Section *Reniformia*, a new section in the genus *Pelargonium* (Geraniaceae)

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A new section of *Pelargonium* L'Hérit. (Geraniaceae), section *Reniformia* (Knuth) Dreyer is described in which 8 species and 2 subspecies are included. *Pelargonium reniforme* Curt. is designated as the type species for the section. All included species are endemic to southern Africa, with the majority of taxa centred in the Eastern Cape Province. Section *Reniformia* is characterised by its floral structure, a basic chromosome number of x = 8 and pollen grains with a striate-reticulate tectum.

Keywords: *Geraniaceae*, *Pelargonium*, *Cortusina*, *Reniformia*, taxonomy.

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Introduction

A multidisciplinary study of the section *Cortusina* (DC.) Harv. *s.l.* (genus *Pelargonium*) revealed two distinct groups of species within the section (Dreyer *et al.* 1992). The *Cortusina*-group, centred in the Northern Cape Province and Namibia, includes the species *P. cortusifolium* L'Hérit., *P. crassicaule* L'Hérit., *P. echinatum* Curt., *P. magenteum* J.J.A. van der Walt and *P. sibthorpiifolium* Harv. and the *Reniformia*-group includes the taxa *P. album* J.J.A. van der Walt, *P. dichondrifolium* DC. *P. odoratissimum* (L.) L'Hérit., *P. reniforme* Curt. subsp. *reniforme*, *P. reniforme* subsp. *velutina* (Eckl. & Zeyh.) Dreyer and *P. sidoides* DC. with its centre of diversity in the Port Elizabeth-Grahamstown area of the Eastern Cape Province. The *Cortusina*-group is distinguished from the *Reniformia*-group by various morphological and anatomical characters (Dreyer *et al.* 1992). Species in the *Cortusina*-group share a basic chromosome number of x = 11 and the chromosomes are distinctly smaller than those found in members of the *Reniformia*-group. Pollen grains in this group display an open reticulate tectum, with prominent intra-luminary bacules present in most species. The basic chromosome number of the *Reniformia*-group is x = 8. Pollen grains have reticulate-striate tectums, and intra-luminary bacules are absent (Dreyer *et al.* 1992).

In his revision of the genus *Pelargonium*, Knuth (1912) used inflorescence structure to recognise two subsections within section *Cortusina s.l.*, namely subsection *Reniformia* Knuth and subsection *Odoratissima* Knuth. With the exception of *P. odoratissimum* (included in section *Odoratissima*), all the species in the *Reniformia*- and *Cortusina*-groups were included in his subsection *Reniformia*. *P. cortusifolium*, which is included in the *Cortusina*-group, constitutes the type species of the section *Cortusina s.l.* The sectional name *Cortusina s.s.* is, therefore, retained for members of the *Cortusina*-group. Dreyer *et al.* (1992) emphasise the need for a new section to accommodate the members of the *Reniformia*-group. The subsection *Reniformia* is, therefore, raised to sectional level as the section *Reniformia* (Knuth) Dreyer, and the species from the *Reniformia*-group are placed in this new section. *P. reniforme* is designated as type species of the section *Reniformia*.

The taxonomy of the diverse section *Ligularia s.l.* was re-evaluated by Albers *et al.* (1992). This led to the description of the new section *Subsucculentia* J.J.A. v.d.Walt (Van der Walt *et al.* 1995) and the reappraisal of the sections *Chorisma* DC. (Albers *et al.* 1995) and *Jenkinsonia* (Sweet) DC. (Van der Walt *et al.* 1997). Albers *et al.* (1992) also suggested a close affinity between the species *P. abrotanifolium* (L.f.) Jacq., *P. extipulatum* (Cav.) L'Hérit. and *P. ionidiflorum* (Eckl. & Zeyh.) Steud. (all three previously included in section *Ligularia s.l.*) and the species included in section *Reniformia*. Based on similarities in geographical distribution, flower morphology, basic chromosome number and chromosome size, palynology and flavonoid patterns (Albers, pers. com.), *P. abrotanifolium*, *P. extipulatium* and *P. ionidiflorum* are included in section *Reniformia*.

Preliminary molecular data based on nrDNA and cpDNA sequence comparisons indicate a strong phylogenetic affinity between members of the sections *Peristera* DC., *Reniformia* and *Isopetalum* (Sweet) DC. (Bakker *et al.* 1998). These results render the latter two sections paraphyletic and nested within a main *Peristera* clade. This work was corroborated in the consensus tree of a second study by Bakker *et al.* (1999) using trnL-F sequence data. Bakker *et al.* (1999), however, also include one of 66 equally most parsimonious trees in addition to the consensus tree. In this tree, members of section *Reniformia* are assembled into a monophyletic group within the *Peristera* clade. These data affirm the need for a further assessment of the phylogenetic relationships of the section *Reniformia*, perhaps based on a combined multigenic molecular and morphological analysis.

Taxonomic treatment of the section

Reniformia (Knuth) Dreyer sect. nov.
Type species: *P. reniforme* Curt.

Diagnostic features

Suffrutices recti vel decumbentes et aromatici cum radicibus carnosis. Folia simplicia; lamina reniformis, ovata-cordata vel cordata, nonnumquam vadose vel penitus lobata. Hypanthium saepissime longius quam pedicellus, manifeste incrassatum ad basim. Petalum posticum rectum, cetera 4 refracta per 180°. Petala 5; 2 petala postica pauciora quam 3 petala antica, basaliter refracta per 90°; 3 petala antica anguste unguiculata, basaliter refracta per 60°. Stamina 7 fertilia, breviora quam sepala. Filamentum posticum acutum. 2n = 16, 32.

