

# Taxonomy of the *Passerina filiformis* complex (Thymelaeaceae)

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**Keywords:** anatomy, new species, *Passerina*, southern Africa, taxonomy, Thymelaeaceae

### ABSTRACT

Revision of the genus *Passerina* L. indicated a new delimitation of taxonomic entities within the *Passerina filiformis* L. complex. Evidence from leaf anatomy greatly assisted in the recognition of taxa. *P. filiformis* is here divided into two sub-species, namely *P. filiformis* subsp. *filiformis* and *P. filiformis* subsp. **glutinosa** (Thoday) Bredenkamp & A.E. van Wyk, and a new species, *P. montivagus* Bredenkamp & A.E. van Wyk, which is also described. The new taxa are geographically separated: subsp. *filiformis* ranges from Piquetberg in the north through the Cape Peninsula in the south, where it is quite common, to Attakwaskloof in the southwestern Cape; subsp. **glutinosa** occurs along the coast between Vredendal and St Helena Bay; and *P. montivagus* has a wide distribution from Mossel Bay and Oudtshoorn in the south through Eastern Cape and along the Great Escarpment northwards to Zimbabwe, with outliers in Tanzania.

### INTRODUCTION

*Passerina* L., a genus of woody shrublets or shrubs, comprises about 20 species and four subspecies, all confined to southern and eastern Africa (Thoday 1924; Goldblatt & Manning 2000). With the exception of a few species growing along the Great Escarpment, most members are endemic to the Cape Floristic Region with its Mediterranean or semi-Mediterranean climate. In the most recent taxonomic revision of the genus, Thoday (1924) considered *P. filiformis* L. a variable species with a wide range, noting that plants from KwaZulu-Natal are more robust and luxuriant in growth. The purpose of the present paper is to present a taxonomic re-assessment of the *P. filiformis* complex based on evidence from epidermal structure (Bredenkamp & Van Wyk 1999, 2000), leaf anatomy (Bredenkamp & Van Wyk 2001a) and floral morphology (Bredenkamp & Van Wyk 2001b). We propose the subdivision of *P. filiformis* L. into two subspecies and describe a new species; all the new taxa are geographically separated (allopatric).

### MATERIAL AND METHODS

All collections of *Passerina* in the following herbaria (acronyms according to Holmgren *et al.* 1990) were studied for taxonomy and external morphology: BM, BOL, BREM, C, GRA, K, LINN, M, MO, NBG, PR, PRE, PRU, S, SBT, TCD, UPS.

For leaf anatomy, both fresh and herbarium material were studied. Names of taxa and voucher specimens used in anatomical studies are listed in Table 1.

Light microscopy (LM) was used for general leaf anatomical as well as epidermal studies. Methods for preparation of transverse sections and for the study of cuticles are described by Bredenkamp & Van Wyk (2000).

TABLE 1.—*Passerina* specimens examined anatomically and housed at PRE

Taxon	Voucher specimens
<i>filiformis</i>	
subsp. <i>filiformis</i>	Boucher 2833; Bredenkamp 1039
subsp. <i>glutinosa</i>	Schlechter 5125; Taylor 1542
<i>montivagus</i>	Bredenkamp 1012, 1016, 1017, 1327; Gillett 4537; Keet s.n.; Killick 238; Van Wyk & Bredenkamp 1

Scanning electron microscopy (SEM) was used to study epidermal surface features (including epicuticular waxes) and to elucidate the structure of the cuticle (Bredenkamp & Van Wyk 2000). Transmission electron microscopy (TEM) was used to establish the structure of mucilaginous epidermal cell walls (Bredenkamp & Van Wyk 1999).

1. ***Passerina filiformis* L.**, Species plantarum: 559 (1753); Thunb.: 75 (1794); J.C.Wendl.: 18 (1798); Wikstr.: 324 (1818); Thunb.: 374 (1825); Meisn.: 562 (1857); C.H.Wright: 10 (1915); Thoday: 159 (1924); Bond & Goldblatt: 432 (1984); Hilliard & B.L.Burt: 182 (1987); Goldblatt & J.C.Manning: 683 (2000). Type: *Passerina filiformis*, Linnean Herbarium 504.1 (LINN, lecto.!, here designated).

*Passerina phyliformis* Hort. Bot. Bonarensis in Herb Zuccarinii (K. M!), err. typogr.

*P. cupressina* J.C.Wendl. nom. nud. Meisn.: 404 (1840); Meisn.: 563 (1857); Thoday: 159 (1924). *P. cupressoides* Steud.: 273 (1841).

*P. pectinata* Lodd.: 18 (1816) nom. nud. Wikstr.: 347 (1818); Meisn.: 404 (1840); Meisn.: 562 (1857); Thoday: 159 (1924).

Large rounded shrubs up to 2 m high, often lax in shade. *Stems* initially greyish tomentose, cork finely grey-brown tessellate, becoming glabrous, with conspicuous leaf scars and hair-like, whitish fibres protruding between bark fissures. *Leaves* sessile, sometimes glutinous, closely adhering to stem or spreading from stem at an angle of  $\pm 30^\circ$ ; lamina narrow, almost terete, acerose or linear, transversely elliptic or cordiform in c/s, length  $\times \frac{1}{2}$  width (because

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FIGURE 1.—A–C, *Passerina filiformis* subsp. *filiformis*, Bredenkamp 1039: A, inflorescence; B, leaf; C, bract. D–F, *P. filiformis* subsp. *glutinosa*, Schlechter 5125: D, inflorescence; E, leaf; F, bract. G–M, *P. montivagus*, Bredenkamp 1327: G, inflorescence; H, leaf; I, bract; J, flower clasped by bract; K, fruit enveloped by persistent hypanthium, fragmented at neck base; L, membranous pericarp enveloping seed, remnant of lateral style apically present; M, seed with black tegmen. Scale bars: 2.0 mm.

