

Biosystematic studies in *Sedum* of Turkey (Crassulaceae). III *S. euxinum*, a new species from northeastern Anatolia

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SUMMARY

A new, yellow-flowered *Sedum* species is described from Turkey, *S. euxinum*. It is reported from three localities in the northeastern part of Anatolia. *S. euxinum* is classified in *Sedum* series *Alpestria* Berger. Its chromosome number is $2n = 48$, but the species is considered to be diploid ($x = 24$). *S. euxinum* is regarded as a neo-endemic because of its high secondary basic number and restricted distribution at the periphery of the area of *S.* series *Alpestria*.

Key-words: biosystematics, Crassulaceae, *Sedum euxinum*, Turkey.

INTRODUCTION

Chamberlain (1972), in *Flora of Turkey*, reported the yellow-flowered *Sedum alpestre* Vill. from the northwestern part of Anatolia (Uludağ) and the mountains of the northeast. Morphologically and cytologically the plants of Uludağ are indeed identical with *S. alpestre* (H. 't Hart & K. Alpinar unpublished observations), but the plants we collected on the mountains in northeastern Anatolia for the project 'Biosystematic studies in *Sedum* of Turkey' in 1989 belong to a different, hitherto unknown, yellow-flowered, perennial species. The plants are presently cultivated in the Botanic Garden at Utrecht. Cytologically as well as morphologically they differ considerably from *S. alpestre*, and, at least, living specimens of the two species can be easily told apart. The plants are described here as a new species. The systematic position of the species and some aspects of its evolution are briefly discussed.

Sedum euxinum 't Hart et Alpinar, sp. nov. (Fig. 1)

Plantae perennes totae glabrae. Surculi steriles procumbentes, partibus aphyllis serpentibus radicanibus, parce ramificantibus, partibus foliosis ascendentibus vel erectis. Folia sessilia, alterna, laxe imbricata vel patentia, elliptico-oblonga, 4–6 mm longa, teretia apicibus rotundatis. Caules floriferi erecti, 6–10 cm longis, simplices. Inflorescentiae terminales floribus 3 ad 17, ramulis monochasialibus 2 (1 ad 3) proxime subter flore centrali enascentibus. Flores 5-meri, subsessiles, bracteis binis. Sepala inaequalia, oblongo-elliptica, ad 3 mm longa, apicibus rotundatis, basi receptaculo totae adnatis. Petala flava, libera, per anthesin stellatim

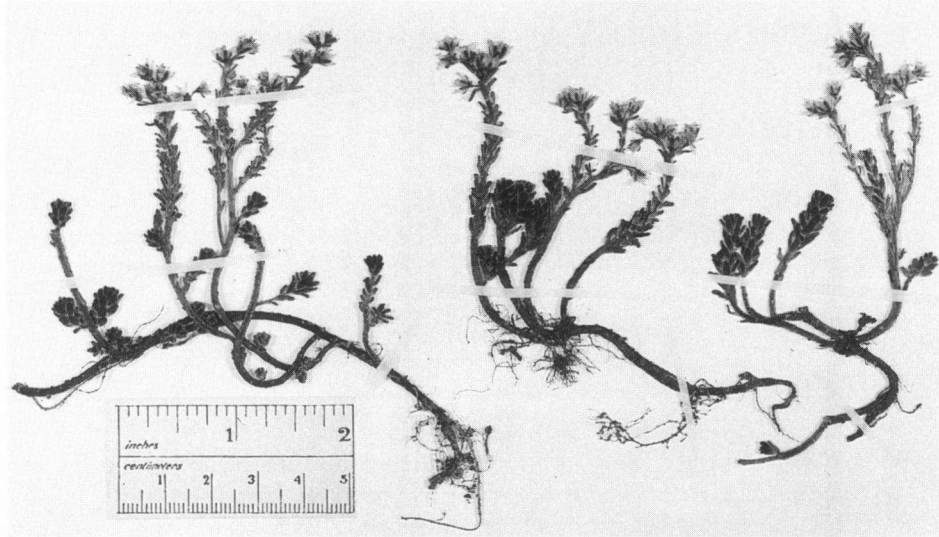


Fig. 1. Habit of *Sedum euxinum* 't Hart & Alpinar. Specimens of the type collection showing the characteristic, procumbent, bare, non-flowering shoots, and loosely imbricate, patent leaves.

patentia, elliptica. Stamina 10, filamentis flavis, antheris flavis. Carpella sessilia, per anthesin suberecta, in stylum tenuem erectum attenuata. Squamae oblongae, apicibus truncatis, emarginatis vel bidentatis. Folliculi maturi ochroleuci, stellato-patentes, labiis pallidis angustis secus suturam ventralem. Semina brunnea ovoidea, testis reticulato-papillosis, apicibus acutis. Chromosomatum numerus $2n=48$. Hab. in regionibus alpinis montium Ponti.

