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Producing organic alcohol and a tequila-like liquor from *Agave americana* L. (Asparagaceae subfam. Agavoideae / Agavaceae) at Graaff-Reinet in the Eastern Cape Province of South Africa: challenges to establish an industry based on a naturalised, alien succulent

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Photographs by the author

Summary: Initiated in the 1990s, and coming into production in the early 2000s, organic alcohol and a tequila-like liquor, 'Agava' was produced from *Agave americana* L. (Asparagaceae subfam. Agavoideae / Agavaceae) in the Eastern Cape Province of South Africa for about six years. Although the drink, initially called 'Spirit of the Blue Agave', only later 'Agava', appeared on the shelves of liquor stores in parts of the country from 2002 to 2008, the industry was not successful. The history of this short-lived venture is documented.

Zusammenfassung: Entwickelt in den 1990er Jahren und ab den frühen 2000er Jahren in die Produktion genommen, wurde in der östlichen Kapprovinz Südafrikas über sechs Jahre lang der Bioalkohol und Tequila-ähnliche Schnaps ‚Agava' aus *Agave americana* L. (Asparagaceae subfam. Agavoideae/Agavaceae) hergestellt. Obwohl das Getränk, anfänglich ‚Spirit of the Blue Agave' und erst später ‚Agava' genannt, in Teilen des Landes von 2002 bis 2008 in den Verkaufsregalen der Spirituosengeschäfte erschien, war die industrielle Produktion nicht erfolgreich. Die Geschichte der kurzen Unternehmung wird dokumentiert.

Introduction

A large number of exotic succulents have been recorded as naturalised, and in some instances as invasive, in South Africa (Walters *et al*., 2011). Not only succulents have found the generally mild climate prevalent over much of South Africa amenable to becoming naturalised; scores of herbaceous and woody species appear on similar lists of unwanted aliens that contribute to, sometimes, radical and destructive habitat transformation (Milton & Dean, 1998; Henderson, 2001; Matthews & Brand, 2004; Musil & Macdonald, 2007). The scourge of invasive alien plants has become a high-profile environmental issue in South Africa, and several years ago the controlling and eradication of aliens received significant attention from the then president of South Africa (Anonymous, 2000a), and even home owners were expected to remove alien vegetation from their properties (Anonymous, 2001). The insidiously negative impacts of the spread of non-indigenous succulent and other plants into once pristine habitats are not only of concern in mild-climate countries such as South Africa (Walters *et al*., 2011), Australia (Forster, 1996; Chinnock, 2015), and Portugal (Silva *et al*., 2015); several countries, such as Switzerland, which has a continental-type climate, share these concerns (see for example Weber, 2000), which are widely considered to be serious threats to global biodiversity (Clout, 1995).

Given the prevalence of exotic aliens in parts of South Africa, occasionally in very dense, impenetrable swathes, it is not surprising that people who live in such areas have considered and implemented ways to derive monetary value from the plants. Some of these uses are destructive and serve the dual purpose of providing an income for local (often rural) communities, as well as acting as a control measure of the invasive plants (Shackleton *et al*., 2006, 2007, 2010). A well-known example is the trimming of branches off, or completely cutting down, invasive Australian wattle trees (for example *Acacia cyclops* A.Cunn. ex G.Don. [Red eye / Rooikrans] and *Acacia saligna* (Labill.) H.L.Wendl. [Port Jackson Willow

Figure 1. Developing fruit, known as 'cactus pears' rather than 'prickly pears', on a spineless cultivar of *Opuntia ficus-indica*.

Figure 3. The fruit of *Opuntia ficus-indica* was used in the production of Baines Prickly Pear cream liqueur in South Africa around the late-1980s and early-1990s. The liqueur is no longer produced.

/ -wilg]) and selling the wood for making cooking and other domestic fires.

A further example of a use of a naturalised succulent is the harvesting of prickly pears from 'wild-growing' *Opuntia ficus-indica* L. plants (Beinart & Wotshela, 2011). In this instance the

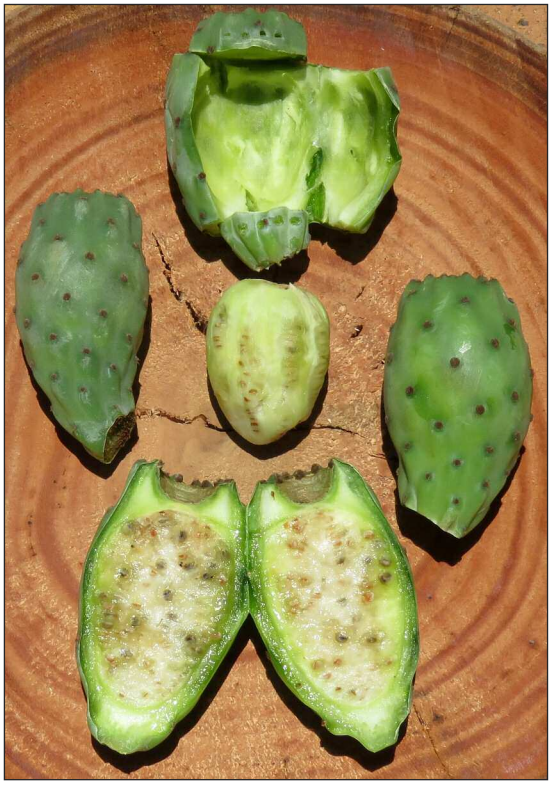

Figure 2. Mature 'cactus pear' fruit picked from a spineless cultivar of *Opuntia ficus-indica* is typically sold in the food and fresh produce sections of chain and departmental stores.

fruit is typically sold informally in makeshift containers by roadside vendors. This is especially the case in the Eastern Cape Province, where dense infestations of the species persist around Port Elizabeth and Uitenhage. Such harvesting of the fruit does no harm to the plants. Typical commercial-scale fruit harvesting from so-called 'tame' *O. ficus-indica*—the spineless forms and cultivars of the species—is more often aimed at supplying fresh produce markets and food sections of chain supermarkets (Figures 1 & 2). This agricultural crop is generally referred to as 'cactus pears', and not 'prickly pears'. At one time the fruit of *O. ficus-indica* was used to produce a cream liqueur, Baines Prickly Pear cream liqueur (Figure 3), but this product was offered for sale in liquor stores in South Africa for a short spell only.

Agave americana L. [subsp. *americana*] var. *americana* (Asparagaceae subfam. Agavoideae / Agavaceae), a continental North American leaf-succulent species naturalised in South Africa (Smith & Mössmer, 1996), occurs in large numbers in natural veld over much of the arid and mesic interior of the country (Figure 4). The

Figure 4. A near mature specimen of *Agave americana* growing in an erosion gulley near the town of Robertson in the Worcester-Robertson Karoo, Western Cape Province, South Africa.

Figure 6. Arguably the best known avenue of *Agave americana* plants in South Africa grows near the junction of the N9 main road and the dirt road turn-off to Glen Harry Game Reserve north of the Karoo town of Graaff-Reinet en route to Middelburg (Eastern Cape Province). These towns are about 100km apart. The avenue, which was established directly adjacent to the barbed wire farm fence line, is on the left-hand side of the road when travelling in a northerly direction.

species has been known to grow in South Africa for several centuries, and has spread into bordering countries.

In this paper, historical efforts to use this species for the distillation of alcohol in South Africa are documented. Dating from the late-1990s to late-2000s, organic alcohol, as well as an alcoholic beverage named 'Agava', were produced near Graaff-Reinet in the Great Karoo in the Eastern Cape Province.

Background

Apart from *Agave americana*, a number of other *Agave* species have escaped from gardens or were planted in fields as barriers or hedges in

Figure 5. A large, very dense, impenetrable stand of *Agave americana* north of Graaff-Reinet, en route to Middelburg, Eastern Cape Province, South Africa. Initial harvesting of piñas for the production of alcohol was done from such stands.

