Comparative characteristics of varietal and blended flavored wines

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Abstract. The study is devoted to the improvement of the technology of fruit flavored wines. The paper presents the results of the physicochemical composition study of apple, pear and honeysuckle juices obtained from the raw materials of the Siberian assortment on suitability for the preparation of flavored wines. Samples of varietal (apple, pear, honeysuckle) and blended (apple-honeysuckle, pear-honeysuckle) flavored wines are prepared. A comparative assessment of product samples according to the physico-chemical composition and organoleptic properties of varietal and blended wine materials and wines was made. It is determined that blending apple and pear juice with a combination of honeysuckle on e has a positive effect on the biochemical assessment of the drink. Thanks to this technology, obtained samples of blended wines are enriched with polyphenolic substances and vitamins. Aromatization was carried out by joint fermentation of juices with spicy aromatic raw materials, which ensures the enrichment of wines with biologically active substances. In the process of the physicochemical parameter analyzing, an increase in the values of the titrated acidity without deterioration of the finished product taste was noted. The obtained samples of blended wines are differed in organoleptic characteristics - the flavor is characterized by an original taste with honeysuckle notes and a pleasant aroma. Preparation of blended flavored wines by the proposed technology allows expanding the range of wine products.

1. Introduction
Flavored wines have therapeutic and preventive properties and functional orientation. Herbal ingredients used for flavoring contain vitamins of group B, PP, C that increase the biological value of the drink, many of them contain compounds with antioxidiant and antiseptic effects. Fruits and berries during the growing season accumulate a large amount of vitamins, phenolic substances, essential oils, nitrogenous, pectin and other compounds. This makes it possible to obtain products with a high content of biologically active substances and a large variety of organoleptic qualities [1].

Valuable raw materials for the production of wines are fruits of Siberian selection varieties, with a large stock of biologically active substances. In particular, there are apples and pears. Apples are the...
most common raw material for fruit and berry winemaking. They are distinguished by a high content of organic acids and phenolic compounds. Varietal wines are made from apples, they are part of the blends. Apple wine materials can also serve as the basis for the preparation of flavored wines.

The use of apples is explained by chemical and technological indicators favorable for winemaking: the sugar content varies from 6 to 15%, the titratable acidity - from 5 to 20 g/dm\(^3\) [1]. Semi-culture apples of Siberian varieties are rich in catechins (530-760 mg/dm\(^3\)), leucoanthocyanins (45-75 mg/dm\(^3\)), flavonols (30-35 mg/dm\(^3\)), chlorogenic acid (180-300 mg/dm\(^3\)), with the sum of phenolic substances 1080-2300 mg/dm\(^3\). The pear fruits of Siberian assortment are distinguished by their peculiar taste, pleasant aroma, and rich chemical composition. They contain 0.6-1.5% of organic acids, 3.15-11.32 mg\(^%\) of vitamin C, 8.65-12.51% of sugars, 160-300 mg \(\%\) of vitamin P; arbutin, serotonin, chlorogenic acid are present. In terms of sugar content, they are not inferior to Central Russian and some southern varieties, they significantly exceed their acidity and vitamin P content.

One of the ways to expand the range of wine products and enrich blended flavored wines with biologically active substances of natural origin is the addition of berry wine materials. Also promising crop for winemaking is honeysuckle. Honeysuckle fruits are rich in P-active substances, represented by anthocyanins, catechins and leucoanthocyanins, vitamins, sugars, pectins, organic acids. In addition, macro- and microelements are present in fruits [6-8].

The creation of blended flavored wines allows obtaining high quality wines and expand the range of manufactured wine products [9,10].

### 2. Materials and methods

The aim of the study is to improve the technology of fruit flavored wines.

Objects of the study: apple juice of Zhebrovsky variety, pear juice of Povislaya variety, honeysuckle juice of Berel variety, spicy aromatic ingredients.

