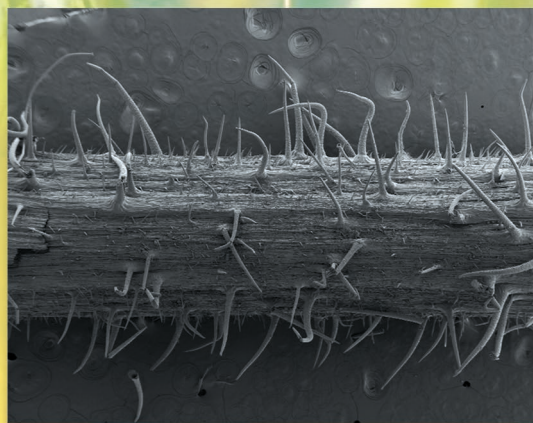
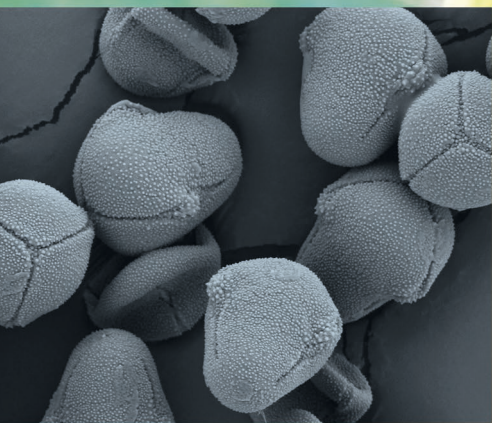


Onosma satensis sp. nov.
(Boraginaceae: Lithospermeae),
a new species from Hakkari (eastern Anatolia, Turkey)

Mehmet FIRAT & Riza BINZET



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diff.pub@mnhn.fr / <http://sciencepress.mnhn.fr>

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ISSN (imprimé / *print*): 1280-8571/ ISSN (électronique / *electronic*): 1639-4798

Onosma satensis sp. nov. (Boraginaceae: Lithospermeae), a new species from Hakkari (eastern Anatolia, Turkey)

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Submitted on 7 October 2020 | accepted on 13 March 2021 | published on 13 September 2021

Firat M. & Binzet R. 2021. — *Onosma satensis* sp. nov. (Boraginaceae: Lithospermeae), a new species from Hakkari (eastern Anatolia, Turkey). *Adansonia*, sér. 3, 43 (16): 185-195. <https://doi.org/10.5252/adansonia2021v43a16>. <http://adansonia.com/43/16>

ABSTRACT

A new species of *Onosma* L. (Boraginaceae: Lithospermeae), from the Hakkari province of eastern Turkey, is described and illustrated. The new species is endemic and distributed in a narrow area in the Sat Mountains. Taxonomically the closest relative of *Onosma satensis* sp. nov. is *O. polioxantha* Rech. f. which also occurs in Turkey. In addition, it is primarily distinguished from *O. polioxantha* by its navicular leaves, longer and reticulate cauline leaves, longer pedicels and calyx, longer and densely patent short setulose outside, reticulate corolla and bigger nutlets. The geographical distributions and map, detailed photographs, habitat description, vernacular name, an IUCN conservation status and identification key for *O. satensis* sp. nov. and *O. polioxantha* were also provided. Nutlets and pollen micrographs of *O. satensis* sp. nov. are presented using scanning electron microscopy.

KEY WORDS

Boraginaceae,
Onosma,
Eudicots,
Irano-Turanian,
new species.

RÉSUMÉ

Onosma satensis sp. nov. (Boraginaceae: Lithospermeae), une espèce nouvelle d'Hakkari (Anatolie orientale, Turquie).

Une espèce nouvelle d'*Onosma* L. (Boraginaceae: Lithospermeae), endémique de la province d'Hakkari en Turquie orientale, est décrite et illustrée. Elle est répartie sur une zone étroite des Monts Sat et est très proche de *O. polioxantha* Rech. f., également présente en Turquie, dont elle se distingue surtout par ses feuilles naviculaires – les caulinaires plus longues et réticulées –, ses pédicelle et calice plus longs, densément hérissés en surface de poils raides plus longs, sa corolle réticulée et ses nucules plus grosses. La répartition, la description de l'habitat, les noms vernaculaires, le statut UICN et une clé d'identification sont fournis, ainsi que des micrographies M.E.B. des nucules et du pollen de *O. satensis* sp. nov.

MOTS CLÉS

Boraginaceae,
Onosma,
Eudicots,
Irano-Touranien,
espèce nouvelle.