Figure 7. The leaves of *Agave tequilana* are narrower than those of *A. americana*, but a similar light blue colour.

southern Africa, and subsequently became established in natural vegetation (Smith, 2011). Today these plants look uncannily at home in their adopted African home, inter alia because their rosulate leaf arrangements resemble those of indigenous aloes. Wherever near-mature specimens of *A. americana*, and other naturalised *Agave* species, are encountered in southern Africa, they are invariably surrounded by small to extensive

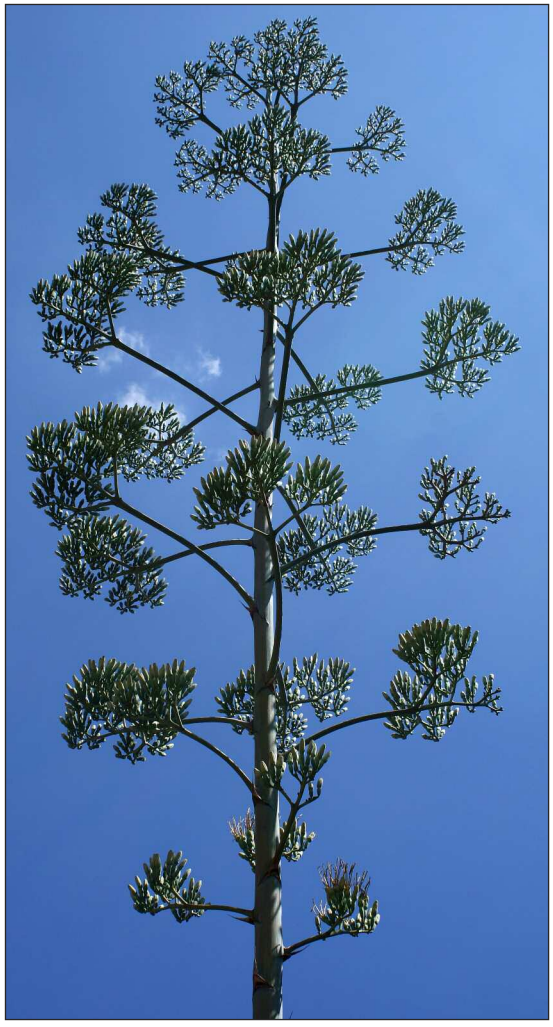

Figure 8. While also reaching a height of several meters, the inflorescences of *Agave tequilana* is more 'open', slender and diffuse than those of *A. americana.*

Figure 9. Close-up of flowering branches of *Agave tequilana.*

Figure 10. After flowering, the inflorescence of *Agave tequilana* carries thousands of bulbils that will root easily where they fall. *A. americana* does not produce inflorescence bulbils.

Figure 11. *Agave angustifolia*, here photographed near Pretoria, in South Africa's Gauteng Province, is one of the *Agave* species naturalised in South Africa. A form of this species, in agricultural circles known as *Agave espadín*, is the most widely used agave in mezcal production.

crops of small to medium-sized plants that developed from the central, 'mother' plants, or through the production of, sometimes, thousands of bulbils carried on declining inflorescences. In this way most of these species form small, dense colonies that are scattered in the natural vegetation. Especially thick concentrations of *Agave americana* are known from parts of the Jansenville—Graaff-Reinet—Middelburg region in the Eastern Cape Province of South Africa (Figures 5 & 6).

In its native Mexico and southern United States, *Agave americana* has multiple uses and is inter alia harvested for the production of mezcal and pulque (Aguirre Rivera, 2001; McEvoy, 2014: 92; Nevaer, 2013: 22; Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, 2006; Vásquez-García, 2007: xii). It has also been mooted as a crop for bioethanol production and afforestation especially in so-called marginal lands (Kant, 2010; see also Nobel, 2010; Morales, 2011), and the extraction of fibres from its leaves for the building industry, and agave syrup production from the leaves and piñas (agave hearts, also called cabezas), have also been investigated (see for example http://researchspace.csir.co.za/dspace/bitstream/10204/1371/1/Boguslavsky_2007.pdf; and Slabbert, 2007). Further, agaves in general also have been suggested for bioenergy production in arid and semi-arid climate zones (Davis *et al*., 2011).

The best known of the alcoholic beverages produced from species of *Agave* is tequila (Martínez Limón *et al*., 1999), a type of mezcal (Valenzuela-Zapata & Nabhan, 2003; Stewart, 2013: 2–16). Although tequila, more or less as known today, had been distilled for centuries in Mexico, this drink became known internationally following its exposition at the Chicago's World Fair held in 1893, and 17 years later in San Antonio, Texas (Bowen, 2015: 36). Tequila must be distilled from one species only, *Agave tequilana* F.A.C.Weber (1902) (Figures 7, 8, 9 & 10), and additionally originate from a specifically defined geographical region in Mexico [the state of Jalisco, and parts of Nayarit, Michoacán, Guanajuato, and, rather controversially, Tamaulipas] (McEvoy, 2014). In past centuries, especially in and around Guadalajara, the capital of the western-Pacific Mexican state of Jalisco, mezcal production—the drink was not yet known as tequila—symbolised the stability provided by hacienda life, as opposed to a more chaotic lifestyle often associated with pulque consumption (see later) (Pérez Rocha, 1998; Gaytán, 2014: 28–32). In 1994, Mexico was recognised as the exclusive producer of both tequila and mezcal by the United States and Canada, and by Europe in 1997 (Bowen, 2015: 41). However, it should be noted that agave distillates, using a range of *Agave* species, are produced in at least 24 Mexican states (Bowen, 2015: 157).

In contrast to tequila, mezcal may be produced from about 50 different *Agave* species and cultigens, and can be made in eight Mexican states [all of Durango, Guerrero, Oaxaca, San Luis Potosí, and Zacatecas, and in parts of Guanajuato, Michoacán, and Tamaulipas]. A form of *Agave angustifolia* Haw., in the agricultural trade often known as *Agave espadín*, or simply as *espadín*, is widely cultivated for mezcal production (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad , 2006); in 2014, *espadín* was used in the production of 77% of the agave spirits certified as mezcal (Bowen, 2015: 133). A very vigorous form of *A. angustifolia* has also become naturalised in South Africa (Figure 11) (Smith, 2011).

In 2012, annual tequila production amounted to 250 million litres, while only 10,000 litres of mezcal were produced during that year (Martineau, 2015: 106). In the designated region in Mexico where tequila may be produced, 150 distilleries are in operation, but these produce a staggering more than 1,600 different tequila brands; about 17,500 agave farmers (called 'agaveros') operate in the region (Martineau, 2015). Both tequila and mezcal are controlled by regulatory councils; the Tequila Regulatory Council (CRT = Consejo Regulador del Tequila) and Mezcal Regulatory Council (CRM = Consejo Regulador del Mezcal), respectively, using the more popular acronyms of their Spanish names. The roles of these Councils entail, inter alia, the verification and certification of the denomination of origin (see later), and implementation of quality standards for the drinks, so providing a guarantee of their authenticity (Bowen, 2015: 48).

Tequila typically comes in four different expressions: blanco [unaged, bottled straight from the still] (Figure 12), reposada [barrel-aged for between two and 12 months] (Figures 13 & 14), añejo [barrel-aged for from one up to three years], and extra añejo [barrel-aged for three years and longer] (McEvoy, 2014: 51, 137). Mezcal comes in the same expressions, except extra añejo. Tequila is not only consumed neat; it forms the basis of numerous cocktails, of which the margarita (Figure 15) and tequila sunrise must rate as the two most popular drinks. The margarita is mooted as one of the top five cocktails in most countries, and even has a World Margarita Day [22 February] allocated to it (Anonymous, 2016: 18).

Tequila is nowadays also being used in mixtures with beer (Anonymous, 2002) (Figure 16), and in aperitifs (Figure 17).

Figure 12. (left) This bottle of Camino Real® tequila blanco, from Queretaro, Mexico, sold at 40% alcohol by volume, is marketed with a miniature sombrero and poncho. **Figure 13.** (centre) This tequila, Corralejo®, from Guanajuato, Mexico, has been aged to reposada level, and is sold at 38% alcohol by volume. **Figure 14.** (right) The establishment of Jose Cuervo® tequila arguably dates back to 1758 when a stretch of land and distillery, in Jalisco, Mexico, was deeded to Don José Antonio de Cuervo (Bowen, 2015: 31). His son, José María Guadalupe Cuervo, was without doubt the first to obtain a mezcal production license in 1795 (Orellana, 1999: 30); see the date on the label on the bottle. This tequila has been aged to reposada level, and is sold at 43% alcohol by volume.

