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Gardea, Alfonso A.; Findley, Lloyd T.; Orozco-Avitia, J. Antonio; Bañuelos, Noemí; Esqueda, Martín; Huxman, Travis H.

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Bacanora and Sotol: So Far, So Close

Bacanora y sotol: tan lejos y tan cerca

Alfonso A. Gardea[*1]
*Lloyd T. Findley**
*J. Antonio Orozco-Avitia***
*Noemí Bañuelos***
*Martín Esqueda***
Travis H. Huxman[1]

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* Coordinación Académica Guaymas, CIAD
** CIAD, Unidad Hermosillo
[1] Biósfera 2, Universidad de Arizona

Dirección para correspondencia:
gardea@ciad.mx (Alfonso A. Gardea)

Resumen / Abstract

El propósito de este trabajo es familiarizar al lector con algunos aspectos relacionados, no sólo con dos bebidas alcohólicas de profundo arraigo en la cultura rural del México norteño, sino también con Agave angustifolia, conocido en Sonora como "agave (o mezcal) bacanora"; y un grupo de especies del género Dasylirion, conocido en México como "sotoles", y "desert spoon" o ¨cuchara del desierto¨ en los Estados Unidos de América. Ambas comparten múltiples características morfológicas, fisiológicas y ecológicas que les permiten vivir en ambientes áridos. De igual forma, también intenta señalar aspectos únicos de las dos denominaciones de origen que protegen la elaboración de esas bebidas y que han surgido en los albores de este siglo, así como a las normas que rigen su elaboración.

Palabras clave: *Agave angustifolia*, *Dasylirion* spp., bacanora, sotol, desert spoon, normas (reglas), denominaciones de origen.

The aim of this paper is to familiarize the reader with two alcoholic spirits deeply rooted in the rural culture of northern Mexico, as well as Agave angustifolia, known as "agave (or mescal) bacanora" in Sonora; and a group of species in the genus Dasylirion, known in Mexico as "sotols", and as "desert spoon" in the USA. Both share multiple morphological, physiological and ecological traits, which allow them to thrive in their arid environs. It also points out aspects unique to the two designations of origin that protect the elaboration of these distilled spirits, both formulated near the beginning of this century, as well as the sets of regulations specifying the standards for processing.

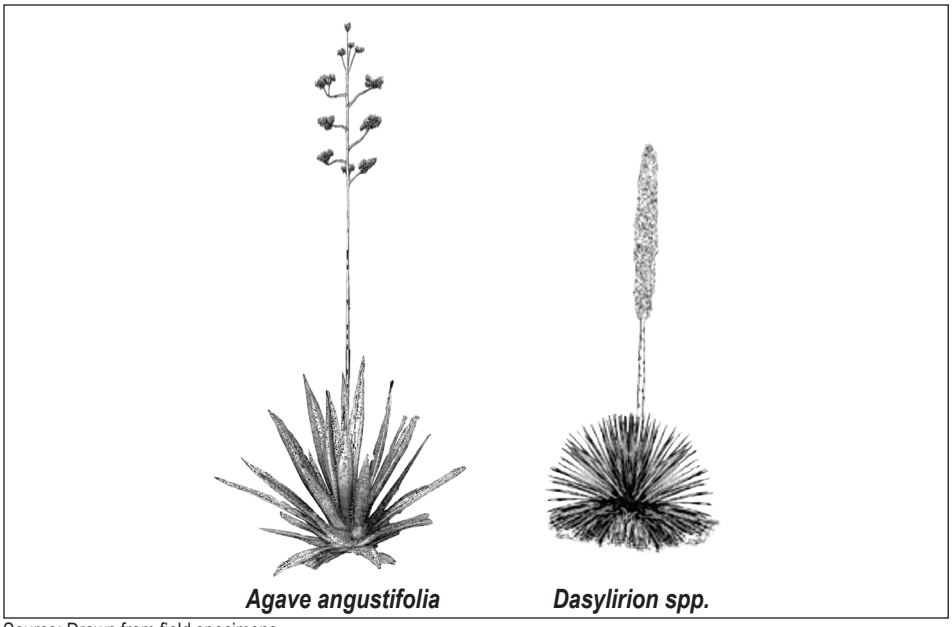
Key words: *Agave angustifolia*, *Dasylirion* spp., bacanora, sotol, desert spoon, norms (regulations), designations of origin.

