QUANTITATIVE ANALYSIS OF SOLUBLE AND INSOLUBLE FORMS OF PECTIN SUBSTANCES IN GRAPES IN DIFFERENT PHASES OF VEGETATION

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Annotation: It is quite important to study the dynamics of the accumulation of pectin substances in grapes in order to regulate the grape must and wine conditions and to increase the quality. Quantitative content of soluble and insoluble pectin substances was determined in the grape clusters of some varieties of Georgian industrial vine according to the vegetative phases. Based on the quantitative data of the experiment, the process of the destruction of protopectin in the cluster and the accumulation of hydropectin in the juice was determined, which is followed by softening and ripening of the grape seed. This process is carried out with more or less intensity in different varieties and origins of grapes.

Key Words: Pectin substances, protopectin, hydropectin, vegetative phase, veraison, fruit set, ripening

Introduction: Only the highest quality products can survive the largest competitive environment of alcoholic drinks in the world today. Winemaking - the oldest agricultural sector of mankind has faced new challenges in the XXI century. The continuous tradition and heritage of more than 8000 years allows Georgian enological science to have its crucial word in the production of premium wines.

For the quality of wine it is very important to study the dynamics of the accumulation of pectin substances in grapes according to the vegetative phases, especially during the ripening period. The transparency and stability of the wine and its commodity significantly depend on them.

The initial form of pectin substances is protopectin, which is the antecedent of soluble pectin substances - a source of supply for their production.

The juice extracted from unripe grapes picked during the period of the veraison does not contain pectin substances. At the beginning of grape ripening, the process of the breakdown of the cell membrane and softening of the seed is going on due to the destruction of protopectin and production of hydropectin.

These processes are followed by the mobilization of aromatic, phenolic, dyes from the content of the cell into the juice and its enrichment.

The hydropectin in wine also significantly influences its quality, creating delicacy, smoothness and velvety. However, in addition to these positive properties, pectin may also has a negative effect on them. Depending on the quantity, pectin in fresh wine sometimes makes filtration of wine difficult. Therefore it is necessary to carry out preventive measures and keep the golden mean of the content of hydropectin.

Based on these actual issues, the goal of our research was to determine quantitative content of soluble and insoluble pectin substances in different parts of the grape cluster of some Georgian industrial vine varieties (Rkatsiteli, Mtsvane, Khikhvi, Kisi and Saperavi of different origins) during the vegetative phases such as, fruit set, veraison, fruit ripening and over ripening.

Experiment, Results, Conclusions. The quantity of protopectin in the stem and seed of the given grape samples as well as the concentration of protopectin and hydropectin in the grape cluster were determined in every phase spectrometrically based on the Carbazole and Gravimetric methods (by weight) and by using the precipitation of calcium pectate and Metlitski methods. (Literature].

