

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Federal Research Institute for Vine Breeding
Geilweilerhof - 6741 Siebeldingen (Fed.Rep. Germany)

C o n f e r e n c e A g e n d a

25.9.1973

- Section I -

Wild growing vines as gene resources in breeding

Chairman: H.P. Olmo, Davis (USA).

- 10.00 - 10.45 h M. Rives, Pont-de-la-Maye (France):
Wild growing vines as gene resources in
breeding
- 10.45 - 11.00 h M. Neagu and M. Iacob, Bucarest (Rumania):
On the occurrence of the wild growing vine
(*Vitis silvestris* Gmel.) in Rumania and
its importance for vine breeding
- 11.00 - 11.15 h F. Schumann, Neustadt (Fed.Rep. Germany):
Investigations on wild-growing vines in
Germany
- 11.15 - 11.30 h S. Iwano and Y. Yatomi, Tokio (Japan):
An introduction to wild-growing vines
as breeding resources in Japanese varieties
- 11.30 - 11.45 h H. Becker, Geisenheim (Fed.Rep. Germany):
Investigations on selections of wild specimen
of *Vitis riparia* with regard to rootstock
breeding
- 11.45 - 12.00 h W. Schenk, Geisenheim (Fed.Rep. Germany):
Investigations on callus formation in
wild-growing vines

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Wild growing vines as gene resources in breeding

M. RIVES

Station de Recherches de Viticulture
Institut National de la Recherche Agronomique
I.N.R.A.
Pont-de-la-Maye (France)

Summary

The genus "Vitis" is found growing spontaneously throughout the whole northern hemisphere from Japan to California, westwards, with but a few terrestrial gaps, approximately between the latitudes 10° and 55°.

The variety of environments that this huge domain encompasses implies a correspondingly important genetical variation within the genus. This is only increased by the variable prevalence of parasites according to the regions, and the correlative evolution of resistances.

The fact that, with the exception of Muscadinae, there seems to exist no genetic barrier between the "species" of Vitis should make it very easy to use this variation in breeding.

Examples will be given of traits that may be sought for in wild growing vines, with an attempt to look beyond the now classical search for disease resistance.

In a final section, interest will be focussed to the importance of wild-growing *V. vinifera* in Europe for the theory of the origin of varieties of grapes and for breeding.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

On the occurrence of the wild growing vine
(*Vitis silvestris* Gmel.) in Rumania and
its importance for vine breeding

M. NEAGU - M. IACOB

Institute for Agronomy "Nicolae Balcescu"
Bucarest (Rumania)

Summary

The occurrence of wild vines in Rumania, in the Danube plain, the Danube delta, in Moldavia, in Siebenbürgen, southern Banat, near Crisana and at the foot of the Carpathian mountains, has been established by numerous authors. Furthermore investigations have been carried out on the variability of the vegetative growth and the reproductive organs. On the other hand, ecological research concerning the resistance of *V. silvestris* in Rumania to frost, diseases and pests and its importance in vine breeding was only started by us few years ago.

The wild vine is found especially in biotopes with a favourable warm-damp microclimate, a light soil from the plain, rich in humus and with a high water table. The species can be found in a not too thickly populated forest environment and on the edges of the forest as a part of the wild flora (*Populus alba*, *Fraxinus excelsior*, *Acer campestre*, *Quercus robur* etc.). Together with other climbing plants as *Periplocha graeca*, *Hedera helix*, *Clematis vitalba*, it imparts an exotic appearance to the forest.

M. NEAGU - M. IACOB

On the occurrence of the wild growing vine (*Vitis silvestris* Gmel.) in Rumania and its importance for vine breeding

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The natural populations we have investigated correspond completely with the forms described by Gmelin. They are characterised by dioecism, small, 3-4 lobed leaves, small, black berries with 2-3 seeds. According to our observations and specialist literature, the wild vine is infected with plasmopara. However, no large necroses were found, as with the *V. vinifera* cultivars. An infection of *Eriophyes vitis* was also noticed.

As this species was high in fertility, vigour and resistance to calcium and frost, it was introduced into our breeding programme.

Investigations on wild-growing vines in Germany

F. SCHUMANN

State Teaching and Research Institute for Viti-
culture and Fruit-growing
Neustadt/Weinstr. (Fed. Rep. Germany)

Summary

The population of wild vines in the "Upper Rhine" gene reservoirs is continually decreasing. Whereas some 100 years ago "thousands" of wild vines were to be found in the forests of the Rhine plain and of its tributaries, the author only knows of 39 living examples which have been discovered during studies carried out since 1963. Two of these wild vines died in the meantime and this is suspected of another two. During the period of the investigations, the trunks of eight vines have been cut down. No young, naturally grown vines have been found.

Morphological differences between the wild vines studied have been detected, which indicates a genetical variance within the population.

Thus, before 1857, Bronner was able to establish amongst the "thousands of wild vines" the existence of numerous plants which differed from the usual types of wild vine, and he planted an assortment of seven male, 16 female and 13 androgynous vines. The fertile types differed from each other in the shape, colour and size of berries, as well as in flavour and maturation time and furthermore in size and shape of the bunch and also in their fertility. The leaves had but few sinuses, 3-5 lobes and differed in size, pilose, colour and shape of petiolar sinus. Bronner also described differences in vigour, wood colour and shape of the petiole and rachis.

It is not possible to draw any conclusions from the variability in Bronner's assortment concerning the conditions prevailing at the natural habitat, because some types, e.g. with green berries, only occurred three times amongst thousands, whereas others were found much more frequently, e.g. *Arminia silvatica* Bronner.

At present wild vines correspond in general to this type. However, differences in the shape of the grape, leaf size and shape and trunk cross-sections have been established in the most thoroughly investigated population on the island in the Rhine near Ketsch. Contrary to all the later investigations, Bronner's data regarding the predominance of female, i.e. fruit bearing vines in the forests of the plain was confirmed, for, out of 20 definable vines of the Ketsch population, 13 were fruit bearing and 7 were male.

In order to investigate more thoroughly the variability of existing wild vines and to select interesting types for breeding, we propose that the existing wild vines should be planted in an assortment and under comparable conditions. At the same time, more attention should be paid to the preservation of wild vines in their natural habitat, for the investigations on the wild vine assortment showed that even here their preservation could not be guaranteed over a number of years. Attempts to replant seedlings and rooted vines have begun and have been partly successful.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

An introduction to wild-growing vines
as breeding resources in Japanese varieties

S. IWANO - Y. YATOMI

Tokyo (Japan)

Summary

As early as 1930, the late Yasushi Oinoue carried out crossings between the *Vitis vinifera* cultivars Muscat of Alexandria, Zinfandel and Flame Muscat, which resulted in the new varieties "Shôri" (white) and "Seikô" (black).

Later (1968) Seishiro Iwamatsu crossed *Vitis coignetiae* with *Vitis riparia*. This resulted in an hermaphrodite cultivar which seems suitable for red wines.

In 1940, Yoshimune Yatomi crossed *Vitis thunbergii* with Sweet Muscat (= Sanjaku x Flame Muscat, *Vitis vinifera*), which resulted 1944 in red wine varieties. Further selectioning is still being carried out.

In 1966, Toshio Matsushima crossed Seibel 10076 with *Vitis flexuosa Thunbergii*, which resulted 1970 in several promising red-wine varieties.

Y. Yatomi introduced in 1962 a new red-wine variety from Chima, a hybrid no. 28 (*Vitis vinifera* L. cv. Muscat Hamburg x *Vitis amurensis* Rup.) and in 1965 he crossed this with "Shôri" (= *V. coignetiae* x *V. vinifera*) and selected 1969 a vigorous, disease resistant, white-wine variety.

In 1966, S. Iwano crossed *Vitis amurensis* cv. Japonica with Seibel 13053 and selected 1969 a vigorous, disease resistant, early maturing, red wine variety.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Investigations on selections of wild specimen of
Vitis riparia with regard to rootstock breeding

H. BECKER

Hessian Research Station for Viticulture,
Fruit-growing and Horticulture
Geisenheim (Fed. Rep. Germany)

Summary

The stock plants which are suitable for viticulture in northern Europe inherit from *Vitis riparia*. Random forms have been selected from the extensive gene material of this species when breeding rootstocks, but the genetical constitution does not necessarily meet the ecological requirements of our viticulture. The *V. riparia* forms which are used in France, e.g. *riparia Gloire de Montpellier*, require a relatively high amount of warmth, and probably descend from the southern area of distribution of this species. Some wild forms of *V. riparia* have, therefore, been brought to Germany, mainly from northerly zones (USA and Canada) and the following features were studied: completion of the vegetation phase, lignification, formation of calli and roots, grafting ability, vigour, resistance to plasmopara and oidium, resistance to phylloxera, cold hardiness, variability of leaf shape, etc.

It appeared that the more northerly the region of plant origin in the *V. riparia* distribution area, the greater the proportion of forms which had an early completion of the vegetation phase. The vigour and the internodal length of those cultivars which are suitable for our viticulture decreased towards the end of the vegetation period, and there is a visible lignification of the shoots.

H. BECKER

Investigations on selections of wild specimen of *Vitis riparia* with regard to rootstock breeding

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With regard to the completion of the vegetation phase, these *V. riparia* forms behave similarly to those of our *V. vinifera* cultivars with early cane maturity.

Some *V. riparia* vines of Canadian origin have a very early leaf fall. The root formation is better than with common root stocks. Most forms have a good grafting ability. The vigour is variable, however, and permits vigorous cultivars to be selected. They are comparable with the other *V. riparia* forms with regard to resistance to phylloxera and mildew. By using selected *V. riparia* strains it is possible to cross-breed ecological features which are favourable for North-German viticulture. Several graphs are presented showing the results of the different performance appraisements.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Investigations on callus formation in
wild-growing vines

S. SCHENK

Hessian Research Institute for Viticulture,
Fruit-growing and Horticulture
Geisenheim (Fed.Rep. Germany)

Summary

Despite numerous publications to elucidate the problems, there are still significant deficiencies in our knowledge of the systematics, the taxonomy and the ecology of *Vitis* cultivars and this affects our knowledge of the mode of reaction of the physiological development of those forms which are interesting for viticulture. It seemed a good idea, therefore, to investigate in comparison with well known rootstock cvs. the regeneration ability of hardwood cuttings of those *Vitis* species and ecotypes in the assortment of the Institute for Vine Breeding and Propagation at Geisenheim. For this purpose, 50 cuttings of each cultivar were grown under constant conditions of temperature (25° C) and humidity, and the callus formation was appraised.

The different species and their hybrid products can be divided into three groups according to the timing of the appearance of a visible callus at the position of the apical cut of the seedling.

In the first group, cultivars with early callus formation, are the rootstocks Kober 125 AA, Geisenheim 26 and *V. monticola* Buckl. (N.Y.), M.G. 143 A, *V. riparia* Michx., *V. amurensis* Rupr., Kober 5BB Kl. 13 Gm and *V. berlandieri* Planch. (Ress. Nr. 1). The numerous ecotypes of *V. riparia* Michx. also belong to this group.

W. SCHENK

Investigations on callus formation in wild-growing vines

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The second group of cultivars, with moderately early callus formation, consists of *V. rupestris* Scheele (Texas), Teleki 8 B, Selection Oppenheim (SO 4), *V. Solonis* (*V. longii* Prince), 3309 C, *V. cinerea* Engelm.

The third group, with a later callus formation, includes amongst others the species *V. vulpina* Linn. (= *V. riparia* Michx.), *V. riparia* Michx. (Urbana 2) and *V. vinifera* Linn. ssp. *sativa* D.C. white Riesling.

With regard to the amount of calli produced by 50 seedlings in 32 days, the species *V. berlandieri* Planch. (Ress. Nr. 1), *V. rupestris* Scheele (Texas) and *V. riparia* Michx. head the list. These are followed by the rootstocks 143 A M.G., *V. rupestris* Scheele (du Lot), Kober 5 BB Kl. 13 Gm, Kober 125 AA, Geisenheim 26 and Dr. Deckerrebe.