Geographical distributions and ecology

The varieties of plants from which bacanora and sotol spirits are made (Figure 1) evolved in parallel manner in the arid regions of northern and northwestern Mexico and extending into the southwestern USA (Figure 2). *Agave angustifolia (sensu lato),* with its many varieties, possesses wide adaptability to different ecosystems and thus has wide distribution, extending from Costa Rica in the south to the Sonoran Desert in the north (Figure 2; Gentry, 1982; Shreve and Wiggins, 1964; Turner et al., 1995). The genetic variability found in *A. angustifolia* suggests that it is the result to adaptation to biotic and abiotic factors present in its range (Barraza-Morales et al., 2006). For a more detailed inventory of Agavaceae and Nolinaceae in central México, see Golubov et al. (2007). In northwestern Mexico, the agave bacanora, as it is known in Sonora, is widespread from arid coasts of the Sea of Cortez up and into the western slopes of the Sierra Madre Occidental, extending its presence into canyon bottomlands of the neighboring state of Chihuahua (Gentry, 1982; Olhagaray, 1994; Martin et al., 1998). Genetic studies of wild *A. angustifolia* populations in the Sonoran Desert demonstrated that a wide variation exists and speciation is under way, that is, populations are still actively evolving (Sánchez-Treyer et al., 2009). Compared to species of *Dasylirion, Agave angustifolia* is a species with wider distribution and therefore with increased adaptability to different environmental conditions, including those tropical and subtropical. On the other hand, as opposed to species of *Dasylirion, A. angustifolia* does not develop cold-hardiness (Nobel and Smith, 1983) and cannot thrive in cold areas subjected to winter frosts. However, evidence exists suggesting that henequen agave (also known as sisal), *A. fourcroydes* Lem., evolved from *A. angustifolia,* demonstrating an interesting adaptive branching from the latter heat-adapted species (Colunga-García et al., 1999).

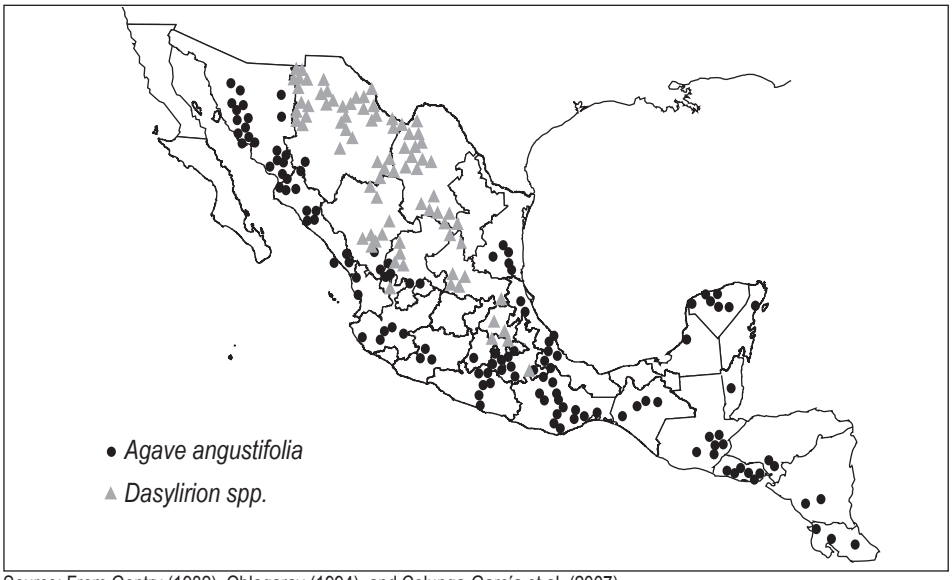
Sotol plants, in comparison, have a more restricted distribution. For practical purposes, most of the species placed in the genus *Dasylirion,* commonly referred

Figure 1. Typical appearance of plants used for bacanora *(Agave angustifolia)* and sotol (*Dasylirion* spp.) production. Both show reproductive stage of each plant. Harvesting for spirits production begins just before the formation of the flower/seed stalks shown here



Source: Drawn from field specimens.

Figure 2. Geographic distribution in Mexico and Central America of *Agave angustifolia* and *Dasylirion* spp.



Source: From Gentry (1982), Ohlagaray (1994), and Colunga-García et al. (2007).

to as sotols, are essentially endemic to the (higher) Chihuahuan Desert, although they can be found in the mountains of the Sierra Madre Occidental and descend (less abundantly) to the Sonoran Desert to the west, even reaching into southern Arizona where both deserts merge (Shreve and Wiggins, 1964). At their southern boundary, sotols are found in the Mexican state of San Luis Potosí and extend northward to the states of Coahuila, Chihuahua and Texas, while some populations may be found in Sonora, Arizona and New Mexico, as well. It is no coincidence that Big Bend National Park harbors extensive stands of naturally occurring sotols, which have remained mostly intact since they were not available for commercial extraction. For their ability to survive without irrigation, among other reasons, species of *Dasylirion* (with *D. wheeleri* being one of the most common species) are often employed as attractive ornamentals, and are one of the most conspicuous elements of urban and suburban landscapes in southern Arizona, for example.

