

Salvia brachyantha subsp. *tankutiana* (Lamiaceae), a new subspecies from Central Anatolia

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Abstract: As an initial part of a revisional study based on the genus *Salvia* L. (Lamiaceae), extensive field studies, herbarium and literature surveys have been conducted on the basis of the *S. brachyantha* (Bordz.) Pobed and *S. modesta* Boiss. in order to understand their taxonomic status. As a result of the present study, *S. brachyantha* and *S. modesta* are accepted as distinct species. Moreover, *S. brachyantha* subsp. *tankutiana* Bagherpour, Celep, Kahraman & Doğan subsp. nova is first described from central Anatolia, Turkey. The diagnostic morphological and micromorphological characters of *S. brachyantha* subsp. *brachyantha*, *S. brachyantha* subsp. *tankutiana* and *S. modesta* are discussed. Distribution, conservation status and photograph of the taxa are also given.

Key words: Central Anatolia, new subspecies, *Salvia*, Turkey

İç Anadolu'dan yeni bir alttür: *Salvia brachyantha* subsp. *tankutiana* (Lamiaceae)

Özet: *Salvia* L. (Lamiaceae) cinsi üzerine temel alınan revizyon çalışmasının ilk bölümü olarak, *Salvia brachyantha* (Bordz.) Pobed ve *S. modesta* Boiss. türlerinin taksonomik statülerini anlamak için kapsamlı arazi, herbaryum ve literatür çalışmaları gerçekleştirildi. Bu çalışmanın sonucu olarak, *Salvia brachyantha* ve *S. modesta* farklı türler olarak kabul edildi. Ayrıca, İç anadolu bölgesinden *S. brachyantha* subsp. *tankutiana* Bagherpour, Celep, Kahraman & Doğan alttürü tanımlandı. *S. brachyantha* subsp. *brachyantha*, *S. brachyantha* subsp. *tankutiana* ve *S. modesta* taksonlarının ayırtedici karakterleri tartışıldı. Taksonların dağılım, koruma statüleri ve fotoğrafları verildi.

Anahtar sözcükler: İç Anadolu, yeni alttür, *Salvia*, Türkiye

Introduction

The genus *Salvia* L., the largest genus in the family Lamiaceae, contains about 1000 species worldwide. The genus is distributed principally in three regions, ranging from Central and South America to western Asia, and also into eastern Asia (Walker & Sytsma, 2007).

Boissier (1879), in his 'Flora Orientalis', recognized 75 species of *Salvia* from Turkey and placed these species under seven sections, all of which had been recognized previously by Bentham (1833). These sections are as follows: *Eusphace* Benth., *Hymenosphace* Benth., *Aethiopsis* Benth., *Plethiosphace* Benth., *Drymosphace* Benth., *Horminum* Benth. and

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Hemisphace Benth. Later, sect. *Eusphace* was changed to sect. *Salvia* by Hedge (1972). In 'Flora of Turkey' (Hedge, 1982a), the species were not referred to sections. According to published work, leaf, calyx, corolla and stamen characteristics are the most important diagnostic characters for distinguishing sections and species within *Salvia*. In our study on the sectional delimitation of Turkish *Salvia* (Doğan et al., 2007), *Salvia brachyantha* (Bordz.) Pobed and *S. modesta* Boiss. were placed within sect. *Aethiopsis*.

The first revision of *Salvia* in Turkey was made by Hedge (1982a), who recognized 86 species, 1 hybrid and 1 doubtful species. Since then, six more new species, two new varieties and three new records have been described from Turkey (Celep et al., 2009a; 2009b; İlçim et al., 2009; Kahraman et al., 2009; Celep et al., 2010a; 2010b; Celep et al., 2011a). *Salvia aucheri* Benth. var. *canescens* Boiss. & Heldr. has been raised to subspecies rank (Celep et al., 2011b). Moreover, two synonym species have been accepted as valid species (Kahraman et al., 2010).

