

Notes on African plants

VARIOUS AUTHORS

AGAVACEAE

AGAVE VIVIPARA: A NATURALISED ALIEN IN SOUTHERN AFRICA

'...invasive species are a kind of habitat destruction. When invasive species take over a habitat, they erase the native richness and diversity of species. What we really need is an everyday concern among ordinary people about biodiversity and the issue of invasiveness.'

—Dr Vandana Shiva in conversation with IUCN's Ricardo Bayon (1997–1998)

The indigenous succulent flora of southern Africa represents 55 mostly unrelated plant families and includes all possible types of life forms. A small minority of exotic succulents (24 species according to Smith *et al.* 1997) can be regarded as naturalised in southern Africa. These species are mostly representative of the Cactaceae (19 species) and, to a much lesser degree, the Basellaceae (1 species), Agavaceae (2 species) and Portulacaceae (2 species) (Smith *et al.* 1997). Some of the species of Cactaceae, e.g. *Opuntia ficus-indica* (L.) Mill. (prickly pear) and *O. aurantiaca* Lindl. (jointed cactus) are aggressive noxious weeds that have invaded and transformed certain parts of the southern African landscape.

In recent years, at least among urban gardeners, the popularity of agavaceous taxa is seemingly on the increase. The plants are being used as inexpensive, permanent barriers to ward off intruders. With their formidable spines, large and compact habit, drought resistance and aggressive growing capability, they are ideally suited for this purpose. With the abandonment of habitations, these hardy agaves can persist without human intervention and subsequently become adventive aliens (Kloot 1987) in the local flora. One such species, *Agave decipiens* Baker was recently recorded in South Africa (Smith & Steyn 1999a). This paper deals with a comparable alien, namely *A. vivipara* L. var. *vivipara*.

Agave vivipara, often known by one of its synonyms, *A. angustifolia* Haw., is a variable species native to central America (Gentry 1982; Forster 1992). It is thought that the species was the wild ancestor of henequén (*A. fourcroydes* Lem.), a cultivated species known worldwide for the high quality of its fibres (Colunga-GarcíaMarín & May-Pat 1993; Colunga-GarcíaMarín *et al.* 1999). Mr Bernard Ulrich (Pforzheim, Germany) has in turn suggested to the second author that *A. vivipara* is possibly a selected form of the widely cultivated *A. sisalana* Perrine, source of sisal hemp. Currently, six varieties, including the typical variety, and two cultivars are recognised in *A. vivipara* (Forster 1992). According to Gentry (1982), this species complex has the most wide-ranging distribution of agaves in North America (for a list of exsiccatae see Gentry 1982: 586–590). The plants commonly occur in tropical savanna, thorn forest and drought-deciduous tropical forests. However, the species also survives in extreme habitats such as the arid Sonoran Desert with about 250 mm rain per annum and in montane pine-oak forests with a yearly precipitation of

1 680 mm. In these natural habitats, wild populations of *A. vivipara* exhibit a gradient in morphological variation, with characters such as plant size, length of leaves, distribution of marginal teeth and mass of leaf fibres showing a high degree of plasticity. Also, improved growth conditions in gardens result in an increase in leaf length and fibre content and a decrease in thorniness (Colunga-GarcíaMarín & May-Pat 1997).

Since pre-Hispanic times, wild populations of *A. vivipara* have been prized by the inhabitants of central America not only for their fibres—which are used for hammocks, bags and fabrics—but also, the peduncles, leaves, stems and roots are used for building material, utensils, tools, food, fermented beverages and medicine (Cruz-Ramos *et al.* 1985; Colunga-GarcíaMarín & May-Pat 1993; Nobel 1994). With increasing attention being paid to the utilisation of invasive aliens (Zimmermann & Zimmermann 1987; Anon. 1988; Howell & Schnell 1991; Turksvykwekersvereniging 1997), southern African environmentalists should take cognisance of the Mexican ethnobotanical uses of *A. vivipara* with a view to duplicating some of these practices locally.

The typical variety of *A. vivipara* is easy to distinguish from *A. decipiens*, the only species with which it can be confused in southern Africa. Important morphological distinctions between the two taxa are given below (Table 1).