Pulque, a beverage produced from the fermentation of aguamiel, or honey water, tapped from certain agave species, including *Agave salmiana* Otto ex Salm-Dyck (Corcuera, 2000; Salinas Pedraza, 2000; Thiemer-Sachse, 2008; Smith & Figueiredo, 2012), is also widely consumed (Figure 18). The alcohol content of pulque varies between 2–7% by volume, which is much less than that of tequila and mezcal.

Taxonomy of *Agave americana*

Agave americana is widely recognised as an exceedingly variable species, which is reflected in the about two dozen synonyms included under this name. However, a number of infraspecific entities have been formally established (Table 1), and are still widely accepted in many parts of the world (see for example Smith & Figueiredo, 2007). Note though that (González Elizondo *et al*., 2009) consider some of the forms traditionally included in *A. americana* as warranting recognition as a different species. *A. americana* has numerous characters that makes it desirable as material for large-scale landscaping, including that it is quick-growing and robust, with highly architectural rosettes. It is also suitable for pot culture and is so grown in many parts of the world (Figure 19). Given these domestic and amenity garden uses, as well as the manifold ethnobotanical uses it has been put to in its native New World, in parts of which it is naturalised (González Elizondo *et al*., 2009: 43), it is not surprising that numerous enhanced forms with preferred gardening and other characters have been selected, and remain recognised, especially among gardeners and succulent plant collectors. However, Hochstätter (2015) recently reduced the 10 infraspecific entities recognised in the species to four subspecies: apart from the typical one, *A. americana* subsp. *americana*, he also recognised *A. americana* subsp. *expansa*, (Jacobi) Hochstätter, *A. americana* subsp. *oaxacensis* (Gentry) Hochstätter, and *A. americana* subsp. *protamericana* Gentry.

Of the various forms of *Agave americana*, two

Table 1. Taxonomy of *Agave americana* based mostly on Gentry (1982: 278–290), with some characters useful to differentiate among the subspecies and varieties. Of these infraspecific taxa only # 1, *Agave americana* [subsp. *americana*] var. *americana*, was used in the production of liquor near Graaff-Reinet in South Africa.

#	Taxon	Selected leaf characters
1	*Agave americana* subsp. *americana* var. *americana*	Leaves very long, glaucous, untidily floppy; rosettes often leaning to one side
2	*Agave americana* subsp. *americana* var. *expansa*	Leaves long, glaucous, straight; rosettes usually erect
3	*Agave americana* subsp. *americana* var. *marginata* Trel.	Leaves greyish-green or mid-green with white or yellow sections along the margins
4	*Agave americana* subsp. *americana* var. *medio-picta* Trel.	Leaves with broad yellow section in the centre
5	*Agave americana* subsp. *americana* var. *medio-picta* 'Alba'	Leaves with broad white section in the centre
6	*Agave americana* subsp. *americana* var. *oaxacensis* Gentry	Leaves light bluish white to nearly white, margins with close-set teeth
7	*Agave americana* subsp. *americana* var. *picta* (Salm-Dyck) A.Terracc.	Leaves very long, uniformly green or green with yellow margins, guttered
8	*Agave americana* subsp. *americana* var. *striata* Trel.	Leaves with numerous longitudinal yellow or whitish stripes; general appearance of plant yellowish or bluish
9	*Agave americana* subsp. *americana* var. *variegata* Trel.	Leaves somewhat spirally twisted, with yellow sections along the margins
10	*Agave americana* subsp. *protamericana* Gentry	Leaves short, surfaces often sandpapery rough to the touch

have been recorded as naturalised in southern Africa, namely *A. americana* [subsp. *americana*] var. *americana* (Smith & Mössmer, 1996; Smith & Klopper, 2007; Smith *et al*., 2008), and *A. americana* [subsp. *americana*] var. *expansa* (Jacobi) Gentry (Smith & Figueiredo, 2011) (Figure 20). The var. *expansa*, however, has a much more restricted naturalisation range in South Africa (Smith & Figueiredo, 2011; Smith, 2011: 40–41, Figure 32), with a concentration on and around the Cape Peninsula (see for example Badenhorst, 1999: figure on p. 56), stretching to the Little Karoo. Of the two variants, only *A. americana* [subsp. *americana*] var. *americana* is known from around Graaff-Reinet, and it is this typical variety that has been harvested in the area for the production of a tequila-like drink.

A further species of large-growing agave, *Agave weberi* J.F.Cels ex J.Poiss., that can be confused with *Agave americana* is found in cultivation in southern Africa (Smith & Figueiredo, 2015).

Distribution of *Agave americana* in South Africa

Agave americana occurs in all nine of the provinces of South Africa, most densely so in the southern, central, and eastern parts of the country, including, and especially, in the Karoo region (Smith & Mössmer, 1996; Smith & Klopper, 2007; Smith *et al*., 2008; see map in Smith, 2011: 38, Figure 28). In South Africa the species is therefore appropriately regarded as "Very widespread—common" by Nel *et al*. (2004).

The Karoo covers a vast part of the South African interior. It is essentially an arid to semi-arid region that accounts for just over one-third of the country's land surface (Figure 21). Within the Karoo, the Succulent Karoo Region of Endemism harbours several foci (Centres of Endemism) with high levels of endemism (Van Wyk & Smith, 2001). The town of Graaff-Reinet, where the alcohol production plant was established, however, falls in the Albany Centre of Endemism, which in

the north is abutted by the Great Karoo (Van Wyk & Smith, 2001). The town is also known as the 'Gem of the Karoo', and is the principal town in what is generally referred to as the Cape Midlands, a region in the eastern Karoo. Graaff-Reinet lies at the foothills of the Sneeuberg mountain range where it is tucked into a horseshoe bend of the Sundays River. The Karoo has a harsh climate, but is extensively farmed, especially with small livestock, including sheep (wool, mutton) and goats (mohair, meat). The meat of sheep that have grazed on 'karoobossies' [English: karoo shrublets] take on a uniquely pleasant aroma; this mutton is marketed under the label 'Karoo lamb'. In the Karoo, and elsewhere, *A. americana* is consistently, even in English, known by its Afrikaans common name, 'garingboom' (Powrie, 2004).

Agave americana has also been recorded from several of South Africa's neighbouring countries, including Zimbabwe (Maroyi, 2006: 185), and Lesotho (Figure 22).

Distilling harvested *Agave americana* piñas into an alcoholic beverage in South Africa

Given the abundance of *Agave americana* in parts of the Great Karoo, in the 1990s a local entrepreneur, Mr Gawie Venter, and farmers in the district, investigated ways of using this species as a means of generating income. In September 1997 it was announced that, starting on 01 July 1998, tequila, as well as neat alcohol, will be produced from the "…blou Amerikaanse agave…" [English: "blue American agave"] in a distillery situated on a farm on the outskirts of Graaff-Reinet, on the main road to Middelburg (Stiemie, 1997). For this purpose a distillery (Figure 23), at the time the most modern and sophisticated, computerised such facility established anywhere in the world, was being erected at a cost of ZAR15.0 million. It was also envisaged that it would be the first tequila distillery outside of Mexico. This announcement seemed quite fortuitous as at that time agave plantations were severely affected by pests in its native Mexico (see for example Smith *et al*., 2012 on the agave snout weevil), just as the demand for agave piñas used for distilling tequila, and mezcal for that matter, increased (Joubert, 2002; Martineau, 2015: 106). Given the shortage of agave piñas and the associated rocketing per-kilogram price, it was even reported that a special agave squad was appointed to police the theft of agave in Mexico (Anonymous, 2000b). As one consequence of the agave shortage, the price rose from 0.75 Mex$ (or pesos) per kilogram to 14.00 Mex$ per kilogram between the mid-1990s and 1999 (Anonymous, 2000b; Martineau, 2015: 43–44), and the price of tequila increased substantially (Batres *et al*., 2000). Somewhat surprisingly, South Africa represents one of the biggest international markets for tequila, along with the USA, Germany, and Russia (Martineau, 2015: xvii). In 1997 alone 369,000 litres of tequila were imported into South Africa (Stiemie, 1997).