lamina is rolled)  $(4.0\text{--}5.5\text{--}8.0\text{--}10.0) \times (0.4\text{--}0.6\text{--}1.0\text{ mm})$ , tapering towards rounded apex, slightly widening or widening towards base, coriaceous, smooth, dark green to greyish green, often drying brown; adaxial groove tomentose; abaxial surface convex, glabrous; margin involute. *Inflorescences* subterminal, 10–20-flowered, composed of proliferating spikes. *Bracts* cymbiform, outside glabrous, inside setose from base to central part, ovate-acuminate to widely obovate, length  $\times \frac{1}{2}$  width  $\pm 4.6\text{--}7.3 \times 1.5\text{--}2.0\text{ mm}$ , gradually narrowing to point or narrowing abruptly into filiform point, base cuneate to widely cuneate, main vein strongly developed, often keeled, shortly extended or extending to form leaf-like point; lamina coriaceous or chartaceous; wings glabrous, membranous with distinct venation, margins glabrous or ciliate, often with few trichomes at apex adjacent to filiform point. *Flowers* glutinous or not. *Floral envelope*  $\pm 6.0\text{--}6.5\text{ mm}$  long, yellow-pink during pollination, sparsely tomentose or tomentose at ovary, neck  $1.5\text{--}1.7\text{ mm}$  long, sparsely tomentose or tomentose; outer and inner sepals with adaxial surface glabrous, apex abaxially setose; outer sepals concave obovate, inner sepals concave obovate or obovate,  $\pm 2.2\text{--}2.5 \times 1.4\text{--}1.5\text{ mm}$ . *Androecium*: filament of antipetalous whorl  $\pm 1.1\text{--}1.2\text{ mm}$ , antisepalous whorl  $\pm 2.2\text{ mm}$ ; anthers  $\pm 0.8 \times$

$0.3\text{ mm}$ . *Ovary*  $\pm 2.3\text{--}2.5 \times 0.5\text{--}0.6\text{ mm}$ . *Fruit* enveloped by persistent, loosely arranged hypanthium fragmenting at neck base; pericarp membranous and dry. *Flowering time*: in spring when pollen is wafted away in clouds, cause of hay fever in sensitive persons (Marloth 1925). Figure 1A–F.

#### Leaf anatomy

Leaf structural type B: bundle sheath completely enveloping main vascular bundle, extraxylary sclerenchyma fibres enclosed in bundle sheath (Bredenkamp & Van Wyk 2001a).

*Leaf outline* in transverse section (t/s) cordiform to transversely elliptic. *Adaxial epidermis*: cuticular membrane (CM)  $\pm 2\text{ }\mu\text{m}$  thick, periclinal  $\times$  anticlinal cell diam. in t/s  $15 \times 10\text{ }\mu\text{m}$ . *Abaxial epidermis*, in surface view, glutinous or not, glabrous, CM mostly exhibiting a striate pattern, cuticle with epicuticular waxes, wax plates scarce, oblong, raised  $90^\circ$ , with sharp edges, usually arranged perpendicular to cell rows, epidermal cells arranged in rows, oblong, pentagonal to heptagonal in outline,  $45\text{--}50 \times 30\text{ }\mu\text{m}$ ; CM  $15\text{--}20\text{ }\mu\text{m}$  thick in t/s, pro-



nounced at junctions of epidermal cell walls, grooved in midline of joining walls, concavities and convexities present, periclinal  $\times$  anticlinal cell diam. in t/s (35–)40(–45)  $\times$  45–50(–80)  $\mu\text{m}$ , mucilagination of mainly inner tangential cell walls often resulting in mucilage-filled cavities between remains of epidermal cells and adjacent mesophyll. *Palisade parenchyma* horseshoe-shaped, 1- or 2-layered, density 5 cells per 50  $\mu\text{m}$ . *Spongy parenchyma* aerenchymatic. *Main vascular bundle* 350–420  $\mu\text{m}$  thick, 780–860  $\mu\text{m}$  wide, widely ovate, variously orientated in relation to mesophyll: touching palisade parenchyma abaxially (type B3), sunken into palisade parenchyma (type B4) (Figure 2A) or bordering on abaxial epidermis (type B6) (Figure 2B). *Bundle sheath* completely enveloping vascular bundle, consisting of 13–15(–27) cells. *Secondary vascular bundles* 2–4 on each side of main bundle. *Sclerenchymatous hypodermal sheath* absent. Figure 2A, B.

