WINE PRODUCTION
STATE AND HISTORICAL ROOTS OF ICE WINE PRODUCTION

1. Introduction

Nowadays the world wine market is oversupplied thereby the interest is growing in atypical wine styles differing from another by the own originality of sensory, physical and chemical characteristics. Ice wine is a wine of overripe grapes harvested during the first frost, carefully selected and pressed by hand. Ice wine is a rare, exclusive dessert wine called ice wine. Canada is considered the biggest area of ice wine due to favorable low temperature conditions in the winter having own scientific center identified Cool Climate Oenology and Viticulture Institute (CCOVI) expressing the production volumes and wine composition in provinces.

Difficulty of determining characteristics and entire quality of products depends on former sources of production. Entrepreneurs in the wine business are urged to adapt to changes in customer behavior and to react to trends that they perceive to be important, resulting in diverse innovation ideas and change activities. Thus, data of some wine types are not shown in full, consequently, the roots of origin are keys to understand the features of certain technology. It is the lineage to determine the further development of wine technology.

It is the climate contributed to the emergence of special dessert wine called ice wine. Canada is considered the biggest area of ice wine due to favorable low temperatures in the winter having own scientific center indentified Cool Climate Oenology and Viticulture Institute (CCOVI) expressing the production volumes and wine composition in provinces.

2. Object of research and its technological audit

The object of research is ice wine historical roots, also current producers and areas of development of this wine type.

The aim of research is to represent a complete picture of ice wine history in producing countries and its scopes in wine business, have shown concrete producers that release wine of premium segment.
To achieve this aim it is necessary to perform the following tasks:
1. Analyze the ice wine development in the world from beginning until today.
2. Systematize data obtained for representation of full-value ice wine market.

4. Literature review

Ice wine history has been started in Germany but there is the general information about German Eiswein in the literature [2–5]. Winemakers from wine region Franconia of Germany became first who implemented non-classical processing of frozen grapes [6], using ingenious cultivar. Riesling is the most utilised variety for production of kosher wine [7–9], which leaves on the vine during frosts.

To our knowledge, these are only studies devoted to ice wine beginnings in Canada; ice wine composition is also described by authors from this country [10–15].

Aforementioned state is the leader of ice wine outputs in the world that are mainly in its domestic market. Also ice wine production actively develops in the United States [16–25], but there is none articles highlighting fully about historical origins and characteristics of this wine produced in other countries, which had added ice wine to their profiles. The short surveys are shown by European producers [26–39], which had example of ice wine production from Germany. High education institutions also contributed to the development of high-quality wines, producing own-brand rare alcoholic beverages [40–43].

The number of articles, investigations and research works are dedicated to ascertaining of convenient yeast strains in order to provide fermentation. Despite the increasing number of producers of high quality beverages a little research is known described products of category investigated from different countries.

5. Materials and methods of research

The information base of research was the works of the foreign scientists exactly had been published in short articles in web sites. Also, official sites of companies and wineries investigated, a qualitative survey of vineyards were roots for assaying. The final summarize of the ice wine producers, winemaking and winemaking enterprises (hereinafter jointly referred to as winemaking enterprises) were selected on the basis of the entirety of all data and information necessary for analysis. All figures were produced using Excel software (Microsoft Corp., Seattle, WA).

6. Research results

Dates of ice wine occurrence production in the world are represented in chronological order in Fig. 1.

German wine is produced in the west of Germany, along the river Rhine and its tributaries. Two thirds of Germany’s wine production is white wine. The German wine regions are some of the most northerly in the world. The main wine-producing climate lies below the 50th parallel, which runs through the regions Rheingau and Mosel. The first ice wine (Eiswein) is believed to have been made in Franconia, Germany in 1774 [2]. However, it was not until the middle of the last century that Germany’s wine producers made a conscious effort to produce ice wine on consistent bases. Some believes the production method for these wines was accidentally «discovered» in 1794 in Franconia, the famous region located in the central-southern part of Germany. It seems in 1794, in the city of Würzburg occurred an unexpected frost which caused the freezing of grapes [3]. Commonly known fact in 1829 caused by snap freeze the grapes had not been gathered and then left as food for animals and birds [4].
where from the most noble sort Lemberger (Vitis vinifera «Blaufränkisch») of it are frozen while still on the vine. Nahe, Saale-Unstrut and Hessische Bergstraße are the smallest Eiswein regions.

