NOMENCLATURE

Lectotypification of the Linnaean name *Dianthus virgineus* (Caryophyllaceae) and its taxonomic consequences

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DOI https://doi.org/10.1002/tax.12563

Abstract A lectotype is designated for the name *Dianthus virgineus*. The relationships between *D. virgineus*, *D. caryophyllus* var. *caryophyllus*, and *D. caryophyllus* var. *inodorus* are analyzed. *Dianthus virgineus* is the oldest available name that applies to a species complex that is often referred to as *D. sylvestris* or a broad circumscription of the cultivated ornamental *D. caryophyllus*. The taxonomic consequences are discussed, and the need for further studies is highlighted.

Keywords Linnaean names; Mediterranean Basin; nomenclature; taxonomy; typification

INTRODUCTION

Dianthus L. is the second-largest genus in Caryophyllaceae after *Silene* L., with species occurring across Africa, Asia, Europe, and North America (Mabberley, 2008). Globally, 349 species are currently accepted (WFO, 2021). Most of these species are concentrated in the Mediterranean region, and, according to Marhold (2011), 234 species occur in Europe and the Mediterranean area. One of the most taxonomically challenging species complexes in this genus is that of *D. sylvestris* Wulfen, a name described in 1786 (Wulfen, 1786) and neotypified by Bacchetta & al. (2010). Recently, Tison & Foucault (2014) used the name *D. caryophyllus* L. for this same species complex.

Reviewing the oldest names within this group, we came across those described by Linnaeus, in particular the name *Dianthus virgineus* L. (Linnaeus, 1753), which remains untypified. Here, we typify *D. virgineus* and discuss its relationship to *D. caryophyllus* L. var. *caryophyllus* and *D. caryophyllus* var. *inodorus* L. in the light of previous typifications by Jafri & El-Gadi (1978) and Langen & al. (1984). This study is part of an ongoing project aimed to advance taxonomic knowledge of selected genera of the Italian flora, by an integrated approach (Giacò & al., 2021).

MATERIALS AND METHODS

The protologue of *Dianthus virgineus* (Linnaeus, 1753: 412) was studied to inform the search for original material, also taking advantage of Jarvis (2007). High-resolution digital images from LINN and UPS were consulted. Typification follows the *International Code of Nomenclature for algae, fungi and plants* (*Shenzhen Code*, Turland & al., 2019, *ICN* hereafter). After the nomenclatural study, based on the type localities of *D. virgineus* and *D. caryophyllus* var. *inodorus*, we carried out fieldwork, sampling topotype populations for both names. Twenty individuals of *D. virgineus* were measured in the field in southern France, near Montpellier (vouchers: Montferrier sur Lez, Chemin de la Meule, WGS84 43.677667 N, 3.861414 E, 9 Jul 2020, *L. Varaldo*, PI Nos. 041610–041619), while 17 individuals of *D. caryophyllus* var. *inodorus* were measured in the field in northern Italy, near Verona (vouchers: Busi di Avesa, Province of Verona, Veneto, 213 m a.s.l., WGS84 45.477858 N, 10.985452 E, 18 Jul 2020, *L. Minuto*, PI Nos. 041593–041609). This allowed a comparison between the lectotype specimens and recently collected, complete material.

Article history: Received: 15 Mar 2021 | returned for (first) revision: 20 May 2021 | (last) revision received: 17 Jun 2021 | accepted: 17 Jun 2021 | published online: 27 Aug 2021 | **Associate Editor:** James C. Lendemer |

■ TYPIFICATION OF THE NAME *DIANTHUS VIRGINEUS*

The protologue (Linnaeus, 1753: 412) consists of the nomen specificum legitimum "DIANTHUS caule subunifloro, corollis crenatis, squamis calycinis brevissimis, foliis subulatis" followed by the synonym "Caryophyllus sylvestris repens multiflorus" from Bauhin (1623: 209) and a reference to the Burser Herbarium "*Burs*. XI. 99". Under an unnamed var. β, Linnaeus listed "Tunica rupestris, folio caesio molli, flore carneo" from Dillenius (1732: 401, t. 298, fig. 385) as a further synonym. He also provided a more detailed description of this species, and its provenance was indicated as "*Habitat* Monspelii".

Jarvis (2007: 480) reported that the original material for this name consists of one specimen in the Burser Herbarium at UPS (Burser XI: 99; Fig. 1), one in the Linnaean Herbarium (LINN 581.25), and the illustration by Dillenius (1732: t. 298, fig. 385). The Linnaean Plant Name Typification Project database (http://www.nhm.ac.uk/our-science/data/linnaean-typification/) reports an illustration in the Herbarium Smith (LINN-HS 813.39) as further original material. However, the latter cannot be considered as such, since it is just an ink line drawing, obviously and explicitly based on the specimen "Burser XI: 99" at UPS V-174060 (Smith, 1794).