The definition of physico-chemical parameters included the definition of: mass concentration of sugars according to “Russian Standard 13192–73”, vitamin C according to “Russian Standard 24556–89”, soluble solids according to “Russian Standard 51433-99”, volume fraction of ethyl alcohol according to “Russian Standard 32095-2013”, the mass concentration of titrated acids according to “Russian Standard 32114-2013”, volatile acids according to “Russian Standard 32001-2013”, the total content of polyphenols - with Folin-Ciocalteu reagent.

Studies were performed in 2014-2017 in the experimental workshop and the technological laboratory of the department of M.A. Lisavenko Scientific Research Institute of Horticulture of Siberia, Federal State Budgetary Scientific Institution Federal Altai Scientific Center for Agrobiotechnology. Fruit harvesting was held on the territory of the experimental production department of the institute.

According to “Russian Standard 58012-2017”, the fruits of honeysuckle were attributed to the first grade, after harvesting they were subjected to temperature freezing to minus 18±2°C. Freshly picked fruit of apples according to “Russian Standard 16270-70” and pears according to “Russian Standard 21713-76” were attributed to the first grade.

Preparation of wine materials in the laboratory using the method of micro winemaking: Stage 1 – Inspection and washing of raw materials, first fruits and berries coming for processing, are inspected: separation from damaged, rotten, low-quality fruits, leaves, herbs and impurities. If the fruit is slightly contaminated, the inspection is carried out before washing. In the case of processing of highly contaminated fruit, inspection is carried out after washing. Washing is carried out quickly in cold running water, in order to avoid the transition of soluble substances into water. Washing berries is carried out in gentle mode under the shower.

Stage 2 – Soaking fruits in potassium metabisulphite solution, to prevent oxidative processes and bactericidal action on wild microflora after washing, apples and pears are soaked in potassium metabisulphite solution for 15 minutes. A solution of potassium metabisulphite set in the berry pulp before fermentation.

Stage 3 – Crushing and pressing, juice extracting from washed fruits is produced by crushing and pressing. Shredding of raw materials is one of the most important operations of its processing. The yield
of juice and its quality depends on the maturity of apples, pears, the degree and method of shredding fruits.

Stage 4 – Settlement and clarification of freshly squeezed juice, to remove coarse dregs of freshly squeezed fruit juices, is produced by settling with the introduction of potassium metabisulfite. Then the juice is decanted from the sediment and fermented with France Superstart active dry yeast. The berries are pressed in a crusher and placed in containers of stainless material, added France Superstart active dry yeast (ADY). Fermentation begins on 2-3 day. Thorough mixing of the pulp with immersion pop-up "cap" is carried out 3-4 times a day for 4-5 days. Next, pulp squeeze on the press, and the first fraction wort is transferred to 10, 20 l bottles. The pulp is poured with hot water (50-60°C) in the appropriate percentages for each variety for the purpose of fermentation. Then the pulp is pressed again and get the second fraction wort. Both fractions are combined and continue to ferment in a manner similar to the "white method". This technique is used to reduce the high acidity of the fruit of berry crops.

Stage 5 – Fermentation, during fermentation of juices, sugar undergo transformations. Fermented wine material contains the basic elements of taste, food and dietary value of fruits and new substances formed as a result of fermentation, which lasts from 4 to 10 days depending on the temperature conditions. The optimum fermentation temperature is 18-25°C. Observation of the fermentation is carried out until the specific gravity of the wort reaches a constant value. If fermentation is stopped when residual sugar is in the wort, it is necessary to ventilate the wort by open pouring to rejuvenate the yeast.

Stage 6 – Aging and maturation of wine materials, at the end of fermentation, the wine material is decanted from the sediment with closed overflow into the prepared containers to the top (first overflow). Then, the required amount of potassium metabisulfite is additionally introduced, is hermetically stoppered and sent for extract and maturation at a temperature of up to 10°C for 6, 12, 24 months.

