

# Taxonomic status of *Pelargonium reniforme* Curt.

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**Background:** *Pelargonium reniforme* Curt. is a morphologically variable species that many authors have attempted to split or combine. Confusion relating to the differences between the two subspecies currently included under *P. reniforme* has impeded attempts to assess their conservation status. *Pelargonium reniforme* is closely related to *Pelargonium sidoides*; the two species are indistinguishable when not flowering and their distributions overlap in some areas.

**Objectives:** With this study, we aimed to clarify the taxonomic status of the two subspecies of *P. reniforme*, which has relevance in terms of their conservation status.

**Method:** Leaf shape, petiole length, internode length and flower colour were assessed by studying herbarium specimens of the two subspecies of *P. reniforme* and specimens of *P. sidoides*. Living specimens of the two subspecies were also examined in their natural habitat.

**Results:** The current investigation showed that the morphological characters used to distinguish the two subspecies of *P. reniforme* are too variable to separate them. Variation in some morphological characters may be related to environmental conditions.

**Conclusion:** The recognition of the two subspecies of *P. reniforme* as distinct taxa is no longer justified.

## Introduction

There are over 200 species of *Pelargonium* L'Hér. ex Aiton in South Africa and comparatively few species elsewhere in the world (Vorster 2000). The genus *Pelargonium* is characterised by a zygomorphic flower with a nectariferous spur fused to the pedicel, five petals (rarely four or two), with the posterior petals larger than the anterior petals and 10 stamens, of which only two to seven are fertile (Van der Walt 1985).

There are 16 sections recognised in the genus (Bakker *et al.* 2004). *Pelargonium reniforme* Curt. is a member of section *Reniformia* (R.Knuth) Dreyer ex J.P.Roux (Roux 2013) and is distributed from Middelburg in Mpumalanga southwards to Riversdale in Western Cape and as far west as Mthatha in Eastern Cape. This species is a small shrublet with tuberous roots and pink to deep magenta flowers. Variation in *P. reniforme* in internode length, leaf shape and petiole length has led to several taxonomic opinions. Ecklon and Zeyher (1835) split *P. reniforme* into three distinct species of the genus *Cortusina* (DC.) Eckl. & Zeyh., namely *Cortusina velutina* Eckl. & Zeyh., *Cortusina rubro-purpurea* Eckl. & Zeyh. and *Cortusina reniformis* (Curt.) Eckl. & Zeyh., but these were reduced by Harvey (1860) to varieties as var. *velutinum* (Eckl. & Zeyh.) Harv., var. *sidaefolium* (Thunb.) Harv. and var. *reniforme*. Knuth (1912) later regarded var. *velutinum* as a synonym of *P. reniforme* and raised var. *sidaefolium* to species status as *P. sidaefolium* (Thunb.) Knuth, which is currently known as *P. sidoides* DC. In 1995, Dreyer, Marais and Van der Walt re-established the recognition of infraspecific taxa of *P. reniforme* by recognising *P. reniforme* subsp. *velutinum* (Eckl. & Zeyh.) Dreyer.

*Pelargonium reniforme* subsp. *reniforme* was applied by Dreyer, Marais and Van der Walt (1995) to plants with elongated internodes (5 mm – 12 mm), reniform leaves and petioles 5 mm – 50 mm long. This form, although sympatric with *P. reniforme* subsp. *velutinum*, is more abundant in the Port Elizabeth area, Eastern Cape, where it is restricted to drier coastal plains below 300 m.a.s.l. The form designated as *P. reniforme* subsp. *velutinum* has internodes of 1 mm – 7 mm in length and cordate or reniform leaves with petioles of 25 mm – 130 mm in length. Plants with characteristics corresponding to *P. reniforme* subsp. *velutinum* are, according to Dreyer *et al.* (1995), more abundant between Grahamstown and Queenstown, Eastern Cape. In all other respects the two subspecies are identical and their distinction is difficult.

The closely allied *Pelargonium sidoides* differs from *P. reniforme* in having black or very dark purple flowers. It is usually indistinguishable from *P. reniforme* when not flowering, in having an

identical habit and leaves that are similar in shape and size, usually cordate and velvety. The distribution of *P. sidoides* overlaps with that of *P. reniforme* but is wider, the species occurring throughout Eastern Cape, Lesotho, Free State and southern Gauteng (Van der Walt & Vorster 1988).

### Medicinal use and conservation status

Some *Pelargonium* species are valued by traditional healers for their medicinal uses. The roots or extracts of roots of both *P. sidoides* and *P. reniforme* are used to treat diarrhoea, bronchitis, stomach ailments and respiratory tract infections (Watt & Breyer-Brandwijk 1962). Both species play an important role in traditional medicine and are therefore subject to occasional harvesting for local use, but *P. sidoides* is harvested at a much larger scale for export to Europe for use in the manufacture of a number of medicinal products (Brendler & Van Wyk 2008).

