

this enzyme in disease development was not determined.

When comparing the differences in percentage fructose, glucose and sucrose between healthy and infected root tips, the infected roots of Martin Grande had lower percentages of fructose, glucose and total sugars, and those of Edranol lower percentages of glucose, sucrose and total sugars. Soluble sugars are depleted by wasteful host respiration and by host defence reactions (Kosuge 1978; Asahi *et al.* 1979). Asahi *et al.* (1979) suggested that, in resistance reactions, reduction of soluble sugar levels was probably enhanced and then depressed during infection by a pathogen. They further suggested that in susceptible reactions, reduction of soluble sugar levels may continue because the susceptible host lacks the ability to complete defence reactions quickly. Soluble sugars in infected Martin Grande and Edranol roots may be used to fuel active defence reactions, such as the formation of polyphenols, phytoalexins and other abnormal metabolites.

Further studies of free carbohydrate contents in avocado roots at various time intervals after inoculation with *P. cinnamomi* zoospores and the formation of polyphenols, phytoalexins and other abnormal metabolites are necessary to shed more light on the results reported here. It may be that, in roots of Martin Grande, host metabolism returns from an accelerated to a normal rate after infected cells have completed their defence reactions whilst in roots of Duke 7 and G6, the maintenance of high sugar concentrations in the presence of the pathogen, may be a different resistance mechanism. In roots of Edranol, however, metabolic disturbances may remain uncorrected and the disorderly metabolism of host cells may facilitate a continuing offensive by the pathogen.

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A first record of *Agave decipiens* naturalised in southern Africa

G.F. Smith* and E.M.A. Steyn

Research Directorate, National Botanical Institute, Private Bag X101, Pretoria, 0001 Republic of South Africa

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Agave decipiens Baker is native to the southern parts of Florida, U.S.A. This alien species is reported from South Africa for the first time. In this report the South African plants are described and illustrated, a tube/sepal ideogram is provided and the status of naturalisation is given.

Keywords: adventive alien, Agavaceae, first record, ideogram.

* To whom correspondence should be addressed.

Agave L., the largest genus in the Agavaceae, comprises about 275 species of rosulate, succulent-leaved perennials. The genus is native to the southern parts of the United States of America, Mexico, Central America and the northern parts of South America (Gentry 1982; Mabberley 1997). Popularly known as century plants or American aloes, a number of species have since the early 1860s been introduced into and eventually became established in amenity horticulture in South Africa. Two taxa, *A. americana* L. var. *americana* and *A. sisalana* Perrine are widely distributed in this country (Figures 1 and 2 in Smith and Mössner 1996). The distribution of these agaves is largely a reflection of where they have been planted. Although they have shown limited spread from cultivation they reproduce freely, mainly by suckering. They are currently regarded as naturalised and are included in catalogues of problem plants in southern Africa (Wells *et al.* 1986; Henderson 1995).

