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Mini-review

The Panacea Plants for Environment and Humanity: Caper and Ritha

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Abstract

Caper and Ritha are plants which have very important effects on both living beings and natural habitat. They are used in many areas like medicine, pharmacy, cosmetics and agriculture because of their positive features. Caper is compatible with the Mediterranean ecosystem and resistant to drought and high-salinity. When compared to the other most plants, it can remain green for a long time without water even in the summer season. Due to this magnificent property, this plant is effectively used for environmental protection. It has been reported that Caper contains biologically active compounds such as glucosinolates, alkoloids, phenolics, flavonoid, tocopherol and minerals such as sodium, potassium, phosphorus, calcium, magnesium, zinc and iron. Ritha grows in Asia's tropical and sub-tropical regions. It contributes to the environment like Caper because, it has ability to capture the chemical pollution from the soil. So, it helps to improve the quality and efficiency of the land by holding heavy metals like mercury, iron and zinc in the leaves and grabbing lead and cadmium in its fruits. Moreover, it biologically decomposes injurious organic molecules such as hexachlorobenzene and naphthalene. Furthermore, the nectar of Ritha can kill the flies and larvae of Southern cattle mite's species called *Boophilus microplus.*

Keywords: Capers; Ritha; Ecosystem; Antimicrobial effect; Food and minerals.

Introduction

Origin and botanical information of Caper and Ritha

Caper belongs to Capparaceae family and is known with various names in different countries. For instance, it is known as Geberotu in Turkey, Caper in England, Gollaro in Pakistan, Kabbar in Saudi Arabia and Alcaparro in Spain [1]. Caper has more than 350 types in many different regions of the world; only two species of Caper such as *Capparis spinosa* and *Capparis ovata* are naturally grown in Turkey [2, 3]. Excavations show that history of Caper comes from the Stone Age [3]. Caper has grey-brown, liver shaped seeds and grows in East of the Caspian Sea, Portugal, Egypt, Iran, Crimea, Armenia, Canary coast and the Atlantic coast, North and East Africa, Madagascar, Australia Southwest and Central Asia, Greece, Cyprus and Turkey [4-9].

Generally, a fully grown Caper is approximately 50-100 cm in height, and 2 m in width with thick roots and hair [5, 10]. The plant starts its first development in spring and blossoms from its roots to the bottom in May by continuing its development in entire summer [11]. Efflorescence in flowers happens after the dawn and closes by sunrise. The leaves of Caper fall in winter and wilt. The unopened flower buds should be picked on dry days. Harvesting is carried out regularly throughout the growing season and the collect cuttings are made in February, March or April. If the mature Caper plant has to be transplanted to other zone, wet winter and spring

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seasons are more suitable. Although the fresh Caper seeds germinate easily, this germination is difficult for dried Caper seeds [5, 12].

Comming to Ritha's origin and its botanical feature, it is one of the most important trees and a member of the *Sapindaceae* family in Asia's tropical and sub-tropical regions such as India, Australia, Ethiopia, Mediterranean countries and New Zealand. It is also known with various names such as soapnut, soapberry, washnut, reetha, aritha, dodan and doadni in different parts of the world [13]. Deciduous and evergreen species of Ritha have 150 genes and 2000 different types, especially as *S. emarginatus*, *S. mukorossi*, *S. trifoliatus*, etc [14-16]. Ritha is often 15-20 m in height, and 60-80 cm in width with short bottom and acute leaves. In the period of May-June, they have greenish yellow flowers while in the period of June-January they have mature fruits. These fruits have hard stones in the core and are sized around 1.5 to 2.5 cm (Fig .1 and Fig. 2) [17, 18].

Figure 1. **The tree of Ritha**

Figure 2. **Seeds and cores of Ritha**

Contents of Caper and Ritha

Chemical studies of Caper and Ritha have shown that they contain several beneficial chemical compounds. Different parts of these plants are used in medicine, pharmacy, cosmetics and agriculture.