INTRODUCTION

Boraginaceae is a subcosmopolitan family and including with 90 genera and 1600-1700 species. Recent phylogenetic studies show that the currently used infrafamilial classification is highly obsolete (Chacón *et al.* 2016).

The genus *Onosma* L. is one of the characteristic member of the Irano-Turanian phytogeographical region with its 150-180 species. It belongs to tribe Lithospermeae Dumort. which presently comprises 25 genera and 460 species (Chacón *et al.* 2016). *Onosma* is distributed in North West Africa, Asia and Europe, but mainly centered in Turkey and Iran (Johnston 1954; Kazmi 1970; Weigend *et al.* 2016; Chacón *et al.* 2016; Cecchi *et al.* 2016; Nasrollahi *et al.* 2019). Especially the SW Irano-Turanian region plays a major role in speciation and evolution of *Onosma*. Since over the 80 % of *Onosma* species occur in Turkey, Iran, N Iraq and W Pakistan, these countries are considered the main centre of diversity of the genus (Boissier 1879; Riedl 1967, 1978; Binzet *et al.* 2010; Binzet & Akçin 2012; Mehrabian *et al.* 2013; Koyuncu *et al.* 2013; Ranjbar & Almasi 2014; Tarımcılar *et al.* 2015; Binzet 2016a, b; Cecchi *et al.* 2016). This genus has biennial and perennial members, and is generally suffruticose, hirsute to prickly-strigose herbs (rarely small shrubs) with bracteate, scorpioid cymes, clavate to cylindrical corollas and trigonous-ovoid, smooth nutlets (Weigend *et al.* 2016).

In the most recent plant check-list of Turkey entitled “A Checklist of the Flora of Turkey (Vascular Plants)” (Binzet 2012), Binzet recognised 96 species (including one hybrid) belonging to the genus *Onosma* in Turkey. Recently, *O. atila-ocakii* Koyuncu & Yaylacı (Koyuncu *et al.* 2013), *O. demirizii* Kaynak, Tarımcılar & Yılmaz (Tarımcılar *et al.* 2015), *O. malatyana* Binzet (Binzet 2016a), *O. anatolica* Binzet (Binzet 2016b), *O. juliae* L. Cecchi & Selvi (Cecchi *et al.* 2016) and *O. erzincanica* Binzet & Eren (Binzet & Eren 2018) were described as additional six members of the genus from Turkey. Turkey is well known for the high diversity of its phanerogamic flora, which is also reflected by the species richness in the genus *Onosma*.

Onosma is a taxonomically difficult genus with various chromosome numbers and ploidy levels (Cecchi *et al.* 2016) and its subgeneric classification is still unclear. The infrageneric taxonomic history of the genus, it was briefly reviewed by Cecchi *et al.* (2016), has mainly been based on the morphology of the fruiting calyx and the indumentum inside it (Candolle 1846) or the type of leaf indumentum (Schur 1866; Borbás 1877; Boissier 1879). Peruzzi & Passalacqua (2008), treated Boissier's sections within three informal groups: 1) *Asterotricha*, with basal leaves covered by asterosetae or stellate bristles; 2) *Haplotricha*, with basal leaves covered by simple setae only; and 3) *Heterotricha*, with both asterosetae and simple setae on basal leaves. In this study, the statement proposed by Peruzzi & Passalacqua (2008) was followed. Recent chromosomal and molecular studies showed that *Heterotricha* evolved by hybrid speciation between *Haplotricha* and *Asterotricha* (Teppner 1971, 1972, 1991; Nasrollahi *et al.* 2017).

In July 2018, during fieldwork in Sat Mountains in Hakkari province, eastern Turkey, the first author collected an interesting specimen of *Onosma* on rocky, stone, and calcareous areas. Subsequently fruity samples of this plant were collected from the same area in August 2018. As a result of our detailed macro- and micromorphological studies and after thorough consultation of the literatures (Boissier 1879; Dinsmor 1932; Riedl 1967; Popov 1974 and Riedl 1978), we concluded that the collected *Onosma* specimens differ from all other *Onosma* species in morphological characters. Taking into consideration the morphology, it seems our collection is closely related to *O. polioxantha* from which we delimit it. The new species *O. satensis* Firat & Binzet, sp. nov. (Haplotricha group) from eastern Anatolia is described.