It was recently noticed that a further species of *Agave* has

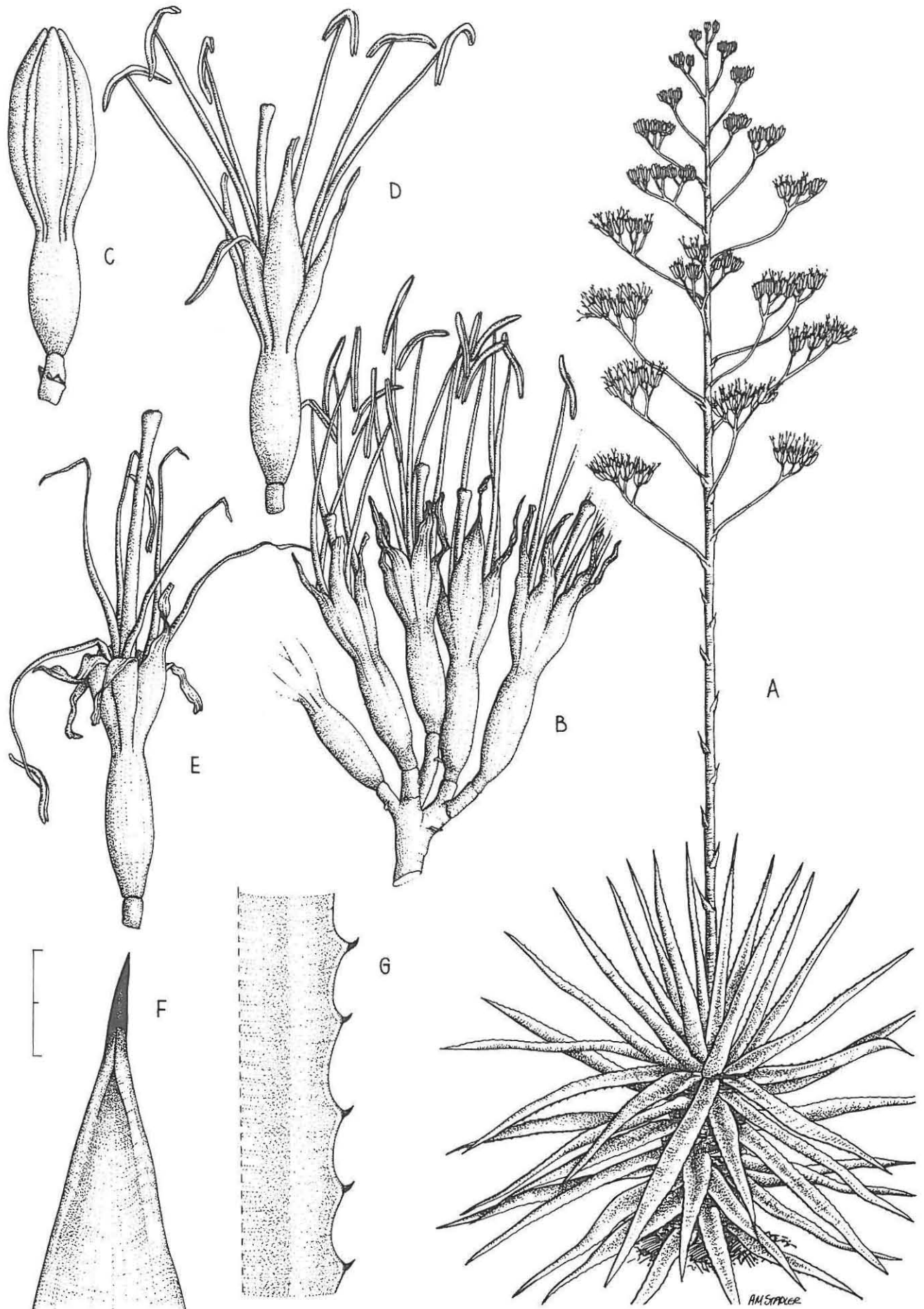


Figure 1 *Agave decipiens* Baker. A. habit of plant, 7 m tall; B. flower cluster; C. mature bud; D. flower in male phase; E. flower in female phase; F. leaf apex; G. leaf margin. B–G $\times 1$, from G.F. Smith & F.M.A. Steyn l. Scale bar 20 mm. Artist: Ann Stadler.

become naturalised in the eastern parts of Pretoria, Gauteng Province, South Africa. This transitional grassland/savanna area lies in the subtropics and is subject to summer rain which occurs predominantly as thunder storms (Figure 2B). The plant was subsequently identified as *A. decipiens* Baker (Figure 1).

In taxonomic literature on the family, *Agave decipiens* is one of the lesser known species. Gentry (1982) reports that it grows spontaneously only in Florida, U.S.A., an area also situated in the subtropics and nourished by convective rain storms (Figure 2A). The species belongs to the sword-leaved group of agaves (group *Rigidae sensu* Gentry 1982), characterised by narrow and mostly rigid, outstanding leaves, arranged in a radiate spiral. Several of the taxa included in the *Rigidae*, e.g. the *A. vivipara* L. complex, *A. fourcroydes* Lem. and *A. tequilana* Weber, are worldwide of considerable economic importance for their production of excellent natural fibres (Gentry 1982; Colunga-GarcíaMartín & May-Pat 1993) and alcoholic beverages (Hutson 1995). *A. decipiens* does not share these remarkable properties. In fact, the specific epithet *decipiens* was prudently chosen by Baker (1892) to avoid confusion '...with forms of *A. rigida* (an obsolete name of doubtful application, possibly referring to *A. sisalana* or *A. vivipara* L.) of which the fibre is so much more valuable that it would lead to loss and disappointment if *A. decipiens* were cultivated for economic use.'

