

Lorenzo Gallo

## Nomenclatural adjustments and typifications in the genus *Phedimus* (*Crassulaceae*)

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**Abstract** This paper deals with the taxonomical position and the nomenclature of two taxa belonging to the genus *Sedum* (*Crassulaceae*), today treated as *Phedimus*, namely *Sedum middendorffianum* Maxim. var. *diffusum* Praeger and *Sedum oppositifolium* Sims. The correct taxonomical application of names is based on the nomenclatural types designated here.

**Keywords** lectotype, neotype, *Phedimus middendorffianus* var. *diffusus*, *Phedimus spurius* subsp. *oppositifolius*

Dr. Lorenzo Gallo  
Strada Val San Martino sup. 194  
10131 Torino - Italy.  
[lorenzogallo1959@hotmail.it](mailto:lorenzogallo1959@hotmail.it)

### Introduction

The genus *Phedimus* was established by Rafinesque (1817, p438) for *Sedum stellatum* L. (= *Phedimus stellatus* (L.) Raf.), although already two years earlier he published it as *nomen nudum* (Rafinesque 1815, p174). This name was long forgotten until 't Hart (1995, p168), reestablished it, adding the taxa belonging to the subsection *Spathulata* Boriss. of the genus *Sedum* ('t Hart 1984, p405), due to shared morpho-anatomical features (simultaneous presence of flat leaves and patent follicles) and the successful hybridization of *P. stellatus* with *S. stoloniferum* S. G. Gmel. The splitting of *Phedimus* from *Sedum* is now widely accepted, also because it is supported by several phylogenetic studies (Mayuzumi & Ohba 2004, Gontcharova et al. 2006, Gontcharova, & Gontcharov, 2009, Nikulin et al. 2015). After 't Hart (1995, p168), other scholars have made new combinations sub. *Phedimus* (Ohba et al. 2000, pp400-402, Son et al. 2016, p294, Bomble 2016, p29) and this work proposes two further combinations together with the typification of the basionyms.

### Materials and Methods

An extensive study of the taxonomic literature concerning the taxa involved in this research (*Sedum middendorffianum* var. *diffusum* Praeger, *Sedum oppositifolium* Sims and *Sedum spurium* M. Bieb.) was performed. Original material (*exsiccata*) used for describing these taxa was reviewed in the according herbaria; also the original illustrations (published and unpublished) accompanying the text were evaluated.

### Results and Discussion

#### *Phedimus middendorffianus* (Maxim.) 't Hart var. *diffusus* (Praeger) L. Gallo comb. nov.

Basionym: *Sedum middendorffianum* Maxim. var. *diffusum* Praeger (Praeger R. L. 1921. An account of the genus *Sedum* as found in cultivation: p117, footnote).

≡ *Sedum middendorffianum* Maxim. 'Diffusum' (Praeger) Hensen & Groendijk-Wilders (1986, p10 [not seen, J. Shaw comm.]).

≡ *Sedum kamtschaticum* Fisch. & C. A. Mey. var. *Middendorffianum* (Maxim.) Groendijk-Wilders & Springate (1995, p192) forma *diffusum* (Praeger) Groendijk-Wilders & Springate (1995, p192).

≡ *Phedimus diffusus* (Praeger) Bomble (2016, p29).

Recently reported in Germany as established in the wild (Bomble 2016, p29), *Sedum middendorffianum* Maxim. var. *diffusum* was described by Praeger (1921, p117 in note), from cultivated plants; it differs from var. *middendorffianum* by the decumbent habit and lanceolate leaves, which are more toothed on the margins than in the type variety (Evans 1985, p127, Stephenson 1994, p154). These features also make it very similar to *Phedimus kamtschaticus* (Fisch. & C. A. Mey.) 't Hart, in fact, Groendijk-Wilders & Springate (1995, p192; 2011, p42 [Shaw in litt.]) treat it as *Sedum kamtschaticum* var. *middendorffianum* forma *diffusum*. In view of the poor differences with respect to other taxa of the genus *Phedimus*, we propose to maintain the taxonomic rank chosen by Praeger, although an according combination in the genus *Phedimus* is still missing.

**Lectotype (designated here):** The original drawing for Praeger 1921, p116, fig. 59b by Eileen Barnes, extant as an unnumbered manuscript in Royal Irish Academy, Dublin, figure on left-hand side of sheet (J. Shaw, pers. comm.) (see Nelson 1993, p103).

<https://www.biodiversitylibrary.org/item/52929#page/128/mode/1up>.

