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Research Article

CAPER (*Capparis* L.) TAXA AND PRODUCTS IN TÜRKİYE

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ABSTRACT. This study has been carried out since 2009 to reveal the economic importance and products of *Capparis* taxa in Türkiye. Roots, leaves, fresh shoots, flowers, buds, fruits and seeds of them are used as food, cosmetics and health fields. In addition to being used as food, it is used us a raw material in the pharmaceutical, cosmetics, dyes and feed industries. Caper products are widely used in many countries. They spread naturally in Türkiye, except for the Trakya region. The plants are not cultivated regularly. Their buds and fruits are generally collected from nature and made into brine, are exported. In Türkiye, there are two species of genus *Capparis: C. spinosa* and *C. ovata* which are naturally distributed and 6 varieties belonging to them. These taxa are: *C. spinosa* L. var. *spinosa*, *C. s.* var. *inermis* Turra, *C. s.* var. *aegyptia* (Lam.) Boiss.; *C. ovata* Desf. var. c*anescens* (Coss.) Heywood, *C. o.* var. *palaestina* Zoh. and. *C. o.* var. *herbacea* (Willd.) Zoh. Today, many products obtained from *Capparis* taxa, which have the potential to be among industrial plants and whose consumption demands are increasing day by day, are evaluated within the scope of export, contributing to the economy and especially to increasing rural employment. Due to the low production and high collection cost, exported products are mostly produced from imported semi-finished products. This reduces the economic input and employment foreseen for the export of the plants. Studies on standardization, clinical trials and extract production and active ingredient isolation in caper products, which are included in the functional foods group, are lacking.

Keywords: *Capparis taxa, Phytotherapy, Functional foods, Pharmaceutical raw materials, Drug, Nutritional values*

INTRODUCTION

Throuthout history, people have learned how to be treated by feeding. Foods that have 'functional foods'. Recently the subject is among the priorities of the scientific world, the pharmaceutical and food industries. In the paper, a plant group that stands out as functional foods and many therapeutic products in Türkiye, namely the genus *Capparis* is described in various aspects. Among the people in Turkiye; they are known by names such as 'Kebere, Kapari, Gebere, Gebreotu, Çaltı dikeni, Deve dikeni, Yılan kabağı, Yabani karpuz, Kedi tırnağı, Gevil, Bubu, Şebellah' [1, 2, 3].

Although *Capparis* taxa are perennial bushes and have been found in Türkiye and other Mediterranean contries for many years, their importances have increased in recent years due to its use in treatment [4]. In addition to being used as a raw materials for foods, pharmaceutical, cosmetic, paint industries. Its products are widely used in many countries. It spreads naturally in Türkiye, except for the Trakya region. Two species of it; *C. spinosa* and *C. ovata* are common [4, 5, 6]. The species are predominatly in İstanbul, Adana, Mersin, Osmaniye, Balıkesir, Muğla, Antalya, Burdur, Isparta, Denizli, Kütahya, Muğla, Çanakkale, Çorum, Aksaray, Niğde, Ankara, Tokat, Artvin, Hakkari, Zonguldak, Aydın, Diyarbakır, Mardin, Şanlıurfa vilayets. It has been determined that it spreads in provinces of Mardin and Şanlıurfa. Perennial, bushy structure, growing thorny, oblique

or semi-upright, full leaves, showy flowers, 4 sepals, 4 petals, nectar pockets on the petals. The fruits are fleshy and similar to watermelon. It develops in barren and unproductive lands, on slopes with its developed root system that can go very deep [7, 8, 9].

C. spinosa grows upright in rocky areas in the Mediterranean region; *C. ovata*, on the other hand, attracts attention with its oblique growth form on steppes, slopes and roadsides, generally in the inner parts far from the sea. It is considered as a very suitable plant for the economic evaluation of non agricultural areas. Considering this feature, it has been started to be cultivated in barren lands in order to meet the increasing demand in recent years [10]. Cultivation studies are carried out by seeds collected from nature for seedling production or by cuttings taken from plants in nature [11, 12].

