



Original Research Article

Satureja avromanica Maroofi (Lamiaceae): An addition to flora of Turkey with contributions to its taxonomy

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Satureja avromanica Maroofi (Lamiaceae) has been recorded for the first time in the Flora of Turkey (C9, Şırnak, Siirt). Detailed morphological description, images, distribution map, pollen and nutlet morphology of this new record are provided in this study. Pollen grains of *S. avromanica* are isopolar, 6- colpate, oblate (P/E 0.88), Amb hexagonal. Exine is reticulate with 0.27µm thickness. In this study, this species nutlet was investigated for the first time.

Key words: New record, *Satureja avromanica*, Siirt, Şırnak, Lamiaceae, Turkey

INTRODUCTION

The genus *Satureja* L. (Lamiaceae) which comprises more than 70 species grow naturally in the whole of Europe, particularly at the Mediterranean basin. Also there are some species in Iran, The Caucasus, Russia and Africa. In Turkey there are 15 species belonging to the genus *Satureja*. Five of these species are endemic to Turkey and they grown in the Mediterranean and Aegean regions (Öztekin,2012). *Satureja* species are called "Anix, kekik" (Firat, 2013) by the local people and are used as tea, spice and traditional medicine. Also essential oils of *Satureja* species are used in medicine and perfume industries (Kokdil,1993). There have been some studies on the essential oil contents of *Satureja* species (Tumen et al., 1998).

Pollen morphology is meaningful considering the systematic relationships among the Lamiaceae genera (Erdtman, 1945; 1966; Cantino, 1992a; 1992b; Harley et al., 1992; Abu-Asab and Cantino, 1993; 1994). The seed surfaces of Lamiaceae have been studied by many researchers (Kahraman et al., 2009; Budantsev and Lobova, 1997).

MATERIALS AND METHODS

During field studies in Şırnak and Siirt in October 2013 and 2014, plant specimens belonging to *Satureja* were collected from Cudi Mountain, Gabar Mountain and Botan River (Figure 1). Collected specimens were identified using Flora of Turkey and the East Aegean Islands (Davis et al., 1998;

Davis, 1965; 1985), Turkey and the East Aegean Islands (Supplement) (Güner et al., 2000) and Türkiye Bitkileri Listesi (Damarlı Bitkiler) (Öztekin, 2012). Results of diagnosis revealed that these materials resembled those of *Satureja avromanica* Maroofi growing naturally in the Kurdistan region of Western Iran (Boissier, 1879; Rechinger 1982; Maroofi, 2010). Collected plant specimens from field studies were deposited in the Yüzüncü Yıl Üniversitesi Fen Fakültesi Herbarium (VANF).

Pollen properties of materials were prepared according to Wodehouse (1935) and investigated under a light microscope. Polar and equatorial axes, colpus length and width, exine and intine thicknesses of pollen were measured until the curve of Gauss was achieved (50 pollen). The pollen and seed morphology of *Satureja avromanica* were examined using scanning electron microscope and light microscope for the first time as described. Microscopic images were captured with Olympus BX41 light microscope. To investigate the pollen exine, pollen were coated with gold and scanned with JEOL JSM 7001-F scanning electron microscope at the Biology Department, Firat Üniversitesi.