Erect to decumbent, perennial, rarely deciduous subshrubs, herbaceous, aromatic, 0.1–0.5 m tall when in flower, seldomly branched from base. *Root system*: tap root with complex system of tuberous lateral roots, sprouting. *Stem* with reduced or elongated internodes; young stems herbaceous to semi-succulent, green, glandular to velutinous; older stems leafless, woody, brown, glabrous, covered with remains of stipules and petioles. *Leaves* clustered, rosulate or well-spaced and alternate, simple, lamina (5–)15–75(–105) × (5–)20–80(–105) mm, reniform, ovate-cordate, cordate or orbicular, sometimes palmately to irregularly lobed or incised, apex acute or obtuse, base

cordate or attenuate, margins crenulate, crenate, dentate, lobate or irregularly incised, adaxially velutinous and/or glandular, abaxially tomentose to lanose interspersed with glandular hair; petiole slightly to much longer than lamina, (5–)25–100(–250) mm long, oval to triangular in cross section, sometimes adaxially shallowly grooved, glandular to velutinous; stipules free, (0.5–)1–8(–12) × (0.5–)1–3(–4) mm, triangular, acute or obtuse, membranous, indumentum as on petiole, persistent or semi-persistent. *Inflorescence*: solitary, axilary pseudo-umbels or a flowering branch with elongated internodes, reduced laminae and several pseudo-umbels; pseudo-umbels with (2–)4–10(–15) flowers each; peduncle (20–)30–90(–120) mm long, unbranched, velutinous interspersed with glandular hair; pedicel (0.5–)1–12(–14) mm long, shorter than hypanthium. *Hypanthium* red or green, (5–)9–40(–45) mm long, pubescent and glandular, base distinctly thickened, nectiferous tube red or green. *Sepals* 5, lanceolate to narrowly triangular, green or red with white or pink margins, 4–8 × 1–3 mm, posterior sepal straight, others basally reflexed through 180°. *Petals* 5, white, pink, purple, magenta, maroon to black; posterior two grouped together, smaller than anterior three, mostly with feather-like markings, oblanceolate to spathulate, apices truncate to retuse, (7–)9–14(–15) × (1–)2–3(–5) mm, apically recurved through 90°; anterior three oblanceolate to obovate, apex truncate, retuse or rounded, (7–)8–12(–15) × (2–)3–5 mm, narrowly clawed, basally recurved through 60°. *Stamens*: 7 fertile, of three or four different lengths, shorter than sepals; posterior filament acuminate; anthers pink to purple, posterior 3 smaller than anterior 4; staminodes 3. *Ovary* 2–3 mm long, ovate or pyriformed, densely villous. *Style* 1–3 mm long, glabrous. *Stigma* with 5 recurved branches, 1–2 mm long. *Mericarps* 5, base 4–5 mm long, tail (3–)11–16(–21) mm long. 2n = 16; 32.

Geographical distribution (Figure 1)

The distribution area of the section *Reniformia* stretches from the Western Cape along the southern coast to the Eastern Cape. From here the area expands inland into the Free State, with a single species expanding over parts of Northwest Province, Gauteng and Mpumalanga and another species confined to Mpumalanga. The diversity centre of the section is in the Eastern Cape (32°S 26'E and 33°S 26'E) where six of the eight species are represented.

Key to species

1a Inflorescence a solitary, axillary pseudo-umbel, lamina base cuneate or cordate ..... **2.**
2a Lamina 3–5 segmented, each segment subdivided into 3 or more lobes, base cordate ..... ***P. abrotanifolium***
2b Lamina obtrullate, sometimes trifid to tripartite, base cuneate ..... ***P. exstipulatum***
1b Inflorescence a flowering branch with several pseudo-umbels, lamina base cordate ..... **3.**
3a Stamens of four different lengths ..... **4.**
4a Lamina reniform, margin crenate to crenulate, flowers white (seldomly pale pink) ..... ***P. dichondrifolium***
4b Lamina ovate to elliptic in outline, margin irregularly pinnately incised, flowers pale to dark pink ..... ***P. ionidiflorum***
3b Stamens of three different lengths ..... **5.**
5a Flowers white to pale pink, petiole adaxially grooved .. **6.**
6a Leaf margin crenate, length/width ratio of posterior petals > 6 ..... ***P. odoratissimum***
6b Leaf margin dentate, length/width ratio of posterior petals < 5 ..... ***P. album***
5b Flowers pink, magenta, maroon or black, petiole adaxially not grooved ..... **7.**
7a Flowers maroon to black, petals spathulate to linear, sepals green with white margins ..... ***P. sidoides***
7b Flowers pink to purple, petals oblanceolate to ovate, sepals red with pink margins ..... ***P. reniforme***

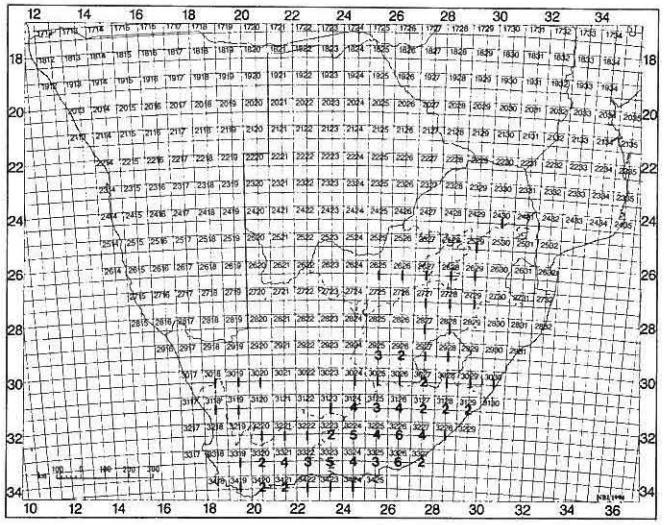

Figure 1 Distribution and concentration of species in the section *Reniformia*.

Taxonomic treatment of species

1. *Pelargonium abrotanifolium* (L.f.) Jacq. in Hortus Schoenbrunnensis: t. 36 (1797); Willd.: 688 (1800); Sweet: t. 351 (1820); DC.: 661 (1824); Harv.: 282 (1860); Knuth: 384 (1912); Van der Walt: 1, fig. (1977). Type: Linn. 858.19, lecto., here selected (STEU, photo!).

Geranium abrotanifolium L.f.: 304 (1781); Cav.: 276 (1787); Thunb.: 115 (1794); Andr.: without page number (1805). *Geraniospermum abrotanifolium* (L.f.) Kuntze: 94 (1891).

Geranium incisum Andr.: t. 67 (1799). Poiret: 756 (1812). *Pelargonium incisum* (Andr.) Willd.: 686 (1800); Sweet: t. 93 (1820); DC.: 661 (1824); Harv.: 283 (1860); Knuth: 385 (1912). *Ligularia incisa* (Andr.) Eckl. & Zeyh.: 69 (1835). *Geraniospermum incisum* (Andr.) Kuntze: 95 (1891). Iconotype: Andrews t. 67 (1799).

