

SOTOL.

BY DR. V. HAVARD, U. S. ARMY.

Name.—This interesting member of the Liliaceæ has been described under different names; it is the *Dasyilirion texanum* Theele, of Watson's "Revision of the Liliaceæ," and the *Dasyilirion graminifolium* Zucc., of Torrey's Botany of the Mexican Boundary Survey. It appears to me that the *D. wheeleri* Watson, may not be specifically distinct from it.

Sotol is the Mexican name under which it is well known along the Upper Rio Grande, and bear-grass its common, meaningless Texan appellation.

Description.—Perennial, characterized by a thick tuft or cluster of long, green, armed leaves, from the midst of which rises, periodically, a stout stem ten or twelve feet high, bearing a long, close panicle; caudex none or rarely, in old plants, six to eighteen inches high; leaves very numerous, roughly estimated at four or five hundred, erect in the center, thence gradually spreading to the ground, their expanded, white, ladle-shaped bases four or five inches long, three or four inches wide and two lines thick, ending rather abruptly into the long, narrow body of the leaf with which it contrasts sharply in color; at the point of transition is a pair of thin, coriaceous wings; leaf, exclusive of the base, three to four and a half feet long, seven to ten lines wide below, gradually tapering to a point which is split into coarse fibers; armed on both sides with teeth hooked downwards, very variable in shape, size and relative distance mostly two lines long and six lines apart, often tinged with violet at apex or throughout; edges between the teeth finely serrated; panicle two or three feet long; partial panicles three to four inches long, erect in the female plant, flexuous and pendant in the male, subtended and often overtopped by broad, lanceolate bracts; fertile racemes two to four, staminate racemes only one to two inches long; fruit three-winged, broadly oval or subcordate, three lines long, on pedicels hardly one line long; the narrow wings less than one line wide, sometimes free, generally more or less adnate to the style, straight or diverging but seldom rising above it; seed triangular pyramidal with obtuse apex, 1 line long and broad, minutely rugulose under a lens; embryo slender, cylindrical, in the center of a horny albumen as long as the seed.

It may be seen that this description differs from that of authors in some particulars, such as the absence of any conspicuous caudex, the larger size of the leaves and hooks, and the variable degree of adnation of the wings to the style in the fruit.

The bear-grass produces a fructiferous stem every three or four years, when sufficient material has been accumulated in the succulent leaves. It is mainly propagated by seeds shaken off their stately support by the wind and carried away in various directions; the young plant grows rapidly and shoots its first stem when four or five years old. It blossoms late in summer and the seeds ripen in the fall; most of them remain on the stalk all winter, and many persist until late in the ensuing year.

Habitat.—The home of the sotol is Western Texas, South-eastern New Mexico and Northern Chihuahua. Proceeding westward from San Antonio, I first met it after crossing the San Pedro or Devil's river; beyond the Rio Pecos it becomes abundant, covering almost exclusively square miles of arid and stony slopes, beyond question the most striking botanical feature of the country. It extends west, probably to the Colorado. If specifically it includes the *D. wheeleri* Watson, it is the prevalent *Dasy-lirion* of Southern Arizona.

The sotol grows best at a certain altitude, five or six hundred feet above the level of the Rio Grande, that is to say, above the region of the *Yucca baccata* and the lower line of the *Agave lechuguilla*, on nearly all the foot-hills of Western Texas. It thrives in dry, rocky soil where no grass can grow, and sometimes, insinuating its long, filamentous roots into invisible fissures, seems to spring from the living rock.

Uses.—The first experience of the traveler with the bear-grass, whose hooks scratch and tear everything they touch, is a disagreeable one; but further acquaintance with frontier life makes him consider it one of the beneficent provisions of nature. In some of our camps, where other fuel could not be procured, we made good fires of the old stems of this plant. These are sufficiently strong and long for use in building the walls and roofs of huts or Mexican jacals. As a fiber plant the sotol is worthless; even if it were possible, with the defiant hooks, to scrape off the fibers, they are too few and weak to be serviceable.

The base of the leaves and the young stems are full of a sweet, refreshing and nourishing saccharine matter which supplies food

and drink; no one need suffer from thirst or hunger who finds a tuft of bear-grass and has a long handled knife or an axe with which to overcome it and cut off, as low as possible, some of the central leaves; often these can be torn off by pulling them with a twist at the unarmed apex. The nutritive saccharine substance lies mostly in the white, expanded bases which always give to the test a large proportion of glucose. These bases are closely and compactly imbricated into a bulby expansion or "head," from which the leaves proper seem to grow; this head, trimmed down to the white, fleshy moss, is ready for use either on the road, in the Mexican kitchen or by the mescal manufacturer. For eating, it can be boiled, broiled or baked, previously, if convenient, cutting an axial hole through it to render the cooking more rapid and thorough. Broiling on coals takes an hour or less. Baking, the usual mode of preparing it for food, is done in an oven or, if in the field, in a small heated pit where it is kept about twenty-four hours, or until it has acquired a rich brown color. The scales are detached and eaten as needed after peeling off the thin epidermis covering both sides, or again they may be ground into atole. Their sweet taste, not unlike that of molasses, reminds one of the "mescal" of the Arizona Apaches, that is, the baked head of the *Agave palmeri* and *Agave parryi*. This, however, differs from the sotol head in being much smaller and consisting mostly of the thickened top of the rootstock, so that its solid, homogeneous mass can be cut in slices like a cake.