The intention of the distillery at Graaff-Reinet was that neat alcohol would form the bulk of the production; the distillery's capacity was predicted to have been 240,000 litres of neat alcohol and tequila per month. This development was widely welcomed and seen as a boost to the local economy of Graaff-Reinet, where 58 local inhabitants would be employed in the distillery. A company, Tequila and Mezcal [misspelled as "Mazcal"] Distillers (Bpk) [Ltd], was established and to ensure a steady and sufficient supply of *A. americana* plants for processing, the company entered into contracts with local farmers to ensure material for the ensuing 39 years. Initially piñas would be 'wild'-harvested in the district (Figure 24), but plants would also be established in plantations for future harvesting (Figures 25 & 26).

On 18 October 1997, a month after it was announced that tequila would be produced at Graaff-Reinet, Mr Aldo Aldama, the secretary for economic and cultural affairs in the Mexican Embassy in South Africa, announced that international trade agreements prohibit the production of a drink called tequila outside of Mexico. Aldama further stated that: "Tequila is unique to Mexico, just like champagne can only be produced in certain areas of France…[…]… The name belongs to the people of Mexico…the distillery is no problem; using the names 'tequila' and 'mezcal' is". This statement issued by the Mexican Embassy was questioned by Mr Venter, managing director of Tequila and Mezcal Distillers, who said that: "It is ridiculous for Mexico to say they own the names 'tequila' and 'mezcal'—they are not brand names". At this time, October 1998, orders for the first year's entire projected batch of 250,000 (up from 240,000) litres of alcohol produced per month had already been sold, even though it was anticipated that the distillery would only come into operation seven months hence (July 1998). Shares were sold in the distillery and Venter stated that in two weeks more than ZAR2.0 million had been raised. In the *Cape Times* (*Business Report* section, p. 8) of 15 July 1998, as well the *Sunday Times* (*Business Times* section, p. 12) of 19 July 1998, for example, similar advertisements, under the banner "Invest your money where it is most likely to grow" announced that 10.5 million ordinary shares at a price of 120 South African cents per share was being offered to the public, with the

Figure 15. A margarita cocktail, shown here, is one of the top five cocktails in most countries.

Figure 16. Tequila is nowadays also used to flavour beer. This product of The Netherlands, Desperado®, contains 5.9% alcohol by volume, and is here served with lupin seeds (derived from *Lupinus albus* L.) as a pickled snack.

offer closing on 31 July 1998. It was noted that the ZAR7.5 million needed to purchase a computerised alcohol distillery from Portugal would likely be raised within a week (MacGregor, 1997). At the time it was suggested that "…more than 500 people…" [up from 58] would be employed, presumably by the distillery itself, and associated activities, which was seen as a major boost to job creation in the Karoo.

Four months later, in February 1998, it was announced that the South African company, Tequila and Mezcal Distillers, has agreed to change its name to Reinet Distillers Ltd, and that they no longer intended to produce tequila. The earlier announcement, released in September 1997 by Mr Venter, that tequila will be produced in Graaff-Reinet in 1998, provoked a strong response from Mexico, which previously, on 13 April 1974, had been granted the title and appellation of origin rights (see later) for tequila (Anonymous,

Figure 17. Tequila is also used in aperitifs, such as this one known as 'Cactus Chilli'® that yields an "Exciting blend of Mexican Tequila and Red Hot Chillies". It contains 24% alcohol by volume. Note the use of an image of the cowboy cactus, *Carnegiea gigantea*, on the label.

1998; McEvoy, 2014: 63), which was recognised by the World Intellectual Property Organization (WIPO) in 1978 under the Lisbon agreement, the year in which the Norma Oficial Mexicana set, inter alia, production standards for tequila (Martineau, 2015: 62; McEvoy, 2014: 63). The appellation of origin, also referred to as a denomination of origin, essentially protects an industry against international competition and strengthens the links between the history, landscape (sometimes called 'terroir'), and products (Gaytán, 2014: 121–125). Similarly, the Norma Oficial Mexicana NOM-070-SCFI-1994, which governs the application of a denomination of origin for mezcal production, certification, classification, regions, and labelling was granted on 28 November 1994 (McEvoy, 2014: 66), with the WIPO granting mezcal an appella-

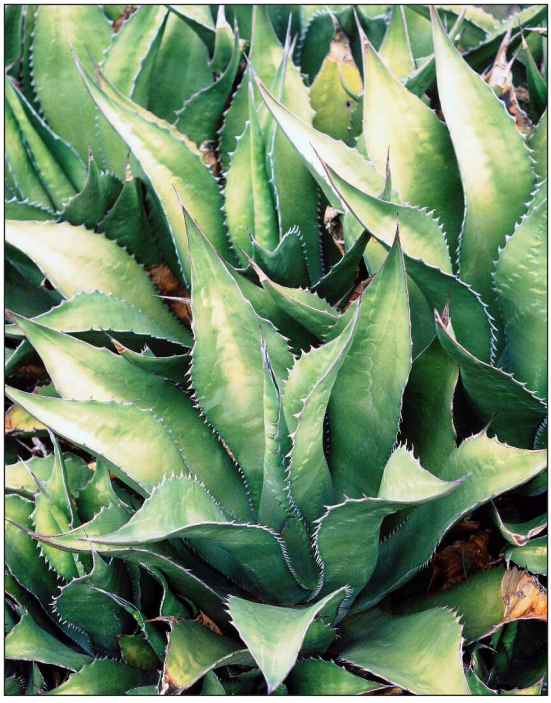

Figure 18. *Agave salmiana*, which is naturalised near Port Elizabeth, Eastern Cape Province, South Africa, is one of the species from which the fermented drink pulque is obtained.

Figure 19. A young specimen of *Agave americana* growing in an urn-shaped, Romanesque pot on a pillar of a fence surrounding a public park in the south-central Portuguese university town of Évora.

Figure 20. *Agave americana* [subsp. *americana*] var. *expansa* naturalised near Hout Bay in South Africa's Western Cape Province.

tion of origin on 03 March 1995. However, Reinet Distillers carried on with their plans to produce alcohol from *Agave americana*, although they no longer intended calling the drink they anticipated producing from it, tequila. Interestingly, coinciding with this period, annual tequila production in Mexico nearly doubled (Bowen, 2015: 66, 69).

In July 1999, one year after the first alcohol should have been produced from *Agave americana* by what was now called Reinet Distillers, it was announced that the distillery had been unable to start production as a result of what was referred to as technical problems (Breytenbach, 1999a). The distilling equipment had been imported from Portugal from Cosvalado-Comércio de Serviços Vitivinícolas e Alimentares, SA. The technical problems apparently related to the pressure cooker of the still not complying with South African safety standards, which, according to Mr Venter of Reinet Distillers, prevented the distillery from initiating production. Reinet Distillers therefore applied for an urgent court order in the Cape High Court against Cosvalado to prevent further payments (about ZAR3.0 million; see Breytenbach, 1999b) being made to the company.

Three days later on 16 July 1999 it was reported that Cosvalado-Comércio de Serviços Vi-

tivinícolas e Alimentares, SA, was opposing the court order as their attorney in Cape Town, Mr Basilio de Sousa, stated that the distillation of alcohol could indeed be initiated, and that the pressure cooker should be used as an open cooker (Breytenbach, 1999b).

By August 1999 the court matter that had to determine who will be held responsible for the required changes to the equipment at the distillery had not yet been settled (Sundstrom, 1999). Mr Venter of Reinet Distillers maintained that "…production [of alcohol] could not be started until the problems with the equipment, which was not up to South African safety standards, were sorted out". By then Reinet Distillers was "…suffering financially…" as the company, which had hoped to list on the Johannesburg Stock Exchange, was "…losing thousands of rands in earnings each day" (Sundstrom, 1999). At this stage it was noted that, once operational, the distillery will produce organic alcohol for use in French perfumes, as well as an alcoholic drink, "Spirit of the Blue Agave", which was intended to be similar to the Mexican spirit, tequila. By now the two-storey, bricks-and-mortar distillery (Figure 23), which was built on 20 hectares of land purchased from a nearby farmer, Mr T.E.T. (Everitt) Murray, was surrounded by tidy rows of young, recently established plants of *Agave americana* (Figures 25 & 26).