Agave decipiens is not commonly cultivated in other parts of the world with climates similar to that prevalent in the natural habitat of the plant. For example, *A. decipiens* does not appear in the European Garden Flora (Couper & Cullen 1986) nor on the lists of naturalised Agavaceae for Australia (Forster 1987–1988; 1996).

Interestingly, a comparison of floral structure in South African and Central American representatives of the species shows differences in the shape of the tube and in the position of filament insertion in the tube (compare tube/sepal ideograms in Figures 2A and 2B). Since intraspecific variation in floral structure does occur in the *Rigidae* (Gentry 1982:556, Figure 20.3), the above-mentioned dissimilarities may not be significant.

Like most species of the genus, *A. decipiens* is monocarpic, i.e. it flowers once after several years of rosette growth and then dies. However, the species is highly proliferous from subterranean stolons and rapidly forms small colonies. Similar to *A. sisalana*, the plants are generally bulbiferous on their inflorescences. This trait serves as an additional highly successful mechanism for establishing new populations. Seed-set has yet to be observed in South Africa.

The plant described here was collected along a roadside in Pretoria, South Africa, where it had apparently escaped from a garden. Although the actual date of introduction is unknown, the population has evidently persisted without, or in spite of, human intervention for several years and was reproducing freely, albeit vegetatively.

According to Kloot (1987) the naturalisation of alien plants, i.e. the process by which such plants are assimilated into the local flora, occurs in three successive stages which merge into each other. During the **casual** stage the plants do not persist for more than a few years without constant fresh introductions. This is followed by an **adventive** stage when the plant is reproducing only sparingly and is persisting without, or in spite of, human intervention at one or a few locations, generally for less than 25 years. Eventually, the plant becomes **established** and the final stage of naturalisation is reached—the alien is widespread over large parts of the country or locally abundant in one or more regions, generally reproduces freely and has persisted for at least 25 years. In the light of Kloot's (1987) criteria for categorising naturalised alien plants, *A. decipiens* had advanced beyond the casual stage. It should be regarded and duly listed as an adventive alien in South Africa.

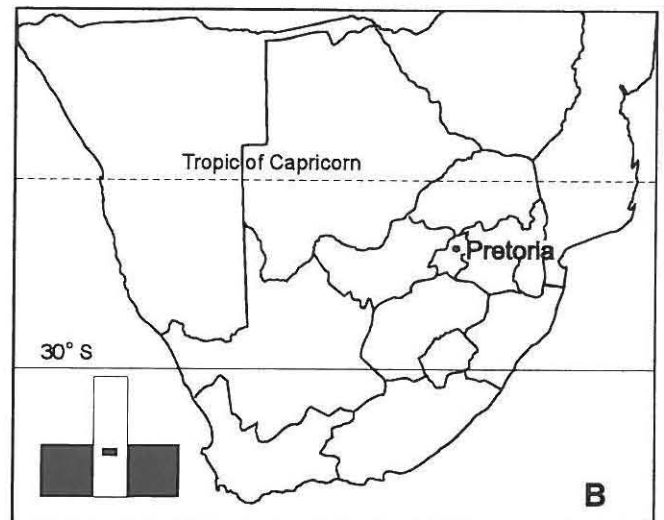
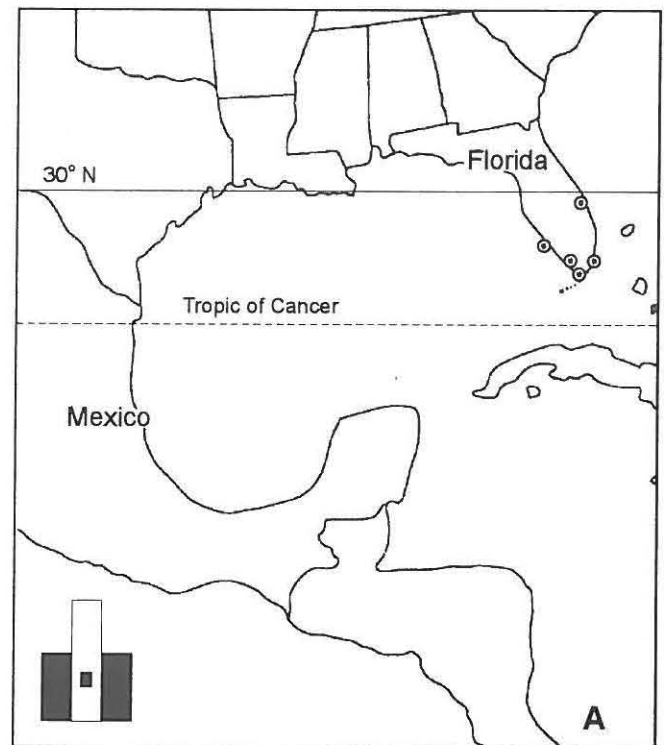