An appraisal of the average callus formation at different times gave a picture of the quantitative progress of the regeneration and permitted conclusions to be drawn on the behaviour as a grafting partner. This early diagnostical data is of particular importance for rootstock breeding, as the constitution of the physiological development, which is genetically determined, allows the choice of a suitable crossing partner. In this regard, the oecotypes of *V. riparia* Michx. play a most important role.

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C o n f e r e n c e A g e n d a

25.9.1973

- Section II -

Genetical and cytological problems of grape breeding

Chairman: G. Staudt, Geilweilerhof (Fed.Rep.Germany)

- 14.00 - 14.45 h H.P. Olmo, Davis (USA):
Genetical and cytological problems of
grape breeding
- 14.45 - 15.00 h M. Rives, Pont-de-la-Maye (France):
Helping grapevine variety breeding away from
the fishing pool bank
- 15.00 - 15.15 h P. Kozma, Budapest (Hungary):
Possibilities of increasing the efficiency of
vine breeding in quality and quantity
- 15.15 - 15.30 h L. Avramov, B. Pejkić, M. Jovanović and
M. Milutinović, Belgrade-Zemun (Yugoslavia):
Cytochemical investigations on histones
and nucleic acids during microsporogenesis
of the cv. "Kardinal" (*Vitis vinifera* L.)
- 15.30 - 16.00 h Interval
- 16.00 - 16.15 h R. Linder, Lille-Annappes (France):
Meiosis, appearance of pollen grains and
early genetical diagnosis
- 16.15 - 16.30 h V. Lepadatu and V. Dvornic, Bucarest (Rumania):
Investigations on the formation of reproductive
organs and the development of the fertilisation
process in the vine
- 16.30 - 16.45 h W.S. Semin and L.M. Jakimov, Kischinew (USSR):
Irradiation of pollen as a factor for in-
creasing variability in vine breeding

- 16.45 - 17.00 h G. Staudt, Geilweilerhof (Fed.Rep. Germany):
Cytological investigations on the fertilization
and fertility of grape vines
- 17.00 - 17.15 h S. Lazic, Sremski Karlovci (Yugoslavia):
Analysis of the genotypes of certain *Vitis*
vinifera cultivars
- 17.15 - 17.30 h K.V. Smirnov, Samarkand (USSR):
The breeding of seedless grapevines
- 17.30 - 17.45 h M.V. Melkonian, Erewan (USSR):
On the inheritance of high sugar content in
the hybrid grape offspring
-

M. Neagu, Bucarest (Rumania):

The present day state of research on vine breeding and
genetics in Rumania

K.S. Pogossian, Erewan (USSR):

On grape heterosis

M.S. Schuravel, Kischinew (USSR):

Selection of seedless and early maturing grape-vines

P.K. Soldatov, Samarkand (USSR):

Genetic basis of clonal selection of grapes

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
Geilweilerhof 25 - 29 September 1973

Genetical and cytological problems of
grape breeding

H.P. OLMO

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(USA)

Summary

The very high genetic variability of cultivated vinifera can be attributed to hybridization amongst a number of feral subspecies, and not to differentiation and selection within a single species. Once cultivated varieties are introduced they introgress readily with other native *Vitis*, so that new races are produced. Examples are given for the North American, Oriental, Caribbean and other races.

Biochemical genetics is playing a more important role in studies in *Vitis*. Examples are given of inheritance of anthocyanins. Studies of quantitative inheritance are very limited, examples of peduncle length and date of fruit ripening in the vinifera grape are reviewed. Work in isozymes may prove to be very useful in identifying species and cultivars, but the techniques are as yet difficult to perfect. Developmental genetics can be profitably expanded, especially in such problems as seedlessness and berry size.

Cytological studies on chromosome number, morphology, and behavior in the grape family are leading to a better understanding of the evolution of the group. Chromosome number and size are uniform in the genera *Ampelocissus*, *Ampelopsis*, and *Parthenocissus*, with $2n = 40$. The *Muscadinia* section of *Vitis* has this same number.

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Cissus remains a very large group of species and probably consists of a number of taxons that will be subdivided into other genera. The basic number is 6, but there are a number of high polyploids in the group.

Vitis is consistently unique in that all species have $2n = 38$. It is a secondary polyploid with original basic numbers of $6+6+7$. To date, the only attempt at genome analysis has been with the Vitis x Muscadinia hybrids. Such hybrids have now proven to be extremely valuable as gene sources of resistance to many diseases and insects that can be incorporated easily into the vinifera genome.

Tetrastigma and Cyphostemma frequently show a gametic number of 11, this is perhaps an indication of an additional basic number of 5, not present in other genera.

On taxonomic grounds these two genera appear most primitive, which also corresponds with the lower basic chromosome number.

Relationship between the genera await hybridization and genome studies to resynthesize the pathways in their evolution.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Helping grapevine variety breeding away from
the fishing pool bank

M. RIVES

Station de Recherches de Viticulture
Institut National de la Recherche Agronomique
I.N.R.A.
Pont-de-la-Maye (France)

Summary

In a vegetatively propagated species, little is known of the genetical control of characters, of the genotypical value of potential genitors, as well as of the nature of the correlation between characters in both space and time that conditions the feasibility of early selection.

In such a situation the probability of finding a good candidate in the progeny of a wisely planned cross is very low (and follows a POISSON law, hence our title!).

With no means to improve on the knowledge without first performing the job, one is led rather to improve on the methods, and especially on the strategy of plant breeding, to increase the chances.

A strategy will be explained that is designed to maximise both the efficiency and the frequency of genetical recombinations as a means to maximise variation and the reassortment of traits among the progenies, based on recent theoretical results on recombination.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September

Possibilities of increasing the efficiency of vine
breeding in quality and quantity

P. KOZMA

University of Horticulture
Budapest (Hungary)

Summary

In accordance with the demands for large scale production, the Faculty of Viticulture of the University of Horticulture set itself in 1948 the target of developing new vine cultivars by hybridization, whose features were to be strong growth, high fertility and superior quality. For this purpose, several indigenous vines and several hundred well known cultivars from the grape collection were examined for growth, maximum biological fertility, and high yield and quality, and the heritability of these features was tested.

Our hybridization work led to the following results:

- The peak performance in biological fertility was attained by the hybrids (F_1 , F_2) of the cultivar Terra promessa and its hybrid descendants (e.g. with Rezsö, etc.). Its primary and secondary fertility coefficient was 2-4 with an average of 2000-3000 flowers/inflorescence. Crossings with vigorous cultivars and with Terra promessa seedlings had a very high biological fertility potential and a good yield quality. With moderately vigorous cultivars, it was difficult to obtain a good relationship between shoot growth and yield intensity under physiologically favourable conditions.

P. KOZMA

Possibilities of increasing the efficiency of vine breeding
in quality and quantity

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- When crossing very fertile cultivars (fertility coefficient around 2) which at the same time had a strong growth (such as Lindenblättrige, Izsáki Sárfehér, Pamid etc.) with quality cultivars (Muscat Ottonel, Traminer, Weißer Riesling, Pamid etc.) the inheritance of growth factors was good, that of fertility was poor (better in F_2 or R_1) but the inheritance of the quality was good and dominant. When crossing new strains, the quality of the hybrids may exceed that of the parent cultivars.

- In some hybrid combinations (e.g. Blaufränkisch x Kadarka, Blaufränkisch x Cabernet franc, Damascener x Königin der Weingärten), it was possible to obtain an increase in growth and biological fertility (hybrid effect, heterosis effect) and at the same time preserve the quality.

- The higher the reproductive quality of a cultivar, the lower the variance in fertility, i.e. in cultivars with a lot of flowers and a high yield, the differentiation of the flower parts is stimulated.

- By hybridization it was possible to obtain all combinations of biological fertility, time of maturity, sugar and acid production, flavour and aroma.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Cytochemical investigations on histones
and nucleic acids during microsporogenesis
of the cv. "Kardinal" (*Vitis vinifera* L.)

L. AVRAMOV - B. PEJKIC
M. JOVANOVIĆ - M. MILUTINOVIĆ

Institute of Horticulture and Viticulture
Faculty of Agriculture
Belgrade-Zemun (Yugoslavia)

Summary

The amount of histones, non-histonic proteins and nucleic acids contained in the pollen mother cells was investigated by using cytochemical methods during the microsporogenesis of the cv. Kardinal (*Vitis vinifera* L.). The following results were obtained:

1. The nucleic acid content increases immediately before and at the beginning of meiosis, followed by a decrease until the tetrad stage and an increase again.
2. The non-histonic proteins show the same tendency as the nucleic acids, however, their formation in the pollen mother cell begins even before meiosis. The content then decreases during all meiotic states up to the formation of gones and again a considerable protein synthesis occurs.
3. The synthesis of histones on the other hand is quite different. The content of histone is only increased during meiosis and reaches its maximum at the tetrad stage or in the young pollen grains.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Meiosis, appearance of pollen grains and early
genetical diagnosis

R. LINDER

University Lille
Lille-Annappes (France)

Summary

The grape production of the vine depends on a regular fertilization, which requires a normal gematogenesis and the production of functional gametes. Any meiotical disturbance makes fertility uncertain.

The appearance of abnormal or empty pollen grains can be traced back to meiotical anomalies or disturbances due to the influence of climatic conditions, the hybrid state, nuclueus-cytoplasmic interference, structural chromosome deficiencies, polyploidy ... Moreover, the pollen can have up to 50% abnormal grains due to the action of one letal gene. This is a single, active allele of the male gametophyte. This phenomenon is interesting, because it can be detected as soon as mutation of a normal allele occurs.

The appearance of such a mutation could be studied during investigations carried out in the experimental plots at the Viticultural Institute in Colmar

- on the one hand, mostly combined with certain rootstocks,
- on the other hand, in unequal frequency, according to the clones of the different varieties.

R. LINDER

Meiosis, appearance of pollen grains and early genetical diagnosis

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It can be assumed that a grafted vine brings a certain degree of mutability but also that the rate of mutability is a significant test for the state of health of the breeding strain.

A systematic research on the factorial pollen letality thus permits an early diagnosis of a depressive state of the hereditary substance, for on the one hand the letal pollen mutation is immediately apparent and on the other hand such a mutation is generally accompanied by slight physiological-somatal deficiencies which are not immediately perceptible.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Investigations on the formation of reproductive
organs and the development of the fertilisation
process in the vine

V. LEPADATU - V. DVORNIC

Vine and Wine Centre
Institute of Agronomy "N. Balcescu"
Bucarest (Rumania)

Summary

The authors have studied the formation of the microspores and macrospores of a number of vines with functional female and normal flowers, and also the fertilisation process and the influence of the variety on this process and the development of the zygote.

They have noted that the size of the pollen mother cells increases up to the beginning of the meiotic division. The heterotypical division ends with the formation of 2 nuclei and the normal homeotypical division terminates with the formation of the tetrads. It has also been noticed that diads or triads were formed, which lead to an increase of the microspores and a modification of the number of chromosomes.

It was confirmed that the pollen grains of vines with functional female flowers were smaller in diameter and were lacking in germinating pores. Contrary to the grains of the normal hermaphrodite flowers, their grains stay undivided. The reductional division does not take place simultaneously in all mother cells of the anther, which causes the formation of pollen with a different germinating capacity.

V. LEPADATU - V. DVORNIC

Investigations on the formation of reproductive organs and the development of the fertilisation process in the vine

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The duration of the macrosporogenesis process is subject to environmental influences. Following the division of the megaspore, two nuclei are created, which in turn undergo two successive divisions and a chromosome reduction, which results in the 7 cells of the embryo sac.

In some cases, the pollen nuclei join together again after the fertilisation of the oosphere.

At the commencement of flowering, the stigmata become receptive. The maximum duration of the receptiveness is influenced by the temperature and the humidity. After fertilisation, the zygote becomes dormant and approx. 84 hours later begins dividing.

Some isolated cases have been registered, where certain pollen cells have fused with non-specialised nucleic cells, resulting in modified caryotype cells which bring about changes in the metabolism of the cell itself and that of the neighbouring cells and the zygote. There are also cases where the antipod cells multiply.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Irradiation of pollen as a factor for increasing
variability in vine breeding

W.S. SEMIN - L.M. JAKIMOV

Moldavian Institute for Fruit-growing, Viticulture
and Enology
Kischinew (USSR)

Summary

The combinations of hybridization and artificial mutagenesis increases genetical variability. The irradiation of the pollen from crossings of European vine cultivars with semi-cultivated forms is particularly promising in this connexion.