R. L. Praeger's herbarium collections are stored at BEL and DBN (Thiers 2019), but no specimens of *Sedum middendorffianum* have been found in there, and therefore, the original drawing reproduced in the protologue has been selected as a lectotype: This is morphologically consistent and was drawn from a living plant cultivated in a garden by Eileen Barnes at the request of Praeger (cf. Nelson 1993, p103).

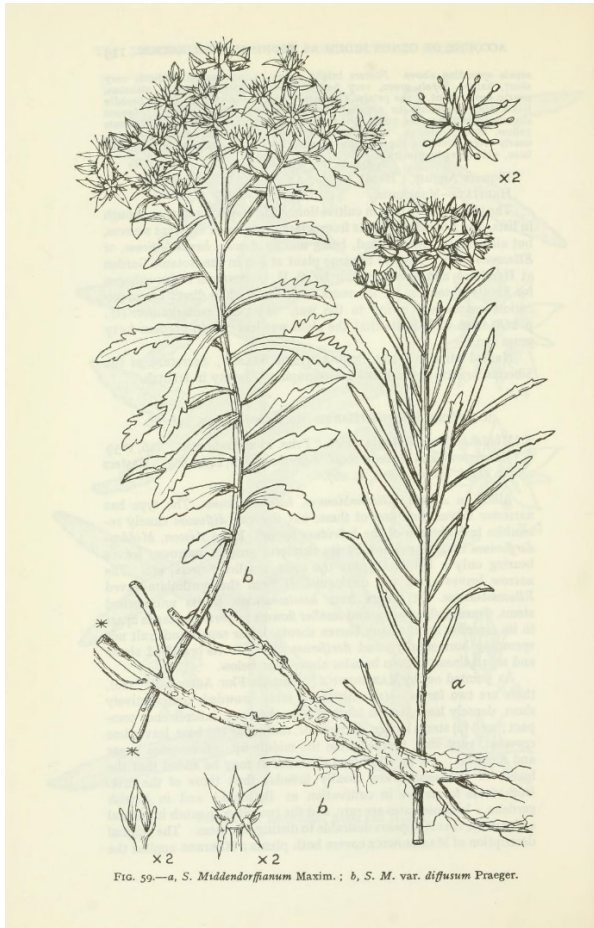


Fig. 1 Lectotype *Phedimus middendorffianus* (Maxim.) 't Hart var. *diffusus* (Praeger) L. Gallo *comb. nov.* Illustration taken from Praeger (1921).

***Phedimus spurium* (M. Bieb.) 't Hart subsp. *oppositifolium* (Sims) L. Gallo *comb. et stat. nov.***

Basionym: *Sedum oppositifolium* Sims, Curtis's Botanical Magazine: 43, t. 1807 (1816).

= *Sedum spurium* M. Bieb. var. *album* [sub *alba*] Trautv. (1876, p370).

≡ *Sedum spurium* M. Bieb. subsp. *oppositifolium* (Sims) R. L. Evans (1983, p200).

= *Sedum spurium* M. Bieb. 'Album' R.L. Evans (1983, p200).

≡ *Phedimus oppositifolius* (Sims) Essl & Rabitsch (2002, p128) *comb. inval.* (Art. 41.1, I.C.N. Turland et al. 2018).

Although tentatively, Sims (1816: number 1807) also included *Sedum denticulatum* Pursh in Donn (1815, p149) among the synonym *Sedum*. However this name (invalid because *nomen nudum*) is not included here, because in the protologue there are no useful data to clarify its identity; the only information available is related to its origin and life form: "M. Caucasu *Sedum* 1806 July. A. H. 24".

With regard to the year of publication of the name *Sedum oppositifolium* Sims, there are different interpretations in the literature. Some authors suggest 1815 (Borissova 1939, p60, 't Hart & Bleij 2003, p201, Marhold 2011) while I.P.N.I. (<https://www.ipni.org/>) and the Smithsonian Institution Libraries (TL-2) cite 1816

(<https://www.sil.si.edu/DigitalCollections/tl-2/search.cfm>).

Following TL-2, the latter is the year of publication of the pictures from number 1787 to 1859, therefore including *Sedum oppositifolium* (number 1807) and has been followed here.

Sims' description (Sims 1816: n. 1807) was based on plants grown in the "collection of the Comtesse de Vandes, at Bayer-Water", possibly used as a model for the illustration n. 1807 attached to the text.