RESULTS

Description of *Satureja avromanica* Maroofi

S. avromanica is a suffruticose, perennial; 35-80 cm high, many stemmed, slender, nonaromatic or lemon-scented;

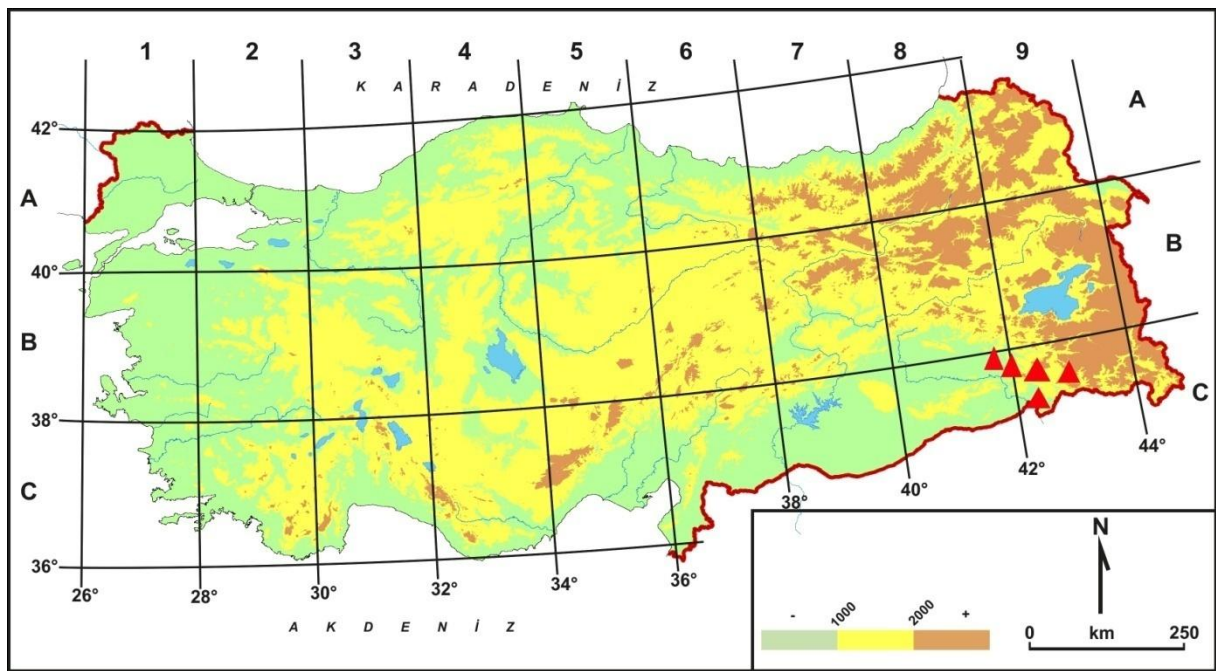


Figure 1: Geographical distribution of *Satureja avromanica* Marooft in Turkey

mostly simple or with a few branches with woody stock and short brachyblasts in its leaf-axils; \pm angled but not tetragonal, ascending-arcuate to erect, grayish green above, creamy at the middle and brown below with dense or rather lax papilla and sometimes sparse stipitate glands above; glabrous to sparsely papillose below. Leaves are opposite or in fascicles, entire, lax, sessile or subsessile in lower part with petiole up to 1 mm long, cuneate-oblong to cuneate-obovate or lanceolate; up to 35 mm long and up to 6 mm broad, oblanceolate; upper leaves are smaller than the lower leaves, grayish-green, dotted with hyaline yellowish-orange or green sessile glands and covered by lax or dense papilla; sometimes glabrescent in mature and on lower leaf surfaces, obtuse to subacute, flattened, revolute to involute at the margin; main nerve distinctly prominent. Inflorescence terminal, in lax cymes, main inflorescence longer than the laterals on branches; verticillasters mainly with 3 or rarely 1-2 flowers; pedicels 1-4mm long, shorter than the calyx; bracts c.1 mm long, lanceolate or oblong-ovate, folded lengthwise; bracteoles 2, smaller than the bracts, nearly the same shape (Figure 2).

Calyx pubescent, dark purple in the beginning, paler to green later, 3.5-6.5 mm long, tubular, 2-labiate, sometimes covered with papilla and sessile or stipitate glands on the outside, more or less glabrous inside, 10 veined; teeth of the calyx shortly hairy at the margin; lower lip teeth 1.7-2 mm, upper c.1 mm long, subulate-triangular. Corolla pubescent, slender, violet to purplish-lilac, paler below the tube to white, 10-30 mm long, straight, covered with papilla and sparse yellowish sessile glands, decrease below; inner surface of the middle and lower lobes usually with fasciculate violet hairs; other lobes with sparse whitish

papilla; inner surface of corolla tube in lower part of stamens pilose; upper lobes slightly shorter than the lowers; tube without ring of hairs. Stamens 4, included in tube; the anterior pair longer; upper filaments 1.5 and lower filaments 1.8-2.5 mm long. Anthers sagittate, purplish-violet, 0.5 mm long. Style shorter than the stamens in the beginning, developed later and exerted from the tube; style branches equal or subequal. 4 nutlets, minutely glandular-hairy above, with obtuse- rounded apex, bright to deep brown, \pm smooth, 1.75 \times 0.79 mm long, oblong to broadly ovate, with 4-5 nerves in posterior. Pollen grains isopolar, 6-colpate, oblate (P/E 0.88), polar axis (P) 38.52 μ m, equatorial axis (E) 43.68 μ m. Amb hexagonal. Exine were 1.40 μ m thick. clg 35.58 μ m, clt 5.72 μ m. Apocolpium was large. Membrane of colpus granulate. Exine reticulate. Diameter of lumina 0.73 μ m, muri 0.27 μ m.

