

NEW GRAPEVINE VARIETIES WITH AN INCREASED RESISTANCE TO FUNGAL DISEASES

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Abstract

In the Czech Republic, grape breeders have studied for a long time problems associated with the resistance of grapevine plants to major fungal disease, i.e. downy mildew and powdery mildew of grapevine. The introduction of such new varieties into the practice contributes significantly to the ecologisation of viticultural production. In addition to the increased resistance, a higher quality of grapes and wine is another important trait of these new varieties. Varieties with an increased degree of resistance to fungal diseases represent a significant part of the collection of genetic resources at the Faculty of Horticulture of the Mendel University of Agriculture and Forestry Brno. In these genetic resources, both agronomical and oenological properties have been systematically studied. At present, two Czech varieties with an increased resistance to fungal diseases are registered in the Czech Republic, viz. 'Malverina' and 'Laurot'. The aim of this study is to describe new varieties, which are now tested in State Varieties Trials and the agronomical and oenological characteristics of the following varieties are presented: white wine varieties 'Erilon' and 'Savilon' and red wine varieties 'Cerason', 'Kofranka', and 'Nativa'. 'Erilon' and 'Savilon' are must varieties of the 'Sauvignon Blanc' type while 'Cerason', 'Kofranka' and 'Nativa' are varieties of a markedly European type, which are very suitable for production of various types of cuvée. All these new varieties are also suitable for organic viticulture.

Introduction

The origin of breeding and selection of grapevine for the resistance against various diseases and pests can be dated back to the year 1880 when Millardet in France anticipated as the first that it could be possible to combine the quality of European grapevine with the resistance of wild American grapevine species.

From the genetic point of view, a successful combination of resistance to fungal diseases with high yields and quality of grapes and wine requires to apply very complex methods of breeding and selection. However, all these traits are of a polygenic nature and for that reason it is possible to be successful only when advancing slowly, step by step.

The European grapevine (*Vitis vinifera* L.) is susceptible to mildew diseases and phylloxera. It seems that it either does not show any traits of genetic resistance or that these traits are so weak that they cannot be manifested under climatic conditions of Central Europe. The intention of plant breeders is to transfer to final crosses stable yields, good quality of grapes and wine as well as good adaptability to soil and climatic conditions which are typical properties of *Vitis vinifera* and to combine them with the resistance of American *Vitis* species. This breeding method consists of a series of little steps based on a gradual formation of such vine seedlings that correspond to defined breeding goals and result in the obtainment of the desired combination of productive traits at the end of the breeding process (Alleweldt, 1970).

Interspecific varieties of *Vitis vinifera* can be defined as hybrids of the species *Vitis vinifera* L., European grapevine with other members of the genus *Vitis* spp., i.e. with species originating from North America and Asia (Becker, N., 1989).

The total resistance and/or absolute immunity to fungal diseases cannot be found in any wild or cultural form of grapevine belonging to the botanical subgenus *Euvinifera*. The final resistance results from an exchange of conflicts taking place between the aggressivity of the pathogen and the host plant's defence capacity. Both these factors are influenced by environmental conditions, especially by weather (Becker, 1999).

Terms of „resistance“ and „interspecific varieties“ were discussed by Rebholz (2000) who wrote that the keyword „resistance“ substantiates „the trait-conditioned resistance to diseases“. This author suggests to use other, more fitting expressions, when the term „resistance to fungal diseases“ will be replaced by terms „tolerance to fungal diseases“ or „field resistance to fungal diseases“ that characterise this situation in a more exact manner.

As far as the most interspecific varieties are concerned, the quality of wine is very important. The process of breeding, selection and new varieties trials must be subordinated to this general objective. Problems of wine quality accompany this type of varieties for a very long time. They can be characterised as the presence of the so-called „hybrid tone“, i.e. a taste and a smell resembling gooseberry, white currant and strawberries, which is typical above all for varieties originating from *Vitis labrusca*. Besides, this taste is often very unpleasantly influenced also by a high content of acids (above all of malic acid).

