

Synopsis of the genus *Salix* (Salicaceae) in southern Africa

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ABSTRACT

One species of *Salix*, *S. mucronata* Thunb. (= *S. subserrata* Willd.), with five subspecies, is recognized as indigenous to the southern African region. Problems of delimitation in the genus in southern Africa are discussed, and a key to the indigenous and exotic taxa is presented. The synonymy of the subspecies is presented, with leaf silhouettes and a distribution map of each. The following new combinations are made: *S. mucronata* subsp. ***hirsuta*** (Thunb.) Immelman, *S. mucronata* subsp. ***capensis*** (Thunb.) Immelman, *S. mucronata* subsp. ***woodii*** (Seemen) Immelman and *S. mucronata* subsp. ***wilmsii*** (Seemen) Immelman.

UITTREKSEL

Een *Salix*-spesie, *S. mucronata* Thunb. (= *S. subserrata* Willd.), met vyf subspesies, word erken as inheems in die suider-Afrikaanse gebied. Probleme met omgrensing in die genus in suidelike Afrika word bespreek, en daar is 'n sleutel tot die inheemse en uitheemse taksons. Die sinonimie van die subspesies word gegee, met blaarsilhoeëtte en 'n verspreidingskaart van elk. Die volgende nuwe kombinasies word gemaak: *S. mucronata* subsp. ***hirsuta*** (Thunb.) Immelman, *S. mucronata* subsp. ***capensis*** (Thunb.) Immelman, *S. mucronata* subsp. ***woodii*** (Seemen) Immelman en *S. mucronata* subsp. ***wilmsii*** (Seemen) Immelman.

INTRODUCTION

Identification of taxa within the genus *Salix* in southern Africa is difficult for the following reasons: 1, all species are dioecious; 2, spring leaves, which are present when the flowers first appear, differ considerably from summer leaves, and are similar in all the southern African material; 3, flowers and fruits are similar in all the taxa; 4, leaf and pubescence characters are highly variable within the taxa, so that it is difficult to discern a pattern.

METHODS

Specimens were borrowed from all major South African herbaria, as well as from Windhoek and Harare. The following macromorphological characters were examined: leaf size, shape and margins; petiole length; pubescence of leaves and twigs; and structure of flowers and fruits. The glands in male and female flowers were examined. The number of stamens in the male flowers was counted, because this character has been often used to distinguish species of *Salix* in other parts of the world. Adaxial and abaxial leaf surfaces, as well as pollen and seeds, were viewed with the SEM.

RESULTS

No taxonomically useful results were obtained from either the SEM examinations or the stamen counts. The number of stamens varied from 3-12 per flower, and varied even within the same inflorescence. The glands of both male and female flowers varied considerably, with 2 to numerous glands in the male flower and a glandular ring in the female. This ring varied from entire to deeply lobed, the number and size of the lobes being irregular, but it

did not present any pattern. Fruits and flowers of all southern African specimens were found to be essentially similar.

Leaf length, breadth, proportions and margin, pubescence of both leaves and twigs, and petiole length, however, did differ between taxa, and these differences were correlated with distribution. In northern SWA/Namibia, the south-western Cape and the northern Transvaal, the summer leaves are large, relatively broad, glabrous or sometimes with grey canescence, and have either entire or toothed margins. Around the Olifants River (south-western Cape) the leaves are similar in shape to the above but have a dense covering of long silvery trichomes. Specimens from the rest of the Cape Province, including the Orange River system, and extending along the Vaal into the Transvaal and Orange Free State, and into Lesotho, have short, relatively broad leaves, always toothed and glabrous, with short petioles and glabrous twigs. Plants from Natal and most of the Transvaal (excluding the Vaal and its tributaries), have long narrow leaves, always toothed, with longer petioles and (usually) grey-canescence twigs. Plants with larger, broader leaves, nearly always with entire margins, occur in the Transvaal Lowveld and escarpment from Swaziland to the northern Transvaal border and into Zimbabwe.