The conservation statuses of the two subspecies of *P. reniforme* are listed as 'Not Evaluated' (South African National Biodiversity Institute [SANBI] 2013a, 2013b), as the difficulty in distinguishing between them hinders data collection for conservation assessments. There is concern about the conservation status of *P. reniforme* as it can be harvested along with *P. sidoides* where the two occur sympatrically because of their morphological similarity. The conservation status of *P. reniforme* is thus currently listed as 'Near Threatened' as a result of suspected widespread overharvesting (Raimondo *et al.* 2012). The conservation status of *P. sidoides* is 'Least Concern' because, although it is heavily harvested, it is a very widespread and common species (De Castro *et al.* 2012). The clarification of morphological differences between the two subspecies of *P. reniforme* is regarded as a high priority by the Threatened Species Programme (D. Raimondo pers. comm., 29 May 2012) so that the conservation status can be properly assessed. We therefore investigated the species in an attempt to resolve the taxonomic problem. Morphological comparisons were made between the two subspecies, as well as with the nearest relative, *P. sidoides*, to clarify taxonomic uncertainty and subsequently contribute to the conservation of this species. The possibility that variation in some morphological characters is related to environmental conditions was also investigated by observing specimens of both subspecies of *P. reniforme* in their natural habitat.

### Research method and design

Specimens (101 in total) of both subspecies of *P. reniforme* from the National Herbarium in Pretoria (PRE), all wild-

collected and covering the entire geographical range of the subspecies, were studied to assess morphological variation between the two subspecies. A total of 15 specimens were previously identified as *P. reniforme* subsp. *reniforme* and 86 as *P. reniforme* subsp. *velutinum*. In addition, 140 specimens of *P. sidoides* from PRE were investigated in order to determine whether similar variation occurred in this species. The diagnostic characters distinguishing the two subspecies – that is, the lengths of the petioles and the internodes, as well as the leaf-shapes – were recorded for each specimen. A digital image of the holotype of *P. reniforme* subsp. *velutinum* from the Herbarium at the Swedish Museum of Natural History, Stockholm (S) was also examined. Observations of both subspecies were made in the area between Humansdorp, East London and Queenstown.

### Taxonomic treatment

*Pelargonium reniforme* Curt. in Curtis's Botanical Magazine 14: 493 (1800); Pers.: 229 (1806); Desf.: 457 (1809); Willd.: 703 (1809); Ait.: 171 (1812); Haw.: 307 (1812); Sweet: t. 48 (1820); DC.: 666 (1824); Hoffmg.: 95 (1824); Loudon: 574(1829); Don: 737 (1831); Steud.: 289 (1841); Harv.: 300 (1860); Knuth: 447 (1912); Pole-Evans: 672 (1937); Watt and Breyer-Brandwijk: 454 (1962); Batten and Bokelman: 89 (1966); Smith: 381 (1966); Clifford: 237 (1970); J.J.A. van der Walt: 40, Figure (1977); Webb: 69 (1894); Dreyer, Marais and Van der Walt: 325 (1995). *Cortusina reniforme* (Curt.) Eckl. & Zeyh.: 77 (1835). *Geranium reniforme* (Curt.) Andr.: 108 (18000; Poir.: 751 (1812); Steud.: 679 (1840). *Geranospermum reniforme* (Curt.) Kuntze: 95 (1891). Iconotype: Curt.: t. 493 (1800).

*Cortusina velutina* Eckl. & Zeyh.: 77 (1935). *Pelargonium reniforme* var. *velutinum* (Eckl. & Zeyh.) Harv.: 300 (1860). *Pelargonium reniforme* subsp. *velutinum* (Eckl. & Zeyh.) Dreyer, in Dreyer, Marais and Van der Walt: 328 (1995). Type: SOUTH AFRICA. **Eastern Cape:** 'campestris ad fluvium "Zwartkopsrivier" et collibus in "Adow" [Addo] (Uitenhage)', Ecklon & Zeyher 598 (S, holo. – digital image!).

### Description

#### Comparison of diagnostic characters of the two subspecies

Based on field observations as well as morphological comparison of herbarium specimens, *P. reniforme* subsp. *velutinum* was found to have internodes that were variable in length and a range of petiole lengths overlapping with those of subsp. *reniforme* (Table 1). This finding contradicts the descriptions given by Dreyer *et al.* (1995) to distinguish the two subspecies.