Caper is used in traditional medicines to cure various illnesses due to the presence of beneficial compounds. Researchers reported that the chemical contents of seeds, buds, flowers and fruits of the caper plant (Fig. 3 and Fig. 4) contain high amounts of hydrocinnamic acid, alkaloids, phenolic acids, tannins, fatty acids (fatty acid composition are given as 42 to 46% oleic, 45 to 51% linoleic 7 to 9% palmitic and stearic acids), reducing sugars, polyphenols, flavonoids (such as derivatives of quercetin and kaempferol), carotenoids, starch, indole and derivatives of aliphatic glucosinolate. Furthermore, the plant also contains sodium, potassium, phosphorus, calcium, magnesium, zinc and iron as well as raw protein, fat, cellulose, and fiber. Thus, it is considered as a source of energy [2, 10, 19-24]. It also contains small amounts of bismuth, cadmium, lithium, lead, and selenium [25]. It has also been reported in the literature that the Caper leaves stock the fat components [6]. The essential oil components can be stored up by Caper leafs because of the active ingredient present in chemical content of Caper plant. It is used in medical and cosmetic industry and is widely used in the food industry due to its rich content of nutrients. In addition, it is commonly used in the environmental landscaping because of its physiological features [11].

Several studies based on chemical composition of Ritha have shown that there are triterpenoids saponins (oleanane, dammarane, tirucullane), sugar, natural resins, flavonoid, fatty acid ester [13, 14] (such as a linoleic, palmitic, stearic, oleanolic, sapindic), trifolioside, genin, phenolic acid (*cis*-*p*-coumaric acid, *p*-hydrobenzoic acid, sinnamic acid and *etc.*), steroids and carbohydrates [16] in its chemical structure.

Figure 3. **The flower of Caper (a) and faded Capper (b)**

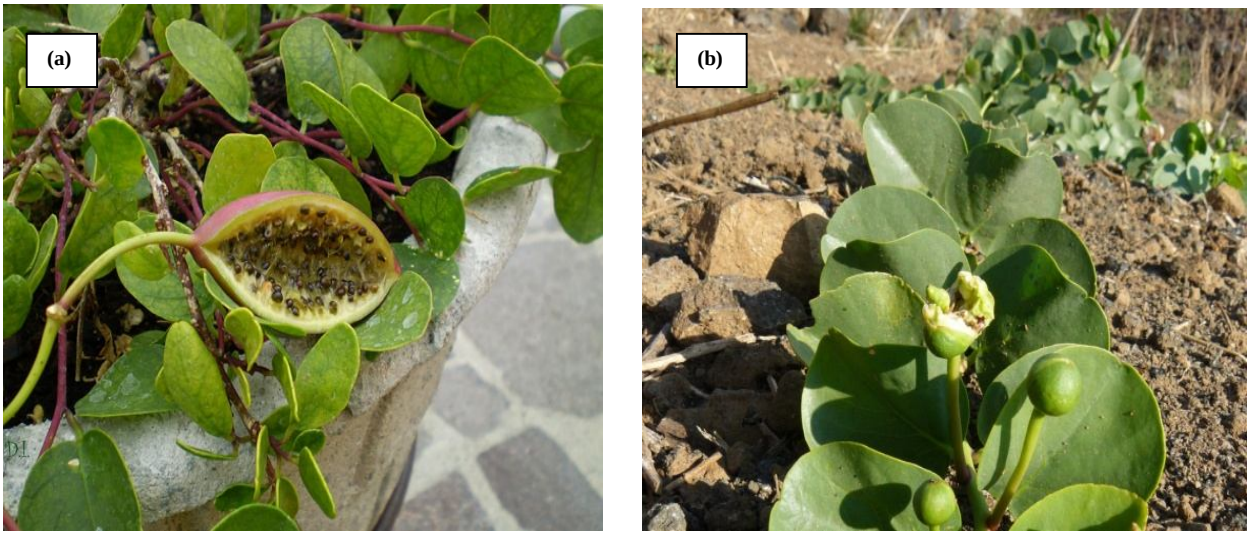

Figure 4. **Seeds, buds, fruits and plants of Caper (a and b)**

Industrial Applications of Caper and Ritha

Existence of plants is as old as the human civilization. Owing to their variety of features, plants have been used for thousands of years in many fields. Among these fields the medicine, pharmacy, cosmetics and agriculture are prior. Caper and Ritha have also drawn attention in these areas recently. Thus, the importance and use of Caper and Ritha in various industries have been discussed in this review.