Salvia modesta Boiss. was first collected from alpine region of Erciyes Mountain in central Anatolia by B. Balansa in 1856 and then described as a new species by Boissier (1879). In 1915, *S. brachyantha* was first recognized as a variety of *S. modesta* by Bordzilowski (*S. modesta* Boiss. var. *brachyantha* Bordz.). Subsequently, var. *brachyantha* was raised to species level by Pobedimova (1954) who differentiated it from *S. modesta* on the grounds of the arachnoid eglandular indumentum on the calyces, smaller corollas and included corolla tube in the calyces. Moreover, Pobedimova (1954) indicated that *S. modesta* grows neither in the Caucasus nor in eastern Turkey. Hedge (1957) pointed out that further studies and materials needed to establish whether the specific difference between *S. brachyantha* and *S. modesta* exist. On the other hand, *S. eriophora* Boiss. & Kotschy is distantly related to *S. brachyantha* (Hedge, 1982a).

Since 2006, the authors have collected many specimens of *S. brachyantha* and *S. modesta* from central and eastern Anatolia (Figures 1-2). They also studied the type (for *S. modesta* in G herbarium) and herbarium specimens of the species. In 2008, while conducting field work in Kaman-Kırşehir (central

Anatolia), the first author (S.B.) found an unusual population of *Salvia*. At a first glance, it resembled both *S. brachyantha* and *S. modesta*. Subsequently, the population was visited several times in 2009 and 2010 by the authors. The specimens were cross-checked with keys provided by Hedge (1982a; 1982b) and *Salvia* accounts given in the relevant literatures, including Flora Orientalis (Boissier, 1879), Flora U.S.S.R. (Pobedimova, 1954) and Flora Iranica (Hedge, 1982b).

The present study aims to clarify taxonomic status, distribution and conservation status of *S. brachyantha* and *S. modesta* and to determine for certain taxonomic status of the recently found specimens in Kaman-Kırşehir.

Material and methods

Since 2005, as a part of a taxonomic revision of the genus in Turkey, the present authors have carried out extensive field works and collected a large number of specimens and examined many specimens at various herbaria (ANK, AEF, B, BM, E, G, GAZI, HUB, ISTE, ISTF, K, LE and KNYA). In addition, population sizes and phenological and ecological properties were observed in the field.

Our own specimens, type and herbarium specimens are used in the study. During field studies, we aimed to visit as many as different habitats and populations to ensure representative geographical coverage of the species in Turkey. In the field, habitat and relevant field observations were also recorded. When the species was detected, we observed following criteria: the area of occupancy and distribution, populations and their size and the number of mature individuals. Threat categories were assessed according to IUCN Red List Categories Version 3.1 (2001). The specimens have been deposited at the Department of Biological Sciences, Middle East Technical University and various herbaria (ANK, E, G, GAZI, ISTE, LE).

For palynological investigations, pollen material was obtained from herbarium samples. The pollen slides were prepared according to Wodehouse's (1935) technique. For light microscopy (LM) studies, pollen grains were dissected from herbarium samples and placed on clean microscope slides. Glycerin-



Figure 1. A-Habit of *Salvia brachyantha* subsp. *brachyantha*, B-Flower.

gelatin and basic fuchsin were added to the pollen and then mixed with a clean pin to be scattered. The polar length (P), the equatorial length (E), the colpus length (Clg), the exine and the intine thickness for 30 pollen grains were measured under a Leica DM1000 binocular light microscope (1000×) and P/E ratios were calculated. For scanning electron microscopy (SEM), unacetolyzed pollen grains were first mounted on double-sided carbon tape affixed to aluminum stubs, covered with gold with an Hummel VII sputter coater and photographed with a JEOL-6060 SEM to determine exine sculpturing. The terminology of the pollen follows that of Punt et al. (2007).