Two of the four *Passerina* specimens in the Linnean Herbarium are named *P. filiformis* in the handwriting of Linnaeus; these specimens are numbered 504.1 and 504.2 in Savage (1945). Number 504.2 is undoubtedly *P. paleacea* Wikstr. Thoday (1924) maintains that number 504.1 is a Clifford specimen and probably the one Linnaeus saw when he wrote the first edition of *Species plantarum* (1753). Savage (1945) added the inscription [? ex herb. Cliff.], indicating doubt as to the origin of this specimen. The first author has seen this specimen and agrees with Thoday (1924) that it matches the concept of *P. filiformis* perfectly, as it is known in the Cape Peninsula. The phrase '*Passerina foliis linearibus*' in the *Species plantarum* (1753), has clearly been copied by Linnaeus from *Hortus Cliffortianus* (1738) and from Van Royen (1740). The leaves in the illustration in *Hortus Cliffortianus* are  $\pm$  lanceolate and the bracts are very similar to those of *P. filiformis* subsp. *glutinosa* (Thoday) Bredenkamp & A.E. van Wyk stat. nov., which has acerose or filiform leaves. The specimen labelled *Passerina filiformis* L. in Clifford's Herbarium is sterile, lacks characteristic bracts or flowers and could possibly be *P. vulgaris* Thoday (= *P. filiformis* L. subsp. *vulgaris* Meisn.). *P. vulgaris* is the dominant *Passerina* species in the southern and southwestern Cape and is constantly confused with *P. filiformis*. Specimen 504.1 in the Linnean Herbarium, which is named *P. filiformis* by Linnaeus, is here designated as the lectotype. *Thymelaea aethiopica*, in Plukenet (1700: 180), is cited in synonymy under *P. filiformis* by Linnaeus (1753). The illustrated synonym of Breynia (1678) most probably belongs to the genus *Phylla* L. (Rhamnaceae) and that of Burman (1739) is clearly a species of *Struthiola* L. (Thymelaeaceae).

**Etymology:** the Latin specific epithet *filiformis* (= thread-like) obviously refers to the narrow leaves of this species. The vernacular name 'sparrow-wort' was suggested by Miller (1768) for all *Passerina* species, indicating *P. filiformis* as 'sparrow-wort with linear convex leaves'. Wendland (1798) used the German equivalent *fadenförmige Vogelkopf*. Marloth (1925) mentioned the names *kannabas* and *kaalgaar*. The following Afrikaans names appear in Smith (1966) and some of them also in Palmer & Pitman (1972) and Coates Palgrave (1977): *bakbossie*, *bakkersbossie*, *bruingtonna*, *fyntaaibos*,

*gannabas*, *gonnabas*, *kaalgaarbos*, *kaalgaring*, *kabelgaring*, *kannabas*, *koordehaar*, *taaibos*, *windmakersbessie*, *windmakersbossie*.

### Key to subspecies

- Branchlets and inflorescences dry; bracts widely obovate, narrowing abruptly into filiform point . . . . . 1a. subsp. *filiformis*  
Branchlets and inflorescences glutinous; bracts ovate-acuminate, gradually narrowing to point . . . . . 1b. subsp. *glutinosa*

### 1a. subsp. *filiformis*

*Leaves* spreading from stem at angle of  $\pm 30^\circ$ ; lamina almost terete, cordiform in c/s, length  $\times$   $\frac{1}{2}$  width (4.0–)5.5–8.0(–10.0)  $\times$  0.6–1.0 mm, slightly widening towards base, dark green to greyish green. *Inflorescences* not glutinous. *Bracts* widely obovate, length  $\times$   $\frac{1}{2}$  width  $\pm 7.3 \times 2.0$  mm, base widely cuneate, main vein strongly developed, often keeled, extending to form a leaf-like point; lamina chartaceous; margins glabrous, often with a few trichomes at apex adjacent to filiform point. *Flowers* not glutinous. *Floral envelope*  $\pm 6.0$  mm long, tomentose at ovary, neck 1.7 mm long, tomentose, outer sepals concave, obovate, inner sepals obovate. Figure 1A–C.

### Leaf anatomy

*Leaf outline* in t/s transversely elliptic to cordiform. *Adaxial epidermis*: CM  $\pm 2$   $\mu\text{m}$  thick; periclinal  $\times$  anticlinal cell diam. in t/s 15  $\times$  10  $\mu\text{m}$ . *Abaxial epidermis*, in surface view, not glutinous, cells oblong, 45–50  $\times$  30  $\mu\text{m}$ ; CM 15–20  $\mu\text{m}$  thick in t/s, periclinal  $\times$  anticlinal cell diam. (35–)40(–45)  $\times$  45–50(–80)  $\mu\text{m}$ . *Palisade parenchyma* in 1 or 2 layers of elongated cells. *Main vascular bundle* 350–420  $\mu\text{m}$  thick, 780–860  $\mu\text{m}$  wide, touching palisade parenchyma abaxially (type B3) or sunken into palisade parenchyma (type B4) (Figure 2A). *Bundle sheath* consisting of 13–15 cells. *Secondary vascular bundles* 3 or 4 on each side of main bundle.

**Diagnostic characters and relationships:** subsp. *filiformis* is morphologically distinguished by the almost terete, adaxially grooved, acerose or linear leaves, the cymbiform, widely obovate floral bracts, which abruptly narrow to a filiform point (Figure 1A–C), and by the long ( $\pm 1.7$  mm) hypanthium neck. As both subsp. *filiformis* and *P. vulgaris* occur in the Cape Peninsula, they are often confused. Diagnostic characters of *P. vulgaris* include linear to narrowly lanceolate leaves, the diamond-shaped bracts and leaves with a hypodermal sclerenchymatous sheath (Bredenkamp & Van Wyk 2001a). Some specimens of subsp. *filiformis* with incurved, tapering leaves and the necks of the hypanthium exerted from the clasping, veined bracts, could be mistaken for *P. falcifolia*. The apical beard on the young leaves and outer sepals and the glabrous inner sides of the bracts are reliable diagnostic characters, distinguishing the subsp. *filiformis* from *P. falcifolia*.