From a plant biodiversity aspect, the Sat Mountains in the province of Hakkari in eastern Turkey are very rich areas. Not only the geographic structure, but also the military- security conditions have obstructed the area from being explored. According to the literature, after Joy Garden, who carried out the first floristic investigation in Hakkari in 1858, a total of 22 foreign botanists have performed investigations and collected nearly 700 taxa from Hakkari (Firat 2013, 2014). In spite of this, this area remains greatly unexplored thanks to the Sat mountain chain, which is approximately 40 km long and extends to the Iraqi border. This area comprises many unexplored regions that still contain completely wild habitats. In recent years, many new taxa have been discovered at this area by the first author, such as *Clinopodium hakkariicum* Dirmenci & Firat (Firat & Dirmenci 2009), *Verbascum kurdistanicum* Firat (Firat 2015), *Cirsium semzinanicum* Firat (Firat 2016a), *Iris koyuncui* Firat (Firat 2016b), *Saxifraga hakkariensis* Firat (Firat 2016c), *Gundelia colemerikensis* Firat (Firat 2016d), *Stachys hakkariensis* Akçiçek & Firat (Akçiçek *et al.* 2016), *Iris zagrica* B. Mathew & Zarrei subsp. *hakkariensis* Firat (Firat 2017) and *Scilla hakkaniensis* Firat & Yildirim (Firat & Yildirim 2020).

MATERIAL AND METHODS

Specimens of *Onosma satensis* sp. nov. were collected during flowering and fruiting periods in 2018 and 2020 from Sat Mountains, Hakkari province (Eastern Anatolia, Turkey) by the first author. Totally 20 herbarium specimens were collected from two localities and deposited in VANF, ANK, HUB, (acronyms according to Thiers 2018), and in the personal herbarium of the first author (Herb. M. Firat) and the Herbarium of Mersin University. We have compared the *O. satensis* sp. nov. with type specimen of *O. polioxantha* kept at W and the relevant taxonomic literature of *Onosma* (Boissier 1879; Dinsmor 1932; Riedl 1967; Popov 1974; Riedl 1978). Preliminary conservation assessments were made using the IUCN (2016) guidelines. For the palynological studies we selected 50 pollen grains and 30 mature nutlets randomly and they were measured using by light microscope (LM) and stereo-binocular mi-



FIG. 1. — *O. satensis* sp. nov. in its type locality: **A**, habit; **B, C**, flowers. Photographs by Mehmet Firat.

croscop. In addition, for analysis of some morphological characters, observations were made using a scanning electron microscope (SEM).

For palynological studies pollen grains were taken from herbarium specimens using LM, and prepared according to the Wodehouse methods (Wodehouse 1935). The polar axis (P), equatorial axis (E), and other characteristics (see Table 1) of the pollen grains were measured using an Olympus BX40 with a 100× objective until a Gaussian curve was acquired (Table 1). For SEM observations,

pollen was isolated from dried voucher materials without any additional treatment. The isolated dried pollen was deposited on carbon-coated aluminium probe holders and coated with platinum. Pollen grains and nutlets were photographed with a ZEISS supra 55. Palynology nomenclature follows Wodehouse (1935), Faegri & Iversen (1989) and Punt *et al.* (1994).

Some numbers in the article are preceded by the sign minus “-”; whenever a number is preceded by a minus, e.g. -20 µm, it means “up to” 20 µm.



FIG. 2. — *O. satensis* sp. nov. in its paratype locality: **A-C**, habit (in flower); **D**, habitat. Photographs by Mehmet Firat.

RESULTS

MORPHOLOGICAL RESULTS

Onosma satensis Firat & Binzet, sp. nov.
(Figs 1-3)

Onosma satensis sp. nov. is related to *O. polioxantha* Rech. f., but it differs from *O. polioxantha* by with patent setose and short hairs stem indumentum (not adpressed setose and puberulous in *O. polioxantha*), sterile shoots leaves and cauline leaves are navicular (not navicular in *O. polioxantha*), cauline leaves 120 × -16 mm (20-40 × 5-9 mm in *O. polioxantha*), leaves are distinct reticulate (not reticulate in *O. polioxantha*), pedicel 4-5 mm in flowering and -17 mm in fruit (3-4 mm in *O. polioxantha*), calyx 13-17 mm in flowering and -27 mm in fruit (12 mm in flower and -14 mm in fruit in *O. polioxantha*), Corolla 20-22 mm and densely patent short setulose outside and reticulate (14-17 mm, puberulous and lobes ciliate in *O. polioxantha*), nutlet 4.5-5 × 4-4.5 mm (2.5-3 mm in *O. polioxantha*).

TYPE. — **Turkey**. C9 Hakkâri, Yüksekova Province, Sat mountains, Oremar region, Zozana Herduav plateau, rocky, stone, and calcareous areas, 1376 m, 37°22'41"N, 44°10'08"E, 7.VII.2018, *M. Firat* 34040 (holo-, VANT; iso- ANK, in the personal herbarium of the first author [Herb. M. Firat] and the Herbarium of Mersin University).

