

AGAVACEAE

FURCRAEA FOETIDA: AN INVADING ALIEN IN SOUTH AFRICA

The genus *Agave* L. has long been recognized as invasive in southern Africa, and until recently was thought to be the only one of eight genera in the Agavaceae (Verhoek 1998) to have become regionally naturalized (Smith & Mössmer 1996; Smith 2003). In recent years, colonies of large plants bearing a loose resemblance to agaves in general vegetative habit (Figure 15) have been noted as widely naturalized in Kwa-Zulu-Natal, the Western Cape and Mpumalanga (Figure 16); these have been determined as *Furcraea foetida* (L.) Haw. (syn. *F. gigantea* Vent.) of the tribe Agaveae (Agavaceae). A plate of this Meso- and South American species is reproduced in Verhoek (2002). *F. foetida* bears some resemblance to those species of *Agave* locally grown, particularly in domestic and amenity horticulture; it also has rigid, succulent leaves, rather than leathery, flaccid ones, and in this regard resembles young specimens of *Agave americana* L., but the leaves are verdant green and not glaucous. The main morphological differences between *Agave* and *Furcraea* are presented in Table 1.

Taxonomically, *Furcraea* Vent. is a poorly understood genus—see for example Ahmed Kahn (1997) on the species cultivated in India, and García-Mendoza (1999, 2000) on the tree-like furcraeas. Geographically, *Furcraea* extends from east-central Mexico through the Antilles and eastern Brazil to Peru; it is the only genus in the Agavaceae with a primary distribution centred south of Guatemala. Approximately 20 species are recognized in two subgenera: *F.* subgen. *Furcraea* and *F.* subgen. *Roezlia* (Verhoek 1998). The subject of this report is subgen. *Furcraea*. Various orthographic variants on *Furcraea* exist in the literature: *Furcroya*, *Furcroea*, *Fourcroea* and *Fourcroya* (Drummond 1907; Verhoek 1998).

Furcraea foetida occurs naturally from Guadeloupe, southwards through northern South America to Brazil and the Caribbean (Greater Antilles) (Grisebach 1864; Howard 1979). Through the agency of humans this species is now known to have naturalized widely in the Pacific and Indian Ocean Islands, including the Seychelles, Madagascar, the Mascarene Islands (Baker 1888; Drummond 1907; Macdonald *et al.* 1991), Marquesas Islands, Cook Islands, Fiji, Guam, French Polynesia, Hawaii, Tonga, New Caledonia, Australia (Forster 1986) and New Zealand. It is also now known from Florida in the USA (Francis 2009; PIER 2009). Morris (1887)

described how the Mauritius-based hemp industry was originally initiated in about 1875 in order to utilize the large number of plants that had naturalized along the island coastline following their introduction from South America in about 1790. The extensive uses to which *fique*, the Columbian name for this plant and its fibres had historically been employed, has been documented in detail (Anonymous 1916). By 1917 the species was under cultivation for its sisal-like fibres in several countries besides Mauritius, including Malawi [Nyasaland], Sri Lanka [Ceylon] and India (Anonymous 1917). When crushed, the leaves of some cultivars give off a strong odour, hence the origin of the specific epithet and an alternative common name ‘foetid aloë’ (Morris 1887). Selections with pronounced marginal leaf spines have subsequently been planted widely as barrier plants in tropical regions (Howes 1946), and variegated cultivars, e.g. cv. ‘Mediopicta’ grown in horticulture as landscaping and large, potted accent plants (Smith 2005).

Its arrival in South Africa may be traced to its importation by the Natal Botanical Gardens (now the Durban Botanic Gardens) sometime before the early 1880s, \pm 130 years ago. It (as *Fourcroya gigantea*) receives mention as a garden accession in an early visitors’ guide (Wood 1883), with archival records revealing that a further cultivar arrived in November 1894 (as *Fourcroya gigantea* var. *variegata*) from the [Lalbagh] Botanical Gardens in Bangalore, India. The Durban Garden propagated and later distributed material to meet the demands of a growing fibre industry in Natal, now Kwa-Zulu-Natal (KZN). The Garden Director recorded how Mauritius hemp was ‘receiving much attention’, with large areas planted to this economically important species (Wood 1907)—a good source of fibre for rope and cordage (Anonymous 1887). In support of the emerging South African hemp sector, Wood (1907) reported dispatching—over 12 months—a total of 2 350 plants (as *F. gigantea*), to farming enterprises, from Umzumbe (KZN South Coast) northwards to Zululand.

The ability of *Furcraea foetida* to invade is associated with the production of copious bulbils, \pm several thousand per plant, on an inflorescence (Figure 17A, B). After flowering, these viviparous plantlets eventually drop, rooting easily on contact with the soil to form dense monotypic thickets that exclude native vegetation (ISSG Database 2009); plants are accordingly transformers (Pyšek *et al.* 2004). A dense stand of > 1

