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Review Article

Cultivation and utilization of "Greek mountain tea" (*Sideritis* spp.): current knowledge and future challenges

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Abstract

The Greek ecosystems consist of a variety of plant species, of which a large percentage have aromatic and medicinal properties. Aromatic and medicinal plants play an important role in the health of people worldwide, especially in developing countries. The present review focuses on *Sideritis* spp. that is an important plant with an increased attention in the last years for its wide range of uses and especially due to its medicinal properties. The location and conditions of the areas that can be used for its cultivation should be similar to those of its natural habitat in order to keep the product quality. It is important to mention that both the yield and the lifetime of the crop depend to a large extent on cultivation care. Furthermore, it is noteworthy that *Sideritis* spp. fetch an auspicious potential for improvement of memory in healthy adults as well as in dementia patients. Currently, the demand for these plants and their derivatives has increased because they are natural, eco-friendly and generally recognized as safe products with high economic value. Therefore, it comprises an important commodity for extensive cultivation in Greece in the near future. Hence, this emphasizes the need of extensive study for reporting the additional information on the aromatic and medicinal importance of *Sideritis* spp.

Keywords: Cultivated practices, Ecology, Diversity, Compounds, Essential oil, Sideritis

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Introduction

Since ancient times, medicinal plant species have been of great importance in people's lives, becoming a component of curative treatments. Hippocrates, the so-called father of medicine, was one of the first to observe and study the therapeutic properties of the plants. Then followed by Theofrastus, who was also considered to be the father of botany (Gurib-Fakim, 2006) and Dioskouridis (Vokou et al., 1993; Touwaide, 2005).

Medicinal and aromatic plants play an important role in people's health throughout the world, especially in developing countries. Human societies throughout the world have acquired a wide range of empirical knowledge, mainly over the centuries, in the medicinal uses of plants. According to Rates (2001), a medicinal plant is defined as any plant used: (a) to alleviate, prevent or cure a disease or modify a physiological or pathological process, and (b) as a source for the production of medicines. A total of 422,000 plant species have been recorded worldwide, of which 12.5% have been reported to have therapeutic properties, while 25% of the medicines in the modern pharmaceutical industry have as a raw material plant species (Schippmann et al., 2002).

The Mediterranean Basin is considered to be a "Global biodiversity hotspot" (Beltran et al., 2014). The geographical position of Greece combined with the interactions between the biotic and abiotic factors has designated Greece as a region of great importance regarding the aromatic and medicinal plant species that provide therapeutic, economic and environmental benefits (e.g. *Sideritis* spp., *Origanum* sp., etc.) (Katsiotis & Chatzopoulou, 2015). *Sideritis* constitutes one of the most important aromatic plants worldwide. *Sideritis* internationally known as mountain tea - includes about 140 species, many of which are native to Greece. The genus *Sideritis* is polymorphic and taxonomically complex because of the frequent hybridization that occurs in the natural populations (Kassi et al., 2004; Kalivas et al., 2014). The native species in Greece belong to the genus *Sideritis*, sect. Empedoclia BENTHAM and are the following: *Sideritis athoa* (Athos's tea), *Sideritis cladestina* Chaub. & Borry (Taygetos's tea), *Sideritis euboea* Heldr. (Euboa's tea), *Sideritis raeseri* Boiss. & Heldr. (Parnassos's tea), *Sideritis scardica* Griseb. (Olympus's tea), *Sideritis syriaca* L. syn. *S. cretica* Sibth. & Sm. (Malotira) (Chatzopoulou, 2012; Shtereva et al., 2015; Latté, 2016). It is noteworthy that studies focusing on cultivation, ecology and utilization of "Greek mountain tea" (genus *Sideritis*) in important and widespread Mediterranean agro-ecosystems, are scarce. Hence, the main aim of our study is to present information about the cultivation and the aromatic and medicinal importance of "Greek mountain tea" (genus *Sideritis* spp.) and future challenges

Sideritis types and plant morphology

Species of the genus *Sideritis* belong to the Lamiaceae family of the order Lamiales. This genus includes perennial plants, most of which are native to the Balkan Peninsula.