DISCUSSION

It was difficult to distinguish clearly any of the taxa morphologically, except the Olifants River taxon which has densely silvery-pubescent leaves. Most characters showed at least some overlap and, in the case of the Transvaal Lowveld taxon, the characters were especially variable. However, it is possible to recognize most specimens as belonging to one or other of several taxa and, in addition, the

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variation is geographically correlated. For these reasons it was decided not to place all indigenous plants in a single highly polymorphic taxon. Burt Davy (1922) in his study of the genus in the whole of Africa, was the first to suggest that each species or variety of *Salix* was restricted to a certain drainage basin(s). In southern Africa at least, this conclusion can be accepted, though distributions of the taxa do overlap to some degree in the south-western Cape and to a larger extent in the Transvaal. Each taxon shows a well defined range and for this reason, although the morphological differences are small, the taxa are recognized at subspecific rather than varietal level.

It is not certain whether the variability and intergrading of characters is due to inter-taxon hybridization since no attempt has been made to hybridize the indigenous taxa under controlled conditions. It is possible that *S. mucronata* subsp. *wilmsii* is a hybrid between subsp. *woodii* and subsp. *mucronata*. It is in many ways intermediate between these two subspecies, it occurs within the range of both, and it exhibits a great range of variation within the subspecies. Its variation, however, may also be ascribed to inter-taxon diversity. Therefore, until experimental studies have been done, it appears best to maintain it as a separate taxon. The taxa are difficult to identify because the differences between them are both small and variable. A further difficulty results from the fact that there is a great difference on each plant between the spring (immature) and summer (mature) leaves. It is preferred to call them spring and summer leaves respectively, as 'immature' implies further development, whereas the leaves maintain their differences even when growth is complete. The

spring leaves are smaller, broader in proportion to their length, often obovate, the margins are entire and the apices may be rounded rather than acute. The transition to summer leaves is gradual, but is usually complete by November. In the following key, only specimens collected from November to May have been considered. For specimens collected at other times of the year the locality may present the only clue to identity. Unfortunately, as stated earlier, no flower or fruit characters were found to distinguish taxa. This made the identification of type specimens difficult, as a number were collected in spring and in some cases no locality was given.

It is often stated that the southern African taxa do not have stipules. Examination of fresh material of subsp. *woodii*, however, showed that this was not strictly true, as vestigial stipules are present on young twigs. These are ± 1 mm long, thick in texture, and are later deciduous; in dry herbarium material they are not noticeable. *S. mucronata* subsp. *mucronata* does have stipules further north in its range, but not within southern Africa.

A few exotic species appear to have become naturalized in southern Africa, and are included in the key. *S. babylonica* (Weeping Willow) (Figure 1.13) is widespread and well known, while the other species, from the few specimens available, appear to be more restricted. No specimens have been seen which appear to represent hybrids between the indigenous and exotic taxa. More collecting of exotic willows is needed, together with information about whether they are cultivated, naturalized or spreading. Only female plants of the exotic species are present in this country, and none of the specimens seen were male.

