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RESEARCH ARTICLE

Vitis vinifera L. A Commonly Used Plant in Public Health: Effect Of Iba Applications On Rooting Metabolism of Vine Wood Cuttings Obtained From Different Regions

Onur DİRİCAN[*°],Şükran ÇAKIR[**]

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SUMMARY

In this study, Indole-3-Butyric Acid's (IBA) effect was examined on rooting metabolism of green cuttings, Hasandede and Kalecik Karası varieties that were cultural forms of Central Anatolia Region that was one of the important gene centers of Vitis vinifera L.(The grape) is one of the most important plants in the world due to its unique properties in public health especially for its flavonoid content. It was observed that IBA applied varieties showed different growth in different concentrations of IBA. While IBA affects the root development positively in terms of both cultivars, it has been found that it shows optimal root development as 6000 ppm in Hasandede variety, 7500 ppm in Kalecik Karası in concentration. This difference was statistically evaluated and varieties were discussed in comparison.

Key Words: *IBA, Rooting Metabolism, Vitis vinifera L., Hasandede, Kalecik karasi.*

Halk Sağlığında Yaygın Olarak Kullanılan Vitis vinifera L. Bitkisi: Farklı Bölgelerden Elde Edilmiş Üzüm Odun Çeliklerinin Köklenme Metabolizması Üzerine IBA Uygulamalarının Etkisi.

ÖZET

Bu çalışmada Vitis vinifera L.(asma)'nın önemli gen merkezlerinden biri olan İç Anadolu Bölgesinin kültür formlarından Hasandede ve Kalecik Karası çeşitlerinin, yeşil çeliklerinin köklenme metabolizması üzerine İndol-3 butirik asit'in (IBA) etkisi incelenmiştir. Vitis vinifera halk sağlığında özellikle flovonoid içeriği ve kendine özgü özellikleri sebebiyle dünyada en önemli bitkilerden biridir. IBA uygulanan çeşitlerin farklı IBA derişimlerinde farklı gelişim gösterdiği gözlemlenmiştir. IBA, her iki çeşit açısından da kök gelişimini pozitif yönde etkilerken, Hasandede çeşidinde 6000 ppm, Kalecik Karası çeşidinde ise 7500ppm derişimin de optimum kök gelişimi gösterdiği tespit edilmiştir. Bu fark istatistiksel olarak değerlendirilerek, çeşitler karşılaştırılmalı olarak ele alınmıştır.

Anahtar Kelimeler: *IBA, Köklenme metabolizması, Vitis vinifera L., Hasandede, Kalecik karası.*

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[*] University of Kirikkale, Graduate School of Natural and Applied Sciences, Department of Biology, Kirikkale, Turkey
[**] University of Kirikkale, Faculty of Sciences and Arts, Department of Biology, Kirikkale, Turkey.

° Corresponding Author;
Tel: 0 318 357 42 42 / 40 38,
Fax: 0 318 357 23 29,
E-mail: onurdirican@hotmail.com

