Taxonomy of the genus *Pelargonium* (Geraniaceae): the section *Polyactium*

3. The subsection *Polyactium*

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Received 5 January 1998; revised 31 August 1998

The subsection *Polyactium* of the genus *Pelargonium* (section *Polyactium*) is treated taxonomically in view of currently available information. All species are geophytes with massive, naked underground tubers. Seven species are recognized, which have almost identical flowers but differ greatly in respect of the morphology, texture, and indumentum of the leaves. All share a basic chromosome number of x = 11, but polyploidy of up to hexaploid level occurs, with each species tending to have a characteristic level of ploidy. Six of the species are restricted to the winter rainfall area, while the seventh occurs in the winter rainfall area but also extends quite far into the summer rainfall region.

**Keywords:** Geraniaceae, *Pelargonium*, taxonomy, South Africa.

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Introduction

The subsection *Polyactium* of *Pelargonium* section *Polyactium* consists of 7 species. Like the subsections *Magnistipulacea* and *Schizopetala* (Maggs, Vorster & Van der Walt 1995a), it has a well-developed underground tuber, but it is unique in having pale mustard-yellow petals, with or without variably-developed very dark purple (almost black) markings which may be expressed to such an extent that the yellow pigmentation is restricted to the margins of the petals. The flowers are almost regular, and dusk-scented. The subsection *Caulescensia* (Maggs, Vorster & Van der Walt 1995b) also has pale mustard-yellow petals, but usually without any black markings, and lacking the underground tuber. Most of the species of the subsection *Polyactium* occur in the winter rainfall region, with only *P. pulverulentum* penetrating into the summer rainfall region along the east coast.

**Taxonomy**

*Pelargonium* L'Héritier sect. *Polyactium* subsect. *Polyactium* De Candolle, Prodrumus ... 1: 655 (1824).

Type: *Pelargonium multiradiatum* Wendland (cf. Vorster & Maggs, 1992) (Figure 1).

*Pelargonium* L'Héritier sect. *Pelargium* (sic) ser. *Isopetaloides* De Candolle subser. *Tristia* De Candolle, Prodrumus ... 1: 662 (1824), p.p.

Type: *Pelargonium triste* (Linn. ex L'Héritier) L'Héritier (lecto., here designated) (Figure 26).

*Pelargonium* L'Héritier sect. *Pelargium* (sic) ser. *Isopetaloides* De Candolle subser. *Bicolora* De Candolle, Prodrumus ... 1: 664 (1824), p.p.

Type: *Pelargonium bicolor* (Jacquin) L'Héritier (synonym of *P. lobatum* (Burman f.) L'Héritier) (lecto., here designated).

*Pelargonium* L'Héritier sect. *Pelargonium* De Candolle subsect. *Caulescensia* Knuth in Das Pflanzenreich 4, 129, 53: 352 (1912), p.p.

Type: *Pelargonium bicolor* (Jacquin) L'Héritier (synonym of *P. lobatum* (Burman f.) L'Héritier) (lecto., here designated).

*Pelargonium* L'Héritier sect. *Pelargonium* De Candolle subsect. *Subacaulis* Knuth in Das Pflanzenreich 4, 129, 53: 351 (1912).

Type: *Pelargonium multiradiatum* Wendland (as for sect. *Polyactium*).

*Continued from S. Afr. J. Bot. 61: 173–179 (1995)*

Geophytes with large, naked root tubers connected by thickened underground stems; and aerial stems poorly-developed, often ephemeral. Leaves large, usually radical, erect or prostrate, simple to variously pinnatifid to pinnate or repeatedly divided into linear segments. *Peduncle* unbranched; pseudo-umbel spheroid and multi-flowered; flower almost regular, dusk-scented; hypanthium well-developed and much longer than pedicel; petals almost equal, pale yellow without or with almost black markings which can be developed to such an extent that only a narrow yellow border is visible; genitals short and hardly exerted. *Chromosome number* x = 11.

Seven species, mostly restricted to the winter rainfall region but with one (*P. pulverulentum*) extending into the summer rainfall region along the east coast.

**Key to the species**

1 a Lamina divided into linear segments ........................................ 2

   b Lamina not divided into linear segments ............................ 4

   2(1)a Lamina at least 2 x as long as wide, usually with dense hoary indumentum; fertile stamens 7 .................. *P. triste* [p. (133)]

   b Lamina almost as long as wide, indumentum adaxially inconspicuous; fertile stamens 5 or 6 .................. 3

   3(2)a Lamina up to 130 × 110 mm; segments branching off rachis at acute angle, 0.5–1.0 mm wide; fertile stamens 6 .................. *P. n beetifolium* [p. (119)]

   b Lamina up to 450 × 450 mm, abaxially sparsely striose; at least basal segments branching off rachis at right angle, up to 3 mm wide and often decurrent along rachis and rachillae so that latter are winged; fertile stamens 5 .......................... 4(1)a Lamina laciniate, glaucous and leathery, margin ciliate; petals mostly dull yellow with very dark maroon centre markings; fertile stamens 6; known only from Eastern Cape and KwaZulu-Natal .................................. *P. pulverulentum* [p. (123)]

   b Lamina not laciniate ........................................ 5

   5(4)a Lamina pinnate to pinnatifid .................................. 6

   b Lamina simple to 5-plicate, cordiform .................. 7

   6(5)a Lamina 2–3x as long as wide, adaxially densely striose to hirsute, membranous, not glaucous; fertile stamens 7 .................................................. *P. radulaefolium* [p. (131)]

   b Lamina almost as long as wide, glabrate, leathery, glaucous; fertile stamens 6 or 7 .......................... *P. pilarsii* [p. (121)]

7(5)a Base of lamina not decurrent, veins radiating from point of
Figure 1 Pelargonium multiradiatum: type illustration in Wendland’s Collectio plantarum 2: t 59 (1809). By courtesy of the Mary Gunn Library, National Botanical Institute.
Chromosome number

$2n = 22$ (Van der Walt s.n. sub STEU 1465, counted by Gibby; Fischer 320 counted by Albers - see Acknowledgements).

Diagnostic features

$P. \text{ multiradiatum}$ resembles $P. \text{ triste}$ (Linnaeus) L'Hérîtier (p. 133) and $P. \text{ anethifolium}$ (Ecklon & Zeyher) Staudt (p. 119) by the linear divisions of the lamina. It differs from $P. \text{ triste}$ by its lamina being almost as wide as long and with inconspicuous indumentum, compared to the lamina being at least twice as long as wide and conspicuously hoary. It differs from $P. \text{ anethifolium}$ by having much larger leaves, up to $450 \times 450$ mm instead of up to $130 \times 140$ mm; by the leaf segments being wider (up to 3 mm compared to 0.5-1.0 mm); by at least the basal segments branching off the rachis at a right angle instead of an acute angle; and by having 5 instead of 6 fertile stamens.

Flowering

Flowering specimens have been collected from September to the following March, but most plants seem to flower during the summer months, from December to February (Figure 2). More than other species in this subsection it tends to be evergreen.

Geographical distribution

This species has a fairly restricted distribution range in the Western Cape Province, extending from Clanwilliam southwards to the Cape Peninsula (Figure 3).

This is a winter rainfall area, with hot and dry summers; the annual rainfall over most of this area being 300 to 400 mm. Plants of this species have been recorded at altitudes varying.
Figure 4  *Pelargonium multiradiatum*: exposed parts, almost life-size. Based on van der Walt s.n. sub STEU 1465, originally from the Cedarberg range. After van der Walt & Vorster, *Pelargoniums of southern Africa* 3: 96 (1988); det. Elaphie Ward-Hilhorst.
from 150 to 1500 m, mostly on sandstone-derived soils but occasionally also on shale. It is a component of low, open fynbos.

History

*P. multiradiatum* was in cultivation in Europe in the early 1800’s and the original description is based on this cultivated material. Described as long ago as 1809, this species was lost for many years, so that its status as a natural species was questioned by Knuth (1912). It was only rediscovered in the 1930’s when it was collected on the Cape Peninsula, on the lower slopes of Karbonkelberg (Salter 1938b). Since then a fair number of collections were made, but none again on the Cape Peninsula. This must rank as a species which has been severely depleted in numbers by agricultural and urban development.

Synonymy

A number of names were contemplated as possible synonyms of *P. multiradiatum*, but we came to the conclusion that they apply to hybrid plants, probably of garden origin:

*Pelargonium sanguineum* Wendland: regarded as a hybrid between *P. multiradiatum* and *P. fulgidum* (Linnaeus) L’Hér. by Knuth (1912), with which we concur.

*P. atrosanguineum* Dietrich: listed as a synonym of *P. sanguineum* by Knuth (1912). No specimens could be traced, but from the description it seems to be a hybrid.