TABLE 1.—Main morphological distinctions between *Agave decipiens* and *A. vivipara*

Character	<i>Agave decipiens</i>	<i>Agave vivipara</i>
Habit	Lax rosette crowned by young leaves; stem distinctly thickened by broad leaf bases	Compact rosette with very short internodes; stem not perceptibly thickened by leaf bases
Leaves	Mature leaves laxly disposed horizontally and downward, firm in texture, not very fibrous, leaf blades concave above, convex below, cymbiform in transverse section	Mature leaves radiating, ascending to descending, hard-fleshy, massively fibrous, leaf blades flat in transverse section
Leaf margin	Sinuously toothed	Straight
Marginal teeth	Small, 1–2 mm long, straight to decurved, on low green prominences, firmly attached to leaf margin	Large, up to 5 mm long, with broad bases and slender, decurved (hooked) cusps, easily detachable
Inflorescence	Umbellate branches gracefully upcurved	Umbellate branches spreading horizontally
Flowers	Emitting a strong, fetid scent	Scented, but not foul-smelling

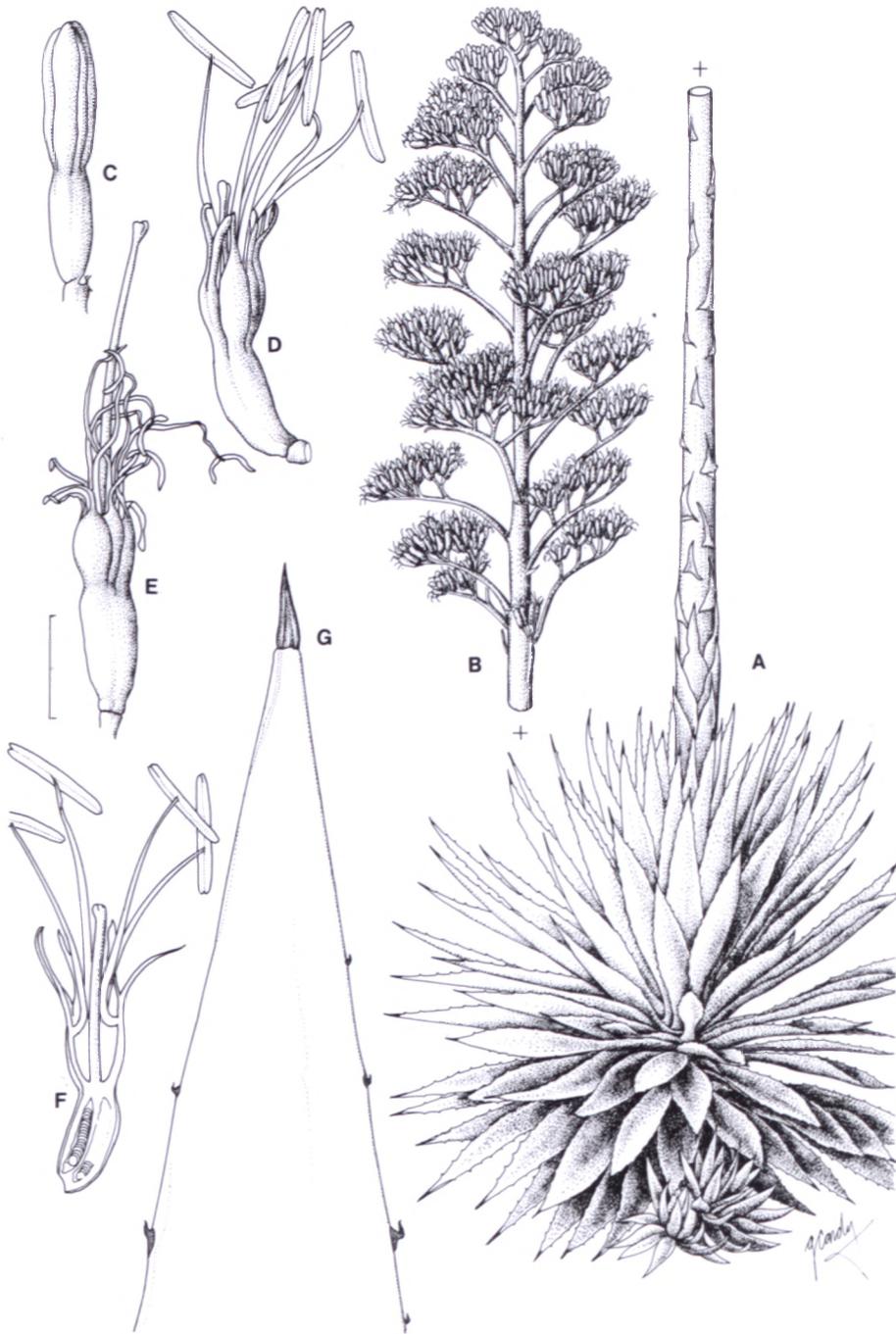


FIGURE 1.—*Agave vivipara* var. *vivipara*: A, habit, rosette 1.5 m tall; B, panicle 2 m tall. C–F, protandrous flower: C, bud; D, male phase; E, female phase; F, longitudinal section. G, distal part of leaf showing straight margin and hooked teeth. C–G, $\times 0.65$. Scale bar: 20 mm. All drawings made from live material collected by E.M.A. Steyn and deposited under G.F. Smith & E.M.A. Steyn 2 (PRE). Artist: G. Condy.

Agave vivipara var. *vivipara* is widely cultivated in Australia and is listed as an established alien in the *Flora of Australia* (Forster 1996). In South Africa this variety, as well as the attractive *A. vivipara* cv. *Marginata* with its yellow-edged leaves, is frequently cultivated (Smith & Steyn 1999b). In urban Pretoria the typical variety has recently been found as a garden escape in a few locations, for example on an open stand (Smith & Steyn 1999b) where the plants had possibly spread from garden refuse dumped earlier, and along a roadside in eastern Pretoria. In the latter