Potential Status of Persimmon (*Diospyrus kaki* L.) in Türkiye and Its Impact on Human Health

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Abstract. Anatolia is the gene center of many fruit species grown in the world and is also very rich in terms of fruit species and varieties. *Diospyrus kaki* L., known as persimmon, is one of these fruit species. Considering Türkiye's ecological conditions, persimmon has a great potential for production. In recent studies, the potential health effects of persimmon have been cited as an important factor, increasing the popularity and consumption of persimmon. In addition, persimmon has become the center of attention in recent years due to the attractive orange color of the fruit, its distinctive taste and structure, rich in antioxidants and phenolic compounds. In this review study, it was aimed to increase awareness of the production potential of persimmon grown in Turkiye by revealing its production potential, and to shed light on decision-makers in future production planning by providing information in terms of economic importance and health.
Keywords: Human health, Persimmon, Production, *Diospyrus kaki* L., Türkiye.

1 Introduction

Persimmon, which means 'sacred food' or 'food of the gods' in Greek, is known in Türkiye under different names such as 'fruit of paradise', 'paradise apple', 'date', 'currant apple', 'amme' and is very popular due to its attractiveness and taste. It has been cultivated in Central Asia since ancient times [40]. The genus Diospyros includes about 400 species. Most of them are native to the tropics and subtropics and include evergreen and deciduous trees and shrubs [41]. *Diospyros kaki* belonging to the Ebenaceae family has been consumed as an important food source in China, India and Japan since ancient times. Since the 20th century, *Diospyros kaki* has spread throughout Europe and China accounts for approximately 77% of the global production [1]. This fruit species was brought from its homeland in China to Japan in ancient times, where it was produced on a large scale. It then spread to Korea and the United States of America ([46], [29]. In Japan, persimmon, which has more than 800 varieties, is called "Japanese Apple" and is consumed by Japanese people in summer and winter ([30], [46], [23], [33], [29]). Europe became acquainted with persimmon after the 17th century [23]. Since the end of the 19th century, persimmon has been recognized in many countries located in the temperate climate zone. In recent years, especially in California, Italy, Brazil and Israel, modern persimmon orchards have been established and interest in this fruit has increased [46]. Although it is not known when it was brought to Türkiye, it is thought that it has been cultivated since ancient times ([43], [21]).

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Since it was introduced to Türkiye through Trabzon and distributed to other provinces, it was named Trabzon persimmon. This fruit is also known locally in Türkiye under names such as Persimmon, Amme, Grafted Uvaz, Russian Persimmon, Japanese Persimmon, Batumi Persimmon, Laz Persimmon, and Paradise fruit. Persimmon (*Diospyros kaki*) has become the center of interest in recent years due to the attractive orange color of the fruit, its distinctive taste and structure, and its richness in antioxidants and phenolic compounds [10].

1.1 Ecological Requirements of Persimmon

Although persimmon is a subtropical fruit, it is also adapted to warm and temperate climates. Since the tree sheds its leaves in winter, it is more resistant to low winter temperatures than other subtropical fruit species. In general, it can withstand temperatures down to -12 ºC ([30], [46]). In our country, persimmon can be cultivated both in coastal and inland regions. The flower structure of persimmon has three different flower types: hermaphrodite, female and male flowers. Female flowers have male organs, male flowers do not have female organs, and hermaphrodite flowers have both sex organs. Fruits can be seeded or seedless depending on fertilization status. Leaves are simple, oval or pointed, with toothless margins and short petioles. The leaves, which fall off in winter, turn yellow orange or red in autumn, and can also be used as ornamental plants with their beautiful appearance and the beautiful appearance of the fruits on the tree in the same period. Fruit size varies between 50-300 grams and can even reach up to 350 grams. Fruit shapes can be conical, long conical, round and flattened according to the varieties. The fruit peel, which is greenish-yellow, orange-yellow, orange-yellow, orange, orange-red in harvest formation, turns orange, red-orange or red in eating maturity. Although propagation is done by generative and vegetative methods, generative propagation is mostly used in

rootstock production. Among vegetative propagation techniques, grafting is widely used. Pruning Shape pruning is done to shape the trees. For this purpose, different climax branched (modified leader), goble, palmette and different wire training systems can be applied. Irrigation, since the flowering of persimmon is in a period when the ambient temperature is high, irrigation should be done if necessary to prevent the trees from experiencing water stress during this period. Otherwise, fruit set will decrease with an increase in flower and small fruit dropping. Irregular irrigation causes cracks in the fruits in late summer and near harvest, reducing the quality and marketable fruit ratio. One third of the nitrogen fertilizers should be applied to the soil in early spring, one third in April-May and the other third in June, coinciding with the crown projection of the trees. Potassium and phosphorus fertilizers should be applied together or separately to the pits or ditches opened in a circle with a depth of 15-20 cm and a width of 15-20 cm coinciding with the crown projection of the trees in November-December and covered with soil.
Soil cultivation in persimmon can be done in three ways in general.
No Cover System: In this system, weed growth is not allowed by continuous soil cultivation.
Semi-Covered System: In this system, it is aimed to keep cover crops during periods of abundant rainfall and to make better use of rainfall and irrigation water by tillage during periods of scarce rainfall.
Covered System: In this system, cover crops, especially forage crops, are kept in the garden in the form of meadow as live mulch.
The harvest starts to bear fruit 3-4 years after planting and reaches full yield after 7 years of age. With good care, young trees can yield 20-40 kg per tree, while this value can exceed 150 kg in adult trees. The fruits of persimmon should be picked when they are firm and have the size and color (orange-dark orange) specific to the variety.under Adana climate.