Fig. 1. *General appearenges of Capparis spinosa and C. ovata plants in their habitats*

Records about the caper plant date back to before Christ. Aristotle (384-322 BC) and Hippocrates (460-377 BC) included the caper plants in their works. Its name was mentioned in ancient Egyptian and Roman documents and its benefits were mentioned. Caper was also frequently used in the kitchen during the Ottoman time, and Evliya Çelebi referred to its taste and usefulness in his travel book [3]. So far, studies on caper are generally related to food [13, 14], agricultural [7, 10, 15, 16, 17, 18], ecological [3, 9, 19], chemical [20], biological [1, 8, 21] and geographical [8]. This paper has been prepared to introduce the economic importances and products of the genus *Capparis* taxa in Türkiye.

MATERIALS AND METHODS

Capparis taxa throughout Türkiye were collected and identified with the help of 'Flora of Turkey' [8]. These specimens have been turned into herbarium materials and are preserved by placing them in the GUL Herbarium (in Isparta). These investigated herbarium samples are:

Capparis spinosa L.: Y. Bulut 59(GUL 7/1/1-01) from Antalya Manavgat; Özçelik 13266(GUL 7/1/1-07); A. Koca 17(GUL 7/1/1-06) from Mersin, Silifke-Mut; A.Koca 20(GUL 7/1/1-08) from Mersin, Mut, Silifke; Özçelik 13286(GUL 7/1/1-08) from Mersin, Mut, Karaman.

Capparis spinosa L. var. *inermis* Turra: Özçelik 13283(GUL 7/1/1-1) from Mersin, Mut, Silifke; Mersin, Silifke-Mut; Özçelik 13284(GUL 7/1/1-2); Özçelik 12939(GUL 7/1/1-3) from Antalya, Manavgat. It is known to spread only from Antalya.

Capparis spinosa L. var. *aegyptia (*Lam.) Boiss.: Özçelik 13285(GUL 7/1/1-4) from Mersin, Mut.

Capparis ovata Desf. Özçelik 13287(GUL 7/1/2-3) from Mersin, Mut, Silifke; 13278(GUL 7/1/2-4) 12898(GUL 7/1/2-5); Özçelik 12901(GUL 7/1/2-6); Özçelik 12831(GUL 7/1/2-7); B. Muca 11(7/1/2-8); B. Muca 12(7/1/2-9); A.Koca 21(GUL 7/1/2-10); B. Muca 10 (GUL 7/1/2-11); B. Muca 11(GUL 7/1/2-8).

Capparis ovata Desf. var. *palaestina* Zoh.: Özçelik 13288(GUL 7/1/2-1) from Mersin, Mut, Silifke; Özçelik 13898(GUL 7/1/2-2).

Plant names that are frequently repeated in the text are abbreviated with initials. Other abbreviations are written according to world standards. The findings were obtained from the local people, industrialists, people who consume the products and literature informations. In the paper, the economic importance of Türkiye's *Capparis* taxa and their products are given.

RESULTS AND DISCUSSION

The species belonging to the genus *Capparis* L. (Capparidaceae), which are popularly known as 'Kebere, Gebere, Gebreotu, Kapari' in Türkiye, are perennial, bush-shaped, oblique or upright growing plants. They show natural distribution in countries under the influence of the Mediterranean climate. In addition, it is planted to barren areas that are open to erosion, for scope of combating erosion. In Türkiye, there are two species of *Capparis* genus; *C. spinosa* and *C. ovata,* which are naturally distributed, and 6 varieties belonging to them. These taxa are: *Capparis spinosa* var. *spinosa*, *C. spinosa* var. *inermis, C. spinosa* var. *aegyptiaca, C. ovata* var. *canascens, C. ovata* var. *palaestina.*

The cultivation of the plant is not carried out regularly, and the buds and fruits, which are generally collected from nature and made in brine, are exported. Due to the low production and high collection cost, exported products are largely produced from imported semi-finished producted. Observations and scientific datas suggest that its consumption is increasing gradually.