Stage 7 – Storage of dry wine materials, constant physicochemical and microbiological monitoring is carried out in the process of long-term aging. During this period, there is a natural clarification of wine materials and the formation of their taste and aroma. It is necessary to produce 2-3 overflow in a timely manner (removal from the secondary sediment) and topping up the tanks with healthy cider material in order to avoid acetic acidification. The temperature during aging of wine materials should be no higher than 10°C.

3. Results
To get the juice products, apples of Zhebrovskoe variety, pears of Povislaya variety, honeysuckle fruits of Berel variety were used. Additionally, a physico-chemical analysis of the obtained natural apple, pear and honeysuckle juices was performed. The data of the physico-chemical composition (soluble solids (SS), sugar-acid index (SAI), sugar content, titratable acidity, active acidity (pH), content of polyphenolic compounds and vitamin C (in the appropriate units) are presented in Table 1

Table 1. Physical and chemical indicators of apple, pear and honeysuckle juices harvests 2014-2016 (P≥0.95).

| Sort          | RSV, % | Sugar, % | Titratable acidity, g / dm³ | SKI, ed. | pH, ed. | Amount of polyphenols, mg / dm³ | Vitamin C, mg% |
|---------------|--------|----------|----------------------------|----------|---------|--------------------------------|----------------|
| Zhebrovskoye  | 13.65  | 12.78    | 9.44                       | 13.89    | 3.21    | 1841.00                        | 3.53           |
| Povislaya     | 14.15  | 13.07    | 10.06                      | 13.46    | 3.52    | 1105.00                        | 2.45           |
| Berel'        | 11.60  | 7.70     | 29.80                      | 2.58     | 2.99    | 5223.00                        | 25.10          |

Note P≥0.95

The studied juices are rich with polyphenolic substances, the highest content of which is found in the honeysuckle juice. Apple and pear juices have a high sugar content and moderate acidity. Honeysuckle juice has a high acidity and has a low SAI.
To determine the best ratio of ingredients in flavored wines, first of all, the organoleptic indicators of blends (apple or pear juice of the studied varieties and honeysuckle fruit juice) were evaluated, then of five variants of developed percentage ratios of juices (90:10, 80:20, 70:30, 60:40, 50:50) was chosen the optimal ratio 80:20. A mixture of spicy aromatic raw materials in dry and crushed form was introduced during fermentation in all the studied juices.

The resulting blends (juice from apples of Zhebrovskoe variety; juice from apples of Zhebrovskoe variety + juice from honeysuckle fruits of Berel variety; juice from pears of Povislaya variety; juice from pears of Povislaya variety + juice from honeysuckle fruits of Berel variety) were fermented by ADY using the “white” method, the fermentation process lasted 22±1 days. To achieve a greater natural fermentation into alcohol, sugar was additionally added. A physico-chemical assessment of the obtained blends is carried out (Figure 2).

The nutritional value of juice and wine is determined by the content of various substances in the raw materials. In the total number of apple and pear SS, sugar holds the first place. According to our research, the total sugar in apples (Zhebrovskoe variety) and pears (Povislaya variety) of the Altai assortment varies from 12.8% to 13.1%. Fruit juice sugars practically do not participate in the creation of the wine materials taste, since they are almost completely fermented by yeast into alcohol. Titratable acidity is at 6.0%. The titratable acidity of the fruit correlates with a pH at 3.0-4.0, SAI is about 13.0 units. In the fruits of berry crops of Altai varieties (honeysuckle of Berel variety), the SS content is within 11.6%, vitamin C is 25 mg/100g, active acidity (pH) is 2.99 units, SAI is 2.58 units.

The quantity and quality of the produced juice largely depends on the chemical composition and percentage of the main components of apples and pears. Determining factors are the ratio of sugars and organic acids (sugar acid index). Most suitable for the production of blended flavored wines – sugar acid index is 13 units, the sugar content is higher than 9 g/cm³, organic acids is 6-9 g/dm³.