History

The use of these two remarkable plant resources by humans dates from prehistoric times. Native Americans used them as sources of food, fiber, construction material, and –once their stored starches are cooked into sugars and fermented as alcoholic beverages– for ritual purposes (Hodgson, 2001). For some ethnic groups these resources played important roles not only in subsistence, but also in defining lifestyles, such as the Apache band known as "Mescaleros" (from mescal) (Basso, 1971; Robert and Robert, 2004). But even before them, archaeological evidence found at Paquimé (Casas Grandes in northwestern Chihuahua), for example, demonstrates the multiple uses of their fibers and other byproducts by ancient cultures of Aridamerica (Braniff, 2001, 2008).

Acknowledged by historians, the earliest ethnographic records regarding agave use were left by Jesuit missionaries; cornerstones allowing insight into what was then known as the Gran Chichimeca region of northern New Spain. Perhaps the three most important of such records are those left by Andrés Pérez de Rivas (1985) in 1646, Ignacio Pfefferkorn (1983, 1984) in 1794-1795, and Juan Nentuig (1977) in 1764. All agree that the use of agaves (often referred to as mescals) was far more extensive than the simple production of alcoholic beverages (including distilled spirits following the introduction of that process by the Spaniards). They were also used as food and medicines, and represented an important element of survival for regional indigenous groups such as the Pima, Ópata, Eudebe, Mayo, Yaqui, Seri and Guarijío. The following words of German Jesuit Ignacio Pfefferkorn are revealing:

> Mescal leaves are infallible against scurvy… You cannot find a better remedy to heal wounds… from its roots [sic, stem] a delicious spirit is distilled, even tastier than the best of rosolis. Be-

> sides reinforcing one's stomach, it stimulates appetite and is good as a digestive. The roots are also used as food, in fact, most people, particularly Indians, roast roots only for feeding purposes; they are sweet, nutritious and have the additional advantage of keeping without spoilage for several weeks. Therefore, these peoples like them very much and, practically, they constitute the daily staple for the Apache, in whose country, mescal grows better than in Sonora (Pfefferkorn, 1984: 73-74).

Modern ethnobotanic research has also documented the importance of agaves or mescal plants among the Seri, Guarijío and Mayo in Sonora. Gentry (1942) describes *Agave angustifolia* being used as food and spirits among the Guarijío and Mayo, as well as by the regional mestizos. Felger and Moser (1985), whose work among the Seri or Comca'ac resulted in the most complete ethnobotanic study in Northwest Mexico, confirmed that this species and other agaves are used as fermented beverages, food staples and even as a water substitute in times of emergency. Yetman and Vandevender (2002) reported that the Mayo use *A. angustifolia* as food and medicine and to make cordage, tools and other products such as carrying bags and handbags. At present, the Guarijío use three agave species to make a beverage known as ¨batari¨ (Martin et al., 1998). Even today, Sonoran Desert peoples use of agaves is widespread and meaningful. For example, Nabhan (1985) wrote that agaves

> ha[ve] been a caloric mainstay, a fiber, medicine, and ceremonial element in desert cultures. There persists little more than mere fragments of agaves' many uses scattered out among the indigenous cultures of the greater Southwest [USA] – an Apache family harvesting Agave parryi for food, hauling them in a pickup truck in central Arizona; an old Papago man planting bulbils [a type of vegetative reproduction] of Agave murpheyi at the Quitovac oasis; a Seri Indian using cooked Agave cerrulata leaves as an emergency source of potable liquids; a Warihio [Guarijío] using Agave vilmoriniana for soap along the Río Mayo; a Tepehuan weaver shaping handbags out of fiber from species in the Sierra Madres.