ETYMOLOGY. — The specific epithet derives from the name of Sat Mountain (Yüksekova/Hakkari) where the type specimens were collected (locus classicus).

PHENOLOGY. — Flowering from June to July and fruiting from July to August.

HABITAT AND ECOLOGY. — The species is a perennial that grows on rocky areas, nearly melting snow at an altitude of 1300-2000 m (Fig. 3) with plants such as *Prangos ferulacea* (L.) Lindl., *Prangos pabularia* Lindl., *Campanula persica* A. DC., *Pimpinella kotschyana* Boiss., *Allium microspatum* Ekberg, *Allium anacoleum* Hand.-Mazz., *Scorzonera latifolia* (Fisch. & C.A.Mey.) DC., *Hypericum scabrum* L., *Stachys kurdica* Boiss. & Hohen., *Cruciata taurica* (Pall. ex Willd.) Ehrend., *Rhabdosciadium anatolyi* Lyskov & Kljuykov, *Psathyrostachys fragilis* (Boiss.) Nevski, *Nonea anchusoides* Boiss. & Buhse and *Amygdalus carduchorum* Bornm.

DISTRIBUTION AND SITE CONDITIONS. — *Onosma satensis* sp. nov. only occurs on the Sat Mountains (Yüksekova/Hakkari) and can be considered as endemic to eastern Anatolia (Fig. 4). It represents an Irano-Turanian mountain element. Future studies will assess its likely distribution in the neighbouring northern Iraq and Iran.

CONSERVATION STATUS. — The distribution area of *Onosma satensis* sp. nov. is less than 50 km². The species was collected from one locality in which c. 1000 individuals were counted. Some anthropogenic and grazing effects were observed on the population. Based on the



FIG. 3. — Distribution area and habitat of *O. satensis* sp. nov. (Sat Mountains).



FIG. 4. — Distribution map of *O. satensis* sp. nov. (▲) and *O. polioxantha* Rech. f. (●).

above data and observations, the IUCN (2016) red list category of *Onosma satensis* sp. nov. is suggested as “Critically Endangered” (CR), B1b (i, ii, iii).

VERNACULAR NAME. — *Onosma satensis* sp. nov. is called (Kurdish name) “Mejmejok” by the local people of the Hakkâri/Yüksekova Province. *Onosma* species are known by the local people under many names in Kurdish; e.g. “Şiranok”, “Hewajo”, “Dimkiri”, “Dıvan-koşk”, “Gorisazer”, “Mijmijok”, “Emzik”, “Memije”, “Giyaderman” and in Turkish; e.g. “Emzik otu”, “Havaciva”, “Emcek”, “Tavşan gözü”, “Sincar” (Firat 2013).

SPECIMENS EXAMINED. — *Onosma satensis* sp. nov.: Turkey, C9 Hakkâri, Yüksekova Province, Sat mountains, Dula Vare Mili region, Carte hill, nearly melting snow, 1935 m, 37°24'11"N, 44°06'33"E, 31.VII.2019, *M. Firat* 35150 (in flower) (para-, VANF, HUB and in the personal herbarium of the first author [Herb. M. Firat]); Oremar region, Zozana Herduav plateau, rocky, stone, and calcareous areas, 1416 m, 37°22'40"N, 44°10'05"E, 11.VII.2020, *M. Firat* 35648 (in flower) (in the personal herbarium of the first author [Herb. M. Firat]); 17.VIII.2020, *M. Firat* 35690 (in fruit) (in the personal herbarium of the first author [Herb. M. Firat]).

Onosma polioxantha: Turkey, SE Anatolia, A/B3 Eskişehir, Mihaliççik to Sariyar baraji, 900 m, D[D.37219]!; B7 Elaziğ, 12 km E of Elaziğ, 1160 m, *M. Zohary* 3764 (!); B7 Erzincan, Kemaliye, Sırakonak, Killik Cave path, Üstünca Spring around, rocky and steppe, 1250-1400 m, 05.VI.2009 (Mersin; *Binzet* 200925); B8 Erzurum, 30 km W of Erzurum, 1780 m, *M. Zohary* 67334 (!); B9 Bitlis, 2 km from Bitlis, 1630 m, *Hub.-Mor.* 13528 (!); B9 Bitlis, Kurdistan, Bitlis, 1400 m, [8.VI.]1939, *Frödin* 149 (holo-, W) (Herb. No: 10222); B9 Bitlis, 10 km south of Bitlis, Araptal, Waldrand, 1500 m, 17.VI.1984 (Herb. No: 1991-07873); B9 Van, 24 km from Timar (Canik) to Van, 1750 m, *D.* 44191 (!); C6 Maraş, Maraş to Göksun road, 1400 m, *Stn. & Hend.* 5551 (!); C9 Mardin, foot of Kasrik gorge, 9 km from

Cizre, 350 m, *D.* 42667 (!); Hakkari, Çukurca, 1200 m, *D.* 44824 (!); C10 Hakkari, 19 km from Bacirge to Yüksekova, 2150 m, *D.* 45182 (!); C9 Hakkari, Çimenli, Köyü, Şıva İros around, slopes, 1700 m, 15.VII.2009 (Mersin; *Binzet* 200920).