Caper, one of the two plants, is an enormous source of protein as well as very significant for the living beings due to the presence of many elements in its body structure. This is why it has wealthy nutritional values [10-23]. It is used for raising livestock [19].

It is known that the blossomed flowers of Caper have been used as food additive to give a different taste since early ages [22]. Caper is made from blossoms and young flowers waited in vinegar, which produces different aroma that is similar to mustard and black pepper [23]. Caper sauce is used in fish, meat, pizza and salads to furnish taste [3, 26]. Also, salted and fermented forms of Caper are fairly popular in food trade of the world. Its pickle is made and exported in many countries like Turkey, Canary Islands, France, Morocco, Spain and Italy (Fig 5) [7, 9, 11, 23]. The fresh Capers increase the fiber intake; however, sodium contents are increased in the packing products of them. Cooking with Caper has not got more calories since each tablespoon contains just about two calories. But, due to their high salinity content, consumption of Caper should be controlled [27].

Figure 5. **Pickled Caper**

The first use of Caper due to its medicinal and aromatic properties comes from Sumerian, Ancient Greek and Romans to cure diseases [8]. The pharmacological research on Caper revealed that the leaves, flowers, buds, fruits and roots of it possess anti-oxidant, anti-allergic, anti-inflammatory, anti-rheumatic, anti-viral, anti-nociceptive, analgesic, anti-bacterial, anti-diabetic, anti-pyretic, anti-hyperglycemic, hypolipidemic, anti-spasmodic, antibiotics, anti-leishmanial, anti-hepatotoxic, anti-proliferative and anti-fungal effects. It has a cell renewal effect as well as works effectively as diuretic and renal sanitizer, worm remover, swelling reducer, expectorant, appetizer and wound healer. It is helpful in lowering blood pressure, increases sexual stamina, and is used as a laxative. On the other hand, it has been reported that it played an active role in the treatment of certain diseases such as heart disease, kidney disorders, gout, hardening of the arteries, rheumatism, sciatica, stomach and hemorrhoid ulcers [2, 3, 9, 22, 23, 26, 28-33]. Furthermore, it is known that the boiled crust of Caper is used to cure anemia or discharge of joints. Additionally, the flowers and buds of Caper can be effectively used as kidney disinfectant and to improve liver function [7]. Besides it improves the immune system, avoids costiveness and is also good in stabilizing blood cells [34].

It is known that Caper is used as a firming agent, tonic and an ointment to cure hair loss in cosmetic industry owing to its feature of revitalizing the old cells. Moreover, it can be used as a perfume additive in the perfume industry in order to get desired odors [2, 6, 22, 35]. It is also reported that Caper can serve as UVB radiations protector to healthy people and can prevent the burns and redness on the skin that probably occur due to the UV radiation; on account of these features it is also used to control wrinkles. In some countries, it is known as a natural aphrodisiac [36].

Ritha is used in many industrial fields such as cosmetics, food and medicine in order to serve people because of the presence of diverse components in its chemical structure.

Ritha's seeds contain 32% raw protein and also supply 44% of the amino acids such as aspartic acid, glutamic acid, lysine, serine, glycine, arginine, alanine, valine, leucine/isoleucine, proline and tryptophan which are required by human body. Leaves of Ritha are one of the essential food sources for the animals [37, 38]. Thus, it is as an efficient food resource for humans and animals [38].

