

Salvia Species and their Biological Activities Naturally Distributed in Tokat Province

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Abstract: Our country which is located in the temperate climate zone is rich in terms of plant genetic resources due to its different ecological and topographical characteristics. Our country has about 12 thousand plant taxa in its flora. Among these plant taxa medicinal and aromatic plants have an important place. *Salvia* species, which are in the Lamiaceae family that contains medicinal aromatic plants are used for food, tea, cosmetics and perfumery industry and medical purposes among the public. This genus contains 900 species worldwide. In Turkey flora, its 95 species, including 51 endemic ones spread naturally. Tokat province, which is located in the Central Black Sea District Region showing the transitional characteristics between Black Sea region climate and Central Anatolia climate, is rich in plant diversity. Tokat is also rich in terms of *Salvia* species. It is estimated that there are about 15 *Salvia* species throughout the province. In this review, information about *Salvia* species and their biological activities which are distributed naturally in Tokat province are provided.

Keywords: Sage, *Salvia*, Tokat.

INTRODUCTION

The world population increases rapidly every year and will lead to an increase in food needs, which means the rapid use of plant and animal diversity. Living resources, which is an indispensable part of meeting the basic needs of people, especially food, is based on biological diversity.

Improving the yield of planted plants, increasing adaptability to environmental and climate conditions is also carried out with its wild forms, which are important in terms of plant diversity. However, environmental and genetic resources have been destroyed due to reasons such as industrialization and globalization that have developed since the 19th century. Decreasing genetic resources have made people aware of environmental and natural resources in time. This awareness has brought the biodiversity concept in mind [1].

Biodiversity is a dynamic system of genes, species, ecosystems and ecological phenomena in a certain region. Genes are defined as the continuation of species and ecosystem [2, 3]. The gene and species in a region reflect ecosystem richness. In this respect, biological diversity is indispensable for the continuation of humanity. As in every country, its biodiversity is an important wealth of Turkey.

Turkey is located between the northern latitudes 36-42° and 26-45° east longitudes. The world is divided into 37 flora regions considering the relationships between the distribution of plants and their different characteristics [4]. Among these regions, Turkey is located in a region where three flora areas, including

European-Siberian, Iran-Turan and Mediterranean overlap. With its location and gypsum-containing soils[5], it also has significant plant diversity and genetic resources

Turkey is also rich in terms of *Salvia* diversity and is home to 96 species and 4 sub-species. *Salvia* species are those plants that are as economically important as they are medically. Additionally, they have grown to be decorative ornamental plants in gardens and parks thanks to their beautiful looking flowers [6].

Numerous researches have been carried out on the biological activities of *Salvia* species that have spread in almost every province of Turkey. Among these provinces, Tokat is located in the Central Black Sea region and is a province in transition between temperate Black Sea and continental climate with arid summers and cold winters. Tokat contains many different ecological areas. The province is rich in forests, pastures and meadows, and contains many flora and faunas as well. Tokat flora is also rich in medicinal aromatic plants such as Tyme, black cumin, fenugreek, lemon balm, fennel and sage[7].

In Tokat flora, it has been reported by various

researchers that there are 15 *Salvia* species including *S. viridis*, *S. glutinosa*, *S. cryptantha*, *S. cyanensis*, *S. verticillata* subsp. *amasiaca*, *S. sclarea*, *S. aethiopsis*, *S. virgata*, *S. tomentosa*, *Salvia multicaulis*, *Salvia candidissima* subs. *candidissima*, *S. bracteata*, *S. reeseana*, *S. syriaca*, *S. frigida* [7,8-13]. In this review, *Salvia* species which are known to show the natural distribution in Tokat province and biological effects are provided.

Salvia aethiopsis L

It is a taprooted herbaceous plant with 15-60 cm long primer root which is biennial or perennial. The plant spreads on pasture, steppe, fallow fields, roads and field sides which can be seen from the sea level up to 2100 meters height [14,15]. It is an Iranian-Turanian element and is popularly known as woolly sage. The antibacterial and cytotoxic effect of the plant-containing aethiopinone terpene was determined [14]. Moreover, the antioxidant, herbicidal and antifungal activity of the plant were determined by the studies conducted [16,17].

Salvia viridis L

The plant is an annual plant and can grow up to 23-26 cm [18]. The flowers of *S. viridis* turned to white from lila-purple are used for treatment in Anatolia, its seeds and leaves are used to increase the quality of the liquor in fermentation vials. Likewise, its flowers and leaves are also used for the treatment of gum and throat infections [19]. 1-oxoferruginol active ingredient which is included in *S. viridis* exhibits antibacterial activity [20].

Salvia glutinosa L

It is a perennial aromatic plant that grows in deciduous forests and Northern and Southern Anatolia bushes, spruce forests in moist regions [21]. This species, known as sticky sage [22] is rich in monoterpenes and sesquiterpenes [23].

Salvia cyanenses Boiss et Bal

It is a perennial plant which can grow up to 25-70 cm and prefers different habitats such as volcanic and limestone slopes and road sides. It spreads at sea level up to 2300 m. It spreads in continental Anatolia in our country. It is an endemic species [10]. It contains terpenoids and flavonoids [24] and has antiviral, cytotoxicity, antioxidant effect [2, 25].