European grape varieties served as mother plants with androgynous flowers and functional female flowers. The pollen came from the root stock cultivars *Vitis amurensis* and European grape varieties and also from forms and cultivars whose features are normally dominant. Kobalt 60 was used as irradiation source, the dosage was between 0,5 and 60 kr.

The results of the genetical analyses were:

The paternal characteristics are dominant in the descendants pollinated with non-irradiated pollen (control) and in those from pollen irradiated up to 6-8 kr. In the descendants of pollen irradiated with doses up to 10-15 kr, seedlings with characteristics of the maternal form were to be found as well as those of the paternal plant. Those seedlings from pollen irradiated with 20 kr had features of the maternal plant for the most part. At the same time, plants were discovered with new characteristics which are not present in the parent forms.

Cytoembryological investigations have shown that when the irradiation dosage is increased the vitality of the pollen declines, the percentage of germinated pollen grains decreases, the growth intensity of the pollen becomes weaker and the mitosis of the generative cells is inhibited. More rarely, a complete spermatogenesis can be observed.

Microscopic investigations showed a modification of the endoplasmic reticulum in the pollen grain, the increase of easily oxidizable substances and an enlargement of the nucleus elements. When the pollen was irradiated with doses up to 30 kr the membranes stuck together and anisotropy and other phenomena were observed. With a dose of 50 kr, signs of degeneration were present.

The results have shown that by using dosed irradiation on both intra- and interspecific crossings it is possible to increase the variability of the features of the descendants and to weaken the characteristics of the paternal plant.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Cytological investigations on the fertilization and
fertility of grape vines

G. STAUDT

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Summary

In most of the *V. vinifera* cultivars and hybrids with wild growing species, good seed set is an important factor for berry growth and thereby for the yield and yield dependability. The aim of our investigations is to determine the causes which lead to a decreased seed set and therefore to a decreased yield.

Meiosis and pollen development: Despite large differences in pollen fertility (2-60% germination in vitro) no meiotic differences were found in the cultivars Riesling, Müller-Thurgau and Aris. With the cv. Aris, for example, in two years of different pollen fertility (1970 38% and 1971 2%), no significant differences were found in the chromosome pairing and the chiasma frequency (21,5 and 22,5 chiasmata/PMC). However, a post meiotical degeneration of the microspores was observed, the extent of which depends on the temperature. In 1970 the temperatures during this critical phase of pollen development were higher than in all the other years investigated. The daily maximum temperatures were always higher than 20° C and the minimum temperatures never lower than 12° C. It can be concluded that a positive correlation exists between the favourable climatical conditions in 1970 and the higher germination capacity of the pollen grains.

G. STAUDT

Cytological investigations on the fertilization and fertility of grape vines

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The higher berry set, the higher germinating capacity of the seeds and the 25% higher berry weight in this year can either be interpreted as a result of the high germination capacity of the pollen grains and of the favourable climatical conditions, or only of the latter.

Pollen tube growth: The germination capacity of the pollen grains depends on the temperature. With in vitro cultivation, a normal germination was observed at 15° C, although the germination was delayed for two hours in comparison with the control (28° C). At 10° C, even after three days of cultivation, only a few pollen grains germinated. When these preparations were transferred to 28° C the germination was normal. After 5 days of cultivation at 8° C a few pollen grains still germinated, and the same applied after 7 days at 5° C.

When cut inflorescences were cultivated in vivo at 10° C, germinating pollen grains were observed in the stigmata and the styles after four days. When inflorescences were cultivated for four days at 2° C, no germination took place, however, when they were transferred to 28° C, germination was normal. After 6 days at 2° C no germination took place, not even after being transferred to 28° C. The stigmata and styles, however, were still functional after 14 days at 2° C.

From these investigations it can be concluded that 1) reduced pollen fertility is not necessarily due to meiotic disturbances, and 2) pollen germination and pollen tube growth may still take place even at relatively low temperatures.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Analysis of the genotypes of certain
Vitis vinifera cultivars

S. LAZIC

Institut za Vinogradarstvo i Vocárstvo
Sremski Karlovci (Yugoslavia)

Summary

In order to gain knowledge of the genetical characteristics of our indigenous plants and to bring to light some inheritance factors of the vine, we have carried out the self-fertilization of nine red and white vine cultivars (Prokoupatz, Pinot noir and Blaufränkisch rot, Steinschiller, Slankamenka, Welschriesling, Smedervka, Chasselas blanc and Bouvier). From a plantation established in 1964, approx. 5% of the vines studied showed very different characteristics, the classification being the result of several assessments made at different intervals.

None of the cultivars investigated was completely homozygote. The most homozygous were Welschriesling and Chasselas blanc.

Sex and berry colour are characteristics which are produced by a pair of allelomorphs. The correlation between the dominance and the recessivity of the genes producing the same characteristic from cultivar to cultivar are very different. For this reason, we cannot speak of a scale of genes which are characteristic for the same vine feature; that which causes the high heterogeneity of the vine forms, enables the existence of thousands of different varieties and the creation of innumerable cultivars of this species. This is caused by a relatively small number of genes, which participate in the creation of one feature.

S. LAZIC

Analysis of the genotypes of certain *Vitis vinifera* cultivars

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With regard to the genes for pigments in the red varieties, a distinction seems possible between the homozygous and heterozygous lines, the homozygous line having clear red coloured berries, and the heterozygous ones having bluish-red berries. Branas also observed this with teinturier grapes.

The breeding of seedless grapevines

K.V. SMIRNOV

Scientific Research Institute of Fruit-growing
and Viticulture R.R. Schreder
Samarkand (USSR)

Summary

Grape seedlessness is a valuable viticultural quality. Therefore, the working out of methods of selection of seedless varieties of grapes is very important from both theoretical and practical aspects.

On the basis of results achieved by Soviet and foreign authors the following concept was settled:

1. The seedlessness of grapes was studied and the degree of seedlessness classified.
2. The most effective hybridization for obtaining seedless grapes was achieved by comparing the practical results of selection work done in different ways and by different methods.
3. In accordance with the above, we obtained the following results:
 - a) The character of inheritance of seedlessness and size of berries was studied;
 - b) due to the results of correlative interactions seedless varieties of grapes with bigger berries were obtained after hybridization;
 - c) prospective varieties and combinations of crossing were selected for the further breeding programme;
 - d) the absence of correlative dependance between the percentage of seedless seedlings of grapes in the hybrid population and seed number or berry size of their parentage was determined.

On the inheritance of high sugar content
in the hybrid grape offspring

M.V. MELKONIAN

Scientific Research Institute of Viticulture,
Wine-making and Fruit-growing of the Armenian
SSR
Erewan (USSR)

Summary

To enrich the grape assortment with new varieties possessing a higher sugar content, it is important to know the nature of inheritance in the hybrid offspring of different crossing combinations and to define more exactly the selection principles of the parental plants and their combining ability.

The investigations have been carried out in the South of Armenia under Professor S.A. Pogossian.

More than 2500 seedlings of 55 hybrid combinations obtained from intervarietal crossings of European grape and interspecific hybridization with participation of tested Amur-European hybrid forms have been studied.

In the offspring obtained by crossing some varieties of the Eastern ecological and geographical group, only some seedlings (1,5%) have a higher sugar content than the parental forms.

Crossing Eastern with some West European varieties as well as crossing these with some varieties of the Black Sea basin has provided a considerable percentage of high sugar producing seedlings (52,9-57,9%).

M.V. MELKONIAN

On the inheritance of high sugar content in the hybrid grape offspring

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The largest number of high sugar producing seedlings has been obtained in the offspring from crossing the varieties of the West European group with Amur-European hybrid forms taken according to their sugar content.

Leaves of high sugar producing varieties and hybrid seedlings have a high photosynthetic activity and the fruits have more fruit sugar than glucose, a larger quantity of sugar and more vitamins of the B-group compared to the low sugar producing ones.

The best results in breeding of high sugar producing seedlings were obtained by crossing Saperavi, Aligote, Cercial and some others with Amur-European hybrid forms as well as crossing the last with new selective varieties such as Urartu, Tigrani and elite forms "C"-484 (Madeleine angevine x Chasselas Muscadine), "C"-128 (Ichkimar x Janvarsky cherny), "979/2" (Spital Arakseni x Cherny Sladky).

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The present day state of research on vine breeding
and genetics in Rumania

M. NEAGU

Institute for Agronomy "Nicolae Balcescu"
Bucarest (Rumania)

Summary

Research on vine genetics and vine breeding has been developed in state establishments mainly over the last four decades. At present, this research is carried out according to a general plan which is coordinated and directed by the horticultural section of the Academy of the Science of Agriculture and Forestry, Bucarest.

The main problems to be solved at the present time are:

- a) The improvement of the quality and yield of the berries and cuttings of *V. vinifera* cultivars and grafting stocks by mass and clonal selection.
- b) The creation, by means of intraspecific hybridization, of new cultivars for table grapes, wine berries and raisins which are better than the existing varieties in yield and quality.
- c) The breeding by interspecific hybridization of new root stocks which are more adapted to the environmental conditions and have a greater affinity for *V. vinifera* cultivars.
- d) The creation of high quality cultivars which have a high yield and are at the same time resistant to diseases, e.g. phylloxera etc.

M. NEAGU

The present day state of research on vine breeding and genetics in Rumania

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Despite the fact that the possibility of creating something new is limited, mass selection, and above all clonal selection for producing breeding material have proved indispensable for assuring the biological purity and authenticity of old and new creations. The variability manifested not only in old cultivars, but also in new ones such as Cardinal (with round and oval berries) and others, has facilitated the selection of many valuable clones which are already registered (Tamioasa - resistant to frost, Babeasca - early maturing and very productive wine berries, and root stocks Craciunel 2, Craciunel 71, with an early ripening, etc.).

The possibilities of interspecific hybridization are far from being exhausted. Because of the large variability of F_1 and the possibility of choosing elite material even with this generation, the wine and table grape cultivars Select, Triumph, Rusidava and others have been selected and registered. By interspecific hybridization between autochthon cultivars and American vines, root stocks with good prospects have been obtained. Important conclusions on the theory and practice of vine breeding can also be drawn from this.

On grape heterosis

S.A. POGOSSIAN

Scientific Research Institute of Viticulture,
Wine-making and Fruit-growing
Ministry of Agriculture of the Armenian SSR
Erewan (USSR)

Summary

For the past 15 years selective work on grape vines has been carried out to breed high-productive varieties:

- a) grapes for table use, of different ripening periods with heterotic yield, fruit largeness, containing particularly valuable nutrient elements;
- b) high-yielding vintage varieties with the heterosis by amino acid composition, content of sugar, pigments and B-group vitamins.

A greater quantity of the seedlings with the heterosis by earliness has been obtained in the offspring when crossing East early varieties with the ones of the West-European group and their hybrid forms, and a markedly lower quantity has been obtained with participation of middle- and lately-ripening varieties.

Although a small number of early-ripening seedlings has been obtained while crossing early-ripening varieties only within East ecological and geographical group, specimens being heterotic by earliness have not developed.

The heterosis also manifests itself differently by fruit largeness according to the parent plant selection. While crossing the large-berried varieties a considerable greater number of the offspring-seedlings is superior to the parental plants in fruit size than

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in the offspring-seedlings of crossings of varieties possessing very large fruits (as the majority of Central Asiatic varieties for table use).

A better effect to manifest the heterosis by fruit largeness is provided in those cases when very large-fruited varieties being crossed differ considerably in origin and conditions of a long culture.

With regard to the content of physiologically active substances conditioning the high nutritive value of the grapes, the heterosis, as a rule, manifests itself more in the offspring when crossing the varieties possessing a high content of these substances and manifests itself less when only one of the parental pairs possesses a high nutritive value.

In a true selection of varieties being crossed, a considerable number of the offspring-seedlings (in some combinations up to 50%) manifest the heterosis by their content of B-group vitamins and amino acids. For the selection of varieties for table use only some seedlings being heterotic in complex features (fruit largeness, content of vitamins, amino acids, particularly irreplaceable ones, high yield) are of particular value.