As regards the development of beverage spirits, although it is generally accepted that the arrival of Europeans to the New World and their introduction of distillation techniques made possible the production of the more potent alcoholic drinks that we know today, there is archaeological evidence that distillers were used by Philippine immigrants to produce coconut spirits as early as the late XVI century (Valenzuela-Zapata and Nabhan, 2003; Zizumbo-Villarreal and Colunga-García, 2007). As new technologies became available, those early techniques evolved and, in doing so, contributed to the elaboration and expression of the present Mexican identity. The prohibition of all alcoholic spirits by the Mexican government in the early 20th century (Salazar-Solano, 2007) did little to prevent the mescals bacanora and sotol from being produced and consumed, just as the similar Volstead Act around the same time in the USA largely failed to stop the smuggling of these beverages northward across the border on mule back (see more of this early "globalization" effort in Recio, 2002, and Annerino, 2008). Although for Americans such prohibition ended in 1933, in Mexico, the production of both bacano-

ra and sotol spirits remained illegal much longer (Salazar–Solano, 2007). Several reasons can be proposed to explain such a ban. However, it ended up by favoring the development of other beverages such as the so-called vino-mezcal produced from agave azul *(A. tequilana)* in and around Tequila in the state of Jalisco, today famously known as tequila, while harsher policies were enforced against the "moon-shining" production of the mescals bacanora and sotol in rural northern Mexico. The result is still noticeable today: while production of some spirits remained outlawed, the tequila industry began to flourish, developed its expertise in production and, as a result, a technological gap developed, as compared to those spirits whose production was still banned. This, in a way, resembled the colonial experience, when wine production in New Spain was banned to protect the powerful wine exporters in Spain who dominated that New World commerce.

However (and looking on the "bright side"), such a ban on the production of bacanora and sotol also kept them as a limited offer in the marketplace, which translated into less pressure on wild populations, which otherwise could have resulted in overexploitation of limited resources (Salazar-Solano and Mungaray-Lagarda, 2009; Núñez-Noriega, 2003). Nevertheless, the clandestine production of both of these spirits still threatens wild stocks and their value to the services their ecosystems provide, unless a careful and successful reforestation (replanting) can be achieved.

Aspects of taxonomy

Many morphologic characters and, increasingly, genetic components are taken into account when a species is identified and described. In agaves and dasylirions, the morphology of the flowers and the form and distribution of the leaves are particularly important, deserving of separate mention. Agave leaves are distributed around the bulbous stem (also called "cabeza") at precise angles of 137°, following the unique distribution discovered by Fibonacci in the 12th century (Cook, 1979; Nobel, 1988; Wade, 2006).

When legal documents employ scientific names (genus and species), taxonomy becomes more than a classificatory and nomenclatural science. For official norms (regulations, standards), taxonomy should serve as a reference, conditioning which species are to be used as raw materials for, in this case, the fermenting and distilling of alcoholic spirits. As stated by their respective Designations of Origin (DOs), bacanora and sotol can only be made from the species acknowledged in such regulations: only *Agave angustifolia* for bacanora, but several species of *Dasylirion* (most commonly *D. wheeleri*) for sotol, excluding those listed as protected. Although "specifically defined" from a legal standpoint, from a taxonomic viewpoint the higher classification of the plants in question is not that clear-cut (Table 1). What has been confounding to botanists over the years is the wide spectrum of morphological differences demonstrated by *A. angustifolia*. This variability has led to descriptions of several nominal (described and named) species

Table 1. Former and present taxonomic hierarchies of the genera Agave and Daysilirion

Hierarchy	Former Classification		Suggested Classification (Chase et al., 2009)	
Order	Liliales		Asparagales	
Family	Agavaceae	Nolinadeae	Asparagaceae	Ruscaceae
Subfamily	–	–	Agavoideae	Nolinadeae
Genus	*Agave*	*Daysilirion*	*Agave*	*Daysilirion*

Sources: http://www.itis.org; http://www.ars-grin.gov/cgi-bin/npgs/html/genus.pl?3406.

now considered synonyms of that single widespread species. For example, after a careful review of this agave, García-Mendoza and Chiang (2003) concluded that its intraspecific taxonomy is extremely complicated, likely a result of its variation due to adaptation to diverse ecosystems within its wide geographical range.

This morphological variability has led to the publication of descriptions and the naming of more than 20 taxa, most now considered synonyms (different scientific names that have been determined to refer to just one natural species). More detailed analyses of morphological and molecular characteristics should be able to clarify its nomenclature and settle taxonomic disputes (García-Mendoza and Chiang, 2003). Morphologic differences among closely related agaves are often so subtle that the species can be difficult to distinguish. For *A. angustifolia,* the situation is further complicated, since in part of its range hybridizes with *A. rhodacantha,* producing plants which are hard to distinguish not only for the trained eye (Gentry, 1982; Turner et al., 1995), but even through detailed genetic analyses (Moreno-Salazar et al., 2007). Due to the existence of many (morphologic) varieties of this widespread species, *A. angustifolia* has a long list of synonyms, some of which are still employed by various botanists. Thus, while a specimen may be identified as *A. angustifolia* by some authors (as is usually the case today), for others it may be called by a name that was formerly applied, such as *A. yaquiana, A. owenii, A. pacifica* and others (Gentry, 1972; Turner et al., 1995; Valenzuela-Zapata and Nabhan, 2003; Van Devender et al., 2010), but *A. vivipara* has been confirmed to represent a separate species (García-Mendoza and Chiang, 2003). Because of the economic importance of *A. angustifolia,* it is of paramount interest that its nomenclature be as clear and precise as possible, and efforts should be made to do so.