*Pelargonium apiiforme* Jacquin f. (non Geranium apiiforme Andrews): it resembles *P. multiradiatum* by its multi-flowered pseudo-umbels, but *P. radilifolium* (Ecklon & Zeyher) Steudel in its foliage. Knuth (1912) considered it to be a hybrid between *P. multiradiatum* and *P. ibotatum* (Burman f.) L’Hér.

2. *Pelargonium anethifolium* (Ecklon & Zeyher) Steudel, Nomenclator botanicus ed. 2, 2: 283 (1841); Harvey: 273 (1860); Knuth: 357 (1912); Adamson & Salter: 515 (1950); Bond & Goldblatt: 304 (1984); Van der Walt & Vorster: 3 (1988).

*Polyactium anethifolium* Ecklon & Zeyher, Enumeratio plantarum 1: 67 (1835).

Type: WESTERN CAPE PROVINCE, Groenekloof, Ecklon & Zeyher 516 (Pl., lecto., here designated; SI) (Figure 5). Both extant specimens consist of single leaves only, but the identity of the species is in no doubt.

*Geraniopsis anethifolium* (Ecklon & Zeyher) Kunitz, Revisio genera plantarum 1: 94 (1891).

*Polyactium peucedanifolium* Ecklon & Zeyher, Enumeratio plantarum 1: 67 (1835).

Type: WESTERN CAPE PROVINCE, ‘Tulbaghberg’ non procul a ‘Winterhoeck’, Ecklon & Zeyher 518 (Pl., lecto., here designated). Although only a single specimen seems to be extant, most Ecklon & Zeyher collections exist as numerous replicates. For this reason the single specimen seen by us cannot be accepted as holotype, but should rather be termed a lectotype.

*Polyactium peucedanifolium* (Ecklon & Zeyher) Steudel, Nomenclator botanicus ed. 2, 2: 288 (1841).

*Pelargonium callistum* E. Meyer in Drège, Zwei Pflanzengeographische Dokumente: 208 (1843), nom. nud.

*Pelargonium callistum* E. Meyer in Drège, Zwei Pflanzengeographische Dokumente: 208 (1843), nom. nud.

Previous illustration: Van der Walt & Vorster: 5 (1988).

A geophyte with exposed parts ephemeral, poorly developed, mostly unbranched, unarmed, up to 250 mm tall when in flower. Exposed stamens up to 80 mm long and 8 mm in diameter, smooth but covered with remains of petals and stipules, initially succulent but becoming woody with age, glabrous, green. Leaves 2-3x divided into linear segments, membranous, indumentum adaxially inconspicuous: microscopically sparsely stellate, setiferous, dull green and sometimes tinged with red; lamina obtusely triangular or ovate in outline, lamina less than 2x as long as wide: 80–130 x 60–110 mm, segments 0.5–1.0 mm wide and branching off rachis at acute angle, apices of segments acute; petiole up to 170 mm long and 2–4 mm in diameter, persistent; stipules deltoid to cordiform with apices acute, 3–5 x 3–5 mm, membranous but becoming scarios, ciliate but glabrescent, not caducous. Inflorescence an unbranched peduncle up to 190 mm long and up to 2.5 mm thick, carrying a 6–10-flowered pseudo-umbel. Flowers almost regular, 15–22 mm in diameter. Pedicel up to 10 mm long, densely stellate with glandular hairs interspersed. Hypanthium 25–50 mm long. Sepals narrowly ovate with apices acute; abaxially stellate with sparse glandular hairs interspersed but glabrescent, adaxially glabrous; dull green with or without russet streaks and with margins luteal, 7–8 x 2.0–2.5 mm. Petals 5, pale mustard-yellow to dusky pink with purple-black markings which are usually stronger developed on the anterior 3 petals, obovate-spatulate with apices rounded and bases attenuate, recurved to ca 90° with a tendency for the very apices to be incurved; posterior two 8–13 x 4–5 mm; anterior three 7–13 x 2.5–4.5 mm. Fertile stamens 6 (4 long, 2 short and equalling staminodes), pollen bright yellow. Ovary pear-shaped, 3.5 x 1.5–2.0 mm, densely covered in apically-directed hairs, pale green; style ca 1.5 mm long; stigma 3-branched, red; mericarp base 6 mm long, tail 35–40 mm long. (Figure 6).

Chromosome number

2n = 22 (Van der Walt 1042, counted by Albers). 2n = 44 (Van der Walt 1042, counted by Maggs) - see Acknowledgements.

Diagnostic features

Superficially *P. anethifolium* resembles some forms of *P. triste* (Linnaeus) L’Hér. (p. 133) on account of the division of the
Figure 6  Pelargonium anethifolium: exposed parts ¥1. Based on van der Walt 1042, originally from near Darling. After van der Walt & Vorster, Pelargoniums of southern Africa 3: 5 (1988); del. Ellaphie Ward-Hilhurt.
lamina into very narrow linear segments; but it is readily distinguished by the lamina being less than 2x instead of at least 2x as long as wide, by the indumentum of the lamina being inconspicuous to the naked eye instead of mostly densely hirsute (at least in narrow-segmented forms), and having 6 instead of 7 fertile stamens. In *P. multiradiatum* Wendland (p. 117) the lamina is also divided into linear segments; but in that species the segments are conspicuously wider (up to 3 mm wide), and the plant is altogether much larger with lamina up to 450 x 450 mm and up to 15 or even 30 flowers per pseudo-umbel. In addition, at least the lowermost segments branch off the rachis at close to a right angle, whereas in *P. anethifolium* they branch off at an acute angle. In *P. multiradiatum* we observed only 5 fertile stamens per flower, in contrast to 6 in *P. anethifolium*.

Flowering

Plants flower from October to December, with a peak in October and November, after which the exposed parts die back for the remainder of the summer (Figure 7). This period is much shorter than in *P. triste*, which flowers almost throughout the year.

**Figure 7** *Pelargonium anethifolium*: histogram showing distribution of flowering through the year.

Geographical distribution and habitat preference

This species is confined to the western part of the Western Cape Province, from Vansynsdorp southwards to the Cape Peninsula (Figure 8). A record from the Bushman’s River Mouth (Zeyher 176) is doubted and ascribed to incorrect labelling. It is not a very common species, which may be attributed to urban and intense agrical development throughout its distribution area. It occurs on the sandy coastal flats as well as on stony soil in the adjacent mountain ranges on substrates derived from sandstone, at altitudes of 100 to 1600 m. Along the coast it occurs in Sandveld vegetation, and in the mountains it is a component of Arid Fynbos. The annual rainfall over its distribution area varies from 200 mm near the coast to about 600 mm in the mountains, occurring predominantly during the winter months. During the hot and dry summers *P. anethifolium* is dormant and deciduous after flowering.

History

First described in 1835 by Ecklon and Zeyher from material collected by themselves, this species has subsequently only scantily been collected. The explanation for this must be that it has largely been eradicated by habitat destruction due to widespread wheat cultivation throughout its former distribution area, and urban development at the southern end of its range.

Synonymy

*Pelargonium callosum* was published as a *nomn nudum* by E. Meyer in 1843. Harvey (1860: 273) noted that its leaves were even more glabrous than normal for *P. anethifolium*, but concluded that it is nevertheless conspecific with *P. anethifolium*. We examined the material cited by Meyer (Drège 1286 in G, L, P, W), and concur with Harvey’s (*i.e.*) conclusion.

3. *Pelargonium pilansii* Salter in Journal of South African Botany 4: 120, t. 6 (1938a); Adamson & Salter: 514 (1950); Bond & Goldblatt: 308 (1984).

Type: WESTERN CAPE PROVINCE.—’Lion’s Mt. Saddle’, Salter 6453 (BOL!, holo.) (Figure 10).

Previous illustration: Salter: t. 6 (1938a).