location the colony was freely suckering and spreading onto the broad shoulder of the road. Some of the suckering plants were in flower and bulbils were found on an older inflorescence which bore no fruit (Figures 1 & 2A). However, a dried-out infructescence with numerous seed-filled capsules on a dead plant in the same colony showed that the plants are also capable of sexual reproduction (Figure 2B). During germination tests conducted by the first author, $\pm 80\%$ of the large,

black seeds were viable. Similar patterns of distribution and establishment of the species have been observed near Cape Town and Port Elizabeth and Uitenhage, Eastern Cape (Figure 3). *A. vivipara* var. *vivipara* has therefore apparently progressed beyond the adventive stage of naturalisation in South Africa and is currently becoming an established alien (Kloot 1987) like *A. americana* L. and *A. sisalana* (Smith & Mössmer 1996) in the local flora.

1219000-00014 *Agave vivipara* L. var. *vivipara*, Species plantarum 1: 323 (1753). Type: Commelin, Prae-ludia botanica 65, t. 15 (1703) [lectotypified by Wijnands (1983)].

Agave angustifolia Haw. var. *angustifolia*: 72 (1812); Gentry: 559 (1982); Serna & Lopez-Ferrari: 9 (1993); Colunga-Marín & May-Pat: 1455 (1997). Type: St. Helena Island, cultivated. [Neotype: Tozzetti: 2, t. 6 (1810), designated by Gentry: 560, t. 20.6 (1982)].

A. pacifica Trel. in Standley: 118 (1920). Type: Sinaloa, Isla Creston cerca de Mazatlán, *Trelease s.n.* (MO).



FIGURE 2.—Parts of older inflorescences of *Agave vivipara* var. *vivipara*: A, developing bulbils, $\times 0.9$; B, seeding capsule, $\times 0.9$. Scale bar: 20 mm. Material collected by E.M.A. Steyn and deposited under G.F. Smith & E.M.A. Steyn 2 (PRE). Artist: G. Condy.

A. yaquiana Trel. in Standley: 120 (1920). Type: Sonora, from rocky hillsides between Hermosillo & Ures, *Trelease 391* (MO).

A. owenii I.M. Johnston: 999, 1000 (1924). Type: Sonora, on an islet in Guaymas Harbor, *Johnston 3085* (CAS).

(For a more complete list of synonyms, see Serna & López-Ferrari: 9 (1993).