As one of the world's oldest medicinal plant cultures [16], Ritha has been photo-chemically and pharmacologically scanned in the literature. It is revealed that the plant shows liver protecting, fewer dropping, pain killing, expectorant, emetic, anti-microbial, anti-bacterial, anti-oxidant, anthelmintic, anti-nociceptive, anti-protozoal and cytotoxic effects. It is capable to

treat many serious diseases such as cancer, ulcers, asthma, eczema, psoriasis, epilepsy, migraine, diabetes and excessive salivation when used as antioxidant, antiviral, antidiabetic and antitumor agents in pharmacology [15, 16, 39-46]. For instance, Ritha's fruit and roots are used to treat headache. The roots of Ritha are used in the treatment of gout and rheumatism as expectorant and sedative while the powder that is made by its seeds is used in the treatment of dental caries, arthritis, colds, constipation and nausea, the leaves of the tree are also used for joint pain alleviation [13, 16]. It is also known that this plant is widely used as the natural method of birth control as it contains saponins which are sperm reducing agents [13, 47, 48].

Since the studies have shown that Ritha has no toxic effects on the human tissue and especially on the eye tissue, Ritha is used in the cosmetic industry [16, 49]. As a natural surface active substance, Ritha has the quality of cleansing greasy skins [13, 16]. Once this feature of Ritha was discovered, the cosmetic industry started to use Ritha in the production of soaps and shampoos, skin stain removers, firming and tonics, especially hair tonics which are based on plant essences [50, 51]. It is also used for treatment of head lice and bran, support and development of hair health, etc. Ritha is also used in the components of some hair dyes and body lotions in cosmetic industry [15, 16].

Since ancient times, Ritha, which has high amount of saponin has been used for car, glass and paint cleaning purposes and also for polishing valuable items made from gold and silver by Indian jewelers [13, 16].

Environmental Effects

Plants play essential roles in environment. As a critical part of the ecosystem, plants perform various functions like providing oxygen, reducing pollution and preventing soil erosion etc. for the sustainability of life on the world.

Both Caper and Ritha play especially a big role for preventing the soil. Caper, compatible with Mediterranean ecosystem, drought and high-salinity-tolerance and perennial like shrubbery, can do this by its resistible structure with roots going through the bottom and spreading to the soil by herbaceous arms (Fig 6) [7, 11, 12, 52]. Similarly, it has physiological benefits, for example its hard leaves prevent wind erosion as well as it is resistant to fire. As a matter of fact, it is reported that it is used in drought and/or half drought step field and lousy soils [11, 53-55]. Also the flowers of Caper can resist excessive salt and lack of water and can keep themselves green (Fig 1 and Fig 4) [11, 56, 57]. It is also used in landscaping architecture as foliage plants owing to its marvelous features [10, 35].

Figure 6. **Natural spread of Caper in drought slope**

Llike Caper, Ritha can prevent the soil erosion with only its roots like other trees. Both chemical structure and physical features of Ritha have positive impacts on the surrounding environment and living species. For instance, the nectar of Ritha plant can kill flies and fishes [16, 58], it is also important for the protection of animals health because of its lethal effect on larvae of Southern cattle mite's species called *Boophilus microplus.* This type of larvae threatens the animal health as it can be easily transported to the bovine animals such as cow, cattle, ox and etc [59]. Also, Ritha essence can be used to produce eco-friendly and natural surface active substances. These natural surface substances are safely used for the decontamination of soil from hazardous waste. Thus, Ritha helps to improve the quality and efficiency of the land and also contributes to the environment.

In several studies it is revealed that Ritha is a better emulsifier as compared to the other surface active substances because of water-kerosene mixing and herbal oil in order to dissolve the hydrophobic organic substance from the soil [50, 60]. This means that some organic substances like fat molecules, hexachlorobenzene and naphthalene are decomposed by this plant. The residual contaminations are consumed by anaerobic microorganisms. Consequently, Ritha has a quite interesting ecological circulation; it is used by these anaerobic microorganisms during the process of consuming the pollution as a carbon and source of energy. Thus, the increase in concentration of surface active substances leads to the increase of anaerobic microorganisms which ultimately leads to the faster process of purification of the soil [49, 60-62]. Moreover, it is determined that the extracts produced by the seeds of Ritha remove the organic pollution in wastewater [63]. In a similar manner, Ritha's leaves have the ability to grab the heavy metals like mercury, cobalt, chromium, iron and zinc, and its fruits resolve the inorganic pollution of lead and cadmium [64-66].