**Etymology and uses:** according to Van Wyk & Gericke (2000) the name *bakkerbos* commemorates an era in the Cape when the official licensed bakers used the branches



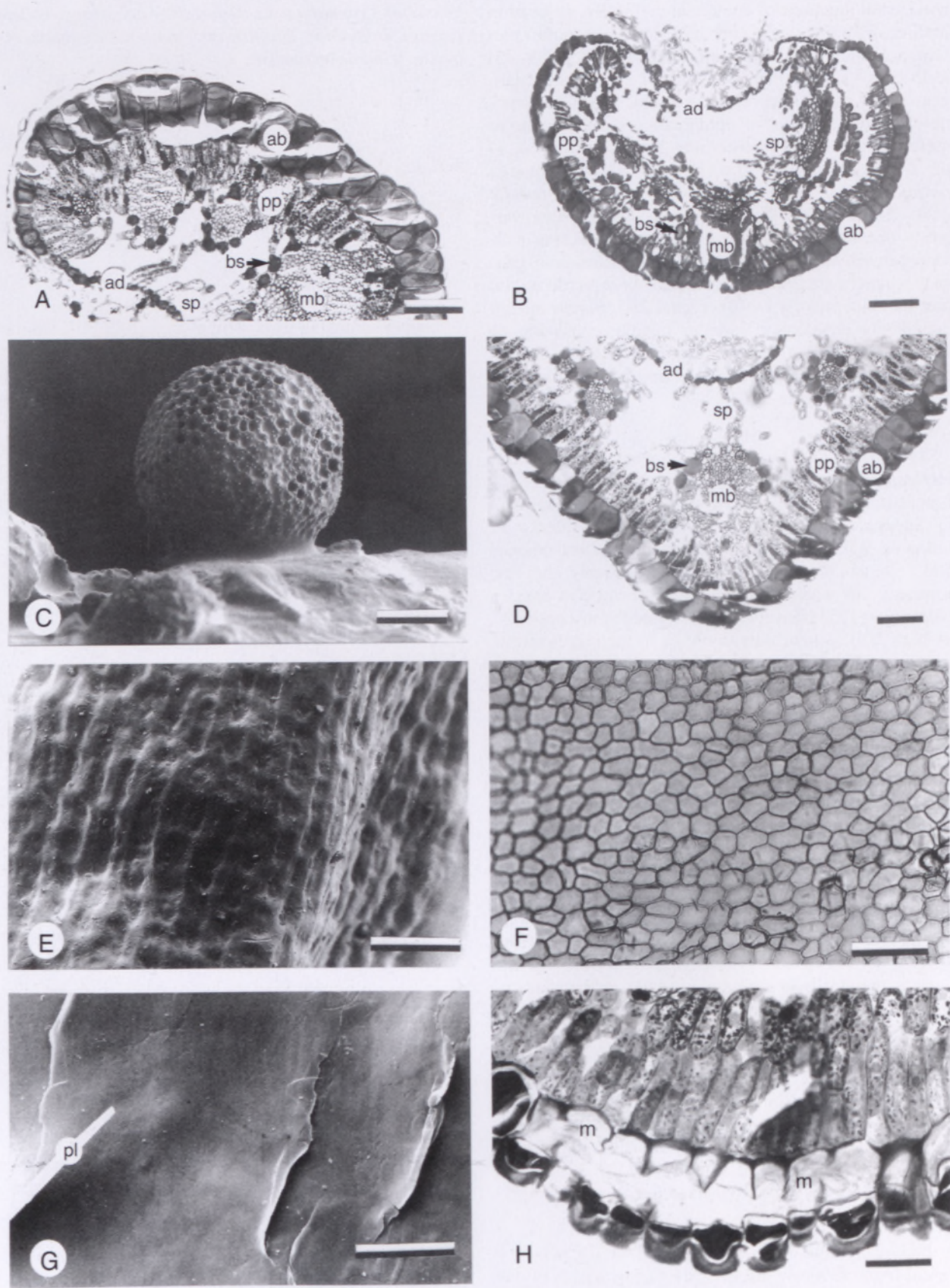


FIGURE 2.—LM photographs and SEM micrographs showing leaf anatomy and epidermal structure of selected species in *Passerina*: A, *P. filiformis* subsp. *filiformis*, Bredenkamp 1039, leaf in t/s, illustrating leaf structural type B4. B, C, *P. filiformis* subsp. *glutinosa*, Schlechter 5125: B, leaf in t/s, from rehydrated herbarium material, illustrating leaf structural type B6; C, glutinous substance sticking pollen grain to leaf surface. D, *P. montivagus*, Bredenkamp 1016, leaf in t/s illustrating leaf structural type C. E–H, abaxial epidermis in *P. montivagus*: E, in surface view, with cells arranged in rows, Bredenkamp 1012; F, epidermal cells oblong, pentagonal to heptagonal, Bredenkamp 1016; G, upright epicuticular wax platelets, Bredenkamp 1016. H, mucilagination of inner tangential cell walls, resulting in mucilage-filled cavities, Killick 238. ad, adaxial epidermis; ab, abaxial epidermis; bs, bundle sheath; m, mucilage; mb, median vascular bundle; pl, epicuticular wax plates; pp, palisade parenchyma; sp, spongy parenchyma. Scale bars: A, B, D–F, H, 100 µm; C, G, 10 µm.



