV tests performed with individual clones of the varietal Chardonnay are presented in Fig. 1. The highest number of positively GFLV plants were found among plants of the clone 161/6. On the other hand, the lowest numbers of infested plants occurred in clones 158/7, 155/6 and 156/4. As far as the evaluation of the presence of ArMV-positive plants in clones of the varietal Chardonnay were concerned, the obtained similar were similar. The highest numbers of positively tested plants (15%) were found in clones 158/7, 160/1 and 161/6. The average numbers of GFLV and ArMV positively tested plants were 14.00% and 13.00%, respectively.



1: *Percentages of plants positively tested for GFLV and ArMV in the variety Chardonnay*

The mapping of the occurrence of viruses, and above all GFLV and ArMV was performed too in many viticultural regions of the world.

Rakhshandehroo et al. (2005) evaluated the rate of infestation in Iran and found out 11.1% and 6.6% of GFLV and ArMV infected plants, respectively.

Ahmed et al., 2004 studied the distribution of grapevine virus diseases in Egypt and did not find any GFLV indivuals.

Anfoka et al. (2004) show GFLV as the most prevalent virus with overall incidence of 80% in Sanghez and Baneh districts in Kodestan. The high incidence of GFLV is possibly due to the presence of grassy weed species that serve as reservoirs for the virus and nematode vector.

Cigsar et al. (2002) studied the occurrence of grapevine viral diseases in Turkey. Results of field and laboratory studies demonstrated that the Turkish vineyards were infected with many important pathogens including GFLV and ArMV infestations.

Results obtained in our studies in vineyards of the Breeding Station Polešovice showed that the situation is comparable with data published in other countries.

All plants under study were evaluated also on the base of visual symptoms of the presence of both aforementioned viral diseases. The visual evaluation is important only as a preliminary tool enabling to identify the occurrence of the disease when selecting the propagated material. Particular symptoms of GFLV and ArMV are presented in Tab. I.. A comparison of results of ELISA test and of a visual evaluation of individual symtoms are presented in Tabs II. and III.. As far as GFLV was concerned, 37 of 43 ELISA-positive plants showed visual symptoms of infection, i.e. 86%. In case of ArMV, altogether 43 plants with positive symptoms of infection were identified among 51 plants positively tested by means of ELISA method, i.e. 84%. Of all varieties under study, the most marked diferences between results of ELISA tests and visual evaluation of symptoms of GFLV and ArMV infection were obtained in the variety Zweigeltrebe.

Laboratory tests of grapevine diseases can be used for diagnostics of this problem in practice, i.e. in vineyards. The identification of infected material can help growers to avoid and/or prevent the dissemination of these diseases into new plantations. The use of ELISA test is the most frequent due to its simplicity and quickness because the results can be obtained within one or two days (Weber et al., 2002).

In our study, the ELISA test also showed to be a very simple and practical method of testing of virus infections in grapevine propagation vineyards.

The obtained results demonstrated a very low occurrence of GFLV and ArMV in grapevine propagation plantations. They also demonstrated that a thorough visual selection can provide a good starting point for the identification of virus diseases and their subsequent testing.

SUMMARY

The occurrence of one and/or more virus diseases in propagation or production vineyards can have numerous unexpected consequences. Virus diseases influence above all production of buds, rooting capability, plant vigour and volume and quality of grape yields.

The aim of this research was to evaluate the occurrence of GFLV and ArMV in vineyards of the Grapevine Breeding Station Polešovice.

In every year from 2001–2004 altogether 225 grapevine plants were tested for the occurrence of GFLV and ArMV. In case of GFLV positive results were obtained in 19.11% of all samples. In case of ArMV there were 22.66%. positive tests Our results demonstrated a occurrence of GFLV and ArMV in propagation vineyards, which was comparable with results obtained abroad.

SOUHRN

Mapování výskytu virových chorob révy vinné: GFLV a ArMV ve vinicích Šlechtitelské stanice vinařské v Polešovicích

Výskyt jedné nebo více virových chorob ve výsadbovém materiálu nebo plodné vinici může mít mnoho neočekávaných důsledků. Virové choroby ovlivňují především produkci oček, schopnost zakořeňování, intenzitu růstu a objem a kvalitu výnosu.

Cílem tohoto výzkumu bylo vyhodnotit výskyt GFLV a ArMV ve vinicích Šlechtitelské stanice vinařské v Polešovicích.

V každém roce v období 2001–2004 bylo testováno 225 rostlin na výskyt GFLV a ArMV. V případě GFLV bylo dosaženo pozitivních výsledků u 19,11 % ze všech rostlin. V případě ArMV bylo pozitivně testováno 22,66 %. Výsledky ukazují, že výskyt GFLV a ArMV v množitelských porostech je srovnatelný s výsledky získanými v jiných zemích.

odrůda révy vinné, virové choroby révy, GFLV, ArMV, metoda ELISA, vizuální příznaky

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