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Chemical Content in Grape Vine Leaves

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Abstract :

Vitis Vinifera represents the genus Vitis, which contains European grapes. Before the discovery of the North American continent, it is thought that grape growing started in Central Asia and extended to the region's east and west. All nations bordering the Mediterranean, the Danube, and the Rhine rivers have grape plants, while Mesopotamia and the Caucasus have grown grapes for at least 6,000 years. In several nations between latitudes 20-50 north and 20-40 south of the equator, grape planting is currently pervasive. Due to its great nutritional content and potential medical applications, it is one of the most significant and popular fruits in the world. 6.1% of the world's total planted grape area is made up of table grapes. Improving the quality and output of grapes and wine requires an understanding of the chemical composition of grape leaves. The Middle East frequently cultivates the Halwani and Kamali cultivars. By examining the chemical composition of grape leaves, we were able to present an overview of recent studies on the chemical composition of grape vines from the Halwani and Kamali kinds, as well as their possible impacts on the production of grapes and wine as well as on human health. Due to their similar environments and growing circumstances, the results indicated that the chemical composition of the two research kinds did not differ significantly from one another.

Keywords: Vitis ViniferaL, Halawani, Kamali, Chemical content.

المحتوى الكيميائي في كرمات العنب

زهراء اياد فالح نصيف
قسم الكيمياء - كلية العلوم / جامعة بغداد

مستخلص

يمثل Vitis Vinifera جنس Vitis الذي يحتوي على العنب الأوروبي. قبل اكتشاف قارة أمريكا الشمالية، يُعتقد أن زراعة العنب بدأت في آسيا الوسطى وامتدت إلى شرق المنطقة وغربها. جميع الدول المطلة على البحر الأبيض المتوسط، ونهر الدانوب، ونهر الراين لديها نباتات العنب، في حين أن بلاد ما بين النهرين والقوقاز تزرع العنب منذ 6000 عام على الأقل. في العديد من الدول الواقعة بين خطي عرض 50–20 شمالاً و40–20 جنوب خط الاستواء، تنتشر زراعة العنب حاليًا. نظرًا لمحتواها الغذائي الكبير وتطبيقاتها الطبية المحتملة، فهي واحدة من أهم الفواكه وأكثرها شعبية في العالم. 6.1٪ من إجمالي مساحة العنب المزروعة في العالم تتكون من عنب المائدة. يتطلب تحسين جودة وإنتاج العنب والنبيذ فهم التركيب الكيميائي لأوراق العنب. كثيرا ما يزرع الشرق الأوسط أصناف الحلواني والكمالي. ومن خلال دراسة التركيب الكيميائي لورق العنب، تمكنا من تقديم لمحة عامة عن الدراسات الحديثة حول التركيب الكيميائي لأشجار العنب من الصنف الحلواني والكمالي، وكذلك تأثيراتها المحتملة على إنتاج العنب والنبيذ وكذلك على صحة الإنسان. ونظراً لتشابه بيئاتهم وظروف نموهم، أشارت النتائج إلى أن التركيب الكيميائي لصنفي الدراسة لم يختلف بشكل كبير عن بعضهما البعض.

الكلمات المفتاحية: العنب الأوربي، الحلواني، الكمالي، المحتوى الكيميائي.

1. Introduction

The genus Vitis, which includes European grapes, is represented by Vitis ViniferaL. One of the 14 genera belonging to the Vitaceae family, which includes more than 70 species and 10,000 thousand species, and is widely spread in subtropical and temperate regions [1]. It is believed that grape cultivation began in Central Asia and in the region between the southern Black Sea and the Caspian Sea, and most botanists agree in the region that it represents the origin of the European grape, Vitis Vinifera L., and from it all grape varieties spread before the discovery of the North American continent, and its cultivation spread throughout East and West [2].

Some researchers also explained that grape trees did not come from Asia Minor, as grape scientists believe, because grapes were present in all the countries surrounding the Mediterranean basin and even the Danon and Rhine rivers. It is believed that the first date of grapes was in Mesopotamia and the Caucasus, about six thousand. Year BC [3].