The various species of *Dasylirion* were once classified in the same botanical family as agaves, the Agavaceae. However, based on leaf shapes and thorn presence, as well as inflorescence types and other characters, Gentry (1982) proposed they be recognized under a separate grouping as the family Nolinaceae (Table 1), a taxon previously described by Nakai in 1936 (Irish and Irish, 2007). Therefore, *sensu stricto,* it is not valid to claim that sotol spirits are made from "a desert agavacea" (as has been done). Moreover, if the very norm regulating sotol-making acknowledges dasylirions as belonging in the family Nolinacea and not in the family Agavaceae ("true" agaves), then that claim is a clear contradiction.

Relying on a mostly molecular-based study, Chase et al. (2009) suggested that the Agavaceae no longer be recognized at the family level, but grouped into a larger, more inclusive family Asparagaceae, while the former Nolinaceae (including dasylirions) be placed in a more inclusive family Ruscaceae, the "distinctiveness" between the two groups in question being relegated to the level of subfamily (Table 1). Although at first glance this issue may seem circumscribed within the realm of scientists and scholars, the fact is that industry and consumers can be affected when norms' definitions are very specific, causing over-reliance on taxonomic names that are subject to normal change via further botanical research.

Designations of Origin (DOs)

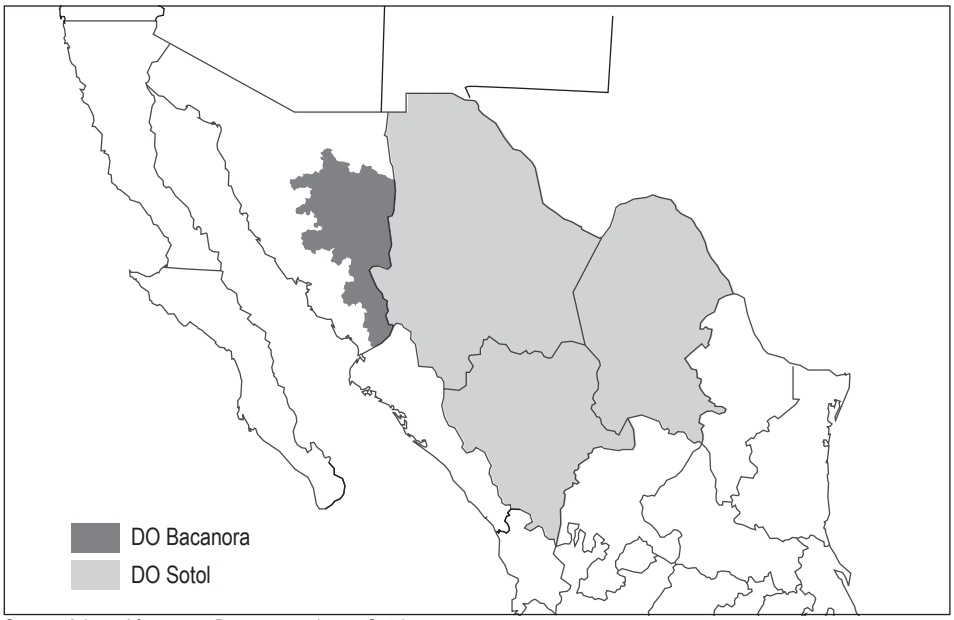
As early as the 15th century, Roquefort cheese production was regulated by a French parliamentary decree. Ever since, many regulating systems have arisen. Among the more important have been the French Appellation d'Origine Contrôlée in 1935, Denominazione de Origini Controllata in Italy in 1963, Denominación de Origen in Spain in 1922 for Sherry and, in 1925, for Rioja wines. However, the role of such designations is not limited solely to regulate production of specific commodities, but also to confer intellectual property and exclusivity for a group of organized producers within a specified geographical region, so that only those products can be acknowledged as such by name and therefore assuring a well-defined position in the global market.

The most visible and well-known Mexican DO regulates the production of tequila. This mescal spirit was acknowledged by the Registry of Appellations of Origin in 1978, under the Lisbon Agreement created by the World Intellectual Property Organization (WIPO), thus becoming a national intellectual property (ianchadwick.com/tequila/denomination.htm).