Distribution of the *C. ovata* and *C. spinosa* taxa is observed in the Canary Islands, especially in the Mediterranean countries, and the Great Sahara and East Africa in the African continents. In Soutwest Asia, it is seen to spread the Balkaş Lakein Cyprus, Syria, Lebanon, Arabian Peninsula, Plaestina, Iran, Irak, Afghanistan, Pakistan, India, Nepal, Türkmenistan, Uzbekistan, Tajikistan, Kyrgyzstan, and Kazakhstan [22].

Localities registered in Türkiye; İstanbul-Büyükdere, Çanakkale-Erenköy, Balıkesir-Edremit, İzmir-Urla, Çeşme, Kemalpaşa, Manisa-Turgutlu, Ege adaları, Denizli-Sarayköy civarı, Çivril, Aydın-Kuşadası, Bafa Gölü çevresi, Karacasu, Söke, Muğla-Marmaris, Milas, Datça, Knidos, Turunç, Bodrum, Antalya-Finike, Patara, Manavgat, Alanya, Adana-Seyhan, Mersin-Mut, Silifke, Karaman, Ankara, Zonguldak-Karabük, Tokat-Niksar, Çoruh, Artvin, Diyarbakır-Silvan, Mardin, Şanlıurfa-Viranşehir, Ceylanpınar, Kahramanmaraş, Hatay, Afyonkarahisar-Dinar; Isparta, Burdur [8, 9].

All parts of the caper plant can be used for different purposes. The whole plant is economic importance. *C. ovata* is most preferred. It is cultivated in Burdur. These are plants that are usually added to dishes as a flavoring (spice). The economic importance of capercorn stems from the use of its buds as therapotic food [16].

The flower buds, fruits and root bark of caper plants are diuretic, constipating and tonic [4, 14, 18, 20]. Caper buds contain 0.3-0.5 % rutin and glaucucapparin [12]. With the flower buds collected from the flora of Türkiye, it has taken an important place in exports

with an average production amount of 5000 tons and a value of 15 million dollars between the years 1995-2000 [4, 10, 23].

According to TÜİK [5] data, the amount of exported caper products is approximately 8000 tons. These values have increased from year to year. These results and interviews in the domestic market and especially in touristic areas, amount ofconsumed caper products are in high level.

Buds and flowers

The most used part is the flower bud. Making pickles from the flower buds of capers is common in the Lake Region. Its bud is a product with commercial value on an international scale. 100 g of dry matter contains 67 mg of Ca, 65 mg of P, 9 mg of Fe and 24 g of protein. Exporting abroad is usually in the form of brine. Canned pickles are eaten in salads, appetizers, on pizza, in the preparation of vegetarian foods and as a side dish alongside meats [18]. The collected mature flowers are dried and ground. 1 teaspoon of ground or whole flower is added into the boiled water, 10 min. It is brewed and drunk as tea. In Dinar district (Afyonkarahisar), probiotics are produced from other parts, especially from buds.

Leaves

Leaves and buds are used as animal feed and have been reported to increase milk yield [16]. Extracts and pulps obtained from leaves, hardened branches and roots are evaluated in the cosmetic industry [18].

Fruits

While the fruits have aphrodisiac properties, they contain various substances that relieve pain and the peels are anti-inflammatory [3]. It is also used in gout, urinary tract diseases and as a bleeding stopper. It has been used as a tonic in traditional Iranian medicine [14].

Roots and Rhizomes

Root bark in India, fresh and dried for countries as a laxative, tonic, expectorant, worm-reducing, pain reliever, those with rheumatic pains, those with paralysis, those with spleen enlargement have been found the cure in medicines obtained from the root bark [3].

Seeds

The seeds are rich in protein care. It carries about about 25-35% protein. This is a very high value. Equivalent to meat or beans. In addition, the seeds are rich in fixed oils and phenolics. The fat rate is approximately the same as the protein rate.

