THE IMPORTANCE OF THE HEALTHY PROPERTIES OF CONDENSED SORGUM SUGUM JUICE IN THE PREPARATION OF FOOD FOR BEES

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Abstract. *The article provides information about the high need of bees for natural, vitamin- and mineral-rich local food products, the results of a chemical analysis of sweet sorghum stem juice processed to create food for bees, as well as the beneficial properties of the results obtained, intended to create food for bee colonies . Information is also provided about the ability of the sweet sorghum plant to produce the expected harvest even in an arid, salty climate and that the composition of the stem juice is rich in carbohydrates, vitamins, macro- and microelements.*

Keywords: *sweet sorghum, stem juice, chemical composition, result, carbohydrates, vitamins, dry.*

INTRODUCTION

The growth of the world's population presents a number of global challenges; along with resources necessary for human needs such as drinking water, electricity, natural resources, etc. causes food shortages and lack of naturalness. Therefore, the duty and task of the intelligentsia is to contribute to the solution of these problems. It is especially important to expand the range of natural food products and preserve the naturalness of their composition. As a result of the growth of consumer culture in countries around the world, the demand for honey and honey products is increasing. This, in turn, requires solving problems associated with feeding bee colonies.

The unique natural and climatic conditions of our republic are very favorable for the cultivation and development of a bee colony based on new technologies. That is why beekeeping is one of the leading branches of agriculture. However, due to the reduction in the size of natural green spaces, parks and green areas in our country, even during the season, there is a lack of nutrition for bee colonies. For the development of the beekeeping industry, for the life and reproduction of bees, it is necessary to create natural and environmentally friendly feeds containing proteins, fats, carbohydrates, minerals and vitamins. All this means that providing the beekeeping industry with additional food products is one of the important and urgent tasks [1].

Therefore, in recent years, due to the chronic feeding of sugar to the bee colony in the republic and the lack of vitamins, fats, carbohydrates, amino acids, micro- and macroelements in such feeds, bees after winter become weak, susceptible to diseases and have a weak ability to reproduce. This requires feeding bees natural, vitamin- and mineral-rich food sources [2].

Today, about 50-55% of the arable lands of our republic are subject to varying degrees of salinization. The sweet sorghum plant chosen as the object of study can be grown in any climatic conditions of our republic, including in arid and saline lands. Sweet sorghum is not only a high-yielding plant, but also removes 31 to 75 t/ha of salts from the soil, as well as toxic substances such as chlorides and sulfites. The sweet sorghum plant is so resistant to salt that when irrigated with salt water from the Caspian Sea, the yield of green mass was 52.7 t/ha [3;4].

High-sugar varieties of this plant are considered domesticated, and some varieties can be harvested up to twice a year.

The amount of dry matter in the varieties of sweet sorghum selected for the study with a high level of sugar content “Karabosh”, “Orange-160”, “Uzbekistan 18” averages 18-23%, which is significant when extracting juice up to 70-80% from the stem [6].

The stem juice of sweet sorghum is rich in carbohydrates, amino acids, minerals and vitamins, and serves to ensure the normal functioning of bees and the production of high-quality honey, which helps strengthen the food supply of beekeeping farms.

PURPOSE OF THE STUDY. The purpose of the ongoing scientific research is to conduct a chemical analysis of the processed juice of the sweet sorghum varieties “Karabosh”, “Orange-160”, “Uzbekistan 18”.

RESEARCH METHODS AND MATERIALS. One of the objectives of the study is to prepare environmentally friendly natural food with high nutritional value to replace traditional food with sugar in the off-season for bees. While sugarcane juice contains only sucrose (crystallizing sugar), sweet sorghum juice contains glucose and soluble starch in addition to sucrose, which inhibit crystallization. This, in turn, reduces the crystallization of honey. In terms of content, sugar obtained from sweet sorghum is superior to sugar from beets and sugar cane, since in addition to sucrose it contains fructose and glucose. Sweet sorghum stalk syrup contains vitamins B1, B2, PP, E and C. This condensed juice can be used not only for feed, but also in the food industry, and this is currently very relevant. The amount of sugar in the juice obtained from selected varieties is 18-25%, that is, 18-20% of the total mass is sugary substances. [6;18;].