Given the financial difficulties experienced by Reinet Distillers as a result of "…faulty equipment…" (Theodosiou, 2000), the company, by this time a ZAR20.0 million venture, was liquidated in December 1999 without having produced a single drop of alcohol.

In mid-May 2000 the Geneva, Switzerland-headquartered Rockwood Group of Companies learned that the distillery was for sale and purchased it (ECN, 2000). The distillery was renamed Agave Distillers, and by mid-October 2000 the first alcohol for use in 'Spirit of the Blue Agave' was finally distilled at Graaff-Reinet (Theodosiou, 2000). Operating in 30 countries, Rockwood specialises in alcohol trading, and managing distilleries and bottling facilities. It was anticipated that most of the 'Spirit of the Blue Agave' produced would be for the export market, with the South African market receiving the product by January or February 2001, three years after the factory was first built.

No longer calling it by the rather unwieldy name of 'Spirit of the Blue Agave', Agave Distillers named the bottled spirit 'Agava', obviously alluding to the genus name *Agave*, and essentially produced two products: 'Agava Silver' and 'Agava Gold' (Figure 27). The former was a clear spirit, while the latter had been rested in oak. 'Agava Gold' has been compared with premium Mexican tequilas and found by numerous consumers in blind tastings to be equal to, and even better than, premium Mexican tequilas (see http://www.ianchadwick.com/tequila/rsa.htm; Fourie, 2002). The methods used for producing 'Agava' were tequila-like and this clearly created a taste profile akin to tequila as opposed to mezcal. Perhaps not entirely unexpectedly, use of the name 'Agava' for the Graaff-Reinet product was also not without controversy, as the derivation of the name from the scientific genus name also raised eyebrows in Mexico (Basson, 2002). Regardless, during 2002 the distillery was doing well, to the point where additional agave piñas for preparation for distillation were being sought (Medewerker, 2002). Sales of 'Agava' were promising, with a distribution volume of 1,500 12-bottle cases per month anticipated for December 2002, and beyond (Pughe-Parry, 2002). By now Agava Distillery was again a 100% South Africa-owned business, after the Rockwood group was bought out at the beginning 2002 (Pughe-Parry, 2002).

In July 2003 (Anonymous, 2004), and again in February 2005 (Brand, 2005), it was announced that South African and overseas investors would be invited to purchase a stake in Agave Distillers. Up to early 2008, alcohol was distilled at Graaff-Reinet, and in South Africa, 'Agava' was stocked by the retailers Ultra Liquors, Spar Tops, and Preston's. Further building of a reputation for 'Agava' was intended through, inter alia, securing overseas distributers, and exporting to international markets such as the USA, Canada, the United Kingdom, Australia, New Zealand, Barbados, the Philippines, China, the Dominican Republic, Europe, and even Mexico (see http://www.ianchadwick.com/tequila/rsa.htm; Basson, 2002; Fowler, 2003). In this regard, a mission to a number of northern hemisphere countries, including Canada, the United Kingdom, and the USA in early 2005 elicited considerable interest from these potential markets (Anonymous, 2005a, 2005b). Agave Distillers, however, decided against selling shares in the company through a public process, which would have required the issuing of a registered prospectus; instead they opted to privately sell shares. The capital raised was intended for expanding its overseas operations (Anonymous, 2005b). The possibility of using the agave harvested for biofuel production, with an anticipated 100 litres of alcohol being obtained per metric ton was also considered (Medewerker, 2006).

Following the suicide of the then director of Agave Distillers, Mr Jan Terblanche, on 29 Janu-

Figure 21. This Karoo plain stretches from New Bethesda near Graaff-Reinet towards Middelburg, in the Eastern Cape. The area is host to a multitude of aromatic 'karoobossies' on which sheep and goats graze.

Figure 23. The white, two-story building housed the still of Reinet Distillery. Spandau Kop [Afrikaans: Spandaukop], a well-known land feature near Graaff-Reinet, is visible on the skyline directly behind the building. The distillery is surrounded by an extensive, recently established (as of date of image) plantation of young *Agave americana* plants, called 'hijuelos' in Mexico. Photograph taken on 08 November 1999.

Figure 25. A young plantation of *Agave americana*. Note that many of the plants have been uprooted and destroyed by small mammals from the surrounding veld.

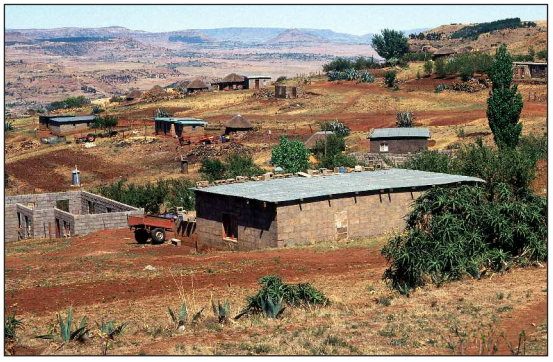

Figure 22. In the mountain Kingdom of Lesotho *Agave americana* is widely planted as a kraal fence, often along with *Aloiampelos striatula* (Haw.) Klopper & Gideon F.Sm.

Figure 24. In this clump, harvesting of the piñas of *Agave americana* for transporting to the distillery of Reinet Distillers near Graaff-Reinet has commenced. Much of the discarded leaf material was left in the veld.

Figure 26. A plantation of *Agave americana* consisting of somewhat older, established plants.

ary 2008, the fortunes of Agave Distillers became "…wound up in an estate" (Du Toit, 2016). The distillery was closed and placed under provisional liquidation at the request of its creditors, including former Dimension Data executive Keith McLachlan (Barnes, 2008). Over the previous "…few years, Agave [Distilleries] shares were sold to the public by brokers from Capital Commitments, of which Terblanche was the chief executive officer" (Barnes, 2008).

Finally, about 15 months later, the liquidators, Mr Bryan Shaw of Progressive Administration, and Mr Raymond Fenner, requested that the immovable property, fixed assets (including the factory), equipment, recipes, and trade mark, be sold on public auction (ClareMart Auction Group, 2009). In June 2009 it was reported that the distillery was sold by public auction for ZAR5.6 million to two separate buyers, the fixed property to a buyer from Graaff-Reinet, while the brand, recipes, and movables apparently went to a Gauteng [a province in north-central South Africa] distiller for ZAR3.6 million.

Conclusion

Between 1995 and 2008 tequila production tripled—in 2008 an astonishing 300 million litres were produced—at the time making spirits derived from agave heart distillation one of the fastest-growing liquor categories globally (Bowen, 2015: 27). Given the enormous demand for such spirits at exactly the time that the Reinet Distillers failed, there was seemingly no rational commercial reason why the production of a tequila-like drink ('Agava') should not have succeeded.

Breaking into any market, such as commercial liquor consumption, where strong brand support and loyalty often reign supreme, is not for the faint of heart. Few new products can claim success in this demanding area. (The South African cream liqueur product 'Amarula'®, which is based on the fruit of *Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro, is an exception.) Establishing the association of quality with, and concomitant recognition of, a new brand is usually a maddeningly slow process that can progress organically or through dedicated marketing and advertising. For a new product to obtain market share, marketing, distribution, and customer care, are key considerations as far as securing both national and international acceptance are concerned. Marketing in turn relies heavily on image and packaging. For example, many tequila consumers regard the *Agave* species from which tequila and mezcal are produced as a 'cactus', which accounts for the image of a cowboy cactus, *Carnegiea gigantea* (Engelm.) Britton & Rose, on the labels of, not only 'Agava', but also some brands of bottled tequila (Figure 17). From 2001 onwards Agave Distillers conducted an aggressive marketing and advertising campaign in the print media aimed at, and reaching, numerous high-end markets, such as *Sawubona*, the South African Airways inflight magazine (Du Toit, 2003; Main Line Media, 2003), the *Sunday Times* newspaper (Pendock, 2001), *Good Taste*, the official journal of the wine of the month club (Biggs, 2004), and *RB Restaurant Business*, a magazine for the food-services industry (Davis, 2005). Electronic media was also targeted (see for example http://www.southafrica.info/business/trade/export/agave-301007.htm#.WC8msbJ97IU).