1.2 Nutritional Value of Persimmon

In the world, there is a trend towards a diet based on natural foods. For this reason, it has been reported that the demand for fruit types such as persimmon, which has anticarcinogenic and antioxidant properties, fiber, low calorie, does not increase cholesterol and is rich in high vitamin C and mineral substances, has increased and is frequently consumed [11]. Persimmon fruits are especially sought after because they are rich in vitamin A and carbohydrates. It also has tannin-rich fruits used in different fields of industry. They have an attractive appearance and taste excellent [30]. Persimmon attracts attention especially with its rich content of vitamin A and carbohydrates. It contains 7.0 grams of vitamin C, 0.40 grams of protein and 0.10 grams of fat in 100 grams of persimmon (Table 1). There are also vitamin A and some E vitamins such as Lycopene, Kolin and Fiber in 100 grams of persimmon. In addition, it has been revealed in studies that it is rich in mineral content, especially potassium, calcium and phosphorus at the highest rates [2].

Table 1. Nutrient content of persimmon

Component	Unit	Value in 100 g
Energy	kcal	73.0
Protein	g	0.40
Fat	g	0.10
Cholesterol	mg	0.00
Carbohydrate	g	15.6
Fiber	g	5.1
Calcium	mg	12.0
Iron	mg	0.10
Potassium	mg	177.0
Vitamin C	mg	7.0
Vitamin A	IU	153.0

Anatolia is the gene center of many fruit species grown in the world and is also very rich in terms of fruit species and varieties [49]. Diospyrus kaki L. known as persimmon is one of these fruit species [30]. The suitability of our country for persimmon cultivation was first determined by a selection study conducted in 1984 [31]. Subsequently, [4] determined that four of the 10 persimmon cultivars (Eylül, Amankaki, Fuyu, Hana Fuyu, Hachiya, Jiro, Harbiye, O'Gosho, Kaki Tipo, and Vainiglia) (Jiro, Vainiglia, Fuyu, and Amankaki) can be cultivated economically under Hatay conditions. Among Diospyros species, Diospyros kaki is grown commercially in Türkiye. However, a limited number of Diospyros lotus plants are also grown in nurseries to be used as rootstocks. Diospyros oleifera is also grown in very small quantities in the Mediterranean region. Since the 1980s, many promising clones have been identified and morphologically and molecularly characterized in different regions of Türkiye through selection studies. Currently, there are 10 registered persimmon genotypes and 1 patented variety.
Persimmon cultures are generally divided into 4 groups according to the maturity of the fruit (in terms of astringency). Information on these 4 commercial species of persimmon is given below.

1. *Diospyros kaki* L.: All persimmon varieties whose fruits are consumed fresh or processed are included in this species. Its origin is China. Japan and Korea are the most common countries.
2. *Diospyros lotus* L.: Originated in Asia and has value only as a rootstock. It is also used as a source of tannin.
3. *Diospyros virginiana* L. Originated in North America. It has value only as a rootstock and is widely used as a rootstock, especially in America. It is also used as a source of tannin.
4. *Diospyros oleifera* L Cheng: Origin is China. This species, which is used as rootstock, is also evaluated as a tannin source [46].
China accounts for 79% of world production [9]. When Japan and Korea are added to China, 95% of world production comes from these countries [40]. Mediterranean countries produce less than 5% of world production [23]. Varieties produced in Asia are more suitable for commercial production than those produced

in Europe. China is the world's largest producer of persimmon, with production reaching about 3.5 million tons in 2021. China accounted for 79% of the total world persimmon production in 2021. The Republic of Korea follows China in persimmon production and its production is 200 thousand tons (Table 2). Türkiye ranks 7th with 77,133 tons and meets 1.78% of the production [1].