Nutlets were first examined using a Leica S8AP0 stereomicroscope to ensure that they were of normal size and mature. In order to determine the average nutlet sizes, 20 mature nutlets were measured. For SEM, the mature nutlets were placed on stubs directly and covered with gold. Subsequently, they were observed and photographed with a JEOL JSM-6400 SEM (Doğan, 1988).

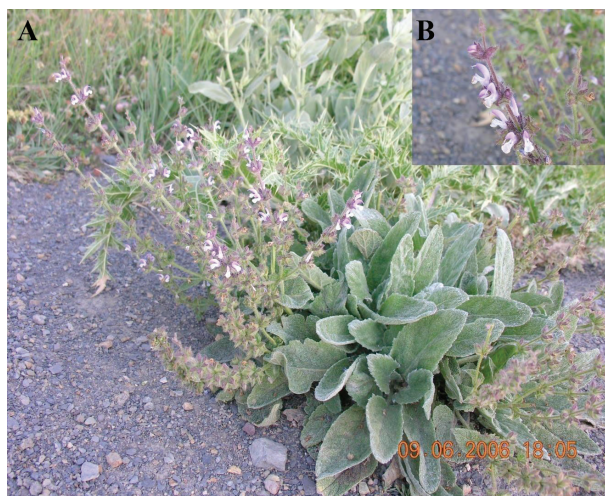


Figure 2. A-Habit of *Salvia modesta*, B-Flower.

Results and discussion

S. brachyantha (Bordz.) Pobed. subsp. *tankutiana* Bagherpour, Celep, Kahraman & Doğan subsp. *nova* (Figure 3)

Type: Turkey, B5 Kırşehir, Kaman, Gönüladağ, above Demirli village, 39°17'567"N, 33°56'860"E, 1424 m, 10.6.2008, Bagherpour 465 (holotype ANK; isotypes E, GAZI).

Diagnosis: *S. brachyantha* subsp. *tankutiana* affinis subsp. *brachyantha* sed differt dense eglanduloso arachnoid piloso et dense capitis glanduloso piloso in caulis, inflorescentia axis et calycis.

Perennial herbs with thick woody rootstocks. Stems solitary or several, erect, 15-50 cm tall, green to purple, sparsely eglandular arachnoid pilose with dense glandular pilose. Leaves simple, oblong to ovate, 3-12 × 2-6 cm, erose, arachnoid pilose with sessile glands, rugose; petiole 1.5-8 cm. Inflorescence axis widely paniculate, densely arachnoid pilose and glandular pilose. Verticillasters 2-8-flowered, usually distant. Bracts broadly ovate-acuminate, green to purple, nearly 5-15 × 5-13 mm. Pedicels 2-3 mm. Calyces tubular campanulate, 6-10 mm, to 13 mm in fruit, purplish, densely eglandular arachnoid pilose and glandular pilose; teeth subulate; upper lip tridentate, median tooth much shorter. Corolla dark violet, 8-12 mm; tube nearly 6-8 mm, ventricose, squamulate; upper lip semi-falcate. Stamens B.

Phenology: *S. brachyantha* subsp. *tankutiana* flowers in June.