As the German Wine Institute (DWI) announced, on the 18 and 19 January 2016 many estates in almost all German wine growing regions were able to harvest grapes. In addition, the last Eiswein crop was 4 years ago, that is explained by climate changes [8]. But opposite data was determined according to report of producer from Pfalz. Winery headed by Hubert Schreiber harvested Silvaner for production of Eiswein in late December of 2014. According to independent review written by Jean Fish and David Rayer only a handful of Mosel Estates produced Eiswein in 2015 among them are Dr. Hermann, Winery Karl Erbes, Winery Bauer and Winery Erben von Beulwitz. Also complication in calculating wine companies consisted in existence of producers which had obtained ice wine only one time. Such enterprises as Kessler-Zink and Karlsmühle from Pfalz had produced elite wine once. The wineries including Dr. Loosen (Mosel), Anselmann (Pfalz), Ernst Bretz (Rheinhessen) and Schreiber (Pfalz) can be considered as the significant sellers of ice wine from Germany. Indeed, in the German wine business with global competition, small business size, costly and capital intensive expansion opportunities, cost leadership as a generic strategy can at best be chosen by a few players in the industry [9].

Despite Germany is considered the homeland of Eiswein, climate conditions do not allow its production every year. In a short time the main producer in the world for this type of wine became Canada where winemakers can obtain the frozen crop. But should be noted that Canadian ice wine history was begun by German emigrant especially Walter Hainle. The first ice wine was a Riesling, made in British Columbia by Walter Hainle in 1973 [10]. But exactly his son Tilman Hainle and his wife Sandra realized the first Canadian commercial product thus continued at their Hainle Vineyards in the Okanagan.

Currently, the Niagara Peninsula region, Ontario is suggested the top producer internationally. The major of wineries are located between the Great Lakes of Ontario and Erie micro-climate of that exhibit conditions are conducive to the growing the late harvest varieties. The wine industry in Canada only through the introduction of ice wine began to increase at a remarkable pace switching to wine quality grapes. Although 40 years ago, Canadian wine business was based on beverages produced from native grapes such as Niagara, Duchess and Catawba [11]. Those wines are known as having foxy descriptions of sensory. Planted acres of late harvest verities occupy the territories, including Ontario, British Columbia, Quebec and Nova Scotia, which generally present the whole Canadian wine sphere. Due to low winter temperatures Canada is a leader in production and in regulating brand of ice wine in the world. Also should be pointed out, without a marketing strategy and management tools Canadian ice wine could not achieve success in the market.

Despite Canadian winemakers who try to obtain ice wine with 9–12 % alcohol [12], elite wines from the Federal Republic of Germany contain lower level of ethanol typically 7–9 %. This fact can be explained by timing harvest contributed largely on concentrating of grapes that in Europe is minus 7 °C. Contrary to this, wineries from Canada must harvest the grapes, when the minimum temperature is —8 °C. Possessing a strong influence in the European Union towards political, economic and social spheres, Germany also largely controls the trends in the wine industry. After their success in the production of ice wine, other countries followed the example. According to the second country that began to freeze on the vine grapes is Canada, but this step was taken by Austria, that is not surprising in terms of the similarity of climate and geographical location of European neighboring states. Since 1971 the country continued the kosher wine tradition in Burgenland on base of Hafner Family Estates. Julius Hafner II produced the first Austrian ice wine on a larger scale and created a portfolio of different BA and TBA wines of the highest quality standard with a long shelf-life [13]. The Austrians like the Germans, first time had used the Riesling, gradually moved on their own resistant varieties of grapes. Thus, today, a large volume of a special type of wine are produced from Gruner Veltliner and Silvaner, the growing center of which is Burgundy [14] that is the major supplier of ice wines from Austria, but considerably loses the neighboring country towards the scope and variety in the category. The total number of producers engaged in the ice business also has a lower value versus Germany. Gruner Veltliner is autochthonous Austrian grape had been frozen at first in The Small Carpathian in 2002 and Slovakian ice wine was obtained next year [15].