Most of the varieties grown commercially in Türkiye have an astringent flavor [16]. About half of the persimmon production is supplied from the coast of Iskenderun Gulf and the south of Hatay region. Together with Çukurova, 2/3 of Türkiye's production is supplied from the Eastern Mediterranean region. Another production area of persimmon is the Eastern Black Sea coast. Approximately 1/5 of Türkiye's production is realized here. Apart from these two areas, production is also found in the Western Black Sea coastal area, especially around Adapazarı and Kocaeli, and in the Büyük Menderes gutter and the shores of the Gulf of Antalya [12]. Although persimmon is widely spread in the Mediterranean Region, the provinces with production centers are located in the east of the region. In the western Mediterranean, persimmon is grown as small seedlings grown from seed in home gardens. In the Eastern Mediterranean, the number of regular gardens is higher [30], [16]. In Türkiye, it is mostly grown in the Mediterranean Region, especially in Hatay province, followed by Adana and Mersin provinces. Early varieties appear on the market in the third week of September in the Mediterranean Region and this period continues until mid-November [14]. The first studies on Japanese varieties started in 1984 at the Citrus Research Institute. With the participation of Mersin Alata Horticultural Institute, six types were selected in the Western Mediterranean Region. A collection of 68 cultivars imported from Italy, Japan and Pakistan was established at Çukurova University. Currently, adaptation studies are being carried out in Southern and Southeastern Anatolia and selection studies in the Black Sea Region [16]. The countries where persimmon is mostly exported are Kuwait, Jordan, Germany, Switzerland and Cyprus [4]. In Türkiye, persimmon production, which was 3.500 tons in 1978, increased steadily in general, reaching 10.500 tons in 1998, 26.277 tons in 2010 and 97.560 tons in 2022. As of 2022, there are 2.556.201 persimmon trees in more than 40 provinces with a total of 1.855.878 trees, 1.663.793 fruiting trees and 892.408 non-fruiting trees [3]. Currently cultivated on an area of 59,491 hectares, persimmon has a great potential considering Türkiye's ecological conditions. The major producing provinces are Adana, Adıyaman, Mersin and İzmir and these four provinces account for more than 50% of the total production. Other important producing provinces are Denizli, Yalova, Hatay, Çanakkale, Kahramanmaraş, Bursa, Gaziantep, Sakarya and Ordu (Table 3). In our country, it is generally grown more widely in the coastal areas of the Mediterranean, Black Sea and Aegean regions. Although persimmon has been cultivated in Türkiye for many years, regular large orchards were very limited in the past and it was mostly grown as individual trees in home gardens. Although its cultivation has been practiced since time immemorial, it has not yet reached the desired level in terms of both production and marketing [32]. It is reported that persimmon can be easily cultivated in many regions of Türkiye and that there are 74 different cultural variations [45], [5]. In Türkiye, persimmon tree area is increasing at a higher rate than production, and although approximately 75% of the existing tree area is of fruit-bearing age, the fact that fruit production is not increasing at the same rate is accepted as an indication that there are various problems related to cultivation. The low average yield indicates that cultural practices related to cultivation are not carried out properly. In addition to this, it is also reported that in some regions where it is traded, scattered cultivation in the form of single or a few trees is also effective [18].

1.3 Türkiye's Persimmon Exports – Imports

When the foreign trade data of persimmon is analysed, Türkiye's export value in 2019 was realized as approximately 106 thousand $(Table 4).

In 2019, the import value of persimmon in Türkiye was realized as 57 thousand $. Saudi Arabia, followed by Israel, Iran, Tunisia and Palestine have an important place in Türkiye's persimmon imports with a share of over 90%. Russia ranks first in persimmon exports, followed by Ukraine and Serbia. Although Türkiye's foreign trade in persimmon is not high, it is a country that both exports and imports. When Türkiye's foreign trade in persimmon is analysed by considering the export values, it is seen that it showed a fluctuating situation in the period 2015-2019 and reached the highest value in 2017. Until 2015, there was no foreign trade in persimmon. On the other hand, while Türkiye had a share of 0.013% in world persimmon exports in 2015, it increased to 0.048% in 2019. These results show that Türkiye is far behind in persimmon exports. Although Türkiye ranks 7th in persimmon production, it is much further behind in persimmon exports.

1.4 Use of Persimmon Fields

In addition to fresh consumption, persimmon fruits can also be dried and frozen. Especially in Far Eastern countries, very astringent varieties with high dry matter and not suitable for fresh consumption are dried. The fruits are also frozen and marketed during the winter months. Since persimmons that are not ripe enough have a very astringent flavor, the persimmons to be frozen must be fully ripe. Persimmons are pureed and frozen and this puree is mostly used in the production of marmalade, jelly, nectar, cakes, sauces, ice cream, cream and custard [14], [46], [8]. The astringent (tannic) varieties of persimmon are eaten after softening and removing the astringent taste, while the non-acrid varieties can be consumed directly or processed in various ways. In addition to fresh consumption, persimmon fruits can also be utilized by drying and freezing. Especially in Far Eastern countries, very astringent varieties with high dry matter and not suitable

for fresh consumption are dried. The fruits are also frozen and marketed throughout the winter months. Persimmons to be frozen must be fully ripe, as unripe persimmons have a very astringent flavor. Persimmons are pureed and frozen and this puree is mostly used for making marmalade, jelly, nectar, cake, sauce, ice cream, cream and custard [14], [46], [8]. One of the methods of making fruits durable is processing them into fruit juice. The first commercial production of fruit juice started in Switzerland towards the end of the 19th century with the introduction of pasteurized apple juice. It then passed to other European countries and showed a rapid development. Developments in production techniques, the adoption of the importance of fruit juice in nutrition and the need to utilize the surplus production during the harvest period of fruits are among the main reasons for the development of this industry [22].

