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THE GEORGIA VELVET BEAN



Several cases of "mutation" which have been thoroughly investigated can be regarded as due to the loss of a single genetic factor. Among these cases the best known is the occurrence of the "false wild oat" in pure strains of oats, which was the subject of a masterly monograph by Nilsson-Ehle. It appears not improbable that the loss of a genetic factor may occur occasionally in almost any pure line of plants. Sometimes the results are of agricultural value.

The Florida velvet bean (*Stizolobium deeringianum*) has long been grown in Georgia as a soil improver and cattle food; usually from Florida seed, since it often fails to ripen seed farther north. Several farmers in Georgia, however, seem to have found an earlier strain in their fields, three years or more ago, and this strain is now extensively grown there. At the left, above, is a photograph of one plant of the Florida velvet bean, taken at Gainesville, Fla., on Sept. 19, 1914; all plants were similar and bore flowers and young pods. At the right is a photograph, taken on the same day, of one of three plants of the Georgia velvet bean, from seeds planted on the same day and in the same row as the Florida. The Georgia plants had dropped their leaves and ripened all their pods, which were dry and ready to pick. In time of appearance of the first flowers, they were as early as the Yokohama bean and nearly two months earlier than the Florida. From crosses between the Yokohama and the Florida, I conclude that the Florida has a factor for late flowering, H, which the Yokohama does not possess. Hence it may be supposed that the Georgia velvet arose from the Florida velvet by the "spontaneous" loss of the factor H. Since H is dominant, the early plants would appear only in the second generation.—John Belling, Agricultural Experiment Station, Gainesville, Florida. (Frontispiece.)

AN AZTEC NARCOTIC

(*Lophophora williamsii*).

So-called "Sacred Mushroom," or Teonanacatl, Still in Use by the Indians of Mexico and the United States, Producing Hallucinations of a Remarkable Nature, Is Identified with the Peyotl Zacatecensis, or Devil's Root of Ancient Mexico, and the "Mescal Button" of Texas.¹

W. E. SAFFORD

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ACCOUNTS of many early travelers in America and missionaries to the Indians call attention to the veneration of the aborigines for various plants, showing that they attributed to all plants a spirit somewhat like that of animals or even of man himself. To certain plants special honors were paid; others were avoided with dread; while others, with no pronounced virtues or evil properties, were little noticed. An example is given by a Mexican writer of the homage paid to a certain tree cut down in order to form a bridge over a stream in Michoacan. The people of the village were called together by the governor and a religious service was held about a cross erected for the special ceremony, with candles burning before it and choristers assisting. A procession was formed which climbed the mountain, where the tree was growing. When it fell there came an aged Indian woman who, taking a few of its branches, laid them on the trunk where it had been cut, and consoling it with loving words begged that it might not feel humiliated or angry; for they had chosen it on account of its magnificent stature and great strength, and it was destined to span a mighty river, so that all the people of the land of Michoacan might

cross over upon it. And before dragging it away they placed upon the place where it had fallen a piece of lighted candle, which had been left over from Holy Thursday; and they repeated in its honor a very solemn litany, sprinkling it with holy water and much pulque.² On the next day, having propitiated the spirit of the tree, they bore away the hewn beam to the bridge with much shouting and jubilation.³

The same author speaks of the veneration paid by the Mexicans to certain medicinal plants and to the narcotics *Ololiuhqui*, the sacred *Nanacatl*, the *Peyotl*, and the *Picietl* (tobacco), "to which they ascribe deity and with which they practice superstitions."