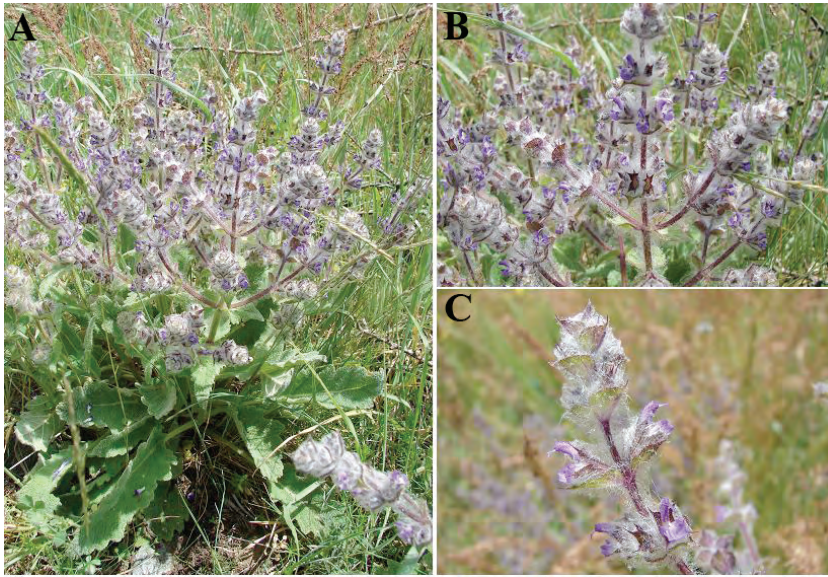


Figure 3. A- Habit of *Salvia brachyantha* subsp. *tankutiana* (from Kaman, type locality), B- Inflorescence, C- Flower.

Etymology: This new subspecies is named in honour of the Turkish architect, professor Gönül Tankut.

Habitat and ecology: *S. brachyantha* subsp. *tankutiana* grows in open *Quercus* sp. and steppe at an altitude of 1400-1700 m. The vegetation in these places is mainly formed by herbaceous and woody plants including *Quercus* sp., *Crateagus* sp., *Astragalus* sp., *Thlaspi* sp., *Phlomis* sp., *Verbascum* sp., *Marrubium* sp., *Vicia* sp., *Euphorbia* sp., *Poa* sp. and *Matricaria* sp.

Distribution: *S. brachyantha* subsp. *tankutiana* is found only from two populations in Kırşehir (central Anatolia), however subsp. *brachyantha* is confined to eastern Anatolia, N.W. Iran and Armenia. *S. modesta* is found only in the central Anatolia around Kayseri, Adana, Yozgat and Kahramanmaraş provinces from several localities.

Conservation status: According to IUCN criteria (2001), *S. brachyantha* subsp. *tankutiana* is evaluated as Endangered (EN) [B2ab (i, ii, iv): area of occupancy less than 500 km², known at no more than five locations] and subsp. *brachyantha* is evaluated as Near Threatened (NT) since they are likely to qualify for a threatened category in the near future. *S. modesta* is evaluated as Vulnerable (VU)

[B2ab (i, ii, iv): area of occupancy less than 2000 km², known at no more than 10 locations; inferred decline in the area]. *S. brachyantha* subsp. *brachyantha* and subsp. *tankutiana* have representing a large number specimens in their habitats, while *S. modesta* has representing less number specimens. All the taxa are produce fertile seeds, however *S. brachyantha* subsp. *brachyantha* and subsp. *tankutiana* produce more seeds than *S. modesta*. The principle threats on the taxa are overgrazing.

Our field and herbarium studies show that *S. brachyantha* is similar to endemic *S. modesta*, but differs from it in several characters. For example, *S. brachyantha* has mostly arachnoid eglandular hairs on inflorescence axis and calyx (in fruit, sparse), and fully lilac to violet-blue corolla upper and lower lips, however *S. modesta* has densely short capitate glandular hairs on inflorescence axis and calyx, and light violet corolla upper lip and whitish to yellowish corolla lower lip.

According to our field trips, herbarium and literature studies, Kaman specimens (Bagherpour 436, 465, 537) clearly seems more similar to *S. brachyantha* than *S. modesta*. However, they possess some morphological and chorological differences from the typical *S. brachyantha* specimens. Therefore,

they are described here as a new subspecies of *S. brachyantha*.

S. brachyantha subsp. *tankutiana* differs from subsp. *brachyantha* by its eglandular arachnoid and densely glandular pilose hairs on the stem and inflorescence (inflorescence axis, calyx and bract).

S. eriophora is distantly related to *S. brachyantha*. It differs from *S. brachyantha* by its linear and crenulate leaves and shorter stems. Taxonomic relationships of the species are given below in the identification key.