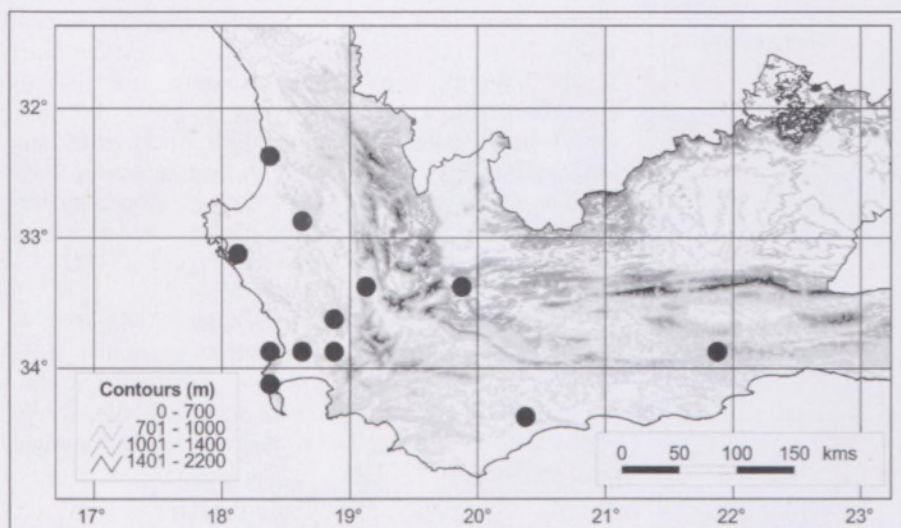


FIGURE 3.—Known distribution of *P. filiformis* subsp. *filiformis*.

and leaves of this plant to heat their ovens. The plants used at that time were clearly the subsp. *filiformis*. When ignited, plants of subsp. *filiformis* disappear in a blaze of hot flame owing to a waxy secretion on the leaves (Smith 1966). The plants were formerly used for heating up stoves. Today it is quite scarce in the vicinity of Cape Town, because of the commercial use of this once abundant resource. At maturity, these plants are quite ornamental and have been cultivated in Britain and Europe since the time of Linnaeus. Plants of the subsp. *filiformis* are soboliferous and vigorous resprouters. They are well adapted to the Cape climate and would be suitable for reclamation plantings in areas where alien invasive vegetation has been cleared. The tough bark was used by indigenous peoples instead of twine (Marloth 1925). According to Laidler (1928) a decoction of this plant is used by the rural people of the Cape for shooting pains.

**Distribution and ecology:** *P. filiformis* subsp. *filiformis* is common in the Cape Peninsula and is distributed from Piquetberg, across the Hex River Mountains, to Attaquaskloof in the southwestern Cape. It grows in rocky areas, mostly on south-facing mountain slopes and on sandy plains, such as the Rietvallei and Stellenbosch Flats. Figure 3.

**Conservation status:** Least Concern (LC) (IUCN Species Survival Commission 2000).

1b. subsp. ***glutinosa*** (Thoday) Bredenkamp & A.E. van Wyk, stat. nov.

**TYPE.**—Malmesbury Div., around Langeenhed Station, Thoday 215 (BOL!; NBG, lecto!, here designated).

*P. filiformis* L. var. *glutinosa* Thoday in Kew Bulletin 4: 160 (1924).

**Leaves** glutinous, closely adhering to stem or spreading at angle of  $\pm 30^\circ$ ; lamina narrow, acerose or linear, transversely elliptic in c/s, length  $\times \frac{1}{2}$  width  $\pm 7.0 \times 0.4$  mm, tapering towards rounded apex, widening towards base, dark green, drying brown. **Inflorescences** glutinous, somewhat longer than in typical subspecies. **Bracts** ovate-acuminate, gradually narrowing to point, length  $\times \frac{1}{2}$  width  $\pm 4.6 \times 1.5$  mm, base cuneate, main vein strongly developed; lamina coriaceous; wings membranous, with

distinct venation; margins often ciliate. **Flowers** glutinous. **Floral envelope**  $\pm 6.5$  mm long, sparsely tomentose at ovary, neck 1.5 mm long, sparsely tomentose, outer and inner sepal lobes concave-ovate. Figure 1D–F.

Thoday 215 in NBG was chosen as lectotype because of the longer inflorescences and the conspicuously glutinous, narrow leaves. Duplicates of the syntype of var. *glutinosa*, Schlechter 5125, from BM, C, K, MO, PRE and S were seen. Although these specimens agree closely with the concept of var. *glutinosa* (Thoday 1924), the glutinous character is not evident in the dried specimens.

#### Leaf anatomy

**Leaf outline** in t/s transversely elliptic. **Adaxial epidermis** with CM  $\pm 2 \mu\text{m}$  thick; periclinal  $\times$  anticlinal cell diam. in t/s  $15 \times 10 \mu\text{m}$ . **Abaxial epidermis**, in surface view, glutinous (Figure 2C), cells slightly oblong,  $50 \times 30 \mu\text{m}$ ; CM  $15 \mu\text{m}$  thick in t/s, periclinal  $\times$  anticlinal cell diam.  $40 \times 55 \mu\text{m}$ . **Palisade parenchyma** in 2 layers of elongated cells. **Main vascular bundle**  $\pm 400 \mu\text{m}$  thick,  $\pm 820 \mu\text{m}$  wide, sunken into palisade parenchyma abaxially (type B4) or bordering on abaxial epidermis (type B6) (Figure 2B). **Bundle sheath** consisting of  $\pm 27$  cells, adaxially radiating outwards, abaxially tanniferous, specializing into collenchyma in contact with abaxial epidermis. **Secondary vascular bundles** 2 or 3 on each side of main bundle.

**Distribution and ecology:** subsp. *glutinosa* occurs in the Strandveld (Acocks 1988), from Doring Bay in the north to St Helena Bay in the south. The vegetation surrounding Doring Bay is described as Strandveld Succulent Karoo by Hoffman (1998). The area is characterized by deep, calcareous, coastal Quaternary sands and generally low rainfall. St Helena Bay is situated in the Sand Plain Fynbos (Rebello 1998). This part of the range has a Mediterranean-type climate with summer drought and deep acid sands. Sand Plain Fynbos is a highly endangered vegetation type because of urbanization and the impact of alien invasive plant species (Rebello 1998). Figure 4.