The specific official sets of regulations and geographic delimitations acknowledged for the exclusive making of sotol and bacanora were approved by the Mexican government on April 15, 2004 and October 28, 2005, respectively. Figure 3 shows the geographic delimitations for both DOs in northern Mexico.

These documents represent the finalizations of intensive legal, economic and social processes started long before their approval, including the building of consensus among producers, who, until then, were working clandestinely in the illegal production of those beverages. Also, the constitution of each DO had to undergo careful negotiations, each, challenged along the way by problems of differing magnitude. While the geographically wider DO-Sotol includes producers in three different states (Chihuahua, Durango and Coahuila), the DO-Bacanora includes producers in only 35 (usually small) contiguous municipalities (counties) located mainly in the foothills and mountains of eastern Sonora. Such integration of documents faced different difficulties. Nonetheless, the important role played by state officials, as well as the leading role played by the federal Secretariat (Ministry) of Economy, must be acknowledged. However, only time will tell if those efforts will result in con-

Figure 3. Geographic delimitation of bacanora and sotol Denominations of Origin (DOs) in northern Mexico. The area in black includes thirty five municipalities on the western slopes of the Sierra Madre Occidental in Sonora; the area in gray includes the states of Chihuahua, Coahuila and Durango.



Source: Adapted from NOM-Bacanora and NOM-Sotol.

solidated industries. Because of actual government dependency, it is valid to compare the Mexican situation with European DOs in structure and operation, as well as organization and functioning. While Mexican DOs require a solid governmental presence, in Europe the State plays only a promotional role, plus any necessary representation in international commerce courts, and the producers are left to freely assemble, dictate and operate their own DOs. Even field or facility inspections and technical auditing are carried out by personnel hired by each DO.

Available Technology

Regarding field situations, sotol production still depends almost exclusively on the harvesting of wild plants, with only a handful of cases of cultivation. This situation places DO-Sotol in a delicate position when the slow growth rate of dasylirions is taken into account, and overharvesting may result in raw material shortages in the near future. On the other hand, the production of bacanora, although still locally utilizing plants from wild stocks, shows an increasing trend in planting and cultivation by using stocks from both sexually and vegetative propagated plants; that is, plants originated either from seeds or plant parts. This relatively new trend is supported through different state and federal programs and is done

usually as block plantations, as in the tequila system, and with technology developed for tequila production (Núñez et al., 2008). Another system is by reforestation (replanting) of *Agave angustifolia* on cattle ranches where bacanora agave has been traditionally harvested. In this case, planting is done by paying attention to specific ecological associations of this agave with other plants in the landscape. While still in the nursery stage, bacanora agave roots are inoculated with native mycorrhiza, which are symbiotic fungi that help the plant to become established and increase field survival, thus eliminating the need for synthetic fertilizers (Ochoa-Meza et al., 2009). By either method, bacanora agave plantations are becoming increasingly common, and it is firmly expected that, through careful management, the availability of the raw material will not become a limiting factor in the production of bacanora. Additionally, the availability of selected clonal lines of *A. angustifolia* showing more efficient metabolism should allow for shorter periods between planting and harvesting (Esqueda and Vargas, 2007). Another basis for selection of individuals from wild populations is their different content of reducing sugars, this way development of specific clonal material will prove more productive in the field, as demonstrated by *Esqueda et al.* (2011) Such alternatives are not currently available for the species of *Dasylirion* in the DO-Sotol.

In considering the processing phase, it is evident that in both cases most small-scale operations, known as "vinatas," follow traditional (rustic) processing methods. However, it is important to point out that several differences exist, mostly defined by their respective norms (regulations) as dictated by federal agencies. The following points describe this issue in more detail.

Mexican Official Regulations or Norms (NOMs, the acronym in Spanish)

These are sets of regulations or standards, with parameters enforced by the Mexican government, that become officialized after discussions and agreements between producers (or harvesters), industry representatives, distillers and retailers. They are designed to standardize parameters of quality control for specific products, such as the alcoholic spirits under discussion. Some spirits with standards set by specific Mexican NOMs are named mescal beverages such as tequila, "mezcal" (principally produced in Oaxaca in southern Mexico), sotol and bacanora. Some other "mescals" are produced in the country, but are not protected under specific NOMs.

According to information contained in their respective NOMs, it is clear that NOM-Sotol is the more specific, as far as processing parameters are concerned, compared to a less precise situation described for NOM-Bacanora. Although the format for both documents is very similar, a close analysis yields information and insight that should be taken into account when their regulations are potentially updated in the future. Table 2 shows some differing criteria for several quality attributes described by both NOMs.