In the selection of technical varieties, particularly in South zones, it is important to breed varieties with a high sugar content (including ones with intensively coloured fruits) fulfilling the requirements for the production of white and red dessert and liquor wines.

The best effect of the heterosis by sugar content manifests itself in the offspring when crossing East varieties of high sugar content with certain ones of West-European group (Aligote, Cabernet, Cersial, Muscadines, Cemilion, etc.), new selective cultivars

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with high sugar content and also selected Amur-European hybrid forms. With such selection of pairs, the greatest number of heterotic seedlings possessing a considerable superiority over initial forms with regard to sugar content is obtained in the offspring when crossing the varieties with different rates of sugar accumulation and when one of the parental pairs possesses an intensive sugar accumulation in the first half of the ripening period and the other at the end.

The heterotic effect has also increased when crossing these varieties with a high sugar content with ones possessing a steady rate of sugar accumulation as well as when pollinating with pollen mixture of these varieties.

Two new varieties of Tigrani and Urartu have been bred for the past years, there have been isolated seven valuable seedlings, heterotic by sugar content (27,0 - 31.0%), which are superior to the parental pairs with high sugar content by 2,0 - 4,0%, to the aboriginal standard varieties by 5,0 - 7,0% and which exceed them in yield. Wines of these new varieties and elite forms have been rewarded with gold medals at international contests.

The investigation of a new hybrid fund obtained from crossing these heterotic new varieties and elite forms points to potential possibilities of a further increase in the heterosis by sugar content of new varieties being bred.

As to pigments, the maximum heterosis is provided in the offspring of the hybrids of which both parental pairs possess a greater set and content of anthocyanins (particularly delphinidin, petunidin, malvidin and dark-cherry anthocyan) in a definite quantitative ratio.

A considerably greater number of high-yielding elite seedlings with the heterosis by content of pigments and some seedlings in a combination with the heterosis by sugar content has been obtained in the offspring of hybridizations with the participation of Saperavi and new, selective varieties of Karmraut and Tigrani.

Elite seedlings selected from the offspring with a participation of Amur-European hybrid forms are heterotic in complex of features combined with a high frostresistance.

Thus, the complex heterozygous nature of grape gives great possibilities of breeding new varieties possessing the heterosis by a complex of very important biological feature.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Selection of seedless and early maturing grape-vines

M.S. SCHURAVEL

Moldavian Institute for Fruit-growing, Viticulture
and Enology
Kischinew (USSR)

Summary

Seedless grapes are of great commercial value for table grapes, raisins, and also for wine grapes. However, the number of cultivated, seedless cultivars in the world is very low.

In the last few years the breeding of seedlessness has become very important. By crossing we succeeded in selecting a number of new, high quality, seedless varieties. In doing this the correlation between berry development and berry growth for breeding large, seedless berries was particularly difficult.

One of the peculiarities of seedless cultivars or cultivars with seeds which are not completely developed, is their "apparent early ripening" which is why they number amongst the early ripening cultivars. The correct choice of the primary cultivars for hybridization plays a decisive role in breeding for seedlessness.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
Federal Research Institute for Vine Breeding
Geilweilerhof - 6741 Siebeldingen (Fed. Rep. Germany)

C o n f e r e n c e ' A g e n d a

26.9.1973

- Section III -

Principles of early diagnoses in vine breeding

Chairman: M. Rives, Pont-de-la-Maye (France)

- 9.00 - 9.45 h G. Alleweldt, Geilweilerhof (Fed. Rep. Germany):
Methods of early diagnoses in vine breeding
- 9.45 - 10.00 h R. Wagner and A. Bronner, Colmar (France):
Investigations on *Vitis vinifera* seedlings
in order to develop early diagnostic methods
of breeding
- 10.00 - 10.15 h P. Huglin and J. Balthazard, Colmar (France):
Variability and fluctuation in the structure
of the inflorescences and bunches of some
Vitis vinifera cultivars
- 10.15 - 10.45 h Interval
- 10.45 - 11.00 h G. Reuther and H. Becker, Geisenheim
(Fed. Rep. Germany):
Methods and results of early diagnosis of
cold-hardiness
- 11.00 - 11.15 h A. Eifert, Budapest (Hungary):
Some aspects of cold hardiness tests during
model experiments in climatic controlled
chambers
- 11.15 - 11.30 h P. Ja. Golodriga and L.P. Troschin, Yalta
(USSR):
The estimation of the ecological variance
of cultivars and elite forms of the species
V. vinifera L.
- 11.30 - 11.45 h J.I. Nekrassow, Kischinew (USSR):
Early diagnostics in vine breeding with the
help of biopotentials

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Methods of early diagnoses in vine breeding

G. ALLEWELDT

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Siebeldingen (Fed. Rep. Germany)

Summary

The great amount of technical work involved and the time which is necessary to determine the valuable features of new cultivars compel us to develop methods of early diagnostics. In order to be applicable to breeding, these methods should be simple and speedy to carry out, and give sure results. This paper attempts to give a systematic representation of early diagnostics, taking into consideration the genetical basis and also the possibilities or limits of application.

The first classification of early diagnostics comes from the identification of qualities *b e f o r e* or *a f t e r* the phenotypical manifestation. The genetical basis derives from the pleiotropic gene activity, from the genes linking and the gene action system. As an example of the early diagnosis of pleiotropical genes or linked genes which can be carried out before the features sought for have appeared, the close correlation between the hypocotyl colour, the discolouration of the leaves and the colour of the berries, and also between the leaf shape and sexuality, is given. Much more extensive results have been obtained from the early diagnosis which registers the performance features according to the habitual or physiological manifestation. These are divided as follows:

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1. Early diagnoses, which register the visible or easily measurable features in the phenotype,
2. early diagnoses, by which characteristics of the plant are recognized only under certain environmental conditions,
3. early diagnoses, which are based on physiological correlations,
4. early diagnoses on the basis of chemical analyses.

Examples are given in all groups. In conclusion, the importance of the development of early diagnoses for future vine breeding is stressed in order both to increase the effectiveness of breeding achievements and to shorten the breeding time.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Investigations on Vitis vinifera seedlings
in order to develop early diagnostic methods of breeding

R. WAGNER - A. BRONNER
Institute for Viticulture and Enology
I.N.R.A.
Colmar (France)

Summary

One of the features which would seem the most suitable for early diagnosis is fertility. Whether the germinating capacity of the pollen is also of interest is not yet certain.

1. Fertility of Vitis vinifera seedlings

These investigations showed the respective importance of several parameters and of the vigour in particular, as Huglin and Julliard (1963) have already suggested. However, the analysis leads to quite different results, depending on the developmental phase of the plant. Thus, after one year's growth in hydroponical culture in the glasshouse, the vigour is no longer a limiting factor for flower initiation. Nevertheless, a highly significant regression exists between fertility and diameter or length of the basal internodes of the seedling.

The fertility of a bud depends also on its insertion. The most fertile plants are those on which flowers are initiated at the earliest or are located at the most proximal bud on the axe, i.e. approximately at the height of the first tendril. It was thus possible to determine the height for pruning one year old seedlings which would both give a satisfactory prediction of fertility and sufficient buds for grafts and rootings.

R. WAGNER - A. BRONNER

Investigations on *Vitis vinifera* seedlings in order
to develop early diagnostic methods of breeding

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According to the data obtained in 1972, the regression between the fertility in the vineyard to that in the greenhouse is highly significant. However, an increased plant space in the greenhouse seems to give optimal results.

2. Pollen germination

This feature shows a great genetical variability, which could lead to insufficient or irregular yields, especially in northern regions. In order to assess the value of this criterion for early diagnosis, the germination percentages of approximately sixty varieties were compared with the distribution of this same feature on descendants of seedlings containing no female plants. It could be shown that a considerable part of the test plants had badly germinating pollen, but it still has to be proved, that the elimination of these plants compensates the expenditure of work.

Further possible selection criterions will be tested in future investigations.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Variability and fluctuation in the structure of
the inflorescences and bunches of some
Vitis vinifera cultivars

P. HUGLIN - J. BALTHAZARD

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National Institute for Agronomical Research
Colmar (France)

Summary

Under defined environmental conditions, the possible yield of a vine cultivar is determined by the average number of inflorescences per shoot or the average fertility of the latent buds left after pruning and the average weight of grapes at harvest.

This last characteristic can be split into several components:

- number of flowers
- number of berries per bunch
- average berry weight.

Each of these features presents a special problem for the breeder.

It is a well known fact that the composition of inflorescences and bunches varies with each cultivar. Data on the cultivars grown in Alsace are given in the tables in the text.

Very few investigations have been carried out on the fluctuation of this characteristic, and observations made in 1959, 1960 and 1968 on the fruit bearing canes of approx. a dozen buds reveal the following facts:

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1. The number of flowers per inflorescence at the same insertion increases considerably with the insertion of the shoot on the fruit bearing cane (e.g. 1959 - Gewürztraminer: basal shoot $n = 65$, 10th shoot $n = 137$).
2. It is possible to find 1, 2 or 3 inflorescences on the same shoot. The number of flowers per inflorescence decreases considerably with the insertion of the inflorescences 1.> 2.> 3. (e.g. Riesling 1960: 1. = 271, 2. = 242, 3. = 157 flowers).
3. The basal inflorescences are better performed on shoots with 3, rather than with 2 inflorescences (e.g. Sylvaner 1968: 3 inflorescences = 295, 2 inflorescences = 227 and 1 inflorescence = 108 flowers).
4. Most cultivars show a negative correlation between the numbers of flowers per inflorescence and the setting percentage. For this reason the fluctuation in the number of berries is much less than that of the number of flowers.
5. The removal before flowering of one of two or three inflorescences has no effect on berry-set of the others.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Methods and results of early diagnosis of
cold-hardiness

G. REUTHER - H. BECKER

Hessian Research Institute for Viticulture,
Fruit-growing and Horticulture
Geisenheim (Fed. Rep. Germany)

Summary

A number of phenological, histological and physiological criteria can be applied when assessing the cold-hardiness of vines. Some of these criteria are included in the lignification - e.g. a good browning of the bark, a high number of secondary phloem fibers, favourable wood-pith ratio and a high starch and sugar content in the tissues. The data of bud burst was compared with cane maturity after freezing rooted vines of 28 standard and new cultivars to -18° , -22° and -24° C. In order to obtain more exact characteristic information of cold hardiness of some cultivars, histochemical vitality tests were carried out on the tissues of buds and shoots, the dynamics of carbohydrate metabolism and the change in amino acid pattern during freezing.

If the survival was based at -18° C, which was low for a few of the very sensible cultivars as Müller-Thurgau, Silvaner or Reichensteiner, then there was no correlation between the amount of secondary phloem fibers and the wood-pith ratio. It appeared that the very resistant cultivars, such as the American wild vines and the interspecific hybrids, had a small amount of wood and a low number of secondary phloem fibers, while the cold-sensitive cultivars could show opposite proportions.

The increase in sugar content following the starch hydrolysis caused by frost and the vitality test with triphenyl tetrazolium chloride prove to be more exact criterions for diagnosing cold hardiness. The total content of reserve carbohydrates is of secondary importance for the mobilization activity. By using vital staining it was possible to differentiate the extent of damage in buds and sprouts. It was observed that in both sensitive and resistant cultivars an increase in amino acid, i.e. alanine, glutamic acid, arginine, aspartic acid and serine occurred when the frost increased. Generally, the cold hardiness was lower in February than in December. This is traced back to an endogenously controlled rhythm in the carbohydrate metabolism.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Some aspects of cold hardiness tests during
model experiments in climatic controlled chambers

A. EIFERT

Research Institute for Viticulture and Enology
Budapest (Hungary)

Summary

Only years of practical experience can decide the success of breeding for cold hardiness. The breeders, however, endeavour to obtain information on the characteristics of their cultivars as soon as possible. In doing this, they rely on the results of various test methods and early diagnosis. In order to avoid misinterpretation of early diagnostic results, the frost and winter hardiness of vines should not be considered as a static feature, but as a dynamically developing means of behaviour.

The influence of the incidents during the vegetation period on the development - within the genetically limited frontiers - are at least as important as the hardening phase and the frost effect itself.