The most important native species of *Sideritis* in Greece are presented in the below Table 1.

Crop ecology and cultivation practices

Wild populations of *Sideritis* spp. thrive in mountainous areas of high altitudes, over 1000 meters, usually on sunny slopes with a high inclination. Furthermore, it seems to occur on rocky soils with a sand-clay composition, a wide range of pH: 6.9-8 and a low content in nutrients. Also, the high temperature at daytime and the low temperature at night, at such habitats, seems to have a positive effect (Koutsos, 2006). Plants of this genus are adapted to grow in their natural environment. Thus, due to the particular ecological requirements of plants, the selection of the appropriate habitat for cultivation is particularly important. The location and conditions of the areas that can be used for cultivation should be similar to those of their natural habitat in order to keep the product quality. Under these conditions, cultivated plants - already stressed because they are genetically adapted to a different environment - are less vulnerable to pests and diseases, and require less input and cultivation practices. Thereby, organic farming becomes more possible and economical (Katsiotis & Chatzopoulou, 2015).

Field preparation and planting

Excessive soil treatment is not necessary for installation. The preparation of the field is carried out in the summer with a deep plowing shortly before planting, depending on the ground. Then, a milling or light plowing and a disc harrowing follows, mainly to control herbaceous plants and to facilitate planting (Goliaris, 1999).

The planting takes place in the middle of autumn after the first rain period or alternatively at the beginning of spring. As far as the Greek conditions are concerned, it is preferable in the autumn after the first rainy season. The planting density is about 17.000-29.000 plants per ha (0,70-1 m between the lines and 0,50 - 0,60 m on the lines) (Maloupa et al., 2013). If the planting take palace in spring and the soil is dry it is suggested that irrigation of the new plants be carried once or twice, in order to minimize the loses.

Table 1. Morphological description and plant distribution of *Sideritis* species (Koutsos, 2006; Deligeorgidis et al., 2008; Evstatieva & Alipieva, 2012; Dordas, 2012; Dimopoulos et al., 2013; 2016).