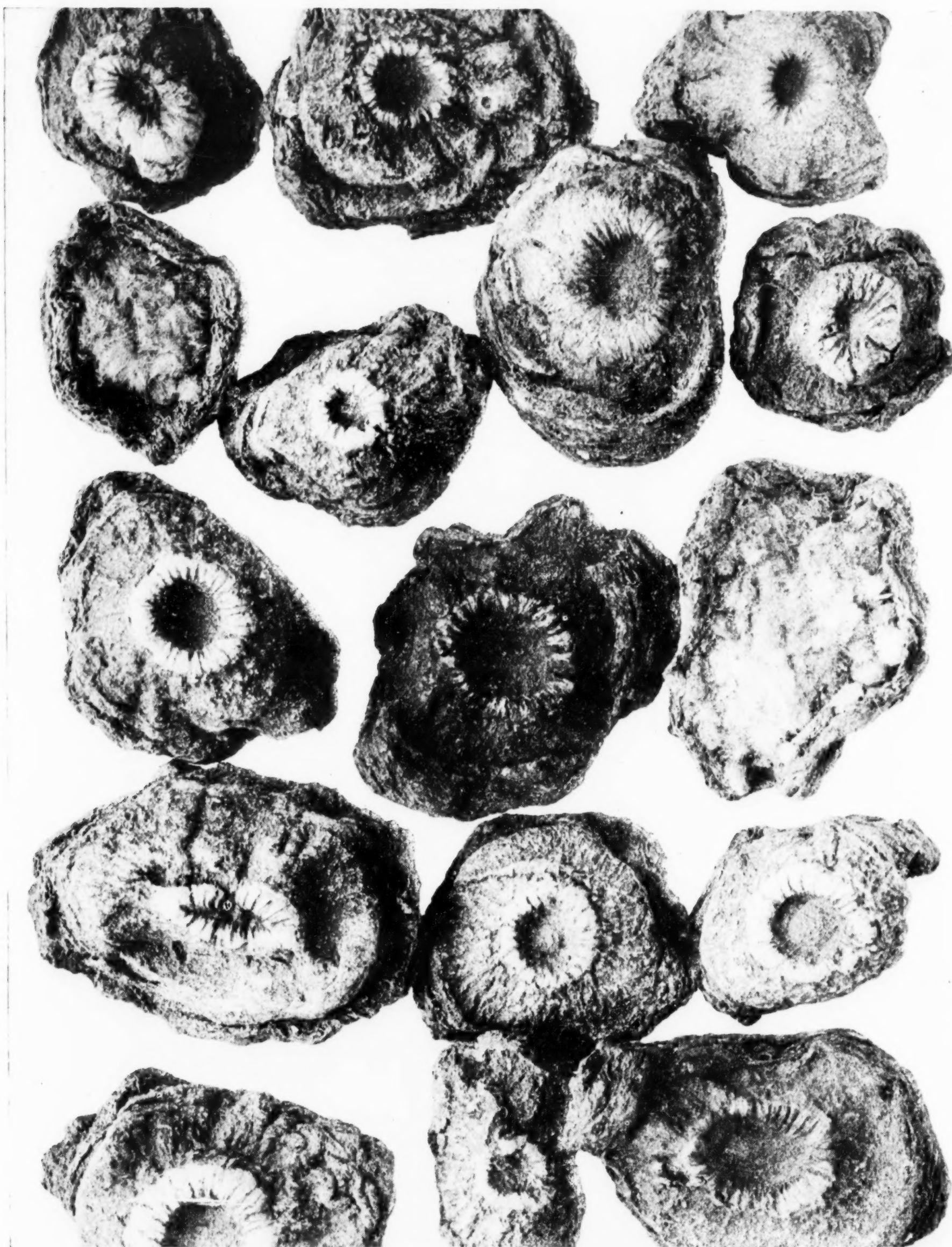
METHODS OF EXORCISM

The following example is among those given to show the method of exorcism employed by the Aztec *titzitls*, or herb doctors. In this case the spirit of the *Ololiuhqui*, is addressed. "Come now, come hither, *Green Woman*, behold the green heat and the brown heat; remove thou the flaming or scarlet heat, the yellow heat, or by this token I send thee to the seven caves. And, I command thee, put it not off till tomorrow or another day; for sooner or later thou wilt be compelled to do it. Who is the

¹ Based upon a paper entitled "Identification of the Teonanacatl, or 'Sacred Mushroom' of the Aztecs with the narcotic cactus, *Lophophora*, and an account of its ceremonial use in ancient and modern times," read by the author May 4, 1915, at a meeting of the Botanical Society of Washington. Published by authority of the Secretary of Agriculture.

² Fermented sap of the Century Plant (*Agave americana*), which also yields the strong distilled spirit called mescal.

³ Jacinto de la Serna, "Manual de Ministros par el conocimiento de idolatrías y extirpacion de ellas." In Documentos inéditos para la Historia de España, vol. 104, p. 159-160.



THE AZTEC NARCOTIC CACTUS, TEONANACATL

"God's Flesh," or "Sacred Mushroom" of the Aztecs—discs cut from the crown of the cactus *Lophophora williamsii* and dried. Photograph of specimens received by the Bureau of Chemistry, U. S. Department of Agriculture from the Indian Office in 1914. Now widely used as a narcotic by Indians on United States Reservations.—Natural size. (Fig. 1.)

god—the so powerful and superior one—who can destroy the work of thy hands? I command it, I, the prince of enchantment.” Others using the Hueinacatzli (“great-ear”), Mecaxochitl (“cord-flower”), and Coanenepilli (“serpent’s tongue”), repeat the following: “Come hither, thou, the yellow and ardent red one; come and expel the green pain, the brown pain, which now wishes to take away the life of the son of the gods!” And with the herb Atlinan (“water-weed”), “I invoke thee, my mother, thou of the precious waters! Who is the god or who the so powerful one that wishes to destroy and burn my enchantment? Ea! Come thou, sister of the Green Woman, whom I am about to go and leave in the seven caves, where the green pain, the brown pain, will hide itself. Go and rub with thy hands the entrails of the bewitched one, so that thou mayst prove thy power and fall not into disgrace!”