The Burser specimen at UPS (UPS V-174060) consists of a branch with two stalks bearing a single flower each and two dozen basal leaves. This specimen is labelled as "Caryophyllus Syl. repens multi florus Bauh.", and "Monspelii sponte" (= [growing] spontaneously at Montpellier). The specimen matches the diagnosis concerning the flower number ("caule subunifloro"), petals shape ("corollis crenatis"), epicalyx scales ("squamis calycinis brevissimis"), and leaf features ("foliis subulatis"). We also compared the specimen to a recent collection of 20 individuals from the Montpellier area (Table 1). The epicalyx, calyx and corolla of these plants are completely congruent with those of this original material and the protologue. The only feature not visible in the UPS specimen, due to the absence of flower buds, is the calyx shape just before anthesis, which is gradually tapering into an acuminate apex in the plants collected in the surroundings of Montpellier.

A second specimen was also found at UPS in the Burser Herbarium (Burser XI: 96; UPS V-174057 [digital image!]). While this specimen cannot be definitely considered original material due to the different polynomial reported on the label ("A. Caryophyllus Syl. humilis flore unico Bauh?"), it was also collected at Montpellier and identified as *Dianthus virgineus* by Juel (1936: 72). The specimen could potentially be a duplicate of the other Burser specimen discussed above. It consists of two individuals, both showing flowers in bud. The overall morphology of this specimen matches that of UPS V-174060, and the acuminate calyx shape before anthesis, which is not visible in that collection, is evident in UPS V-174057.

LINN 581.25 consists of a stalk with two flowers, one fully developed and the other in bud, with a dozen leaves at the base. At the bottom of the sheet there is the annotation "9 ~~plumarius~~ virgineus", which makes questionable its status of original material (Jarvis, 2007). In addition, the petals in this specimen are deeply fringed, making it apparently more consistent with the protologue of *Dianthus plumarius* L. ("corollis multifidis"; Linnaeus, 1753: 411) than that of *D. virgineus* ("corollis crenatis"), and the annotated *Species plantarum* number 9 is that of *D. plumarius*. Accordingly, the specimen in LINN can be only doubtfully considered original material and also conflicts with the protologue.

The illustration by Dillenius (1732: t. 298, fig. 385) depicts a branch with six flowering stalks bearing one or two flowers each, and includes the polynomial "*Tunica rupestris, folio*

Fig. 1. "Caryophyllus Syl. repens multi florus Bauh., Monspelii sponte", Burser XI: 99 (UPS V-174060), lectotype of the name *Dianthus virgineus* L. The coin is 10 SEK (20.5 mm in diameter).

caesio molli, flore carneo". These plants, according to Dillenius (1732) grew spontaneously in Somerset, England. This illustration refers to the unnamed var. β in the protologue, so it was not considered the typical form by Linnaeus (1753).

All the available original material, with the exception of the doubtful specimen in LINN, agrees with the current application of the *Dianthus sylvestris* complex (Tutin & Walters, 1993; Bacchetta & al., 2010). We designate Burser XI: 99 (UPS V-174060) as the lectotype, since it is in full agreement with the protologue, and extant specimens are preferred over illustrations in typification (Jarvis, 2007). Based on the morphology of the lectotype, the name *D. virgineus* clearly applies to a group of taxa referred to by some authors as *D. sylvestris* (e.g., Tutin & Walters, 1993; Bacchetta & al., 2010) and by others as *D. caryophyllus* sensu latissimo (e.g., Tison & Foucault, 2014; Tison & al., 2014). More specifically, within this group of taxa, the name *D. virgineus* applies to plants so far named *D. sylvestris* subsp. *longicaulis* (Ten.) Greuter & Burdet (Tutin & Walters, 1993), *D. caryophyllus* subsp. *longicaulis* (Ten.) Arcang. (Tison & al., 2014), *D. longicaulis* Ten. (Bacchetta & al., 2010), or *D. godronianus* Jord. (Tison & Foucault, 2014; see also the interesting discussion by Godron, 1847). Given that the name *D. caryophyllus* applies to cultivated plants of unknown origin (see below), *D. virgineus* is the oldest name available that applies to the whole complex of native species, and the above-mentioned group of taxa should be referred to it, accordingly.

Dianthus virgineus L., Sp. Pl. 1: 412. 1753 ≡ *Tunica virginea* (L.) Scop., Fl. Carniol., ed. 2, 1: 302. 1771 ≡ *Dianthus rupestris* Lam., Fl. Franç. 2: 536. 1779, nom. illeg. (Art. 52.1) ≡ *Dianthus scheuchzeri* Rchb., Fl. Germ. Excurs.: 811. 1832, nom. illeg. (Art. 52.1) ≡ *Dianthus caryophyllus* var. *virgineus* (L.) Fiori, Fl. Italia 1(2): 379. 1898 – **Lectotype (designated here):** Caryophyllus Syl. repens multi florus Bauh., Monspelii sponte, Burser XI: 99 (UPS No. V-174060 [image!]).