Species	*Morphological description*	*Distribution*
Sideritis clandestina (Bory & Chaub.) Hayek (Taygetos's tea)	Perennial herbaceous plant, up to 40cm high. Its stem is simple or branched, and the leaves are fuzzy, with a shadowy hue, oblong - speared, intact or saw - shaped, the lower leaves with petiole and the upper epiphytic or with petiole. The calyx is bell-shaped, covered by dense bristles.	Peloponnisos
***Sideritis perfoliata* subsp. *athoa* (Papan. & Kokkini) Baden** (Athos's tea)	Native to mount Athos and Samothraki. It is a perennial herbaceous plant, up to 40cm high. The stem is upright, straight or branched and woody at its base. The leaves are lanceolate and flowers are yellow in color. Also, the calyx is bell shaped.	North Aegean islands & North-East Greece
***Sideritis curvidens* Stapf**	Annual herbaceous plant, up to 5-15cm high. A white thin fuzz covers all the parts of the plant. With one or more straight green stems. The flowers are white and rare purple.	East Aegean islands – present, East Central Greece, Ionian Islands, Kiklades, Kriti and Karpathos, North Aegean islands, North Central Greece, North-East Greece,Peloponnisos, Sterea Ellas, West Aegean islands
***Sideritis euboea* Heldr.** (Euboa's tea)	Perennial herbaceous plant, up to 30-50cm, with a dense and white fuzz all over the whole parts of the plant. Its stem is strong, simple or sometimes branched. The leaves are elongated and the flowers are yellow colored. The calyx is tubular which ends in teeth and has fluff.	West Aegean islands
***Sideritis lanata* L.**	Annual herbaceous plant, with white thin fuzz all over the parts of the plant. The flowers are white with black spots.	East Aegean islands, Kiklades, North Aegean islands, North-East Greece, Peloponnisos
***Sideritis montana* L.**	Annual or biannual herbaceous plant, up to 35cm. The stem is upright straight and woody in the base. The leaves are simple and the flowers are yellow.	East Aegean islands, East Central Greece, Ionian Islands, North Aegean islands, Peloponnisos, South Pindos, Sterea Ellas, West Aegean islands
***Sideritis perfoliata* L.**	It is a perennial herbaceous plant, up to 30- 50cm high. The stem is green colored, straight or branched and woody at its base. The leaves are lanceolate and flowers are yellow.	North Aegean islands, North-East Greece, South Pindos, North Pindos,
Sideritis purpurea Benth.	Perennial herbaceous plant up to 30cm high, with lanceolate leaves. The flowers are yellow, white or purple.	East Central Greece, Ionian Islands, North Central Greece, North-East Greece, Peloponnisos, South Pindos, Sterea Ellas, West Aegean islands
Sideritis raeseri Boiss. & Heldr. (Parnassos's tea)	Perennial herbaceous plant, up to 40cm high, with a thin stem and lanceolate leaves and yellow colored flowers. The calyx ends in teeth.	North Central Greece, Peloponnisos, Sterea Ellas & South Pindos
Sideritis scardica Griseb.(Olympus's tea)	Perennial herbaceous plant, with a simple or branched stem. The leaves are lanceolate, intact or slight saw - shaped with white fuzz. The flowers are yellow colored and the calyx is probably bell-shaped and covered with dense bristles.	North Central Greece, North Aegean islands & East Central Greece
Sideritis sipylea Boiss.	Native to mounts of Samos, Chios, Lesvos and Ikaria. Perennial herbaceous plant. A dense white fuzz covers all the parts of the plant. The flowers are yellow with some brown spots.	East Aegean islands
***Sideritis syriaca* L.** (Malotira)	Perennial herbaceous plant, up to 50cm. Its stem is usually simple, strong, upright, covered with dense white fuzz. The leaves are oblong - lanceolate, and the flowers are yellow colored. The calyx is tubular and ends in teeth.	Kriti & Karpathos

The propagation materials that are used are the cuttings and the seedlings. The cuttings are taken from older crops which have maximum production. The parent crops must be healthy and the cuttings are taken a couple of days before the planting. On the other hand, to generate the seedlings is a time cosuming process. During late summer, especially in August producers should collect the seeds from the blossoms of their parent crops. Then the seeds are placed in polystyrene or plastic trays with potting soil. Irrigation is recommended every day for the first ten days and then every two or three days depending on the weather. In 60-70 days (middle November) the seedlings will be ready for transplanting in the field.

When cuttings are used, planting is done manually only. Nevertheless, planting can be done with tobacco or tomato transplanting machines when seedlings are used and large non-sloping fields are to be planted (Mylonas, 2017).

Soil cover is suggested only in the first and second year of plantation, because in the next few years the plants will have covered the surface of the field and therefore the herbaceous plants will not be able to find space or light to grow (Koutsos, 2006).

Fertilization – Irrigation

During November, the basic fertilization takes place, with a compound fertilizer (12-12-17 or 15-15-15 about 250 kg per ha), which is dispersed among the plants. Also in late February to early March a spring fertilization is used with some nitrogen fertilizer (40-0-0 or 20-0-0 with 25 or 50 kg per ha).

In recent years, there has been a trend in April, during the period of intense plant growth, to apply nitrogen foliar lubrication in order to aid growth and maximize production. In total, 40-50 units of nitrogen, 30-37 units of phosphorus and 37-42 units potassium per ha are administered. In case of organic farming, it is suggested to apply well-digested and sterilized manure, compost and other organic products approved in organic farming. In total, 20-30 units of nitrogen and 10-15 units of phosphorus and potassium are administrated per ha in organic farming.