The cultivation of grape trees is very ancient in Iraq, since the settlement of man in the Mesopotamian Valley, and its cultivation spread during the reign of the Assyrian king Ashurbanipal, as confirmed [4] and according to what was mentioned [5] that the Sumerians and their grapes were flourishing since 4000 BC, and at the present time cultivation is widespread Grapes are grown in many countries of the world between latitudes 20-50 north of the equator and 20-40 south of the equator [6].

The grape tree is considered a blessed tree and is mentioned in several verses in the Holy Quran. It is one of the most important and most consumed types of fruits in the world, due to its high nutritional value, as the fruits contain sugars, vitamins, organic acids, mineral salts, proteins, fats, etc. In addition to its importance in medical uses in treating many diseases [7].

Grapes also rank first in the world in terms of production, and table grapes constitute 6.1% of the total grape area planted in the world. Warba comes in first place in grape cultivation, followed by Asia and Africa8]].

Grape vines are a valuable agricultural crop throughout the world, with many varieties grown for consumption and winemaking. Understanding the chemical content of grape leaves is important to improve the quality and pro-

ductivity of grapes and wine. There are two grape varieties commonly grown in the Middle East: Al-Halwani and Al-Kamali. Many studies have been conducted to investigate the chemical content of grape vines, including their phenolic compounds, antioxidants, minerals, and other nutrients. These studies have shown the potential health benefits of consuming grapes and their products, as well as the importance of environmental factors in shaping the chemical composition of grape vines. In this context, the chemical content of the Halwani and Kamali grape vines was of particular interest to researchers, as these varieties are known for their unique flavors and are widely grown in the Middle East. This paper will provide an overview of current research on the chemical content of Helwani and Kamali grape vines, and their potential implications for grape and wine production and human health.

2. Literature Review

An increase in the content of nitrogen, phosphorous and potassium elements is an important measure of plant growth, because the accumulation of these elements in plant tissues indicates its activity and an increase in its ability to absorb these elements and benefit from them in the process of photosynthesis, respiration, cell division and elongation.

The element nitrogen is one of the basic nutrients of the plant, and its importance is evident in that it is the main component of amino acids, which is the building unit of protein, as nitrogen represents 16% of the protein, and it is also included in a large number of important organic compounds in the vital processes in the plant, such as DNA, RNA and proteins. It also enters with magnesium in the formation of the chlorophyll molecule, and it has been found that 70% of the leaf nitrogen is included in the formation of photosynthetic pigments. Nitrogen is also important in the formation of energy compounds such as ATP, $NADH_2$, $NADPH_2$ and in the construction of cellular membranes such as mitochondria, plasma, and others [9].

It is involved in the formation of enzymes, vitamins, and amides, and it is also involved in the synthesis of cytochromes, which are important in the process of respiration and photosynthesis, and from the foregoing, the importance of nitrogen and its reflection on plant growth has become clear, so the

deficiency of this element results in a major imbalance in plant growth [10].

Phosphorous is considered an important major element in plant nutrition, and it is called the key to life, due to its direct role in most physiological processes that cannot take place inside the plant without it, as it ranks second in terms of need and quantity after nitrogen, as it contributes to a number of processes. It is vital for the plant, as it is involved in the installation of cellular membranes such as the mitochondrial plasma membrane and chloroplasts, as well as the vacuole membrane, as well as the formation of phospholipids [11].

It also enters into the synthesis of some organic compounds that have great importance in vital activities such as amino and nucleic acids and energy-rich compounds such as ATP, ADP and enzyme accompaniments NADP and NAD, which have an important role in the processes of oxidation and reduction [11].

Another physiological function of phosphorus in the biosynthesis process is its formation of pyrophosphate bonds, which allow the transfer of energy, so phosphorus is considered one of the energy elements that contribute to the process of manufactured materials (sugars) from their places of formation in the leaves to the rest of the plant organs such as roots, stems and fruits, where phosphorus is linked With the hydroxyl groups of sugars or alcohols, which dissolve them and transport them to their needs in the plant [12].

Phosphorus also participates with nitrogen in several functions, including the formation of vital plant membranes (vacuole membrane, mitochondrial plasma membrane, and chloroplasts) and in the formation of energy-rich compounds ATP, $NADPH_2$, $NADH_2$, which result from photosynthesis through photo phosphorylation. It also participates with nitrogen in the formation of DNA that carries genetic characteristics and RNA is dominant in the process of protein formation [10].