Table 2. Comparison of several attribute differences between Mexican Official Norms (NOMs) for bacanora and sotol production

Attribute	NOM-Bacanora	NOM-Sotol
Raw material	*Agave angustifolia*	Several *Dasylirion* species, except those officially protected
Authorized raw-material sugar content	100 % from Agave angustifolia	51-100 % from Dasylirion spp.
Yeast for fermentation	[Not specified]	Native or commercial
Allowed methanol (ppm)	30-300	0-300
Allowed furfural (ppm)	To 4	0-4
Ethyl carbamate	[Not especified – see text]	[Not specified – see text]
Type of barrel for aging	White oak	Acacia, ash, beech, chesnut and oak

Sources: NOM-168-SCFI-2004 and NOM-159-SCFI-2004.

Authorized Species (raw materials). As mentioned above, sotol production may include several species of wild *Dasylirion* (e.g., *D. wheeleri*), while bacanora production is restricted to *Agave angustifolia*. Although at present, wild stock availability is a limiting issue, it is evident that a strict interpretation of the nomenclature and current taxonomy of the species does not allow the use of closely related taxa; neither other species, nor their hybrids. This situation is ever present when harvesting from the wild, since in some cases differences between species are very hard to interpret, even by trained people.

Sugars. NOM-Sotol allows the use of sugars fermented from sources other than the basal stem ("cabeza") of *Dasylirion* spp., but not to exceed 49% of musts, as is called the syrup obtained from hydrolization (cooking) of the stems, either before or after fermentation. Enrichment with sugars from other sources (e.g., cane sugar) also implies that different qualities are to be expected in the final product. Therefore, clearly readable labels should inform consumers of the proportion of sugars and their origins used in the production of the various sotols.

On the other hand, NOM-Bacanora does not allow enrichment with extraneous sugars, but only those provided by *Agave angustifolia.* Thus, any legally produced mescal bacanora may be labeled as deriving from "100% agave," any further labeling specifying *A. angustifolia* may not be necessary.

Yeasts. NOM-Sotol is more specific regarding the use of yeasts to start alcoholic fermentation because it accepts either native or commercially cultured strains. The latter strains imply better control of the fermenting process since the use of wild types may result in erratic fermentation and uncontrolled production of volatiles responsible for flavors and aromas. NOM-Bacanora acknowledges the need for fermentation yeasts, but no further remarks specify sources (of either type).

Methanol content. As regards methanol content, both NOMs should be amended to be more specific in defining accepted thresholds. In the case of sotol, the permissible range is set from 0 to 300 parts per million (ppm). Although current

analytical tools are widely available, it is clear that detection methodologies continue to evolve and refine, and new alternatives may emerge, each time becoming more precise. Even so, such tools cannot "prove" that a beverage sample does not contain any methanol residue at all. In other words, a zero value for methanol in a beverage is extremely hard, perhaps impossible, to substantiate, thus redefining such a lower threshold simply as "less than 300 ppm" in NOM-Sotol would be more realistic. The situation for bacanora (and tequila) is even worse because the admissible range for methanol is 30 to 300 ppm. Therefore, if a theoretically excellent and essentially "pure" bacanora is produced with, say, only 5 ppm methanol residue, it is –from the strictly legal standpoint– outside (lower than) the established standard and does not comply with NOM-Bacanora, thus unsoundly treating methanol as a "required metabolite," rather than a dangerous byproduct caused by deficient processing. Recently, tequila exports to China were challenged to lower methanol content from 120 ppm (1.2 g/L) to only 20 ppm (0.2 g/L), right below the lower threshold acknowledge by its own self-defined NOM (Valverde, 2012).

Furfural. This is another health-hazard byproduct produced when agave stems (cabezas) are cooked in rural firewood pits, as was normal until fairly recently. Its thresholds are set following the same criteria –and limitations– as methanol. DO-Bacanora, correctly, does not define a lower threshold, only specifying that its furfural content must not exceed 4 ppm. DO-Sotol, however, permits a range between 0 and 4 ppm.

Ethyl carbamate. Although some pioneering analytical efforts in research laboratories at the Research Center for Foods and Development (CIAD, its acronym in Spanish), using limited sample sizes, have been unable to detect traces of ethyl carbamate contaminant in either bacanoras or sotols, its monitoring should be considered by the developing industries in an effort to protect consumer health. At present, official inspections do not consider this chemical among their parameters of quality control. Yet, should the industries promote this forward step, it would be acknowledged as an independent initiative committed to consumer protection.

