



Three new geophytic species of *Pelargonium* (Geraniaceae) from the Western Cape Province, South Africa and their relationships within section *Hoarea*



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ABSTRACT

Pelargonium psammophilum E.M.Marais, *Pelargonium naviculifolium* E.M.Marais and *Pelargonium montaguense* E.M.Marais are described as new species. All are deciduous geophytes with turnip-shaped tubers belonging to section *Hoarea* (Sweet) DC. These three species share obovate to widely spatulate petals with narrow cuneate claws, undulate margins and prominent black blotches in the centre of the posterior two petals, acting as attraction points to the flower. However, they differ in leaf shape. *Pelargonium psammophilum* has erect, simple, lanceolate to finely divided leaves, *P. naviculifolium* has erect, simple, lanceolate leaves and *P. montaguense* has prostrate trifoliolate leaves with relatively long and thin petioles. The flower structure of the three species corresponds to that of *Pelargonium heterophyllum* Jacq., *Pelargonium tenellum* (Andrews) G. Don and *Pelargonium trifoliolatum* (Eckl. & Zeyh.) E.M. Marais. The six species are compared with regard to the flower and leaf morphology, palynology and chromosome numbers. They all occur in the winter rainfall region along the western and southern coast of the Western Cape Province as illustrated in the accompanied maps. The three new species described here are illustrated and a key for the identification of the six species with a *P. heterophyllum* flower type is also included.

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1. Introduction

Section *Hoarea* (Sweet) DC., comprising about 100 species of deciduous geophytes, is the largest section of *Pelargonium* L'Hér. and is characterized by a more or less turnip-shaped tuber covered by flaking periderms and a very short stem from which the scape and leaves emerge (Marais, 1994). Of all sections of *Pelargonium*, section *Hoarea* has the largest variation in floral structure (Marais, 1981) and the subdivision of this section is mainly based on the variation in the androecium and petals (Marais, 1994). Since the sepals and the staminal column are both persistent long after fruit set, a comparison between them plays an important role in the identification of species and was used in an informal subdivision of section *Hoarea* (Marais, 1994). In about one third of the species all the filaments are much shorter than the sepals, in another third the lateral and anterior filaments are about the same length as and in the rest the filaments are longer than the sepals (Marais, 1994). The colour of and markings on the petals, their shape and orientation during anthesis, the pollen structure and chromosome number of the species were used in the subdivision of these informal groups.

In both *Pelargonium heterophyllum* Jacq. and *P. trifoliolatum* (Eckl. & Zeyh.) E.M.Marais the posterior stamen is very short and the lateral

and anterior ones more or less the same length as the sepals, the posterior petals are narrowly spatulate or narrowly obovate with undulate margins, laterally curved and with prominent black blotches on the transition between the claw and the apex. These two species are thus grouped as the *P. heterophyllum* flower type (Marais, 1994). Although the petals of *Pelargonium tenellum* (Andrews) G. Don are linear and the prominent black blotches are lacking, the structure of its androecium fits in best with that of the *P. heterophyllum* flower type (Marais, 1994).

Pelargonium psammophilum E.M.Marais, *P. naviculifolium* E.M.Marais and *P. montaguense* E.M.Marais are three new species that share the characteristics of the *P. heterophyllum* flower type. The flowers of these three species are similar in having obovate, widely spatulate or spatulate posterior petals with undulate margins, usually laterally curved and with a prominent black blotch on the transition between the claw and the apex, and the claws of the petals form a sheath in which the stamens are concealed. The posterior petals are laterally recurved during anthesis and the prominent black blotches act as attraction points to the flower. The species within the *P. heterophyllum* group are separated largely by differences in leaf characters.

Pelargonium psammophilum is quite common in the Western Cape and known from several collections made during the nineteenth century, among others by J.F. Drège and C.W.L. Pappé. It is characterized by its heteroblastic leaf development and large variation in leaf shape, similar to that of *Pelargonium longifolium* (Burm.f.) Jacq. and

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Pelargonium proliferum (Burm.f.) Steud., which is probably the reason for the confusion of these species in herbarium collections in the past. Although one herbarium specimen of *P. naviculifolium*, collected by H. Bolus in October 1915, could be traced, this species really came to our knowledge through a collection made by Ellaphie Ward in November 1979. This was also the specimen she used for the accompanying illustration. No herbarium specimens of *P. montaguense* could be traced and this very attractive species was first collected by Jan Vlok in September 2006.

The aim of this paper is to describe three new species of the *P. heterophyllum* flower type. To achieve this, a morphological study was done, accompanied by field work and palynological studies, and a comparison of the known chromosome numbers (Gibby et al., 1996).

2. Material and methods

Morphological data were gathered from field studies, plants grown in the Botanical Garden of the University of Stellenbosch and herbarium specimens from the following herbaria (abbreviated according to Holmgren et al., 1990): BM, BOL, E, G, K, MEL, MO, NBG, P, PRE, S, SAM, STE, STEU, TCD and Z. Species of section *Hoarea* usually flower after the leaves have died and herbarium specimens of flowering plants are often without leaves. Complete herbarium specimens were prepared from plants collected in the field and grown in the garden. Leaves and flowers were sometimes collected at different stages. Rainfall figures are derived from the rainfall maps of Jackson (1961). Pollen grain specimens were sampled from plants growing in the Botanical Garden of the University of Stellenbosch (Table 1) and prepared according to the acetolysis method of Radford et al. (1974). The equatorial diameter of the acetolyzed pollen grains was measured under a light microscope on specimens mounted in glycerin jelly (25 pollen grains per specimen) and the structure of the pollen walls was studied with a scanning electron microscope. Chromosome numbers used were obtained from unpublished results of Prinsloo (pers. comm.) and Gibby et al. (1996).