Sotol mescal.—The main and paramount use of sotol is in the making of a spirituous liquor known as "mescal" along the border, but in the interior of Mexico, to avoid mistaking it for a similar product from maguey, called sotol mescal. This fabrication is carried on mostly in the Mexican States of Chihuahua, Coahuila and Sonora, and sotol mescal is the ordinary alcoholic beverage of the native population. It is precluded in Texas by the high duties laid on this class of industry.

The distillery, or vinata, is located in foot-hills, near water, and in the midst of a perennial crop of bear-grass. Trains of burros bring in every evening their loads of heads; these as trimmed by the axe of the peon and ready for the oven, are subconical in shape, twelve or fifteen inches high and broad, and weigh from twenty to twenty-five pounds; they attain much larger dimensions in favorable localities, and a vinata proprietor has even

assured me that it is not uncommon to find them measuring two feet or more in diameter and weighing as much as seventy-five pounds. All heads seem to be good for the purpose, even those with a growing stem are not spared, though they doubtless contain less sugar, and the cutting is only suspended by the floods of the rainy season, from June to September, during which period the vinata is closed, and the mescal bibber constrained to reform; now also is the time to shift the establishment, if needs be, to a more abundant field of sotol.

The oven in which the heads are baked is a circular pit about ten feet in diameter and depth, and lined with rough stones. Into it combustibles are thrown and a brisk fire kept up for one day; it is then cleaned, filled with heads and lastly covered with a roof of hay and earth well trodden down. In three days the baking is through; the heads are now chopped with hatchets and the fragments pounded into a coarse, shreddy pulp, which is thrown into vats four or five feet square, to undergo fermentation; in cold weather warm water is added, otherwise it does not appear to be necessary. During the first few days bare-legged men tread in the vats to stir and mix the pulp. In from six to ten days, according to season, the fermentation ceases and the contents of the vats, solid and liquid, are transferred to the still. The first liquor obtained, being richer in alcohol and possessing to a higher degree the peculiar aroma of sotol mescal, is considered of better quality. The used-up leaves, still sweet to the taste, are fed upon with relish by the donkeys, hogs, dogs and chickens of the vinata.

A rough calculation makes me estimate at one pint the quantity of liquor obtained from one average head; the yield would doubtless be much greater if, instead of roughly pounding the baked heads, they were crushed into a fine pulp by appropriate machinery. A vinata in good running order will turn out a Mexican barrel a day (about twenty-eight gallons), sold at an average price of fifteen dollars, and retailing for thirty or forty cents a quart. The revenue laws of Mexico, exceedingly severe on articles of prime necessity, are very lenient on the vinatas, which, if first-class, are only taxed fifty dollars a year.

The liquor obtained from the sotol is limpid and colorless, its smell penetrating and its taste, *sui generis*, somewhat raw, pungent and bitter, but with a pleasant aroma not unlike the smoky

flavor of Scotch whisky. Its percentage of alcohol is about that of whisky, perhaps a little higher; it burns readily with a yellowish, purple flame, leaving an intensely bitter residue, and gives an acid reaction with litmus paper.

Sotol mescal is a pure, wholesome alcoholic drink; if the best brand be kept long enough to lose its sharp edge, it compares favorably with good whisky; Mexicans prefer it, and with reason, to the ordinary frontier whisky, and the American toper takes kindly to it if the latter be not readily accessible. On account of its cheapness and characteristic taste, mescal is very seldom adulterated. As far as I have observed, it has no peculiar effect upon the system; stomach, liver and kidney troubles, which might be referred to its action, are very rare, nor do the acid, pungent and bitter elements, contained in it, seem to affect any of the organs unfavorably. In the parlance of the toper, and to his thinking no mean advantage, there is much less headache in it than in whisky.

This sotol mescal should not be confounded with maguey mescal, or tayuile, the product of the maguey plant, *Agave americana*, and the liquor perhaps more generally known under the name of mescal in the United States; it is extensively manufactured in the interior Mexican States from the abundant sap collected in the cavity made by removing the young central leaves. Although much like it in taste and effects, it is a finer article than the former and commands a higher price.

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THE FAUNA OF THE NICKAJACK CAVE.

BY E. D. COPE AND A. S. PACKARD, JR.

THIS cave is situated near that point of the southern boundary of Tennessee where it is joined by the line which separates the States of Georgia and Alabama. In dimensions it ranges with the Mammoth and Wyandotte caves of Kentucky and Indiana, whose faunæ have already been described in earlier volumes of the NATURALIST. Many miles of galleries have been explored, and no end has yet been reached. The entrance is in the northern side of a hill, not far from the road that passes on the south side of the bottom of the Tennessee river. It is of much more imposing proportions than that of either of the caves already mentioned. The visitor climbs the hill from the road, following