For an image of the lectotype, see Fig. 1.

■ RELATED LINNAEAN NAMES AND THEIR RELATIONSHIP WITH *DIANTHUS VIRGINEUS*

***Dianthus caryophyllus* var. *caryophyllus*. —** According to Langen & al. (1984), *Dianthus caryophyllus*, which is also the type of the generic name *Dianthus*, is homotypic with *D. caryophyllus* var. *coronarius* L. (published by Linnaeus, 1753: 410), and applies to cultivated plants of unknown origin. These plants are commonly regarded as closely related to, albeit clearly distinct on morphological grounds from, the *D. sylvestris* species complex (Tutin, 1964; Tutin & Walters, 1993). *Dianthus caryophyllus* has glaucous, flat, wide (2–4 mm, even 1 cm in some cases), flaccid basal leaves and strongly fragrant, often sterile and polypetalous flowers, while *D. sylvestris* has green, convolute, narrow, wiry basal leaves and flowers not or slightly fragrant (Tutin, 1964; Pignatti, 1982; Tutin & Walters, 1993; Brullo & Guarino, 2017). Moreover, *D. caryophyllus* has been cultivated for hundreds of years for ornamental purposes, and complex hybridization events are involved in the origin of a high number of cultivars (Onozaki, 2018). Accordingly, we do not agree with the application of this name to wild plants commonly referred to the *D. sylvestris* species complex (Bacchetta & al., 2010), as was done by Tison & al. (2014).

Dianthus caryophyllus L., Sp. Pl. 1: 410. 1753 ≡ *Dianthus caryophyllus* var. *coronarius* L., Sp. Pl. 1: 410. 1753 ≡ *Dianthus coronarius* (L.) Burm.f., Fl. Indica: 13. 1768, nom. illeg. (Art. 52.1) ≡ *Dianthus coronarius* Lam., Fl. Franç. 2: 536. 1779, nom. illeg. (Art. 52.1) – Lectotype (designated by Ghafoor in Jafri & El-Gadi, Fl. Libya 59: 104. 1978): Herb. Linnaeus No. 581.8 (LINN [image!]).

***Dianthus caryophyllus* var. *inodorus*. —** Following the typification by Langen & al. (1984), the name *Dianthus caryophyllus* var. *inodorus* L. (Linnaeus, 1753: 410) applies to plants from the surroundings of Verona (Veneto, northern Italy) (Séguier, 1745). Within *D. caryophyllus* and its varieties,

Table 1. Morphological comparison among the lectotypes of the names *Dianthus virgineus* and *D. inodorus* and topotypes from Montpellier (southern France) and Verona (northern Italy), respectively.

	D. virgineus (lectotype)	*D. virgineus* (topotype)	*D. inodorus* (lectotype)	*D. inodorus* (topotype)
Innermost epicalyx scale length/width ratio	1.02	1.24 ± 0.50	1.99	1.31 ± 0.27
Calyx length/width ratio	3.46	3.92 ± 0.39	6.50	5.99 ± 2.17
Calyx shape before anthesis	Gradually tapering into an acuminate apex*	Gradually tapering into an acuminate apex	Abruptly tapering into an acute apex	Abruptly tapering into an acute apex
Corolla limb length (cm)	0.50	0.52 ± 0.08	n/a	1.15 ± 0.02
Corolla limb width (cm)	0.47	0.47 ± 0.07	n/a	0.90 ± 0.02
Corolla limb length/width ratio	1.06	1.12 ± 0.14	1.21	1.29 ± 0.17

Mean values and standard deviation are reported for plants collected by us. * = from the specimen UPS V-174057.

D. caryophyllus var. *inodorus* is the only one that applies to wild plants (Langen & al., 1984), representing a potential heterotypic synonym of *D. virgineus*. However, the analysis of the morphological features that can be deduced from the lectotype and the original description (Séguier, 1745: 435–437), along with those measured on 17 plants recently collected in a topotypical population (Table 1), allow us to highlight several morphological differences with respect to *D. virgineus*. For instance, the calyx, just before anthesis, is abruptly tapering into an acute apex in *D. inodorus*. In addition, calyces, epicalyx scales, and petal limbs are more slender.