Pelargonium monsoniaefolium Steud: 601 (1821). Type: unknown.

Ligularia canescens Eckl. & Zeyh.: 69 (1935). Type: as for *P. incisum* Andr.

Diagnostic features

Much-branched, twiggy, aromatic subshrub. *Leaves* alternate, grey-green; 3–5 segmented, each segment subdivided into 3 or more lobes, lamina base cordate. *Inflorescence* a solitary, axially pseudo-umbel with 1–5 flowers. *Sepals* red with pink margins. *Petals* white to pink or mauve. *Stamens* of four different lengths. 2n = 16; 32. (Illustrated in: Van der Walt 1977, p. 1)

Geographical distribution (Figure 2)

P. abrotanifolium has a wide distribution through vast areas of the Western and Eastern Cape Provinces, with an extension into the Free State and Northern Cape Provinces. In the west, the distribution area receives mostly winter rain, with rainfall patterns shifting to summer showers in the eastern part of the range. *P. abrotanifolium* grows in arid habitats and is often found on rocky outcrops.

Selected specimens studied

—**3020** (Brandvlei): Kareebergen (–DD), *Schlechter 8265* (BOL).
—**3024** (De Aar): Phillipstown, Grasfontein (–BC), *Fahrmeijer 2238* (PRE).

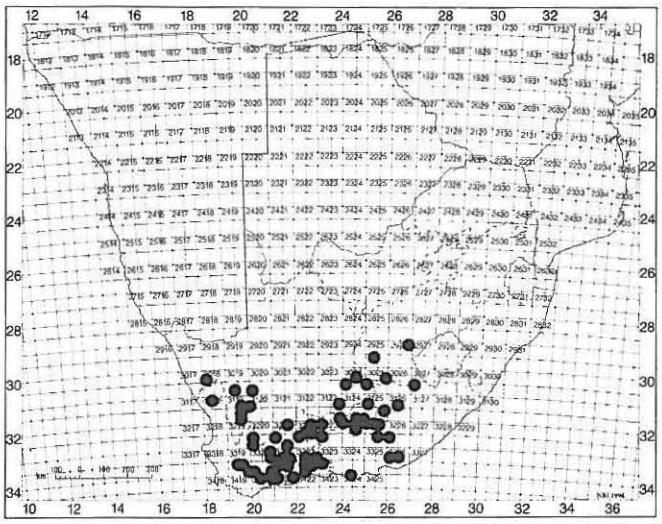

Figure 2 Geographical distribution of *P. abrotanifolium*.

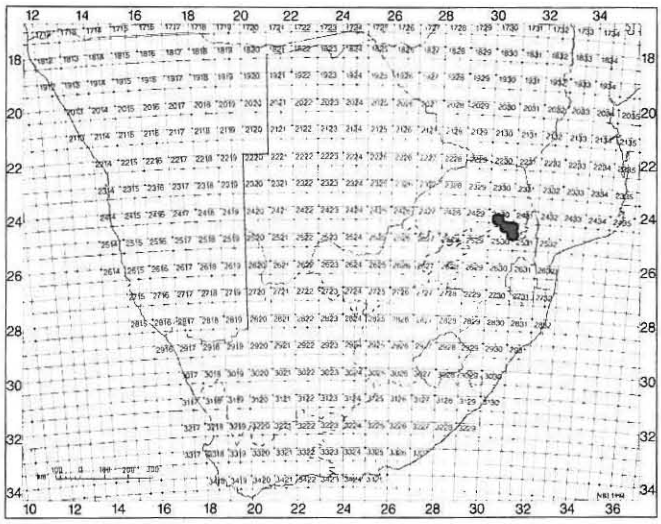

Figure 3 Geographical distribution of *P. album*.

—**3027** (Lady Grey): Lady Grey (–CA), *Gerstner 127a* (PRE).
—**3119** (Calvinia): 14 km from Calvinia on Loeriesfontein road (–BC), *Goldblatt 3940* (MO); Boschberg (–DC), *MacOwan 30153* (SAM).
—**3126** (Queenstown): Houthoek, Sutherland (–CA), *Hanekom 1568* (PRE).
—**3222** (Beaufort West): Karoo National Park, Bulthoudersbank (–AD), *Bengis 392* (PRE); Bleak House Farm, Beaufort West (–CA), *Gibbs Russel, Robinson & Herman 323* (PRE).
—**3321** (Ladismith): Klein Swartberg (–AD), *Van der Walt 190* (PRE).
—**3326** (Grahamstown): 5.6 km from Grahamstown on Cradock road (–BC), *Marais 403* (BOL).
—**3421** (Riversdale): Farm Tolange, Riversdale (–AB), *Bohnen 7292* (PRE).
—**3424** (Humansdorp): George, on road to Klipdrift (–BA), *Fourcade 5053* (BOL).

2. *Pelargonium album* J.J. v.d. Walt, in Dreyer & Van der Walt, South African Journal of Botany 56: 65 (1990). Type: Mpumalanga: 2 km SE of Pilgrim's Rest, on road to Graskop, *Van der Walt & Vorster 1344* (PRE, holo.!; K!; STEU).

Diagnostic features

Subsucculent, semi-decumbent, aromatic subshrub. *Leaves* clustered, rosulate, densely glandular, sticky; lamina cordate with 5–7 palmately incised lobes, prominently veined, margin dentate; petiole adaxially grooved. *Inflorescence* a flowering branch with several pseudo-umbels, each pseudo-umbel with 4–9(–15) flowers. *Sepals* green with white margins. *Petals* white; length/width ratio of posterior petals < 5. *Stamens* of three different lengths. 2n = 16. (Illustrated in: Dreyer & Van der Walt 1990, p. 56)

Geographical distribution (Figure 3)

P. album is restricted to a small area in Mpumalanga east of Pilgrim's Rest. This is mainly a summer rainfall area, with rainfall figures ranging between 700–1000 mm per annum. *P. album* grows on humus rich soils, in shady rock crevices on dolomite hills.