Regardless of the efforts to create local and international markets for 'Agava', this venture proved to be short-lived. For about a decade it provided the hope that it would be an injection of capital for farming and town communities in the Karoo, especially around Graaff-Reinet. The fact that the drink could not be called tequila underscored the importance of having had appellation of origin status awarded to tequila in 1974, and mezcal in 1994. It should also be recognised that tequila has become closely associated with, and an enduring symbol of, what is generally known as 'Mexicanness', or 'lo mexicano' (Gaytán, 2014: 6).

The first law that tied the production of food or drink to a specific place was passed in France in 1905, and winemakers in Champagne, France, were the first to use it to protect their wine (and eventually other products, such as cheese); this constituted the initiation of the concept of "appellation d'origine", or appellation of origin. In 1974, tequila became the first product from beyond Europe to be protected by a denomination of origin (DO) (Bowen, 2015: 4, 40), a term used in a similar sense as 'appellation of origin'. Having a DO awarded to a certain place gives that place the right to produce a certain drink or food item that has a unique characteristic or taste derived from natural or human factors. In general, an important principle of a DO is therefore that certain places (including climate and soil, for example), and production practices justify being protected, as these impart the unique taste of a food or drink. Notably though, the DO for tequila is largely silent on how it is to be made, which has resulted in distilleries moving away from traditional practices to more industrialised ones that are more profitable, but has the inherent risk of negatively impacting on the flavour of tequila (Bowen, 2015: 77, 83). A further advantage of a DO is that it has the potential to initiate 'product' tourism; i.e., discerning users increasingly want to see and expe-

rience the place of origin of a favoured product. Tequila's DO further prevented "…producers in places like South Africa or Spain from selling ***fake*** tequila." [emphasis added] (Bowen, 2015: 70). Arguably, without brand protection for tequila and mezcal, the outcome of the Graaff-Reinet-based agave alcohol business may well have been different.

In 2011, the Mexican Institute of Industrial Property, which manages DOs in that country, made a proposal to brand the word 'agave' for the exclusive use of producers associated with existing DOs, such as those for tequila and mezcal. Shortly thereafter a proposal was made that suggested that all agave spirits produced outside of the DOs should be labelled as 'Agavaceae', i.e., the (still widely used) scientific name of the Century plant family (Bowen, 2015: 156). However, about a year later, in late-2012, the Mexican Congress recommended "…that the proposal […] be withdrawn" (Bowen, 2015: 159). If this proposal succeeded, it would have had an impact on especially small-scale producers in non-DO regions of Mexico in that they would have been prohibited from using the word 'agave' on the labels of their oftimes 100% agave liquor products.

The DO for tequila is very specific as far as the species to be used for tequila production is concerned; it must be *Agave tequilana*, variously known in the vernacular in English as blue agave and in Spanish as agave azul. This inevitably gave rise to the establishment, at least in the area defined by the DO (see **Background** above), of an agave monoculture consisting almost exclusively of this species, with many specimens established in plantations being of the same age. As in, for example, commercial forestry where a single species or cultivar is planted in enormous blocks for paper and pulp or mine prop production, managing a monoculture brings its own challenges, such as controlling its susceptibility to infestations by host-specific insect, fungal, and bacterial pests. Karoo farmers with stands of *A. americana* should be particularly vigilant to the possible spread of the agave snout weevil, which is known to be enormously destructive once established in a collection (Smith *et al*., 2012). Such infestations easily give rise to secondary infections that can be even more destructive and spread exceedingly rapidly (Figure 28).

In its native Mexican habitats there is some concern regarding the sustainability of harvesting agave piñas from natural populations for mezcal production, especially in the case of small-growing species, such as *Agave potatorum* Zucc. (Figures 29 & 30), which is commercially known as 'tobala' (Mahr, 2015). Given that *A. americana* is a naturalised alien in South Africa's Karoo, its 'wild'-harvesting from pockets where it became established would have had a minimal, if any, impact on local biodiversity. It is likely though that on-going demand for raw material for ultimate distillation into a tequila-like drink, would have given rise to the deliberate establishment of more, and larger, plantations of *A. americana* in the Graaff-Reinet district and beyond.

Recently (December 2016), the introduction of a new distilled product, called 'La Leona', which is made from "100% Karoo agave", was announced (see https://www.laleona.co.za/). La Leona is produced from agave from Graaff-Reinet at Northside Distributors (Totpak) in Ventersdorp, in the North-West Province of South Africa, for Sarah Kennan (Tim Murray, personal communication). In addition, an anti-itch and skin care cream, Agavesol, based on *Agave americana* from Graaff-Reinet, was recently launched (see https://agavesolcream.wordpress.com/), and, when available, pickled agave flower buds are being bottled and sold by the Murray family of Roode Bloem, a farm in the Graaff-Reinet district (Du Toit, 2016). As the Karoo has given its name to at least one product, 'Karoo lamb' (see **Distribution of *Agave americana* in South Africa** above), it may be wise to formally and permanently link the name of this region of South Africa to locally grown 'agave' as well.

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References

Aguirre Rivera, J.R., Charcas Salazar, H. & Flores Flores, J.L. (2001). *El maguey mezcalero potosino*. Consejo Potosino de Ciencia y Tecnología, Gobierno del Estado de San Luis Potosí & Instituto de Investigación de Zonas Desérticas, Universidad Autónoma de San Luis Potosí, San Luis Potosí.

Anonymous. [Reuter]. (1998). SA firma laat vaar sy tequila-planne. *Beeld* [*Sake-Beeld*] Maandag, **23 Februarie 1998**: 2.

Anonymous. [Environment Writer]. (2000a). Mbeki declares war on SA's alien plants. *Cape Argus* Friday, **25 February 2000**: 4.

Anonymous. [Reuters]. (2000b). Special police guards for in-demand tequila plant. *Pretoria News* Thursday, **10 August 2000**: 8.

Anonymous. [South African Press Association; SAPA]. (2001). Alien plant clearance plan for

Figure 27. Oak-aged 'Agava' Gold (left) and 'Agava' Silver (right). Both products were sold at 43% alcohol per volume.

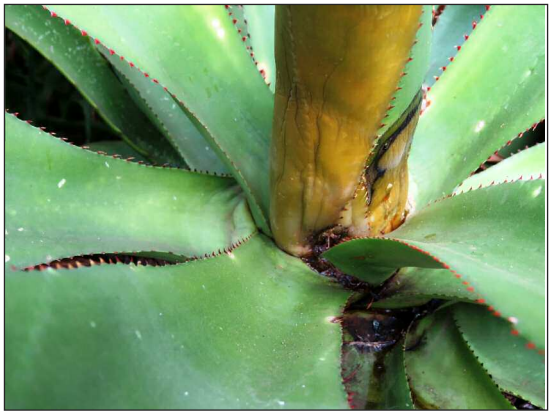

Figure 28. A specimen of *Agave obscura* Schiede that was attacked by the agave snout weevil. The plant suffered an almost immediate and aggressive secondary fungal infection that destroyed the central leaf cone within days.

homeowners. Legislation will compel sellers to remove invaders. *The Star* Tuesday, **06 February 2001**: 5.

ANONYMOUS. [SOUTH AFRICAN PRESS ASSOCIATION; SAPA-DPA]. (2002). Hand me down that bottle of tequila. *The Star* [*The Star*'s 'Tonight wine and dine' section.] **11 January 2002**: 12.

ANONYMOUS. (2004). Hardehout uit aalwynsap. [Image and caption only, containing invitation for investment in Agave Distillers]. *Die Burger* **04 July 2003**.

ANONYMOUS. (2005a). SA se 'tequila' kry kontrakte. *Die Burger* [*Sake-Burger*] **07 Maart 2005**: S12.

Figure 29. A specimen of *Agave potatorum*, tobala, about to start pushing up an inflorescence pole. The piñas derived from this species are much smaller than those obtained from *A. americana* and *A. tequilana*, for example.

Figure 30. Close-up of the inflorescence of *Agave potatorum*, tobala.

ANONYMOUS. (2005b). Beleggers dors vir tequila-aandele. *Die Burger* [*Sake-Burger*] **05 Junie 2005**: S9.