The above data do not support the conspecificity of *Dianthus inodorus* with *D. virgineus*. In fact, although both clearly fall within the variability of the *D. sylvestris* species complex (Bacchetta & al., 2010), *D. virgineus* applies to plants so far named *D. longicaulis* or *D. godronianus* (see above), while *D. inodorus* could represent a heterotypic synonym of *D. sylvestris* Wulfen s.str. (Tutin, 1964; Pignatti, 1982; Tutin & Walters, 1993; Bacchetta & al., 2010; Brullo & Guarino, 2017). Nonetheless, the exact identity of *D. caryophyllus* var. *inodorus* as a synonym of *D. sylvestris* (a species described from eastern Alps) has been questioned by multiple authors (Pignatti, 1982; Langen & al., 1984, Brullo & Guarino, 2019). Further comparative studies are currently underway to clarify the taxonomic relationships among the taxa belonging to the *D. virgineus* species complex, including *D. inodorus* (L.) Gaertn. and *D. sylvestris* Wulfen.

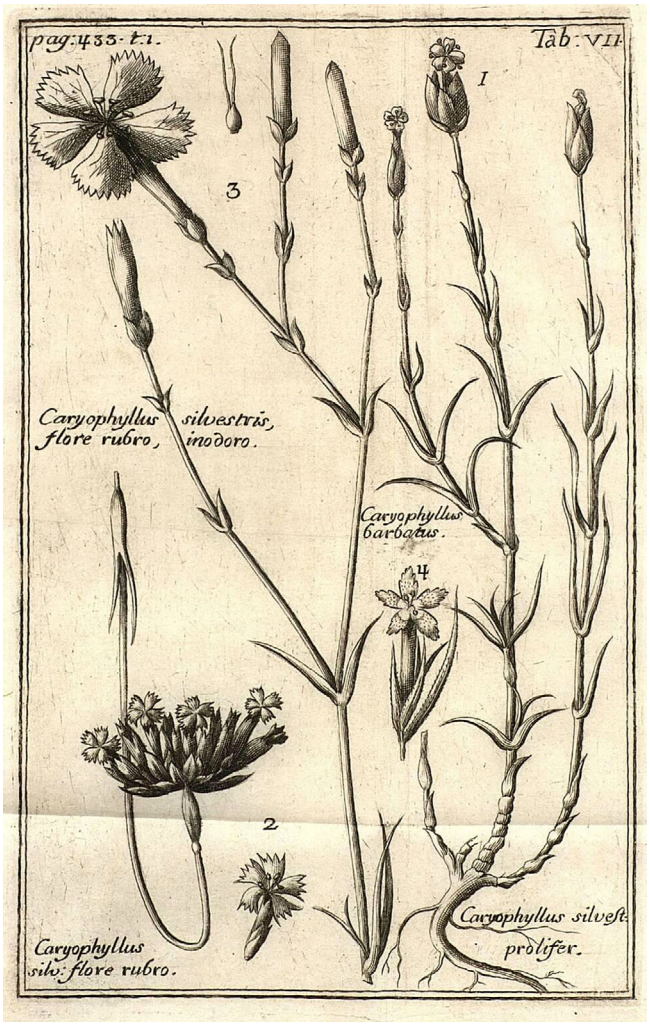

Fig. 2. Illustration of "*Caryophyllus silvestris, flore rubro, inodoro*" in Séguier (1745: 433, t. VII, fig. 3), lectotype of the name *Dianthus caryophyllus* var. *inodorus* L.

Dianthus caryophyllus var. *inodorus* L., Sp. Pl. 1: 410. 1753 ≡ ***Dianthus inodorus*** (L.) Gaertn., Fruct. Sem. Pl. 2: 227, t. 129, fig. 13. 1790 – Lectotype (designated by Langen & al. in Taxon 33: 719. 1984): [illustration] "*Caryophyllus silvestris, flore rubro, inodoro*" in Séguier, Pl. Veron. 1: t. VII, fig. 3. 1745.

For an image of the lectotype, see Fig. 2.

■ AUTHOR CONTRIBUTIONS

LP and GA made preliminary nomenclatural research, GD and GB drafted the manuscript, LM and LV collected and analysed topotypical materials of *Dianthus virgineus* and *D. inodorus*, DG first noticed morphological differences among the two taxa. All authors contributed and reviewed advanced versions of the manuscript. — GD, https://orcid.org/0000-0003-4184-398X; GA, https://orcid.org/0000-0001-5790-3516; GB, https://orcid.org/0000-0002-6345-3117; DG, https://orcid.org/0000-0003-4677-3730; LM, https://orcid.org/0000-0002-1582-3806; LP, https://orcid.org/0000-0001-9008-273X

■ ACKNOWLEDGEMENTS

We thank the curator of UPS (M. Hjertson) for providing scanned specimens from Burser Herbarium. This work was supported by the Progetto di Ricerca di Rilevante Interesse Nazionale (PRIN) "PLAN.T.S. 2.0 – towards a renaissance of PLANt Taxonomy and Systematics" led by the University of Pisa, under the grant number 2017JW4HZK (Principal Investigator: Lorenzo Peruzzi). Open Access Funding provided by Universita degli Studi di Pisa within the CRUI-CARE Agreement.

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