Specimens studied

—**2430** (Pilgrim's Rest): River near Penge (–AD), *Krynauw 660* (PRE); Kaspersnek (–DA), *Venter s.n.* sub. *STEU 3440* (STEU); 6.4 km S of Branddraai (–DB), *Meeuse 10028* (PRE, SRGH); Blyde River (–DB), *Van der Walt 1509* (STEU); 1.6 km E of Pilgrim's Rest (–DD), *Codd 9797* (K, PRE); Pilgrim's Rest (–DD), *Rogers 23257* (BOL); Bourk's Luck (–DD), *Schonken 102* (STEU); 2 km SE of Pilgrim's Rest, on Road to Graskop (–DD), *Van der Walt & Vorster 1344* (K, PRE, STEU).

3. *Pelargonium dichondrifolium* DC in Prodromus systematis naturalis regni vegetabilis: 656 (1824) (as *dichondraefolium*); Spreng.: 56 (1826); Don: 730 (1831); Steud.: 285 (1841); Harv.: 293 (1860); Knuth: 448 (1912); Clifford: 265 (1970); J.J.A. van der Walt & Vorster: 45, fig. (1988). Type: Eastern Cape Province, Bruintjieshoogte, *Burchell 3048* (G-DC, holo. (STEU, photo!); B; K!; L; PRE!).

Geraniospermum dichondrifolium (DC.) Kuntze: 94 (1981).

Pelargonium reliquifolium N.E. Br.: 100 (1906); Clifford: 242 (1970). Type: Eastern Cape Province, Middelburg Division, Rosmead Junction, *Sims s.n.* sub. *Galpin 5632* (K, holo.!; PRE!).

Pelargonium burchelli Knuth (1907). Type: as for *P. dichondrifolium* DC.

Pelargonium cradockense Knuth: 74 (1907); Knuth: 449 (1912); Clifford: 241 (1970); Webb: 39 (1984). Type: Eastern Cape Province, Cradock, *Kuntze s.n.* (B, lecto.!, here designated; K!).

Pelargonium middletonianum Knuth: 26 (1909). Type: Eastern Cape Province, Middleton, *Rogers s.n.* sub. *Bolus 12956* (BOL, holo.!).

Diagnostic features

Herbaceous, erect to decumbent subshrub. *Leaves* clustered, rosulate, velutinous; lamina reniform, margin crenate to crenulate; petiole very long [40–80(–120) mm], thin, persistent. *Inflorescence*: a flowering branch with several pseudo-umbels, each pseudo-umbel with 2–4(–11) flowers. *Sepals* green to red with white margins. *Petals* white or pale pink. *Stamens* of four different lengths. 2n = 16: 32. (Illustrated in: Van der Walt & Vorster 1988, p. 47)

Geographical distribution (Figure 4)

P. dichondrifolium is restricted to the drier Karoo areas of the eastern Cape, including the districts of Somerset East, Cradock and Middelburg, with a single collection known from the Free State. This area receives most of its rain during summer, with rainfall figures ranging between 200–300 mm per annum. Along

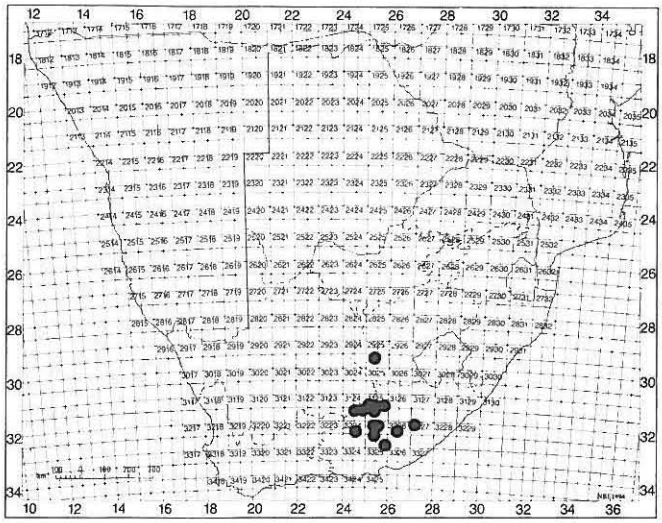

Figure 4 Geographical distribution of *P. dichondrifolium*.

the southern border of its range, summer rain is supplemented by winter showers, with the annual rainfall increasing up to 600 mm in the Peddie area. *P. dichondrifolium* grows on shallow, humus rich soils in rock crevices on dolomite, granite or sandstone hills.

Selected specimens studied

—**2925** (Jagersfontein): Fauresmith Reserve (–CB), *Henrici 3568* (PRE).
—**3124** (Hanover): Middelburg (–DA), *Van der Walt 1425* (PRE).
—**3125** (Steynsburg): Grootfontein (–AC), *Acocks 15967* (PRE); Rosemead Junction, Rosemead (–AC), *Sims s.n.* (K, PRE); Culmstock near Scoombie Station (–AD), *Southey 27* (PRE); Koffiebus near Scoombie (–BC), *Schweickerdt 1264* (PRE); Steynsburg (–BD), *Marais s.n.* (BOL); Doornberg, Middelburg (–CB), *Acocks 8660* (PRE).
—**3224** (Graaff Reinet): Graaff Reinet (–BC), *Fischer 375* (STEU).
—**3225** (Somerset East): Hill near Michausdal, Cradock (–AB), *Dreyer 23* (STEU); *Holland 1* (BOL, PRE); *Rogers s.n.* (BOL, MO); 8.5 km NE of Cradock, on road to Middelburg (–BA), *Fischer 52* (STEU); E of Cracock on road to Cookhouse (–BA), *Van der Walt & Vorster 1366* (STEU); Summit of Bruintjieshoogte, Somerset East (–CB), *Burchell 3084* (K, PRE).
—**3227** (Peddie): Peddie (–AA), *Sims 20263* (PRE).

4. *Pelargonium exstipulatum* (Cav.) L'Hérit. in Ait., Hortus Kewensis: 431 (1789); L. Hérit.: t. 35 (1792); Willd.: 685 (1800); Desf.: 464 (1809); Willd.: 711 (1809); Harv.: 283 (1860); Knuth: 387 (1912); J.J.A. van der Walt & Vorster: 61, fig. (1981). Type: Exact locality and collector unknown, specimen with Cavanilles' handwriting (MA, holo.!).