**Conservation status:** Near Threatened (NT) (IUCN Species Survival Commission 2000).



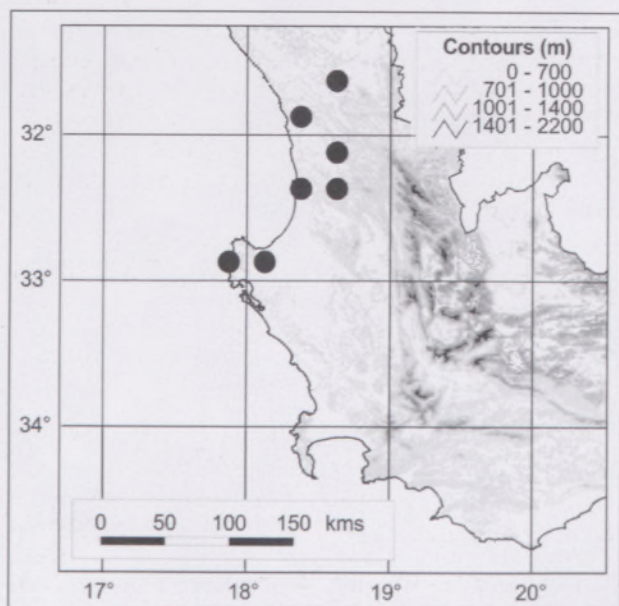


FIGURE 4.—Known distribution of *P. filiformis* subsp. *glutinosa*.

2. *Passerina montivagus* Bredenkamp & A.E. van Wyk, sp. nov., a *P. filiforme* L. habitu robustiore et luxuriantiore distinguenda. *Folia* cymbiformia, secus nervum medium plicata, lanceolata, ad apicem rotundatum decrescentia, basi expansa. *Bracteae* cymbiformes, ovatae ad obovatae, extra glabrae, intra basaliter setosae, in carinam longam, fere cylindricam, adaxialiter sulcatam, leviter incurvam gradatim decrescentes, basi cuneatae, coriaceae, sed lateris vel alis chartaceis, plus minusve tricostatis, marginibus trichomatibus conspicuis crassis serialibus secus dimidium distalem obsitis.

TYPE.—KwaZulu-Natal, 2930 (Pietermaritzburg): hills above Pinetown, 2400 ft, (–DD), 3 December 1891, J.M. Wood in PRE49409 (PRE!, holo.; MO!, iso.).

*Passerina filiformis* L.: 559 (1753) pro parte, excluding type; Thunb.: 75 (1794); Wikstr.: 324 (1818); Thunb.: 374 (1825); Meisn.: 562 (1857); C.H. Wright: 10 (1915); Thoday: 159 (1924); Bond & Goldblatt: 432 (1984); Hilliard & B.L. Burt: 182 (1987); Goldblatt & J.C. Manning: 683 (2000).

Low, spreading shrub 1(–2) m high, vigorous resprouter. *Stems* initially greyish tomentose, cork fissuring lengthwise into fine, dark grey, tomentose strips, older branchlets glabrous, with conspicuous leaf scars. *Leaves* sessile, spreading from stem at angle of  $\pm 45^\circ$ ; main vein sturdy; lamina cymbiform, folded along main vein, lanceolate, often slightly falcate, length  $\times \frac{1}{2}$  width 5.6–7.0(–8.0)  $\times$  0.7–1.0 mm, tapering towards rounded apex, expanded at base, ciliate, coriaceous, smooth, greyish green; adaxial surface tomentose; abaxial surface glabrous; margin involute. *Inflorescences* subterminal, 10–20-flowered, composed of proliferating spikes, common. *Bracts* cymbiform, outside glabrous, inside basally setose; lamina coriaceous, ovate to obovate, length  $\times \frac{1}{2}$  width  $\pm 6.3 \times 1.6$  mm, narrowing gradually into sturdy, leaf-like point of extended main vein, base cuneate; wings chartaceous  $\pm 3$ -ribbed, obscurely veined, greyish green, margins conspicuously lined with strong white trichomes along distal half, often reaching up to apex. *Floral envelope*  $\pm 6.6$  mm long, yellow-pink during pol-

ination, tomentose at upper half of ovary, neck tomentose  $\pm 2.3$  mm long; adaxial surface of outer and inner sepals glabrous, apex setose abaxially; outer sepals cymbiform, inner sepals obovate,  $\pm 2.1 \times 1.3$  mm. *Androecium*: filament of antipetalous whorl  $\pm 0.8$  mm long, antisepalous whorl  $\pm 1.7$  mm long; anthers  $\pm 0.8 \times 0.3$  mm. *Ovary*  $\pm 2.2 \times 0.7$  mm. *Fruit* enveloped by persistent, loosely arranged hypanthium fragmented at neck base; pericarp membranous and dry. Figure 1G–M.

Thoday (1924) noted that plants named *P. filiformis* in KwaZulu-Natal are more robust and luxuriant than those from Western Cape. Wood s.n. from Pinetown was chosen as the holotype of *P. montivagus* as it is a good representation of the new taxon and was determined and cited by Thoday (1924).