**TABLE 1:** Summary of diagnostic characteristics of *Pelargonium* species recorded from herbarium specimens.

Character	<i>Pelargonium reniforme</i> subsp. <i>reniforme</i>	<i>Pelargonium reniforme</i> subsp. <i>velutinum</i>	<i>Pelargonium sidoides</i>
Leaf shape	Reniform	Cordate or reniform	Cordate or reniform
Petiole length measurements from herbarium specimens (mm)	10–115	6–138	12–200
Petiole length according to Dreyer <i>et al.</i> (1995) (mm)	5–508	25–130	Not given
Internode length (mm)	1–15	1–10	1–3
Internode length according to Dreyer <i>et al.</i> (1995) (mm)	5–12	1–7	Not given

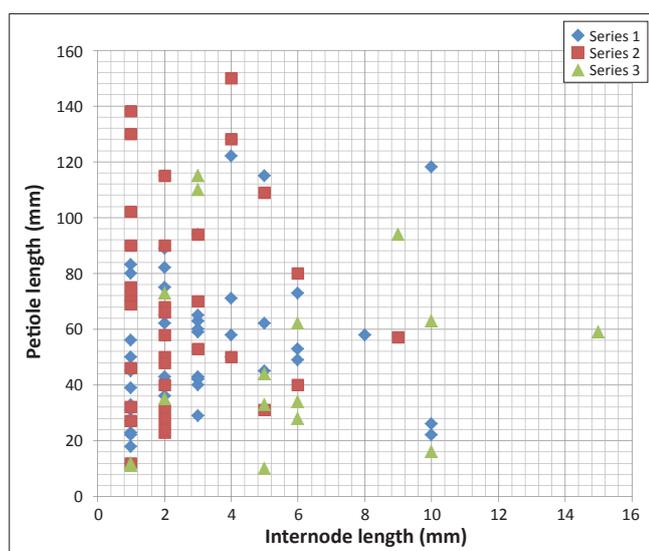
Source: Comparative data where stated from Dreyer, L.L., Marais, E.M. & Van der Walt, J.J.A., 1995, 'A subspecific division of *Pelargonium reniforme* Curt. (Geraniaceae)', *South African Journal of Botany* 61(6), 325–330

Character variation was plotted on a scatter plot chart (Figure 1), which shows that all variation overlaps in both subspecies. This implies that these characters cannot be used to distinguish the two subspecies. The petiole length of subspecies *velutinum* overlaps completely with that of subspecies *reniforme* and this characteristic is therefore also not useful to distinguish the two subspecies. Most of the specimens with characteristics that correspond with subspecies *velutinum* have cordate leaves; although, there are a few that are reniform. All specimens corresponding to subspecies *reniforme* have reniform leaves. Figure 1 shows that variation in the leaf shape is not correlated with petiole length or internode length and therefore this character is too variable to reliably be used to distinguish subspecies.

*Pelargonium sidoides* is vegetatively similar to the descriptions given in Dreyer *et al.* (1995) for subspecies of *P. reniforme*; however, one consistent characteristic of *P. sidoides* is the short internodes (usually 1 mm but never longer than 3 mm in length), whereas the internode length in *P. reniforme* varies between specimens. The other consistent difference between the two taxa is the flower colour, as described above.

## Influence of habitat on morphology

Although specimens with the form *P. reniforme* subsp. *reniforme* are concentrated around Port Elizabeth, observations of plant characteristics in this area revealed that a possible cause for variation is the microhabitat in which the plant was growing. Plants growing in the shade of dense grass in the Port Elizabeth area tended to have both longer internodes (as in subsp. *reniforme*), as well as longer petioles (as in subsp. *velutinum*). It is possible that availability of nutrients, water and sunlight affects internode and petiole lengths, which could explain much of the variability of these characteristics in *P. reniforme*.



Source: Authors' own creation  
Series 1, *Pelargonium reniforme* subsp. *velutinum* with cordate leaves; Series 2, *Pelargonium reniforme* subsp. *velutinum* with reniform leaves; Series 3, *Pelargonium reniforme* subsp. *reniforme* with reniform leaves.

**FIGURE 1:** Scatter-plot chart of character variation within *Pelargonium reniforme* subsp. *reniforme* and *Pelargonium reniforme* subsp. *velutinum*.

## Conclusion

The findings of this study show that it is not possible to reliably distinguish between *P. reniforme* subsp. *reniforme* and *P. reniforme* subsp. *velutinum* and we recognise a single variable species for all populations.

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## Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

## Authors' contributions

M.A. (SANBI) examined herbarium specimens and took measurements under the training and guidance of J.E.V. (SANBI). M.A. contributed to writing of the manuscript and collated background information. J.E.V. undertook fieldwork, contributed to writing the manuscript and editing it and supervised the project.

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