Geophyte, with exposed stem poorly developed (up to 20 mm long and 5–10 mm in diameter) and sparsely branched, unarumed, up to 350 mm tall when in flower. *Exposed stem smooth, initially herba­ceous and somewhat succulent and green but turning woody and brown with age, glaucous. Leaves simple to 5-lobate or pinnatifid or pinnate, thinly coriaceous, more or less glabrous, glan­dular, glau­cous but tinted red to varying degrees; lamina cordiform in outline, decurrent along petiole, base cordate, apex rounded, bases of pinnate attenuate, apices of lobes acute, 40–120 x 40–80 mm; petiole up to 140 mm long, basal portion persistent; stipules narrowly ovate with apices acute, ca. 8 x 2.5–3.0 mm, membranous but becoming scario­uous, abaxially strigose but glabrescent, persistent. Inflorescence a stout unbranched peduncle, up to 300 mm tall and 2–3 mm in diame­ter, carrying a pseudo-umbel of (5–) 10–17 almost regular flowers. Pedicel much shorter than hypanthium: 1.0–1.5 mm long, densely strigose and with glandular hairs interspersed. Hypanthium up to 60 mm long. Sepals narrowly ovate with apices acute, abaxially strigose with sparse glandular hairs interspersed, adaxially glabrous, yellow-green and often strongly tinged pink, margins hyaline, ca. 10 x 1–2 mm. Petals 5, pale dirty yellow to cinnamon-coloured, spathulate with apices rounded, recurved through more than 90° with apices somewhat incurved; posterior two 13–15 x 4.0–5.5 mm, occasionally with diffuse smoke-purple markings; posterior three ca. 12 x 4.5 mm, markings inconspicuous or absent. Fertile stamens 6 or 7 (4 longer, 2 or 3 shorter and equalling staminodes), pollen yellow. Ovary ovoid, ca. 3.5 x 1.5 mm, with apically-directed hairs, pale green; style short; ca. 2 mm long; stigma 5-branched, red; mericarp base ca. 6 mm long, tail ca. 30 mm long. (Figure 9).

Chromosome number

2n = 22 (*von der Wals* s.n. sub STEU 1626, counted by Maggs; Fischer 344, counted by Albers — see Acknowledgements).
Figure 9  *Pelargonium pillansii*: 1. Tuber with lower portion of aerial stem, ×0.7; 2. Ephemeral aerial stem bearing inflorescences, ×0.7; 3. Flower in frontal view, ×2.8; 4. Flower with petals removed, in lateral view, ×2.8; 5-9. Calyx segments in abaxial view: 5 & 9, anterior; 6 & 8, lateral; 7, posterior, all ×2.8; 10. Anterior petal, ×2.8; 11. Posterior petal, ×2.8; 12. Androecium, splayed, inside view, ×3.5; 13. Androecium, posterior part, outside view, ×3.5; 14. Gynoecium, ×2.8; 15. Basal leaf, ×0.7. From *Journal of South African Botany* 4: 121 (1938); del. W.F. Barker.
Diagnostic features

*P. pillansii* resembles *P. pulverulentum* Sweet (p. 123) by its glaucous leaves with the lamina decurrent along the petiole; but differs in that the lamina may be pinnatifid or even pinnate and never laciniate nor ciliate, and by the markings on the petals being inconspicuous or absent compared to the very prominent purple-black markings in *P. pulverulentum*. In *P. pillansii* the chromosome number is mostly $2n = 22$, while in *P. pulverulentum* it is $2n = 44$. *P. pillansii* is a Western Cape species; and its replacement by the morphologically not dissimilar *P. pulverulentum* in the Eastern Cape and KwaZulu-Natal may be indicative of a closer than specific relationship between the two taxa.

Flowering

Plants flower from February to April, i.e. in late summer and autumn, usually before the commencement of the rainy season (Figure 11), and are leafless at the time of flowering.

Geographical distribution and habitat preference

This species has a wide distribution in the winter rainfall region of the Western Cape Province, from the Gifberg southwards to the Cape Peninsula, and thence eastwards to the Langkloof.
Figure 13 *Pelargonium pulvulentum*: type illustration in Sweet’s *Geraniaceae* 3: t. 218 (1824). A form with entire and undissected leaves. By courtesy of the Mary Gunn Library, National Botanical Institute.

*Pelargonium pulvulentum* Sweet var. *pedicellatum* (Sweet) Harvey in *Flora capensis* 1: 273 (1860); Knuth: 355 (1912).

*Pelargonium pulvulentum* Sweet var. *lanatosericeum* Knuth in *Das Pflanzenreich* 4, 129, 53: 356 (1912).

Type: EASTERN CAPE PROVINCE—'Baumsteppenregion der Kaffernländer - Grahamstown', Schonland 318 (ZI, lecto., here designated).

*Polyactium arenarium* Ecklon & Zeyher, *Enumeratio plantarum* 1: 66 (1835); non *Pelargonium arenarium* (Burman f.) De Candolle, *Prodromus...* 1: 680 (1824).

Type: EASTERN CAPE PROVINCE—'Winterhoeck'sberg', Uitenhage', Ecklon & Zeyher 506 (Pl., lecto., here designated).
Figure 14  *Pelargonium pulverulentum*: a plant of unrecorded provenance with deeply dissected leaves, $\times 1$. After van der Walt, *Pelargoniums of southern Africa* [1]: opp. p. 37 (1977); del. Ellaphie Ward-Hilhorst.
Pelargonium arenicola Steudel, Nomenclator Botanicus ed. 2, 2: 280 (1841).
Type: as for Polyaactium arenarium.

Polyaactium primulaefforme Eckl. & Zeyher, Enumeratio植物arum 1: 65 (1835).
Type: EASTERN CAPE PROVINCE.—"Zwartkopsrivier" (Uitenhage), tum prope ‘Klipplattrivier et Bontebocksvlakte’ (Tombakland) et in collibus apud ‘Philipstown’ (Ceded Territory’), Eckl. & Zeyher 503 (SI, lecto., here designated; MEL; SAM; W!).

Pelargonium primulaefforme (Eckl. & Zeyher) Steudel, Nomenclator Botanicus ed. 2, 2: 239 (1841).

Pelargonium testaceum Baker in Refugium Botanicum 4: sub t. 241 (1871b).
Type: WESTERN CAPE PROVINCE.—‘Piquetberg’, Drège 503 (K! lecto., here designated; MO; PRE; W!).

Pelargonium hollanedi Leighton in South African Gardening & Country Life 22: 229 & 232 (1932); Batten & Bokelmann: 86 (1966).
Type: EASTERN CAPE PROVINCE.—‘Witteklip, near Port Elizabeth’, Holland s.n. sub N.B.G. 10/0/31 (BOL!, holotype).

Previous Illustrations: Sweet: tt. 218 & 250 (1824); Baker: t. 214 (1871b); [Phillips]: t. 146 (1924); Leighton (1932); Batten & Bokelmann: t. 73.1 (1966); Van der Walt: opp. p. 37 (1977)

A geophyte with exposed parts poorly developed, deciduous, unwooded, up to 600 mm tall when in flower. Exposed stems smooth, hard and woody, densely striate and hisurate with scattered glandular hairs, initially green but turning brown with age, up to 500 mm long and 5–10 mm thick. Leaves basal, simple to (3-)5(-7)-pinnatifid to pinnate or occasionally 3-foliolate, lamina decurrent along petiole, coriaceous, conspicuously ciliate, glabrous but occasionally densely pubescent, glaucous; lamina ovate to cordiform in outline, base cordate, apices of segments rounded to almost acute, 35–120 × 30–130 mm; petiole up to 200 mm long, deciduous; stipules cordiform to ovate with apices acute, 4–10 × 3–6 mm, membranous becoming scarious, conspicuously ciliate, abaxially densely striose becoming glabrous. Inflorescence a stout unbranched peduncle 100–150(–400) mm long and up to 3 mm in diameter, carrying a pseudo-umbel of 5–10–18 almost regular flowers. Pedicel much shorter than hypanthium: 2–20 mm long, densely striose and with glandular hairs. Hypanthium 20–50 mm long. Sepals narrowly ovate with apices acute, practically glabrous but hisurate at apices and villous along adaxial margins, yellow-green to brown tinted with red, margins hyaline, 7–10 × 1–2 mm. Petals 5, dull yellow, spatulate; posterior two 10–14 × 3–6 mm, reflexed at ca. 90° near base and slightly inflexed at apex, without markings or streaked with purple-black; anterior three slightly narrower: up to 5 mm wide. Orientated similarly to posterior petals but less markedly reflexed, with entire central area uniformly purple-black leaving only a narrow dull yellow margin. Fertile stamens 6 (4 long, 2 short and equalling staminodes), pollen bright yellow. Ovary pear-shaped, 1–3 × 0.5 mm, densely covered in apically-directed hairs, pale green; style ca. 2 mm long; stigma 5-branched, deep maroon; mericarp base 8–9 mm long, tail 35–45 mm long. (Figure 14).

Chromosome number
$2n = 22$ (Fischer 69, counted by Albers). $2n = 44$ (Fischer 71, counted by Albers, by Maggs, and by Yu & Horn; Gibby & Crompton 129, counted by Gibby; Gibby & Crompton 177, counted by Gibby; Van der Walt 568b, counted by Maggs; Van der Walt 875, counted by Albers; Van der Walt 878, counted by Gibby; Ward s.n. sub STEU 1100, counted by Maggs). $2n = 66$ (Dobay P54/75, counted by Gibby; Gibby 66, counted by Albers; Gibby & Crompton 166, counted by Gibby). See Acknowledgements.