Identification key for *S. brachyantha*, *S. modesta* and *S. eriophora*

- 1. Stem and inflorescence eglandular arachnoid.....2
- 1. Stem and inflorescence densely glandular capitate*S. modesta*

- 2. Leaves linear-oblong, to 10 mm wide and margin crenulate..... *S. eriophora*
- 2. Leaves oblong to ovate, 8-60 mm wide and margin erose..... *S. brachyantha*

Pollen and nutlet micromorphology

The pollen grains of the taxa are hexacolpate, radially symmetrical and isopolar. The length of the polar, equatorial and colpus axes and exine and intine thickness are summarized in Table. All taxa have bireticulate ornamentation. According to results, the most common shape of pollen is spheroidal in *S. brachyantha* subsp. *tankutiana* and *S. modesta*, but suboblate is observed in subsp. *brachyantha* (Figure 4).

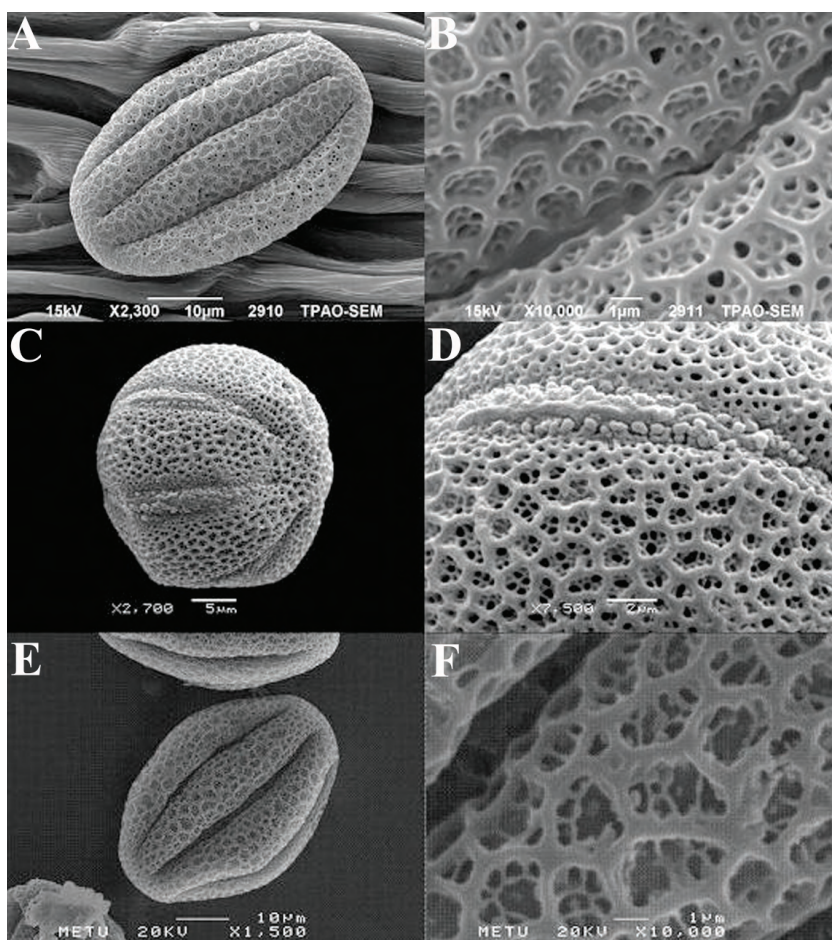


Figure 4. SEM micrographs of the pollen of *S. brachyantha* subsp. *tankutiana*.(A-B), *S. brachyantha* subsp. *tankutiana* (C-D) and *S. modesta* (E-F).

The nutlet size of the taxa are given in Table. The nutlets of *S. brachyantha* subsp. *tankutiana* and *S. modesta* are broadly ovate, while the nutlets of subsp. *brachyantha* are ovate. According to results, nutlet size of subsp. *brachyantha* is clearly bigger than the subsp. *tankutiana*. On the other hand, surface sculpturing of *S. brachyantha* subsp. *tankutiana* is smooth to colliculate, while surface sculpturing of *S. brachyantha* subsp. *brachyantha* and *S. modesta* is colliculate to verrucate with striate exocarp cells (Figure 5).