INTRODUCTION

Metabolism and biological activities of plants originated with ethnobotanical information. These kind of studies are also most important for ethnopharmacological approaches and indigenous organisms (Suntar,İ.,2014). The grape (*Vitis vinifera* L.) has a specific metabolic structure and these kind of metabolic contents are significant in public health and pharmacological applications. Vines are known to be effective in LDL oxidation for many years. Currently, there are several health-promoting supplements in market. Major compounds like (+)-catechin (%11), epicatechin- (4β-8)-epicatechin (dimer B2) (%6), (-)-epicatechin (%10), epicatechin 3-O-gallate-(4β-8)-catechin (B1-3-O-gallate) (%7), and (-)-epicatechin 3-O-gallate (9%) are responsible for this health promoting activities. But not all the major compounds can be found in all species and also their concentrations may vary in different varieties. *V.vinifera* contains structures such as catechol oxidase and many major phenolics (65-76%), both of these compounds known to be very important antioxidants. Antioxidants proposed to have positive effects on memory enhancement and sanity they are also known anticancer molecules. V.vinifera's bioactive components also helps immune system to stay strong (Harel. et. al. 1971; Aslam. et.al. 2015;Kequan, et.al. 2012; Vislocky. et.al.2010). Therefore, extraction of *Vitis vinifera* L. species is vital to enlighten the effects of this plant (Chidambara M.K.N. et. al. 2002). Grape (*V.vinifera*) belongs to *Vitis* genus of Vitaceae J. family of P. team. This grape species is distributed in Turkey, Europe and West Asia. The number of grape varieties that are commercially grown in our county and qualified as can be considered as a standard is due 70-80 (Çelik et al. 1998, Çelik et al. 2005). However, grape-vine rootstock numbers that are commonly used in different regions of our country is just 6 (41B, 5BB, 1103P, 110R, 99R, Rup. Du Lot). However, variety and grape-vine rootstock standardization shows a dynamic structure. The number of varieties can change according to the consumer preferences and the number of rootstocks can change according to the climate and soil properties of vineyard regions (Çeliket al.2005). Especially Hasandede and Kalecik Karası are known in Central Anatolia as two types that are exemplary of these changes and having economic importance. It is an important method to accelerate the formation of root system for reproduction that is made of herbal organisms, grape-vine rootstocks. Root formation in rootstocks is dependent on many factors such as content of nutrients and hormones of the prepared plant (Hartman and Kester 1974; Yıldız, 2000). Herbal hormones are effective in adventitious root formation. Especially auxins encourage the formation of rootstocks (Çimen, 1988). IAA, IBA or NAA from oxy groups are used as a rootstock hormone. Indole compounds generally make more hairy roots from naphthalene compounds. Recently, IBA is the most practically used compound that has low toxicity and high ability to form roots (Hartman and Kester, 1986; Burak, 1991; Riov, 1993; Eriş, 2003). Growth regulators are not effective substances allowing the rootstock production in each plants These are auxiliaries and serve for abbreviation of steel in the rooting period and increasing the rooting rate (Ürgenç,1982). The aim of this study was to investigate the effect of different IBA concentrations on rootstocks rooting metabolism of *V.vinifera* varieties of Hasandede and Kalecik Karasi and to investigate the metabolic differences between two plantal organisms known to have different morphological specifications.

MATERIAL & METHODS:

V. vinifera rootstocks used in the study were collected in March which was the beginning of the spring semester of 2010, in the period that was known as budding season, and its leaves were collected in June. The samples were obtained from 10 different individuals; 5 of each from Hasandede and Kalecik Karası grape plant varieties from Hasandede District, Kırıkkale Province and Gökdere Village, Kalecik District, Ankara Province, Turkey, respectively. The collected plant specimens were identified by Prof. Dr. Şükran Çakır Arıca. As the rooting medium, perlite that had been obtained from a volcanic rock was used. Steels that are available in a heated medium have been maintained at an ambient temperature of 25°C for 12 weeks. In addition to seasonal periodism, day-night medium has been created by electric lightmeans that has been specifically set with 12 hour sections by considering the daily photoperiodism. Therefore, heat, light and moisture have been applied evenly for all individuals (Fig.1). As of March, steels obtained from Hasandede and Kalecik Karasi varieties during budding period have been shortened in 10-12 cm length and 2-3 buds have been ensured in each steel. A total of 90 pieces of steels were used at 3 different time intervals (4,8 and 12 weeks) together with control group (water), 2 different IBA concentration with 5 different individuals taken from each of two varieties. Concentrations were evaluated in terms of *V. vinifera* species and the appropriate IBA concentrations were used as 6000 ppm and 7500 ppm. IBA (Indole 3-Butyric Acid) was applied as root growth regulating substance with ''quick dipping method'' to encourage rooting. 95% ethyl alcohol was used for 90 rootstocks prepared before this application in order to remove substances that may negatively affect the structure and will develop in the root area. At the end of the 12 weeks of rooting period, root quality parameters were investigated such as rooting in steel, the

average number of roots, the average root length (cm), and the degree of routing (0=rooting absent, 1=weak, 2=moderate, 3=good, 4=very good). Results were evaluated by analysis of variance. These values were reported by taking individuals of this week out at the end of the fourth week at first and the study continued by applying the same way for 8th and 12th week individuals.