This breeding goal is important also for Czech grapevine breeders. The objective of this paper is to characterise some selected properties of these varieties and to present some comments concerning methods of vinification on the one hand and quality of wine on the other.

Material and Methods

All varieties were followed within the period of 1996 – 2006 and originated from the collection of genetic resources of the Faculty of Horticulture in Lednice na Moravě. Their origin is presented in Tab. 1. The vineyard is situated in Lednice na Moravě (locality „V Mendeleu“) and belongs to the Mikulov viticultural subregion in the distance of approximately 10 km from the Czech-Austrian border. The spacing of vines is 2.0 x 1.0 m and the number of buds per vine with a horizontal cane. The height of stems is 70 – 80 cm.

Variety	Origin
Erilon	<i>(Blaufränkisch x Cabernet Franc) x (Merlan x Fratava)</i>
Savilon	<i>Rakisch x Merlan</i>
Kofranka	<i>Merlan x Fratava</i>
Cerason	<i>Merlan x Fratava</i>
Nativa	<i>Fratava x Merlan</i>

Table 1: Candidate varieties and their origin

The resistance of individual varieties to frost and fungal diseases (downy mildew, powdery mildew and grey mould) was followed within the period of 1996 – 2004. Their resistance was classified according to the OIV Scale (1983), in which 9 = a high resistance and 1 = a high sensitivity. The frost resistance was evaluated also according to a nine-point scale, in which 9 = a high frost resistance and 1 = very low frost resistance. Within the study period no chemicals (i.e. fungicides and insecticides) were used in the experimental vineyard.

The presented results involve also information about qualitative parameters of varieties under study (sugar content, titrable acids and pH) as estimated in years 2005 and 2006. These values were also obtained according to OIV methods.

Results and Discussion

At the very beginning of this discussion it is necessary to raise a question: Which is the factual resistance of grapevine varieties obtained by means of this breeding method?

As usual, when speaking about the cold hardiness and disease resistance plant breeders prefer the term 'tolerance' to 'resistance', mainly due to the fact that it means that this is a limited property that is influenced by growing conditions and climatic factors of each site (Hofäcker, 2000).

Results of evaluation of the tolerance to the most important fungal diseases and winter frosts are presented in Tab. 2.

	Downy mildew on leaves	Powdery mildew on leaves	Powdery mildew on berries	Gray mould on berries	Winter hardiness
Erilon	6.50	6.25	6.00	4.88	7.50
Savilon	5.75	6.00	5.63	6.50	7.85
Kofranka	6.88	6.38	6.75	6.88	7.85
Cerason	6.75	6.38	6.63	6.75	8.25
Nativa	5.38	5.50	5.50	5.38	7.35

Table 2: Evaluation of tolerance to fungal diseases and winter frosts using the OIV Scale (1983).

The obtained results indicated that all varieties under study showed a relatively high tolerance to fungal diseases. The highest tolerance was observed to downy mildew and this was in accordance with the objective of breeding and selection of new grapevine varieties. A relatively high tolerance to downy mildew, powdery mildew and grey mould was found out in varieties 'Kofranka' and 'Cerason'. Basing on practical experiences with growing these varieties it can be concluded that these varieties can be grown either with a minimal use of chemicals or even without any chemical protection. As far as the occurrence of fungal diseases was concerned, the lowest tolerance was observed in the variety 'Nativa', which should be therefore treated with fungicides 2 – 4 times within the growing season.

Basing on these results it can be concluded that at present there are some varieties, which – under normal growing conditions – show a sufficient tolerance to all three fungal diseases mentioned above and thus need not be treated by chemicals. As far as the degree of varietal differences is concerned, it is necessary to realise that this tolerance is influenced by the climate and local weather conditions. This means that the degree of tolerance is never fully satisfying and that it is always influenced by variety, climate and weather.

Regarding the use of these varieties under normal growing conditions it is necessary to keep in mind that their basic qualitative parameters (i.e. pH as well as contents of sugar and titrable acids in must) are also very important. Detailed results of these analyses are presented in Tab. 3.