ANONYMOUS. (2016). Oh margarita! *High Life* [in-flight magazine of British Airways] **February 2016**: 18.

BADENHORST, E. (1999). The best in the west. *Sawubona* **June 1999**: 50–56, 58, 60, 62–63.

BARNES, C. (2008). Bad hangover for Cape tequila producers. *Saturday Star* **Saturday 15 March 2008**: 4.

BASSON, J. (2002). Virus in Meksiko kan SA se tequilabedryf stu. *Die Burger* **05 November 2002**.

BATRES, V., BRAHIM, M.B. & BUCHANAN, R. (2000). Tequila's happy hour. *Ingens Bulletin* **23**: 21–23 [reprinted in *Ingens Bulletin* with acknowledgement to *Time*, 27 March 2000).

BEINART, W. & WOTSHELA, L. (2011). *Prickly pear. The social history of a plant in the Eastern Cape*. Wits University Press, Johannesburg.

BIGGS, D. (2004). *Aribba* Agava! The Karoo tequila. *Good Taste* (*The official journal of the wine of the month club*) No. **169** (January/February 2004): 86–90.

BOWEN, S. (2015). *Divided spirits. Tequila, mezcal, and the politics of production*. University of California Press, Oakland, California.

BRAND, N. (2005). SA se 'tequila'-vervaardiger sê Mexikane die stryd aan. *Die Burger* **02 February 2005**.

BREYTENBACH, W. (1999a). Karoo garingboom-aanleg in knyp. *Die Burger* **13 Julie 1999**.

BREYTENBACH, W. (1999b). Oos-Kaap groep kán glo alkohol vervaardig. *Die Burger* **16 Julie 1999**.

CHINNOCK, R.J. (2015). Feral opuntioid cacti in Australia. Part I. Cylindrical-stemmed genera: *Austrocylindropuntia*, *Cylindropuntia* and *Corynopuntia*. *Journal of the Adelaide Botanic Gardens* Supplement **3**: 1–69.

CLAREMART AUCTION GROUP. (2009). Veilings/Auctions. Tequilafabriek buite Graaff-Reinet te koop. *Die Burger* **Saterdag 02 Mei 2009**: 6.

CLOUT, M. (1995). Introduced species: the greatest threat to global biodiversity? *Species* **24** [June 1995]: 34–36.

COMISIÓN NACIONAL PARA EL CONOCIMIENTO Y USO DE LA BIODIVERSIDAD (CONABIO). (2006). *Agave. Mezcales y diversidad*. Secretaria de Medio Ambiente y Recursos Naturales, Fundación Ford, y Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México.

CORCUERA, S. DE MANCERA. (2000). El pulque, su uso y abuso. In: A.M. PÉREZ ROCHA (ED.), *Maguey. Arte tradicional de México*. Revista Libro Número **51**: 54–63. Artes de México y del Mundo, S.A. de C.V., México, D.F.

DAVIS, D. (2005). Tequila, its history, facts and second home in the Karoo. *RB Restaurant Business* **January 2005**: 34–35.

DAVIS, S.C., GRIFFITHS, H., HOLTUM, J., LARQUÉ SAAVEDRA, A. & LONG, S.P. (2011). Editorial. The evaluation of feedstocks in GCBB continues with a special issue on *Agave* for bioenergy. *GCB* [*Global Change Biology*] *Bioenergy* **3**: 1–3.

DU TOIT, J. (2003). Mexican waive. *Sawubona* **March 2003**: 64, 66.

DU TOIT, J. (2016). The darling buds of tequila. *Sunday Times* [*Combined metros*] **13 July 2016**: 52.

ECN. (2000). Switsers koop aanleg vir garingboom-alkohol. *Die Burger* **22 Mei 2000**.

FORSTER, P.I. (1996). Naturalised succulents in the Australian flora. *Haseltonia* **4**: 57–65.

FOURIE, E. (2002). SA 'tequila' is kragtiger. *Die Burger* [*Naweekjoernaal*-seksie] Saterdag **17 August 2002**: 1.

FOWLER, M. (2003). SA tequila lok buitelanders. *Die Burger* [*Sake-Burger*] **23 Januarie 2003**: S2.

GAYTÁN, M.S. (2014). *¡Tequila! Distilling the spirit of Mexico*. Stanford University Press, Stanford, California.

GENTRY, H.S. (1982). *Agaves of continental North America*. The University of Arizona Press, Tucson.

GONZÁLEZ ELIZONDO, M., GALVÁN VILLANUEVA, R., LÓPEZ ENRIQUEZ, I.L., RESÉNDIZ ROJAS, L. & GONZÁLEZ ELIZONDO, M.S. (2009). *Agaves. Magueyes, lechuguillas y noas del Estado de Durango y sus alrededores*. CIIDIR Unidad Durango, Instituto Politécnico Nacional, Durango, Dgo., México & Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), Tlalpan, México, D.F., México.

HENDERSON, L. (2001). *Alien weeds and invasive plants. A complete guide to declared weeds and invaders in South Africa*. Plant Protection Research Institute Handbook No. **12**: 1–300. Plant Protection Research Institute, Agricultural Research Council, place of publication not stated.

HOCHSTÄTTER, F. (2015). *Agave* Linné (Agavaceae). Privately published on the web at: http://fh-navajoirt.org/Agave.pdf

JOUBERT, M. (2002). Van alle kante. Tequila se skop is nie regtig so erg as wat sommige beweer, en die wurm… *Die Burger* **04 Februarie 2002**.

KANT, P. (2010). Could agave be the species of choice for climate change mitigation? *IGREC [Institute of Green Economy] Web Publication* No. **11/2010** [September 13, 2010]. 4 pp.

MACGREGOR, D. (1997). Karoo tequila? 'No way, José', says Mexico, and Mr Venter is right in the centre. *The Saturday Star* **October 18, 1997**: 5.

MAHR, D. (2015). Production of artisanal mezcal, tequila's sassy little sister. *Cactus & Succulent Journal (U.S.)* **87**: 4–14.

MAIN LINE MEDIA. (2003). South African oddities and insights. *Sawubona* **February 2003**: 64.

MAROYI, A. (2006). Preliminary checklist of introduced and naturalised plants in Zimbabwe. *Kirkia* **18**(**2**): 177–247.

MARTINEAU, C. (2015). *How the gringos stole tequila. The modern age of Mexico's most traditional spirit*. Chicago Review Press Incorporated, Chicago.

MARTÍNEZ LIMÓN, E., CALDERWOOD, M. & MONSIVÁIS, C. (1999). *Tequila. Tradición y destino*. Segunda Edición. Revimundo, México.

MATTHEWS, S. & BRAND, K. (2004). *Africa invaded. The growing danger of invasive alien species*. Global Invasive Species Programme [GISP], place of publication not stated.

MCEVOY, J. (2014). *Holy smoke! It's mezcal. A complete guide from* Agave *to Zapotec*. Mezcal PhD Publishing, place of publication not stated.

MEDEWERKER. (2002). Verbouers soek dringend nog agave. *Die Burger* **27 Desember 2002**.

MEDEWERKER. (2006). SA nog ver van mieliepetrol. Garingboom as bron kry nou aandag. *Die Burger* [*Agri-nuus* / *Agri news*] **Donderdag 27 Julie 2006**: 6.

MILTON, S.J. & DEAN, R.J. (1998). Alien plant assemblages near roads in arid and semi-arid South Africa. *Diversity & Distributions* **4**: 175–187.

MORALES, M. (2011). As demand for tequila surges, sustainable practices follow. *USA Today* [An independent supplement by Mediaplanet]. **April 2011**: 8.

MUSIL, C.F. & MACDONALD, I.A.W. (2007). *Invasive alien flora and fauna in South Africa. Expertise and bibliography*. SANBI Biodiversity Series **6**: 1–176. South African National Biodiversity Institute, Pretoria.

NEL, J.L., RICHARDSON, D.M., ROUGET, M., MGIDI, T.N., MDZEKE, N., LE MAITRE, D.C., VAN WILGEN, B.W., SCHONEGEVEL, L., HENDERSON, L. & NESER, S. (2004). A proposed classification of invasive alien plant species in South Africa: towards prioritizing species and areas for management action. *South African Journal of Science* **100**: 53–64.