Potassium is one of the most important macronutrients that plants need, as it is called the main positive ion or the master of positive ions. This element is present in the form of a free ion inside the plant and does not enter into the composition of any organic compound [13]. Potassium is important and its impact on plant physiology. In several ways, this element affects the vital activities of the plant, and the deficiency of this element causes leaves, flowers

and fruits to fall in plants exposed to water stress. In the cytosol of plants due to its control over the process of opening and closing stomata and its presence as a free ionic in the cytosol of plants and then controlling the water content in plant (Fournier et al., 2005). It plays a major role in a number of vital activities, such as cell expansion, nitrate reduction, and the formation of proteins, and the plant's need for it is great, as it is believed that its ability to bind to proteins is weak, so it needs it in large quantities in order to form the potassium-protein complex [14], and potassium has a significant effect on many physiological processes, such as increasing the efficiency of the leaf in photosynthesis and respiration, as well as it has a role in the metabolism of carbohydrates and proteins through the activation of enzymes, and clearly there are a large number of enzymes exceeding 60 enzymes in the plant system that are activated by this element, including syntheses enzymes , oxidoreductase enzymes and transferase enzymes.

3. Materials and Methods

3. 1.Grape varieties

The current study includes two grape varieties, Halawani and Kamali, where the Halwani variety is symbolized by the symbol (G1), while the Kamali cultivar is symbolized by the symbol (G2).

The Halawani grape, which is called in Iraq the valley grape, is considered one of the finest and best table varieties found in Iraq, as it is characterized by its elongated and conical clusters with one shoulder, and the large sized spherical grains, red in color, turning to dark purple and sometimes violet, and according to its exposure to sunlight, its grains are attractive with Thin skin and fleshy pulp. As for the seeds, they are small in size, numbering from (2-4) seeds per pod, with a sweet taste. It is a desirable table variety, and the total dissolved solids are very high when ripe.

The clusters bear the process of transportation and storage, and the flowers are hermaphroditic, and the leaves are five-lobed and very deep. The origin of the Halawani grape is from the Helwan region near Damascus in Syria. It is considered one of the most desirable varieties, and it is strong in growth and needs pruning with long canes with (12 eyes) and its clusters can remain until December without damage. It is one of the late-ripening varieties, as it ripens

at the end of August and the beginning of September in the central region of Iraq, according to the environmental conditions of the region. The clusters are large, winged, conical, and the cluster holder is large.

As for the flowers, they are functionally hermaphroditic and characterized by stamens that curve outwards, so they need a pollinated cultivar when planting them. The leaves of the Kamali grape are five-lobed, the lower part contains many fins. As for the upper side of the leaf, it is smooth, and the top of the growths is purple, and the color of the vegetative branches is purple.

3. 2. Chemical qualities

The samples were taken at the time of harvest, by separating the kernels from the clusters using small scissors, the kernels are separated from the vesicle so that the vesicle cushion is left attached to the kernel and the cut is directly under the cushion to prevent leakage or loss of juice from the kernels, after that they were placed in polyethylene bags and preserved The samples are analyzed by placing them in the refrigerator at (2°C) until the next morning, after which the kernels are cut and the seeds removed from them.

3. 2. 1. Leaves content of nitrogen, phosphorus and potassium (NPK) (%)

15 leaves were taken from the middle of the branch for each experimental unit, and the leaves were washed with plain water and then with acidified water, after that they were washed with distilled water, and then they were placed on blotting paper to get rid of excess moisture, after that they were placed in paper bags (envelopes) perforated and then entered into the oven, after that it was ground with an electric mill, and (0.2 g) of the crushed sample was taken and the samples were digested by adding (4 ml) of concentrated sulfuric acid H2SO4 and (2 ml) of concentrated perchloric acid, HCJO, and then the estimation of the elements mentioned as follows:

A. Potassium K (%)

It was calculated using a flame photometer according to the method mentioned by [12].

B. Phosphorus P (%)

Phosphorus was estimated using the ammonium molybdate method, and after color development, it was read by a spectrophotometer UV1100, of German origin, at a wavelength of 882 nanometers, according to the method [11].