Plants perennial, glabrous throughout. Non-flowering shoots procumbent, with the leafy parts ascending or erect, 3–7 cm, and the leafless parts trailing and rooting, 10 cm or more long, 2–3 mm in diameter, sparingly branched. Leaves green, sessile, alternate, loosely imbricate or patent, elliptic-oblong, 4–6 × 1.5–1.7 mm, semiterete (elliptic in cross-section), with a round tip, and a truncate, slightly spurred base (spur 0.1–0.3 mm). Flowering shoots usually erect, 6–8(–10) cm, simple, often with 1–5, small, secondary, axillary inflorescences with 1–4 flowers. Terminal inflorescences with 7–12 (3–17) flowers on 2 (1–3) monchiasial branches of 1–3(–4) cm, arising immediately below the central flower. Flowers 5-merous, subsessile (pedicels to 0.5 mm), with two bracts. Lower bracts leaf-like, up to 5 mm long. Sepals green, unequal, oblong-elliptic, up to 3 mm long, with a rounded tip, and basally completely fused with the receptacle. Petals yellow, free, stellate-patent during anthesis, elliptic, 4–5 × 2 mm, acute, with a small dorsal acumen. Stamens 10, with yellow filaments, 3–4 mm long, and yellow anthers of *circa* 0.8 mm. Carpels yellowish-green, sessile, (sub-)erect during anthesis, 3–4 mm long, tapering into a slender, erect style of *circa* 0.7 mm long, with 8–12 ovules in each loculus, and with yellowish, oblong, truncate or emarginate or bidentate squamae of *circa* 0.8 × 0.3 mm at the base. Ripe follicles pale yellowish-brown, stellate-patent, 4.5–6 mm, with pale, narrow lips along the ventral suture. Seeds brown, ovoid, 0.6–0.8 mm long, with a reticulo-papillate testa, and acute apex. Chromosome number $2n=48$.

Type: Turkey, prov. Rize; Kirklar Dağı, near Ovitdağı Geçidi, volcanic rocks and rocky slopes, 2650 m, K. Alpınar & H. 't Hart AH-504 [HRT-31368], 12 VIII 1989 (holo. ISTE, iso. U).

Additional collections: Turkey, prov. Artvin; Alaca Dağı, Savval Tepe, rocky slopes near Çamurlu Yayla, 2300 m, K. Alpınar & H. 't Hart AH-522 [HRT-31386], 13 VIII 1989; prov. Rize; Kirklar Dağı, near Sivrikaya N of Ovitdağı Geçidi 23 km S of Iskidere, E of the road to Rize, 1850 m, K. Alpınar & H. 't Hart AH-512 [HRT-31376], 12 VIII 1989. (HRT numbers are the accession numbers of the plants cultivated at Utrecht).

DISCUSSION

Of the small, herbaceous, yellow-flowered species of *Sedum* section *Sedum* (the Eurasiatic species of *S.* subgenus *Sedum*) the European and North African species of *S.* series *Alpestria* Berger form a comparium (Clausen 1975; 't Hart 1978, 1982, 1985). In addition to habit, colour of the flowers, and crossability, the species of *S.* series *Alpestria* share several other morphological features. They are all glabrous throughout, and have semiterete to terete, obtuse (rarely subacute) leaves, cincinniform inflorescences with two (1–4) branches, (sub-)sessile, obdiplostemonous, 5-merous flowers with two bracts, obtuse sepals which are basally fused with the receptacle, lanceolate, apiculate petals, stamens with yellow anthers, and stellate-patent follicles which usually have distinct lips along the ventral suture, and contain 8–14 ovoid seeds with a reticulate or reticulo-papillate testa. This description also suits *S. euxinum*, and the affinities and evolutionary relationships of this species are certainly to be sought for in *S.* series *Alpestria*. *S. euxinum* is a very distinct species though, and it can be easily separated from the other species of *S.* series *Alpestria* by a unique combination of morphological characters. Its most distinctive features (diagnostic characters) are the trailing, leafless non-flowering shoots with the erect or ascending, sparingly branched leafy shoots (Fig. 1), and the loosely imbricate or patent, oblong-elliptic, semiterete leaves with a round tip and truncate base (shortly spurred).