Variety	2005				2006			
	Sugar (°Oe)	Acid (g.l ⁻¹)	pH	Date of harvest	Sugar (°Oe)	Acid (g.l ⁻¹)	pH	Date of harvest
Erilon	81	12.21	3.02	12.10.	94	12.48	3.11	9.10.
Savilon	88	8.42	3.05	10.10.	94	7.60	3.33	16.10.
Kofranka	90	11.70	2.99	25.10.	99	11.06	3.40	16.10.
Cerason	92	11.52	2.96	18.10	92	13.28	3.16	16.10.
Nativa	82	11.01	3.08	5.10.	85	10.38	3.16	16.10.

Table 3: Basic qualitative parameters of varieties under study (vintages 2005 and 2006).

The majority of these varieties ripened in the course of October. Red wine varieties are later and the lowest average sugar content was found out in the variety 'Nativa' in both vintages. In red wine varieties 'Kofranka' and 'Cerason' the sugar content was very good. Red wine varieties were characterised also by a relatively high content of titrable acids. When making red wine from these varieties it is necessary to pay a great attention to malolactic fermentation. The white wine variety 'Erilon' also showed a higher content of acids in must and this must be controlled by agrotechnical measures performed during the growing season.

The spread of interspecific varieties is supported also by results of surveys of wine marketability. As far as the white wine are concerned, their aroma and fresh, pleasant acid are the most important parameters that influence their purchasing while in case of red wines the most important factors are above all their intensive colour, distinctive aroma and content of tannins.

Basing on results of a long-term follow up of the varieties present in the collection of genetic resources it is possible to describe and recommend the tested varieties not only from the agrotechnical but also oenological point of views.

“ERILON“

This is a white wine variety. As far as the vineyard sites are concerned, it has medium to high requirements and prefers slopes with a very good insolation. Wet localities are not suitable. Soil quality is of lower importance. 'Erilon' grapes are mature in the first half of October. The recommended crop load is 4 – 6 buds per sq. m. The medium height of trellis (with the height of stems 60 – 80 cm) and pruning to one cane are suitable methods of growing for this variety. 'Erilon' is a vigorous variety with dense foliage and for that reason it is necessary to pay attention to defoliation. The aromatic ripeness of berries, which can be easily evaluated by taste, is a very important parameter of quality. 'Erilon' grapes should be processed under reductive conditions. After pressing, must should be clarified by means of sedimentation and thereafter fermented at lower temperatures using a pure yeast culture. The objective is to make wine with marked aroma and gentle acid. 'Erilon' is suitable for making of varietal wines. Grapes are usually of quality, cabinet wine and late harvest grades. The produced wines should be dry and are of „Sauvignon blanc type“.

“SAVILON”

This is also a white wine variety. It requires a good terroir that is suitable for growing white wine varieties. Soil quality is of lower importance and it can be cultivated in a wide spectrum of soil types. 'Savilon' grapes are mature in the first half of October. The recommended crop load is 4 – 6 buds per sq. m. If the load is lower it is usually not necessary to reduce the number of grapes in the course of growing season. Its foliage is of medium density and for that reason it is sufficient to perform only the basic leaf removal in the course of the growing

season. The harvest time is determined on the base of the sugar content and maturity of berries; their taste should resemble nettles and fruit. Quality wines with predicate are usually very good. Grapes should be processed under reductive conditions. It is very important to produce wine with a well-balanced ratio between aroma and fullness of wine taste. The cool fermentation is usually not a fully optimal method of wine making. It could be rather interesting to try to press whole grapes. This variety is suitable for making of varietal wines and the late harvest is the most suitable quality category. This wine is aromatic, with a more pronounced fruity character and gentle herbal tones, similar to ‘Sauvignon Blanc’; it is of full taste and with fresh acids.