1.5 The Effect of Persimmon on Human Health

Today, the consumption of processed foods is increasing in parallel with the developing living conditions and changing nutritional understanding. Every day, new information is emerging about the vitamins, minerals and elements that the body needs and the amounts that should be taken, and fruit juices, vegetable juices, fruit and vegetable juices are produced as an alternative to vegetables and fruits in order to meet this need. Fruit and vegetable juices are mainly included in human nutrition as a source of minerals and vitamins. In addition, fruit and vegetable juices are rich in carotenoids, flavonoids and other phenolic compounds that are important for health and nutrition. These phytochemicals play a role in the prevention of chronic diseases, cancer and cardiovascular disorders, aging-related nerve degeneration by binding or removing free radicals [42]. In recent years, consumers want to consume products with high nutritional value and rich in phenolic antioxidants. Therefore, the demand for fruit and vegetable juices with these characteristics is increasing. In our country, fruit juice consumption, which was 4.4 liters per capita in 2000, reached 11 liters in 2008 [13]. Persimmon (*Diospyros kaki* L) has become the center of interest in recent years due to its attractive orange color, distinctive taste and structure, rich in antioxidants and phenolic compounds [10]. Persimmon has a therapeutic effect on cardiovascular diseases [48], [33]. Recent studies have shown that the fruit has cholesterol and blood pressure lowering properties, strengthens the immune system, and plays an important role in the prevention of digestive system disorders and cancer diseases that are common today [48], [15], [9]. In general, persimmon is good for relieving weakness, anemia, vitamin deficiency, gastrointestinal diseases and colds. It is also reported that this fruit is effective in stopping diarrhea, stimulating appetite, curing gastritis and intestinal inflammation [4].

Recent studies have shown that persimmon has cholesterol and blood pressure lowering properties, strengthens the immune system, and has an important place in the prevention of digestive system disorders and cancer diseases that are common today [48], [15], [9]. The fact that persimmon fruits are very rich in ascorbic acid and phenolic compounds provides high antioxidant activity of this fruit. The demand for persimmon, which has an important place in functional products, has been increasing in recent years, especially due to its rich carbohydrate and tannin content as well as vitamins A and E [34], [6], but our persimmon production is not at the desired level due to the problems experienced in cultivation, especially in the harvest and post-harvest stages. Persimmon (*Diospyros kaki* L.) offers excellent nutritional quality in many countries due to its sensory properties as well as its content of carbohydrates and other bioactive phytochemicals, dietary fibers, vitamins, minerals, carotenoids and phenolic compounds, as well as its potential for application in different industrial fields [27], [38]. Persimmon (pulp) is rich in vitamins, especially vitamin C (~70 mg/100 g) and vitamin A (~65 mg/100 g), and minerals such as calcium (~9 mg/100 g) and iron (~0.2 mg/100 g). Ferulic acid, p-coumaric acid and gallic acid are the main phenolic acids found in persimmon. These compounds give persimmon antioxidant activity due to their chemical structure (number of bound hydroxyl groups). Carotenoids, which contribute to both color and nutritional value, are the main pigment found in persimmon (pulp and skin) [35], [47]. Except for lutein and lycopene, which are carotenoid groups that decrease during fruit ripening, carotenoid content increases rapidly as green and ripe persimmons turn into soft ripe persimmons. Among these groups, the highest content of β-cryptoxanthin (50%) is followed by lycopene (10%), β-carotene (10%), zeaxanthin (5%) and lutein (5%) [7]. The fat-soluble antioxidants, especially lutein, astaxanthin and zeaxanthin, have the ability to capture free radicals and thus prevent the oxidation of lipids. Persimmon fruit may contain different types and amounts of carotenoids in different parts. However, the final composition and concentration of carotenoid content is to some extent appropriately regulated by the different developmental stages of plant tissues. For example, the amount of β-cryptoxanthin, β-carotene, lycopene or lutein is higher in the peel than in the pulp [47]. Other carotenoids identified in persimmon fruits are cis-mutatoxanthin, antheraxanthin, neolutein, cryptoxanthin, α-carotene and also fatty acid esters of zeaxanthin. Tannins (epicatechin, epicatechin-3-O-gallate, epigallocatechin and epigallocatechin-3-O-gal-lat), another important component found in persimmons, have been identified as bioactive compounds with effects that can prolong life and reduce the incidence of stroke in hypertensive rats. This effect has been attributed to the fact that tannins in persimmon are 20 times stronger than vitamin E, which has antioxidant properties [26]. Persimmon, which is considered a good source of fiber, meets 15.90% of the fiber requirement of men and 24.20% of women in a day with an average 168 g portion containing 6.05 g of fiber [25]. Dietary fiber is associated with various health benefits as it has an effect on nutrient absorption, modulation of gut microbiota, postprandial glycemia, insulinemia, and cholesterolemia [24], [36]. Studies have proven that persimmon, which is a source of many therapeutic