Barrel aging. Differences exist in the types of wood barrels utilized to age the distillates in question. Sotol may not only be aged in the well-known oak barrels, but also in barrels built of wood from acacias, chestnut, beech and ash. Bacanora, however, must be aged solely in white-oak barrels, which are more expensive and less available, thus increasing production costs.

Market Vision

Before entering this subject, it is important to comment that recent investments made by two private-sector sotol distilleries account for more than all bacanora investments to date, both private and collective. Such information is pertinent since it helps to define entrepreneurial profile efforts under both DOs. This disparity has influenced the various commitments, strategies, and willingness to in-

vest in technology and innovation and, at the end of the day, in defining the market horizons being envisioned.

For a DO, the collective investment vision is particularly important, since it defines goals that a group purports to achieve. It not only concerns high product quality, but, in a wider scope, also all of the commitments established to achieve those objectives. Not disregarding potentially important individual efforts, it seems clear that a well-orchestrated collective effort can reach higher standards in a shorter period of time.

DO-Bacanora shares a collective vision focused on a regional product with high demand, not only in Sonora, but also in what has been called "the nostalgia market" represented by numerous ex-patriot Sonorans living in the southwestern USA (Núñez-Noriega, 2003; Salazar-Solano and Mungaray-Lagarda, 2007). Though, attention should be given to such a market niche, it seems clear that it may become a somewhat "restricted vision" at some point in the future, necessitating exploration and penetration of markets well beyond such a limited arena.

The former may also be the case for DO-Sotol. However, it may be instructive to examine the strategy employed by a couple of high-quality sotol brands, whose products have garnered first prizes for spirit beverages in international contests. Such events, held in different parts of the world, achieve close competition among first-quality spirits, including tequilas and other mescals. Judges acknowledged those brands' sotol products as *"an interesting alternative to tequilas, with a reminiscence of desert flavors and aromas,"* thus endorsing their qualities. Such recognition sets the basis for a more solid incursion into the competitive world market of spirit beverages. Less than such an achievement would imply that sotol mescals remain mere regional curiosities with limited outreach.

In comparison, DO-Bacanora integrates a more homogeneous group of producers from 35 contiguous municipalities. This characteristic implies a decisive strength, since it allows the entity to research, find and channel the most sought-after federal and state subsidies and other supports. For this to be realized, the assumption is that such resources are provided, administered and executed in a transparent fashion. A second assumption is that having access to such supports will allow DO-Bacanora a comparatively easier transition to a more competitive level.

Lessons can be learned from similar industries, such as those experienced by the dairy industry, and even those for tequila production. Both are constituted by groups of raw-material producers and processors, and their relationship is profoundly affected by raw-material price negotiations. In the bacanora and sotol cases, the harvesters (and, increasingly, growers) form the social basis of the system, including also land owners where the plants are gathered or planted. It is expected that as more plantations reach sustainable harvesting levels (either as new solid blocks or as replanted pastures), the ratio between harvesters, growers and processors may change. But in any case, it is in this social foundation where the productive chain starts (Salazar-Solano and Mungaray-Lagarda, 2009) and

its inclusion in the benefits deriving from each DO should be considered; that is if a socially responsible policy is to be adopted. Harvesters/growers and processors may take simultaneous advantages of social, economical and political natures, as well as a rapid and solid position in the market.

In the current bacanora production system, other advantages can be pointed out. As mentioned before, because sugars from sources other than the agave plant are not permitted for use, all legally-sanctioned bacanoras can claim to be made from "100 % agave." Furthermore, and sooner than later, the newly planted commercial stocks will attain sustainable harvesting level, thus alleviating "predation" pressure caused by wild-collecting and avoiding depletion of the wild agave stocks. Therefore, environmental-friendly practices can eventually also be claimed by the nascent industry. At present, most bacanora production is still based on the collecting of wild plants and therefore could conceivably be claimed as "organic." Although chances that toxicological analyses could prove otherwise are rather null, the valuable ecological services that wild stocks provide their ecosystem, such as essential food sources (flower nectar and pollen) for migrating bats, and for food and construction materials utilized by local bird and rodent (e.g., pack rat) populations, would likely preclude an acceptable designation of "organic" or "environmentally friendly." Other issues like kosher certification can be explored as well, in order to position these spirits in markets demanding high-quality products.

In general, the ideas expressed here attempt to describe the different strategies in support of both bacanora and sotol DOs in their long path to becoming established and solid alternatives for rural development in northern Mexico. As very probable means for providing new sources of income, such developments could alleviate current problems of demographic migration and consequent depopulation of the countryside, as well as a mitigation strategy to fight poverty and illegal-drug related problems and the concomitant violence they foster.

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