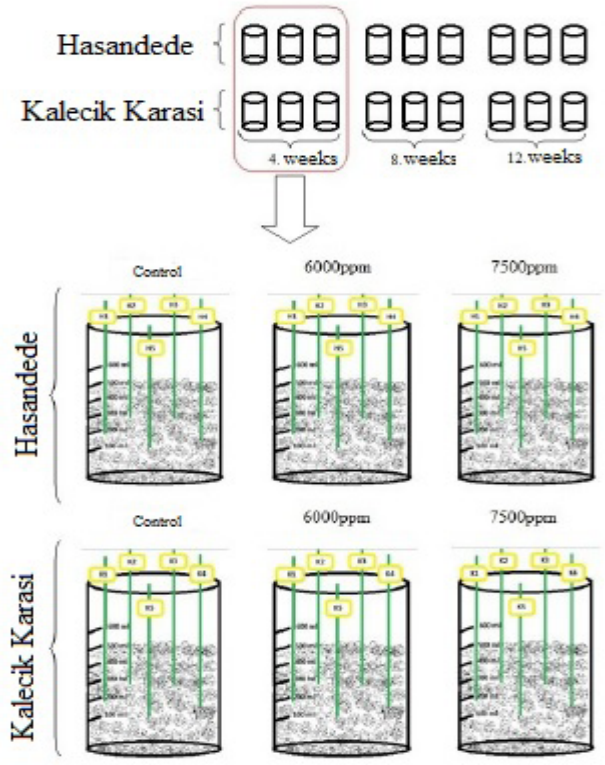

Figure 1: Mechanism for the observation on the effect of IBA on Hasandede and Kalecik Karasi

RESULTS AND DISCUSSION

The rooting rate was recorded at the end of 4th, 8th and 12th week as a result of IBA concentration application used in the study (Table 1,2 and 3). In addition, root length and herbal growth of each individual were photographed (Fig.2,3).

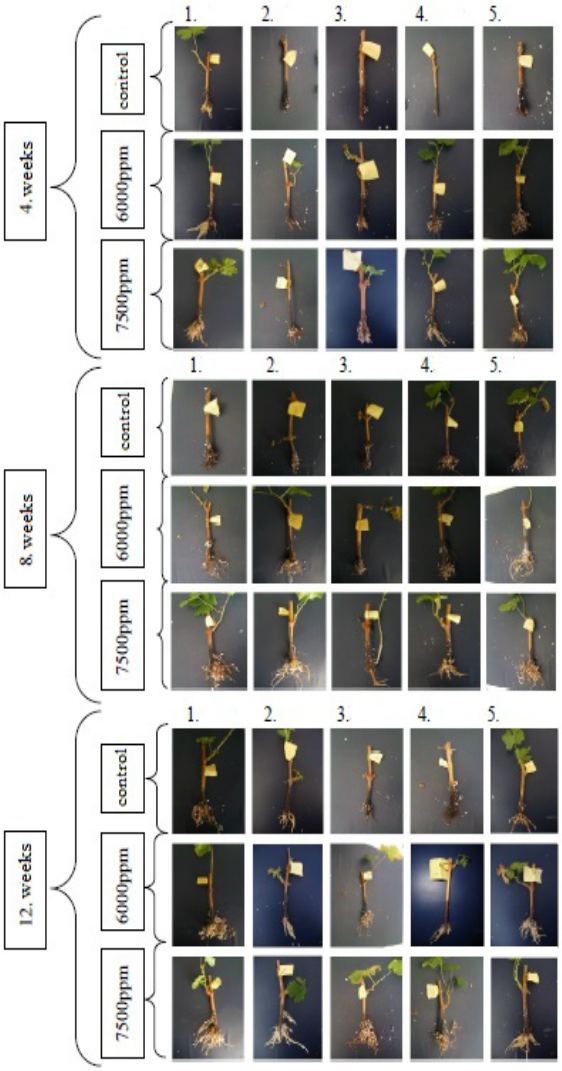

Figure 2. The overview of the rooting on Hasandede.