DESCRIPTION

Perennial, rootstock with long slender branches, root bark easily separated. Stems numerous, to 50 cm and to 4 mm diameter, erect to ascending, unbranched, patent setose and short hairs. Usually with a number of sterile shoots at flowering and anthesis time. Sterile shoots to 25 cm. Sterile shoot leaves navicular, broadly oblanceolate, petiolate -20 × -1.2 cm, petiole long 4-6 cm, patent setose 1-1.5 mm, with tuberculate and short hairs on upper surface and patent setose with ± tuberculate and short hairs on below surfaces sparsely, acute, margins straight. Basal leaves similar to sterile shoots leaves. Cauline leaves navicular -12 × -1.6 cm, oblanceolate to oblong lower petiolate, upper sessile and smaller in size, distinctly reticulate, covered with patent setae (-1 mm) above and on beneath and short hairy on both surfaces, acute, margins straight. Bracts few, -5 × -0.9 cm, smaller in size to upper, lanceolate to linear, covered with patent setose ± tuberculate on both surfaces. Inflorescence of 1-3 lax cymes, elongating to 15 cm after flowering. Pedicels 4-5 mm in flower, elongating to c. 17 mm in fruit, covered with patent setose tubercles and short hairs. Calyx 13-17 mm in flower, to 27 mm in fruit, lobes linear, linear-lanceolate, base accrescent and becoming gibbous, covered with patent setose ± tubercles and short hairy on outside and sparsely patent setose and short hairs inside. Corolla golden yellow, 20-22 × 4-5 mm at widest