From numerous cold hardiness investigations, the following was shown:

1. The biochemical changes which reveal themselves during hibernation,
2. the effect of the ecological conditions of the vegetation period.

The tables and illustrations give data on

- 1.1. the changes in the cold hardiness from "field" and "stored" samples during the hibernation,

A. EIFERT

Some aspects of cold hardiness tests during model experiments
in climatic controlled chambers

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1.2. the differences within the same cultivar due to age,

1.3. the differences in the amount and the trend of cold
tolerance specific to each cultivar

and also on

2.1. the differences within the same cultivar due to
different locations,

2.2. the influence of nutrition and yield,

2.3. the influence of methods of cultivation and of the
micro climate.

Taking into account the former life of the vines and using
an exact, precisely drawn-up frosting programme in climatic
controlled chambers, the varieties can be characterised
according to their genetical features.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The estimation of the ecological variance
of cultivars and elite forms of the species *V. vinifera* L.

P. Ja. GOLODRIGA - L.P. TROSCHIN
Scientific Research Institute for
Viticulture and Enology "Magaratsch"
Yalta (USSR)

Summary

The extensive gene material (approx. 5000 vine cultivars) of the species *V. vinifera* L. can be divided into three ecological groups, of which the following two are the most interesting:

- a) cultivars which have a wide ecological adaptability, e.g. Aligote, Rheinriesling, Rkaziteli, etc.,
- b) cultivars which require specific environmental factors in order to develop and give normal yields, e.g. Nimrang, Taifi rosa, Pinot gris etc. (P. Ja. Golodriga, 1969).

When breeding new cultivars with a high ecovariance, we were interested in the inheritance of a wide ecological variability in the F_1 population. For this reason, crossings were carried out with cultivars of differing ecovariance (G. Wricke, 1965; Y. Eberhart and W. Russell, 1968). In order to ascertain the statistical significance, the coefficients of variance and variability were calculated.

The cultivars "Magaratsch Bastardo" and "Magaratsch Rubinowy" which produce table and dessert-wines, and the table grape cultivar "Early Magaratsch", number amongst the highest quality cultivars bred in the Magaratsch Institute which at the same time give very high yields.

P. Ja. GOLODRIGA - L. P. TROSCHIN

The estimation of the ecological variance of cultivars
and elite forms of the species *V. vinifera* L.

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Elite forms of technological importance, which are distinguished for their high phenotypical stability are "Magaratsch 18-62-39" (Kuldshinski x Rkaziteli) and "Magaratsch N 5-62-36" (Kuldshinski x Mzwane Kachetinski).

The quality of ecological adaptability is inherited with matroclinal prevalence by the descendents.

The investigations are continuing.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Early diagnostics in vine breeding with the help
of biopotentials

Ju. I. NEKRASSOW

Moldavian Institute for Fruit-growing, Viticulture
and Enology
Kischinew (USSR)

Summary

The early diagnosis of winter hardiness in seedlings is of great importance for vine breeding. Up to now, however, there is no method by which the winter hardiness of the seedlings can be determined without injuring the plants. A measuring device has, therefore, been developed by which the biopotential of the vine seedlings can be measured.

The winter hardiness in relation to the well known cultivars can, therefore, be assessed according to the reaction of the plants to environmental stimuli (sudden temperature changes, light treatment, etc.).

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
Federal Research Institute for Vine Breeding
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C o n f e r e n c e A g e n d a

26.9.1973

- Section IV -

Genetics of resistance to plant and animal pests

Chairman: G. Alleweldt, Geilweilerhof (Fed. Rep. Germany)

- 14.00 - 14.45 h D. Boubals, Montpellier (France):
Basic elements of resistance to plant and animal pests and their inheritance
- 14.45 - 15.00 h J. Csizmazia, Budapest (Hungary):
Achievements in breeding of resistant vines by repeated hybridization and back crossings with American vine species
- 15.00 - 15.15 h M.P. Coutinho, Lissabon (Portugal):
Application of radiation to obtain vines resistant to Plasmopara
- 15.15 - 15.30 h D. Verderevski and K. Voitovitsch, Kischinev (USSR):
The gene reservoir of vine species and varieties resistant to plasmopara and the method of gradual breeding for complex immunity to the most important fungus diseases and phylloxera
- 15.30 - 15.45 h Z. Zankov, Sofia (Bulgaria):
Results of the breeding of vines resistant to mildew
- 15.45 - 16.15 h Interval

- 16.15 - 16.30 h J. Iwanov and W. Waltshev, Plewen (Bulgaria):
The inheritance of features of cold hardiness and plasmopara resistance by interspecific hybridization of vines
- 16.30 - 16.45 h P.N. Nedov and P.P. Berber, Kischinew (USSR):
The heredity of resistance to phylloxera and root rot agents in grape vines
- 16.45 - 17.00 h G. Rilling, Geilwéilerhof (Fed.Rep. Germany):
Biochemical changes in vines infested by phylloxera
- 17.00 - 17.15 h L.A. Lider, Davis (USA):
A study of resistance in Vitis species to the Dagger nematode, Xiphinema index
- 17.15 - 17.30 h J.P. Doazan, Pont-de-la-Maye (France):
Susceptibility of some grapevine varieties (V. vinifera L.) to excoriose (= dead arm pro parte) (Phomopsis viticola). Distribution of the trait among progenies of crosses
- 17.30 - 17.45 h N. Gusun, W. Semin and L. Jakimov, Kischinew (USSR):
Artificially induced mutagenesis for the selection of resistant grape vines
-

N. Gusun, Kischinew (USSR):

The complex resistance to frost, fungus diseases and phylloxera in vine breeding

I.N. Naidenowa and K.A. Voitovitsch, Kischinew (USSR):

The selection of grape vines resistant to plasmopara based on the diagnosis of the infection

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The basic elements of resistance to plant and
animal pests and their inheritance

D. BOUBALS

National Academy of Agronomy
National Institute for Agronomical Research
Montpellier (France)

Summary

The pests of the vine treated in this paper are

- amongst the plant pests: downy mildew (*Plasmopara viticola*), oidium (*Uncinula necator*), grey rot (*Botrytis cinerea*), black rot (*Guignardia Bidwellii*), anthracnosis (*Gloeosporium ampelophagum*)
- amongst the animal pests: phylloxera (*Phylloxera vastatrix*), the nematodes: those which damage the roots directly (*Meloidogyne incognita* etc.) and those which are vectors of virus diseases (*Xiphinema* sp.); root scale insects (*Margarodes vitium*).

According to our present knowledge it seems that amongst these parasites the resistance of certain *Vitis* species or inter-specific hybrids to the root form of phylloxera could only possibly become defective due to the appearance of biological races or strains with increased virulence.

It is essential when breeding to know the behaviour of the Vitaceae with regard to each of the pests indicated above. Thus the different degrees of resistance and susceptibility can be defined and it can be determined which forms are suitable for breeding work within the crossing possibilities of the Vitaceae.

D. BOUBALS

The basic elements of resistance to plant and animal pests
and their inheritance

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It is necessary to know the way in which the Vitacea are resistant to the pests in order to carry out rational breeding for resistance by hybridization.

This knowledge can be gained by an exact study of the behaviour of the pests on representative plants of all the genera in the Vitaceae. The findings can then be verified by observing the F_2 populations of crossings between resistant plants and plants susceptible to pests. In this way a special manner of resistance, the so called hypersensibility of the host plant to fungi can be exactly assessed.

With regard to animal pests, those plants which are abiotic to these pests should be emphasised.

Finally, one should assess the importance of those resistance factors, which have a quantitative effect on the development of the pest.

When crossing resistant and susceptible plants, the knowledge mentioned above gives us an understanding of the ways of inheritance of resistance.

The numerous investigations carried out show that the inheritance of resistance in the vine is complex, and of a polygenic nature. One should search for cases where there is a partial dominance of resistance, for these are the easiest to use in breeding work (e.g. *Phylloxera radicicola*). However, these cases are rare, and with most of the pests - especially with fungi - the resistance depends on polygenic systems, where the factors work in a cumulative, arithmetical manner. This can only be done by hybrid breeding work, which often spreads over a long period of time.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Achievements in breeding of resistant vines
by repeated hybridization and back crossings with
American vine species

J. CSIZMAZIA

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Summary

In 1948 the Research Institute for Viticulture and Enology at the Experimental Station at Eger began a systematic hybridization in order to select resistant or tolerant vine varieties in Hungary. The planning of the breeding work was based on German, French and Russian publications.

First of all, the French hybrids Seibel and Seyve Villard were studied, classified and selected so that the breeding work could be carried out to combine the original varieties showing the best resistance characteristics. During the breeding work it was established that it is possible to link resistance and good quality in the hybrid A x E and to increase these two characteristics by repeated back-crossings so that those of the parent plants may be exceeded.

The results of breeding work recently published in international literature also demand a strict distinction between tolerant and resistant vine varieties and the old varieties, so called "direct-producers". The origin and quality should be included when naming the varieties. Those varieties which come from repeated crossings and back crossings between American and European varieties, and whose quality is not inferior to those of the European varieties, should be called "Polyvitis".

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Achievement in breeding of resistant vines by repeated hybridization and back crossings of American vine species

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This name brings out the fact that the Polyvitis varieties reunite the heritage of several species and varieties of Vitis. Considering their good quality, equal to that of the V. vinifera varieties, they should no longer be considered as "direct-producers", nor should they be submitted to restricted cultivation.

The first Hungarian Polyvitis cultivar was registered in 1970 under the name "Zalagyongye" (Perle de Zala). This cultivar comes from a crossing between SV. 12-375 and Perle of Csaba. It has been admitted for cultivation in certain viticultural areas.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
Geilweilerhof 25 - 29 September 1973

Application of radiation
to obtain vines resistant to Plasmopara

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Summary

The breeding of vines resistant to *Plasmopara viticola* is of great interest to Portugal, because mildew is still the most important fungus disease of the vine in this country.

The problems of breeding resistant grapevines, i. e. limited infection spots on the leaves, lack of *Vitis vinifera* "resistance sources" and correlations between the resistance genes and some other genes responsible for lower quality of grapes, justify the interest paid to experimental mutagenesis.

Consequently, we have included in our breeding programme, which we have been conducting for a long time with classical methods (clonal selection, hybridization, planting of a large number of seedlings) the treatment of seedlings and scions with X-rays and neutrons.

The present paper gives the results obtained up to now regarding percentage of seed germination and chlorotic seedlings as well as the breeding of mildew-resistant plants.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The gene reservoir of vine species and varieties resistant to plasmopara and the method of gradual breeding for complex immunity to the most important fungus diseases and phylloxera

D. VERDEREVSKI - K. VOITOVITSCH

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Kischinew (USSR)

Summary

The control of the most important fungus diseases and of phylloxera should be solved by breeding high quality, complex resistant vine cultivars by means of the method of gradual breeding for immunity. The first step to be taken in this breeding process is the creation of a collection of resistant forms. The following parent forms can serve as gene donors for immunity to plasmopara:

1. Plasmopara resistant biotypes of *Vitis vinifera* L.
These are discovered by means of the infection diagnosis of mass-propagated seedlings. Vines resistant to plasmopara occur with the frequency of between 1 and 10 per 100 000 seedlings. It was observed that seedlings resistant to plasmopara occur frequently in the descendants of the cultivars Cabernet-Sauvignon, Merlot, Kundza tetri and Odjaleche.
2. By using the new French bastard species such as S.V. 20-473, S.V. 20-365, S.V. 20-366, S.V. 20-347, S.V. 23-657, S.V. 12-309 etc. the combination of resistance and grape quality is increased.
3. Biotypes of *V. amurensis* Rupr. which are resistant to plasmopara.

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The gene reservoir of vine species and varieties resistant to plasmopara and the method of gradual breeding for complex immunity to the most important fungus diseases and phylloxera

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4. The East-Asian vine species *V. romaneti* Rom. and Gail.,
V. thunbergii Sieb. and Zucc.

5. *V. rotundifolia* Michx.

When crossing, the maternal form plays an important role in transferring resistance or susceptibility.