Results are presented in diagrams 1,2,3 and 4

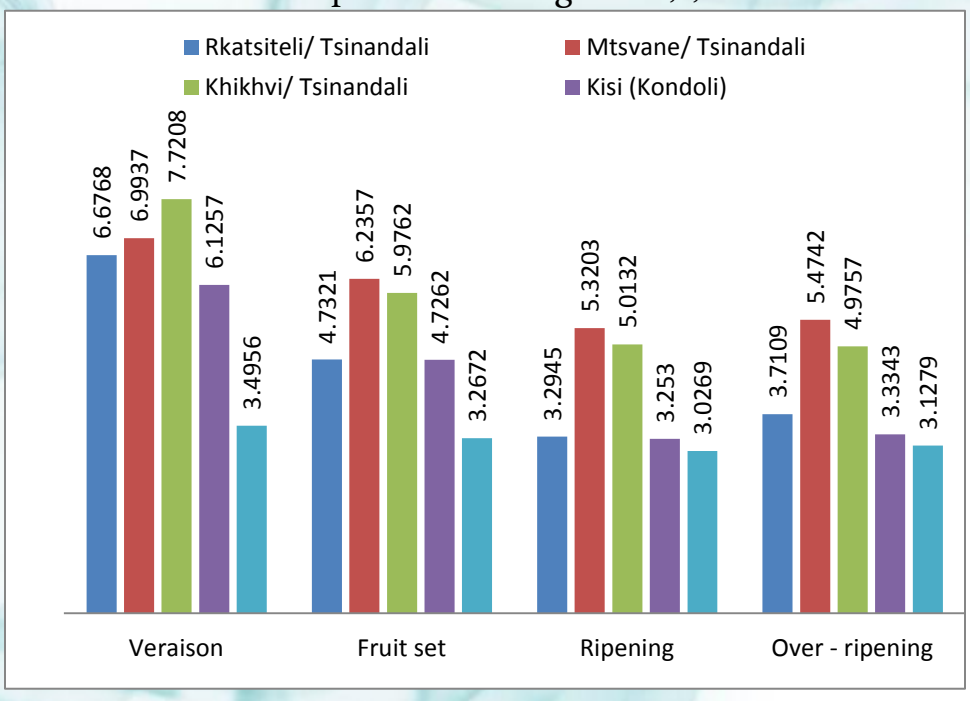

Diagram 1 – Content of protopectin in the stem of white grapes according to the phases

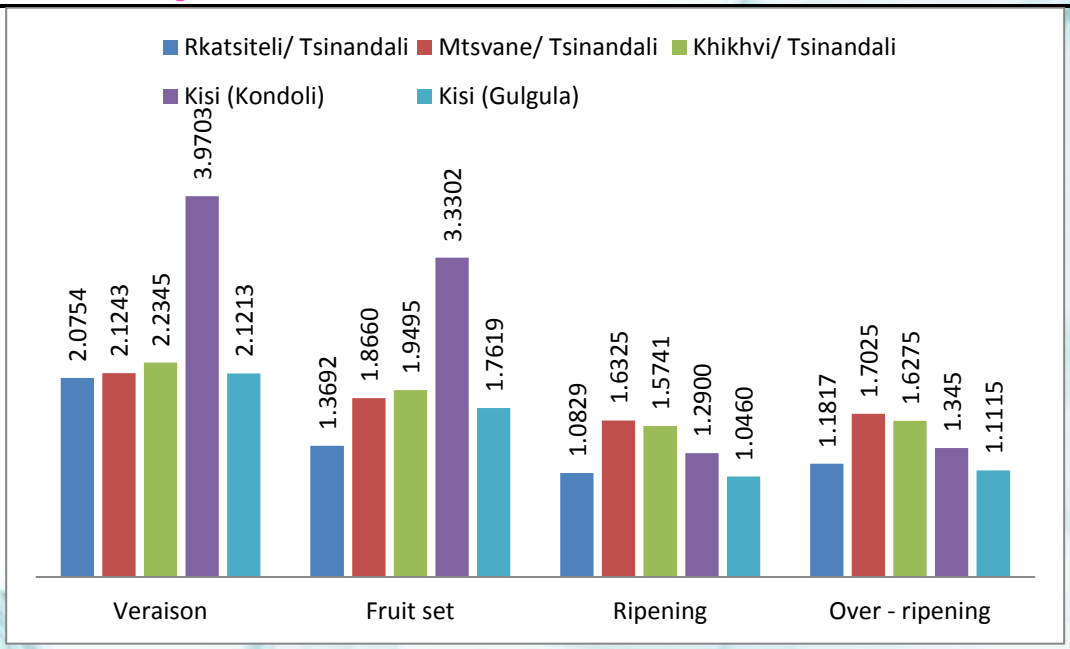

Diagram 2 - Content of protopectin in the seed of white grapes according to the phases