*Sedum oppositifolium*, may have come from the Caucasus ("[...] it seems that it is a native of Mount Caucasus") (Sims 1816: n. 1807). Its morphological resemblance to *Sedum spurium* M. Bieb. (= *Phedimus spurium* (M. Bieb.) 't Hart), has always made its taxonomic interpretation difficult and contradictory: Many scholars have treated them as distinct taxa (species or subspecies) (Meyer 1831, p151; Ledebour 1846, p184; Boissier 1872, p778; Borissova 1939, p60; Grossheim 1950, p266; Evans 1985, p300); however for other botanists they are merely synonyms (Hamet 1908, p15; Praeger 1921, p194; Fröderström 1932, 7 suppl., p10; J alas et al. 1999, p106; 't Hart, Bleij 2003, p201). Borissova (1939, 9, pp58-61) sets out a detailed morphological account of the two taxa and a synoptic table to compare the differences between them is proposed here (Tab. 1).

Tab. 1 Comparison of morphological characters between *Sedum oppositifolium* Sims and *Sedum spurium* M. Bieb. (from Borissova 1939)

Characters	<i>Sedum oppositifolium</i>	<i>Sedum spurium</i>
<b>Bracts</b>	Not surpassing the inflorescence	Surpassing the inflorescence <sup>1</sup>
<b>Sepals</b>	Light green	Green or reddish
<b>Petals</b>	Acuminate, white or pale yellowish cream-colored	Acute, pink or purple [in the key p. 39]
<b>Filaments</b>	Whitish	Red
<b>Anthers</b>	Yellow later dark	Orange-red
<b>Follicles</b>	Green [white cf. Sims]	Reddish

<sup>1</sup> = Morphological feature attributed by the author at *Sedum involucreatum* M. Bieb., treated by 't Hart & Bleij (2003, p201) as synonymous of *Sedum spurium*.

The distribution of *Phedimus spurium* subsp. *oppositifolius* may include the eastern part of the *Phedimus spurium* s.l. area (Caucasus), and more precisely: Armenia (Takhtadjan 1958, p356) Georgia (Boissier 1872, p778, Nakhutsrishvili 1999, p118, p133), Iran (Boissier 1872, p778, Parsa 1948, p663, Jansson & Rechinger 1970, p10, sub *Sedum spurium*) and

probably also Azerbaijan (Batsatsashvili *et al.* 2016 sub *Sedum spurium*). The collections pertaining to Anatolia ('t Hart & Bleij 2003, p201) would instead be referred to *Phedimus spurium* s.s. From an ecological point of view, *Sedum oppositifolium* is a more xerophilous plant than *Sedum spurium* (Borissova 1939/9, p61); the species is "usually

located in poor thin soils, even in rock crevices" (Batsatsashvili *et al.* 2016, p3) and on rocks in the high-altitude pastures (Nakhutsrishvili 1999, p118 and p133). *Sedum oppositifolium* was furthermore found to be naturalized in Germany (Vollrath & Lauerer 2005, p299). To summarize, this taxon is sufficiently morphologically distinct and geologically separate from *Phedimus spurium* to deserve a subspecific rank. Its taxonomic relationship with *Crassula crenata* Desf. (= *Phedimus crenatus* (Desf.) V. Byalt has yet to be evaluated (cfr. Borissova 1939, p58; Byalt 2001, p284). The subspecific combination under *Phedimus* has been lacking up to now (see also Essl & Rabitsch 2002, p128), and is provided here, together with the typification.



Fig. 2 Neotype of *Phedimus spurium* (M. Bieb.) 't Hart subsp. *oppositifolius* (Sims) L. Gallo comb. et stat. nov. Illustration taken from Sims (1816).

**Neotype (designated here):** Curtis's Botanical Magazine, 43, t. 1807 (1816)

[<https://www.biodiversitylibrary.org/item/14327#page/103/mode/lup>].

The search for specimens on which the protologue relied did not lead to any results; more specifically, no original material was found at BON, where the Sims collection is kept, and at Kew under :

(<http://apps.kew.org/herbcat/refineQuery.do?queryId=25&sessionId=176FDD70393D7FD7E49ED4CDFB1D3B74>).

The picture attached to the protologue could be designated as

lectotype, because it was possibly drawn from the same cultivated plant used for the description (see above) but this is not sure. Therefore, in order to be safe, we prefer to designate it as neotype. The plate is in excellent agreement with the protologue and with Borissova (1939, p60), showing opposite leaves and white petals and, above all, bracts not surpassing the inflorescence, filaments white, anthers yellow and follicles white [in accordance with Sims] or green.

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