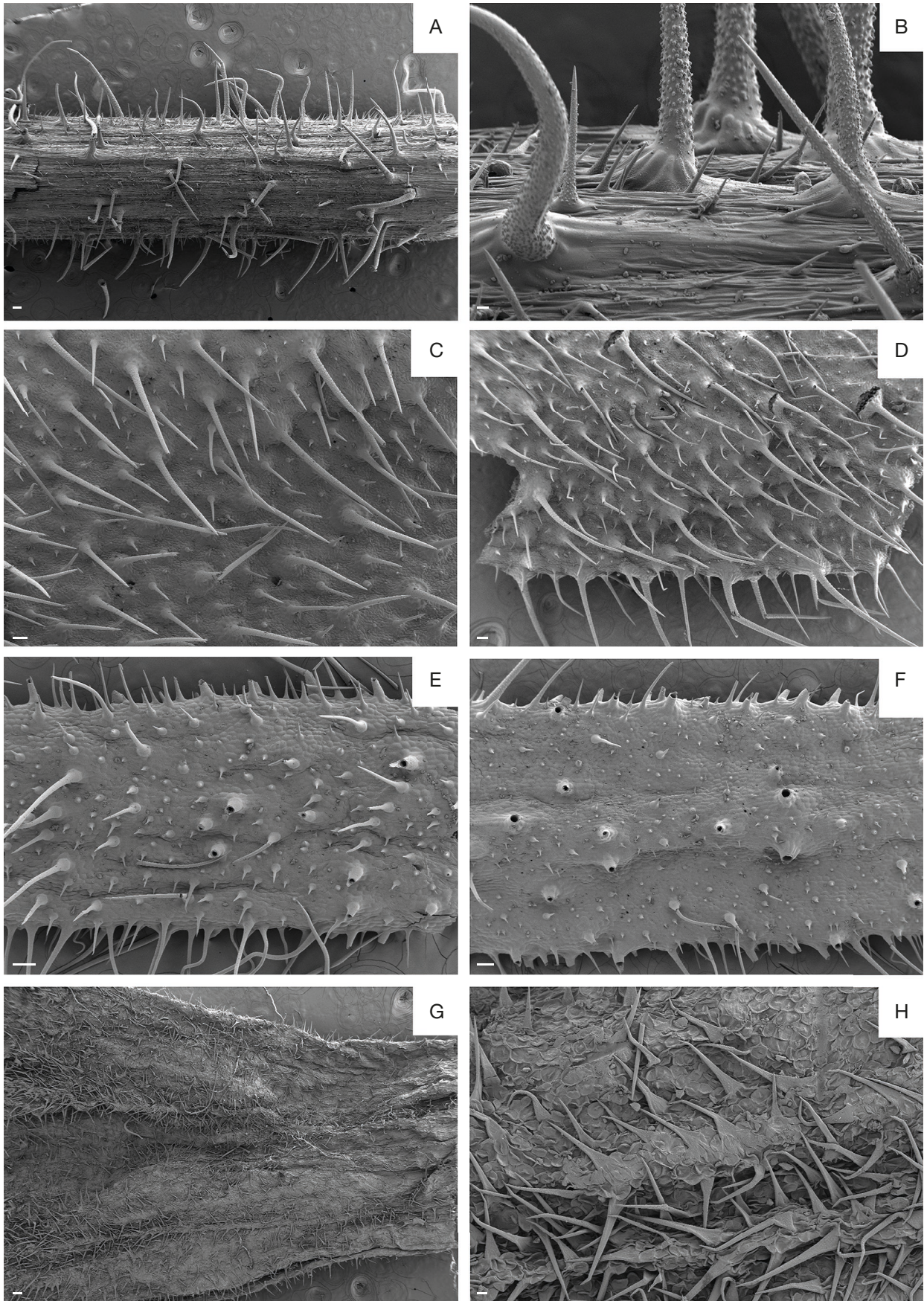


FIG. 5. — SEM micrographs of indumentum of *O. satensis* sp. nov.: **A, B**, stem; **C**, upper leaf surface; **D**, lower leaf surface; **E**, upper calyx surface; **F**, lower calyx surface; **G, H**, corolla. Scale bars: A, C-G, 100 μ m; B, H, 20 μ m.

TABLE 1. — Morphological parameters of *O. satensis* sp. nov. pollen. Abbreviations: **P**, polar axis; **E**, equatorial axis; **plg**, pores length; **plt**, pores width; **clg**, colpus length; **clt**, colpus width; **Ex**, exine thickness; **i**, intine thickness; **t**, polar triangular edge length.

Taxa	Pollen shape P/E	P (µm)	E (µm)	plg (µm)	plt (µm)	clg (µm)	clt (µm)	Ex (µm)	i (µm)	t (µm)
<i>O. satensis</i> sp. nov.	Subprolate 1.17	17.39 ± 0.58	14.80 ± 0.50	4.04 ± 0.56	4.47 ± 0.49	14.58 ± 0.65	5.24 ± 0.52	0.66	0.46	6.05

TABLE 2. — The main differences between *O. satensis* sp. nov. and *O. polioxantha* Rech. f..

Characters	<i>O. satensis</i> sp. nov.	<i>O. polioxantha</i> Rech. f.
Stem	numerous, -50 cm and -4 mm diameter, patent setose and short hairs usually with a number of sterile shoots at flowering and anthesis	1-2, 20-25 cm, adpressed setose and puberulous
Cauline leaves	sterile shoots leaves and cauline leaves are navicular typically cauline leaves -120 × -16 mm, oblanceolate to oblong basal and lower cauline petiolate, upper sessile and smaller in size, distinct reticulate	20-40 × 5-9 mm, lanceolate to oblong-lanceolate, yellowish-green above, greyish beneath, basal petiolate, cauline sessile
Inflorescence	1-3 lax cymes, elongating to 15 cm after flowering	2-5 lax cymes clustered at stem apex
Pedicels	4-5 mm long in flowering, elongating to c. 17 mm in fruit	3-4 mm
Calyx	13-17 mm in flower, to 27 mm in fruit, lobes linear, linear-lanceolate, covered with patent setose ± tubercles and short hairy on outside and sparsely patent setose and short hairs inside	12 mm in flower, 14 mm in fruit, lobes lanceolate, nerves projecting as 5 setose keels
Corolla	golden yellow, 20-22 mm, campanulate, campanulate-cylindrical, densely patent short setulose outside and reticulate	bright yellow, 14-17 mm, ± cylindrical, puberulous, lobes small, revolute, ciliate
Anthers	c. 8 mm	c. 7 mm
Nutlet	4.5-5 × 4-4.5 mm, beaked, shine cream and Brown variagated, ventrally and ± dorsally keeled, acuminate	2.5-3 mm, broadly ovate, with distinct laterally compressed beak, greyish, smooth to slightly rugulose

point below lobes (c. 7-8 mm wide when pressed), campanulate, campanulate-cylindrical, densely patent short setulose outside and reticulate, lobes 5, reflexed, 2 × 2.5 mm, widely triangular, acute, annulus glabrous. Anthers included or sterile tips exerted, linear, c. 8 mm, sagittate, connate at base. Filaments c. 3 mm. Style 4-5 mm protruding outside the corolla limb, stigma small, distinctly bilobed. Nutlets 4.5-5 × 4-4.5 mm, broadly ovate, beaked, shiny cream and brown variagated, ventrally and ± dorsally keeled, acuminate. Pollen grains heteropolar, subprolate P/E (Polar axis/Equatorial axis) ratio 1.17.