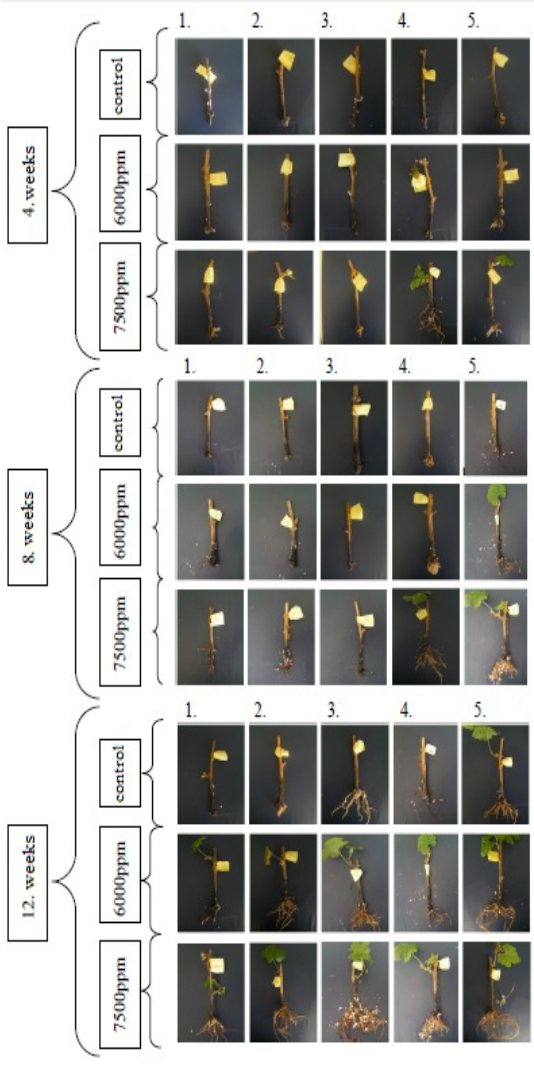

Figure 3. The overview of the rooting on Kalecik Karasi.

Table 1. The rooting reports of Hasandede and Kalecik Karasi grapes after 4th week controls.

	Hasandede (*Vitis vinifera* L.)			Kalecik Karasi (*Vitis vinifera* L.)		
	Control	6000ppm	7500ppm	Control	6000ppm	7500ppm
1	10-12 Roots 0.5-2 cm (1)	12-14 Roots 1-3 cm (1)	14-16 Roots 1-4 cm (1)	No rooting (0)	1-2 Roots 0.1-0.5 cm (1)	4-6 Roots 0.5-1 cm (1)
2	8-10 Roots 0.1-0.3 cm (1)	8-10 Roots 0.5-3 cm (1)	10-12 Roots 1-3 cm (1)	No rooting (0)	4-6 Roots 0.1-0.5 cm (1)	6-8 Roots 0.5-2 cm (1)
3	No rooting (0)	8-10 Roots 0.5-1 cm (1)	10-12 Roots 0.5-2 cm (1)	No rooting (0)	2-4 Roots 0.5-1 cm (1)	4-6 Roots 0.5-1 cm (1)
4	No rooting (0)	14-16 Roots 0.5-2 cm (1)	14-16 Roots 1-4 cm (1)	No rooting (0)	4-6 Roots 0.1-0.5 cm (1)	8-10 Roots 3-6 cm (2)
5	8-10 Roots 0.1-0.5 cm (1)	10-12 Roots 2-5 cm (1)	12-14 Roots 2-6 cm (1)	6-8 Roots 0.5-1 cm (1)	8-10 Roots 0.1-1.5 cm (1)	8-10 Roots 1-4 cm (1)

Table 2. The rooting reports of Hasandede and Kalecik Karasi grapes after 8th week controls.

	Hasandede (*Vitis vinifera* L.)			Kalecik Karasi (*Vitis vinifera* L.)		
	Control	6000ppm	7500ppm	Control	6000ppm	7500ppm
1	12-14 Roots 1-3.5 cm (1)	14-16 Roots 1-6 cm (2)	18-20 Roots 2-8 cm (2)	2-4 Roots 0.5-2 cm (1)	3-4 Roots 1-4 cm (1)	8-10 Roots 3-5 cm (2)
2	12-14 Roots 0.1-0.5 cm (1)	12-14 Roots 1-5 cm (2)	14-16 Roots 3-7 cm (2)	4-6 Roots 0.5- 1cm (1)	8-10 Roots 0.5-1 cm (1)	12-14 Roots 1-3 cm (1)
3	6-8 Roots 0.5-1.5 cm (2)	10-12 Roots 1-3 cm (1)	12-14 Roots 1-7 cm (2)	1-2 Roots 0.1-0.5 cm (1)	2-4 Roots 0.5-1.5 cm (1)	6-8Roots 0.5-3 cm (1)
4	12-14 Roots 1-5 cm (2)	14-16 Roots 1-2 cm (1)	16-18 Roots 3-7 cm (2)	10-12 Roots 0.1-0.5 cm (1)	10-12 Roots 0.5-1 cm (1)	16-18 Roots 3-7 cm (2)
5	10-12 Roots 3-7 cm (2)	14-16 Roots 3-9 cm (3)	16-18 Roots 4-10 cm (3)	8-10 Roots 2-6 cm (2)	10-12 Roots 1-5 cm (2)	18-20 Roots 3-7 cm (2)