The comparium of *S.* series *Alpestria* comprises nine species native to Europe and two species endemic to North Africa ('t Hart 1982, 1985, 1991). Of the nine European species only *S. alpestre*, *S. annuum* L., *S. laconicum* Boiss. & Heldr. and *S. urvillei* DC (= *S. sartorianum* Boiss. & Heldr.) have been reported from Anatolia (Boissier 1872, Chamberlain 1972). 't Hart (1990) described a new species, *S. ursi*, of *S.* series *Alpestria* from SW Anatolia (Sandras Dağı, prov. Muğla), which seems to be quite common in central and southern Anatolia (H. 't Hart & K. Alpınar unpublished observations). Although, *S. euxinum* and *S. ursi* fully agree with *S.* series *Alpestria* morphologically, it remains to be shown whether they can indeed be hybridized with the other species of the comparium.

In *S.* series *Alpestria* the basic chromosome numbers $x=6, 8, 11, 13, 16, 22, 23$, and 29 occur ('t Hart 1978, 1982, 1983b, 1990; Hébert 1977). The chromosome number $2n=48$ of *S. euxinum* fits well into an euploid series based on the basic number $x=6, x=8, x=12$, or $x=24$, and accordingly it may be diploid, tetraploid, hexaploid, or octoploid. As the plants are fully fertile, a triploid condition (based on $x=16$) seems rather unlikely. The length of the chromosomes of *S. euxinum* varies from 0.3 to 1.5 μm and its karyotype is rather asymmetrical, though not conspicuously so at first sight (Fig. 2a). In regard to karyotype symmetry and chromosome length *S. euxinum* differs significantly from *S. alpestre* (Fig. 2b) as well as from the other paleodiploid species of *S.* series *Alpestria* ('t Hart 1983b) with the basic number $x=6$ or $x=8$, i.e. *S. grisebachii* Boiss. & Heldr.



Fig. 2. Karyotype variation in *Sedum* series *Alpestria* Berger. (a) *Sedum euxinum* 't Hart & Alpınar, $2n=48$, Savval Tepe (Turkey, Artvin), AH-522, HRT-31386. (b) *S. alpestre* Vill., $2n=16$, Ulu Dağ (Turkey, Bursa), AH-170, HRT-30905. (c) *S. grisebachii* Boiss. & Heldr., $2n=16$, Demircihali (Turkey, Kırklareli), AH-251, HRT-30986. (d) *S. laconicum* Boiss. & Heldr., $2n=16$, Parnon Mts. (Greece, Ioannina) HRT-28847. (e) *S. ursi* 't Hart, $2n=12$, Sandras Dağı (Turkey, Muğla), HRT-30396. The karyograms were drawn from root-tip sections stained with haematoxylin ('t Hart 1990). The AH numbers refer to the collection numbers (specimens at ISTE). The HRT numbers are accession numbers of plants cultivated at Utrecht (vouchers at U).

(Fig. 2c), *S. laconicum* (Fig. 2d), and *S. ursi* (Fig. 2e). These cytological differences most definitely exclude a simple and direct relationship (polyploidy) between these species. With respect to the ploidy-level of *S. euxinum* the asymmetry of its karyotype is quite instructive. *S. euxinum* has one pair of conspicuously small chromosomes, which resemble B-chromosomes (Fig. 2a). However, these two very small chromosomes occur in the two plants from Kırklar Dağı as well as in the plant from Savval Tepe, and therefore are considered to be autosomes. As each plant has only one pair of these chromosomes, we consider *S. euxinum* to be diploid with the secondary basic number $x=24$.

The centre of diversity or centre of speciation of *S. series Alpestria* is located in the eastern part of the Mediterranean region ('t Hart 1985, 1991). The larger part of the morphological (number of species) and of the cytological (cytotypes) diversity of the series occurs in the southern Balkans. Furthermore, the diploid cytotypes of the paleodiploid taxa ($x=8$) are concentrated in this area, i.e. the diploid form of *S. grisebachii* ($2n=16$) is endemic to the Balkans, the diploid cytotype of *S. laconicum* is restricted to the southern part of Greece and Crete, and the ancestral, outcrossing form of *S. alpestre* (= *S. erythraeum* Griseb.) is endemic to northern Greece ('t Hart 1983a; Hagemann & 't Hart 1986). The species with secondary, high basic chromosome numbers, on the other hand, occur exclusively towards the periphery of the distribution area of *S. series Alpestria*. *S. multiceps* Coss. & Dur. ($x=29$) and *S. tuberosum* Coss. & Let. ($x=23$) are endemic to North Africa ('t Hart 1982). Of *S. sexangulare* L. ($x=37$) the diploid form occurs in southern central Europe and the northern part of the Balkans, whereas the triploid cytotype ($2n=111$) is most common in central and western Europe ('t Hart 1978). Similarly, *S. euxinum* is regarded as a neo-endemic.

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