Salvia verticillata subsp. amasiaca (Freyn & Bornm) Bornm

It is a plant that is in herbaceous perennial form, can grow up to 15-80 cm, prefers rocky slopes, meadows, fields and roadsides, spreads from 20 to 2300 m above sea level. It is very widespread all over Anatolia in our country and comparatively rare in South East Anatolia [10,26]. The species contains phenolic compounds and its methanol extract exhibits a strong antioxidant [27] and antimicrobial effect [28].

Salvia sclarea L

It is a plant that is biennial or short-lived perennial plant which can grow up to 100 cm, spreads in rocky slopes, meadows, fields and roadsides and can be seen in places up to 2000 m above sea level. It can spread everywhere except Western Anatolia in our country [10]. *S. sclarea* plant contains sesquiterpenoid, diterpenoid, monoterpenes and its essential oil has an antibacterial, antifungal, anti-inflammatory, antiviral, antioxidant, insecticidal effect [20, 29].

Salvia virgata Jacq

It is perennial, can grow up to 20-160 cm, it can be seen mostly in fields such as bushes, forests, meadows, empty fields, roadsides. It spreads all over Turkey up to 2300 m above sea level [10]. In addition to being an important and high value plant utilized in medical applications, *S. virgata* is used against the skin diseases as a wound healer among the public [30, 31]. Similarly, this type has antioxidant, antimicrobial and antibacterial effect [15, 32, 33].

Salvia multicaulis Vahl

It is a perennial herbaceous plant with a rhizome which can grow up to 10-34 cm and prefer different habitats such as limestone and red earth slopes, rocky slopes, empty fields. It can be seen in places of 550-2600 m from sea level. It spreads in Eastern Anatolia and Central and South Anatolia link in our country [10]. It has been determined that it exists in Tokat province as well [12]. *S. multicaulis* plant contains terpenoids [34]. *S. multicaulis* species has antioxidant, antimicrobial, antifungal, antibacterial and insecticidal effect [35-37].

Salvia cryptantha Montbret & Aucher ex Benth

The plant is an endemic species that spreads in rocky areas and calcareous hills and high altitude places. *S. cryptantha* which is a perennial plant that grows up to about 10-30 cm and distributed in 700-2500 m altitudes in rocky areas and limestone hills in wild form [38,39]. This species, which is mainly widespread in Continental Central Anatolia in Turkey, has an effect of antitumor [39] antioxidant and wound healing [25], insecticidal [40], herbicidal [12], antifungal [41].

Salvia tomentosa MILL

In addition to being Mediterranean originated and known as big-flowered sage [42]. *Salvia tomentosa* is also called as Tenturdiyot herb, Moşabla or Blank leaf and it is a plant with a wide distribution in Turkey [28]. This species is perennial and is seen in limestone slopes, fallow fields, steppes and roadsides with altitude of 90-2000 m [10,15]. *Salvia tomentosa* is rich in phenolic compounds and terpenoids [28,43] and exhibits antioxidant [44,45], insecticidal and antibacterial [46], herbicidal [12], antifungal effects [41].

Salvia candidissima subsp. candidissima Vahl

This species, which can grow up to 30-90 cm, spreads up to 700-2000 m from sea level and prefers rocky limestone and clayey slopes, shrubs, empty fields and roadsides. It is located in Central Anatolia and especially in Eastern Anatolia in Turkey [10]. It is rich in terpenoid [47] and flavonoids [48] and its extracts exhibit antioxidant effect [15].

Salvia bracteata Banks et Sol

It is a perennial plant in herbaceous form with 50-2000 m altitude and spreads in almost every region of Turkey [49]. *S. bracteata* roots contain diterpenoids [50] and has an antimicrobial effect [51].

Salvia reeseana Hedge & Hub. Mor

It is an endemic species that can grow up to 35-50 cm in perennial herbaceous form. This species spreads in volcanic and calcareous areas, in the field sides that has 700-1400 m altitude [52].

Salvia syriaca L

It is a perennial herbaceous plant with rhizomes and can grow up to about 30 cm. Such steppe fields are spread in continental Anatolia with planted and fallow fields, steppe areas in 450-1850 m altitude [15,52,53]. *S. syriaca* species contains flavonoid and terpenoid [54] and has antimicrobial [55], antioxidant [56], antidiabetic [54], allelopathic effects [57].

Salvia frigida Boiss

It is a perennial herbaceous plant with rhizomes and can grow up to 10-30 cm. The plant spreads in places including *Pinus nigra*, *Juniperus*, *Abies* and *Pyrus* groves, limestone slopes, slits and pasture areas with 1000-2500 m altitude [58]. *S. frigida* seeds contain the fatty acids [59]. This species has antimicrobial [60,61], antiviral and cytotoxic effects [62].

CONCLUSION

Our country is in an important position in terms of plant diversity. It is also of great importance thanks to having 95 *Salvia* species. Tokat province and its districts are also rich in *Salvia* species. It is estimated that there are about 15 *Salvia* species throughout the province. In this review, information about 15 *Salvia* species known to show the natural distribution in Tokat and its vicinity, their distribution, chemical contents and biological activities in our country is given. We are convinced that they will continue to work on *Salvia* species, which are rich in compounds and biological activity.

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