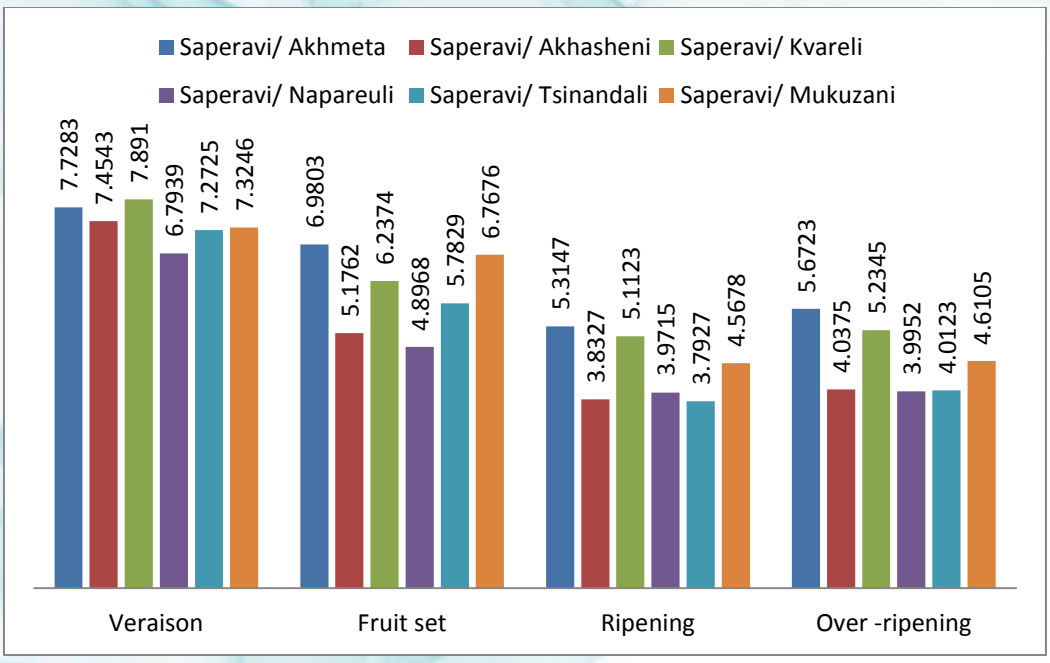

Diagram 3- Content of protopectin in the stem of Saperavi grapes according to the phases

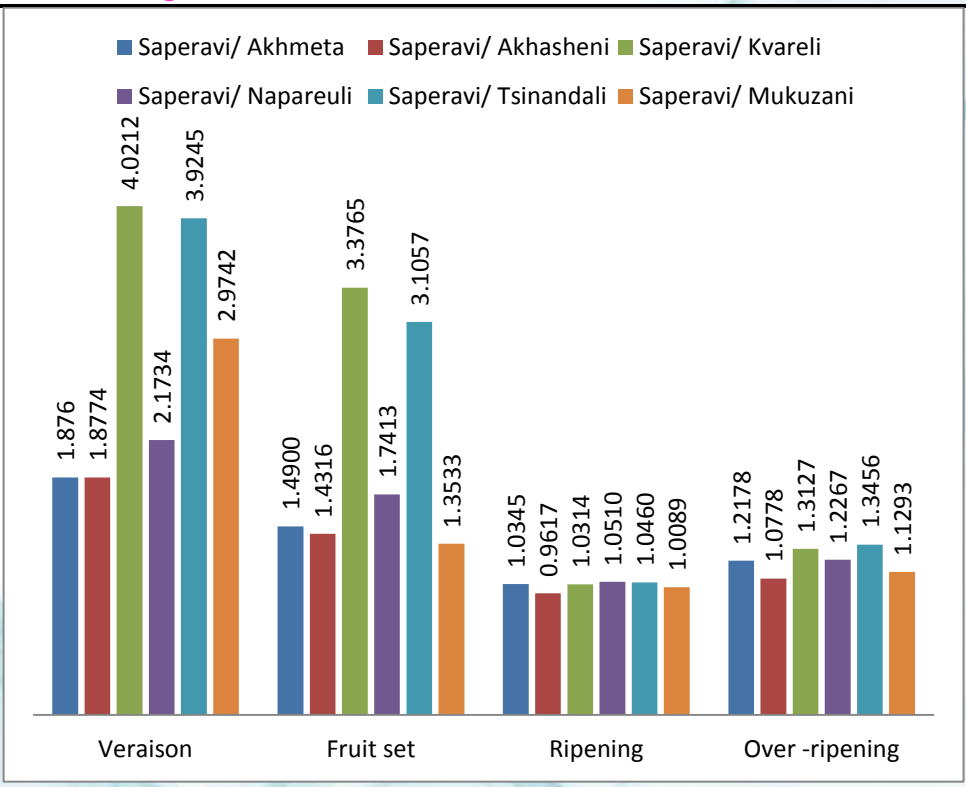

Diagram 4 - Content of protopectin in the seed of Saperavi grapes according to the phases

As the diagrams 1,2,3 and 4 show the quantity of protopectin in grape cluster decreases from veraison to ripening. And in the phase of over ripening, the quantity of protopectin in the stem increases in every sample which is caused by the evaporation of the juice due to the breakdown of the cells of the seed skin and the concentration of dry substances, including pectin substances in the seed. Compared to Saperavi of other origin, Kvareli Saperavi and Tsinandali Khikhvi from white grapes are distinguished with the highest ability to accumulate protopectin during the veraison phase.