Sideritis is primarily a type of perennial dry crop, but it seems to benefit from small doses of irrigation. In this way, the water can be absorbed quickly and the root system remains dry. After extensive research, we came to the conclusion, that the most effective method of irrigation is drip irrigation because it provides uniform humidity in the root area of the crop plants, leaving the roots of the herbaceous plants dry. It is suggested to irrigate the crop two or three times during April. In 60-70 days (middle November) the seedlings will be ready for transplanting in the field (Mylonas, 2017).

Another research about the effect of substrate type and irrigation frequency on growth of *Sideritis athoa* and other Mediterranean xerophytes was carried out (Papafotiou et al., 2016). Two types of substrate with 10 cm depth were used, grape marc compost: perlite: soil: pumice and grape marc compost:perlite:pumice and two irrigation frequencies during the dry period, every 5 days (normal) and every 7 days (sparse). According to this study, the growth of plant diameter of *S. athoa* was promoted by the soil substrate during the first dry period, whereas at the end of the second dry period plant diameter was not affected by the substrate type. Irrigation frequency did not affect the diameter of *S. athoa*.

Herbaceous plants management

In this crop, during the vegetative growth of plants, is a particular competition between crop plants and herbaceous plants is observed. Therefore the need to control herbaceous plants is necessary, in order to obtain production and maintain plant productivity for several years. It is a fact that, in the first years of plantation there are usually annual herbaceous plants, while in older plantations both perennial and annual herbaceous plants are observed, that grow between the growing plants. The main herbaceous plant species that are found in *Sideritis* fields come from two main families the Asteraceae and Poaceae. The most common herbaceous plants are the *Senecio vulgaris* L., *Sonchus* spp., *Sinapis arvensis* L. and *Vicia spp.* But the most durable and difficult to control herbaceous plants are the *Cynodon dactylon* (L.) Pers., *Echinochloa* P. Beauv. and *Cyperus rotundus* L. from Poaceae family.

The most effective but at the same time most costly, tedious and time consuming way of getting rid of the herbaceous plants is the hoeing. Hoeing is done manually with the use of hoe and carpentry. Usually the hoeing starts in September and continues without stop until the beginning of the harvest; until the beginning of May (Mylonas, 2017).

Harvest - Yield

The best harvest season is the stage of full blooming, when the flowering stems begin to be wooded, because it seems that the leaf's content in essential oil, and thus in aroma is the largest (Koutsos, 2006).

Depending on the conditions of each year, usually in middle May, the lower altitude fields are in the harvest stage. So, the harvest starts from lower to higher altitudes. During harvest, the entire inflorescence is cut and underneath a part of the stem, about 10-15 cm long, with a knife, scissors or sickle (Mylonas, 2017). *Sideritis* can be cultivated in the same field for 5-8 years from which both 2nd and 3rd year are the most productive. From the 4th year and onwards the production begins to decrease. It is important to mention that both the yield and the lifetime of the crop depend to a large extent on cultivation care. In a full year of production, yields in dry product reach 1000-1500 kg dry weight per ha (Dordas, 2012).

Drying process

Then the quantity of tea plants that are harvested after bundling is transferred for drying to specially designed sheds in order to obtain the best greenish-yellow color. The basic principle is to place the plants as quickly as possible (after the harvest) in a dry, warm place, without direct sunlight, with good ventilation and dust free. Drying in the sheds is done either by spreading or in small bundles hanging upside down in a shady, cool place. Drying takes 5-8 days without the use of technical means. If the drying does not take place in shade or when the type of metal of the shed is not the appropriate, then the plants become discolored and their quality is degraded (Gabrieli and Kokkalou, 1990). There is also a degradation of quality and appearance when high atmospheric humidity prevails during drying, i.e. when it is raining. Another common way of drying the plant material-, (large quantities of harvested tea plants in industrial applications), is by using ovens into which a stream of air is fed. The plant material is placed in special panes with small holes so as to allow hot air to circulate inside the oven and to achieve the drying of the plant at low temperatures and in a short period of time. Furthermore, this method prevents the loss of active ingredients and -/- or their spoilage (Mylonas, 2017).