agents, is effective against cancer formation. In one study, methanolic extracts of persimmon calyx (PCE) were shown to have cytotoxic effects on human cancer cells [17]. Another study aimed to obtain a potent pharmaceutical compound from D. kaki polyphenols that could act as an AKT1 inhibitor. In silico study using molecular workspace software was used to find the therapeutic potential of phytochemicals from D. kaki against AKT1 through molecular docking and drug-like properties. At the end of the study, it was determined that bioactive compounds obtained from D. kaki could potentially be a new anticancer agent by inhibiting AKT1 [28]. In addition, carotenoids and tannins found in persimmon are responsible for improving physiological threats with antibacterial, antiallergic, anticancer and antioxidant activities, removing free radicals, reducing cardiovascular risk factors (blood pressure and cholesterol) and reducing the risk of diabetes mellitus [20], [37]. It also has dermatological effects such as reducing melanin synthesis, protecting the skin against ultraviolet rays and skin damage, anti-inflammatory effect, and giving the skin a "golden yellow" color [19]. Persimmon is rich in phenolic compounds that are antioxidants. These compounds protect cells from free radicals against chronic diseases. Persimmon seeds have strong radical activity. In addition, tannins found in high amounts in the fruit have antimutagenic, anticarcinogenic and antioxidant activity [33].

2 Conclusion

Türkiye is a country with an important potential in persimmon cultivation with its ecologies. In Türkiye, 97,560 thousand tons of persimmon is produced on approximately 59.491 thousand decares of land, yearly. Although persimmon production is carried out in 50 provinces in Türkiye, the largest share in total production belongs to the Mediterranean region, followed by the Aegean, Marmara, Black Sea and Southeastern Anatolia regions. According to TURKSTAT data for 2022, Adana (29.067 tons), Mersin (13.759 tons) and Adıyaman (11.794 tons) are in the first three places with their total production of persimmon. It is seen that our imports are higher than our exports. With the increasing importance of fruits in human nutrition, it is recommended to consume different types of fruits for a healthy life. In this consumption, persimmon is one of the species that has not yet taken the desired place but can make significant contributions to healthy life. All over the world and especially in Türkiye, as in developed countries, the interest in fruits with high antioxidant capacity and rich in anthocyanins and products produced from these fruits, which are of great importance for human health, is increasing [39]. Recent studies have shown that persimmon has cholesterol and blood pressure lowering properties, strengthens the immune system, has an important place in the prevention of digestive system disorders and cancer diseases that are common today.

In this review study, information about the production potential, economic value and health importance of persimmon (*Diospyros kaki* L.) grown in Türkiye was given and it was foreseen that it could be a guide for producers who will grow persimmon in the future.

Table 2. World Persimmon Production Amount (tons)

Years	**2017**	**2018**	**2019**	**2020**	**2021**
China	3.092.115	3.226.901	3.207.516	3.350.795	3.429.438
Korea	298.382	263.030	316.042	198.817	200.610
Japan	224.900	208.000	208.200	193.200	187.900
Azerbaijan	147.219	160.092	177.130	185.247	192.474
Brazil	182.185	156.935	168.658	158.687	170.242
Uzbekistan	88.233	88.719	94.065	85.100	83.600
Türkiye	38.043	46.676	51.317	60.661	77.133
Israel	29.000	28.000	27.000	21.908	30.000
Iran	24.257	24.765	25.272	30.508	31.318
Other Countries	270.759	505.394	458.494	223.836	431.531
World	4.395.093	4.209.720	4.321.391	4.230.462	4.332.166

Table 3. Production amount of persimmon by provinces in 2022.