Some of the breeding strains resistant to plasmopara, which were selected from intra- or interspecific crossings have a complex resistance to *Plasmopara viticola*, other fungus diseases, phylloxera and frost. From the cultivars and forms resistant to plasmopara, 24,2% are resistant to *Oidium* and *botrytis*, 12,5% to *radicicole* phylloxera and 25% had a considerable frost hardiness.

Breeding cultivars, which only have a high resistance to plasmopara, should be gradually crossed with those resistant to *oidium*, *botrytis*, phylloxera etc.

Amongst the new cultivars which we have bred, the table grape variety *Nistru* has a high complex-resistance to *Plasmopara viticola*, phylloxera, *botrytis* and *oidium*; the variety *Vierul* is resistant to *Plasmopara viticola*, phylloxera, *botrytis* and frost; the cultivars *Kriuljanski* and *Biruinza* are resistant to *Plasmopara viticola*, *botrytis* and frost, and the cultivar *Solnetschni* is resistant to *Plasmopara* and, together with a good early ripening, is very tolerant to phylloxera.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Results of the breeding of vines resistant to mildew

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Summary

During the period 1955 - 1966, interspecific crossings were carried out in order to obtain cultivars resistant to mildew. For this purpose, we used the cultivars Muscat rouge, Pinot noir, Tamyanka and Muscat of Hamburg (mother plants) and the direct producers Seibel 4986 and Alicante Terras 20 (father plants). At the second stage of hybridization, the mother plants used were the diverse elite forms obtained during the primary crossing, the father plants used were still the same, cultivated forms.

The data from the analyses show that most of the seedlings had inherited the characteristics of the direct-producers with regard to the organoleptical quality of the grapes, the tolerance to mildew, however, was transmitted by the cultivated varieties. Thus, for example, 69,6% of the seedlings from Pinot noir x Seibel and 91,3% from the crossing Tamyanka x Alicante Terras 20 were resistant to mildew. The percentage of seedlings from the different hybrid combinations belonging to classes 2 and 3 varied between 8,7 and 22,1%, the proportion of plants in category 1 was between 0,0 and 8,3%. With regard to the organoleptic characteristics, 98,7-99,5% of the seedlings from the various combinations inherited the characteristics of the direct-producers.

Four hybrid forms have been selected during the course of the investigations which have a relatively high resistance to mildew and organoleptic qualities neighbouring those

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Results of the breeding of vines resistant to mildew

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of the cultivated varieties. These elite hybrids are:
No. 22-19 (Muscat rouge x Seibel 4986), No. 29-1 (Pinot
noir x Seibel 4986), No. 8-1 (Muscat Hambourg x Alicante
Terras 20) and No. 22-15 (Muscat rouge x Seibel 4986-129-
2/X Dimyat).

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The inheritance of features of cold hardiness and plasmopara resistance by interspecific hybridisation of vines

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Summary

Investigations carried out on 1187 seedlings from 23 hybrid combinations gave the following results:

1. In the F_1 population from crossing *V. amurensis* with *V. vinifera* cultivars, 83,3% of the seedlings had very high, and 16,7% had increased frost resistance. Some of the seedlings also had qualities which are very valuable from a viticultural and breeding point of view.
2. The descendants of crossings between interspecific new breeds (Sarja Sewera, Seibel 1000, Seibel 4986, Seive Villard 12375) and *V. vinifera* cultivars are distinguished by a high variability in cold hardiness. Seedlings of the F_1 population with Seibel 1000 and Sarja Sewera have a better cold-hardiness than the other populations. The least cold-hardiness was within the population with Seive Villard 12375 as a parent.
3. The highest amount of seedlings resistant to plasmopara showed the hybrid populations from Seive Villard 12375 x *V. vinifera*.
4. There is no genetical correlation between cold hardiness and resistance to plasmopara.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The heredity of resistance to phylloxera and
root rot agents in grape vines

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Summary

The study of the heredity of resistance to phylloxera and microbial root rot agents plays a decisive role in solving the phylloxera problem by means of breeding for immunity.

The heredity of resistance was investigated on the hybrid descendants of 6 crossing combinations of vine cultivars with differing susceptibility. The European vines served as primary parents for the susceptible and easily susceptible cultivars. Some species and bastard species of Seyve Villard and Seibel were used as the tolerant and resistant parents. The resistance of the parental pair and the hybrid seedlings to phylloxera and root rot agents was defined in a 5 score scale which was drawn up according to the gall formation and the character of the root rot.

The following results were obtained:

- a) In the hybrid descendants of resistant x susceptible, the number of resistant seedlings was 26-41%;
- b) from the crossing susceptible x resistant, the number of resistant seedlings was 16-70%;
- c) in the descendants of susceptible European cultivars x tolerant bastard species, a transgression was observed (6-61% of the seedlings exceeded the resistance of both primary parents);

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- d) a transgression was also noticed in the descendants of the crossings tolerant x susceptible and susceptible x susceptible, when one of the parent cultivars was a complicated hybrid species and the resistant genes were recessive.
- e) The heritability (h^2) of the resistance to phylloxera and root rot varied (depending on the combination) between 11,3 and 83,9%;
- d) Many resistant seedlings have a high commercial value and are not inferior to the standard cultivars.

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Biochemical changes in vines infested by
phylloxera

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Summary

In the course of investigations on the biochemical basis of the development of phylloxera galls, both free and bound amino acids (AA) of galled and non-infested vine leaves and roots were determined.

The patterns of the b o u n d AA from galled and non affected vines were largely identical, the total AA concentration in the leaf gall on the investigated V. vinifera cultivars was lower in every case than in the control leaves.

On the contrary, the leaf galls had a higher concentration of f r e e AA than the controls. In comparison, leaf galls have more arginine, threonine, serine and especially more glutamine. Aspartic acid, glutamic acid, alanine and phenylalanine are proportionally reduced. The changes in free AA observed in the root galls are not so drastic - possibly because the root is an important site for AA synthesis. It is only at a more advanced stage, namely when the alates develop at the root galls, that a rapid decrease in free (and also in bound) AA is observed.

The changes observed in the leaf gall in the free AA spectrum are discussed under the aspect of the oxidative deamination of AA.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
Geilweilerhof 25 - 29 September 1973

A study of resistance in Vitis species
to the Dagger nematode, Xiphinema index

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Summary

A greenhouse technique for testing grapevines to the ectoparasitic nematode, *Xiphinema index*, has indicated that a high level of resistance exists among several *Vitis* species. These include *V. rotundifolia*, *V. solonis*, *V. californiana* and *V. smalliana*. Crosses between these species and with the susceptible *V. vinifera*, *V. rupestris* and *V. riparia*, have given resistant seedlings which display good vigor and rootability. Grafting trials are now underway with the most promising of these selections.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Susceptibility of some grapevine varieties (*V. vinifera* L.)
to excoriose (= dead arm pro parte) (*Phomopsis viticola*)
Distribution of the trait among progenies of crosses

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Summary

It is known that "excoriose" is not equally severe on all varieties. However published observations are scanty and fragmentary; we have started a study on the behavior of a number of varieties in our collection (more than 200) towards this parasite.

Visual scoring on a 0-5 scale confirmed the existence of important differences: Pinot Meunier, Mourvèdre, Negrette, Riesling, Cinsaut, Cabernet-franc, Sylvaner, Aligoté, Ugni blanc were among the least susceptible; Baroque, Gros Vert, Alphonse Lavallée, Cardinal, Olivette Noire, Jaoumet were among the most susceptible.

Once confirmed, these observations may be useful in adjusting control methods according to the varieties.

On the other hand, we have tried to investigate the inheritance of the varietal response to the parasite. For that purpose, we have devised an artificial inoculation technique on cut herbaceous shoots maintained in water and a scoring scale.

Observations on selfed progenies of the varieties Merlot and Alicante Bouschet as well as a progeny of the cross between these varieties, point to the dominance of susceptibility.

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Artificially induced mutagenesis for the
selection of resistant grape vines

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Summary

In order to breed cultivars with a high winter hardiness and resistance to phylloxera and plasmopara, it was necessary to find mutagenic agents, to determine the concentration of active agents and to establish its means of application. Thus, grape seeds of inbreeding lines from free, interspecific and intraspecific pollinations were treated with gamma rays (0,5-30 kr), ethylene imin, dimethyl sulphate, nitrosoethylene carbamide, nitrosomethyl carbamide or colchicine (0,0005-1,0%). The cultivars used were Rkaziteli, White Muscat, Muscat Ottonel, Cabernet, Aligote and Riesling. The selection was made after considering the commercial value of the seedling and infecting with plasmopara and leaf phylloxera and checking the winter hardiness. In comparison to the non-treated controls, a high proportion of resistant seedlings was detected, particularly after treatment with nitrosoethylene carbamide or gamma rays.

The effect of mutagenic agents depends on the genetical nature, the physiological factors and on the agent and its concentration. Thus seeds which have previously been soaked and stratified are more sensitive than dry ones. If the seeds are stratified after treatment with mutagenous agents, the mutagenous effect is reduced a little and the survival rate is increased.

The effect of the mutagenesis on the embryo tissues of the grape seeds is such that only some cells can be modified or a lot of cells all at the same time, so that the chimera character is established. Generally, after germination, the normal tissues grow considerably quicker than the mutated tissue, which is why the mutations can seldom be phenotypically distinguished. Thus de-chimerizing methods have been used, by removing the shoots of 2-3 year-old seedlings up to the root neck. It was then possible to find material with morphological modifications amongst the newly formed shoots. These mutants can be used as primary material for further breeding work.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

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The complex resistance to frost, fungus diseases
and phylloxera in vine breeding

N. GUSUN

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Summary

The new social-economic conditions and technical progress necessitate the breeding of new vine varieties which do not need to be covered with soil, do not need chemical protection against fungus diseases, and do not need to be grafted onto phylloxera resistant rootstocks. The Moldavian Republic produces high quality cognac wines from wine cultivars belonging to the species *V. vinifera*. However, these cultivars do not meet the above mentioned requirements and consequently their yield is not dependable.

The surest and most effective method of solving this problem is interspecific hybridization, taking into consideration the independent distribution of characters in the hybrid offspring, the separation of coupled characters, the integration and location of the resistant genes in certain loci of the chromosomes and the formation of gene blocks. Such polygenic blocks represent a uniform whole and as such are transferred to the descendants in differing degrees of dominance. There are no genetical obstacles for the combination of high quality and resistance to unfavourable environmental conditions, fungus diseases and phylloxera.

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The breeding work we have carried out is based on an exact examination of the primary material and the creation of a corresponding assortment including the best table and wine grape varieties of differing ecological-geographical origins and also new resistant cultivars from several breeders (I.W. Mitschurin, A.M. Negrul, M.S. Schuravel, Ja. I. Potapenko, S.A. Pogosian, Seyve Villard and others). These forms serve as gene donors for further crossings. An analysis is made of every hybrid population in order to determine the inheritance of characters of resistance in correlation to quality. The general and specific combining ability of the parent plant and the breeding value of each combination are also ascertained.

The selection is made according to resistance and quality. The selected seedlings are propagated on 10-25 vines and analyses of resistance, yield and wine quality are repeated. Following the secondary selection and propagation on 250-500 plants, a further examination takes place and the promising cultivars are referred for state cultivar examination.

In the last few years it has been possible to breed new varieties which are cold hardy, resistant to plasmopara and botrytis, tolerant to phylloxera, which give quality wines and which attain or surpass the level of the standard cultivars.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
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C o n f e r e n c e A g e n d a

27.9.1973

- Section V -

Genetics of resistance to unfavourable conditions of
soil and climate

Chairman: P. Huglin, Colmar (France)

- 9.00 - 9.45 h K.S. Pogossian, Erewan (USSR):
On physiological frost-resistance features
of grape varieties and forms differing in
origin
- 9.45 - 10.00 h P.J. Golodriga, Yalta (USSR):
The breeding of vines for unfavourable
conditions of climate and soil
- 10.00 - 10.15 h R. Pouget, Pont-de-la-Maye (France):
Problems arising in the breeding of root
stocks resistant to calcium chlorosis
- 10.15 - 10.45 h Interval
- 10.45 - 11.00 h G. Mayer, Klosterneuburg (Austria):
On the cold-hardiness of grape vines
- 11.00 - 11.15 h A.M. Aljew, Yalta (USSR):
The breeding of winter-hardy vines
- 11.15 - 11.30 h A. Calo' and A. Costacurta, Conegliano
(Italy):
The reactions of different *Vitis vinifera* L.
cultivars to some environmental factors
- 11.30 - 11.45 h V. Grinenko and L. Pudrikova, Kischinew
(USSR):
The reaction of grape tissue to dehydration
as a character of ecological adaptability
-

V.V. Grinenko, Krasnodar (USSR):

The regulation of the water content of the vine as a means
of adaptability to environmental factors

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

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On physiological frost-resistance features
of grape varieties and forms differing in origin

K.S. POGOSSIAN

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Summary

The hardening process is the most important stage in development of frost-resistance while preparing plants for the hibernation.