Figure 15 Pelargonium pulverulentum: histogram showing distribution of flowering through the year.

Diagnostic features
Due to the remarkable variability of its foliage, Pelargonium pulverulentum is often confused with other species in the subsection. The densely pubescent form can be confused with the consistently velutinous Pelargonium lobatum, but in that species the base of the lamina is never decurrent. The more common glabrous form can be confused with Pelargonium pilanthes, but is easily distinguished by the ciliate leaf margins; furthermore Pelargonium pulverulentum is an Eastern Cape and KwaZulu-Natal species while Pelargonium pilanthes is known from the Western Cape only.

Flowering
Plants flower from July to the following April, but predominantly from September to March (Figure 15). It is deciduous during the winter months.

Geographical distribution and habitat preference
This species is known from Mtunzini in northern KwaZulu-Natal, southwards to Humansdorp (Figure 16), at altitudes varying from sea level to more than 1600 m. It is a component of grassland, often on sandy soils. This area receives a summer rainfall amounting to 600–1000 mm per annum, and it is unexpected that a species occurring under such relatively wet conditions compared to the other species in the section, should have such glaucous and leathery leaves.

Figure 16 Pelargonium pulverulentum: known geographical distribution.
History

It is strange that *P. pulverulentum* was only described in 1824, because traveller-collectors such as Masson, Sparman, and Thunberg should have encountered it in the early 1770's. However, after 1824 it was repeatedly described under various new names, no doubt because of its polymorphy. Several excellent illustrations, all but one in colour, appeared over the years, illustrating different variants.

Synonymy

*Pelargonium pedicellatum* Sweet, treated as a variety of *P. pulverulentum* by Harvey (1860) and Knuth (1912), was distinguished on account of its longer pedicels and bracts. The present study revealed these structures to vary widely and continuously, so that separate taxonomic status cannot be justified.

*Pelargonium pulverulentum* var. *lanatosericum* Knuth was distinguished on account of its dense foliar indumentum. Hairiness of the leaf was, however, found to be another continuously variable characteristic so that the variety cannot be upheld.

*Pelargonium hollandii* Leightox was distinguished by its densely pubescent, anisodichotomously pinnatisect leaves. Once again this syndrome was found to fall within the normal range of variation recorded in *P. pulverulentum*.

5. *Pelargonium lobatum* (Burman f.) L'Héritier in Aiton, Hortus kewensis ed. 1, 2: 418 (1789); Willdenow: 650 (1800); Persoon: 228 (1806); Willdenow: 701 (1809); Aiton f.: 165 (1812); Sweet: sub t. 51 (1821); De Candolle: 662 (1824); Meyer: 209 (1843); Presl: 27 (1845); Harvey: 272 (1860); Szyszlyowiec: 9 (1888); Knuth: 354 (1912); Adamson & Salter: 515 (1950); Kidd: 146 (1950); Van der Walt: 24 (1977); Kidd: 146 (1983); Wijnands: 107 (1983); Bond & Goldblatt: 307 (1984); Vorster: 347 (1985); Bohnen: 33 (1986); Vorster: sub t. 1924 (1986).

*Geranium lobatum* Burman f., Specimen botanicum de Geraniis: 44 (1759); Linnaeus: 950 (1763); Burman f.: 19 (1768); Cavaniiles: 250 (1787); Thunberg: 114 (1800); Andrews (without page number) (1805); Thunberg: 519 (1823).

Type: WESTERN CAPE PROVINCE.- 'Cap. BON. SPEI', Oldenlandia s.n. in Herb. Burman (G!, lecto.- cf. Vorster in S. Afr. J. Bot. 51: 347–348, fig. 1 (1985). (Figure 17).

*Polyactium lobatum* (Burman f.) Ecklon & Zeyher, Enumeratio plantarum 1: 65 (1835).

*Geraniospermum lobatum* (Burman f.) Kuntze, Revisio genera plantarum 1: 95 (1891).

*Geranium bicolor* Jacquin, Hortus vindobonensis 3: 23 (1776); Cavanilles: 248 (1787); Andrews (1805, no page number).

Type: Plate 39 in Jacquin, Hortus vindobonensis vol. 3 (1776).

*Pelargonium bicolor* (Jacquin) L'Héritier in Aiton, Hortus kewensis ed. 1, 2: 425 (1789); Curtis: sub t. 201 (1793); Willdenow: 680 (1800); Persoon: 232 (1806); Desfontaines: 463 (1809); Willdenow: 709 (1809); Aiton f.: 179 (1812); Sweet: sub t. 97 (1821); De Candolle: 664 (1824); Hoffmannsegg: 87 (1824–1826); Sprengel: 57 (1826); Steudel: 677 (1841); Harvey: 275 (1860); Knuth: 349 (1912).

Type: as for Geranium bicolor Jacquin.

*Geranium bicolor* var. *magnai* Andrews, Geraniums 1805, no page number.

Type: Unnumbered plate of *Geranium bicolor* var. *magna* in Andrews, Geraniums (1805).

Type: as for *Geranium bicolor* Jacquin.

*Pelargonium amoenum* Salisbury, Prodromus stirpium in horto ad chapel Allerton vigentium: 314 (1796); De Candolle: 663 (1824).

Type: as for *Geranium bicolor* Jacquin.

*Pelargonium heracleifolium* Loddiges, Botanical Cabinet 5: sub t. 437 (1820).

Type: Plate 437 in Loddiges, Botanical Cabinet vol. 5 (1820).

*Geraniospermum heracleifolium* (Loddiges) Kuntze, Revisio genera plantarum 1: 94 (1891).

*Pelargonium geoffroianum* E. Meyer in Drège, Zwei pflanzengeographische Dokumente: 209 (1843), nom. nud.; ex Baker in...
Figure 18 *Pelargonium lobatum*: a plant from Lion's Head, Cape Town, with deeply dissected leaves. ×1; det. Ellaphie Ward-Hilhorst.
Refugium botanicum 4: sub t. 219 (1871a); non L’Héritier, Compendium generalium: 39 (1802).

Type: WESTERN CAPE PROVINCE.—‘Slangheuvel’, Drège 1279 (Pl. lecto., here designated; BM!; G; K!; L!; OXF!; S!).

Previous illustrations: Commelin: t. 62 (1701); Jacquin: t. 39 (1776); Cavanneilles: t. 114.1 & 2 (1787); Curtis: t. 201 (1793); Andrews: unnumbered plates sub Geranium bicolor. G. bicolor var. magora, & G. lobatum (1805); Sims: t. 1896 (1818); Lodidges: t. 437 (1820); Sweet: tt. 51 & 97 (1821); Baker: t. 219 (1871a); Kidd: opp. p. 146 (1950); Staffleur: t. 4 (1969); Van der Walt: t. 24 (1977); Kidd: opp. p. 146 (1983); Wijnands: p. 107—reproduction from Moninckx atlas (1983); Vorster: fig. 1—lectotype sheet (1985); Vorster: t. 1924 (1986).

A geophyte with exposed parts poorly developed, deciduous, unarmed, up to 500 mm tall when in flower. Exposed stipes smooth, basally hard and woody, distally herbaceous and densely velutinous and with numerous glandular hairs, initially green but turning brown with age. up to 900 mm long and 5–8 mm thick. Leaves basal, prostrate, simple, pinnaulate to 3-foliolate, herbaceous, velutinous with scattered glandular hairs interspersed; lamina ovate to cordiform in outline. base cordate, apex acutish, margins crenately denticate, 100–200 x 80–320 mm; petals up to 320 mm long, deciduous; stipules cordiform to ovate with apices acute, ca. 13 x 9–10 mm, initially membranous and densely velutinous and with numerous glandular hairs. conspicuously ciliate, but becoming scarious and glabrous with age. Inflorescence a stout unbranched peduncle 120–350 mm long and 2.0–2.5 mm in diameter, carrying a pseudo-umbel of 6–15 almost regular flowers. Pedicel much shorter than hypanthium: 1–2 mm long, densely velutinous and with glandular hairs. Hypanthium 25–35 mm long. Sepals narrowly ovate with apices acute, abaxially densely velutinous and with scattered glandular hairs, adaxially almost glabrous, margins ciliate, yellow-green with margins hyaline, 4.8–8 x 1.0–2.5 mm. Petals 5, almost equal, 9–12 x 2.5–5.0 mm, dull yellow and mostly with an extensive black centre marking leaving the yellow ground colour only visible along the margins. spatulate with petals rounded; posterior two reflexed at ca. 90° near base and slightly inflexed at apex; anterior three orientated similarly to posterior petals but less markedly reflexed. Fertile stamens 5 (4 long, 3 short and equalling stamnodes), pollen pale yellow. Ovary pear-shaped, ca. 3 x 2.0–2.5 mm, densely covered by apically-directed hairs, pale green; style ca. 1 mm long; stigma 5-lobed, deep red; mericarp base ca. 6 mm long, tail ca. 30 mm long. (Figure 18).