Provinces	**Total fruit orchard area (decare)**	**Number of trees at fruit-bearing age**	**Number of trees at non-fruiting age**	**Average yield (kg)**	**Production quantity (tons)**
Adana	14.401	308.221	182.277	94	29.067
Mersin	5.417	168.390	50.795	82	13.759
Adıyaman	5.560	107.891	67.705	109	11.794
Denizli	8.538	282.760	93.060	20	5.766
İzmir	536	92.330	9.540	58	5.333
Yalova	2.311	70.080	28.140	73	5.126
Çanakkale	4.470	73.255	107.910	60	4.363
Hatay	2.330	81.311	45.759	43	3.458
Bursa	4.199	58.856	115.011	50	2.928
Kahramanmaraş	1.185	46.320	13.110	42	1.966

Table. 4 Import and export status of persimmon in Turkey

Years	**Export Value (thousand $)**	**Import Value (thousand $)**	**Export Quantity (tons)**	**Import Amount (tons)**
2015	44	16	66	70
2016	40	49	81	48
2017	152	138	296	132
2018	59	7	140	13
2019	106	57	141	147

References

1. Anonymous, Faostat. Access address https://www.fao.org/faostat/en/#data/QCL 2018. Access date:20 Marc 2023 (2023a)
2. Anonymous, https://www.fitekran.com/besin-degeri/trabzon-hurmasi/ Access date: 05.Aprıl.2015 (2023b)
3. Anonymous, Türkiye İstatistik Kurumu, Bitkisel Üretim İstatistikleri,. Access address:https://biruni.tuik.gov.tr/bitkiselapp/bitkisel.zul Access date:24 Marc 2023 (2023c)
4. Anonymous, Trabzon Hurması Yetiştiriciliği Accessaddress https://www.ordutb.org.tr/trabzon-hurmasi/ Access date:20 February 2023 (2023d)
5. Bayazit, S., Ö. Tuzcu, A. B. Küden, B. İmrak, Bazı Trabzonhurması (Diospyros kaki L.) Tür ve Çeşitlerinin Soğuklama Gereksinimlerinin Saptanması. Anadolu Tarım Bilim. Derg., 2012,27(**3**):127-132. (2012)
6. Butt, M., Sultan, M., Aziz, M., Naz, A., Ahmed, W., Kumar, N., Imran, M, Persimmon (Diospyros kaki Thunb.) fruit: hidden phytochemicals and healty claims. EXCLI Journal, 14, 542. https://doi.org/10.17179/excli2015-159 (2015)
7. Cano, M. P., Gómez-Maqueo, A., Welti-Chanes, J., García-Cayuela, T, Characterization of Carotenoid and Carotenoid Esters of Astringent Persimmon Tissues (Diospyros kaki Thunb. Var. Rojo Brillante). Effects of Thermal and High Pressure Non-Thermal Processing CHEMISTRY. https://doi.org/10.20944/preprints201811.0548.v1 (2018)
8. Cemeroğlu, B., Karadeniz, F., Özkan, M, Meyve ve Sebze İşleme Teknolojisi. Gıda Teknolojisi Derneği Yayınları, No:28, 690 S, Ankara (2003)
9. Chen, X.N., J.F. Fan., X. Yue., X.R. Wu., L.T. Li, Radical Scavenging Activity And Phenolic Compounds İn Persimmon (Diospyros Kaki L. Cv. Mopan). Journal Of Food Science., Vol. 00, Nr. 0, (2008)
10. Daood, H.G., Biacs, P., Czinkotai, B., Hoschke, A, Chromatographic investigation of carotenoids, sugars and organic acids from Diospyros kaki fruits. Food Chemistry **45**, 151–155 (1992)
11. Demircan, B.,Velioğlu, Y. S, Avokado: Bileşimi ve sağlık üzerine etkileri. Akademik Gıda, 19(**3**), 309-324. (2021)