Ice wine production is developed in seven states in the United States that makes it the third country in the world by dessert wine volume. Ice wine has a long history in Germany and is big in Canada, but it remains a small niche in the multibillion-dollar U.S., confined mostly to upstate New York, Ohio and Michigan. Also the ice wines are made by states Washington, Oregon and Idaho that comprise into wine region West Coast can compete with aforementioned ones. But it is New York produces the greatest ice wine amount among all states today (Fig. 2).

The interesting fact exists between designations of premium wine producing in countries located in North America. The United States indicates sweet wine by term «ice wine» whereas Canada uses «Icewine» for its product label. The wine titles on bottles in Europe are marked according to translation of native language: Germany, Austria — Eiswein, The Czech Republic — Levedé víno, Hungary — Jégborjú, Slovenia — Ledeno vino, Slovakia — Radecké ino, Croatia — Ledene herbe, Russia — ледяное вино. Luxembourg labeled Givre for the differences and identification of its own product. China, Bulgaria and Japan mark their beverages as Icewine.

According to source [16], the first USA ice wine producer was Hunt Country in Branchport nearby Keuka Lake in New York. Hunt has been making ice wine since 1987, annually reserving a few rows of grapes among his
65 acres under production using the Vidal blanc, a tough-skinned grape that hangs in loose bunches. But it should be pointed out in 1981 the first ice wine experiment was conducted by the Great Western Winery in upstate New York's Finger Lakes region [17]. In 1988 Hunt Country released the 1987 vintage of Vidal Blanc Ice Wine, the first genuine Ice Wine produced in the United States and available to the general public. In addition, The Finger Lakes is considered the largest ice wine region in USA. The majority of wineries are located on a relatively narrow strip of land near each lake. Such layout allows obtaining ice wine harvest every year due to cool climate conditions [18].

But anyway Ice wine was first produced in Michigan in 1983 by Mark Johnson. He had studied the winemaking in Germany at the Federal Research Station and Institute in Geisenheim, then worked at Chateau Grand Traverse and is currently the head winemaker at Chateau Chantal located on the Old Mission Peninsula [19]. Nowadays the state is the third largest ice wine producer in North America after Ontario and New York due to the cool-climate vinifera varieties [20]. In 2002, for example, six Michigan wineries produced over 13,000 half-bottles of ice wine, a record at that time [21]. Ohio is also the home of making ice wine. Valley Vineyards was first in Ohio to produce rare sweet wine [22]. Most of the viticulture land in Ohio lies along the edges of the lake, where the temperatures are moderated by the insulating capacities of the water. By the same token, such distribution is suitable for cultivation of grapes widespread for ice wine making especially in Grand River Valley. Mazza Vineyards is biggest and the first Pennsylvania winery to make ice wine that belongs to Lake Erie Country in the north west of state [23]. Suitable climatic conditions of the states allow producing a wide variety of wine-making grapes, thus, the ice wine volumes are increasing every year.

Also the premium wine is made in all four regions of the Pacific Northwest basically in Washington and Idaho, with the finest traditionally coming from British Columbia's Okanagan Valley. The US state as Idaho, parts of Montana, northern California and southeastern Alaska represent other definitions of the Pacific Northwest region. Sometimes the Pacific Northwest is defined as being the Northwestern United States, wholly in the west region. Sometimes the Pacific Northwest is defined as being the Northwestern United States, wholly in the west region. Sometimes the Pacific Northwest is defined as being the Northwestern United States, wholly in the west region. Sometimes the Pacific Northwest is defined as being the Northwestern United States, wholly in the west region.

In addition, production of dessert wines, from late harvest to ice wine thus providing power significance of own position inside world ice category. The premier bottle of premium wine was represented in 2005 [32]. It should be also mentioned that winegrowing region (Pregrada, Hrvatsko Zagorje) has unique microclimate conditions that provide desirable acidity in wine, the one which is so hard to accomplish in sweet wines. Simultaneously with Croatia Furano Winery located in region of Central Hokkaido, Japan also initiated to make ice wine. Wine is produced only red in limited batches and sold only at the local shops. Furano Winery is only-begotten Japanese company that interests in ice wine generation.