Geranium exstipulatum Cav.: 253 (1787); Thunb.: 115 (1800); Juel: 202 (1918).

Geraniospermum exstipulatum (Cav.) Kuntze: 94 (1891).

Pelargonium pallidum Salisb.: 316 (1796). Type: as for *P. exstipulatum* (Cav.) L'Hérit.

Diagnostic features

Erect, much-branched aromatic subshrub. *Leaves* alternate, viscous; lamina obtrullate to widely obtrullate, sometimes trifid to tripartite, base cuneate; petiole semi-persistent. *Inflorescence* a solitary, axilary pseudo-umbel, 1–5 flowered. *Sepals* green to red with white margins. *Petals* pale pink to purple. *Stamens* of four different lengths. 2n = 16. (Illustrated in: Van der Walt & Vorster 1981, p. 60)

Geographical distribution (Figure 5)

P. exstipulatum occurs in the Little Karoo, from Ladismith in the west to De Rust in the east. This area receives 150–300 mm of rain per annum, mostly during winter. *P. exstipulatum* grows on sandy soil in rocky habitats.

Selected specimens studied

—**3321** (Ladismith): 10.4 km SE of Ladismith (–AD), *Acocks 14613* (PRE); Huis River Pass (–BC), *Bolus 20596* (BOL); Calitzdorp (–DA), *Bayliss 1682* (Z); Roodeberg, Ladismith (–DA), *Compton 3860* (BOL); Gamka Reserve, Tierkloof, Calitzdorp (–DA), *Olivier 3128* (STEU).
—**3322** (Oudtshoorn): Boomplaas, Cango Valley, Oudtshoorn (–AC), *Moffett 218* (STEU); Schoemanspoort, Prince Albert (–AC), *Wells 3741* (PRE); Oudtshoorn, Cango Caves (–CA), *Britten 1726* (PRE).
—**3323** (Willowmore): Near Trompetterspoort and Groot River (–BA), *Zeyher 108,5* (MEL).

5. *Pelargonium ionidiflorum* (Eckl. & Zeyh.) Steud. in Nomenclator botanicus 2,2: 287 (1841); Knuth: 388 (1912); J.J.A. van der Walt & Vorster: 81, fig. (1981). Type: Eastern Cape Province, Bothasberg et probe Hermanuskraal ad fluvium Vishrivier (Albany), *Eckl. & Zeyh. 532* (S, lecto.!, here designated; K!; L!, M!, MO!; OXF!; P!; SAM!; W!)

Ligularia ionidiflora Eckl. & Zeyh.: 69 (1835). *Geraniospermum ionidiflorum* (Eckl. & Zeyh.) Kuntze: 95 (1891).

Diagnostic features

Erect, branched subshrub. *Leaves* clusterd at end of branches; lamina ovate to elliptic in outline, irregularly pinnately incised, base cordate. *Inflorescence* a flowering branch with several pseudo-umbels, each pseudo-umbel with 2-7 flowers. *Sepals* red with pink margins. *Petals* pale to dark pink. *Stamens* of four different lengths. 2n = 16. (Illustrated in: Van der Walt & Vorster 1981, p. 83)

Geographical distribution (Figure 6)

P. ionidiflorum is restricted to the districts of Cradock, Somerset East, Fort Beaufort and Grahamstown in the Eastern Cape Province. This area is relatively dry, receiving between 300-750 mm rain per annum, mainly during summer. *P. ionidiflorum* usually grows between rocks or in rock crevices.

Selected specimens studied

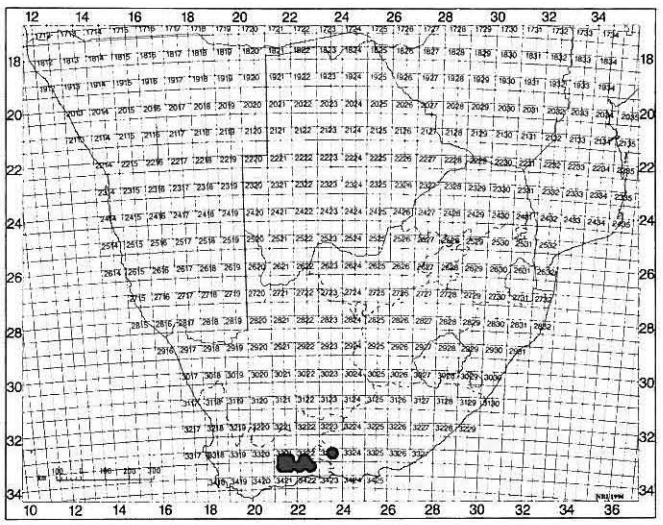

Figure 5 Geographical distribution of *P. exstipulatum*.

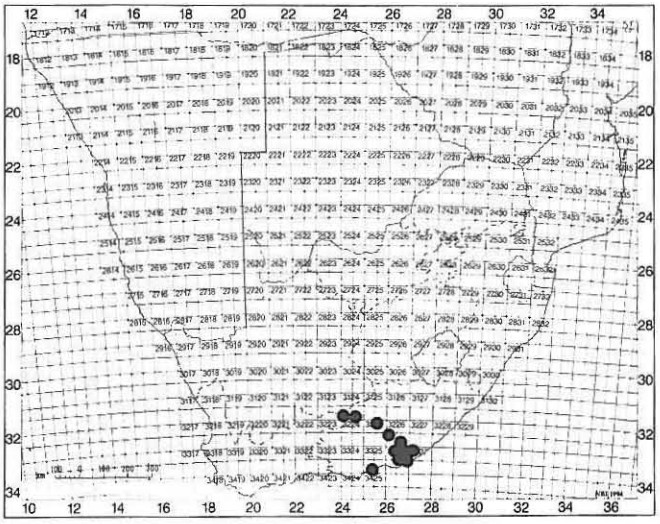

Figure 6 Geographical distribution of *P. ionidiflorum*.