Chromosome number
2n = 22 (Van der Walt 474, counted by Albers; Makin 2141, counted by Gibby — see Acknowledgements).

Diagnostic features
P. lobatum is distinguished by its large, simple to 5-lobate, cordiform, prostrate, membranous leaves which are almost invariably covered with a soft and dense velvety indumentum. It may bear a superficial resemblance to the pubescent form of P. pulverulentum (p. 123) but the base of the lamina is never decurrent along the petiole as in P. pilansii (p. 121) and P. pulverulentum, nor is the lamina ever leathery and glaucous as in these two species.

Flowering
The flowering period is well defined, stretching from June to December with a marked peak in September (Figure 19).

Geographical distribution and habitat preference
This species occurs commonly throughout the winter rainfall region of the Western Cape Province, from about 31° south along the west coast southwards to the Cape Peninsula and then eastwards to Mosselbaai (Figure 20). Over most of the range the annual rainfall varies between 400 and 600 mm, but at the extreme north-western end of the range it may be less than 200 mm. It is commonly associated with fynbos, along the sandy coastal flats and some 150 km inland on the foothills of the mountain ranges.

History
The earliest known illustration was published in 1701 in Caspar Commelin’s Rariorum plantarum historia (vol. 2: t. 62) (see our Figure 21). This in turn is based on a watercolour painting by Maria Moninckx subsequently reproduced in monochrome in Wijnands (1983: 107). Commelin (1701: 123) stated that the plant was received from Africa in 1698, and this also constitutes the earliest record of this species. Surprisingly there are no older records, for it was almost certainly common around Table Bay and it is surely more unusual and conspicuous than P. triste (q.v.) which was figured as early as 1635. In spite of its early introduction into Europe, this species was not recognized in the first edition of Linnaeus’ Species plantarum, because Linnaeus included it in his broad concept of Geranium triste. Burman f. (1759) did recognize it as specifically distinct, and accordingly published a description.

Synonymy
In previous literature (e.g. Knuth, 1912: 354) P. heracleifolium Loddiges was cited as being the correct name for what in this

Figure 19 Pelargonium lobatum: histogram showing distribution of flowering through the year.

Figure 20 Pelargonium lobatum: known geographical distribution.
Figure 21  *Pelargonium lobatum*: earliest known published illustration, from Caspar Commelin’s *Rariorum plantarum horti medici Amstelodamensis [Sic] historia* vol. 2: t. 62 (1701). By courtesy of the Afdeling Speciale Collecties, Bibliotheek Landbouwuniversiteit, Wageningen, The Netherlands.
work is called *P. radulifolium* (Ecklon & Zeyher) Steudel (p. 131). It is typified by the illustration accompanying the original description, which clearly depicts *P. lobatum*.

*P. geijeri* Baker was cited by Knuth (1912: 354) as a synonym of what he called *P. heracleifolium*, but again the type specimen is clearly *P. lobatum*.

6. *Pelargonium radulifolium* (Ecklon & Zeyher) Steudel, Nomenclator botanicus 2, 2: 289 (1841); Harvey: 273 (1860); Knuth: 356 (1912) - all as *radulafolium*; Bond & Goldblatt: 308 (1984); van der Walt & Vorster: 121 (1988).

A geophyte with exposed parts poorly developed, deciduous, unarmed, up to 300 mm tall when in flower. Exposed stems rough due to stipular and petiolar scars, basally hard and woody, distally herbaceous and sparsely villous with glandular hairs interspersed, initially green but turning brown with age, up to 120 mm long and 2–10 mm thick. Leaves basal, erect, pinnate to 2-pinnatifid, herbaceous, glandular to axially striate or hisurate with short glandular hairs on both surfaces; lamina 2–3 times as long as wide, base of segments cuneate, apices of segments rounded, margins dentate, up to 280 (–320) × 90 (–160) mm; petiole up to 130 mm long, deciduous; stipules cordiform to ovate with apices acute, 5–10 × 3–8 mm, membranous becoming scarious, sparsely ciliolate, abaxially densely strigulose becoming glabrous, with scattered glandular hairs. Inflorescence a stout unbranched peduncle up to 200 mm long and up to 3 mm in diameter, carrying a pseudo-umbel of 4–20 almost regular flowers. Pedicel much shorter than hypanthium: 1.0–2.5 mm long, densely strigose and with glandular hairs. Hypanthium 20–55 mm long. Sepals narrowly ovate with apices acute, abaxially densely strigulose and with scattered glandular hairs, adaxially glabrous, margins ciliate, yellow-green with apices red and margins hyaline, 6–10 × 1–3 mm. Petals 5, almost equal, 11–18 mm long, dull yellow to flesh-coloured with maroon to purple-black markings, spathulate with apices rounded; posterior two 4.0–5.5 mm wide, reflexed at ca 90° near base and slightly reflexed at apex; anterior three 3.5–5.0 mm wide, orientated similarly to posterior petals but less markedly reflexed. Fertile stamens 7 (4 long, 1 medium, 2 short and equalising staminodes), pollen golden yellow. Ovary pear-shaped, ca 3.5 × 2.0 mm, densely covered in apically-directed hairs, pale green; style 1.0–1.5 mm long; stigma 5-branched, red; mericarp base 6–7 mm long, tail 35–40 mm long. (Figure 24).

Chromosome number

2n = about 60 (Dobay P35/75, counted by Albers). 2n = 66 (Dobay P40/75, counted by Gibby & by Maggs) - see Acknowledgements.

Diagnostic features

*P. radulifolium* is distinguished by its erect, pinnate to 2-pinnatifid leaves of which the lamina is 2 to 3 times as long as wide, membranous, not glaucous, and adaxially often densely striose or hisurate. In *P. pillansii* (p. 121) the lamina is also pinnate to pinnatifid; but almost as long as wide, leathery, glaucous, and glabrate.

Flowering

It is a summer-flowering species, with its flowering period extending from August to April with a peak in January and February (Figure 23).

Geographical distribution and habitat preference

This species occurs commonly throughout the winter rainfall region of the Western Cape Province, from about 31° south
Figure 24  Pelargonium radulifolium; a plant from near Paleisheuwel, x1. After Van der Walt & Vorster, Pelargoniums of southern Africa 3: 120 (1988); del. Ellaphie Ward-Hilhorst.
along the west coast southwards to the Cape Peninsula and then eastwards to Port Elizabeth in the Eastern Cape (Figure 25), at altitudes varying from sea level to 1500 m. The annual rainfall varies from 200 to 800 mm. It is commonly associated with fynbos, growing on sandstone-derived soils which may be very stony.

Synonymy
For many years this species was erroneously known as *P. heldeffalum* Loddiges [e.g. Knuth: 354 (1912)], but examination of the type showed that that name should rather be in the synonymy of *P. lobatum* (Burman f.) L'Héritier. *P. geifolium* Baker was cited by Knuth (1912: 354) as a synonym of what he called *P. heracleifolium* Loddiges. The type shows it to be a synonym of *P. lobatum*. The name is a later homonym for *P. mulliradiatum* Wendland in *Aiton, Hortus kewensis* ed. 1, 2: 418 (1789); Salisbury: 312 (1796); Willdenow: 651 (1800); Willdenow: 701 (1809); Alton f.: 166 (1812); De Candolle: 662 (1824); Sweet: sub t. 254 (1824); Steudel: 286 (1841); Meyer: 209 (1843); Presl: 27 (1845); Harvey: 273 (1860); Knuth: 357 (1912).

*Pelargonium* *triste* (Linnaeus) L'Héritier in *Aiton, Hortus kewensis* ed. 1, 2: 418 (1789); Willdenow: 650 (1800); Persoon: 228 (1806); Willdenow: 761 (1809); Aiton f.: 165 (1812); De Candolle: 662 (1824); Steudel: 290 (1841); Harvey: 274 (1860); Knuth: 358 (1912); Marloth: 90 (1925); Adamson & Salter: 514 (1950); Kidd: 122 (1950); Rice & Compton: sub t. 20.2 (1950); Mason: 130 (1972); Jackson: 32 (1977); Van der Walt: 46 (1977); Anon.: 72, fig. 215 only (1980); Le Roux & Schelpe: 98 (1981); Codd & Gunn: 93 (1982); Kidd: 122 (1983); Bond & Goldblatt: 309 (1984); Bohnen: 33 (1986); Le Roux & Schelpe: 114 & 115 (1988); Du Plessis & Duncan: 56 (1989).

*Geranium* *tristiforme* (Burman f.) Ecklon & Zeyher, *Enumeratio plantarum* 1: 667 (1835).