TABLE 1.—Main morphological distinctions between *Agave* and *Furcraea*

Character	<i>Agave</i>	<i>Furcraea</i>
Leaf apex	Long, hard, sharp spine	Hard button or short, firm point
Flower arrangement	Paired or in umbellate clusters	In clusters of 3–5
Flower orientation	Erect or horizontal	Pendulous
Filaments	Exserted, subulate, without basal cushion-like swelling	Included, abruptly expanded below middle forming basal cushion-like swelling
Stigma	3-lobed	Capitate or shortly 3-lobed
Perianth	Tubular or campanulate	Campanulate only

acre may be observed at Lake Eland Game Reserve (KZN South Coast). By definition (Pyšek *et al.* 2004), *F. foetida* is invasive rather than simply naturalized or a casual alien, as colonies are known to have persisted for more than 10 years, and, via vegetative propagules, to have spread more than 100 m in less than 50 years. Longer distance dispersal events (of bulbils) are seemingly facilitated by man, with naturalized subpopulations currently known as far apart as Klein Brakrivier in the Western Cape, and Loskop Dam in Mpumalanga. Bulbil production follows shortly after flowering, at which time resources in the (dying) basal rosette are transferred to aerial vegetative propagules, and more rarely to developing fruit and seed. A hundred percent survival and rooting of fresh Puerto Rican bulbils ($n = 100$) placed in moist potting mix have been observed after a single week, with plantlets attaining an average height of 178 ± 4 mm after only one month (Francis 2009). Parent plants also produce new plantlets by lateral budding (offshoots). Further weedy characteristics are exhibited by *F. foetida*: its capacity to thrive in sun as well as partial shade, its non-susceptibility to fire (plants singe rather than burn), and a variable phenology. Plants appear to flower when they attain sufficient vigour and size to support the large inflorescence, at 5–20 years depending on environmental conditions (Francis 2009).

***Furcraea foetida* (L.) Haw.**, Synopsis plantarum succulentarum: 73 (1812); Howard (1979); PIER (2009); Verhoek (2009).

Agave foetida L.: 323 (1753).

F. gigantea Vent.: 65 (1793); Sims (1821) (as *Furcraea*); Bailey (1958).

Massive, robust, fibrous-rooted multi-annual, monocarpic, leaf succulent. *Stem* short, ± 1 m high, usually only 200–300 mm long within ± 2.5 –3.5 m diam. basal rosette. *Leaves* up to 50, rigid, outermost recurving, verdant green to yellow-green, linear-lanceolate to oblanceolate, up to 2400×200 (–250) mm, thick, firm, smooth or obsolescently striate, somewhat roughened beneath, fleshy with thread-like parallel fibres; margins hard and smooth, usually entire at least in distal half, sometimes basally with a few hooked marginal spines shaped like shark's teeth pointing towards the leaf apex, mature apex a firm, blunt point. *Inflorescence* fast-growing, paniculate; scape 5–12 m high; panicle \pm as long as peduncle, central branches much branched; after flower senescence frequently producing large number of bulbils 10–160 mm long. *Flowers* with pedicels articulated, 6–12 mm long, in clusters of 2–5, pendulous, only a few open at a time for several weeks, white, greenish white, yellowish green, or pale blue-green, tubular, 25 – 50×10 – 18 mm, scented. *Perianth* segments 6, with tepals spreading, 23–30 mm long, oblong, distinct except at base. *Stamens* 6, inserted; filaments short, abruptly expanded below middle. *Ovary* inferior, 12–15 mm long; style inserted, dilated, 3-lobed proximal to middle; stigma 3-lobed. *Fruits* capsular, loculicidally dehiscent, infrequently produced. *Seeds* many, black, flat, 2 rows



FIGURE 15.—Small colony of *Furcraea foetida*, Umzimkulu Mouth, KwaZulu-Natal. Photograph: N. Crouch.

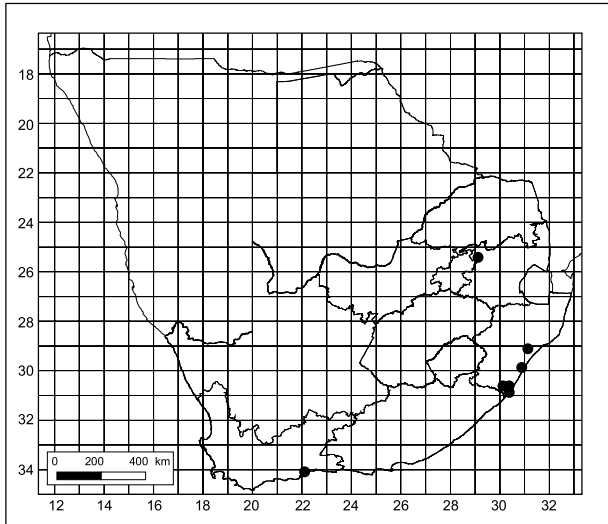


FIGURE 16.—Known naturalized distribution of *Furcraea foetida*, ●, in FSA region, based on sight records and herbarium vouchers.

per locule. *Chromosome number* $2n = 60$. *Flowering time*: mainly in the cooler months in South Africa, but often spontaneous throughout the year.

Specimens examined

KWAZULU-NATAL.—2930 (Pietermaritzburg): Pinetown, roadside cutting alongside M13 highway, about 200 m eastbound beyond onramp to N3, 293 m, (–DD), 13-01-2010, *N. Crouch 1261* (NH). 3030 (Port Shepstone): Wichman's farm, (–CD), 29-12-1968, *A.P. Wells 437* (NH).

Common names: Mauritius hemp, foetid aloe, *aloës vert* (Morris 1887), green aloe (Anonymous 1887). Wild populations in Columbia are referred to as *figue* (Anonymous 1916) or *cabuya* (Drummond 1907), as *cadère*, *chanvre de Maurice*, *choka* and *choka vert* on French Reunion (La Réunion) (ISSG Database 2009), and elsewhere as female *karata*, *maguey*, *mayuey criollo*, and *cocuisa* (Francis 2009).



FIGURE 17.—*Furcraea foetida*: A, mature inflorescence with aerial bulbils; B, aerial bulbils proliferating on a mature inflorescence branch. Photographs: N. Crouch.

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