Utilization of *Sideritis spp.*

Uses and benefits

Species of the genus *Sideritis* has been used since ancient times as a therapy because of the anti-inflammatory, anti-rheumatic and antimicrobial actions (Vasilopoulou et al., 2013; Cinar et al., 2009). The mountain tea is one of the most well-known herbs of the greek nature, with many beneficial properties. The prepared beverage is preferred because of the beneficial action in colds and inflammation of the upper respiratory system, while recent surveys have shown that contributes to the fight against Alzheimer's disease (Hofrichter et al., 2016). It is reported that plants of genus *Sideritis* contain terpenoids (iridoids and caurans), phenolic derivatives (flavonoids, phenolic acids, phenylethanoic glycosides), fatty acids (Paliogianni, 2007) and mineral content (Romanucci et al, 2017). Chemical analysis has shown that the extract of *Sideritis* plants contains three main classes of active ingredients: Essential oils, Diterpenes and Polyphenols (Linardaki, 2007). But most researches focus on the Essential oils.

Essential oils

The first studies on the recognition of the oils constituents start mainly at the beginning of the 80s. The first paper was published in 1986 entitled: The composition of the essential oil in the Greek mountain tea (*Sideritis* spp.) (Koedam, 1986). As plant material pieces of the species *S. clanderstina* and *S. raeseri* were used and in order to get the oil the method of hydroapostaxis was used, followed by analyses chromatography and mass spectroscopy (varian MAT 445 GC MS system). The results of this procedures gave essential oil for the species *clanderstina*, 0.09% and for *raeseri* 0.12% (on dry drogue).

The chromatographic analysis of the two species resulted in giving over 70 different ingredients from which 50 were identified. It is worth mentioning some of the conclusions of this chromatography, especially for *S. raeseri*. In *S. raeseri* the substances bpinene, a-pinene, a-humulene, limonene, b-caryophyllene and germacrene were found in this order (each one with a percentage more than 5%). It is also remarkable that in the study of Papageorgiou et al. (1999) the substance was found as a main component of the oil *S. raeseri* (2.2%) while in the study of Koedam (1986) its percentage is 0.18%.

Moreover, Komaitis et al. (1985) and Romanucci et al., (2017) state that the essential oil constituents of *Sideritis cretica* Boiss are limonene, β-phellandrene, γ-terpinene, p-cymene, hexanol and other compounds which seem to have potential chemotherapeutic applications. Also, in another study two novel acylflavones were found, identified as isoscutellarein 7-trans-p-coumarate and apigenin 7-,40 –bis (trans-p-coumarate) and were isolated from the diethyl ether extract of the *S. syriaca* aerial parts. The extract is also phytochemically characterised by the presence of four known acylated flavone glycosides [apigenin 7-O-

(trans-p-coumaroyl- b-D-glucopyranosides)] and three known acetylated flavone glycosides. Also, in *Sideritis cretica* the most abundant phenolic acids were gallic acid, ferulic acid and caffeic acid, catechin and epicatechin, quercetin, according to Proestos et al. (2008) and 5-caffeoylquinic acid, lavandulifolioside, verbascoside, isoscutellarein, hypolaetin, isoscutellarein and other compounds in *Sideritis scardica*, *Sideritis raeseri*, *Sideritis syriaca*, *Sideritis taurica* and *Sideritis lanata* (Stanoeva et al., 2015). Also, Tirillini et al. (2011) analyzed the oils from leaves and inflorescences of *Sideritis syriaca* L. grown and harvested in Italy. The major components in the oil from leaves contained hexadecanoic acid (31.1%), epi-α-bisabolol (14.5%), benzyl benzoate (7.5%), and (E)-caryophyllene (6.4%), while in the oil from the inflorescences contained epi-α-bisabolol (25.7%), benzyl benzoate (17.7%), hexadecanoic acid (7.8%), β-caryophyllene (7.3%), and (Z)-α-bisabolene (6.0%).