Experiments conducted in Russia have shown that in the conditions of the North Caucasus (September-March) some varieties of sweet sorghum can be stored in bunches for 170 days. This makes it possible to provide manufacturing enterprises with raw materials for a long time. Currently, in many foreign countries, sweet sorghum is used in the food industry for the production of juices, syrups, streams and in various other areas.

From an economic point of view, 1 ton of sweet sorghum sugar is 20% cheaper than 1 ton of beet sugar. If beet sugar is replaced with sweet sorghum syrup, the cost of confectionery products and soft drinks will decrease [19].

In order to fully analyze the chemical composition of the stem juice of sweet sorghum, chosen as the object of study, experiments were carried out together with leading specialists in the laboratory of the Institute of Bioorganic Chemistry named after Academician A.S. Sadykov of the Academy of Sciences of the Republic of Uzbekistan.

Several methods were used in the experiment. To determine the number of water-soluble vitamins, GOST 32903-2014 was used. The analysis was carried out by HPLCh (high performance liquid chromatography) using a diode array detector (DAD).

METHOD FOR DETERMINING THE AMOUNT OF WATER-SOLUBLE VITAMINS

5-10 g of sample was weighed on an analytical balance and placed in a flat flask with a capacity of 300 ml. 50 ml of 40% ethanol solution was added to it. The mixture was boiled with vigorous stirring for 1 hour, equipped with a magnetic stirrer and reflux cooler, and then stirred at room temperature for 2 hours. The mixture was cooled and filtered. 25 ml of 40% ethanol was added to the remainder and re-extracted 2 times. The filtrates were combined and filled to the mark

with 40% ethanol (5÷10%) into a 100 ml volumetric flask. The resulting solution is centrifuged at a speed of 7000 rpm for 10 minutes. The upper part of the resulting solution was taken for analysis.

Working solutions of water-soluble vitamins with a concentration of 1 mg/ml were prepared. To do this, 50 mg of each vitamin standard was weighed on an analytical balance and dissolved in 40% ethanol in a 50 ml volumetric flask.

Phosphorus, acetate buffer systems and acetonitrile were used as eluents in the determination of water-soluble vitamins by HPLC (high-performance liquid chromatography). Initially, working standard solutions were introduced into the chromatograph, and then prepared working solutions [24; 25].

DETERMINATION OF CARBOHYDRATES IN SUGET SORGUM JUICE.

Determination of the amount of carbohydrates, that is, monosaccharides, in the stem juice of sweet sorghum was carried out using high-performance liquid chromatography. To do this, the contents of the sample being determined are degreased and a certain amount of the defatted substance is taken. The resulting sample is extracted with water and kept for a certain time in an ultrasonic water bath to speed up the extraction process. After completion of the extraction process, it is filtered or centrifuged, the supernatant (liquid part) is collected and quantitative analysis is carried out using high-performance liquid chromatography (HPLC) [25].

RESEARCH RESULTS AND THEIR DISCUSSION. Based on research results, it has been established that the stem juice of sweet sorghum contains a sufficient amount of glucose, fructose, sucrose, maltose, all water-soluble vitamins C, B, mineral elements, amino acids and partial protein to create food for bees.