—**3124** (Hanover): Winterhoek Mountains (–CC), *Krauss 1277* (MO); Near Assagaaibos and Botram (–DC), *Drège 2264* (OXF, P, S, Z).
—**3225** (Somerset East): 8.8 km N of Cracock (–BA), *Acocks 16325* (BOL, PRE); Mortimer, Cradock (–AC), *Kensit 9264* (BOL).
—**3226** (Fort Beaufort): Bedford (–CA), *Theron 1099* (PRE); Koonap Heights, Fort Beaufort (–DC), *Britten 2017* (GRA).
—**3325** (Port Elizabeth): Koega River, Winterhoek Mountains, Uitenhage (–CD), *Zeyher s.n.* (MEL).
—**3326** (Grahamstown): Hounslow near Grahamstown (–AB), *Galpin 373* (PRE); Bothasberg (–BA), *Bolus 636* (MEL); Fish River Valley, 32-35 km from Grahamstown (–BB), *Dyer 1539* (PRE); Fish River Valley (–BB), *Phillipson 222* (PRE); 16 km from Grahamstown on Fort Beaufort road (–BC), *Brink 235* (GRA).
—**3327** (Peddie): Keiskamma Valley near Breakfast Vlei (–AA), *Acocks 11860* (PRE).

6. *Pelargonium odoratissimum* (L.) L'Hérit. in Ait., Hortus Kewensis: 419 (1789); Pers.: 299 (1806); Willd.: 701 (1809); Ait.: 167 (1812); DC.: 659 (1824); Hoffmg.: 93 (1824); Sweet: 299 (1824); Loudon: 574 (1829); Don: 734 (1831); Steud.: 290 (1841); Harv.: 301 (1860); Knuth: 452 (1912); Clifford: 238 (1970); J.J.A. van der Walt: 30 (1977); Payet & Cauderon: 207 (1982); Webb: 61 (1984). Type: exact locality and collector unknown, specimen with Linnaeus' handwriting in Hort. Cliff. nr. 345 (BM, lecto.!, here designated (STEU, photo!)).

Geranium odoratissimum L.: 679 (1753); Cav.: 241 (1787); Andr.: without page number (1805); Savage: 118 (1945); *Cortusina odoratissimum* (L.) Eckl. & Zeyh.: 77 (1835); *Geraniospermum odoratissimum* (L.) Kuntze: 95 (1891).

Geranium odoratum Burm.f.: 37 (1759); Thunb.: 518 (1823); Juel: 293 (1918); *Pelargonium odoratum* (Burm.f.) Salisb.: 318 (1796); Hoffmg.: 93 (1824). Type: as for *P. odoratissimum* (L.) L'Hérit.

Geranium africanum Cav.: 242 (1787); Thunb.: 114 (1800); Thunb.: 520 (1823); Juel: 199 (1918). Type: Habitat ad Caput Bone Spei, Lamarck s.n. (P, holo. (STEU, photo!).

Pelargonium odorum Salisb.: 312 (1796). Type: as for *P. odoratissimum* (L.) L'Herit.

Diagnostic features

Erect, herbaceous, aromatic subshrub. *Leaves* clustered, rosulate, velutinous; lamina ovate to elliptic in outline, margin crenate, base cordate; petiole adaxially grooved. *Inflorescence* a flowering branch with several pseudo-umbels, each pseudo-umbel with 4–10 small flowers. *Sepals* green with white margins. *Petals* white to pale pink, length/width ratio of posterior petals > 6. *Stamens* of three different lengths. 2n = 16. (Illustrated in: Van der Walt 1977, p. 31)

Geographical distribution (Figure 7)

P. odoratissimum has a very wide distribution, occurring from Bredasdorp in the west, all along the coast to Port Shepstone in the east. The coastal distribution is extended inland over vast areas of the Eastern Cape Province, including the districts of Queenstown, Graaff Reinet, Somerset East, Fort Beaufort and Stutterheim. The largest part of this area receives summer rain, supplemented by winter rains in the western and southern parts. Despite its wide distribution, *P. odoratissimum* prefers a very specific habitat of moist sandy soils in the shade of other shrubs or rocks.

Selected specimens studied

—**3030** (Port Shepstone): Paddock, Oribi (–CB), *McClean 363* (MO, PRE).
—**3126** (Queenstown): Hangklip, Queenstown (–DD), *Fischer 67* (STEU).
—**3129** (Port St.Johns): Umgazi River Mouth, S of Port St.Johns (–CD), *Gibby & Crompton 116* (STEU).
—**3225** (Somerset East): Bergkwagga Park (–AD), *Brynard 79* (PRE).
—**3228** (Butterworth): Idutywa (–AB), *Pegler 2610* (PRE).
—**3321** (Ladismith): Garcia's Pass (–CC), *Van der Walt 1300* (STEU).
—**3323** (Willowmore): Joubertina (–DD), *Van der Walt 860* (STEU).
—**3325** (Port Elizabeth): Addo Park (–DA), *Hall-Martin 5957* (PRE); Thorn Hill (–DC), *West 366* (W).
—**3327** (Peddie): Keiskamma River (–AA), *Cooper 438* (PRE, Z).
—**3421** (Riversdale): Vals River Mouth, near Riversdale (–BA), *Muir 139* (PRE).
—**3424** (Humansdorp): Kabbeljous River (–BB), *Fourcade 2707* (BOL).

7. *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:

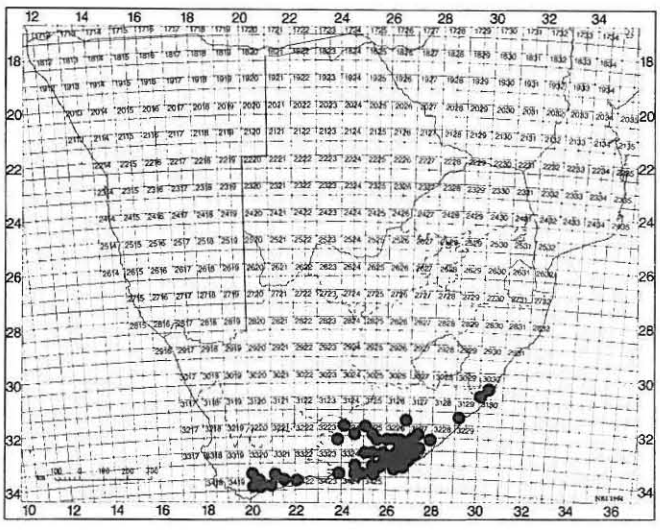

Figure 7 Geographical distribution of *P. odoratissimum*.