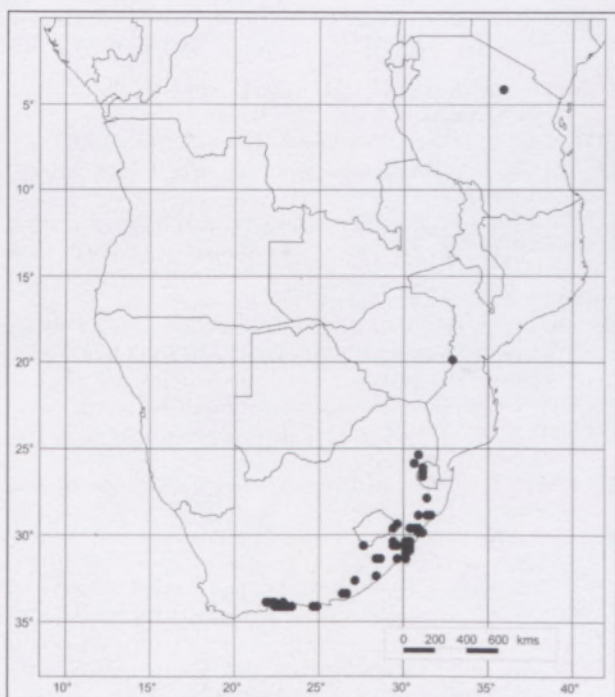
#### Leaf anatomy

Leaf structural type C: bundle sheath capping main vascular bundle adaxially,  $\pm$  absent abaxially, extraxylary sclerenchyma fibres not enclosed in bundle sheath, main vascular bundle bordering on palisade parenchyma, extraxylary sclerenchyma fibres fitting into V-shaped palisade parenchyma (Bredenkamp & Van Wyk 2001a).

*Leaf outline* in t/s carinate. *Adaxial epidermis*: CM  $\pm 2$   $\mu$ m thick, periclinal  $\times$  anticlinal cell diam. in t/s 25  $\times$  15  $\mu$ m. *Abaxial epidermis*, in surface view: cuticle with epicuticular waxes, wax plates scarce,  $\pm$  perpendicular to cell rows, oblong, raised  $90^\circ$ , with sharp edges (Figure 2G), CM mostly exhibiting a striate pattern, epidermal cells arranged in rows (Figure 2E), oblong, pentagonal to heptagonal (Figure 2F), 30–55  $\times$  25–35  $\mu$ m; CM  $\pm 20$   $\mu$ m thick in t/s, pronounced at junctions of epidermal cell walls, grooved in midline of joining walls, concavities and convexities present, periclinal  $\times$  anticlinal cell diam. (22.5–)30.0(–35.0)  $\times$  (40–)55(–90)  $\mu$ m, mucilagination of mainly inner tangential cell walls often resulting in mucilage-filled cavities between remains of epidermal cells and adjacent mesophyll (Figure 2H). *Palisade parenchyma* V-shaped, in 2 layers of elongated cells, density 3 or 4 cells per 50  $\mu$ m. *Spongy parenchyma* aerenchymatic. *Bundle sheath* an adaxial cap of  $\pm 21$  cells, rounded. *Main vascular bundle* (400–)560–630 (–700)  $\mu$ m thick, (820–)980–1180(–1280)  $\mu$ m wide, obovate, bordering on and fitting into the V-shaped palisade parenchyma (type C) (Figure 2D). *Extraxylary sclerenchyma fibres* not enclosed in bundle sheath. *Secondary vascular bundles* 3 or 4 on each side of main bundle. *Sclerenchymatous hypodermal sheath* absent.

*Diagnostic characters and relationships*: *Passerina montivagus* is easily distinguished from *P. filiformis* by its more robust and luxuriant habit. Furthermore, for some distance below the inflorescences, the foliage leaves are expanded at the base and the bracts are ovate to obovate, narrowing gradually into a sturdy, leaf-like point, with margins along their distal half conspicuously fringed by strong white trichomes. *P. montivagus* could also be confused with *P. falcifolia*, but it is distinguished from the latter by the apical beard on the young leaves



FIGURE 5.—Known distribution of *P. montivagus*.

and outer sepals and by the adaxial surfaces of the bracts, which are basally setose with glabrous wings.

**Etymology:** the specific epithet is a compound of the Latin *montanus* (= pertaining to mountains) and *vagus* (= in several directions), referring to the distribution of this species. Von Breitenbach *et al.* (2001) uses the names brown gonna (English), *bruingtonna* (Afrikaans) and *unwele oluncane* (Zulu) for *P. filiformis* in the wide sense, but these names are most appropriate for *P. montivagus* because of its wide distribution.

**Distribution and ecology:** *Passerina montivagus* has a wide distribution, from Mossel Bay and Oudtshoorn in Western Cape northwards mainly along the Great Escarpment to KwaZulu-Natal, Swaziland, Mpumalanga, Northern Province, Mozambique and Zimbabwe. Polhill & Paolo 2372, from Tanzania, represents an extreme form of this taxon, as the bracts are smaller and almost diamond-shaped. The most southwesterly distribution of this species is in the southern Cape, a region transitional between winter and summer rainfall. However, over most of its range, the species receives summer rainfall. Because of its wide distribution, especially along the Great Escarpment, *P. montivagus* is adapted to a variety of habitats, with relatively high rainfall. It is often found along forest margins in the ecotonal zone between Afromontane forest and grassland. It has been recorded from rocky mountain peaks and slopes, river valleys, gorges and among riverside rocks. In coastal regions, it grows on hills and often borders small tributaries of streams flowing to the sea. Figure 5.

Story (1952) reported that *P. montivagus* (= *P. filiformis*) dominated the western half of a small plateau north of the Mount McDonald beacon in the Keiskammahoek District. The plants were not browsed by stock although the plateau was heavily grazed. He

regarded the species as 'useless' and advised that it should be eradicated by hand, as it was not dense enough to burn without additional fuel. This Fynbos species, distributed along the Great Escarpment has not been reported as undesirable or invasive and is currently not regarded as a threat, although it might be a dominant species in restricted areas.