3. Results and discussion

3.1. Morphology

The six species with the *Pelargonium heterophyllum*-type flower have rather small (10–70 × 8–25 mm) turnip-shaped, elongated or moniliform tubers, typical for section *Hoarea*. *Pelargonium trifoliolatum*, *P. psammophilum* and *P. naviculifolium* with erect or erecto-patent leaves can become up to 250 mm tall when in flower, whereas *P. heterophyllum*, *P. tenellum* and *P. montaguense*, with a prostrate growth form only grow up to 70–150 mm tall when in flower.

Leaf variation in this group plays an important role in the identification of species. In species with erect or erecto-patent leaves, the laminae vary from simple and lanceolate, pinnate and heteroblastic and those with prostrate leaves from simple and obovate to trifoliolate.

Pelargonium naviculifolium has erect, simple lanceolate leaves similar to those of *P. longiflorum* Jacq., *P. radicum* Venten. and *P. ellaphiae* E.M.Marais. Only in *P. naviculifolium* are the leaf blades recurved, giving

the laminae a boat-shaped appearance. These four species also differ with regard to their flower structure (Marais, 1994).

The erect pinnately divided leaves with ovate pinnae more or less similar in shape and size of *Pelargonium trifoliolatum* are similar to those of *P. pinnatum* (L.) L'Hér. and *P. viciifolium* DC. These three species can only be distinguished from each other if flowers are present (Marais, 1993).

Pelargonium psammophilum is known for its heteroblastic leaf development resulting in a very large variation in leaf shape. The leaves are erecto-patent and the laminae vary from simple lanceolate to trifoliolate or finely divided. This variation can occur within a population or even in one plant. Similar heteroblastic foliage is characteristic of *P. proliferum*, *P. pilosellifolium* (Eckl. & Zeyh.) Steud., *P. longifolium* and *P. dipetalum* L'Hér., among other species in section *Hoarea*. These four species are distinguished from *P. psammophilum* by their floral structure. *Pelargonium proliferum* and *P. pilosellifolium* have small flowers with very short stamens, *P. longifolium* long, linear or narrowly spatulate petals with undulate margins and usually prominent nectar-guides on the posterior two petals and *P. dipetalum* only two petals in the flower.

Prostrate simple to trilobate or tripartite leaves of *Pelargonium heterophyllum* and *P. tenellum* are shared with about 16 other species in section *Hoarea*, although these two species as well as *P. chelidonium* (Houtt.) DC. can be identified because of the appressed bristles along the margins of the laminae and bristles on the petioles. In *P. heterophyllum* the appressed clavate bristle-like hairs are almost limited to the margins of the laminae, whereas the petioles are covered with short glandular hairs and erect bristles or clavate hairs. In *P. tenellum* the bristles on the laminae or margins are not that obvious, but the petioles are densely covered with appressed bristles interspersed with short glandular hairs. *Pelargonium chelidonium* can be identified because of the appressed bristles abaxially, sometimes only along the main veins and the margins of the leaves as well as the appressed bristles on the petioles. *Pelargonium chelidonium* has bright pink flowers with very short stamens (Marais, 1990, 1994).

The trifoliolate leaves with long, thin, spreading petioles and leaflets more or less similar in size of *Pelargonium montaguense* are similar to those of *P. ternifolium* Vorster and *P. elandsmontanum* E.M.Marais ex J.C.Manning & Goldblatt. The latter two species have relatively long stamens protruding from the flower and belong to the two-petalled flower group (Manning and Goldblatt, 2011). The orbicordiform leaflets of *P. montaguense* are unique within section *Hoarea*.

All the species in the *Pelargonium heterophyllum* group have a branched scape with 2–6 pseudo-umbellets and 3–14 flowers each, typical for section *Hoarea*. The hypanthium length for the species in the *P. heterophyllum* group varies from 9 to 20 mm long and 1.0–2.5 times the length of the sepals, which is relatively short if compared to other species in section *Hoarea*.

The indumentum of the leaves, scape, peduncle and hypanthia is of diagnostic value. Short glandular hairs interspersed with bristles or clavate bristle-like hairs on the petiole or along the margins of the laminae are diagnostic for *P. heterophyllum* and very valuable in identifying specimens without flowers. The indumentum of the peduncle varies from short glandular hairs interspersed with patent bristles in *P. heterophyllum*, hirsute with appressed curly hairs interspersed with glandular hairs in *P. tenellum*, *P. trifoliolatum* and *P. psammophilum*, and hirsute with long appressed hairs interspersed with glandular hairs in *P. naviculifolium* and *P. montaguense*. Additional to the appressed curly hairs with glandular hairs on the peduncles of *P. tenellum*, *P. trifoliolatum* and *P. psammophilum*, bristles are also present in *P. tenellum*, or long soft patent hairs in *P. trifoliolatum* and patent hairs in *P. psammophilum*.

Most species in the *Pelargonium heterophyllum* group have white or cream-coloured to pale pink flowers with obovate or widely spatulate to spatulate petals with undulate margins and prominent dark blotches on the posterior two petals. The exception to this is *P. tenellum* with ligulate petals and without the prominent

Table 1
Specimens studied for pollen morphology.

Taxon	Herbarium	Pollen grain measurements (µm)		
		Min	Max	Average
Specimen	Number			
<i>P. psammophilum</i>				
Van der Walt 663	STEU 1185	48	55	53
<i>P. naviculifolium</i>				
Ward s.n.	STEU 2500	40	55	51
Van der Walt s.n.	STEU 4173	43	62	52

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