“KOFRANKA”

This is a red wine variety. ‘Kofranka’ is suitable for localities with a traditional growing of red wine grapevine varieties. The most suitable are slopes with a very good insolation. This variety should not be planted into dry and easily drying up soils. Grapes of this variety are mature in October. The recommended crop load is also 4 – 6 buds per sq. m. For this variety, the medium height of trellis and pruning to one cane are the most suitable. ‘Kofranka’ is a vigorous variety and for that reason the defoliation is very important. As far as the technological ripeness of grapes is concerned, the phenolic ripeness of skins and seeds is the most important parameter, which determines the length of the maceration period. Already in this stage of vinification it is suitable to use at first the macrooxidation and thereafter the microoxidation (e.g. in wood). The malolactic fermentation is quite indispensable. The variety ‘Kofranka’ is suitable for making cuvées with other red wine varieties and it can be also used for production of organic wine. The deep red colour of this wine is very intensive. Its smell resembles dried plums, sour cherries, and forest fruit. The taste is full and extractive.

“CERASON”

Also ‘Cerason’ is a red wine variety. It has medium site requirements and it suitable for regions with traditional growing of blue must varieties. The recommended crop load is 4 – 6 buds per sq. m. and the medium height of trellis and pruning to one horizontal cane are the most suitable methods of cultivation. Harvested grapes are most frequently classified into the quality and/or late harvest categories. Also this variety should pass through the malolactic fermentation, which results in a more tender taste of produced. Microoxidation and ageing in wood can be also of interest. The variety ‘Cerason’ is also suitable for making cuvées with other interspecific red wine varieties originating from the same crossing and it can be used for production of interesting organic wine. This wine has a deep and very intensive red colour. Its aroma resembles red fruit – sour cherries and cherries. The taste is full and with gentle tannin tones.

“NATIVA”

‘Nativa’ is another variety that is used for production of red wines. It is suitable for good localities with traditional growing of red wine varieties. Wet localities are not recommended. Slopes with a good exposition are the best sites for its growing. Although it has not too great requirements on the quality of soil it does not tolerate apparently drying-up sites. Very wet soils, on the contrary, can intensify the grey mould infestation of plants. ‘Nativa’ ripens in the first half of October and the recommended crop load is 6 – 8 buds per sq. m. Removal of leaves is very important. The defoliation is based on a proper desuckering when all superfluous suckers can be removed. The phenolic ripeness of grapes is of decisive importance for the choice of technology used for processing of grapes. The variety ‘Nativa’ can reach a very good stage of phenolic ripeness and for that reason it is suitable for a long

maceration and production of full and extractive red wines. Such wines should be aged in wood. The malolactic fermentation is an indispensable part of vinification. This type of wine should contain about 13 % (v/v) of alcohol. If the grapes harvested only in the category of quality wine, they should be macerated only for a short period and used for making of aromatic and fresh red wines. 'Nativa' is suitable for production of varietal wines and can be used also for making various cuvées. It is suitable for traditional wine-growing regions. This wine is usually full, extractive and with a dark red colour. It has a fruity aroma with tones of cherries and sour cherries. The content and character of tannins is also of interest.

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Literature

- ALLEWELDT, G., 1970: Hat die Züchtung interspezifischer Kreuzungen eine Zukunft? Der Deutsche Weinbau, 31, p. 1146 – 1148.
- BECKER, N., 1989: Pilzresistente Sorten im Versuchsanbau. Rebe und Wein. 42, 6, p. 242 – 248.
- BECKER, N., 1999: Johanniter und Merzling. Zwei pilzfeste Weisswein-Neuzuchten aus Freiburg. Rebe und Sein. 52, 4, p. 28 – 131.
- HOFÄCKER, W., 2000: Rebenzüchtung: Zukunftssicherung des Weinbaus – gestern und morgen. Der Deutsche Weinbau., 61, p. 22 – 27.
- OIV, Descriptor list for grapevine varieties and Vitis species. OIV Paris, (1983), 135 s.
- REBHOLZ, F., 2000: Pilzresistente Rebsorten – Bühne frei für Newcomer? <http://www.bafz.de/>