Table 3. The rooting reports of Hasandede and Kalecik Karasi grapes after 12th week controls.

	Hasandede (*Vitis vinifera* L.)			Kalecik Karasi (*Vitis vinifera* L.)		
	Control	6000ppm	7500ppm	Control	6000ppm	7500ppm
1	16-18 Roots 3-7 cm (2)	18-20 Roots 4-8 cm (3)	22-24 Roots 4-10 cm (3)	2-4 Roots 1-3 cm (1)	8-10 Roots 2-2.5 cm (1)	10-12 Roots 1-4 cm (1)
2	12-14 Roots 1-3 cm (1)	12-14 Roots 2-5 cm (2)	18-20 Roots 1-9 cm (3)	7-9 Roots 0.5- 2cm (1)	12-14 Roots 2-10 cm (3)	14-16 Roots 2-12 cm (3)
3	8-10 Roots 0.5-3 cm (1)	14-16 Roots 1-7 cm (2)	18-20 Roots 3-9 cm (3)	7-9 Roots 4-8 cm (3)	24-26 Roots 2-12 cm (3)	28-30 Roots 4-14 cm (4)
4	18-20 Roots 1-3 cm (1)	18-20 Roots 2-6 cm (2)	22-24 Roots 6-10 cm (2)	10 Roots 0.5-6 cm (2)	12-14 Roots 3-5 cm (2)	20-22 Roots 3-7 cm (2)
5	10-12 Roots 2-8 cm (2)	18-20 Roots 3-9 cm (3)	2-22 Roots 4-10 cm (3)	12 Roots 2-6 cm (2)	16-18 Roots 5-13 cm (4)	22-24 Roots 6-14 cm (4)

In accordance with statistical analysis of the obtained data, the comparative tables are created. In these tables, the quantity of the average stem length and the average root development are shown comparatively for periods of 4, 8 and 12 weeks (Table 4 & 5). The results and concentrations between Hasandede and Kalecik Karasi were taken into account and p-value, indicating whether the difference was significant or not, was determined. The evaluations were made according to p<0,05 standard. Due to the condition of individuals, "significant difference" in terms of value occurs when it is P<0,05, and in other cases, it is mentioned that there is no significant difference. In terms of no significant difference in the tables, it was expressed with the same letter, and it was expressed with different a letter in other cases. Hasandede and Kalecik Karasi varieties were compared using P values of their root growth rate. Noticeable differences observed only on 6000 ppm IBA group and specifically at the end of 4th week; yet no statistical differences obtained in any other group throughout the whole experiment. At the end of the 8th week, both kinds showed as a similar development and development was observed at similar rates in all weeks. While there was no difference in terms of development in 6000 ppm IBA concentrations and control group (water), there was a difference in terms of development between 6000 ppm and 7500 pmm IBA concentrations. At the end of 12 week, it was seen that there was a similar development rate in both types, at each period that has been considered to be a development. The increase of concentration in both varieties affected root growth in a positive way. This situation was expressed in different letters depending on the rate of development of each concentration.

Table 4. The average lengths of rooting

	4th week			8th week			12th week		
	Control	6000 ppm	7500 ppm	Control	6000 ppm	7500 ppm	control	6000 ppm	7500 ppm
Hasandede	0.35(a)	1.85(b)	2.45 (c)	2.31(a)	3.2(a)	5.2(b)	3.15(a)	4.7(b)	6.6(c)
Kalecik Karasi	0.15(a)	0.49(c)	1.95 (c)	1.32(a)	1.6(a)	3.55(b)	3.3(a)	5.65(b)	6.7(c)