**Conservation status:** Least Concern (LC) (IUCN Species Survival Commission 2000).

#### SPECIMENS EXAMINED

Abbott 43, 308 (2) PRE. Acocks 11549 (2) PRE; 19671 (1b) K, M, NBG, PRE; 24062 (1b) PRE; 890, 5174, 5754 (1a) S. Andraea 1165 (1a) NBG, PRE. Anferweg 850 (1a) PR.

Barker 5795, 8095 (1a) MO, NBG. Bolus 2440 (2) BOL, K; 2925 (1a) BOL, K. Botha 1445 (2) PRE. Boucher 2833 (1b) PRE. Bredenkamp 1012, 1015 (2) PRE; 1016, 1017, 1327, 1359, 1360 (2) PRE; 1039 (1a) PRE. Bremer 317 (2) PRE, S. Buchenau s.n. (1a) BREM. Buitendag 712 (2) NBG, PRE. Burchell 66, 276, 6544 (1a) K. Burmeister s.n. (1a) SBT.

Cheadle & Wells 668 (2) M, PRE. Compton 11762, 14827 (1a) NBG; 15888 (1b) NBG; 25157 (2) NBG; 26157, 29473 (2) NBG, PRE.

Dlamini s.n. (2) NBG, PRE. Drège s.n. (1a) K.

Ecklon s.n. (1a) PR. Edwards 820 (2) PRE. Esterhuysen 26437, 34096, 35680 (1a) BOL, MO, M, S.

Forbes & Obermeyer 58 (2) PRE. Fourcade 3473 (2) NBG; 4809 (2) BOL.

Galpin 11016 (2) PRE. Garthside 17 (1a) K. Germishuizen 1705, 9089 (2) PRE. Gerrard 1478 (1a) BM, TCD, K. Gill s.n. (1a) K. Gillett 4537 (2) BOL, PRE. Goodier & Phipps 270 (2) MO. Goodier 637 (2) BM, M, PRE. Grant 1 (1a) C. Hardy s.n. (1a) K, S. Herb. Linairiaro (1a) PR. Herb. Regium Monacense s.n. (1a) M. Herb. Rofski (1a) PR. Herb. Zuccarinii s.n. (1a) M. Hilliard & Burt 14463 (2) PRE; 14654 (2) K; Hilliard & Burt 15671 (2) N, PRE, S; Hilliard & Burt 18772A (2) K, S. Hugo 2019 (2) PRE; 2086 (2) NBG, PRE. Huntley 612 (2) MO, PRE. Hutchinson 258 (1a) PRE; 1298 (2) PRE.

Joffe 576 (2) TCD, PRE.

Keet s.n. (2) NBG, PRE. Killick 238, 3469 (2) PRE. Krebs 282 (1a) MO. Kutzelman's Herbarium, Prague (1a) PR.

Lehman 1891 (1a) C. Lewis 4064, s.n. (2) NBG. Luidberg s.n. (1a) S.

MacOwen 16388 (2) BM; s.n. (2) MO. Mantell & Vassilatos 32 (2) PRE. McKinnon 32 (1a) NBG. Medical Soc. Univ. (1a) K. Meebold 15156, 15157 (2) M. Mogg 13350 (2) K, PRE; 5206, 13397, 38026, (2) PRE. Morris 441 (2) NBG. Moss 5643, T10 (1a) BM. Mund & Maire s.n. (1a) K. Museum Bot. Hauniense (1a) C. Niven & Laubert s.n. (1a) S.

Pappe s.n. (1a) NBG. Pedro & Pedergao 7310 (2) BOL. Pegler 1273 (2) BOL, GRA, NBG, PRE. Penner 1912, s.n. (1a) S, WU; 1919 (2) M, S. Phillipson 1200 (2) MO, PRE. Polhill & Paolo 2372 (2) PRE. Prior s.n. (1a) K.

Rob & Fries 3393, 3396–3399 (1a) UPS, S. Roberts 66, s.n. (2) S. Rogers 16701B (1a) PRE. Rudatis 1204 (2) BM, PR, S.

Schlechter 5125 (1b) BM, C, K, MO, PRE, S. Schmidt 568 (1a) M. Sidey 3862 (2) PRE, S. Sikhakhane 524 (2) PRE. Sparrman s.n. (1a) S. Story 3765 (2) GRA, PRE. Strey 7112, 11363, 11364 (2) PRE; Strey 9321 (2) PRE, S.

Talbot s.n. (1a) K. Taylor 1542 (1b) NBG, PRE. Thoday 215 (1b) BOL, NBG. Thode 4657 (2) NBG. Thom 553, 577 (1a) K. Thompson 41 (1b) NBG, S; 801 (1b) NBG PRE. Trinity College s.n. (1a) TCD. Tyson 1287 (2) MO, NBG; 2621 (2) NBG.

Van der Merwe 1101 (1a) PRE. Van Wyk 2622 (2) PRE, PRU, M; 5332, BSA2586 (2) PRE, PRU. Van Wyk & Bredenkamp 1 (2) PRE, PRU. Van Wyk & Matthews 77719 (2) K, PRU. Victor 556 (2) PRE. Vincent & Wearne 4 (2) PRE.



Wall 1060 (1a) S. Ward 8832 (2) N. PRE: 10669 (2) PRE. Wells 1809 (2) MO. Wolley-Dod. 3103 (1a) K. Wood 1182 (2) BOL: 8938 (2) MO: s.n. (2) MO, PRE. Worsdell s.n. (1a) K. Wright s.n. (1a) MO. Without collector: K692 (1a).

Cultivated: Hort. Herb. Pallas (1a) BM; Hort. Prague (1a) PR; Vinaf s.n. (1a) PR.

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