KEY TO SPECIES AND SUBSPECIES

- 1a Tree with branches hanging vertically; leaves tapering to a long acuminate apex (whip-tip); female flowers sessile 2. *S. babylonica* L. (Figure 1.13)
- 1b Trees or shrubs, branches may droop but not hanging vertically; leaves acute or acuminate but not tapering to a long 'whip-tip'; female flowers and fruits sessile or pedicellate:
 - 2a Branches ascending; stipules usually present, foliose or dentate, may be caducous; female flowers sessile (may be shortly pedicellate in *S. lasiandra*):
 - 3a Basal 1-3 leaves on flowering shoots with long silky golden-white hairs on margin; female flowers with a single gland at base of ovary 4. *S. alba* L. (\times *S. fragilis* L. ?)
 - 3b Basal leaves on flowering shoots without long hairs on margin; female flowers with 2 glands at base of ovary:
 - 4a Petiole with a pair of glands on upper side near junction with lamina; style at least 0.5 mm long; twigs not brittle at nodes 5. *S. lasiandra* Benth.
 - 4b Petiole without glands; style very short or absent; twigs brittle at nodes 3. *S. fragilis* Benth.
 - 2b Branches drooping; stipules, if present, minute and subulate, not dentate; female flowers and fruits sessile:
 - 5a Leaves and branches densely silvery hirsute; found on the Olifants River (SW Cape) and its tributaries 1b. *S. mucronata* subsp. *hirsuta* (Figure 1.4)
 - 5b Leaves and branches glabrous or grey-canescens; not found on the Olifants River:
 - 6a Leaf lamina (8-) 14-23 mm wide, 3-5 (-7) times as long as wide; northern SWA/Namibia, SW Cape and occasionally N Transvaal 1a. *S. mucronata* subsp. *mucronata* (Figure 1.1-1.3)
 - 6b Leaf lamina 5-20 mm wide, usually more than 5 times as long as wide; rarely in SW Cape, never in northern SWA/Namibia:
 - 7a Summer leaves usually shorter than 65 mm; petioles 2-5 mm long; twigs always glabrous; mainly on Orange River and its tributaries, including the Vaal, and on rivers of the southern and eastern Cape as far north as Port Shepstone in Natal, occasionally found elsewhere 1c. *S. mucronata* subsp. *capensis* (Figure 1.5, 1.6)

- 7b Summer leaves usually longer than 60 mm; petioles 4–14 mm long; twigs grey-canescens to puberulous, sometimes glabrous; mainly on Limpopo and Olifants (Transvaal) Rivers and their tributaries, and on Natal rivers as far south as Port Shepstone:
- 8a Summer leaves usually entire, 10–20 mm wide; branches and young leaves often very densely grey-canescens; along Transvaal escarpment and into lowveld as far south as Swaziland, occasional specimens from other places..... 1e. *S. mucronata* subsp. *wilmsii* (Figure 1.10–1.12)
- 8b Summer leaves always toothed, 6–14 mm wide; branches and young leaves less densely canescens, may be puberulous or sometimes glabrous; along whole of drainage basin of Limpopo, Olifants (Transvaal) and Maputo Rivers, and Natal rivers as far south as Port Shepstone..... 1d. *S. mucronata* subsp. *woodii* (Figure 1.7–1.9)

***Salix mucronata* Thunb.**, Prodrum plantarum capensium 6 (1794); Willd. 4: 685 (1806); Thunb. : 31 (1807); Burtt Davy: 70 (1922) p.p.

(a) subsp. ***mucronata***

Type: No type designated by Thunberg, single specimen in herb. Thunb. annotated '*S mucronata*' in his hand, *Thunberg* (sheet 23065, UPS, lecto., here designated; microfiche in PRE!).

S. subserrata Willd.: 671 (1806); Milne-Redhead: 474 (1936); Maire: 50, fig. 1129 (1961); Friedrich-Holzhammer: 14 (1967). Type: Egypt, near Cairo, Bulak, no collector (sheet 18137, B-WILLD; microfiche in PRE!).

S. aegyptica sensu Thunb.: 30 (1807), non Willd. (1806). Syn-types: Cape Province, near rivers at Roodesand, Sept.–Oct., *Thunberg s.n.* (sheets 22885, 22886, 22887, UPS; microfiche in PRE!).

S. safsaf Forssk. ex Trautv.: 6, t. 2 (1836); Forssk.: 76 (1775), as *S. safsaf baelledi*, nom. nud.; Anders.: 196 (1868); Boiss.: 1183 (1897); Skan: 318 (1917); Burtt Davy: 432 (1932) (may refer to subsp. *wilmsii* ?). Type: Egypt, *Herb. Sieber* (LE, holo.; K, iso. fide Wilmot-Dear in litt.).

The unusual distribution of subsp. *mucronata*, which occurs in northern SWA/Namibia and in the south-western Cape, suggests that it may once have occurred in the intervening area, and that it has since died out there due to the drying up of perennial rivers in much of SWA/Namibia and Namaqualand. There is no noticeable difference between the SWA-/Namibian and Cape populations that might justify describing a new subspecies. Subsp. *mucronata* is widely distributed in Africa, entering the area under consideration also in the northern Transvaal, with one record from the eastern Transvaal. Figures 1.1–1.3 & 2A.

