

A second species of *Furcraea* Vent. (Agavaceae), *F. tuberosa* (Mill.) W.T.Aiton, naturalised in South Africa

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Summary: *Furcraea tuberosa* (Mill.) W.T.Aiton (Agavaceae) is recorded as having become naturalised in the Mpumalanga Province of South Africa. A description and illustrations of the species in South Africa are provided, and it is compared with *F. hexapetala* (Jacq.) Urb., with which it can be confused taxonomically. A key based on vegetative characters to distinguish among *F. tuberosa*, *F. foetida* (L.) Haw. and *F. selloa* K.Koch, the latter two being commonly grown or naturalised in South Africa, is included.

Zusammenfassung: *Furcraea tuberosa* (Mill.) W.T.Aiton ist in der Provinz Mpumalanga, Südafrika, verwildert. Eine Beschreibung und Abbildungen der Art in Südafrika ergänzen einen Vergleich mit *F. hexapetala* (Jacq.) Urb., mit welcher sie taxonomisch verwechselt werden kann. Zusätzlich wird ein Schlüssel veröffentlicht, um zwischen *F. tuberosa*, *F. foetida* (L.) Haw. und *F. selloa* K.Koch (die letzten beiden in Südafrika häufig angepflanzt oder verwildert, zu unterscheiden.

Introduction

The potential and real negative invasive impact of *Furcraea foetida* (L.) Haw., a widely grown agricultural crop and ornamental, on natural vegetation in various parts of the world is well documented (see Crouch & Smith, 2011, and references therein). Along with *Furcraea selloa* K.Koch, an ornamental species that has become naturalised in some, especially mild-climate, regions of the world, these are to date the only species of the genus *Furcraea* Vent. that have been recorded as having become established away

from their natural habitats. Recent fieldwork in the eastern parts of South Africa alarmingly revealed a further species, *Furcraea tuberosa* (Mill.) W.T.Aiton, as having become established in South Africa (Figure 1). The country has the richest succulent flora in the world (Smith *et al.*, 1997) and its various habitats provide perfect growing conditions for succulents imported from other parts of the world for cultivation, especially since the natural enemies of these species are usually absent from the country (Walters *et al.*, 2011). Unsurprisingly, the recording of exotic species newly naturalised in South Africa is ongoing. We here provide a description of, and illustrate, *F. tuberosa* as it is found in South Africa, and compare it with *F. hexapetala* (Jacq.) Urb., with which it can be confused. A key based on vegetative characters to distinguish among *F. tuberosa*, *F. foetida* and *F. selloa* K.Koch, the latter two being commonly grown or naturalised in South Africa, is included.

Distinguishing *Furcraea tuberosa* from *F. hexapetala*, *F. foetida* and *F. selloa*

Furcraea tuberosa is native to the Antilles. It is thought that it originated from Hispaniola (Haiti and the Dominican Republic), and that it was introduced by Haitian slaves to the eastern parts of Cuba, where it is naturalised especially near roads and small towns (Álvarez de Zayas, 1996). The species has some economic value as fibres of this plant are used by the Haitian people to produce hammocks and cordage (Álvarez de Zayas, 1996). *F. tuberosa* is close to *F. hexapetala* (Jacq.) Urb., but differs from that species in the teeth on the leaf margins being reddish (Figure 2) and often double or divided, while those



Figure 1. Clumps of *F. tuberosa* photographed near Lydenburg in South Africa's Mpumalanga Province. **Figure 2.** Close-up of the leaf margins and reddish brown teeth of *F. tuberosa*. **Figure 3.** *F. foetida* is widely naturalised in South Africa. Here near Port Elizabeth in the Eastern Cape Province it grows with a further invasive succulent, the smaller *Agave angustifolia* (shorter inflorescences and light bluish green leaves). **Figure 4.** The variegated form of *F. selloa* is widely cultivated in South Africa, especially in parts that have a mild climate. **Figure 5.** Globular bulbils carried on a branch of an inflorescence of *F. tuberosa*. Photos: Gideon F. Smith.

of *F. hexapetala* are single and yellow to brown. *F. hexapetala* is also a larger plant (including the inflorescence) than *F. tuberosa*, with a trunk that can reach a length of 1.0 m, while in *F. tuberosa* the trunk is much shorter, reaching a length of only 30 cm. Further, the inflorescence of *F. hexapetala* is branched along its upper 3/4, while in *F. tuberosa* it is branched in the upper 2/3 (Álvarez de Zayas, 1996).

Two other species of *Furcraea*, *F. foetida* and *F. selloa*, are also widely encountered in South Africa. *F. foetida* (Figure 3) is naturalised in parts of South Africa (Crouch & Smith, 2011), while *F. selloa* (Figure 4), although not recorded as having become naturalised, is a popular and widely grown garden subject.

Invasive properties of *Furcraea tuberosa*

No capsules, and therefore no seed production, were observed on the inflorescence branches of the specimens of *F. tuberosa* naturalised in north-eastern South Africa. Specimens were also not found to sprout from the base. The primary reproductive mechanism of the species as found in its adopted country was clearly through the distribution of bulbils. These vegetative structures are produced in very large numbers on inflorescence branches and easily root where they fall (Figure 5). This gives rise to the establishment of expanding clusters of dense growth in close proximity to the mother plant.

Nomenclature of *Furcraea tuberosa*

The name *Furcraea tuberosa* was published by Aiton (1811) based on *Agave tuberosa* Mill. Although Aiton cited Willdenow (1799: 194) as reference, the name was published about 30 years earlier by Miller (1768) who is its correct author. Miller (1768) described the species as having "...a tuberous root and very long leaves, with spines on their edges..." and referred to it as "*Aloe Americana radice tuberosa minor*. Pluk Alm. 19." Plukenet (1696: 19) had listed it as including two types: "spinosa" (illustrated in Phytogr. Tab. 258 Fig. 1) and "non spinosa" (illustrated in Phytogr.