Indumentum

The indumentum is a very important character in *Onosma* systematic, and is illustrated for *O. satensis* sp. nov. (Fig. 5).

Palynology

Pollen grains are heteropolar, trisyncolporate and subprolate P/E (Polar axis length / Equatorial axis length) ratio 1.17. Exine ornamentation on mesocolpium of the grain is ± insular. The insulae have free scabrae and the scabrae are widely spaced. The number of scabrae in each insulae ranges from 5 to 20. The outline of pollen grains is circular and triangular. The other main palynological characters and SEM micrographs of *O. satensis* sp. nov. are presented in (Table 1 and Fig. 6).

Nutlet morphology

Nutlet ornamentation is rugose type, characterised by the epidermal cells of the nutlet surface having small or fine wrinkles (Fig. 7).

DISCUSSION

Onosma taxa are distributed throughout Turkey, but are particularly common and diverse in Anatolian steppes and within the boreal to subalpine belts of the Taurus range (Binzet & Eren 2018).

In recent years, many new *Onosma* taxa have been defined, especially in Iran (Almasi & Ranjbar 2015; Dehshiri 2018; Mehrabian & Mozaffarian 2018). Since they spread in the nearby geography, it was compared with the new species defined from Iran, but in this study, *O. satensis* sp. nov., defined as a new species, was found to be different from these species. Together with *O. satensis* sp. nov., the total number of *Onosma* species known from Turkey increases to 103. Sixty of those are endemic (endemism level is 58.25%).

Onosma satensis sp. nov. belongs to subsect. *Haplotricha* (Boiss.) Gürke and grows on rocky, stony, and calcareous areas. It is an element belonging to the Irano-Turanian

