Breeding New Grapevine Cultivars with High Cold Hardiness

by Dr. P. Cindric and Dr. V. Kovac, University of Novi Sad, Yugoslavia

Synopsis – Breeding new grapevine cultivars with high cold hardiness by interspecies hybridization Vitis vinifera x Vitis amurensis. Through the preliminary investigations the theoretical elements were worked out, while the results show biological and techno–economical characteristics of a few candidates for new cultivars.

INTRODUCTION

Under the continental climate conditions the success of vinegrowing highly depends on limited factors. A grape yield as well as grape and wine quality directly depend on low temperatures during the winter and the sum of heat degrees during the vegetation (Zilal, 1981; Csepregl, 1985). Since we can not influence the ecological factors, we have to adapt ourselves to them. The increase of savety degree of production under these conditions is possible, first of all with cultivars which have high cold hardiness and an early maturity (Diofasi et al. 1986; Luntz and Nagy, 1986). To that aim we have worked out one program of breeding new cultivars based on interspecies hybridization. We have decided to go this way as we believed that radical solution of this question is not possible inside of Vitis vinifera species. Besides that, grape breeding applying the interspecies hybridization at many countries during the few last decades has brought very important results, especially at the direction of quality improvement of interspecies hybrids (Potapenka, Kostrikin, 1974; Koleda, 1975; Csizmazia, 1977; Golodriga et al. 1978; Taida, 1978; Alleweldt, 1979; Avrujan, 1980; Becker, H. 1980; Becker, N. Zimmermann, 1980; Doazan, 1980; Zotov, 1980; Vojtovic, 1981, Szegedl et al. 1984 and others).

Our intention was to continue the work of preliminary generations of breeders and for further back crossings with Vitis vinifera to use the best interspecies hybrids.

PRELIMINARY INVESTIGATION

The work on this problem began with collecting and studying the selections created in the past several decades by interspecies hybridization between Vitis vinifera, American species and East–Asiatic species Vitis amurensis. The list of the hybrids we have studied is given in table 1. More about them is written down in the paper Cindric et al., 1983.

Two white wine grape cultivars created on the bases of V. amurensia by Hungarian breeders Tamasy and Lokeda appear to be the most interesting ones for our objectives. They are cultivars Kunbarat and Kunleany patented in 1974 and 1975. (Csepregi, Zilai, 1980). Those were results of first back crossing, and theoretically they have inherited 25% of hereditary base of V. amurensis and 75% of V. vinifera.

V. I. Mitshurin was first who conducted planned introduction of the species V. amurensis in grapevine breeding at the beginning of this century aimed at implementing the principle formulated as "shifting of the south to the north" (Vasiljchenko, 1963).

The first notable success with this species were achieved by Soviet breeders: Potapenko, Kostrikin, 1974; Pogosjan et al., 1974; Golodriga et al., 1978, and others. The primary idea was to transmit high cold hardiness possessed by this species to Vitis vinifera cultivars. It is well known that wild forms of V. amurensis can stand very low temperatures (Goiodriga, Sujatinov, 1981).

Besides Soviet Union the species Vitis amurensis is used in other countries in grapevine breeding: Hungary, Bulgaria, West Germany, Czechoslovakia and others.

RESULTS OF PRELIMINARY RESEARCH

Herein we will present some results of the research which describe the most important biological and techo–economical characteristics of cultivars Kunleany and Kunbarat.

Table 1. Investigated Interspecies Hybrids

Hybrids	Originated from Hybridization			Origin
	V. Vinifera	American Species	V. Amurensis	
Kunleany	+		+	Hungary
Kunbarat	+		+	Hungary
Zalagyongye	+	+		Hungary
Bianca	+	+		Hungary
Lakhegyi Mezes	+	+		Hungary
Gocseji Zamatos	+	+		Hungary
Vertes Csillaga	+	+		Hungary
Medina (Medea)	+	+		Hungary
Poloskei Muskat	+	+		Hungary
R–49	+	+		Hungary
Csf II 1209	+	+		Hungary
Rayon D'Or	+	+		France
SV 12–375	+	+		France
SV 18–315	+	+		France
SV 20–473	+	+		France
SV 20–347	+	+		France
S 70–53	+	+		France
Zarja Severa	+		+	USSR
Negru De Jaloveni	+		+	USSR
Saperavi Severni	+		+	USSR
V. Amurensis			+	USSR
Ruskij Concord	+	+		USSR
II 65–89	+	+		USSR
Ljana	+	+		USSR
Bashkanski Krasni	+	+		USSR
Musk. Onjestrovski	+	+		USSR
Strashenski	+	+		USSR
Strugurash	+	+		USSR
Moldova	+	+		USSR
Vierul 59	+	+		USSR
V 68–91	+	+		USSR
Gm 312–53	+	+		Germany
Fr 589–54	+	+		Germany