Last year of the 20th century was also significant for Hungarian wine industry. Wine region Tokaj had originated not only one of the world's top sweet wines, Tokaj Aszú and became famous due to producing native ice wine. Chateau Pajzos became the first winery to produce a Tokaj ice wine that was yielded not from Riesling and from indigenous variety called Furmint [33]. Generally, in Hungary there are few regions, where the weather is suitable for growing grapes for making ice wine.
for the ice wine technology such as Tokaji, Eger, Villány, Balatonfüred-Csopak and Mátra. Each of aforementioned fields has one provider that harvest frozen grapes.

Ice wine has produced in Moldova since 2002. «Dionyssos-Mereni» was the first company that started experimenting with ice wine in the Republic of Moldova. Wine region Codru is the central area consisted of premium wine estates such as «Chateau Vartely», «Lion-Gri», Pucrari Winery [34]. Also there are ice wines inside market offered by Tiraspol Winery & Distillery KVINT. The production of ice wine was acceded by Sweden at that time. Country possesses the coldest conditions influenced on developing atypical technology but such the situation does not allow the annual grape harvest. Blaxsta Winery produces dessert wines from a variety of fruit — apples, raspberries and pears and a plum port. But his prize winner is the 2003 Vidal Ice Wine, which grabbed a silver medal for sweet wine at this year's Challengeduvin competition in Bordeaux, France [35].

Chiomonte is called «Saint Sebastian» conducted the first Italian ice wine testing in January 20 of 2006 that coinciding with the patron saint festivities of the city of Chiomonte, exactly San Sebastiano. The autochthonous grape Avanà was used for production by winemakers in Susa Valley belonged to the Mountain Community. With helping Donna Sommelier Europe, Italian wine association, exclusive wine type was obtained having enriched range of wines of Piedmont [36]. Also, the northwest wine region Valle d’Aosta has only one winery however continental climate can provide bigger ice wine volumes. As well as Czech Republic Italian winemakers ferment wine to high level of alcohol containing 12,5–13 % ethanol. Furthermore, in 1963, two Sicilians, Gary Pillitteri and Lena Agro, immigrated from Raccalmuto with their three children [37], owners of the largest ice wine company Pillitteri Estate Winery.

In the same year the Chinese company began to produce own kosher wines. Company Chang Yu Pioneer is the oldest and largest in China and the ten largest in the world. Every year produces more than 90,000 tons of wine. However, premium wines became involved relatively recently. In 2002 they founded a professional Château via due to France, and in 2006 by dint of Canadians founded the largest ice wine center in China. Ice wine is produced around Lake Huanlon in Liaoning Province in northeast. This place is called the «golden valley of ice wine», the total area of 5000 hectares. Chang Yu planted 340 hectares of Vidal grapes, the most common in Canada.

Bulgarian company Villa Vinifera [38] sell ice wines in very limited quantities having produced firstly in 2009. Despite of it had been made from domestic red Mavrud, but white wine was got. One more interesting fact and also strange the year is not indicated on the front of the label. Neighboring country, Romania created the first amount of premium style using Traminer grapes in 2012 [39].

Winemakers from Jidvei Company located in the Târnava wine country had harvested grapes due to favorable conditions for the production of much more fresh and refreshing white wines than in other areas of state.

It would not have been strange ice wine was derived in country where the weather usually has the high temperatures. According to information [40], popular London magazine about winemaking in the world, The Perico Winery harvested Cabernet Sauvignon grapes for the rare wine in Brazil. In June 2010 in the coastal state Santa Catarina the temperature dropped to −7,5 °C making possible to execute such wine and it shows exactly low conditions are important. In the same period another continent the East Europe began to implement ice wine to their profiles. Thus, the Russian company «Phanagoria» from Krasnodar region using three varieties for ice wine — Riesling, Muscat, Sauvignon started production [41]. In 2011, range was added by another novelty — a unique red ice wine from grapes Saperavi. The grapes for this wine are grown on own vineyards of winery.