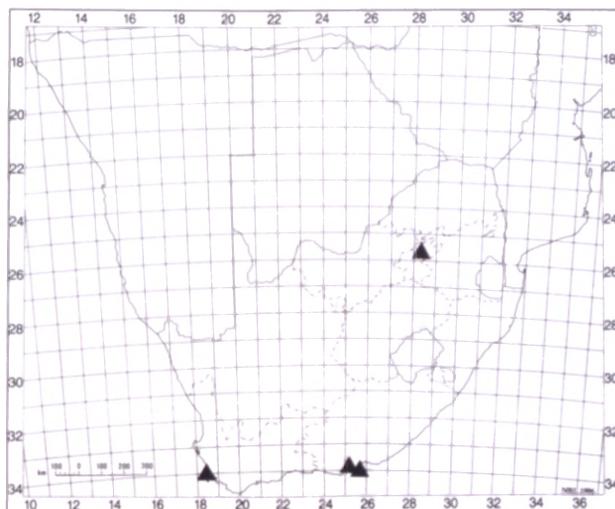


FIGURE 3.—Distribution of *Agave vivipara* var. *vivipara* in southern Africa.

Surculose, caulescent, succulent perennial with radiating rosettes ± 1.5 m diam.; trunk up to 1 m. *Leaves* light green, margins straight, surfaces smooth, hard-fleshy, very fibrous, rigidly spreading, ascending to descending, 0.75–0.9 m long, ± 90 mm wide at midblade, lanceolate, flat in transverse section, narrowed and thickened towards the base; leaf bases broadened, overlapping, stem claspings; teeth easily detachable, usually prominent with low, broad bases and slender cusps, 2–3 mm long, evenly spaced, strongly decurved (apparently releasing an allergen causing painful local swellings when puncturing the skin), commonly reddish brown to dark brown, interstitial teeth usually absent; terminal spine 20–25 mm long, decurrent, conical, reddish brown to dark brown, greying with age, pungent. *Inflorescence* paniculate, 3.5–4.0 m long, bulbiferous after flowering; shaft as long as or slightly longer than panicle; umbels varying in number from 24–36; branches horizontally spreading. *Flowers* yellowish green, about 55 mm long, short-stalked, scented. *Perianth* with tepals unequal, cucullate and pubescent at tip, margins involute, 21–22 mm long, outer segments overlapping the inner; inner segments prominently keeled, wilting before flower reaches female phase, crimping outward and downward; perianth tube succulent, cup-shaped, 11 mm diam. at level of filament insertion, 12 mm deep. *Stamens* exerted 20 mm beyond tepals in male phase flower, yellowish with brownish red speckles; filaments stout, tapered towards apex, inserted in single series in throat of perianth tube, 45 mm long; anthers 22 mm long before dehiscence, cylindrical, yellowish with conspicuous brownish red speckles, versatile. *Ovary* small, 25 \times 10 mm diam., cylindrical, terete, indistinctly grooved in distal region; neck short, slightly constricted; style stout, terete, 72 mm long, light green with brownish red speckles. *Fruit* large, broadly ellipsoid, 30–35 \times 20–25 mm, short-beaked, freely seeding. *Seeds* large, 7–12 \times 6–8 mm, dull black, flattened, D-shaped with complete marginal wing, hilar notch shallow. *Chromosome number* unknown. *Flowering time*: February and March.

GAUTENG.—2528 (Pretoria): Meyers Park area; along Simon Vermooten Road, 0.9 km north of entrance to German School on western shoulder of road, (–CB), G.F. Smith & E.M.A. Steyn 2 (PRE).

Illustrations: Gentry: t. 20.6–20.9 (1982); Smith & Steyn: t. 1 (1999b); Cruz-Ramos et al.: t. 1, 2 (1985).

Common names: kleingaringboom (Afrikaans). Wild populations in the Yucatan (Mexico) are referred to as *chelem* (Colunga-GarcíaMarín & May-Pat 1997).