Examined material

Habitat: Rock crevices, dry limestone bushy slopes

Phenology: Flowering and fruiting times from September-October to November

Distribution in Turkey: Şırnak, Siirt

General distribution: Kurdistan region of Iran, Turkey

Associated with: *Dianthus orientalis* Adams, *Ficus carica* L. subsp. *carica*, *Andrachne aspera* Spreng, *Capparis sicula* Veill. subsp. *sicula*, *Onosma rostellatum* Lehm., *Silene monerantha* F. N. Williams, *Clinopodium serpyllifolium* (M.

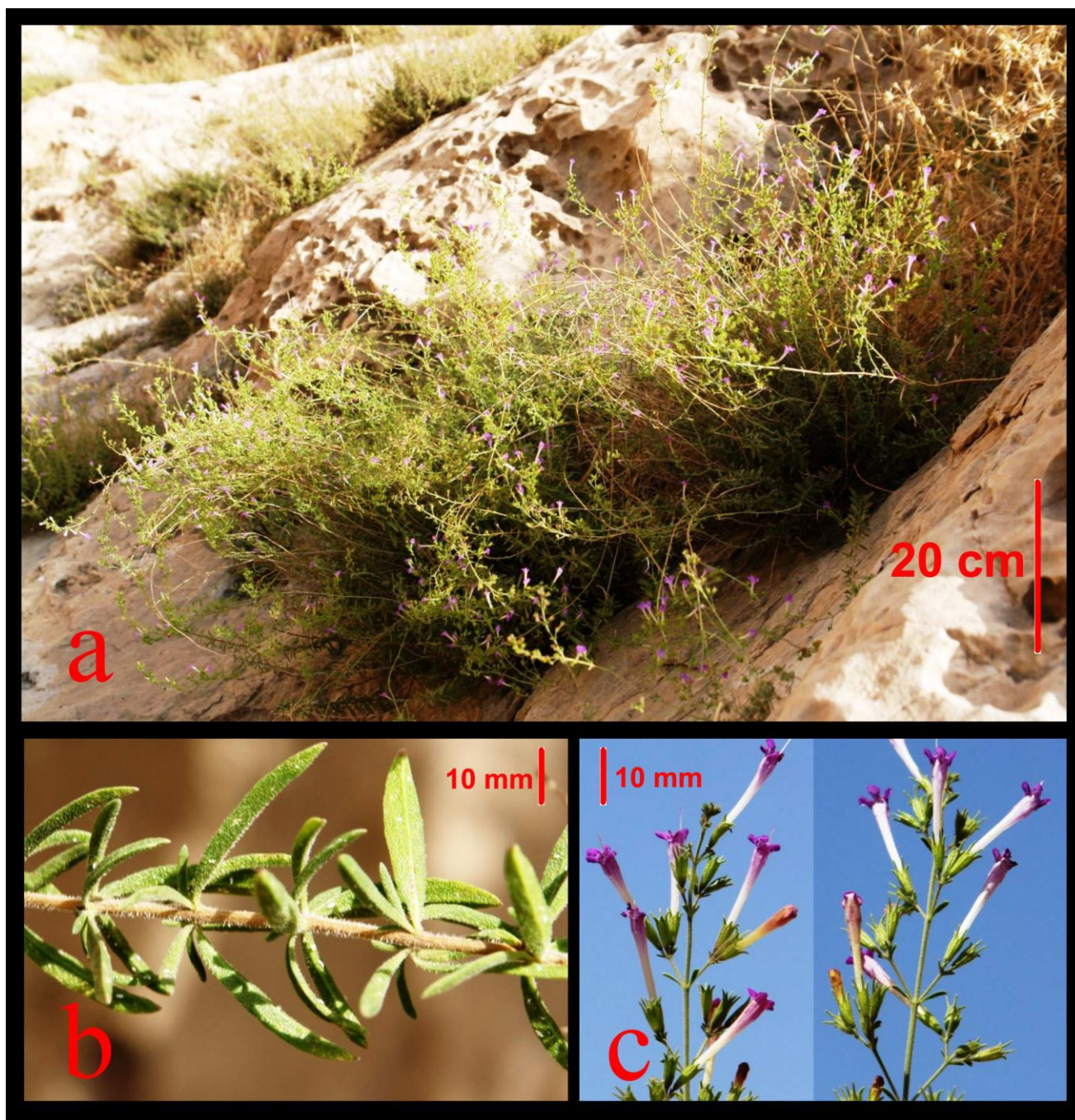


Figure 2: *Satureja avromanica* Maroofi **a-** General view in the natural habitat. **b-** Leaves. **c-** Flowers.

Bieb.) Kuntze subsp. *shirnakense* Firat & Akçiçek

Vernacular name: In Şırnak Province, indigenous people use the name “Anix” for *Satureja* (Firat, 2013).

Palynological investigation

The results of LM data on the pollen grains of *S. avromanica* are summarised in Table 1 and shown in Figures 3a and b. Pollen grains of *S. avromanica* are isoplar, 6- colpate, oblate

(P/E 0.88), polar axis (P) 38.52 μm , equatorial axis (E) 43.68 μm . Amb hexagonal. Exine are 1.40 μm thick. clg 35.58 μm , clt 5.72 μm . Apocolpium is large. Membrane of colpus was granulate. Exine is reticulate. Diameter of lumina 0.73 μm , thickness 0.27 μm .

Nutlet morphology

In this study, this species nutlet was investigated for the first time. Glandular-hairy above, with obtuse- rounded

Table 1. Light microscope measurements of *Satureja avromanica*

Taxa	P (µm)	E (µm)	P/E	Ex (µm)	i (µm)	clg (µm)	clt (µm)	Amb diameter L (µm)	Ornamentation
<i>Satureja avromanica</i>	38.52±2.14	43.68±1.48	0.88oblat	1.40±0.22	0.75±0.11	35.58±0.73	5.72±0.43	10.23±0.91	Reticulate

P: polar axis, E: equatorial axis, clg: length of colpus, clt: width of colpus, Ex: exine thickness, i: intine thickness