Ice wine production has been involved not only by enterprises to expand its product range and the higher education institutions in order to obtain new data from beverage processes. Experiments were carried out by employees of the vineyard «Nad Dworskim Potokiem» of the Jagiellonian University in Lazy wheel (Łazach koło) near Bochnia [42]. In addition, vineyard «Nad Dworski Potokiem» was established in 2005 on the Agricultural Experiment Station of the Jagiellonian University in Lazy near Bochnia initiative of the rector professor Karol Musiol and his inspiration came from the vineyards owned by leading European universities. First Poland Kosher wine was produced in only 20 liters in 2012 and was given to rector at the ceremony of the Jagiellonian University, including the celebration of the 650th anniversary of its founding. It should be pointed out, now the farm «Nad Dworski Potokiem» area occupies over 3,3 hectares, 11 thousand vines are grown. Due to changes in the excise tax rules, it can legally produce beverages and sell it in own store. The result of the working of vineyard white and dry red wine including Seyval Blanc, Bianca, Aurora, Hibernal are made called «Novum», referring to the main building of the Jagiellonian University — Collegium Novum.

Last year Ghislain Houben, professor of entrepreneurship at the University of Hasselt and winegrower, aimed to develop a knowledge center about ice wine in Belgium. Under his leadership the experiments were conducted for the production of ice wine from frozen apples.

In conformity with information [43] Eiswein, in France, was a style introduced by the Germans to the region, like to Canada. The segment is now shrinking in production and importance. They use only the local «Noble» varieties to produce this style of wines particularly in Alsace. However, evidence and common data of French producers are not founded and are not lighten in current study.

All countries producing ice wine by traditional method naturally from grapes that frozen while still on the vine are shown in Fig. 3.

The map represents only that states production of which is commercial and ice wine category includes more than 2 estates. Development of ice technology in Asia continent is significantly lower in comparison with Europe and North America. Three leaders are Canada, Germany and United States of America which together conduct approximately 76 % of total premium ice wine amounts. Only due to the climatic conditions of above-mentioned countries frozen crops are obtained. In addition, experience of winemakers plays an important role in the non-classical winter technology. Percentage ratio between countries produced ice wine is highlighted in Fig. 4 according to it Germany, the Czech Republic and Austria are the top lands of premium drinks in Europe. Pointedly, popularization of ice wine implement is increasing annually inside producing vine growing states.
Fig. 3. Countries producing ice wine commercially

Canada province-producer of ice wine:
1. British Columbia
2. Ontario
3. Quebec
4. Nova Scotia

Fig. 4. Percentage ratio between countries produced ice wine

USA states-producer of ice wine:
1. Washington
2. Oregon
3. Idaho
4. Michigan
5. Ohio
6. Pennsylvania
7. New York

Europe country-producer of ice wine:
1. Germany
2. Austria
3. Czech Republic
4. Slovenia
5. Croatia
6. Hungary
7. Slovakia
8. Italy
9. Moldova
10. Luxembourg

This is evident from the fact that almost 32% viticulture segments worldwide represent premium sectors through ice wine. As ice wine is made in very small amount almost in producing countries, ice wine is not included in statistic list of annual harvest.

7. SWOT-analysis of research results

Strengths. This study for the first time compromises all producers that obtain frozen grapes by natural way to the release of ice wines. The analyzed data showed the percentage ratio between the producing countries, in accordance with which the rare wines production of countries of the «New World» is more developed, despite of their smaller number in the category that indicates the rapid extension of innovative technology for the processing of grapes. Knowledge of these premium wines production centers allows for the potential customer to choose a high quality product and expand the horizons of the premium segment of the market.

Weaknesses. The European countries lag in the production of ice wine towards to volume and the number of producers that affect capture of the wine market by North America.

Opportunities. Overview gives a perspective study and comparison of wines of this sector by the chemical composition of different producers and countries, and to identify factors that significantly impact on the release of ice wines all over the world. Atypical grape processing technology is not fully explored, and requires further explanations regarding agricultural techniques of grapes for ice wine and the production itself.

Threats. Producers and agronomists may face the problem the adverse agro-climatic conditions for grape cultivation, which is intended for the production of ice wine. That is the risk of losses for businesses and the risk of failure for further research. This issue should be addressed at the level of collective solutions.