Figure 2 Distribution and tube/sepal ideogram of *A. decipiens* in **A.** Florida, U.S.A. (adapted from Gentry 1982: 566, Figure 20.12 and p. 556, Figure 20.3, No. 19749) and in **B.** Pretoria, South Africa. In each ideogram the white column represents the sepals, the black the tube, and the small black rectangle the position of filament insertion in the tube.

Nomenclature

1219000-00006 *Agave decipiens* Baker, in Kew Bulletin of Miscellaneous Information 1892: 183 (1892); Gentry, 573 (1982); Graf, 1525 (1980); Jacobsen, 83, 84 (1986). Type: Unknown, lecto.: *A. laxifolia* Baker, in Curtis's Botanical Magazine 122: t. 7477 (1896), designated by Gentry (1982).

Agave laxifolia Baker: t. 7477 (1896).

Description

Herbaceous, arborescent, succulent perennial, freely suckering by stolons, rosettes 1.5 m in diameter, 1.0–1.3 m tall with a trunk of up

to 0.7 m. *Leaves* rigidly spreading, lanceolate, 0.8–0.9 m long, 80–90 mm wide at mid-blade, cymbiform in transverse section, glaucous light green, surfaces smooth; leaf bases enlarged, overlapping, stem clasping, thickening the stem; margins sinuous-toothed, teeth on low, green prominences, slender, shiny dark brown, 1–2 mm long, mostly curved towards leaf apex, irregularly spaced, 5–20 mm apart through mid blade, smaller, interstitial teeth rare; terminal spine conical, without groove, shiny dark brown, pungent, 10–12 mm long. *Inflorescence* paniculate, 6–7 m tall, with 22–25 lateral umbels in upper half of shaft, shaft 60–70 mm in diameter at base, often bulbiferous after flowering. *Flowers* distinctly protandrous, yellowish green, 50–55 mm long, shortly stalked, strongly scented, fetid, usually abscising after anthesis. *Perianth* with sepals equal in length, not succulent, cucullate and pubescent at tip, 21–22 mm long, outer segments 6.5 mm wide at base in male-phase flower, wilting before flower reaches the female phase, crimping outward and downward; perianth tube succulent, 10 mm deep, 10 mm wide at level of filament insertion in female phase flower. *Stamens* exerted 20 mm beyond sepals in male-phase flower, light green with brownish red speckles, filaments stout, tapered towards apex, attached to centre of dorsifixed anther, inserted in single series at 7 mm above base of tube, 45–48 mm long; anthers 20 mm long, linear, conspicuously speckled before dehiscence, versatile. *Ovary* with neck slightly constricted; ovary body terete to indistinctly 6-grooved in distal region, 25 mm long, 7–8 mm in diameter; style stout, terete, 55 mm long in female-phase flower, light green with brownish red speckles. *Fruit* and *seed* not seen. *Chromosome number* unknown.

Additional information

Flowering time: Although some variation in flowering time for *Agave decipiens* has been noticed in South Africa, it flowers most prolifically during winter (Southern Hemisphere) in the summer rainfall region.

Voucher specimen: SOUTH AFRICA, GAUTENG PROVINCE. —2528 (Pretoria): Willows area; along Lynnwood Road, at entrance to smallholding, 'Bougain'. (–CD), G.F. Smith & E.M.A. Steyn 1 (PRE).

In view of the relative obscurity of the species, duplicates of the voucher specimen accompanied by photos and illustrations of the population were donated to the Desert Botanical Garden (DES) and the Missouri Botanical Garden (MO).

Icones: Baker: t. 7477 (1896), Gentry: fig. 20.17 (1982); Graf: p. 76, 77 (1980); Jacobsen, fig. 91 (1986).

Common names: None recorded for South Africa. In the United States of America and Canada the species has been referred to as False sisal (Baker 1892; Bailey & Bailey 1976).

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Ms Wendy Hodgson, senior research botanist at the Desert Botanical Garden, Phoenix, Arizona, is thanked for confirming the identity of a specimen of *Agave decipiens*.

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