Fig. 2. *Picles and some probiotics produced from buds and leaves of caper plants*

Ecology and geography

Between Silifke and Mut, caper plants are abundant. Young individuals in the form of seedlings are strikingly numerous. On the limestone and claystone ground, most of them are in the casmophyte life form. In some, the leaves are reddish. Those in this group can produce little fruit. Only the ends of branches of them produce fruit. When they opened, black seeds are seen. Inner surface of the fruit is light yellow in color. These plants belong to the *C. spinosa* species. The leaves of them are ashen-colored and their populations and genetic diversity are abundant in the red pine forests between 50-35 km from Silifke, Mut'a (Mersin). It grows less on the coastline, better around 400-600 m altitudes. It can be used for rock gardens. Landscape value can be significant. It is not very suitable for fruit picking. It has a cone-shaped habitus. Alantepe village at the bottom of Mut (towards Mut) The gene center of *C. spinosa* rich in *C. spinosa* may be between Silifke and Mut. But it is certainly a center of differentiation of this breed. After the village of Yapıntı, its density decreases. Mut-Karaman Highway 10 km past Mut, most of the forms are flat on and around the roadside. The oblique form ones are *C. ovata*. 15 km from Mut to Karaman, *C. ovata* is denser because there is clay land at the bend. *C. spinosa* is sensitive to altitude and geography, but not to soil. However, *C. ovata* is soil selective.

The most consumed part of the caper is the flower buds. The pea-sized buds are very rich in protein, vitamins, minerals, rutin (the active substance that expands are vessels) and mustard oil glycoside, making is a satisfying food. Canned pickles are consumed in salads, appetizers, on pizza, in the preparation of vegetarian foods, and as a side dish alongside meats. It is known that caper brine and souce are used in approximately 450 kinds of foods. In addition, caper fruits are used in the form of brine, caper flower pickles, jam, tea and marmalade and caper paste [25]. There are chemical compounds such as alkaloid, essential oils, flavonoid, terpen glycoside, organic asid, glucosinolate, mineral substances and vitamins in different organs of caper. Of them, flavanoid and glycosinolate are the main components that provide medicinel and aromatic effects. Aroma is the most important feature of the product in processed buds. Moreover, its semi-ripe fruits and young shoots with small leaves are preserved in brine and consumed in various ways [18]. Various probiotics are produced and exported in Dinar (Afyonkarahisar) from leafy young berries. It is sold in small bottles at a high price and there is no shortage of sales prombem for export.

Apart from the very rich food use range of caper, its underground parts (i.e rhizomes), leaves, fruits and flowers are used in the pharmaceutical industry. Capers are used both directly in the treatment of diseases and substance obtained from the plant are used in the pharmaceutical industry due to its anti-aging and diuretic properties as well as having a potent quality. The flower buds of the plant have high antioxidant properties and it is started in have high canserous cells and prevent proliferation. At the same time, it prevents the damages of carsigonogenic substances taken by the body. As a result of the examinations made at the International Cancer Reasearch Institute, capers are among the plants used in the preparation of exracts that exihibit antitumor activity [3].

While the caper fruits have aphrodisiac properties like the seeds. They contain various substances that lelieve pain and the peels are anti-inflammatory. The gel prepared from the fruits is used in the treatment of rheumatism and snake bites. It is stated that the water prepared by squeezing the caper fruits is good for earaches [3]. It has also been reported to be used as a tonic in traditional Iranian medicine [14]. Mash prepared by crushing caper

leaves is used in the treatment of gout [26]. It is known that caper seeds contain active substances that regulate liver, spleen and kidney functions, treat asthma and hemorrhoisd, and also show aphrodisiac properties [18].