Table 1

Results of chemical analysis of sweet sorghum condensed juice

	Amount of carbohydrates, *mg* %		Amount of vitamins, mg/g	
	Fructose	5.475	B_1	1.256
	Glucose	11.18	B_2	2.95
	Sucrose	28.12	B_6	0,324
	Maltose	1.71	B_9	0,952
			B_{12}	0.845
			PP	2.23
			C	2.89
	Total	46.48	Total	11.447
variety “Karabosh”	Fructose	5.411	B_1	-
	Glucose	11.33	B_2	8.360
	Sucrose	27.59	B_6	0.126
	Maltose	1.69	B_9	0.500
			B_{12}	3.463
			PP	0.956
			C	-
	Total	46.02	Total	11.405
variety “Uzbekistan 18”	Fructose	6.98	B_1	-
	Glucose	12.24	B_2	5.835

	Sucrose	26.91	B	0.391
	Maltose	1.57	B_9	0.161
			B_{12}	7.641
			PP	0.474
			C	0.812
	Total	47.43	Total	13.405

As can be seen from the results of Table 1, the amount of carbohydrates in the stem juice of the variety “Orange 160” is 46.48%, “Karabosh” 46.02%, “Uzbekistan 18” 47.43%. The amount of water-soluble vitamins in the variety “Orange 160” is 11.447 mg/g, in the variety “Karabosh” 10.405 mg/g, and in the variety “Uzbekistan 18” 13.405 mg/g. It has been established that the nutritional value of sweet sorghum juice, which is the object of the study, is quite high.

5-table

Results of determining the chemical composition of stem juice in the field

Maturation period	“Karabosh”		“Orange 160”		“Uzbekiston 18”	
	d.s.w., %	pH	d.s.w., %	pH	d.s.w., %	pH
Grain formation	15.0 ± 1	5.0	15,4 ± 2	5.40	15,8 ± 2	5.25
Milk ripeness	16.0 ± 1	5.40	17,4 ± 3	5.30	17,8 ± 2	5.20
Full ripeness	19.0 ± 1	5,30	21, 2 ± 1	5.20	21, 4 ± 2	5.1

Note: c.s.v. – the amount of dry matter in the juice; pH - acidity of juice

According to the table, the amount of dissolved substances in the stem juice of sweet sorghum at full ripening averages 19÷22% for the early-ripening variety "Karabosh", up to 20.2÷22% for the mid-ripening variety "Orange 160" and 22.4÷23% in the late-ripening variety "Uzbekistan 18".

It has been established that the pH value in the juice of sweet sorghum of the three varieties does not differ sharply and is 5.15 for the early ripening variety "Karabosh", 5.20 for the variety "Orange 160" and 5.1 for the variety "Uzbekistan 18".

CONCLUSION

In conclusion, the results of our analyzes show that the juice obtained by processing sweet sorghum stalks is rich in beneficial properties. The amount of carbohydrates in the juice is 46.48%, and the presence of almost all water-soluble vitamins in the juice increases the energy value of the studied feed. In addition, it has been established that the sweet sorghum plant produces the expected yield in all regions of our republic, even in arid, low-water areas, and there is also sufficient opportunity to obtain juice from the stem, which does not cause any particular difficulties in creating feed.

REFERENCES

1. М.Н.Абдураззокова., А.Ш.Азизов. Значение сока сахарного сорго в сезонные и несезонные периоды в пчеловодстве// Казахстан международный конференция 2021г-№ 8.