Table 2 summarizes the average results from three multi–year experiments. Results show that cultivars Kunbarat and Kunleany besides high yield had substantially higher sugar contents compared to the control cultivar Italian Riesling. Having in mind the fact that they have been picked up earlier than the control cultivar, it is clearly seen that these cultivars fairly well accumulate sugar. For the Kunleany one can conclude that it is resistant to the Botritis cinerea. The wine quality evaluation has shown that wines of these two cultivars are modest, with clear wine flavor and taste, free from foreign admixtures, but in most cases slightly weaker quality compared to the control cultivar.

In generally the lowest level of frozen buds has Kunleany, while the highest has Italian Riesling. The biggest difference for tested cultivars occurred at the beginning of winter, when Kunleany showed the highest resistance and vinifera cultivars the lowest. The resistance of Kunleany decreases during the winter and reaches the lowest point toward the end of winter, although that level is still relatively high. Vinifera cultivars had different resistance during the winter. Traminer and Italian Riesling showed the highest resistance at the mid time, while Muscat Ottonel showed it by the end of winter.

According to our previous results, majority of cultivars originated from V. amurensis show a similar trend in winter hardiness as Kunleany, being the highest at the beginning of winter and subsequently gradually decreasing. It means that in hybridization the highest level of cold hardiness in these varieties in expected to be at the beginning of winter and lowest toward the end of winter. It should be remembered in the choice of the other parent for hybridization to have a different trend of winter hardiness, first of all, to be high toward the end of winter, such as Muscat Ottonel.

RESULTS

Selection Procedure

Breeding program by interspecies hybridization in Novi Sad has included 40 crossing combinations out of which 4000 seedlings has been produced. In this paper we describe results of only eight crossings in which Kunleany and Kunbarat have been crossed with known vinifera cultivars: Pinot Gris, Pinot Noir, Muscat Ottonel, Traminer, Italian Riesling, Irshai Oliver and Nimrang. Crossings have been done in 1976 and 1977.

Out of these eight crossing combinations almost 700 seedlings have been cultivated on their own roots. Thanks to special procedure of intensive care the plants gave first crop at second and third year. The primary selection was concluded definitely with fourth or fifth year (Cindric, 1980,1981).

For test at second grade selection about 70 the most prospective genotypes has been propagated by the method of green grafting on the earlier planted rootstock vines. At that stage of selection the standard cultivars were included, too: Italian Riesling for the genotypes of flat types of wine and Traminer for the genotypes of aromatic wine.

Place and Work Conditions

Tests were done at experimental station in Sremski Karlovci. Geographical coordinates of the place are : North latitude $45^{O}10'$ and East longitude 20^{O}. Sea level about 100 m.

Soil type: eutric cambisol on loess.
Spacing: 3 x 1 m.
Training system: Guyot with trunk of 80 cm above the ground.
Height of support: 195 cm, wires in four level.
Bud load: 6 nouds/m^2
Pruning: 1 x 16 + 1 x 2 = 18 nouds per vine.
Experimental shema: block system with 3 replications.
Number of vines per variant: 36 (12 x 3).
Basic meteorological data for the experimental period are shown in Table 3.

Table 2. Grape Yield and Quality *

Varieties	Yield kg/m^2	Sugar %	Acids g/l	Botrytis %	Vintage Date
Italian Riesling	1.42	16.9	8.5	14	14.x
Kunleany	1.53	21.4	8.8	1	10.x
Kunbarat	1.77	22.4	7.4	8	6.x

* Averages for 3 trials

Cold hardiness has been tested in cold chamber, similar as it has been done by many authors (Pogosjan, 1975; Csernomorec, 1976; Eifert, 1980). Since both cultivars Kunleany and Kunbarat had behaved almost the same, the results of freezing tests are presented only for one of them. Tests at the cold chamber have included some other known white wine cultivars which had been considered for further crossing, (Graph 1). Freezing test at cold chamber had been carried out at $-21^{O}C$ during 10 hours three times a winter: at second half of December, January and February. Black areas on graph show the percentage of totally frozen buds, dots show partly frozen buds, where the central buds were frozen, while the side buds survived, and white areas show the percentage of live buds.

Graph 1.