Within the subspecies as a whole there is a great range of variation, from specimens with glabrous branches and entire glabrous lanceolate leaves, to (in various combinations) broadly elliptic leaves with regularly to irregularly serrate margins, and slender or stout stems with dense canescens. None of the specimens from our area have stipules, though they do occur in the subspecies elsewhere in Africa.

Burtt Davy (1922) seems to have had a mixed concept of *S. mucronata*. His *S. mucronata* var. *mucronata* comprises elements of both subsp. *mucronata* (as delimited here) and of subsp. *capensis*. The range of distribution given on Burtt Davy's map includes that of both subspecies, while the synonyms cited comprise *S. aegyptica* Thunb. (*S. mucronata* subsp. *mucronata*), '*S. capensis* auct. non Thunb.', and *S. mucronata* var. *integra* (placed here under 'taxa insufficiently known'). His illustrations of the leaves are clearly those of *S. mucronata* subsp. *mucronata*. Burtt Davy therefore probably had speci-

mens of both subsp. *mucronata* and subsp. *capensis* in mind when delimiting his *S. mucronata* var. *mucronata*.

Vouchers: *Hemm* 452 (J); *Leistner, Oliver, Steenkamp & Vorster* 110; *Marloth* 4283, 11843; *Merxmüller & Giess* 30494; *Van Wyk, Retief & Herman* 6737.

(b) subsp. ***hirsuta* (Thunb.) Immelman**, comb. nov.

Salix hirsuta Thunb., Prodrum plantarum capensium 6 (1794); Thunb.: 31 (1807); Willd.: 695 (1806); Fries: 120 (1856); Krauss: 88 (1844); Skan: 579 (1912); Adamson & Salter: 311 (1950). *S. capensis* var. *hirsuta* (Thunb.) Anders.: 14 (1867); Anders.: 198 (1868); Sim: 329 (1907). Type: No type designated by Thunberg, single specimen in herb. Thunb. annotated '*S. hirsuta*' (sheet 23028, UPS, lecto., here designated; microfiche in PRE!). Figures 1.4 & 2B.

Vouchers: *Boucher* 1985; *Hanekom* 1272; *Hugo* 746; *Van Jaarsveld* 4496.

(c) subsp. ***capensis* (Thunb.) Immelman**, comb. nov.

Salix capensis Thunb., Flora capensis 31 (1807); Harvey: 347 (1838); Anders.: 197 (1868) excl. vars. *mucronata*, *hirsuta*; Sim: 328, t. 146 (1907); Skan: 576 (1912) excl. var. *mucronata* et syn. *S. aegyptica*; Marloth: 130, fig. 73 (1913); Burtt Davy: 69 (1922); Burtt Davy: 432 (1932); Friedrich-Holzhammer: 14 (1967); Jacot Guillarmod: 161 (1971). Syntypes: Cape Province, near rivers in mountains near Hantam, *Thunberg s.n.*, (sheets 22958, 22959, 22960, UPS, microfiche in PRE!).

S. gariepina Burch.: 317, t. 6 (1822); Pappe: 35 (1862); Burtt Davy: 338 (1921). *S. capensis* var. *gariepina* (Burch.) Anders.: 13 (1867); Anders.: 197 (1868); Sim: 328 (1907); Skan: 576 (1912); Burtt Davy: 432 (1932). Type: Cape Province, Prieska, banks of Orange River, *Burchell* 1637 (K!).

S. crateradenia Seemen: 9 (1899); Skan: 578 (1912). Type: Botswana, *Passarge* 41 of 1896 (not located).

S. mucronata var. *mucronata* sensu Burtt Davy p.p. (excl. eastern element): 71 (1922). *S. mucronata* var. *caffra* Burtt Davy: 71 (1922). Isotypes: Cape Province, Eastern Districts, *Cooper* 48 (BM!, K!).