2. Азизов А.Ш., Абдураззоқова М.Н. Қанд жўхори ўсимлиги поясидан шарбат олиш технологик схемаси ва асалари озуқаси сифатида фойдаланиш// Фан ва технологиялар таррақиёти. Илмий техник журнал. - БухМТИ -2021 - № 5 - 187 б.
3. Махмадияров О.А. Ўзбекистонда асаларилариннг маҳсулдорлигини оширишда табиий ва минерал озуқалардан фойдаланиш технологиясини такомиллаштириш. Дисс. ... т.ф.н. - Самарқанд. 2020 -125 б.
4. Азизов Қ. Ўзбекистонда қанджўхорининг бошланғич манбаси ва селекцияси. Дисс. ... қ.х.ф.н. Тошкент, 2019 - 124 б.
5. Юдахина М.А. Пчеловодство. Красноярск, 2016. - 59 с.
6. Муминов Н. Ш. Технология производства сахаристых веществ из стеблей сахарного сорго. Монография - Ўзбекистон Республикаси Фанлар академияси Фан нашриёти: Ташкент, 1997 - 112 б.
7. Азизов Қ. Ўзбекистонда қанджўхорининг бошланғич манбаси ва селекцияси. Дисс. ... қ.х.ф.н. Тошкент, 2019 - 124 б.
8. Таранов Г.Ф. Корма и кормление пчел. Издание второе, переработанное и дополненное. МОСКВА: 1986 – 94-95 с.
9. Азизов А.Ш. Қанд жўхори навларини танлаш, етиштириш ва қайта тикланувчи энергия хом ашёси сифатида фойдаланишнинг илмий асослари. Дисс. ... қ. ҳ.ф.д. - Тошкент, 2020 - 232 б.
10. В.Скребков. Н.Петрова Пчелы и кормовая база//.”Пчеловодство” 2017-№4- 42 с
11. Е.Н. Ефремова, Н.Ю. Петров.Технология получения сока из сахарного сорго//. Научно-технический журнал, 2020 г.
12. С.Парамонов.Кормления пчел в зиму.Псковский обль. Пчеловодство, 2016-№9-46 с
13. А.З.Брандорф, В.И.Лебедева, М.Н.Харитоновой, А.П.Савина,” Современные проблемы пчеловодства и апитерапии ” монография 2019г. 338с
14. В.Скребков.Н.Петрова Пчелы и кормовая база статье ”Пчеловодства” 2017-№4 42 с
15. Колбина Лидия Михайловна Кормовая база качество продуктов пчеловодства и способы совершенствования технологии содержания пчел в условиях Удмуртской республики. Диссертация Ижевск 1999 г.
16. Г .Ф. Таранов «Корма и кормление пчел»издание второе,переработанное и дополненное. МОСКВА, 1986 г.
17. Э.И.Ковалева, А.И.Албулов, М.А.Фролова, А.К.Елисеев, А.В.Гринь Использование белковой подкормки для увеличения силы пчелосемей и их медопродуктивности статье 2020 г.
18. Н.Б.Билаш Липидная фракция пылцы как аттрактант искуственного белкового корма для пчел . Статье “Пчеловодство” 2018-№8-23ст.
19. А. Селицкий Создание кормовой базы. Пчеловодство 2020-№1-38 с.
20. О. А.Антимирова Тестообразная подкормка Пчеловодство 2016-№ 10 78 с.
21. Содиқова Ш.А., Азизов А.Ш., Додаев Қ.О. Исследование процесса прессования стебля сахарного сорго// Илмий - амалий конференция. - ТДТУ, 2022 - 283 б.
22. Ковтунова Н.А., Ковтунов В.В. Использование сорго сахарного в качестве источника питательнх веществ для человека// журнал Зерновое хозяйство России. - Россия, 2019 - 345 с.