REFERENCES

- ANONYMOUS. 1988. Red dye from an invader cactus weed. *Plant Protection News* 13: 1, 2.
- BAYON, R. 1997–1998. Face to face on invasive species: the end of the biodiversity economy? *World Conservation* 4/1997–1/1998: 45–48.
- COLUNGA-GARCÍAMARÍN, P. & MAY-PAT, F. 1993. *Agave* studies in Yucatan, Mexico. I. Past and present germplasm diversity and uses. *Economic Botany* 47: 312–327.
- COLUNGA-GARCÍAMARÍN, P. & MAY-PAT, F. 1997. Morphological variation of henequén (*Agave fourcroydes*, Agavaceae) germplasm and its wild ancestor (*A. angustifolia*) under uniform growth conditions: diversity and domestication. *American Journal of Botany* 84: 1449–1465.

- COLUNGA-GARCÍAMARÍN, P., COELLO-COELLO, J., EGUIARTE, L.E. & PIÑERO, D. 1999. Isozymatic variation and phylogenetic relationships between henequén (*Agave fourcroydes*) and its wild ancestor *A. angustifolia* (Agavaceae). *American Journal of Botany* 86: 115–123.
- CRUZ-RAMOS, C.A., ORELLANA, R. & ROBERT, M.L. 1985. Agave research progress in Yucatan. *Desert Plants* 7: 71–92.
- FORSTER, P.I. 1992. New varietal combinations in *Agave vivipara* (Agavaceae). *Brittonia* 44: 74, 75.
- FORSTER, P.I. 1996. Naturalized succulents in the Australian flora. *Haseltonia* 4: 57–65.
- GENTRY, H.S. 1982. *Agaves of continental North America*. University of Arizona Press, Tucson.
- HAWORTH, A.H. 1812. *Synopsis plantarum succulentarum*, edn 1. Richard Taylor, London.
- HOWELL, R. & SCHNELL, A. 1991. *Beproofde turksvy resepte*. Publisher and place of publication unknown.
- JOHNSTON, I.M. 1924. Expedition of the California Academy of Sciences to the Gulf of California in 1921. *Proceedings of the Californian Academy of Sciences*, ser. 4, 12: 999, 1000.
- KLOOT, P.M. 1987. The naturalised flora of South Australia. I. The documentation of its development. *Journal of the Adelaide Botanical Garden* 10: 81–90.
- LINNAEUS, C. 1753. *Species plantarum*, edn 1. Salvius, Stockholm.
- NOBEL, P.S. 1994. *Remarkable agaves and cacti*. Oxford University Press, New York.
- SERNA, A.E. & LÓPEZ-FERRARI, A.R. 1993. *Las monocotiledóneas Mexicanas una sinopsis florística*, part 1. Consejo Nacional de la Flora de México, México, D.F.
- SMITH, G.F. & MÖSSMER, M. 1996. FSA contributions 4: Agavaceae. *Bothalia* 26: 31–35.
- SMITH, G.F. & STEYN, E.M.A. 1999a. A first record of *Agave decipiens* naturalised in southern Africa. *South African Journal of Botany* 65: 249–252.
- SMITH, G.F. & STEYN, E.M.A. 1999b. *Agave vivipara*: the correct name for *A. angustifolia* (Agavaceae). *Bothalia* 29: 100.
- SMITH, G.F., VAN JAARSVELD, E.J., ARNOLD, T.H., STEFFENS, F.E., DIXON, R.D. & RETIEF, J.A. (eds). 1997. *List of southern African succulent plants*. Umदाus Press, Pretoria.
- STANDLEY, P.C. 1920. Trees and shrubs of Mexico. *Contributions from the United States National Herbarium* 23. Government Printing Office, Washington.
- TOZZETI, T. 1810. *Annali del museo imperiale di fisica e storia naturale di Firenze*: 2, t. 6.
- TURKSUVYKWEKERSVERENIGING 1997. *Riglyne vir die verbouing van doringlose turksvye vir vrugteproduksie*, edn 2. Groep 7 Trust Uitgewers, Sinoville.
- WIJNANDS, D.O. 1983. *The botany of the Commelins*. Balkema, Rotterdam.
- ZIMMERMANN, H.G. & ZIMMERMANN, H. 1987. Aanwending van jong turksvyblare vir menslike voeding. *Boerdery in Suid-Afrika: Onkruidreëks* B.1.2/1987.

E.M.A. STEYN* and G.F. SMITH*

* National Botanical Institute, Private Bag X101, 0001 Pretoria.
MS. received: 1999-03-31.