Burtt Davy's concept of *S. capensis* is narrower than that adopted here for subsp. *capensis*, and I include taxa he accepts as separate. These are *S. crateradenia* from the northern Cape and *S. capensis* var. *caffra* from the eastern Cape. *S. capensis* var. *integra*, possibly from the eastern Cape, may also belong here but is mentioned under 'taxa insufficiently known' below. *S. mucronata* var. *mucronata* sensu Burtt Davy pro parte, excluding those specimens from the southern and eastern Cape, must also be included. Figures 1.5, 1.6; 2C.

The type of *S. crateradenia* (from the northern Cape) has not been located but, judging from Seemen's description, it is almost certainly *S. mucronata* subsp. *capensis*. He commented that it is close to *S. capensis*, but distinguished it by its well defined style



FIGURE 1. — 1–3, *Salix mucronata* subsp. *mucronata*, summer leaves. 1, Botswana, Chobe River, *Miller B946*; 2, SW Cape, Eerste River, *Boucher 3509*; 3, N Transvaal, Tate Vondo Reserve, *Hemm 452*. 4, *S. mucronata* subsp. *hirsuta*, summer leaf, W Cape, Cederberg, Uitkyk Pass, *Goldblatt 3278*. 5–6, *S. mucronata* subsp. *capensis*, summer leaves. 5, Orange Free State, Willem Pretorius Reserve, *Bourquin 888*; 6, N Cape, Barkley West, *Hafstrom H. 961*. 7–8, *S. mucronata* subsp. *woodii*, summer leaves. 7, Natal, Vants Drift, *Letty 486 sub Codd s.n.*; 8, Transvaal, Pienaars River, *Repton 435*. 9, intermediate between subsp. *woodii* and subsp. *wilmsii*?, summer leaf, Transvaal, Krugersdorp, near Skeerpoort River, *Codd 10096*. 10–12, *Salix mucronata* subsp. *wilmsii*, summer leaves. 10, Transvaal, Lydenburg, Lowveld Botanic Garden, *Buitendag 997*; 11, Transvaal, Kruger National Park, Sigaas, *Van der Schijff 357*; 12, Transvaal, Kruger National Park, near Punda Maria, *Codd 5558*. 13, *S. babylonica*, summer leaf, Cape, near Cape Town, *Ecklon 713*. All in PRE, $\times 1$.