The rhizomes of the plant that is generally defined as a root in people are very important. Dried rhizome bark is used as a diuretic and applied to painful areas in paunded form. The rhizome bark has been used for centuries as a laxative, tonic, expectorant, worm reduce, pain reliever, against rheumatism, paralysis, toothache, spleen enlargement, in fresh or dried form. The juice of bark of its rhizomes is used as drops to relieve earaches and getr id of ear parasities [3]. Exracts and pulps obtained from the leaves, hardened branches and roots of the plant are evaluated in the cosmetic industry. In hair diseases, various ointments are made against hair loss, especially due to its rejuvenating feature of oldcells. Capers are also used as additives to obtain the desired fragrance in parfumes [18]. Immature buds from the caper plant are the most commonly used product. Its brine, which is usually made with vinegar and/or salt, has taken its place in the markets. Apart from this, semi-ripe fruits and fresh leavy shoots are dried and used as a spice. Also, jam is made from its flowers in Türkiye. Fleshy leaves are often on *C. spinosa* is found. *C. ovata* leaves are hairy and herbaceous in structure.

CONCLUSION

Today, many products obtained from the *Capparis* taxa, which have the potential to be among industrial plants and whose consumption demands are increasing day by day, are evaluated within the scope of export, contributing to the economy and especially to increasing rural employment. Due to the low production and high collection cost, exported products are mostly produced from imported semi-finished products. This reduces economic input and employment foreseen for the export of the plants. Studies on standartization, clinical trials and exract production and active ingradient isolation in Caper products, which are included in the functional foods group, are lacking.

The rhizomes, leaves, fresh shoots, flowers, buds, fruits and seeds of caper plants are used in food, cosmetics and health fields. Caper is a group of plants that have the potential to enter among the pharmaceutical industry today. Many products obtained from this plant, where the demands are increasing day by day, are evaluated within the scope of export and make significant contributions to the economy and, in particular, to increasing rural employment. Caper's food products are very expensive, almost like medicine. The preparation of these products requires special skills. These products prepared with care are not sold in ordinary grocery stores.

Caper plants and products, which are widely used today, especially in Mediterranean and Middle Eastern cuisines, are spreading all over the world today in terms of globalization, alternative food searches, organic products and medicinal values, and their ecological value, as well as economic value, is constantly increasing [21, 27, 28, 29].

Varieties of caper are evaluated for different purposes such as nutrition, treatment, erosion control, ornamental plant almost everywhere in the world. Although food consumption is not very common in Türkiye, it is very common in the world, especially in Mediterranean countries such as Spain. However, nowadays, when dietary habits start to change for different reasons, the frequency of decorating grocery shelves and restaurant menus is increasing day by day. In most European countries, the fruits, flower buds and end shoots of the plants are used as condiments and spices to decorate and taste food [4].

European countries buy the most caper products from Spain. It is believed that Spain's annual caper earnings are around 20 000 000 euros. This gain can be explained not only by food, but also by therapeutic production. However, we do not know enough about which products for therapeutic purposes are produced in Spain, how they are produced and how they are used. There are also important caper products in Iran. However, since this country operates in a closed circuit and most researchers cannot clearly explain their views, our information is insufficient.

The production of caper in Türkiye is at a level that can meet needs of the sales. However, the increase in collection and other costs also leads to an increase in imports. Imports are mostly temporary canned products that are imported and processed and exported. 41% of the imports are carried out from Uzbekistan, 38% from Kyrgyzstan, 15% from Syria [24].

Caper plants are an important source of pharmaceutical raw materials. It is used for a large number of diseases. The products should be made specific for each disease. However, the products are not standard and clinical trials have not been conducted on patients who use them. It has not been examined from a pharmacological point of view. Chemical analysis of them is not enough. According to the purpose, region-by-region, population-by-population selections should be made and grown on suitable land. The yield and product should be standardized, certification should be made, and research should be conducted on the availability and medical importance of extracts and the shelf life.

The recommendations within the scope of the protection-use balance are as follows:

An analysis of the export and import data of the Turkish Statistical Institute for the last 15 years gives an idea. Burdur province in the Lakes region is the leader in the production, processing and trade of caper.