The decrease of the content of protopectin is going on with the similar process in solid parts of the seed from the period of veraison to ripening. Kondoli Kisi (3,9703%) is characterized by high content of protopectin during the veraison period. Gulgula Kisi and Tsinandali Rkatsiteli (1,0460% and 1,0829% respectively) contain the smallest quantity of protopectin during ripening. And the seed of Tsinandali Mtsvane (1,6325%) is distinguished by the highest content of protopectin.

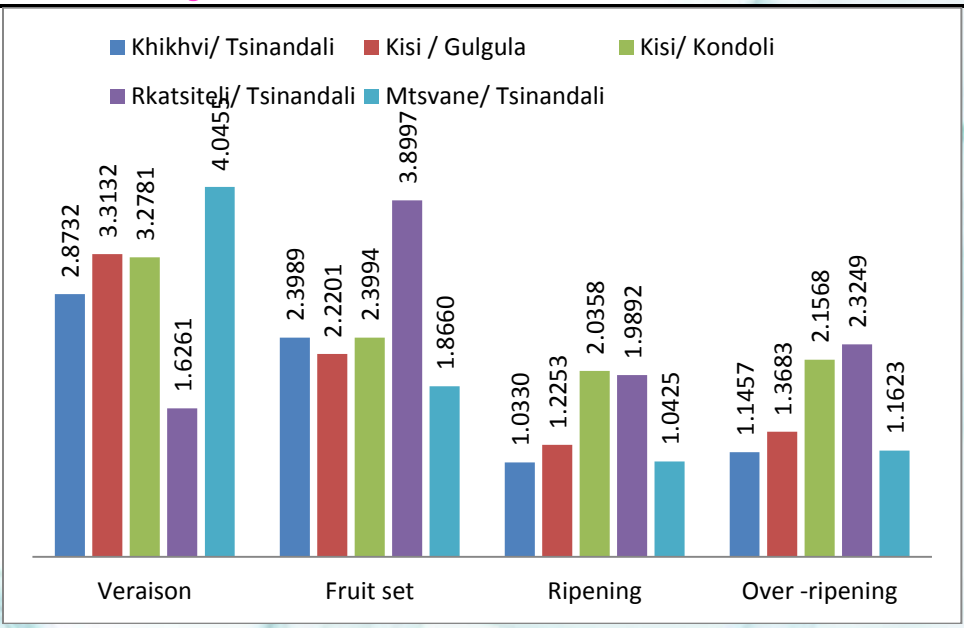

Diagram 5 – Quantitative content of protopectin in the cluster of white grapes according to the phases