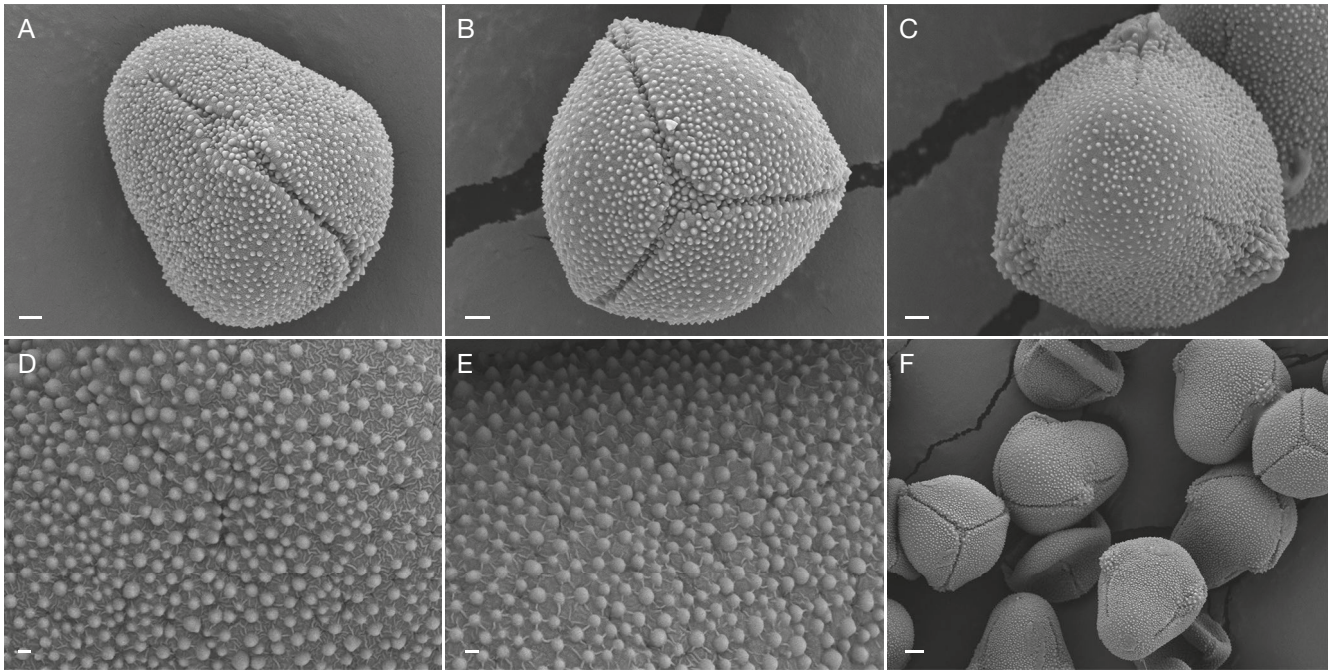


FIG. 6. — SEM micrographs of *O. satensis* sp. nov. pollen: **A**, profil view; **B**, distal view; **C**, proksimal view; **D**, **E**, ornamentation; **F**, autline view. Scale bars: A-C, 1 μ m; D, E, 200 nm; F, 2 μ m.

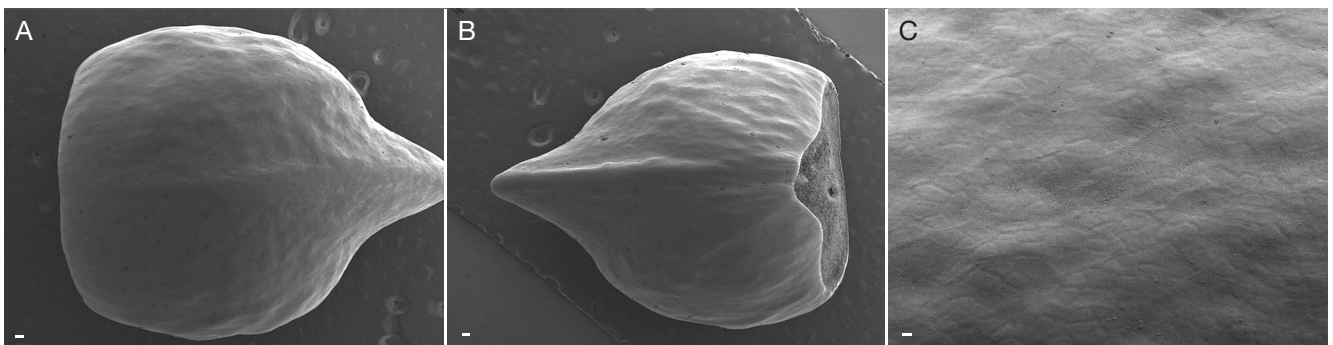


FIG. 7. — SEM micrographs of *O. satensis* sp. nov. nutlets: **A**, dorsal view; **B**, ventral view; **C**, surface ornamentation. Scale bars: A, B, 100 μ m; C, 10 μ m.

phytogeographical region. It shows some affinity to *O. polioxantha*, which is in the same subsection (Figs 1; 2; 4), and can be easily distinguished from *O. polioxantha* by its sterile shoots, patent setose and short hairs of stem indumentum, sterile shoots leaves and cauline leaves are navicular, cauline leaves 120 \times -16 mm, leaves are distinctly reticulate, pedisel 4-5 mm in flowering time and -17 mm in fruiting time, calyx 13-17 mm in flowering time and -27 mm in fruiting time, corolla 20-22 mm, densely patent short setulose outside and reticulate, nutlets 4.5-5 \times 4-4.5 mm,

broadly ovate, beaked, shine cream and brown variaegated, ventrally and \pm dorsally keeled, acuminate, ornamentation is rugose type, characterised by the epidermal cells of the nutlet surface having small or fine wrinkles. The other differences between *O. satensis* sp. nov. and *O. polioxantha* are listed in Table 2.

The necessary detailed key to *O. satensis* sp. nov. and *O. polioxantha* is proposed below. The characters given in the key mainly consider the type specimens studied as well as the relevant taxonomic literature (Riedl 1978).

KEY TO *ONOSMA SATENSIS* SP. NOV. AND *O. POLIOXANTHA* RECH. F.

1. Cauline leaves 20-40 \times 5-9 mm; calyx 12 mm in flower, to 14 mm in fruit; corolla 14-17 mm; nutlets 2.5-3 mm *O. polioxantha* Rech. f.
- Cauline leaves -120 \times -16 mm; calyx 13-17 mm in flower, to 27 mm in fruit; corolla 20-22 mm; nutlets 4.5-5 \times 4-4.5 mm *O. satensis* Firat & Binzet, sp. nov.

Acknowledgements

We would like to thank Alihan Çoruh, who helped first author in the field study, and the SEM laboratory of Mersin University (MEİTAM), for their support for SEM studies. We would also like to thank Barış Ozudoğru and an anonymous referee, who helped us to improve a previous version of the manuscript.

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Submitted on 7 October 2020;
accepted on 13 March 2021;
published on 13 September 2021.