The second study involved with *S. raeseri*, concerning the composition of its essential oil, was conducted with the collaboration of the pharmaceutical Dept. of Messina University of Italy and the laboratory of Athens University (Galati et al., 1996).

The plant material was collected from Mt Parnassos on an altitude of 1800 m in July 1994 and the blooming parts of the plant (bloody drogues) were air-dried. For the extraction of the oil, a procedure of distillation with the plant material remaining in the evaporator for 3 hours, was used. The oil came to be 0.14%. For the identification of its components they used gas chromatograph with helium carrier gas, together with a mass spectrometer (GC/MS) 36 components were identified, representing 86.57% of the oil. On a greater scale the substances camphor (14.9%), 1,8-cineole (11.61%), abisabolol (7.78%), 13(16)14 labdien-8-ol (7.35%), trans-chrysanthenyl acetate (6.35%) and terpinen-4-ol (5.70%) were found.

Also, Dimaki et al. (2017) mention that the incubation of plant material prior to hydrodistillation or ultrasound-assisted extraction in citrate buffer, significantly enhances the overall yield and number of components obtained and is recommended for the analysis of *Sideritis* volatiles. The acidic pre-treatment method was also successfully applied to analysis of cultivated *Sideritis raeseri* Boiss. & Heldr. in Boiss. ssp. raeseri; α-pinene, α- and γ-terpinene and β-thujene were predominant albeit in different percentages in flowers and leaves.

Moreover, according to Baser et al. (1997) found that the major constituents of water-distilled essential oil from aerial parts of *Sideritis scardica* subsp. scardica in Turkey, were P-pinene (17.91%), carvacrol (14.78%) and a-pinene (7.26%).

Other studies concerned with the quantitative and qualitative composition of the essential oil were conducted in Mediterranean countries such as Spain and Turkey (Ezer et al., 1995). In eight species of the genus *Sideritis* of Spain (different from those of Greece) the quantity of the oil did not differ significantly from that of the Greek species, but, in the composition a lot of quantitative differences were found regarding the percentage and the kind of the components.

Most of the studies of aromatic plants is concerned generally with the quantitative and qualitative definition of the essential oil. In these studies, the method of distillation is used, with the top of dried plants during the blooming season.

Distillation time takes from 2.5 - 3 hours. The essential oil yield is quite low in comparison to other aromatic plants (just 0.05 - 0.5%). The separation of the components happens mainly with a gas chromatography using He as a gaseous phase and a variety of columns. The identification results are primarily done with a mass spectrometer.

When the studies have to do with the tracing of special components it seems that the use of organic solvents is preferable. According to Gergis and Argiriadi (1990), it is proposed the removal of the volatile components of the species of the genus *Sideritis* with extraction of the plant parts with liquid carbon dioxide and Freon -11 is proposed.

However, the most economical and widely used method for obtaining essential oil from aromatic plants is water distillation. The only disadvantage of this method is a possible hydrolysis of some of the oils components as the plant material has a direct contact with water (Samaras, 2003).

Two alternatives of this method which are usually used in industries is water distillation by steam so the oil doesn't come in direct contact with water. Nowadays, according to the plant species other more complex methods can be used (Samaras, 2003).

Table 2. Medicinal properties of the genus *Sideritis* spp.