There are big differences between buds collected randomly from nature due to the lack of conformity of the products to the desired standards, the necessary trainings should be given to the collectors about the timing and collection-drying techniques and awareness should be raised, as the competitiveness of exported kebere products is decayed in international markets.

In order to increase profitability in keber, which is important in international trade, the selection of types resistant to adverse environmental conditions, which contain tight flower buds without thorns in the plant, with high yield per plant, and culturing studies should be accelerated and expanded by nature.

Caper plants have a great importance in the improvement of very calcareous and barren soils and the acquisition of these soils to the economy [16]. These areas can be planted with caper. In the face of the increasing demand of farmers, the available information (seed or steel propagation techniques) should be evaluated and seedlings should be produced and distributed by official organizations [1].

Leaves and buds of the plant are used as functional animal feed because they increase the yield of milk and eggs. Due to the aromatic substances contained in flowers and fruits, they are also an important food source for birds, ants, bees in wildlife [3].

Consumers prefer homemade products instead of fabrication products. However, housewives do not know enough about functional food production from caper. However, pickled buds are made by the best housewives. These women should be trained by providing courses.

According to TUIK 2014 data [23] despite the imported caper products, which are about 8000 tons, the amount exported is also around this. These results and the interviews

with brine producers constitute the opinion that the consumption of plant products is increasing in the domestic market and especially in tourist areas. In addition, the demands from the domestic and foreign markets for caper seedlings continue to increase. The natural ecological structure and climatic characteristics of Türkiye are suitable for caper cultivation. Regulation of caper cultivation, selection of varieties with high product quality and yield in plant selection will increase the added value of products. This will increase the preference of farmers for this plant and the market may be formed at prices that attract bud and fruit pickers.

Pickled products produced from the buds and fruits of the caper plant can be used to prevent and treat serious health problems in terms of the active substances they contain. Brine caper products, whose consumption as a food product tends to increase day by day, tend to be produced continuously in Türkiye as long as there is availability at the raw material point Jul.

Capers are valuable herbal products that have been shown by numerous scientific studies to prevent the toxic effect of drugs used in the treatment of MS, stomach ulcers, stroke prevention, prevention of blood diseases, prevention of fatty liver and regulation of functions of platelets, prevention of heart disease, prevention of proliferation of cancerous cells, bone marrow suppression side effects of drugs used in leukemia, lymphoma and chronic intestinal inflammation thanks to the active ingredients contained in capers [30]. Those who receive chemotherapy should not use herbal medicines, especially pomegranate, grapefruit, red orange, kiwi, lentils, broad beans, lentils, etc. should not consume. It is not clearly known which types of capers are processed and offered for consumption in Türkiye. It is considered that the nutritional content of the products should be determined and recommended to the enterprises that trade the superior varieties, and thus both conducting due diligence in this sector and recommending varieties that will provide advantages in production contribute to the deceleration of the sector as an R & D qualification.

It is believed that the information provided gives an idea to the relevant persons, institutions and organizations.

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REFERENCES

[1] Kan, Y., Arslan, N. (2004): Konya'da doğal olarak yetişen kapari (*Capparis ovata* Desf. var. *canescens* (Coss.) Heywood)'de bazı fenolojik ve morfolojik özellikler üzerine bir araştırma/A study on some phenological and morphological characteristics of capers naturally growing in Konya (*Capparis ovata* Desf var. *canescens* (Coss.) Heywood. *14th Herbal Medicine Raw Materials Meeting,* 29-31 May 2002, Eskişehir, Türkiye: 144-148.