Additional specimens examined

***S. brachyantha* subsp. *tankutiana* (paratypes):** Turkey, B5 Kırşehir: North of Kırşehir, Boztepe hills, 1504 m, 17.5.2008, *Bagherpour* 436 (ANK); Kırşehir: Kaman, Gönüldağ above Demirli village, 1400-1700 m, 5.6.2009, *Bagherpour* 537 (ANK).

***S. brachyantha* subsp. *brachyantha*:** A8 Erzurum: İspir, June 1853, *A.Huet*; A9 Kars: Kars, 30.6.1912, *Lonaczewski-Pietruniaka*; B8 Erzurum: between Tercan and Aşkale, 1850 m, 8.6.1957, *Davis* 29321 (E,

ANK); B9 Van: between Van and Başkale, Güzeldere, 2791 m, 11.7.2007, *Kahraman* 1448; Ağrı: 2 km southwest of Hamur, Murat Valley, 1670 m, 3.6.1966, *Davis* 44174 (E), Ağrı: Patnos to Tutak 32. km, 1800 m, *Davis* 43480 (E); Bitlis: North of Ahlat, Yuvadamlı village, 2300 m, 22.6.1995, *Behçet* 904 (VANF); C7 Urfa: between Siverek and Diyarbakır, 17 miles from Siverek, W. foot of Karacadağ, 1050 m, 19.5.1957, *Davis* 28278 (E).

***S. modesta*:** Type: B5 Kayseri: in Cappadociae regione subalpina montis Argaei (Erciyas Da.) in valle Kamechly Tchai (Çomaklı çay), 1700 m, 16.6.1856, *Balansa* 242 (holo. G); Kayseri: Erciyes Mountain above Sakarçiftliği, 1400-2200 m, *Türktekin & Vural* 2358; Kayseri/Adana: Bakırdağ to Saimbeyli, Gezbeli pass, 1970 m, 9.6.2006, *Celep* 1065; Kayseri, Sarız, Yeşilkent (Yalak), Binboğa Da., above Dayoluk village, Afan Plateau, 2172 m, 10.6.2006, *Celep* 1072; Kahramanmaraş: Göksun, Dibek Mountain, Hottaş village, 1720 m, 19.6.1979, *Tuzlacı & Saraçoğlu* (ISTE 42343).

Table. A comparison of palynological and nutlet characters of *S. brachyantha* and *S. modesta*.

	<i>S. brachyantha</i> subsp. <i>brachyantha</i>	<i>S. brachyantha</i> subsp. <i>tankutiana</i>	<i>S. modesta</i>
Pollen data			
Polar length	41.42 ± 3.37 µm	40.58 ± 1.39 µm	43.47 ± 2.24 µm
Equatorial length	48.19 ± 4.05 µm	42.89 ± 2.9 µm	47.81 ± 2.8 µm
Polar/Equatorial ratio	0.86	0.95	0.91
Shape	suboblate	spheroidal	spheroidal
Colpus length	35.97 ± 3.31 µm	32.21 ± 4.27 µm	36.43 ± 2.76 µm
Exine thickness	1.18 ± 0.17 µm	1.54 ± 0.32 µm	1.24 ± 0.33 µm
Intine thickness	0.58 ± 0.07 µm	0.73 ± 0.10 µm	1.06 ± 0.18 µm
Nutlet data			
shape	ovate	broadly ovate	broadly ovate
Length	3.13-3.33 mm	2.50-3.00 mm	2.70-3.29 mm
Width	2.00-2.32 mm	2.10-2.50 mm	2.25-2.69 mm
Surface sculpturing	colliculate to verrucate with striation	smooth to colliculate	colliculate to verrucate with striation