8. Conclusions

1. First producing sources of ice wine technology were identified around the world. The roots and development of rare wine originated from Germany that contributed to its distribution especially in European countries were described and examined. Winemakers from Deutschland had brought the experience of frozen technology to Canadian viticulture industry is predominant leader in ice wine volumes. In addition, the most chosen grape variety for ice wine production is originated in the Rhine region.

2. The ice wine market, starting with the first manufacturers till today was described. Such countries as France, Spain, Chile, Switzerland and Denmark are not determined as ice wine producers in current study due to neither report; however, several sources include its profiles to ice wine category.

It was observed climate conditions, experience of winemakers and emergence of grape varieties are the main keys for developing ice winemaking. Furthermore, our article describes only first producers that obtained ice wine from naturally grapes that have been frozen while still on the vine.

In order to more fully explore the principal particular qualities of premium wines from different states the further studies need include the available information from ice wine producers.

References


Исследованы исторические корни технологии ледяного вина, а также проведен обзор первых фундаментальных работ на эту тему. Обнаружены наиболее крупные центры производства ледяного вина между странами. Приведены разницы маркировки десертного вина в каждой стране.

Анализ современного состояния и исторических корней ледяного вина

Исследованы основные работы на тему ледяного вина, а также проведён обзор первых фундаментальных работ на эту тему. Обнаружены наиболее крупные центры производства ледяного вина между странами, а также разницы маркировки десертного вина в каждой стране.
Розробка комплексного підкислювача для емульсійної продукції оздоровчого призначення

Досліджено склад комплексного підкислювача у рецептурі низькокалорійного соусу. Визначена залежність смакових якостей продукту від концентрації складових комплексного підкислювача. Встановлено концентрації кислот в складі підкислювала (оцтова — 0,2–0,4 %, яблучна — 1,0 %, цитринова — 2,0 %), що забезпечують оптимальні показники смакових якостей продукту.

Ключові слова: харчові добавки, біологічна цінність, низькокалорійний соус, яблучна кислота, комплексний підкислювач.

1. Вступ
Сучасні тенденції розширення асортименту продуктів харчування орієнтовані на створення збалансованої за харчовою цінністю продукції, здатної забезпечити потребу в незамінних нутрієнтах. Значна роль відводиться емульсійним олієжировим продуктам — майонезним соусам, топінгам, дресінгам — як продуктам масового споживання, що доступні усім групам населення та кожен день присутні у раціоні харчування. Це пов’язано, в першу чергу, з можливістю створення широкого асортименту комбінованих продуктів на основі компонентів природного походження, що дозволяє отримувати харчові композиції заданого складу і властивостей, із збалансованим вмістом необхідних нутрієнтів.

Результати досліджень структури споживання харчових продуктів різними групами населення України вказують на відхилення від сучасних принципів здорового харчування [1]. Це пов’язано з тим, що рафінована їжа займає практично весь раціон людини, а вживання продуктів, багатих на клітковину, мінерали, органічні кислоти тощо, зведено до мінімуму. Тому введення у рецептури майонезів та майонезних соусів рослинної сировини та використання у якості харчових добавок натуральних інгредієнтів може збагатити щоденний раціон на біологічно активні речовини.

У зв’язку з цим, актуальними є дослідження, що прийняті пошуку удосконалення рецептур емульсійних продуктів оздоровчого призначення, здатних покрити потреби людини у необхідних нутрієнтах. При розробці відповідних технологічних рішень необхідно враховувати особливості органолептичних показників розробленої продукції відносно нормативних показників.

2. Об’єкт дослідження та його технологічний аудит
Об’єктом даного дослідження є процес розробки рецептур низькокалорійного соусу на основі вторинних продуктів сокового виробництва та виноробства.

Предмети дослідження — смакові якості емульсійної вищезазначеного продукту, органічні кислоти у якості підкислювачів. Було обрано три органічні кислоти, що застосовуються у харчовій промисловості: оцтова кислота, цитринова кислота та яблучна кислота. Одним із проблемних питань при створенні майонезної продукції є створення оптимального рівня рН та органолептичних показників (окремо смакових якостей). Проведення технологічного аудиту має за мету визначення таких основних задач:
— розширення асортименту емульсійної продукції (складові комплексного підкислювача створюють...