Medicinal Properties		
Action	**Essay**	**Reference**
Anti-inflammatory	The flavonoids, terpenes and lipid fight inflammation together with phytosterols, a and b amines and diterpenes.	Charami et al., 2008
Analgesic	This action comes from associations less polar than those of anti-inflammatory substances. Such substances are: phytosterols, a and b amines and diterpenes based on kaourenio.	Gonzalez-Burgos et al., 2011
Antibacterial and antifungus	There are substantial anti-virus and properties, resulting from essential oils having monoterpenic hydrocarbons. From the plants studied more closely were those with essential oils rich in apipenio and carvacrol.	Fokialakis et al., 2007; Aligiannis et al., 2001
Antioxidant	*Sideritis* remarkable antioxidant properties. Especially, extracts of the plants with ethyl acetate and butanol. The antioxidant properties result from the polyphenoles which block the free roots. In comparison with other aromatic plants of the Mediterranean area, the action of Sideritis is moderate. Aerial parts apart from leaves of *Sideritis syriaca*, whose water extracts are widely used as a decoction, were rich in apigenin and phenylpropanoids. These chemical compounds seem to be responsible for the antioxidant activity of Crete's mountain tea.	Hodaj-Çeliku et al., 2017; Gonzalez-Burgos et al., 2011; Armata et al., 2008; Charami et al., 2008; Kostadinova et al., 2008
Alzheimer's disease	*Sideritis scardica* extracts inhibit aggregation and toxicity of amyloid-*β* in *Caenorhabditis elegans* which was used as a model for Alzheimer's disease. The mid-polar extracts (40 and 50% ethanol) were the most active, decreasing the plaque number by 21% and delaying the amyloid-β-induced paralysis by up to 3.5 h.	Heiner et al., 2018
Mental disorders	The effect of various *Sideritis scardica* extracts on serotonin, noradrenaline and dopamine uptake in rat brain synaptosomes and serotonin uptake in human JAR cells was carried out. It was found that the pharmacological profile of *S. scardica* extracts as triple monoamine reuptake inhibitors suggests their use in the phytochemical therapy of mental disorders associated with a malfunctioning monoaminergic neurotransmission, such as anxiety disorders, major depression, attention-deficit hyperactivity disorder, mental impairment or neurodegenerative diseases.	Knörle, 2012
Gastroprotective	Different extracts of *Sideritis scardica* (diethyl ether, ethyl acetate, and n-butanol fractions of the crude ethanol extract) exhibited significant gastroprotective activity. The most effective was the n-butanol extract, which was even significantly more effective than ranitidine at a dose of 100 mg/kg. It was suggested that the high total phenolic content of the butanol extract was responsible for the strong gastroprotective activity.	Todorova & Trendafilova, 2014; Tadić et al., 2012

Mineral content

The cultivated *Sideritis raeseri* is a good source of minerals. More than twenty minerals were found in the dried parts of *Sideritis raeseri* plants. K and Ca were the most abundant, while the Mg increased during flowering. It's remarkable that the concentration of Fe was higher than the other micronutrients such as Cu, Zn and Mn (Romanucci et al., 2017).

Polyphenol contents

Tea, coffee and herb beverages contain high quantities of polyphenols. It's widely known that the consumption of beverages that contains polyphenols increases every year. The total polyphenol content of *Sideritis* is 240g per kg dry weight. So the herbal extracts of *Sideritis* can provide a wide variety of health benefits (Romanucci et al., 2017).

Medicinal properties

The most important medicinal properties of the genus *Sideritis* are presented in the Table 2.

Conclusion

Aromatic and medicinal plants are an important economic resource and earn popularity globally as a source of raw material for pharmaceuticals and traditional health care system. It is believed that cultivation of *Sideritis* spp. may play an important role for Greek agriculture by providing high added value also on remote areas and degraded slopping lands in the semi-arid zone of the country. Also, the cultivation of *Sideritis* spp. can be used as a tool for biodiversity conservation resulting in several environmental benefits. Finally, *Sideritis* spp. are economically important plants and their pharmacological profile suggests their use in the phytochemical therapy of mental disorders associated with a malfunctioning monoaminergic neurotransmission, like major depression or the attention-deficit hyperactivity disorder.

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Contribution of Authors

Solomou A: Conceived Idea, Literature Search, Literature Review, Manuscript Writing, Manuscript final reading and approval
Skoufogianni E: Conceived Idea, Literature Search, Literature Review, Manuscript Writing
Mylonas C: Literature Review, Manuscript Writing
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