Table 2. Physical and chemical indicators of freshly fermented wine materials of harvests of 2014-2016. (P≥0.95).

| Sort                  | RSV, % | Sugar, % | Titratable acidity, g / dm³ | pH, ed. | Alcohol, % vol. | Volatile acids, g / dm³ | Amount of polyphenols, mg / dm³ |
|-----------------------|--------|----------|-----------------------------|---------|-----------------|------------------------|-------------------------------|
| Zhebrovskoye          | 7.20   | 0.75     | 6.13                        | 3.81    | 10.60           | 0.79                   | 1671                          |
| Zhebrovskoe + Berel¹  | 7.40   | 0.67     | 9.71                        | 3.66    | 11.00           | 0.31                   | 2254                          |
| Povislaya             | 7.10   | 0.75     | 6.54                        | 3.84    | 10.70           | 0.81                   | 1701                          |
| Povislaya + Berel¹    | 7.00   | 1.27     | 10.67                       | 3.64    | 9.70            | 0.59                   | 2313                          |

Note P≥0.95

The accumulation of alcohol in the samples was 9.7-11.0% vol. Sugar fermented almost dry. The exception was blended wine material of juice from pears of Povislaya variety + juice from the honeysuckle fruits of Berel variety with a residual sugar content of 1.27%. Titrated acidity in blended wine materials is slightly higher than in varietal wine materials. The content of volatile acids is in the normal range. Blending of fruit wine materials with juice from honeysuckle fruits of Berel variety allowed enriching wine materials with polyphenolic substances, as can be seen from the data presented in Figure 2.

After a long aging of the wine materials, samples of varietal and blending flavored wines were prepared, stabilizing processing of the wine materials and then sweetening and alcohol addition according to traditional technology were carried out.
During the storage of wine materials, a decrease in the content of polyphenolic substances was observed; nevertheless, in the finished wines, their content is at a high level (Figure 1).

*Figure 1.* The content of polyphenols in flavored wines harvests 2014-2015. (P≥0.95).

The volume fraction of ethyl alcohol and the mass concentration of sugars in the finished product correspond to the required indicators for dry flavored wines and are 16.0% vol. and 4.8-4.9%, respectively.

Titratable acidity also changed with aging wine materials. Its value increased in a sample of pear-honeysuckle wine, there was a decrease of titrated acidity in the remaining samples (Figure 2).

*Figure 2.* Titratable acidity of flavored wine harvests 2014-2016. (P≥0.95).

The organoleptic evaluation of the studied wines showed that all samples have a pronounced flavor of taste and aroma. In the flavor of blended wines, there is a spicy honeysuckle bitterness. Flavored wines are crystal transparency and sparkle. Samples of developed blended flavored wines received a higher tasting rating compared to control samples purchased in the trading network.
4. Conclusions
1. A comparative assessment of varietal and blended wine materials and finished apple and pear flavored wines from the juice from apples of Zhebrovskoe variety; pears of Povislaya variety and honeysuckle fruits of Berel variety is presented. According to our research, the content of SS and sugars in juices from Altai assortment apples is high – 13.7 and 12.2%, from pears - 14.2% and 13.1%, respectively. Titratable acidity is 9.0 to 10.0 g/dm$^3$, pH correlates with acidity – 3.0-4.0 units, the amount of polyphenols is high (1105-1841-2458 mg/dm$^3$). As a result of redox reactions during crushing and pressing of fruits, the content of vitamin C in juices is 2.45-3.53 mg/100g. In berry juices, the sugar content is 7.70g/100g, the titrated juice acidity is 29.8g/dm$^3$. The amount of polyphenols is high (5223.0 mg/dm$^3$), the content of vitamin C is slightly lower (25.0mg/100g);
2. It has been established that the use of the honeysuckle fruits of the Berel variety as one of the components of flavored wine blend not only gives it an original taste and aroma, but also enriches with biologically active substances;
3. The organoleptic characteristics of samples of varietal and blended flavoured wines from fruits and berries of the Siberian assortment, characterized by a pronounced flavor taste and aroma, are investigated.

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