[2] Yıldırım, Z., Bayram, E. (1999): Kapari'nin tohumla, çelikle ve doku kültürü yoluyla çoğaltılması/Through seed, cutting and tissue culture of capers. *TUBITAK, TOGTAG-1691, Ankara.*

[3] Anonymous (1997): Kapari (Gebere). *T.R. General Directorate of Afforestation and Erosion Control Publications, Various Publications Series 2, 28, 29, 30, 32, Ankara.*

[4] Özçelik, H., Koca, A. (2011): Türkiye'de kebere (*Capparis* L. /Capparaceae) cinsi ve ekonomik önemi/Caper (*Capparis*/Capparaceae) genus and economic importance in Türkiye. II. *International Symposium on Non-Wood Forest Product, Sept. 8-10.2011, SDU. Faculty of Forestry, Isparta, Turkey, 32-40.*

[5] Anonymous. (1999): Kapari tarımı ve işletmesi/Caper agriculture and management. T.R. Ministry of Agriculture and Rural Affairs, Ankara.

[6] Baytop, T. (1995): Türkçe bitki adları sözlüğü/Turkish plant names dictionary. *Türk Dil Kurumu Publications*, No: 578, Ankara.

[7] Otan, H., Sarı, A.O., Çarkacı, N. (1994): Kapari (*Capparis spinosa* L.) üzerinde agroteknik araştırmalar/Agrotechnical researches on capers (*Capparis spinosa* L.). *1st Field Crop Congress,* 25-29 April 1994, İzmir, Türkiye.

[8] Davis, P.H. (1965): Flora of Turkey and the East Aegean Islands. *Edinburgh Univ. Press,* vol. 1, 495-498.

[9] Ozdemir, F., Ozturk, M. (1996): Autecology of *Capparis* L. species distributed in West Anatolia. *Turkish Journal of Botany*, 20: 117-125.

[10] Faizanullah Bano, A., Nosheen, A. (2010): Role of plant growth regulators on oil yield and biodiesel production of linseed (*Linum usitatissimum* L.). *Journal Chemical Society Pakistan*, 32: 668-671.

[11] Tansı, S., Culcu, A., Nacar, Ş. (1997): Kebere (*Capparis spinosa* L.) tohumlarının çimlenmesi üzerine araştırmalar/Researches on germination of caper (*Capparis spinosa* L.) seeds). *1st Field Crops Congress,* Samsun, Türkiye, 22-25 Sept.: 681-683.

[12] Söyler, D., Arslan, N. *(*2000): Kebere (*Capparis ovata* Desf.) çeliklerinin köklenmesine büyüme düzenleyici maddelerinin etkisi/The effect of growth regulators on the rooting of Caper (*Capparis ovata* Desf.) cuttings). *Turk Journal of Agricultural Foresty, 4(3): 595-600.*

[13] Çil, Y.M. (2006): Oltu (Erzurum) yöresinde yetişen kapari (*Capparis ovata* var. *herbacea*) tomurcuklarının bileşimi ve salamuraya işlenmesi/Composition of caper (*Capparis ovata* var. *herbacea*) buds growing in Oltu (Erzurum) region and processing into brine). *Atatürk University Institute of Science and Technology, Department of Food Engineering* (Master's Thesis), Erzurum, Türkiye.

[14] Romeo, V., Ziino M., Giuffrida, D., Condurso, C., Verzera A. (2007): Flavour profile of capers (*Capparis spinosa* L.) from the Eolian Archipelago by HS-SPME/GC–MS. *Food Chemistry*, 101: 1272-1278.

[15] Özcan, M. (1999): Ham ve Salamura Kapari (*Capparis* spp.) Meyvelerinin Fiziksel, Kimyasal Özellikleri ve Yağ Asitleri Bileşimi/Raw and pickled capers (*Capparis* spp.) physical, chemical properties of fruits and composition of fatty acids). *Tr. J. of Agriculture and Forestry*, 23(3): 771-776.

[16] Filiz, S. (2002): Batı Akdeniz Bölgesi'nde agroforestry (tarımsal ormancılık) uygulamalarında kullanılabilecek uygun türler/Suitable species that can be used in agroforestry applications in the Western Mediterranean Region. Süleyman Demirel Univ. Graduate School of Natural Sciences (Master's Thesis), Isparta, 230 pp.