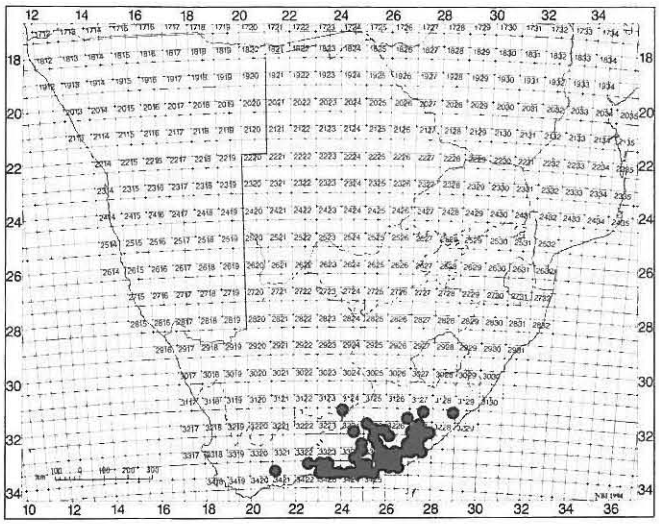

Figure 8 Geographical distribution of *P. reniforme*.

737 (1831); Steud.: 289 (1841); Harv.: 300 (1860); Knuth: 447 (1912); Pole-Evans: 672 (1937); Watt & Breyer-Brandwijk: 454 (1962); Batten & Bokelman: 89 (1966); Smith: 381 (1966); Clifford: 237 (1970); J.J.A. van der Walt: 40, fig. (1977); Webb: 69 (1984); Dreyer, Marais & Van der Walt: 325 (1995). *Pelargonium reniforme* var. *reniforme* (Eckl. & Zeyh.) Harv.: 300 (1860). Iconotype: Curt.: t. 493 (1800).

Geranium reniforme (Curt.) Andr.: 108 (1800); Poir.: 751 (1812); Steud.: 679 (1840). *Cortusina reniformis* (Curt.) Eckl. & Zeyh.: 77 (1835). *Geraniospermum reniforme* (Curt.) Kuntze: 95 (1891).

Diagnostic features

Erect or decumbent subshrub with internodes elongated or much reduced. *Lamina* reniform or ovate-cordate, sometimes with 3–5 shallowly incised lobes; base cordate. *Inflorescence* a flowering branch with several pseudo-umbels, each pseudo-umbel with 4–12 flowers. *Sepals* red with pink margins. *Petals* pink to magenta, oblanceolate to ovate. *Stamens* of three different lengths. 2n = 16; 32. (Illustrated in: Dreyer *et al.* 1995, p. 327). Two subspecies are distinguished by Dreyer *et al.* (1995): subsp. *reniforme* and subsp. *velutinum* (Eckl. & Zeyh.) Dreyer.

Key to the subspecies

Internodes elongated (5–12 mm), petiole (5–)20–40(–50) mm long, leaves reniform ..... (a) subsp. *reniforme*

Internodes short [1–5(–7) mm], petiole (25–)50–90(–130) mm long, leaves seldom reniform ..... (b) subsp. *velutinum*

(a) subsp. *reniforme*

Dreyer, Marais and Van der Walt in South African Journal of Botany 61,6: 326 (1995).

Geographical distribution (Figure 8)

P. reniforme subsp. *reniforme* occurs in a restricted area south of the 33° latitude and between the 24° and 26° longitudes, and is abundant in the Port Elizabeth area. It is geographically isolated from subsp. *velutinum* (Dreyer *et al.* 1995), and restricted to the drier coastal plains, occuring at an altitude lower than 300 m above sea-level. This area receives rain almost throughout the year.

Selected specimens studied

—3324 (Steytlerville): Road between Kruisfontein and Happy Valley (–DD), *Gibby & Crompton 100* (STEU).

—3325 (Port Elizabeth): Krakakamma, Van Stadens River mountains (–CC), *Eckl. & Zeyh. 138* (W); Uitenhage District (–CD), *Cooper 1459* (W); Westering Residential area, near sub-power station (–CD), *Dreyer 18* (STEU); Parsons Vlei (–CD), *Long 528* (PRE); Prince Alfred's Park (–DC), *Cook 1381* (BOL); Port Elizabeth (–DC), *Tyson 2193* (PRE); Bridge Mead near Port Elizabeth (–DC), *Van der Walt 1563* (STEU).

—3424 (Humansdorp): 20 km from Humansdorp on road to Joubertina (–BA), *Van der Walt 864* (STEU); Humansdorp (–BB), *Leighton 3074* (BOL).

(b) subsp. *velutinum* (Eckl. & Zeyh.) Dreyer

Dreyer, Marais and Van der Walt in South African Journal of Botany 61,6: 328 (1995). Type: Cape Province, 'ad fluvium Zwartkopsrivier et collibus in Adow (Uitenhage)', Ecklon & Zeyher 598 [S, lecto.!; G! (2 sheets); L; M; MEL!; MO!; OXF!; P!; SAM!; W!; WU!].

Cortusina velutina Eckl. & Zeyh.: 77 (1835).

Pelargonium reniforme var. *velutinum* (Eckl. & Zeyh.) Harv.: 300 (1860).

Geographical distribution (Figure 8)

The distribution of *P. reniforme* subsp. *velutinum* extends over a large area south of the 31° latitude and between the 21° and 28° longitudes, with extensions along both the southern and eastern coasts. The subspecies is abundant east of Port Elizabeth in the Grahamstown-Queenstown area. The southern part of the distribution area receives rain throughout the year, while rain is restricted to the summer months in the north-eastern part of the area. The plants are found on dry plains and grasslands, and are periodically exposed to fire.

Selected specimens studied

—3124 (Steynsburg): Middelburg (–CA), *Fischer 59* (STEU).

—3128 (Umtata): Umtata (–DB), *Pegler 636* (PRE).

—3225 (Somerset East): Cradock (–BA), *Holland 1* (BOL); Southern slopes of Bosberg (–DA), *Van der Walt 305* (PRE).