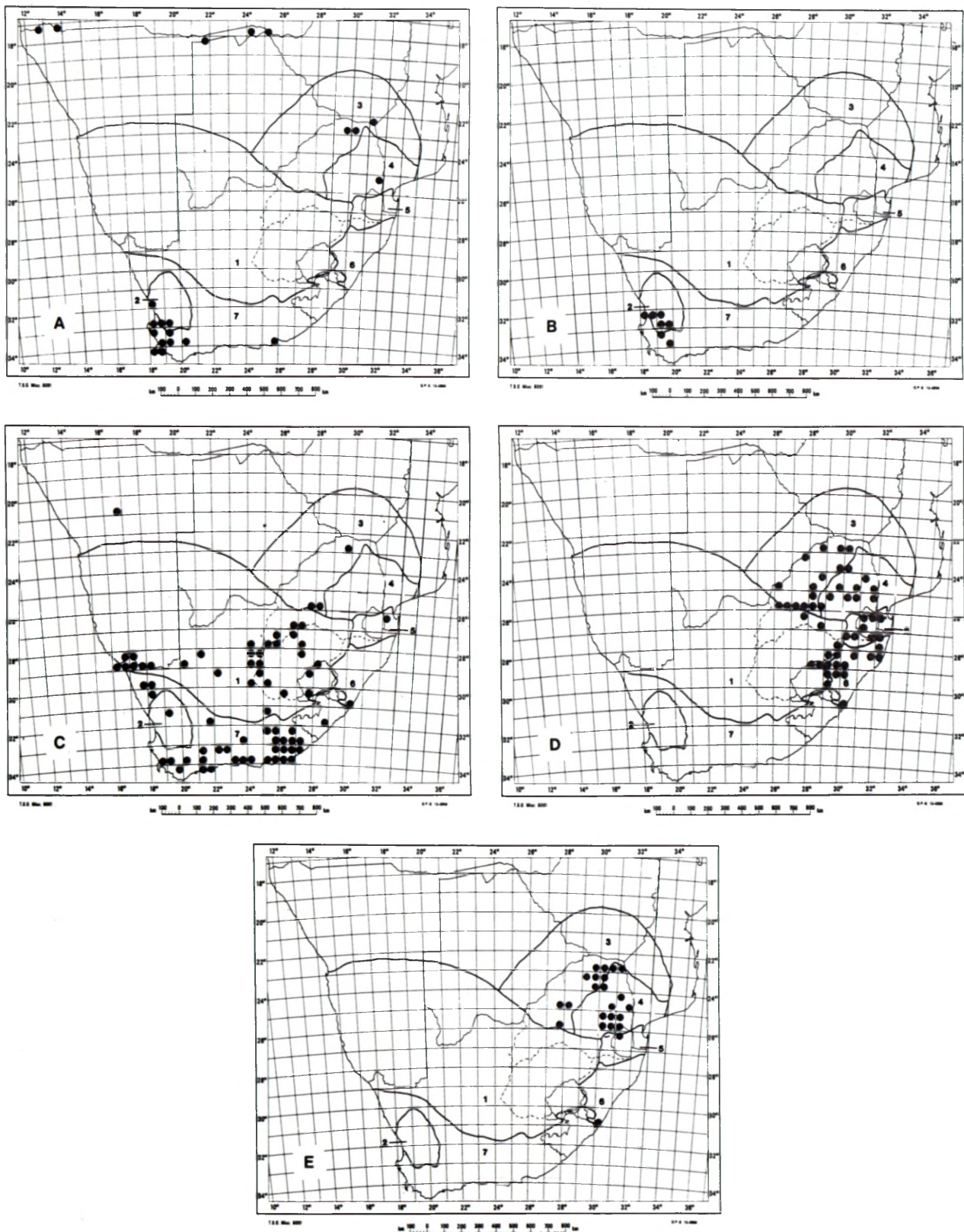


FIGURE 2.— A, *Salix mucronata* subsp. *mucronata*; B, *S. mucronata* subsp. *hirsuta*; C, *S. mucronata* subsp. *capensis*; D, *S. mucronata* subsp. *woodii*; E, *S. mucronata* subsp. *wilmsii*. 1, Orange River drainage basin; 2, Olifants River (Cape) drainage basin; 3, Limpopo River drainage basin; 4, Olifants River (Transvaal) drainage basin; 5, Maputo River drainage basin; 6, Natal rivers; 7, Cape rivers.

and the entire glands in the female flower. Styles have not been found to vary significantly in this study, and the variation in glands was found to be considerable, without any discrete ranges of variation. Burt Davy states that the species comes from the headwaters of the Kuruman River, which is in the northern Cape, and is a tributary of the Orange River. A population of *Salix* has been found at this approximate locality by Mr A. Gubb, of the McGregor Museum, Kimberley, who states that he does not consider it to differ from *S. mucronata* subsp. *capensis* (pers. comm.).

Some specimens which might be intermediate between subsp. *capensis* and subsp. *woodii* have been seen. These are *Green* 88, *Leendertz* 3752, *Muller* 1053 and *Sutton* 884 (all at PRE). These occur near the boundaries of the two subspecies, both between the Orange and Limpopo drainage basins and the Orange River drainage basin and the Natal rivers.

Vouchers: *Hafstrom* H 961; *Merxmüller* 2270; *Moffett* 627; *Oliver* 3121; *Van der Westhuizen* 44/78.

(d) subsp. **woodii** (Seemen) Immelman, comb. nov.

Salix woodii Seemen in Botanische Jahrbücher 21 Beiblätter 53 (1896); Wood: 121 (1907); Skan: 577 (1912); Bews: 79 (1921); Burt Davy: 40 (1921); Burt Davy: 432 (1932); Jacot Guillarmod: 161 (1971); Compton: 172 (1976). Type: Natal, Tugela, near Colenso, *Wood* 4970 (not found).