*Polycyrtum* *tristiforme* (Linnaeus) Ecklon & Zeyher, *Enumeratio plantarum* 1: 667 (1835).
Figure 27 Pelargonium triste: a typical plant from near Cape Town, x1; del. Ellaphic Ward-Hilhorst.
Geranium pastinacifolium Miller, The gardener's dictionary ed. 8: 37 (1768), ex descr.
Type: not designated.

Geranium dactylosum Murray in Commentatio de arboru uva ursi ...: 13, 14 (1780); Linnaeus: 615 (1784); Cavaniules: 260 (1787); Thunberg: 116 (1794); Thunberg: 530 (1823).
Type: Plate 4 in Murray, Commentatio de arboru uva ursi ... (1780) (lecto., here designated).

Pelargonium dactylosum (Murray) Salisbury, Prodrömus ...: 312 (1796); Steudel: 286 (1841).

Pelargonium dactylosum (Murray) Ecklon & Zeyher, Ennumeration plantarum 1: 68 (1835).

Pelargonium triste (Linnaeus) L'Héritier var. dactylosum (Murray) Harvey in Flora capensis 1: 274 (1860); Knuth: 358 (1912).

Pelargonium dactyloides Jacquin, Icones plantarum rariorum 3: 9, t. 522 (1794); Jacquin: 143 (1797); Persoon: 228 (1806); Steudel: 286 (1841); Knuth: 209 (1843); Presl: 27 (1845).
Type: Plate 522 in Jacquin, Icones plantarum rariorum, vol. 3 (1794) (lecto., here designated).

Pelargonium flavum (Burman f.) L'Héritier var. dactyloides (Jacquin) De Candolle, Prodrömus ...: 662 (1824).

Geranium quinquevulnlerum Andrews, The botanist's repository 2: t. 114 (1800).
Type: Plate 114 in Andrews, The botanist's repository, vol. 2 (1800) (lecto., here designated).

Pelargonium quinquevulnlerum (Andrews) Persoon, Synopsis plantarum 2: 228 (1806); Willdenow: 703 (1809); De Candolle: 664 (1824); Hoffmannsegg: 95 (1824-1826); Steudel: 289 (1841).

Geraniopspernum quinquevulnlerum (Andrews) Kuntze, Revisio generar plantarum: 95 (1891).

Pelargonium triste (Linnaeus) L'Héritier var. filipendulifolium Sims in Curtis's Botanical Magazine 40: sub t. 1641 (1814); Harvey: 274 (1860); Knuth: 358 (1912).
Type: Plate 1641 in Curtis's Botanical Magazine vol. 40 (1814) (lecto., here designated).

Pelargonium filipendulifolium (Sims) Sweet, Geraniaceae 1: sub t. 85 (1821); De Candolle: 662 (1824); Steudel: 286 (1841); Meyer: 209 (1843).

Pelargonium filipendulifolium (Sims) Ecklon & Zeyher, Enumeratio plantarum 1: 66 (1835).

Pelargonium nilllefoliatum Sweet, Geraniaceae 3: sub t. 230 (1824).
Type: Plate 230 in Sweet, Geraniaceae, vol. 3 (1824) (lecto., here designated).

Pelargonium carotaefolium Hoffmannsegg, Verzeichniss der Pflanzenkulturen: 87 (1824-1826), nom. nud.

Pelargonium mosstum Hoffmannsegg, Verzeichniss der Pflanzenkulturen: 93 (1824-1826), nom. nud.

Pelargonium multiradiatum sensu Ecklon & Zeyher, Enumeratio plantarum 1: 66 (1835), non Pelargonium multiradiatum Wendland.

Pelargonium papaverifolium Ecklon & Zeyher, Enumeratio plantarum 1: 66 (1835).
Type: WESTERN CAPE PROVINCE.--In sabulous non procul a 'Brackfontein' (Clanwilliam); Ecklon & Zeyher 568 (SI, lecto., here designated).

Pelargonium papaverifolium (Ecklon & Zeyher) Steudel, Nomenclator botanicus ed. 2, 2: 288 (1841).

Polyactium coniophyllum Ecklon & Zeyher, Enumeratio plantarum 1: 67 (1835).
Type: CAPE PROVINCE.--'Caledon' e.g. prope 'klynrivier, Warmbad et Steenboksrivier', Ecklon & Zeyher 515 (Pl, lecto., here designated; PRE!).

Pelargonium coniophyllum (Ecklon & Zeyher) Steudel, Nomenclator botanicus ed. 2, 2: 285 (1841).

Pelargonium tuberosum Steudel, Nomenclator botanicus ed. 2, 2: 290 (1841), nom. nud.

Pelargonium triste (Linnaeus) L'Héritier var. laxatum Harvey in Flora capensis 1: 274 (1860), ex descr.; Knuth: 359 (1912).
Type: WESTERN CAPE PROVINCE.--'Cape and Stellenbosch districts, at the 24 rivers', Zeyher s.n. (not seen).

Previous illustrations: Cornut: t. 110 (1635); Breyn: t. 58 (1678); Burman f.: t. 2 (1759); Murray: t. 4 (1780); Cavaniules: tt. 107.1, 120.1, 120.2 (1787); Jacquin: t. 522 (1794); Andrews: t. 114 (1800); Sims: t. 1641 (1814); Sweet: t. 85 (1821); Sweet: tt. 230 & 254 (1824); Knuth: t. 61 (1912); Marloth: t. 57.1 (1925); Kidd: fig. 5 opposite p. 122 (1950); Rice & Compton: t. 20.2 (1950); Mason: t. 54.2 (1972); Jackson: fig. 24 (1977); Van der Walt: opp. p. 46 (1977); Anon.: fig. 215 (1980); Le Roux & Schelpe: 99 (1981); Codd & Gunn (1982) - reproduction of Cornut: t. 110 (1635); Kidd: fig. 5 opp. p. 122 (1983); Bohnen: t. 4.42 (1986); Le Roux & Schelpe: 115 (1988); Du Plessis & Duncan: t. 3.2 (1989).

A geophyte with exposed parts poorly developed, deciduous, unarmed, usually about 250 mm but occasionally up to 500 mm tall when in flower. Exposed stems rough due to stipit and petal scars, basically hard and woody, distally succulent, initial green but turning brown with age, up to 150 mm long and 5–10 mm thick. Leaves basal, erect to prostrate, pinnately divided to 4-pinnatifidly divided into linear segments usually about 1 mm wide but occasionally up to 8 mm wide in leaves with poorly differentiated segmentation, herbaceous, usually covered in a dense, short, hoary indumentum with short glandular hairs interspersed; lamina at least 2 times as long as wide, bases of segments attenuate and often petiolulate, apices of segments round or truncate, margins entire and involute, 100–450 x 40–150 mm; petiole up to 120 mm long, deciduous; stipules cordiform to ovate with apices acute, 5–8 x 6–10 mm, membranous becoming scarious, abaxially initially densely pubescent. Inflorescence a stout unbranched peduncle 50–250 mm long and up to 2.5 mm in diameter, carrying a pseudo-umbel of 6–15 almost regular flowers. Pedicel much shorter than hypanthium: up to 4 mm long, densely striate and with glandular hairs. Hypanthium 30–55 mm long. Sepals narrowly ovate with apices acute, abaxially densely striate and with sparse glandular hairs, adaxially glabrous, margins ciliate, yellow-green to dull green and occasionally russet-tinted with margins hyaline, 5–7 x 1–3 mm. Petals 5, almost equal, 10–18 mm long, uniformly pale yellow or with a red or purplish black markings leaving only a border of yellow, spathulate with apices rounded; posterior two 4–8 mm wide, reflexed at ca. 90° near base and slightly inflexed at apex; anterior three 2.5–6.0 mm wide, orientated similarly to posterior petals but less markedly reflexed. Fertile stamens 7 (4 long, 3 short and equalling staminodes), pollen bright yellow. Ovary pear-shaped, 3.5–4.5 x 2.0 mm, densely covered in apically-directed hairs, pale green; style 2.0–2.5 mm long; stigma 5-branched, reddish; mericarp base 7–10 mm long, tail 35–45 mm long. (Figures 27 and 28).

Chromosome number
n = 44 (D. Boucher 51, counted by Albers; Marais 1 sub STEU 1334, counted by Yu). n = about 62 (Ward s.n. sub STEU 1103, counted by Albers). n = 66 (Van der Walt 582, counted by Gibby; Fischer 232, counted by Maggs) - see Acknowledgements.
Figure 28 Pelargonium triste: a plant in typical habitat near Springbok. Photo: P. Vorster.

Diagnostic features

*P. triste* is distinguished by its lamina being at least twice as long as wide, usually conspicuously pubescent, divided into linear segments which are usually about 1 mm wide but may be up to 8 mm wide in leaves in which segmentation is poorly developed, and 7 fertile stamens per flower.