12. Durmuş, E., A. Yiğit, Türkiye'nin Meyve Üretim Yöreleri. Fırat Üniversitesi Sosyal Bilimler Dergisi. Cilt:13. Sayı:**2**. Elazığ. 23 - 54. (2003)
13. Ekşi, A., Akdağ, E. 2000' den 2007' ye Türkiye' de Meyve Suyu Üretimi ve Tüketimi. 4 Mevsim Meyve Suyu Dergisi. Yıl: 6 Sayı:**3**. (2008)
14. Gorinstein, S., M. Zemser, R. Haruenkit, R. Chuthakorn, F. Grauer, O, Martin-Belloso, S. T, Comparative content of total polyphenols dietary fiber in tropical fruits and persimmon, Journal of Nutritional Biochemistry, **10**, 367-371, (1999).
15. Gu H, Li C, Xu Y, Hu W, Chen M, Wan Q, Structural features and antioxidant activity of tannin from persimmon pulp. Food Res Int. 2008;**41**:208–17 (2008)
16. Gülcan, R., F.E. Tekintaş., A. Mısırlı., H. Sağlam., G. Günver., H. Nacıoglu. Meyvecilikte Üretim Hedefleri. *Türkiye Ziraat Mühendisliği V. Teknik Kongresi*. 2, 587 - 616. Ankara. (2008)
17. Jo, K.-J., Lee, J.-M., Lee, S.-C., & Park, H.-R, Anticancer activity of persimmon (*Diospyros kaki* L.) calyx extracts on human cancer cells. 5. (2015)
18. Kaplankıran. M., Yıldız.E., Toplu .C, Hatay ili Trabzon hurması Seleksiyonunda ilk bulgular. *1.Trabzon hurması Yetiştirme ve Pazarlama Sempozyumu*-Ünye Sayfa:103-110. (2004)
19. Kashif, M., Akhtar, N., & Mustafa, R, An overview of dermatological and cosmeceutical benefits of *Diospyros kaki* and its phytoconstituents. Revista Brasileira de Farmacognosia, 27(5), 650–662. https://doi.org/10.1016/j.bjp.2017.06.004. (2017)
20. Kawase, M., Motohashi, N., Satoh, K., Sakagami, H., Nakashima, H., Tani, S., Shirataki, Y., Kurihara, T., Spengler, G., Wolfard, K., Molnár, J, Biological activity of persimmon (*Diospyros kaki* L) peel extracts: Bıologıcal Actıvıty Of Persımmon. Phytotherapy Research, 17(5), 495–500. https://doi.org/10.1002/ptr.1183. (2003)
21. Koca, İ. Kızılcık ve Trabzon Hurması Pekmezlerinin Üretim Teknikleri. Gıda Teknolojileri Elektronik Dergisi. 2007 (2) 33 - 37. (2007)
22. Köksal, S, Bazı Meyve Sularında Değişik Dolum Tekniklerinin Belirli Kalite Kriterleri Üzerine Etkisi. Lisans Tezi. Bursa. Uludağ Üni. Ziraat Fak. Gıda Bilimi ve Teknolojisi. 39 s (1986)
23. Llàcer, G., M.L. Badenes, Persimmon Production And Market Options. First Mediterranean Symposium On Persimmon, Zaragoza (Spaın). Cıheam-Iamz, 2002.- Isbn 2-85352-249-0. 126 P. (2002)
24. Makki, K., Deehan, E. C., Walter, J., Bäckhed, F, The Impact of Dietary Fiber on Gut Microbiota in Host Health and Disease. Cell Host & Microbe, 23(**6**), 705–715. https://doi.org/10.1016/j.chom.2018.05.012 (2018)
25. Matheus, J. R. V., Andrade, C. J. de, Miyahira, R. F., Fai, A. E. C. Persimmon (*Diospyros kaki* L.): Chemical Properties, Bioactive Compounds and Potential Use in the Development of New Products – A Review.