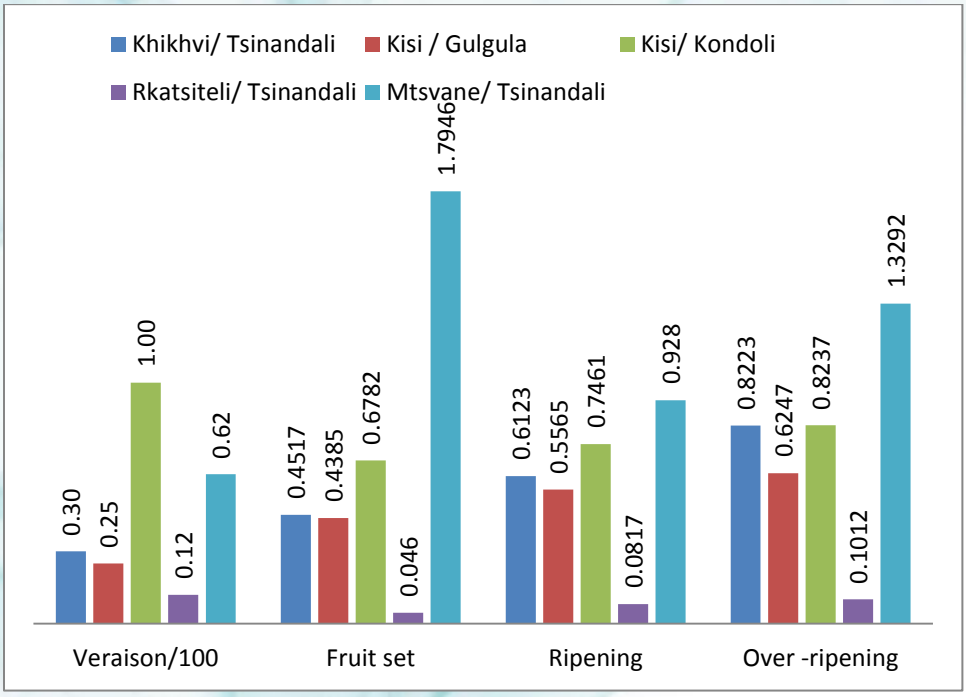

Diagram 6 – Quantitative content of hydropectin in the cluster of white grapes according to the phases

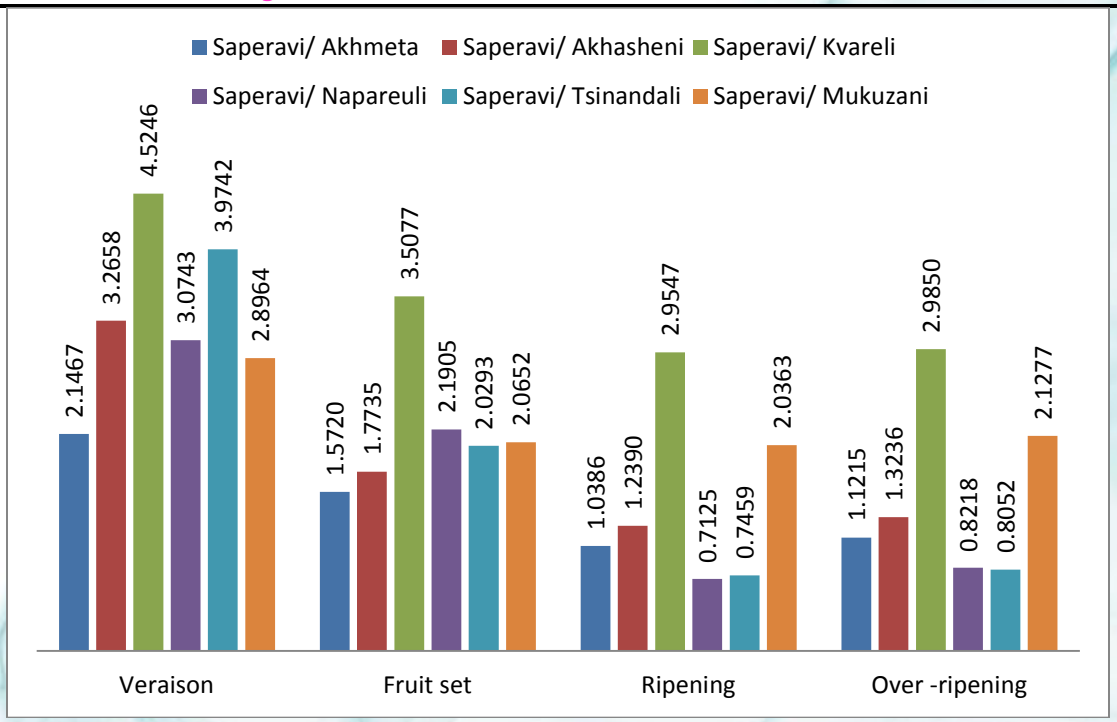

Diagram 7 – Quantitative content of protopectin in the cluster of Saperavi grapes of various origins according to the phases