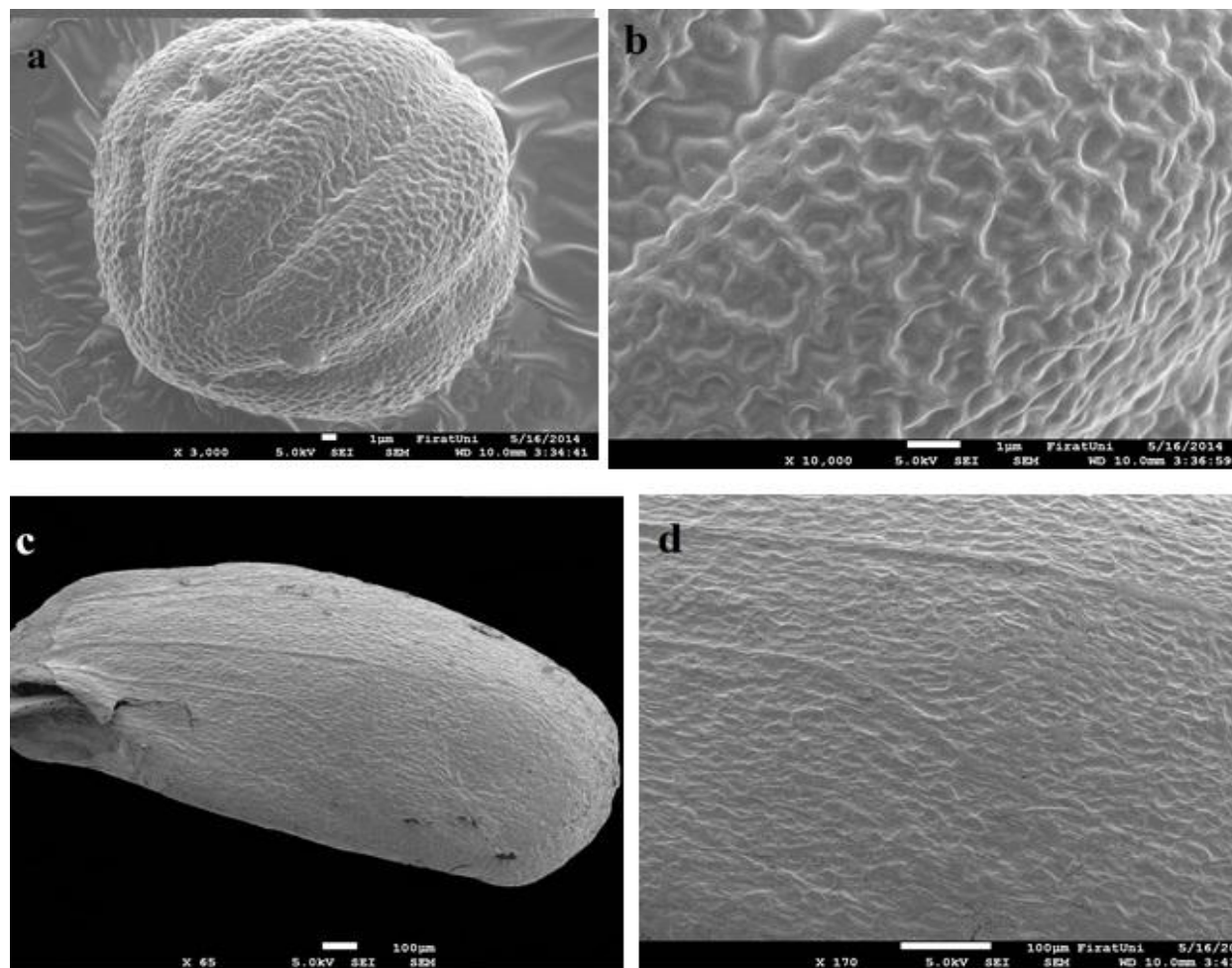


Figure 3: SEM photos of the pollen grains and nutlet coat of *Satureja avromanica*. **a-** equatorial view (x3000). **b-** Detail of pollen grains (x10000). **C-** nutlet coat general shape (x65). **d-** Nutlet coat surface.

apex, bright to deep brown, ± smooth, 1.75×0.79 mm oblong to broadly ovate. Epicarp of seed contains cells which looked like elongated rectangle and polygon. face (x170).

DISCUSSION

The differences between the population of the new records in Turkey and Iran are: Turkish *Satureja* are non-aromatic and rarely fragrant, especially lemon fragrance, has glands on leaf surface which are yellowish- orange. Also, there were some green glands on the leaf surface and although in some population, bractea were oblong-ovate, some were lanceolate. When collected materials were investigated, we assumed that the differences mentioned depended on habitat differences as similar differences were reported for other species of *Satureja* from Turkey.

Length of pollen axis of 25 - 35 µm in Lamiaceae were recorded and prolate- sub-sferoidal. Pollen of are reticulate and apertures were tricolpate or hexacolpate. Colpus were especially smooth and narrow, hexacolpate. Muri were overcast, smooth and fixed (Harley et al., 1992).

Pollen properties of *Satureja* are shown in Table 1 and include; isopolar, 6- colpate, oblate (P/E 0.88), polar axis (P) 38.52 µm, equatorial axis (E) 43.68 µm. Amb hexagonal. Exine were 1.40 µm thick. clg 35.58 µm, clt 5.72 µm. The pocolpium was large. Membrane of colpus was granulate. Exine was reticulate. Diameter of lumina 0.73 µm, muri thickness 0.27µm (Table 1, Figures 3a-b).

Although shape of seed surface of Lamiaceae varies not only on the genus level but also on both the subsection and subspecies level, variety, colour and shape of seed have less value for taxonomy. Hassan et al. (2009) and Kaya et al. (2009) had investigated seed morphology of 15 *Satureja* species and obtained three different seed types. In our study, seed shape was reticulate protuberulate (Figures 3c-d).

Pollen and seed morpholgy of these species was studied for the first time. The outcome of this study will contribute to the taxonomy of the family Lamiaceae especially the genus *Satureja*.

Conflict of interest : The author declare no conflict of interest.

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