[17] Allahverdiev, S. (2003): Kapari türlerinin (*Capparis spinosa* L. ve *Capparis ovata* Desf.) Bartın ilinde kültüre alınması/Caper species (*Capparis spinosa* L. and *Capparis ovata* Desf.) to be taken into culture in Bartın Province'. Project no: TARP-2438, Türkiye.

[18] Coşge, B., Gürbüz, B., Söyler, D., Şekeroğlu, N. (2005): Kebere (*Capparis* spp.*)* yetiştiriciliği ve önemi/Caper (*Capparis* spp.) cultivation and importance. *Bitkisel Araştırma Dergisi*, 2: 29-35.

[19] Bahadır, H., Sakcalı, S., Ozturk, M. (2005): Ecology of *Capparis spinosa. X. European Ecological Congress,* Kuşadası/Turkey.

[20] Artık, N., Nas, S., Yemiş, O., Bakkalbaşı, E. (2008): Kapari (*Capparis* spp.) glukozinolatlarının proses sırasındaki değişimi ve değişik yöntemlerle azaltılmaları/Capers

(*Capparis* spp.) the change of glucosinolates during the process and their reduction by various methods. Project no: TÜBİTAK- TOGTAG 3324, Türkiye.

[21] Bhoyar, M.S., Mishra, G.P., Naik, P.K., Murkute, A.A., Srivastava, R.B. (2012): Genetic variability studies among natural populations of *Capparis spinosa* from cold arid desert of Trans-Himalayas using DNA markers. *Natl. Acad. Sci. Lett.*, 35(6): 505-515.

[22] Yahyaoğlu, Z., Ölmez, Z., Koçak, F. (2001): *Capparis ovata* Desf. (kapari)'da fidan üretim teknikleri ve arazi uygulamaları (*Capparis ovata* Desf. seedling production techniques and land applications in (Capers). Project no: TÜBİTAK-TOGTAG TARP-2050, Ankara.

[23] Anonymous (2000): *T.R. Dış Ticaret Müsteşarlığı, İhracat Genel Müdürlüğü Kayıtları*.

[24] Yılmaz, N. (2008): Kapari, *T.R. Başbakanlık Dış Ticaret Müsteşarlığı İhracatı Geliştirme Etüd Merkezi* (İGEME), TÜİK, Ankara.

[25] Anonymous (2023): https://ascimuratkapari.com/asci-murat-kapari-12-tr.

[26] Ertuğ, F. (2004): Bodrum yöresinde halk tıbbında yararlanılan bitkiler/Plants used in folk medicine in bodrum region. *14th Herbal Medicine Raw Materials Meeting,* 29-31 May 2002, Eskişehir.

[27] Akgül, A., Özcan, M. (1999): Some compositional characteristics of capers (*Capparis* spp.) seed and oil. *Grasas y Aceites,* 50(1): 49-52.

[28] Saadaoui, E., Guetat, A., Tlili, N., El Gazzah, M., Khaldi, A. (2011): Subspecific variability of Tunisian wild populations of *Capparis spinosa* L.. *Journal of Medicinal Plants Research*, 5(17): 4339-4348.

[29] Tlili, N., ElFalleh, W., Saadaoui, E., Khaldi, A., Triki, S., Nasri, N. (2011): The caper (*Capparis* L.): Ethnopharmacology, phytochemical and pharmacological properties. *Fitoterapia*, 82, 2: 93-101.

[30] Bağcı, C., Şimşek, S., Çakmak, E.A., Uyanık, B.S., Solak, M., Yiğitoğlu, M.R., Ozansoy, E. (1999): Keberenin (*Capparis ovata* Desf.) farelerde karaciğer enzimleri ile bazı kan parametreleri üzerine etkisi/Caper (*Capparis ovata* Desf.) (Effect of liver enzymes on some blood parameters in mice. *Genel Tıp Dergisi,* 9(4): 123-125.