Known as middle shrubbery with its strong and endurable structure, Ritha plays a big role in preventing soil erosion and protecting the environmental and ecological balance [17]. Because of that, it can be called natural barrier and can be easily used for the prevention of wind and water oriented natural disasters. A practicality study related to this conducted on the coasts of Bangladesh revealed that it can be safely used on the coasts where there is the risk of Tsunami [67].

Characterized as the source of carbon for drought soils and forests, Ritha can also be used in the production of biodiesel. This adds a new feature to it and makes the plant the centre of attraction for researchers [17].

Conclusions

Breeding of Caper has been started in 1970s in Italy and Spain, particularly. Caper cultivation is decreased in Italy; however Turkey and Morocco are the leaders in cultivation and exporting Caper to England, United State of America and Europe today. Caper cultivation is quite interesting because of low starting cost and higher profit margins even in ordinary lands [68].

Caper can easily grow in humidity-free and salty conditions. Additionally, it can live between 6 and 8 pH levels and grow itself in drought places. However, its blossom level is low when there are not proper conditions. Caper is used as a source of nutrition in many countries. In Turkey, the plant has been grown and exported to different countries since 1996. However, literature survey reveals that Caper was imported in 2004 from different countries [54].

Being a beneficial plant with a nutrient flower makes Caper agriculturally and medically significant. Hence, it gained an economical significance internationally [11]. Preventing soil and wind erosion, and having a late-flammable features, made it attractive for environmentalists, and it is used for landscaping purposes [69].

Caper is energy and crude protein source for both human and animals. Additionally, it contains potassium, calcium, magnesium, zinc and iron. The seeds of C. *spinosa* and C. *ovata*, known as species of Caper grown in Turkey and are also highly rich in mineral contents of Na, Mg, Fe, Zn, K and P. Owing to its rich mineral and protein contents it has nutritive value. It should be noted that the soil, fertilizers and other cultural factors affect the presence and quality of these minerals in Caper plant [70].

Water and soil are two of the most important sources of the earth. The rapid increase of the population in the world increases the speed of consumption of natural sources. Caper, grows in Mediterranean region and needs little water, creates a new chance to protect the natural sources [35], and enhances the countries' economy. Caper should be consciously used for this purpose and usable water and productive soils should be left for the next generations.

Ritha is a plant which has positive effects on the environment just like Caper. The surface active substance, obtained from the plant, has a surface intensity in critical mycelial concentration 0.017gm/cc and 38mN/m in aqueous solution. This

fact shows that its extracts are economically surface active substances [50].

The extract of Ritha seeds serve as a natural extraction system following ionic exchange chromatography phenomena. The cationic and anionic fractions of them remove almost 95-98% of organic pollutants.

Ritha can be used as a natural cleaner as it is easily available for the prevention of environmental pollution. It also contributes to the ecological system by preventing many natural disasters due to its strong physiological structure. It is frequently used in the food industry as it is the natural source of carbon and energy for living things. Ritha can qualify as a natural wealth to be used in the pharmaceutical industry, cosmetics, treatment of many diseases and in the production of biodiesel.

It is possible to say that Ritha's seeds, grown in Asia and especially in India, spread *via* wind. However, the practices like pouring acid, hot water; turd mud on Ritha's seeds significantly fastens its growth [71]. Because of this, if Ritha's growth schedule is planned to be raised according to the need, increase in the germination through the use of these methods will produce fruitful results.

Ritha, which is considered important for the protection of biodiversity and ecological balance, can be used as a natural treatment system to improve forest life standards and national income in wetland areas. However, along with the positive aspects, the negative aspects of the plant like destroying the ecological balance should also be considered. Because of the fact that the plant negatively affects most of the organisms in water and even shows toxic effects on species of fish, it is known that no species of fish is found on the coasts where it grows. That is why Ritha should not be grown in the areas where it will show negative reaction.

Ritha can also be used to control pregnancy. When people use this natural pregnancy control plant, they should evaluate the relationship of gain or loss very well because Ritha has a strong effect as a sperm killer in the prevention of reproductive systems of organisms.

In conclusion, we are very pleased to declare that Caper and Rita are excellent plants.

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