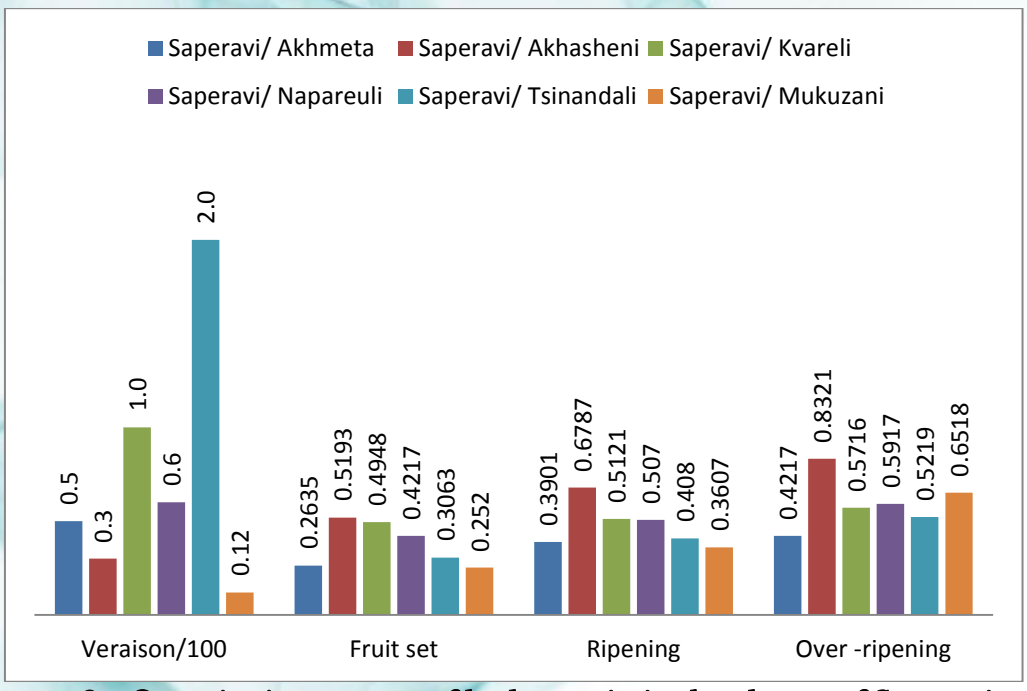

Diagram 8 – Quantitative content of hydropectin in the cluster of Saperavi grapes of various origins according to the phases

The diagrams 5,6,7 and 8 show that the quantity of hydropectin in the veraison period almost equals to zero, in return, protopectin "is getting ready" for an important transformation which it begins in the following phase such as fruit set and continues into ripening. One common regulation

applies to all samples: the process of destruction of protopectin and accumulation of hydropectin already begin in the solid parts of grapes in the phase of a fruit set of the vine vegetation, which is followed by softening the grape seed and then the ripening phase.

Decrease of the quantity of protopectin and increase of the quantity of hydropectin in the grape juice result in a natural growth of the concentration of both in the phase of over ripening.

Akhasheni Saperavi – 0,003-0,5193 – 0,6787 – 0,8321 % is characterized by the highest ability to accumulate hydropectin in the solid parts of grapes, while hydropectin is found in the smallest quantity in the seed of Mukuzani Saperavi (1,0089%). This is very essential for the production of high quality of the future wine.

Among the species of white grapes, Tsinandali Mtsvane is distinguished with the greatest ability to accumulate hydropectin in the juice in which the content of soluble pectin increases from 0,0062% to 0,928% starting from the period of veraison to the fruit set. In this case Tsinandali Rkatsiteli contains the least quantity of hydropectin (0,0817%) in the phase of ripening.

Thus, the conducted experiment determined the accumulation dynamics of soluble and insoluble forms of pectin subtsances in the cluster and constituent parts of Saperavi and white species of grapes (Rkatsiteli, Mtsvane and Kisi) of different origins in the vegetation phases such as the veraison, fruit set, ripening and over ripening.

The dynamics of quantitative change of pectin substances in the cluster is characterized by one and the same regularity for all varities: mobilization from solid parts to the juice.

The conducted studies have a great practical importance for winemaking to produce quality grape must and high organoleptic wine

References:

1. Bagaturia N. (2015) Oenology, production and ageing of wine, Theory and Practice, Tbilisi, Publishing House „Georgian Academic Book“
2. Great Encyclopedia „Wine“ (2017), Part I and II, Publishing House “Palitra“ L. Tbilisi.
3. Durmishidze S., Khachidze O.,(1985)- Biochemistry of Vine, “Science”
4. Ujmajuridze L., Kakabadze G., Mamasakhlisashvili L. (2018), Georgian vine varieties, Tbilisi, Publishing House “Pegasi“
5. Khachidze O., (1955), Pectin substances of vine and wine. Dissertation for the candidacy, Tbilisi
6. Navari G, Langladi P. (2004) Oenology. (Translation by G. Samanishvili).