In the only other species in this subsection in which the lamina is divided into linear segments, *P. anethifolium* and *P. multiradiatum*, the lamina is almost as wide as long and at least adaxially the indumentum is inconspicuous. Furthermore, *P. anethifolium* has only 6 fertile stamens, and *P. multiradiatum* only 5.

Flowering

In this species flowers have been recorded practically throughout the year, but there is a marked peak from September to December (Figure 29).

Geographical distribution and habitat preference

*P. triste* occurs commonly throughout the Northern and Western Cape Provinces, from the Orange River southwards to the Cape Peninsula, and then eastwards to near Mossel Bay (Figure 30). It is very common on the coastal sandy flats, but also occurs in more mountainous terrain at altitudes of up to 1800 m. This distribution falls entirely within the winter rainfall region, but as can be expected from such a wide distribution and altitudinal range, there is a considerable range in the annual rainfall, from about 100 mm to at least 600 mm. It is conspicuous in open places (Figure 28), but as succession progresses and the plants get overgrown by surrounding vegetation they stop flowering and become progressively more inconspicuous. Nevertheless, the substantial underground tuber enables it to survive for many years in semi-aestivation, as manifested by the sudden profusion of flowering individuals after a fire.

History

This was arguably the first species in the subsection to become known to the scientific world, being common around Table Bay where the earliest explorers casted anchor. The oldest known literature reference is in Cornut's *Canadensium plantarum...* of 1635, which includes an illustration (our figure 31). Codd and Gunn (1982) related how the material on which this reference is based was probably collected by the French explorer De Beaulieu at Table Bay on the 24th May 1622.

In the first edition of Linnaeus' *Species plantarum* the concept of *Geranium triste* was broad and included what is now known as *Pelargonium lobatum*. As soon as 1759 Burman f. emended Linnaeus' concept by accepting *Geranium lobatum* as specifically distinct.

Synonymy

Being a common species, *P. triste* is well represented in herbaria. The long list of synonyms reflect its variability in respect of the degree of foliar division and flower size.

Discussion

The aim of taxonomy is not only to define taxa, but also to classify them according to their perceived evolutionary context. Our views on the position of this group within the section *Polyactium*

Figure 29 Pelargonium triste: histogram showing distribution of flowering through the year.

Figure 30 Pelargonium triste: known geographical distribution.
Figure 31  *Pelargonium triste*: earliest known illustration, in Cornut’s *Canadensium plantarum*... (1635). By courtesy of the Mary Gunn Library, Pretoria.
have been stated previously (Maggs, Vorster, & Van der Walt; 1995a), and, therefore, our present concern is the relative taxonomical position of the species within the subsection Polyacatum.

The present geographical distribution of the subsection falls almost entirely within the winter rainfall area, with only one species (P. pulverulentum) extending significantly into the summer rainfall region. This suggests an origin in the winter rainfall region. At present the highest concentration of species (i.e. centre of diversity) is along the south-western coast, between Cape Town and Lamberts Bay, where five species have been recorded in each of four adjacent one degree squares, with some growing in close proximity to each other (Figure 32). Further northwards along the west coast the concentration of species rapidly diminishes until the north-western arm of the subsection's crescent-shaped distribution area is represented over a distance of about 300 km by a single species, P. triste. North-eastwards of Port Elizabeth only a single species occurs (P. pulverulentum), extending far into the summer rainfall region and covering an area almost as extensive as the remaining species in the subsection.

Expressed in terms of the number of one degree squares in which each species has been recorded, P. pulverulentum has the widest distribution (18 squares), closely followed by P. triste (16 squares) and P. lobatum (15 squares). The species with the smallest distribution range is P. multiradiatum which occurs in only 3 squares.

With a basic chromosome number of x = 11, polyploidy up to the level of hexaploidy has been noted. It is tempting to deduce that the level of ploidy tends to increase proportionally to the distance from the centre of diversity (Figure 33), thus supporting the hypothesis that adaptive radiation took place from an archtype with 2n = 22 along the south-western coast, to higher ploidy levels further away from the presumed area of origin. However, close examination of the data shows such a conclusion to be unwarranted. The higher ploidy levels along the east coast, furthest away from the centre of diversity, are representative of a single species (P. pulverulentum) which in general tends to have high levels of ploidy. High ploidy levels, up to 2n = 66, occur throughout the geographical range of the subsection, including the centre of diversity.

Our data suggest that there is a tendency towards set ploidy levels within some species. Thus P. lobatum, P. multiradiatum, and P. pillansii both have 2n = 22, P. anethifolium has 2n = 22 or 44, P. triste has 2n = 44 or 66, and P. radulifolium has 2n = 66. It is noteworthy that four of the seven species show a range of ploidy levels, the most remarkable being P. pulverulentum with 2n = 22, 44, and 66. In general, those species with the widest geographical distribution also have higher levels of ploidy as well as a wider range of ploidy levels. Thus P. multiradiatum, occurring in only three one-degree squares, have 2n = 22; while P. triste (16 one-degree squares) have 2n = 44 and 66, and P. pulverulentum (18 one-degree squares) have 2n = 22, 44, and 66. We speculate that a range of ploidy levels, if not higher levels of ploidy, enables a species to utilise a wider range of ecological niches and so occupy a wider geographical area.

There does not seem to be any relationship between level of ploidy and morphology. Thus chromosome numbers of 2n = 22 were observed in P. lobatum and 2n = 22, 44, and 66 in P. pulverulentum, the two species with the least divided leaves which we consider to be an ancestral or more primitive trait. Parallel with this we observed 2n = 22 in P. multiradiatum and 2n = 44 and 66 in P. triste, both species with extremely divided leaves which we consider to be a derived (relatively advanced) trait.

Like in two of the other three subsections of section Polyaclatum, the flowers of the individual species within the subsection Polyaclatum are practically identical. Not only can the flowers not be used for taxonomical purposes, but they also seem unlikely to constitute effective barriers against interspecific hybridization (the flowering times of the individual species vary, but there is considerable overlap). The interspecific variation is instead manifested by leaf morphology, expressed by degree of incision, texture, indumentum, length/width ratio, and spatial orientation. Barriers against interspecific gene-flow are probably located in individual responses to environmental conditions, resulting in subtly different habitat preferences leading to spatial separation.

The distribution of these species coincides largely with that of the winter-rainfall fynbos vegetation, but P. pulverulentum is largely a component of summer-rainfall short grassland. Within these major vegetation types, the species occur under conditions of considerable seasonal climatic fluctuations. Summers tend to be hot and dry, and winters cool and wet over most of the range; whereas in the summer-rainfall grassland, winters tend to be drier than the summers but sunnier and probably warmer than in the winter-rainfall fynbos.

Figure 32 Pelargonium subsection Polyaclatum: geographical distribution and concentration of species, on a resolution of one degree square (approximately 10 000 m²).
severe. It was probably in response to these restrictions that the well-developed underground storage organs evolved, in order to survive the inhospitable season.

Typical climatic features of the subsection's distribution area are rainfall above 200 mm per year, hot summers, and cool winters without frost. In the west the climate is of the Mediterranean type with dry summers and wet winters, further eastwards the rainfall becomes increasingly non-seasonal, culminating in a summer-rainfall region along the east coast north-eastwards of Port Elizabeth. Quantitatively the rainfall is influenced by local topography and largely depends on the exposure of the site to coastal winds. Coastal localities seldom get more than 750 mm compared to nearby mountain slopes which may receive twice this amount, whereas inland valleys get only 200 to 400 mm (Fuggle & Ashton 1979). In the winter-rainfall area of the Western Cape, rainfall occurs almost exclusively as prolonged and gentle drizzles; whereas in the eastern, summer-rainfall regions precipitation often takes place as violent thunder storms during the summer months.

The proximity of oceans to the distribution area of the subsection has a moderating influence on temperature, and frost occurs rarely. The coastal belt is also characterised by frequent strong winds, and the low or even prostrate growth form may be a reaction to this factor.

The subsection Polyactium is largely confined to sandstone-derived soils, which are poor in nutrients and very well drained. Nevertheless, some individuals, especially of *P. lobatum*, also occur on soils derived from shales, which are clayey and comparatively richer in nutrients.

Acknowledgements

This article is based on part of a MSc. thesis written by Maggs while studying at the Botany Department, University of Stellenbosch, under the leadership of Van der Walt and Vorster. Vorster acknowledges a grant from the Research Fund of the University of Stellenbosch for running costs while preparing the manuscript for publication. Prof. F. Albers of the Botany Department at the Wilhelms-Universität, Münster, repeated and confirmed some of our chromosome counts, and provided additional data. More chromosome counts were obtained from Yu and Horn (1988).