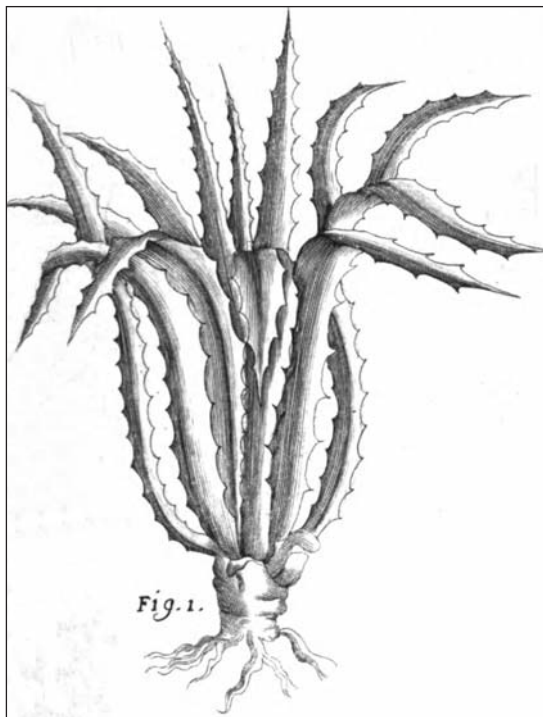


Figure 6. Type of *Agave tuberosa* Mill.: Plukenet (1692) Plate 258 Figure 1.

Tab. 258 Fig. 2). Miller (1768) was clearly referring to the spiny plants. The type of this name is therefore Figure 1 in Tab. 258 (Figure 6).

Furcraea tuberosa (Mill.) W.T.Aiton, *Hortus Kew*, 2nd ed., 2: 303 (1811).

Basionym: *Agave tuberosa* Mill., *Gard. Dict.* 8th ed., *Agave* no. 4 (1768). Type: Plukenet (1692) Plate 258 Figure 1.

Furcraea geminispina Jacobi, *Vers. Syst. Ord. Agav.*: 182 (1865).

For a more complete synonymy of *F. tuberosa* see Thiede (2001).

Large, perennial, rosulate leaf succulents. Stems absent or very short, less than 30 cm long.

Key based on vegetative characters to distinguish between *Furcraea tuberosa*, *F. foetida* and *F. selloa*

1. Leaves pronouncedly sword-shaped, leaf margins unarmed or armed with concolorous or brown teeth..... 2
- 1'. Leaves narrowly attenuate, leaf margins armed with reddish brown teeth ***F. tuberosa***
2. Leaf surfaces smooth; leaf margins unarmed or only basally armed with very few, widely spaced teeth ***F. foetida***
- 2'. Leaf surfaces sand-papery; leaf margins throughout armed with large, regularly spaced, concolorous or brown teeth ***F. selloa***

Rosettes open with semi-erect to spreading leaves. Leaves numerous, bright green, oblong-lanceolate and narrowly tapering, flat to canaliculate; leaf surfaces smooth, 1.0–1.8 m long; apex acute; slightly canaliculate; marginal teeth more or less 5 mm long, reddish brown. Inflorescence a multi-branched, open panicle, 5–8 m tall, bulbiferous, bulbils numerous, ovoid. Flowers about 4 cm long, in clusters of up to three; pedicels 6–10 mm long; tepals oblong, greenish white. Fruit not seen.

Voucher: South Africa, Mpumalanga Province. 2530 (Lydenburg): 2 km from the Weltevrede turn-off on the Machadodorp-Lydenburg road, direction Buffelskloof Nature Reserve. (-AB), in rich loamy soils in savanna vegetation, 25°08'19" S 30°27'00" E, 28 April 2012, *Gideon F. Smith & Estrela Figueiredo* 23 (PRE).

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References

AITON, W. T. (1811). *Hortus kewensis; or, a catalogue of the plants cultivated in the Royal*

- botanic garden at Kew.* 2nd edn. Vol. II. Longman, Hurst, Rees, Orme, and Brown, London.
- ÁLVAREZ DE ZAYAS, A. M. (1996). El género *Furcraea* (Agavaceae) en Cuba. *Ann. Inst. Biol. Univ. Nac. Autón. México, Ser. Bot.* **67**: 329–346.
- CROUCH, N.R. & SMITH, G.F. (2011). Agavaceae. *Furcraea foetida*: an invading alien in South Africa. *Bothalia* **41**: 196–199.
- MILLER, P. (1768). *Gardeners' Dictionary*. 8th edn. Printed for the Author, London.
- PLUKENET, L. (1692). *Phytographia, pars tertia*. Sumptibus Autoris, London.
- PLUKENET, L. (1696). *Almagestum Botanicum*. Sumptibus Autoris, London.
- 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.
- THIEDE, J. 2001. Agavaceae. *Furcraea*. In EGGLE, U. (ed.), *Illustrated handbook of succulent plants: Monocotyledons*. Springer Verlag, Berlin, pp. 78–84.
- WALTERS, M., FIGUEIREDO, E., CROUCH, N.R., WINTER, P.J.D., SMITH, G.F., ZIMMERMANN, H.G. & MASHOPE, B.K. (2011). *Naturalized and invasive succulents of southern Africa*. ABC Taxa, Vol. **11**. The Belgian Development Cooperation, Brussels.
- WILLDENOW, C.L. (1799). *Species Plantarum*. 4th edn. Vol. **2**. Impensis G.C.Nauk, Berlin.