C. Nitrogen N (%)

Nitrogen was determined according

to the Micro Kjeldahl method, according to the method mentioned in [12].

3. 2. 2. **Protein content (%)**

The mineral and organic components present in the sugar alcohols affect growth and fruiting in grapes and the quality of the yield by activating the process of photosynthesis and accelerating the assimilation of protein and sugar substances.

3. 2. 3. Percentage of Total Soluble Solids (T.S.S)

The percentage of total dissolved solids was calculated by squeezing a number of grains that were randomly taken from different cluster locations in the treatments, and it was read by a hand refractometer and an average of four readings were taken for four clusters, to represent the percentage of dissolved solids.

3. 2. 4. Percentage of Total Sugars in Grain Juice Total Sugars (%)

It was calculated using the method [10], where 0.5 ml of pure juice was taken with a pipette of 1 ml and the volume was added to 10 ml of distilled water so that the concentration became diluted to 20 times. From this concentration, 1 ml was taken by pipette and the volume was added to 10 ml with distilled water, so the solution became diluted. To 200 times, 1 ml of juice was taken from it in a 50 ml glass beaker, after that 1 ml of phenol with a concentration of 5% was added to it, and 5 ml of concentrated sulfuric acid 98% was also added to it with continuous manual shaking and a light color appeared, as the mixture was left to cool and after that a light absorption reading By means of a spectrophotometer, type EMCLAB, with a wavelength of (490) nanometers, and when the device is not read, it will be diluted by taking 1 ml of the concentration of the solution that has been diluted to 200 ml times and completing the volume to 10 ml with distilled water, then the last diluted concentration will become 2000 times, as standard solutions have been prepared Glucose to make the standard curve and then project the reading on it and calculate the concentration of total sugars as a percentage in the juice as in the following equation:

The percentage of total sugars (%) is equal to the concentration from the standard curve x dilution / volume of juice taken for analysis x 10000.

3. 2. 5. Calcic Acidity (%)

The total acidity in fruit juice was estimated by leaching with sodium hydroxide (N (0.1) and using phenol-

phthalein as a reagent).

The total acidity is equal to the volume of the base x its molarity x the equivalent weight of the acid / 1000 x 100 / sample volume x dilution.

4. Results and Discussion

In this part of the paper, the most important findings of the study are reviewed and discussed.

4. 1. The content of the leaves of potassium, Phosphorus, Nitrogen elements KPN (%)

Table 1 shows the results of the analysis of grape leaves of the Halawani and Kamali cultivars of the leaves' content of three elements, namely potassium, phosphorus and nitrogen.

Table 1: The content of the leaves of Potassium, Phosphorus, and Nitrogen

Grape varieties	Potassium K (%)	Phosphorus P (%)	Nitrogen N (%)
G1	1.15	0.29	1.82
	1.33	0.39	2.14
	1.41	0.42	2.28
G2	1.12	0.27	1.66
	1.26	0.31	1.84
	1.30	0.34	2.12

Three random samples were taken from the leaves of each variety from different places. We notice the superiority of the Halawani variety G1 over the Kamali variety G2 in the content of the leaves of the three elements. The reason for this superiority is attributed to several factors, the most important of which are the genetic characteristics of each variety and the extent of their influence on its content of chemical elements.

Table 2: KPN (%) T-test

KPN (%)	Grape varieties	Mean	Std. Deviation	P
Potassium K (%)	G1	1.30	.133	.499
	G2	1.23	.095	.503
Phosphorus P (%)	G1	.37	.068	.246
	G2	.31	.035	.268
Nitrogen N (%)	G1	2.08	.236	.340
	G2	1.87	.232	.340

P>0.05

From the table above, we notice that there is no significant change in the potassium, phosphorus, and nitrogen content of the leaves of the two varieties. This is due to the fact that the two varieties were grown in the same environmental conditions, in addition to the same cultivation factors used, such as soil, irrigation, fertilization, and so on. As for phosphorus, this may be due to the soil containing a high amount of phosphorus.

4. 2. Leaves protein content (%)

With regard to the protein content of the leaves, we find a difference in the percentage, as it reached the highest in one of the cases of the second class, G2, and each gave the lowest protein content, reaching 10.41%, as the rate of the first class, G1, was higher by 11.85%.