Food Reviews International, 38(4), 384–401. https://doi.org/10.1080/87559129.2020.1733597B(2022).
26. Matsumoto, K., Kadowaki, A., Ozaki, N., Takenaka, M., Ono, H., Yokoyama, S., & Gato, N, Bile Acid-binding Ability of Kaki-tannin from Young Fruits of Persimmon (*Diospyros kaki* L) In Vitro and In Vivo.Phytotherapy Research, 25(4), 624–628. https://doi.org/10.1002/ ptr.3306 (2011)
27. Milczarek, R. R., Woods, R. D., LaFond, S. I., Breksa, A. P., Preece, J. E., Smith, J. L., Sedej, I., Olsen, C. W., & Vilches, A. M, Synthesis of descriptive sensory attributes and hedonic rankings of dried persimmon (*Diospyros kaki* sp.). Food Science & Nutrition, 6(1), 124–136. https://doi.org/10.1002/fsn3.537(2018)
28. Muhammad, I., Nayab, G. E., Rahman, N., Niaz, S., Ali, A., Khan, H. Anticancer Potential of Diospyros kaki (persimmon) polyphenols against AKT1 (6CCY): Docking based in silico study.https://doi.org/10.13140/RG.2.2.35887.82087. (2022)
29. Nurdan, E, Çanakkale Koşullarında Diospyros Lotus Anacı Üzerine Aşılanmış Değişik Trabzon Hurması (Diospyros Kaki) Çeşitlerinin Fenolojik Özellikleri, Klorofil Düzeyleri ile Çöğür Peroksidaz Enzim Aktivitelerinin Ölçülmesi. Çanakkale Onsekiz Mart Üniversitesi. Fen Bilimleri Enstitüsü Bahçe Bitkileri Bölümü. (Yüksek Lisans Tezi).63s. (2006)
30. Onur, C, Trabzon hurması. Derim (Özel Sayısı), 7(**1**), 4-47. (1990)
31. Onur, S., & Taşdemir, T, Akdeniz Bölgesi Trabzon Hurması Seleksiyonu. Derim, 4(**4**), 168-174 (1987)
32. Özcan, M., Trabzon Hurması Yetiştiriciliği.Hasad Yayınları. ISBN 9758377-42-6. (2005)
33. Özen, A., Colak, A., Dincer, B., & Güner, S. A diphenolase from persimmon fruits (*Diospyros kaki* L., Ebenaceae). Food Chemistry, 85(**3**), 431-437. (2004)
34. Parseker Yönel, S, Uylaşer, V. ve Yonak, S. Trabzon hurmasının bileşimi ve besleyici değeri. *Türkiye 10. Gıda Kongresi*, 21-23 Mayıs, Erzurum, s. 339-342. (2008)
35. Plaza, L., Colina, C., Ancos, B. de, Sánchez-Moreno, C., Pilar Cano, M, Influence of ripening and astringency on carotenoid content of high-pressure treated persimmon fruit (Diospyros kaki L.). Food Chemistry, 130(**3**), 591–597. https://doi.org/10.1016/j.Foodchem.2011.07.080 (2012)
36. Poutanen, K., Fiszman, S., Marsaux, C. F. M., Pentikäinen, S. P., Steinert, R. E., & Mela, D. J, Recommendations for characterization and reporting of dietary fibers in nutrition research. The American Journal of Clinical Nutrition, 108(**3**), 437–444. https://doi.org/10.1093/ajcn/nqy095 (2018).
37. Sakanaka, S., Tachibana, Y., & Okada, Y, Preparation and antioxidant properties of extracts of Japanese persimmon leaf tea (kakinoha-cha). Food Chemistry, 89(4), 569–575.Doi:https://doi.org/10.1016/j.foodchem.2004.03.013. (2005)
38. Santos, A. D. da C., Fonseca, F. A., Dutra, L. M., Santos, M. de F. C., Menezes, L. R. A., Campos, F. R., Nagata, N., Ayub, R., & Barison, A, 1H HR-MAS NMR-based metabolomics study of different persimmon cultivars (Diospyros kaki) during fruit development. Food Chemistry, 239, 511–519. https://doi.org/10.1016/j.foodchem.2017.06.133 (2018)
39. Scheerens, J.C, Phytochemicals and The Consumers: Factors Affecting Fruitand Vegetable Consumption and The Potential for Increasing Small Fruit in The Diet. Horttech11:547-556 (2001)
40. Soriano, J.M., S. Pecchıolı., C. Romero., S. Vılanova., G. Llàcer., E. Gıordanı., M.L. Badenes, Development Of Microsatellite Markers İn Polyploid Persimmon (Diospyros Kaki Lf) From An Enriched Genomic Library. Molecular Ecology Notes., **6**; 368 – 370. (2006)
41. Sponberg, S.A,, Ebeneaceae hardy in temperate North America. (Q.W.Ruscoe, SIPC, DSIR). Persimmon Culture in New Zealand.DSIR Informatıon Publıshıng Centre, Wellington 1984,1-1. (1977)
42. Steffen, L.M., A.R. Folsom., M. Cushman., D.R. Jacobs and W.D. Rosamond, Greater Fish, Fruit, and Vegetable Intakes are Related to Lower Incidence of Venous Thromboembolism: The Longitudinal Investigation of Thromboembolism Etiology, Journal of the American Heart Association. 115;188- 195 (2006)
43. Sütyemez, M., F, Ergenoğlu, Kahramanmaraş Bölgesinde Trabzon Hurması (Diospyros Kaki) Seleksiyonu. Fen ve Mühendislik Dergisi 2000, Cilt **3**, Sayı 1. (2000)
44. Toplu, C., Kaplankiran, M., Demirkeser, T. H., Ozdemir, A. E., Candir, E. E., & Yildiz, E, The performance of persimmon (Diospyros kaki Thumb.) Cultivars Under Mediterranean Coastal Conditions in Hatay, Türkiye. Journal of American Pomological Society, 63(**2**), 33-41. (2009)
45. Tuzcu, Ö. ve M. Şeker, The Situation of Persimmon (Diospyros kaki L.) Cultivation and Germplasm Resources in Türkiye Proceedings of the 5th International Symposium on Temperate Zone Fruits in the Tropics and Subtropics, Acta Horticulturae, 441, 107-114, Adana, Türkiye, (1997).
46. Tuzcu, Ö., B. Yıldırım,Trabzon Hurması ve Yetiştiriciliği. Adana. Tübitak. Türkiye Bilimsel ve Teknik Araştırma Kurumu Tarp

(Türkiye Tarımsal Araştırma Projesi Yayınları). 23 S (2000)
47. Vınha, A. F. S., Carla P. P. Olıveıra, M. Beatrız, Food Waste And By-Products Recovery. Lap Lambert Academıc Publ. (2020)
48. Wright, K. P., Kader A. A, Effect of controlledatmosphere storage on the quality and carotenoid content of sliced persimmons and peaches, Postharvest Biology and Technology **10** 89-97. (1997)
49. Yarılgaç, T., & Yıldız, K, Adilcevaz ilçesinde yetiştirilen mahalli armut çeşitlerinin bazı pomolojik özellikleri. Yuzuncu Yıl University Journal of Agricultural Sciences, 11(**2**), 9-12 (2001).