NEVAER, L.E.V. (2013). *Mezcal. Under the influence of firewater*. Hispanic Economics, Inc., Coral Gables, Florida, USA.

NOBEL, P.S. (2010). *Desert wisdom. Agaves and cacti: CO_2, water, climate change*. iUniverse, Inc., New York.

ORELLANA, M. DE. (1999). El agave tenaz. Microhistoria del tequila: el caso Cuervo. In: G. OLMOS (ED.), *El tequila. Arte tradicional de México*. Revista Libro Número **27**: 28–35. Artes de México y del Mundo, S.A. de C.V., México, D.F.

PENDOCK, N. (2001). Drink. Karoo sunrise. With the world in the grip of a tequila shortage, a local distiller is garnering new interest. *Sunday Times* [*Lifestyle* section] **Sunday 21 October 2001**: 22.

PÉREZ ROCHA, A.M. (ED.). (1998). *Guadalajara*. Revista Libro Número **41**: 1–96. Artes de México y del Mundo, S.A. de C.V., México, D.F.

POWRIE, L. (2004) *Common names of Karoo plants*. G. GERMISHUIZEN & E. DU PLESSIS, (EDS). Strelitzia **16**: 1–199. National Botanical Institute, Pretoria.

PUGHE-PARRY, M. (2002). Karoo 'tequila' can light a fire in a cold man's soul. There's gold in our *garingboom*. *Weekend Argus* [*LIFEetc*. Section]. **30 November 2002**: 33.

SALINAS PEDRAZA, J. (2000). Testimonio de un otomi. In: A.M. PÉREZ ROCHA (ED.), *Maguey. Arte tradicional de México*. Revista Libro Número **51**: 30–45. Artes de México y del Mundo, S.A. de C.V., México, D.F.

SHACKLETON, C.M., MCCONNACHIE, M., CHAUKE, M.I., MENTZ, J., SUTHERLAND, F., GAMBIZA, J. & JONES, R. (2006). Urban fuelwood demand and markets in a small town in South Africa: livelihood vulnerability and alien plant control. *International Journal of Sustainable Development and World Ecology* **13**: 1–11.

SHACKLETON, C.M., MCGARRY, D., FOURIE, S., GAMBIZA, J.,SHACKLETON, S.E. & FABRICIUS, C. (2007). Assessing the effects of invasive alien species on rural livelihoods: case examples and a framework from South Africa. *Human Ecology* **35**: 113–127.

SHACKLETON, C.M., SHACKLETON, S.E., GAMBIZA, J., NEL, E., ROWNTREE, K., URQUHART, P., FABRICIUS, C. & AINSLIE, A. (2010). *Livelihoods and vulnerability in the arid and semi-arid lands of southern Africa*. [Series: Hunger and Poverty: causes, impacts and eradication]. Nova Science Publishers, Inc., New York.

SILVA, V., FIGUEIREDO, E. & SMITH, G.F. (2015). Alien succulents naturalised and cultivated on the central west coast of Portugal. *Bradleya* **33**: 58–81.

SLABBERT, A. (2007). Groenbou nie net 'n klomp strooi nie. *Die Burger* **15 Junie 2007**.

SMITH, G.F. (2011). Agavaceae Dumort. In: M. WALTERS, E. FIGUEIREDO, N.R. CROUCH, P.J.D. WINTER, G.F. SMITH, H.G. ZIMMERMANN & B.K. MASHOPE, *Naturalised and invasive succulents of southern Africa*. Pp. 34–63. ABC Taxa **11**. The Belgian Development Cooperation, Brussels.

SMITH, G.F. & FIGUEIREDO, E. (2007). Naturalized species of *Agave* L. (Agavaceae) on the south-eastern coast of Portugal. *Haseltonia* **13**: 52–60.

SMITH, G.F. & FIGUEIREDO, E. (2011). *Agave americana* L. (subsp. *americana*) var. *expansa* (Jacobi) Gentry (Agavaceae) naturalized in South Africa. *Bradleya* **29**: 67–72.

SMITH, G.F. & FIGUEIREDO, E. (2012). A further species of *Agave* L., *A. salmiana* Otto ex Salm-Dyck (subsp. *salmiana*) var. *salmiana* (Agavaceae), naturalised in the Eastern Cape Province of South Africa. *Bradleya* **30**: 179–186.

SMITH, G.F. & FIGUEIREDO, E. (2015). Notes on *Agave weberi* J.F.Cels ex J.Poiss. (Agavaceae), a large-growing species with invasive tendencies in southern Africa. *Bradleya* **33**: 161–170.

SMITH, G.F., FIGUEIREDO, E., KLOPPER, R.R., CROUCH, N.R., JANION, C. & CHOWN, S.L. (2012). A new specific host for the agave snout weevil, *Scyphophorus acupuntatus* Gyllenhal, 1838 (Coleoptera: Curculionidae) in South Africa: a destructive pest of species of *Agave* L. (Agavaceae). *Bradleya* **30**: 19–24.

SMITH, G.F. & KLOPPER, R.R. (2007). Naturalised species of *Agave* L. (Agavaceae) in the Cape Floristic Region, South Africa. *Bradleya* **25**: 193–195.

SMITH, G.F. & MÖSSMER, M. (1996). *FSA* contributions 4: Agavaceae [*Agave americana*; *Agave sisalana*]. *Bothalia* **26**: 31–35.

SMITH, G.F., WALTERS, M., FIGUEIREDO, E. & KLOPPER, R.R. (2008). Naturalised species of *Agave* (Agavaceae) in the Eastern Cape Province of South Africa. *Bradleya* **26**: 33–40.

STEWART, A. (2013). *The drunken botanist. The plants that create the world's great drinks*. Algonquin Books of Chapel Hill, Chapel Hill, North Carolina.

STIEMIE, M. (1997). Tequila in 1998 op G-Reinet gemaak. *Die Burger* **15 September 1997**.

SUNDSTROM, K. (1999). New hitch for Karoo's agave distillery plant. *Evening Post* **14 August 1999**: 10.

THEODOSIOU, R. (2000). Spirited comeback for troubled 'tequila' distillery. New liquor to hit world's bottle store shelves soon. *East Cape Weekend* **11 November 2000**.

THIEMER-SACHSE, U. (2008). «San Lunes" – eine kulturgeschichtliche Betrachtung zur Pulque-Agave und zum traditionellen Rauschgetränk Pulque in Mexiko. / «San Lunes" – Thoughts on the cultural history of pulque-agave (maguey) and the traditional intoxicating beverage pulque in Mexico. *Schumannia* **5**: 191–206.

VAN WYK, A.E. [BRAAM] & SMITH, G.F. (2001). *Regions of floristic endemism in southern Africa. A review with emphasis on succulents*. Umdaus Press, Hatfield, Pretoria.

VALENZUELA-ZAPATA, A. GUADALUPE & NABHAN, G.P. (2003). *¡Tequila! A natural and cultural history*. University of Arizona Press, Tucson.

VÁSQUEZ-GARCÍA, J.A., CHÁZARO B., M. DE J., HERNÁNDEZ VERA, G., FLORES BERRIOS, E. & VARGAS-RODRÍGUEZ, Y.L. (2007). *Agaves del Occidente de México*. Série Fronteras de Biodiversidad, volume **3**. Análisis y Síntesis. Universidad de Guadalajara-CUCBA, Universidad de Guadalajara-CUCSH, Consejo Regulador del Tequila, A.C, Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco, A.C., Department of Biological Sciences, Louisiana State University, Comisión Nacional Forestal, México.

WALTERS, M., FIGUEIREDO, E., CROUCH, N.R., WINTER, P.J.D., SMITH, G.F., ZIMMERMANN, H.G. & MASHOPE, B.K. (2011). *Naturalised and invasive succulents of southern Africa*. ABC Taxa **11**. The Belgian Development Cooperation, Brussels.

WEBER, E. (2000). Switzerland and the invasive plant species issue. *Botanica Helvetica* **110**: 11–24.

WEBER, F.A.C. (1902). Notes sur quelques Agaves du Mexique occidental et de la Basse-Californie. *Bulletin du Muséum national d'histoire naturelle* (Paris) **8(3)**: 220–223, f. 1–2.