Table 3: The content of the leaves of Protein

Grape varieties	Protein K (%)
G1	11.45
	11.40
	11.85
G2	10.41
	11.54
	13.32

Table 4: Protein T-test

Grape varieties	Mean	Std. Deviation	P
G1	11.57	0.247	.836
G2	11.76	1.467	.844

P>0.05

The protein content of the leaves of the two types shows no discernible difference, as seen in the table above. This is because the same environmental circumstances, including soil, irrigation, fertilizer, and other cultivation parameters, were employed to develop the two types.

4. 3. Percentage of Total Soluble Solids (T.S.S)

Class G1 excelled in the percentage of total dissolved solids (TSS) with the highest percentage, reaching 14.50%, while the lowest percentage was for class G2 at 10.09%.

Table 5: The content of T.S.S

Grape varieties	T.S.S (%)
G1	10.69
	12.31
	14.50
G2	10.09
	11.74
	13.51

Table 6: T.S.S T-test

Grape varieties	Mean	Std. Deviation	P
G1	12.5	1.912	.652
G2	11.78	1.71	.653

P>0.05

The T.S.S content of the leaves of the two types does not significantly differ, as can be seen from the table above. This is because the two types

were produced under the same environmental circumstances and with the same cultivation techniques, including the use of the same soil, irrigation, fertilizer, and other cultivation elements.

4. 4. Percentage of Total Sugars in Grain Juice Total Sugars (%)

The first class, G1, was superior to 15.54% of the total sugars, while the lowest average percentage of total sugars was for the second class, G2, by 13.15%.

Table 7: The content of Total Sugars

Grape varieties	Total Sugars (%)
G1	13.19
	14.93
	15.54
G2	13.15
	14.38
	14.56

Table 8: Total Sugars T-test

Grape varieties	Mean	Std. Deviation	P
G1	14.55	1.219	.563
G2	14.03	0.767	.569

P>0.05

The Total Sugars content of the leaves of the two types does not significantly differ, as can be seen from the table above. This is because the two types were produced under the same environmental circumstances and with the same cultivation techniques, including the use of the same soil, irrigation, fertilizer, and other cultivation elements.

4. 5. Percentage of Calcic Acidity (%)

The G2 variety excelled in the calcareous acidity ratio with the highest percentage, reaching 0.71%, while the lowest percentage was for the G1 variety, with a percentage of 0.47%.

Table 9: The content of Calcic Acidity

Grape varieties	Total Acidity (%)
G1	0.69
	0.57
	0.47
G2	0.71
	0.56
	0.48

The reason for the superiority of the first variety G1 over the second variety is attributed to the genetic variation between the varieties and the consequent difference in the size of the root system, the nature of root growth, and the difference in the ability of the varieties to absorb and accumulate elements.

Table 10: Calcic Acidity T-test

Grape varieties	Mean	Std. Deviation	P
G1	.58	0.110	.946
G2	.58	0.117	.946

P>0.05

The table above shows that there is no appreciable difference between the two types' leaves' levels of calcic acidity. This is because the two types were produced under the same environmental circumstances and with the same cultivation techniques, including the use of the same soil, irrigation, fertilizer, and other cultivation elements.

5. Conclusion

The buildup of chemical elements in plant leaves is a sign of the plant's activity and an improvement in its capacity to absorb these elements and use them in the processes of photosynthesis, respiration, cell division, and elongation. This results in an increase in the content of nitrogen, phosphorus, potassium, and protein, which is a crucial sign of plant growth. Regarding phosphorus in particular, where there were marginally significant variations, this may be because there isn't any phosphorous in the leaves and there is a lot of phosphorus in the soil. The Al-Halwani and Al-Kamali varieties' results tables show that the chemical characteristics of the grapes have improved. This improvement can be attributed to the organic fertilization treatments and the nutrient solution spraying, which have improved the two varieties' vegetative characteristics. Chromium, in leaf area and chlorophyll percentage, improved photosynthesis and consequently increased the percentage of protein, anthocyanins, total sugars, acidity, and dissolved solids in the fruits, as well as because the filling process of the fruits depends on a good supply of nutrients.

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