In our investigations conducted on plants of a great number of varieties and hybrids (*V. amurensis*, *V. coignetiae* Pull., *V. labrusca*, *V. vinifera*) the following problems have been studied in detail: features of the first and second phases of hardening, accommodative reaction of grapevine tissues towards different rates of freezing and thawing, change of tissue resistance to dehydration, regenerative capacity of grapevine tissues according to injury nature.

From the investigations we have established a correlative relationship between the type of variety, the rate and intensity of physiological processes within a degree of frost-resistance and the regenerative capacity of the tissues.

We have established that for the majority of grape varieties a temperature range from +2 to -3^o C with a duration of action equal to 14-20 days is an optimum condition for the course of the first phase of freezing. Frost resistant forms (Amur grape, hybrids of Amur, American and European origin) react more rapidly upon these conditions: starch hydrolysis

K.S. POGOSSIAN

On physiological frost-resistance features of grape varieties and forms differing in origin

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occurs more completely, oligosugars (raffinose, stachyose) are synthesized earlier, high water-holding capacity of cells is stabilized faster.

The action of a temperature range from -3 to -15° C is an optimum condition for the second phase of hardening for all grape varieties and forms. The frost-resistant forms, however, are capable of continuing the hardening even at -17 to -25° C and below; such reduced, negative temperatures are generally pernicious to weak-resistant varieties of the European grape.

In winter, an accommodative reaction towards the rate of freezing, ice-formation in plant tissues, thawing process, i.e. toward the physiological processes playing often a decisive part, is one of the important features of the plant.

According to our investigations the plants of frost-resistant species with a high resistance to freezing in a comparatively rapid ($0,8-2,0^{\circ}$ C/min) decrease of temperature in field conditions have proved to be comparatively enduring also with a very rapid cooling at a rate of $30-50^{\circ}$ C/min. In similar conditions, the hardened plants of the European vine completely perish even at -14° C.

The frost-resistant forms are also characterized by a high accommodative reaction towards rapid thawing. The restoration of a normal state of the plasmolemma in these forms occurs comparatively easily, which largely affects the rate of thawing water entering a cell, providing their survival rate.

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On physiological frost-resistance features of grape varieties and forms differing in origin

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Our investigations on the water state in grapevine tissues during the winter period (calorimetry, thermography) have shown that the grapevine frost-resistance is based upon the water-holding power of cells, and thanks to this, the harmful effect of the frost is reduced with a decrease of the cell dehydration in consequence of an extra-cellular freezing. But the dehydration of the grapevine is considerably difficult due to the presence of water-holding forces and the weak permeability of protoplast for the water. Therefore, for different temperature ranges and grape varieties a super-cooled state of the water can have a different after action: it is useful in temperate frosts, but it is already dangerous in fierce frosts, since a considerable quantity of unfrozen water in a cell freezes in the last analysis.

Compared to weak-resistant varieties of the European grape, a super-cooled state in the frost-resistant forms, interspecific hybrids (with a participation of Amur-grape), can be preserved for a longer time in fierce frosts ensuring some dehydration and a relatively late beginning of the intercellular ice-formation.

In frost-resistant and moderately frost-resistant forms the resistance degree of grapevine tissues to critical temperatures is characterized by the following sequence: xylem > cambium > phloem > parenchyma > phloem rays > adventive buds > main bud. In most weak-resistant varieties of the European grape, particularly in the ones of the East group, cambio-genetic cells are more frost-sensitive.

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and forms differing in origin

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Thus, a maximum frost-resistance of different grape varieties and forms manifests itself over a specific temperature range and is conditioned by the intensity of the number of physiological processes dependent on the live structure of a cell, i.e. the genetic nature of a given variety.

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The breeding of vines for unfavourable conditions
of climate and soil

P. Ja. GOLODRIGA

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Summary

Despite good performance with regard to quality and yield, the cultivars of the species *Vitis vinifera* L. have some fundamental deficiencies, e.g. a low resistance to frost, aridity, fungus diseases and animal pests, a long vegetation period, etc. New cultivars, combining all biological and economical features, can only be bred by hybridisation, polyploidisation or mutation.

1. In some countries with a severe winter, the critical problem is the winter hardiness of *V. vinifera* cultivars. The breeding results to date from the USSR and other countries show that through hybridisation it is possible to obtain new vine cultivars within this species which have a high winter hardiness.

In the most cases, when considerably increasing the cold hardiness of seedlings in the F_1 , the yield decreases. Thus, back-cross is necessary with corresponding primary forms, particularly as it has recently been proved by experiment that by crossing with *V. vinifera* cultivars with increased cold hardiness, a considerable increase of cold hardiness in the F_1 can be obtained.

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2. The duration of the vegetation period of a cultivar is a limiting factor for the cultivation in northerly regions. Unfortunately, in the overwhelming majority of vine cultivars this lasts for 140-175 days and more. These cultivars can, of course, only be cultivated in southern regions.

Up to the present time, proper attention has not been paid to the breeding of new cultivars with a shorter vegetation period. This was probably promoted by the widely held opinion, that early ripening cultivars cannot give good yields. However, experimental data from many breeders in many countries show that by systematic selection of primary forms in the F_1 it is possible to obtain new cultivars with a very early ripening period (89-92 days), which at the same time give high yields. Thus, early ripening and yield intensity are inherited independent of each other.

The breeder can, therefore, create new cultivars with a shorter vegetation period, a high yield, and giving a good wine quality and also in this way widen the area of cultivation of vines and the maturation period of table grapes.

3. Recently (in industrial regions of viticulture) Botrytis infestation led to large-scale damage. Experimental findings show that Botrytis does not have the same effect on all *Vitis vinifera* cultivars and that it is possible to breed cultivars with increased resistance to Botrytis by intraspecific hybridisation. Thus seedlings with increased resistance have been obtained from the crossings "Mourvedre x Muscat Koljovski" and "Cabernet x Saperavi".

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The breeding of vines for unfavourable conditions of climate and soil.

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On the crossings of the cultivars "Kuldshinski x Rkaziteli" and "Kuldshinski x Mzwane kachetinski", the degree of resistance of the berries to Botrytis was higher when compared to the hybrid population of the crossings "Kuldshinski x Terbasch" and "Terbasch x Kuldshinski". The reproductibility of these heriditability factors was established in 1969 with $r_s = 0,10-01,6$. It was possible, therefore, to select seedlings with valuable economical-biological qualities which at the same time had a high resistance to Botrytis.

By means of inter- and intraspecific crossings, therefore, new cultivars can be selected, which combine all the valuable biological and economical qualities and are very adaptable to the conditions of soil and climate of their cultivation area.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

Problems arising in the breeding of root stocks resistant to calcium chlorosis

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Pont-de-la-Maye (France)

Summary

Since 1959 our Research Station has been occupied with the cross breeding of root stocks which are more resistant to chlorosis than 41B (Chasselas x Berlandieri). Numerous difficult problems have been encountered in carrying out this work. For, as well as being resistant to chlorosis, the new cultivars must also possess all the qualities of other rootstocks (resistance to phylloxera, good rooting ability, good affinity, good vigour, and resistance of the mother plant to fungus parasites etc.).

It is not possible to assess the resistance of a new root stock to chlorosis on an ungrafted vine. A *V. vinifera* variety must be grafted onto this rootstock and the reaction of this combination in a soil very liable to chlorosis must be observed for several years. In order to obtain quicker and more exact data on the degree of resistance of new varieties, we use the reciprocal grafting method. If we want to test the degree of resistance of X compared to that of the most resistant rootstock (41B), we carry out four graftings between these two varieties as follows:

$\frac{41B}{41B}$	$\frac{41B}{X}$	$\frac{X}{X}$	$\frac{X}{41B}$
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These different grafts are planted in a soil very liable to chlorosis and the intensity of the chlorosis symptoms is appraised.

R. POUGET

Problems arising in the breeding of root stocks resistant to calcium chlorosis

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1. If $\frac{41B}{41B}$ shows more chlorosis than $\frac{41B}{X}$ and if $\frac{X}{41B}$ has more than $\frac{X}{X}$, we conclude that in both these cases the root system of X supplies the scion with more iron than that of 41B. X can therefore be considered to be more resistant to chlorosis than 41B. In the opposite case, X would be less resistant. This conclusion reveals a characteristic of the rootstock: the capacity of the root system to absorb and transport iron.
2. If $\frac{X}{41B}$ has more chlorosis than $\frac{41B}{41B}$ and if $\frac{X}{X}$ has more than $\frac{41B}{X}$, we conclude that in both cases the foliar system of X requires more iron than that of 41B, for there is more chlorosis, despite the same supply of iron. Thus a characteristic of the scion is revealed: the iron requirement of the foliar system.

This method of reciprocal grafting permits an assessment of both

1. with regard to the root stock varieties, the capacity of the root system to absorb and transport iron
2. with regard to the scion varieties, the iron requirement of the foliar system.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

On the cold-hardiness of grape vines

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Summary

It is difficult to observe cold hardiness of new varieties in the field. Investigations to obtain an insight into the behaviour of various vine cultivars under lower temperatures, by means of artificial freezing gave the following results:

From the cultivars investigated, the following can be considered winter-hardy: Riesling, the Burgundy group, the new varieties FS 4-201-39 (Geilweilerhof), 173-12 and 181-2 (Klosterneuburg) and Perle von Alzey.

Grüner Veltliner, Sylvaner, Neuburger and others proved to be sensitive to frost.

Cold hardiness is influenced to such an extent by so many factors, that the differences in the cultivars become effaced. The following were investigated:

1. The yearly cycle

The first late autumn frosts bring about the transition to the winter state. The coldhardy cultivars are less susceptible in late autumn resp. late winter than the sensitive cultivars.

2. The influence of pre-treatment on cold hardiness

An eight-day thermal treatment (+6° C) brought about a considerable lowering of the cold hardiness, even during winter dormancy, above all in those cultivars sensitive to frost.

3. The water content of the wood in the cultivars sensitive to frost was always higher than that of Riesling. It was not possible, however, to calculate with certainty that a correlation exists between the water content and the damage after freezing.

4. Together with nutrition, the yield has a considerable influence on cold hardiness. It is remarkable that wood from badly supplied plots with low yields and despite bad vigour had a high resistance to frost.

5. No relationship was observed between the wood:pith-ratio and cold hardiness.

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The breeding of winter-hardy vines

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Summary

The increase of winter hardiness is the most important task of vine breeding in the viticultural regions of the USSR, where the vines are covered with soil every year in the wintertime. The main method of breeding new vine cultivars with increased winter hardiness used in the All Russian Scientific Viticultural Research Institute is interspecific hybridisation using *Vitis amurensis* Rupr., which is distinguished for its high winter-hardiness and short vegetation period. On this basis, it was possible to breed valuable, new vine cultivars at the Institute, some of which are already cultivated in practical viticulture or are undergoing state examination.

In order to breed new varieties for wine, large-scale intraspecific crossings with *Vitis vinifera* L. are being carried out. Investigations carried out over several years have shown that cultivars with a comparatively high cold-hardiness can also be selected from these crossings.

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The reactions of different *Vitis vinifera* L.
cultivars to some environmental factors

A. CALO' - A. COSTACURTA

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Summary

A series of investigations was carried out on the variability of some phenological features of *Vitis vinifera* to environmental factors and the interactions between the different factors.

This study ought to demonstrate the specific characteristics of different cultivars within one species, basing on their different genetical nature and reaction to environmental factors.