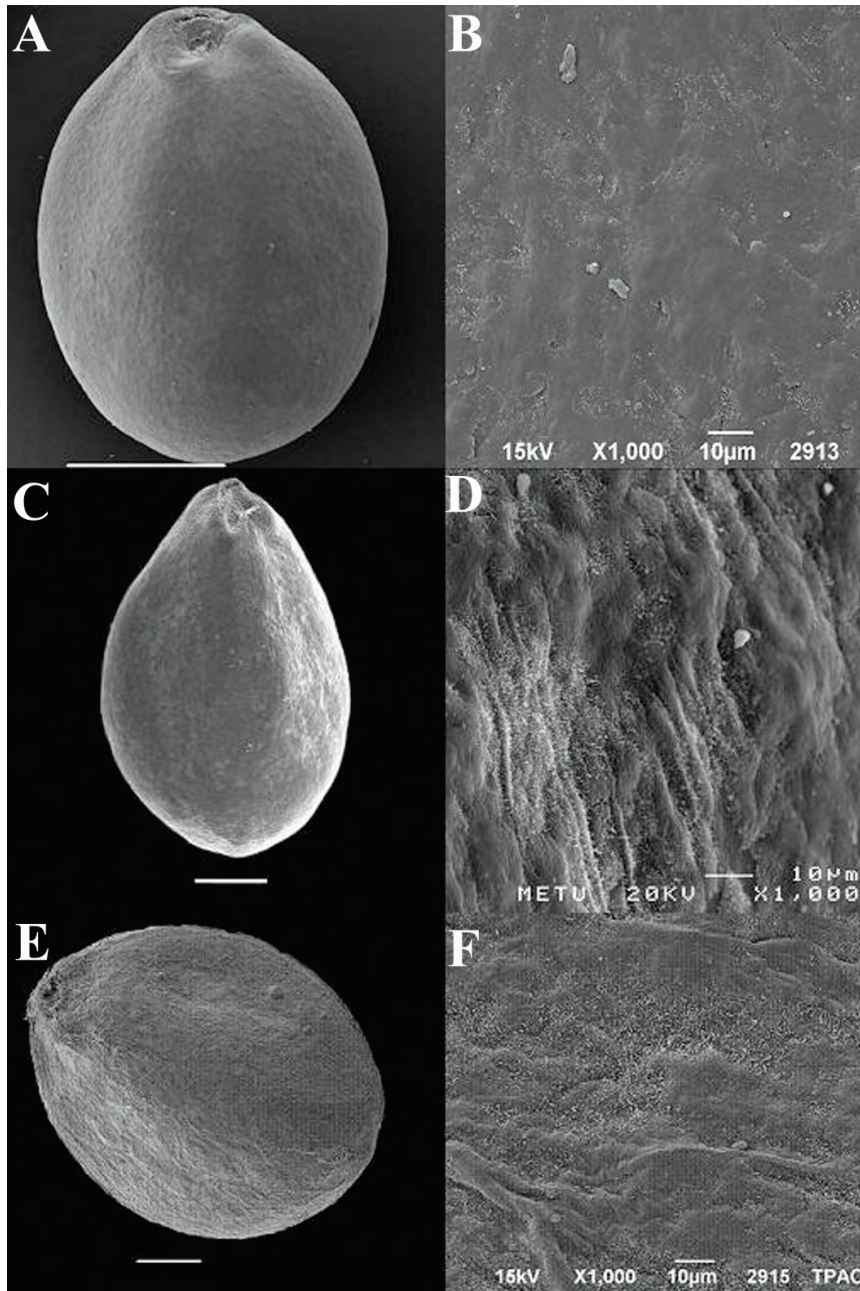


Figure 5. SEM micrographs of the nutlet of *S. brachyantha* subsp. *tankutiana* (A-B), *S. brachyantha* subsp. *tankutiana* (C-D) and *S. modesta* (E-F). Scale bar: 500 μm for A-C & E.

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