Mr. Ben Groen and the Afdeling Speciale Collecties, Bibliothek Landbouwuniversiteit, Wageningen, are thanked for the illustration used as Figure 21. Prof. Gideon F. Smith, Dr. Hugh Glen, and the Mary Gunn Library of the National Botanical Institute kindly supplied the images reproduced as Figures 1 and 13.

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Appendix 1: specimens seen

For each collection the acronym of the herbarium where it is lodged is indicated after the collector’s name and number, followed by the species number as follows:

1 = P. multiradiatum
2 = P. anethifolium
3 = P. piliansii
4 = P. pulverulentum
5 = P. lobatum
6 = P. radifolium
7 = P. triste

Acocks 398 (S): 1; Acocks 9204 (PRE); 4; Acocks 12192 (PRE); 4; Acocks 17278 (PRE); 2; Acocks 21328 (PRE); 5; Acocks 23464 (PRE); 4; Anon. s.n. [Stellenbosch flats] (STE): 7.

Bachmann 276 (BOL): 7; Bachmann 1527 (Z); 5; Bachmann 1532 (Z); 7; Bachmann 2202 (Z); 5; Baker 29 (BOL): 4; Baker 20376 (BOL): 7; Barker 4666 (BOL): 5; Barnard-Fuller s.n. [Cape Flats]: 7; Barnes s.n. [Piekienier’s Kloof] (BOL): 7; Bayer 2300 (STEU): 3; Bayliss 3095 (Z): 4; Bayliss 6315 (MO): 7; Bayliss 7143 (MO): 6; Bernhardi s.n. sub MO 1891318 (MO): 5; Bernhardi s.n. sub MO 1891535 (MO): 5; Bingham 19 (NU): 4; Blium 163 (E): 7; Bohemen 4271 (STE): 5; Bohemen 6372 (STE): 4; Bohenen 70986 (STE): 7; Bokelman s.n. [Gonubie Flats]: 4; Bolus 2273 (BOL): 4; Bolus 2726 (BOL): 7; Bolus 2733 (BOL): 7; Bolus 4523 (BOL): 7; Bolus 5131 (BOL): 5; Bolus 8046 (BOL): 7; Bolus 8481 (BOL): 7; Bolus 8481 (PRE); 6; Bolus 8947 (BOL): 1; Bolus 9323 (BOL): 5; Bolus 10623 (BOL): 4; Bolus 11738 (BOL): 6; Bolus 12631 (BOL): 7; Bolus 13525 (BOL): 5; Bolus 19175 (BOL): 3; Bolus 20525 (BOL): 3; Bolus

s.n. sub BOL 31338 (BOL): 2; Bolus s.n. [Caledon] (BOL): 5; Bolus s.n. [Karoooppoort] (BOL): 5; Bolus s.n. [Piquenier’s Kloof] (BOL): 5; D.A. Boucher 51 (STEU): 7; Boucher 52 (STEU): 5; Boucher 59 (STEU): 7; Boucher 72 (STEU): 5; Boucher 86 (STEU): 7; Boucher 7288 (PRE, STE): 7; Boucher 2238 (STE): 7; Boucher 2913 (STE): 5; Boucher 2960 (STE): 7; Boucher 3216 (PRE, STE): 5; Boucher s.n. sub STEU 472 (STEU): 5; Boucher s.n. [Giffberg] (STEU): 3; Boucher & Shepherd 4593 (STEU): 7; Burgers 2517 (STE): 5; Burke 9104 (PRE): 4.

Cattell & Cattell 125 (STE): 6; Cilliers s.n. sub STEU 1108 (STEU): 7; Cilliers s.n. sub STEU 3458 (STEU): 2; Compton 18250 (BOL): 7; Compton 19353 (NBG): 4; Crookes 114 (NU): 4; Cruden 45 (BOL): 4.

Dahlstrand 562 (MO, PRE): 4; De Kok s.n. [Napier] (STE): 7; De Vos 868 (STE): 7; De Vos 1106 (STE): 7; Dobay P3575 (STEU): 6; Dobay P4075 (STEU): 6; Dobay P5475 (STEU): 4; Dobay 756 (STEU): 4; Dobay 768 (STEU): 4; Doidje s.n. [Wellsington] (PRE): 7; Drège 81 (GRA): 4; Drège 105 (GRA): 6; Drège 1279 (BM, G, K, L, OXF, P, S): 5; Drège 1279 (P): 6; Drège 1280 (G, L, P, W): 2; Drège 7505 (K, MO, PRE, W): 4; Drège 7506 (P): 6; Drège 7507a (PRE): 4; Drège s.n. sub MEL 94135 (MEL): 5; Drège s.n. sub MO 1891317 (MO): 5; Drège s.n. sub MO 1891493 (MO): 5; Drège s.n. [Katerburg] (P): 4; Drège s.n. [No locality cited] (E): 5; Drège s.n. [No locality cited] (K): 5; Drège s.n. [Port Natal] (P): 4; Drège s.n. [Riebeeckkasteel] (PRE): 5; Drège s.n. [Swartkop's River] (MO): 6; Drège s.n. [Wuppertal] (P): 1; Drège s.n. [Zuurberg] (MO, P): 6; Drijfhout 1520 (STEU): 7; Drijfhout 1642 (STEU): 5; Drijfhout 2382 (STEU): 5; Drijfhout 2629 (STEU): 7; Drijfhout 2848

S. Afr. J. Bot. 1999, 65(2)
Appendix 2: index of names

The purpose of the following list is to elucidate the status of names which have been used in the subsection Polyactium. Names now in synonymy, or no longer applying to subsection Polyactium in its current circumscription, appear between brackets and in italics, whereas names considered to be correct are printed in bold italics.

(Geranium anethifolium (Ecklon & Zeyher) Kunth (1891)) = Pelargonium anethifolium (Ecklon & Zeyher) Steudel (1841)

(Geranium apifolium (Jacquin f.) Kunth (1891)) = hybrid (not Geranium apifolium Andrews (1805)) cf. Pelargonium apifolium

(Geranium bicolor (Jacquin) Kunth (1891)) = Pelargonium lobatum (Burman f.) L’Héritier (1789)

(Geranium flavum (Burman f.) Kunth (1891)) = Pelargonium triste (Linnaeus) L’Héritier (1789)

(Geranium heracleifolium (Loddiges) Kunth (1891)) = Pelargonium lobatum (Burman f.) L’Héritier (1789)

(Geranium lobatum (Burman f.) Kunth (1891)) = Pelargonium lobatum (Burman f.) L’Héritier (1789)

(Geranium multiflorum (Wendland) Kunth (1891)) = Pelargonium multiflorum Wendland (1809)

(Geranium pulverulentum (Sweet) Kunth (1891)) = Pelargonium pulverulentum Sweet (1824)

(Geranium quinqueveinatum (Andrews) Kunth (1891)) = Pelargonium triste (Linnaeus) L’Héritier (1789)

(Geranium radulafoliosum (Ecklon & Zeyher) Kunth (1891)) = Pelargonium radulafoliosum (Ecklon & Zeyher) Steudel (1841)

(Geranium sanguineum (Wendland) Kunth (1891)) = hybrid (cf. Pelargonium sanguineum)

(Geranium triste (Linnaeus) Kunth (1891)) = Pelargonium triste (Linnaeus) L’Héritier (1789)

(Geranium bicolor Jacquin (1776)) = Pelargonium lobatum (Burman f.) L’Héritier (1789)

(Geranium bicolor Jacquin var. maga Andrews (1805)) = Pelargonium lobatum (Burman f.) L’Héritier (1789)

(Geranium dacicifolium Murray (1780)) = Pelargonium triste (Linnaeus) L’Héritier (1789)

(Geranium flavum Burman f. (1768)) = Pelargonium triste (Linnaeus) L’Héritier (1789)

(Geranium lobatum Burman f. (1759)) = Pelargonium lobatum (Burman f.) L’Héritier (1789)

(Geranium puncteolatum Miller (1768)) = Pelargonium triste (Linnaeus) L’Héritier (1789)

(Geranium pinatifidum Burman f. (1759)) = Pelargonium triste
| Scientific Name | Synonyms |
|-----------------|----------|
| *Pelargonium* | *Geronium* (L.) | *Geranium* (L.) |
| *G. scabrum* | *G. pulchellum* |
| *G. lamprospermum* | *G. gilvifolium* |
| *G. hybridum* | *G. hybrids* |
| *G. cucullatum* | *G. cucullatum* |
| *G. nematocalyx* | *G. nematocalyx* |
| *G. cylindricum* | *G. cylindricum* |
| *G. radulosum* | *G. radulosum* |
| *G. psilostachyum* | *G. psilostachyum* |
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