The investigations, which covered a period of six years (1964-1969) included dates of bud burst, flowering, berry-set, colouring and maturation of berries and the sugar accumulation of some wine and table grape cultivars of different origins, which were cultivated in the ampelographical assortment of the Viticultural Research Institute in Conegliano (Treviso).

The interpretation of the data obtained leads to the following conclusions:

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- The data of bud burst, onset of flowering, berry-set, colouring and maturation and the periods between the beginning of flowering and berry-set, between berry-set and colouring, between colouring and maturation are strictly specific features of each variety. The same applies to the capacity of sugar accumulation in the berry.

- With the data obtained it was possible to classify into early and late maturing cultivars.

These groups of varieties are distinguished by different reactions to the investigated environmental factors.

The influence of temperature, which is the most important factor with regard to bud burst, flowering, berry-set, colouring and maturation, is particularly dependant on the cultivar, i.e. each cultivar requiring different temperature conditions. These differences are more pronounced when cultivating the varieties in different locations.

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The reaction of grape tissue to dehydration
as a character of ecological adaptability

V. GRINENKO

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and

Moldavian Institute for Fruit-growing, Viticul-
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Summary

Comparative investigations on the vine have been carried out under different ecological conditions - in Central Asia, where the summer is hot and dry, at the Black Sea coast, with a mild sea climate, at the interior of the Krasnodar region in the North-Caucasus, with a continental climate, in the Moldavian region with its dry periods, and finally in the Kabardino-Balkarian-region with a mild, damp climate and lack of warmth in autumn. These investigations have shown a surprising stability of the water content of the tissues under these contrasting conditions. The stability specific to each cultivar was determined by measuring the resistance of the tissues to dehydration.

The behaviour of the tissues to dehydration in a mild, damp climate represented the degree of preparation of the vine for the winter period, as well as its stability with regard to changes in temperature under sometimes critical situations. In vine cultivars belonging to different ecological groups, the extent of preparation is very different in the individual regions, depending on the year and the respective environmental conditions.

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It is assumed that the stability is fixed genetically. This factor is manifested depending on the respective environmental conditions of the plant, which can either be stimulating or inhibiting. The degree of dehydration which the plant can support without damage characterises its stability and its ecological adaptability.

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C o n f e r e n c e A g e n d a

27.9.1973

- Section VI -

Must and wine quality in vine breeding

Chairman: A. Rapp, Geilweilerhof (Fed.Rep.Germany)

- 14.00 - 14.45 h W.M. Kliewer, Davis (USA):
Must and wine quality
- 14.45 - 15.00 h J. Bisson, Cosne sur Loire (France):
Colour as a criterion for selection in
red wine varieties
- 15.00 - 15.15 h A.V. Konovalova and N.I. Gusun, Kischinew (USSR):
The inheritance of berry pigmentation in
relation to resistance
- 15.15 - 15.30 h L. Koshev and B. Ponomartschenko,
Kischinew (USSR):
Microvinification as a method of selection in
vine breeding
- 15.30 - 16.00 h Interval
- 16.00 - 16.15 h A. Rapp, Geilweilerhof (Fed.Rep.Germany):
The amino acids in grape berries and their
importance for the formation of the aroma
components of wine
- 16.15 - 16.30 h N. Aktan, Bornova-Izmir (Turkey):
The influence of berry maturity on the aroma
of wine from Turkish muscat grapes
- 16.30 - 16.45 h H. Eschnauer, Ingelheim (Fed.Rep. Germany):
On the content and origin of minor elements
in grape must and wine

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Must and wine quality
in vine breeding

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Summary

The sugars, organic acids, amino acids, phenolic compounds, anthocyanins, aroma compounds, and minerals in the grape must of *Vitis* species and in cultivars within the species *Vitis vinifera* are compared, both qualitatively and quantitatively. Compounds and/or ratio of various compounds that distinguish or characterize one species or cultivar from another and that have an effect on must and wine quality are emphasized. The influence of external factors, such as climate and cultural practices, on must and wine quality are discussed briefly.

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Colour as a criterion for selection in
red wine varieties

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Cosne sur Loire (France)

Summary

Colour improvement in certain red wine cultivars could be achieved by breeding grapes with a higher content of pigment in the skins rather than by breeding teinturier grape varieties.

It is a fact that the red wine cultivars which are grown in the most northerly regions (e.g. Pinot noir, Gamay noir) give more weakly coloured wines because the modern cultivation conditions tend to reduce the natural concentration of anthocyanins in the berries.

Results can for the time being only be obtained by using a reliable and practical test on the colour intensity of the berries within clonal populations of the most interesting cultivars.

The first experiments showed that the direct investigations of the optical density of the must at vintage seems equally as interesting and much more simple than testing the mash extract.

By applying this method to a large number of clones, numerous micro-vinifications at the early stage of clonal selection could be avoided.

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The inheritance of berry pigmentation in relation
to resistance

A.V. KONOVALOVA - N.I. GUSUN

Moldavian Institute for Fruit-growing, Viticulture
and Enology
Kischinew (USSR)

Summary

Anthocyanes play an important role in many biochemical and physiological processes. They stimulate the formation of carbohydrates and increase the temperature of the tissues, which protects the plant from excessive cooling. In red wine cultivars, respiration and oxydative processes are promoted by anthocyanes.

The task of the breeders in Moldavia is to select early ripening cultivars, which are resistant to fungus diseases, phylloxera and low temperatures and which give wine with high quality flavour and intensive colour.

The heredity of the anthocyan complex in seedlings of hybrid combinations was investigated. The parent cultivars used were: *Vitis amurensis*, Seibel 7053, Seibel 13666, Seyve Villard 18315, Cabernet, Merlot, Aleatico and Pinot franc. Depending on the hybrid combination, a varying dominance of mono- and diglucosides could be determined in the population. In some hybrids, diglucosides were not present, in others a large, genetical variability was observed in the colour intensity and the diglucoside content. Those seedlings which are the result of crossings between red European cultivars and *Vitis amurensis* are of particular interest.

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Most of the seedlings selected showed an improved resistance to plasmopara and frost and a high colour intensity. Their wines are distinguished by the harmony of their flavour and colour intensity.

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Microvinification as a method of selection in
vine breeding

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Summary

Promising new varieties should combine positive agrobiological and technological features. The objective assessment of the technical possibilities of one new strain or another is very important for the overall evaluation. A corresponding microvinification, which is correctly carried out, is a rational selection method for vine breeding.

The methods of microvinification are for the most part identical to the usual technological processes in large wineries. The technological assessment takes place after 5 years of testing, during the course of which the new wines undergo an organoleptical examination as early as December and their chemical components are also analysed at this time.

Microvinification gives the possibility of examining the technological characteristics of a large number of new varieties within a short time. After being examined for 3-4 years, those cultivars which have positive technological and agrobiological features are handed over for final assessment to the state examination.

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The amino acids in grape berries and their importance
for the formation of the aroma components of wine

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Summary

The total amino acid content of wine berries increases during the growth and maturity phase, whereas the rate of increase of some amino acids differs. Thus the arginin content, for example, remains constant - when compared to the total concentration of amino acids - whereas the percentage of prolin and leucin considerably increases.

The amino acids, which are formed in the wine berries from the various primary components (sugar, CO₂, malic acid, etc.) are themselves primary components for numerous berry constituents. Thus glutamic acid is greatly metabolized, and when the berry maturity advances and the temperature increases, more sugar is formed from the glutamic acid.

The supply of amino acid in grape must, which depends on various factors, has a decisive influence on the formation of volatile fermentation products.

Taking fermenting alcohol and i-butanol as example, the importance of the separate amino acids and the concentration of amino acids for the formation of these components during the alcoholic fermentation is shown. Both alcohols are formed from the C-skeleton of the glucose as well as from glutamic acid and aspartic acid.

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The influence of berry maturity on the aroma
of wine from Turkish muscat grapes

N. AKTAN

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Bornova-Izmir (Turkey)

Summary

In Turkey, muscat grapes are mostly grown in Izmir and in the suburbs Bayrakli and Bornova. The grapes have typical aroma substances, some of which are known. The yield of the muscat variety is approx. double that of the other varieties grown in Turkey. Muscat vines are very susceptible to diseases, however, and therefore, their cultivation is continually decreasing.

The aroma of muscat grapes changes considerably during fermentation. We recommend, therefore, that this variety should be used for sweet wine production.

The maturity of the muscat berry is very rapid. To produce dry wines, an exact and correct timing is necessary for the vintage because the sugar accumulation in these grapes is very rapid, up to 140° Oe, with an acid content of only 3-4%. The appropriate timing of the vintage is also very important for the aroma, which changes during maturity. A berry maturity of 94-98° Oe is considered to be the optical harvesting time. Berries at a more advanced stage of maturity have a considerably increased content of acetaldehyde, methanol, acetic ester and ethyl-lactate. A higher sugar content (120° Oe) is only desired for sweet wines, the acid deficiency can then be compensated by the addition of 1 g/l tartaric acid.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING
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On the content and origin of minor elements
in grape must and wine

H. ESCHNAUER
Ingelheim/Rhein (Fed. Rep. Germany)

Summary

In the alcoholic beverage "wine", composed of complex ingredients, more than 100 anorganic and organic substances have been detected up to now, of which approx. 40 are minerals and minor elements. Reliable information has existed for some time on the minerals, and we are steadily increasing our knowledge of the minor elements, even though our data on the cycle of each minor element is not yet complete.

Examples of possible interpretation which can be made from the amount of primary minor elements contained in grape must and wine are given: the minor element borine gives information as to the growing area of the grape vines, boron of the fertiliser used and manganese of the vine cultivar. It follows from this, that not only the knowledge of the amount of the minor elements present, but also the origin and classification can be considered when judging a wine.

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Genetic basis of clonal selection of grapes

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Summary

Spontaneous variability within a variety of grapes after vegetative propagation can be of modificative and very seldom of mutative nature.

Clonal selection of grapes can be carried out either to maintain high productivity and phenotype levelling or to improve the genotype. It has been shown that the range of modificative variability of productivity of plants is very wide. However, vegetative propagation from both high and low yielding plants did not differ in its productivity and in fact was an isogenic monoclonal population of the plants of the variety. Selection of modifications for the purpose of genotype improvement of a variety is not effective. The improving selection must be carried on from spontaneous or induced heterogeneous population of the clonal variety. General methods of inducing and calculation of somatic mutations, of dechimerising and selection of useful forms are recommended.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The regulation of the water content of the vine
as a means of adaptability to environmental factors

V.V. GRINENKO

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and Viticulture of the North-Caucasus
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Summary

By regulating the water content and conserving its relative stability, the plant can adapt itself to, and survive changeable environmental conditions.

The reaction of the plant organs to dehydration characterises the relative stability of a vine cultivar when confronted with increased physiological stress. This adaptability is the sum of the reactions of the whole organism of the plant. It is linked with cell respiration and the susceptibility of the plant to toxic enzymes, with the activity of the photosynthesis mechanisms and also with reactions to light and temperature. Changes in these processes coincide with changes in the constitution of the albumin, with the thermal stability of the protoplasm and its permeability and also with other signs of the plant's ability to stand up to stress. This ability can be judged as a criterion for estimating the adaptability of new breeds to the environmental conditions prevalent at their future location.

INTERNATIONAL SYMPOSIUM ON VINE BREEDING

Geilweilerhof 25 - 29 September 1973

The selection of grape vines resistant to plasmopara
based on the diagnosis of the infection

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Summary

In Kischinew, the breeding of vines resistant to plasmopara began in 1947. The work was based on D.D. Verderevski's considerations on the development of evolution of a specific immunity to infectious diseases.

The first step in breeding was to assess the infection diagnosis of thousands of seedlings, which descended from crossings with European vine cultivars. The result was a collection of resistant plants which served as primary material for further breeding work. By crossing these seedlings with European vine cultivars, the variability of the strains resistant to plasmopara was increased - some of these had features of quality and are therefore very promising. It was possible to increase considerably the number of strains resistant to plasmopara by crossing with the French hybrids S.V. 20-473 and S.V. 20-366.

At present, the most promising strains are undergoing production testing and 5 of these have been accepted for the State cultivar examination.