The statistical results of evaluations were given in different IBA concentration applications in root pieces of varieties during 4 weeks, p-values depending on the comparison, the two types of control (water) group at a similar rate development was observed, 6000ppm and 7500ppm IBA at concentrations at different rates, a growth was observed. While there have been no difference in Hasandede variety, control (water) and 6000 ppm IBA concentration in terms of growth and in 6000 ppm and 7500 ppm, a significant difference was observed to be present in IBA concentrations. In Kalecik Karasi variety, there was a difference in control (water) and 6000 ppm IBA concentration in terms of growth and in 6000ppm and 7500ppm, however, no significant difference was present in IBA concentrations. At the end of the 8 weeks period, comparison of control and 6000 ppm IBA applied group shown meaningful differences. Study also reported that both of the species shown similar growth to 7500 ppm IBA levels. At the end of 12th week, the development was observed in different ratios in the control group (water) and growth rate was not different in 6000 ppm and 7500 ppm IBA concentration groups. While the development within Hasandede variety showed a difference only between 6000 ppm and 7500 ppm IBA concentrations the growth in Kalecik Karasi variety was observed to be different in all three concentrations.

Table 5. The average numbers of roots

	4th week			8th week			12th week		
	Control	6000 ppm	7500 ppm	Control	6000 ppm	7500 ppm	control	6000 ppm	7500 ppm
Hasandede	5.8(a)	11.4(a)	13.0(b)	11.4(a)	13.8(a)	16.2(b)	13.8(a)	17.0(a)	21.0(b)
Kalecik Karasi	1.4(a)	4.8(c)	7.0(c)	6.0(c)	7.6(c)	13.0(b)	8.2(c)	15.4(a)	19.8(b)

In some vegetal organisms, the studies on IBA concentration affecting root development were examined and findings were found in the literature. Zenginbal et al. (2006) studied the effect on *Actinidiadeliciosa* L. species and wood steels and determined the live steel and rooting rate by using root number and quality. As a result of this study, the best results were obtained at the end of steels, 6000 ppm IBA application. Erdogan&Aygun (2007) examined the effects of IBA on black mulberry rooting of cuttings. Erdogan and Aygun's study reported that control group reached up to 42.5% rooting success rate. Study also shown that, the IBA application to the cuttings increased success rate by 14.2%, also Erdogan and Aygun extend their study to show the effects of exposure to different concentration of IBA; reported values of 4000 ppm, 6000 ppm and 8000 ppm of IBA resulted with 57.5%, 60% and 52.5% increase compared to control group. They expressed that quality criteria such as average number of root length, exchange weight and degree of rooting are formed at the highest 8000 ppm application. Söyler and Aslan (2000) observed that 500 ppm NAA 28% and 250 ppm 29% in IBA, there have been a root development with a quick dipping method in *Capparisspinosa* L. type steels. Yıldız et al.(2009) examined the roots of wood, half-wood and green steels of *Morusnigra* L. The number of roots per steel were lower in both control and hormone applications in wood steels. In half wood steels, root number of control was achieved as 1.0 rate and 7500 ppm IBA has reached 5.07 in IBA applied steels. In green steels, control group's root number was specified as 4.38 and this value was 10.33 in IBA, 1134 in 7500 ppm IBA. Cute&Tekintaş (2004), *Uniperusoxycedrus* subsp. *macrocarpa* on steel in his work, rooting 3000ppm and 5000ppm with different concentrations including , as a result of the application, they stated that there have been no cellular developments related to rooting.

CONCLUSION

In this study, IBA's effect was examined on root formation in steels of *V.vinifera* made with similar techniques, steels that belonged to Hasandede and Kalecik Karası varieties that had different rooting ability were used and as a result of the study, Hasandede variety at 6000 ppm concentration, Kalecik Karasi variety at 7500 ppm concentration were observed as having optimum development in terms of root. Different metabolism behavior of

V.vinifera samples after applications of IBA showed that these two samples taken from different fields can be a representative of different varieties. In the light of this information the effect of *V.vinifera* which is commonly used in Turkey may show different effect in public health as a supplementary. It is proposed that application of any growth hormones may play very important and positive role in V.vinifera's metabolism which expectedly results increasing concentration of contents such as bioactives and antioxidants. We also suggest investigating the molecular relationship between Kalecik Karasi and Hasandede varieties for taxonomic design and classification of biological organisms.

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