For a discussion of specimens intermediate between this subspecies and subsp. *capensis*, see under that subspecies. It also appears to grade into subsp. *wilmsii*.

Although the type has not been found, the detailed description allows it to be confidently identified as this subspecies. The leaves are said by Seemen to be 90 × 11 mm, with the margin having small sharp teeth, and the shape narrowly lanceolate to linear, which can only be subsp. *woodii*. The fact that the type comes from Natal, from the Tugela River near Colenso, confirms this identification. Figures 1.7–1.9 & 2D.

Vouchers: *Acocks* 10120; *Codd* 10095; *Duggan & Henderson* 24; *Killick & Marais* 2130; *Letty* 481; *Rogers* 2736 (GRA).

(e) subsp. **wilmsii** (Seemen) Immelman, comb. nov.

S. wilmsii Seemen in Botanische Jahrbücher 27 Beiblätter 64: 9 (1900); Burt Davy: 40 (1921); Burt Davy: 432 (1932). *S. woodii* var. *wilmsii* (Seemen) Skan: 578 (1912). Type: Transvaal, Lydenburg, *Wilms* F.S.A. 1350 (PRE, lecto., here designated!; BOL!).

S. wilmsii × *safsaf*, Burt Davy: 432 (1932). Type: Transvaal, Lydenburg, Grootfontein River, foot of Burgers Pass, *Davy* H 1559 (PRE!). Burt Davy also cites: Transvaal, Barberton, *Pole Evans* H 2965 (PRE!), and queries whether it is the reciprocal cross.

S. wilmsii × *woodii*, Burt Davy: 432 (1932). Isotypes: Transvaal, Barberton, *Galpin* 1278 (GRA!, PRE!).

Specimens of this subspecies have been seen which are very close to subsp. *mucronata*, e.g. *Hardy* 401 and *Hemm* 452. In its typical form, subsp. *wilmsii* is easily distinguishable, but it may approach subsp. *woodii* and subsp. *mucronata* in appearance. Only further research can establish whether the taxon is simply very variable or whether it has under-

gone introgressive hybridization with these other subspecies. As mentioned in the Discussion, subsp. *wilmsii* itself may also be a hybrid between subsp. *woodii* and subsp. *mucronata*. In its 'pure' form, subsp. *wilmsii* has stout, densely canescent twigs and large, broadly lanceolate, entire leaves, which are densely grey-canescens when young. Figures 1.10–1.12 & 2E.

Vouchers: *De Winter* 7685; *Gerstner* 5492; *Hardy* 957; *Prior* 33; *Theron* 3569.

Taxa insufficiently known

S. mucronata Thunb. var. *integra* Burt Davy in Journal of Ecology 10: 70 (1922). Type: Cape Province, Camdeboo, on the flats and at the river near the Camdeboosberg, 2000–3000 ft, *Drège* s.n. (K!, S!). The Stockholm specimen is *S. mucronata* subsp. *capensis* but the one from Kew is subsp. *hirsuta*, with large entire leaves and dense silvery pubescence on the young leaves and twigs. No other specimen resembling this has been seen from the area, and it is possible that the Kew specimen has been mislabelled. Drège did collect at the Olifants River, where subsp. *hirsuta* occurs.

S. woodii var. *grandifolia* Burt Davy, Flowering Plants and Ferns of the Transvaal 2: 432 (1832), nom. nud. Specimens cited: *Davy* 10614; *Legat* H 4331; *Robertson* 1474 (none of these found). Burt Davy speculates whether this is not a hybrid between *S. woodii* and *S. wilmsii*.

S. woodii Seemen × *safsaf* Forssk. ex Trautv.?, Burt Davy, Flowering Plants and Ferns of the Transvaal 2: 432 (1932). Type: Transvaal, Louis Trichardt, 3100 ft, *Rogers* 21690 (not found). From the description this could be subsp. *woodii*.

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