23. ГОСТ 28562-90. Продукты переработки плодов и овощей. Рефрактометрический метод определения растворимых сухих веществ. Введ. 01-07-91. - Москва: Стандартинформ, 2010 - 17с.
24. ГОСТ ISO 2173-2013. Продукты переработки фруктов и овощей. Рефрактометрический метод определения растворимых сухих веществ. Москва: Стандартинформ, 2014 – 12 с
25. ГОСТ 25555.0-82. Продукты переработки плодов и овощей. Методы определения титруемой кислотности. Дата введ 01-01-83. - Москва: Стандартинформ, 2010 - 4 с.
26. ГОСТ ISO 750-2013. Продукты переработки фруктов и овощей. Методы определения титруемой кислотности. Москва: Стандартинформ, 2020 – 12 с
27. ГОСТ 32903. Продукция соковая. Определение водорастворимых витаминов: тиамина (B_1), рибофлавина (B_2), пиридоксина (B_6) и никотинамида (РР) методом обращенно-фазовой высокоэффективной жидкостной хроматографии. Москва: Стандартинформ, 2014 - 28 с.
28. ГОСТ 34151. Продукты пищевые. Определение витамина С с помощью высокоэффективной жидкостной хроматографии. Москва: Стандартинформ, 2014 - 14 с.
29. ГОСТ 33409-2015. Продукция алкогольная и соковая. Определение содержания углеводов и глицерина методом высокоэффективной жидкостной хроматографии. Москва: Стандартинформ, 2019 - 15 с.
30. Билаш, Н.Г, Б. Беневоленская. Заменители корма пчел// Пчеловодство, - 2002 - №2 - 24-28 с.
31. ГОСТ 8759-92. Sorghum. Requirements for state purchases and deliveries. Требования при заготовках и поставках. Дата введения: 01 - 06 - 93^1. М: Стандартинформ, 2019 - 7 с.
32. Zokirova M., Saribaeva D., Xojieva S. Research technology of production of herbal and natural preserves //European Journal of Molecular & Clinical Medicine. – 2020. – Т. 7. – №. 2. – С. 325-333.
33. Saribaeva Dilorom Akramzhanovna, Zokirova Mashkhura Sodikzhanovna Study of the elemental and amino acid composition of ginger extract // Universum: technical sciences. 2021. No. 11-3 (92). (Date of access: 11/03/2022).022).
34. Saribaeva D. et al. Ginger root as a source of biologically active substances //E3S Web of Conferences. – EDP Sciences, 2024. – Т. 486. – С. 02028.
35. Akramjanovna D. S., Aripova K. O. Producing the processes of obtaining functional drinks based on medicinal plants extract //E3S Web of Conferences. – EDP Sciences, 2024. – Т. 486. – С. 02018.
36. Khamdamov A. M. et al. Simulation of a multistage distillation process in a rotary disc device //Annals of the Romanian Society for Cell Biology. – 2021. – С. 5939-5948.
37. Мансуров О. А., Игамбердиева Д. А., Хамдамов А. М. Системный анализ процесса сушки сельхозпродуктов //Главный редактор: Ахметов Сайранбек Махсутович, д-р техн. наук; Заместитель главного редактора: Ахмеднабиев Расул Магомедович, канд. техн. наук; Члены редакционной коллегии. – 2021. – С. 77.
38. Hamdamov Anvar, Ismailov Kozimjon, Xudayberdiyev Absalom HYDRODYNAMICS OF CONVEX-CONCAVE PLATE COLUMN FOR COTTON OIL MISCELLANEOUS

DISTILLATION // Universum: технические науки. 2023. №6-5 (111). URL: https://cyberleninka.ru/article/n/hydrodynamics-of-convex-concave-plate-column-for-cotton-oil-miscellaneous-distillation (дата обращения: 03.04.2024).

39. Мелибоев М. Ф. У., Эргашев О. К., Отаева Ш. Р. К. РАЗРАБОТКА ТЕХНОЛОГИИ ПОЛУЧЕНИЯ ПОРОШКА (ПОРОШКООБРАЗНОЙ МАССЫ) ИЗ ПРОДУКТОВ, ВЫСУШЕННЫХ МЕТОДОМ МИКРОВОЛНОВОЙ СУБЛИМАЦИИ //Universum: технические науки. – 2022. – №. 11-4 (104). – С. 49-51.
40. Meliboyev, M. M. "Impact of the combined drying method on the drying object and economic analysis of the organoleptic characteristics of the dried product." Namangan muhandislik-texnologiya instituti ilmiy-texnika jurnali 3-97 (2021).
41. Meliboev, M. F. "Mamatov Sh. M., Ergashev OK Energy consumption and economic indicators in sublimation and microwave sublimation dry plum." Universum: technical science 5.98 (2022): 9-12.
42. Meliboyev, M. M. "Mamatov Sh. M., Ergashev OK Mevalarni energiyatejamkor vakuum-sublimatsion quritish qurilmasida dielektrik mikroto ‘lqinlardan foydalanib quritish." Namangan davlat universiteti ilmiyaxborotnomasi 2 (2021).