—3227 (Stutterheim): Happy Valley, 11.2 km from Hogsback (–AC), *Johanson 1251* (GRA, PRE); King William's Town (–CD), *Tyson 2899* (PRE).

—3321 (Ladismith): Garcia's Pass between Riversdale and Ladismith (–CC), *Leipoldt s.n.* (BOL).

—3323 (Willowmore): Haarlem (–CB), *Thode 2431* (PRE); Road between Uniondale and Joubertina (–DD), *Esterhuysen 24220* (BOL, PRE).

—3324 (Steytlerville): Assegaaibos (–CD), *Breyer 23591* (PRE).

—3325 (Port Elizabeth): Zuurberg near Ann's Villa (–BB), *Olivier 3489* (STEU); Addo Park, rhino camp (–BC), *Hall-Martin 6699* (PRE); Addobos (–BD), *Brynard 443* (PRE); Spring Nature Reserve (–CD), *Oliver 2184* (STEU).

—3326 (Grahamstown): Farm Hounslow, Albany (–AB), *Killick 811* (PRE); 3 km from Fort Beaufort turn-off on Grahamstown-King William's Town road (–BC), *Dreyer 22* (STEU); Boesmans River (–CA), *Story 2353* (PRE).

—3327 (Peddie): Peddie (–AA), *Acocks 12777* (PRE).

—3423 (Knysna): Plettenberg Bay (–AB), *Rogers s.n.* (PRE).

8. *Pelargonium sidoides* DC. in Prodromus systematis naturalis regni vegetabilis: 680 (1824); Don: 742 (1831); Steud.: 290 (1841); J.J.A. van der Walt & Vorster: 129, fig. (1988). Type: Exact locality unknown, *Thunb. s.n.* sub. *Herb. Thunb. 15655* [UPS, lecto.; (STEU, photo!)]

Geranium sidaefolium Thunb.: 114 (1800); Thunb.: 518 (1823); Steud.: 679 (1840); Juel: 205 (1918). *Pelargonium sidaefolium*

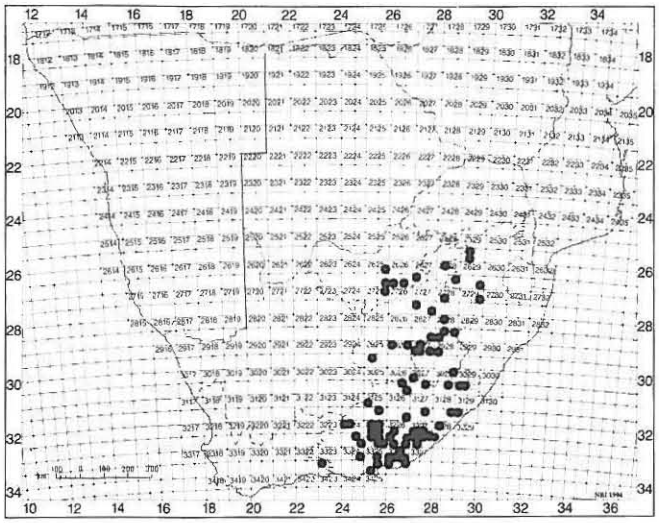

Figure 9 Geographical distribution of *P. sidoides*.

(Thunb.) Knuth: 448 (1912); Engl.: 714 (1915); Burtt-Davy: 191 (1926); Watt & Breyer-Brandwijk: 455 (1962); Batten & Bokelman: 87 (1966); Smith: 575 (1966); Clifford: 237 (1970); Webb: 74 (1984); Hilliard: 168 (1987); non Willd. (1809). *Cortusina sidaefolium* (Thunb.) Eckl. & Zeyh.: 77 (1835). Type: as for *P. sidoides* DC.

Pelargonium reniforme var. *sidaefolium* (Thunb.) Harv.: 300 (1860).

Diagnostic features

Erect, woody to herbaceous subshrub. *Leaves* clustered, rosulate, velutinous, silver-green; lamina ovate-cordate, base cordate. *Inflorescence* a flowering branch with several pseudo-umbels, each pseudo-umbel with 4–12 flowers. *Sepals* green with white margins. *Petals* maroon to black, spathulate to linear. *Stamens* of three different lengths. 2n = 16; 32. (Illustrated in: Van der Walt & Vorster 1988, p. 129)

Geographical distribution (Figure 9)

P. sidoides has a very wide distribution in the Eastern Cape Province, Lesotho, Free State, Northwest Province, Gauteng and Mpumalanga. The largest part of the distribution area receives between 200–800 mm rain per year mainly during summer. *P. sidoides* thrives in direct sunlight, and is mostly found on sand or loam.

Selected specimens studied

—**2529** (Witbank): Klein Olifants River (–CB), *Schlechter 4031* (BOL, Z).
—**2626** (Klerksdorp): Welgelegen, Wolmaransstad (–CC), *Hanekom 1808* (PRE).
—**2629** (Bethal): Ermelo (–DB), *Burtt-Davy 5487* (PRE).
—**2728** (Frankfort): Sterkfontein (–AD), *Venter 3119* (PRE).
—**2828** (Bethlehem): Leribe, Basutholand (–CC), *Dieterlen 367* (PRE, Z).
—**2926** (Bloemfontein): Blaerfontein (–AA), *Bouwer 2193* (PRE).
—**3028** (Matatiell): Mt Fletcher, Faluka-Lozi Drift (–DA), *Johnson 723* (STEU).
—**3124** (Hanover): Middelburg, Gordonville (–DA), *Acocks s.n.* (PRE).
—**3127** (Lady Frere): Calameer, Themboland (–DA), *Van Wyk 249* (Z).
—**3224** (Graaff Reinet): Oudeberg (–DD), *Bolus 778* (BOL).
—**3225** (Somerset East): Summit of Swaershoek Pass (–AD), *Story 60* (PRE).
—**3226** (Fort Beaufort): Great Winter Mountains south of Tarkastad (–AD), *Comins 790* (PRE).
—**3228** (Butterworth): Kei River (–CA), *Krook 2173* (W).
—**3325** (Port Elizabeth): Addo Park (–BC), *Van der Walt 880* (PRE, STEU).
—**3326** (Grahamstown): Botha's Hill, 16 km from Grahamstown (–BA), *Dyer 1453* (PRE).

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