EARLY HISTORY OF TEONANACATL

Bancroft, in referring to the narcotics used by the ancient Mexicans, mentions one, which was believed by the early Spaniards to be a fungus. In writing of their ceremonial feasts he says: “Among the ingredients used to make their drinks more intoxicating the most powerful was the *teonanacatl*, ‘flesh of God,’ a kind of mushroom which excited the passions and caused the partaker to see snakes and divers other visions.”⁴ This information was undoubtedly derived from accounts of the Spanish padres, one of whom, Bernardino Sahagun, writing before the year 1569, states that it was the Chichimeca Indians of the north who first discovered the properties and made use of these “evil mushrooms which intoxicate like wine.”⁵

They were gathered in the territory now northern Mexico and southern Texas, preserved by drying, and carried

southward. The inhabitants of the Valley of Mexico knew them only in their dry state. It is also very probable that the early writers who recorded their use had seen them only when dry and never knew them as living plants. Francisco Hernandez, the physician sent by Philip II in 1570 to study the resources of Mexico, or New Spain, describes them under the heading “*De nanacatl seu Fungorum genere*.” From the harmless white-mushrooms (*iztacnanacame*), red-mushrooms (*tlapalnanacame*), and yellow orbicular-mushrooms (*chimalnanacame*), used for food, he distinguished them as *teyhuinti*, which signifies “intoxicating.”⁶

In this connection it is interesting to note that this Nahuatl word, *teyhuinti*, or *teyuinti*, (from *yuinti*, to be drunk) survives, in the form of *tejuino* or *tehuino* in the State of Jalisco, Mexico, and *tesuino* or *tizwin* in the south-western United States, as the name of certain intoxicating drinks, the principal of which is a kind of beer brewed from malted maize.

DETERMINATION OF THE DRUG

Three centuries of investigation have failed to reveal an endemic fungus used as an intoxicant in Mexico, nor is such a fungus mentioned either in works on mycology or pharmacography; yet the belief prevails even now that there is a narcotic Mexican fungus, and it is supported by Siméon in his monumental dictionary of the Nahuatl language, in which the following definitions occur:

“*Teonanacatl*, espèce de petit champignon qui a mauvais gout, enivre et cause des hallucinations; il est médicinal contre les fièvres et la goutte.”⁷

“*Teyuinti*, qui enivre quelqu’un, enivrant; *teyuinti nanacatl*, champignon enivrant.”⁸

In connection with his study of the economic plants of the Mexicans and the Indians of the south-western United

⁴ Bancroft, H. H., *Native Races*, 2: 360. 1875.

⁵ Sahagun, Bernardino (1499-1590). *Hist. Nueva España* (ed. Bustamente), vol. 3, p. 118.

⁶ “Quoniam inebrare solent, Teyhuinti nomine nuncupati sunt, et e fulvo in fuscum vergant colorem, risum inopportunitum concitent, imaginemque citra risum inebriantium possint exhibere.” Hernandez, Francisco (1514-1578). *Hist. Pl. Nov. Hisp.* (ed. Rom.) 2:357. 1790.

⁷ Siméon, Rémi, *Dict. de la langue Nahuatl*, p. 436, 1885.

⁸ *Op. cit.* p. 412.



THE "DEVIL'S ROOT"

Peyotl Zacatecensis (*Lophophora williamsii*). "The root is of nearly medium size, sending forth no branches nor leaves above ground, but with a certain wooliness adhering to it. [On account of its magic properties] this root scarcely issues forth, but conceals itself in the ground, as though unwilling to harm those who may discover it and eat it."—Francisco Hernandez, 1576. Photograph natural size. (Fig. 2.)

States the writer has sought diligently for a fungus having the properties attributed to the *teonanacatl*. As this narcotic was used by various tribes of *Chichimecas*, and the *Chichimecas* inhabited the territory situated in what is now northern Mexico and the southwestern United States, it was natural to look for the plant in this region. No such fungus, however, was discovered, but in its place a narcotic plant having properties exactly like those attributed to the *teonanacatl* was encountered; moreover, one form of this plant, when prepared as a drug, resembles a dried mushroom so remarkably that at first glance it will even deceive a trained mycologist. It is discoid in form and apparently peltate when seen from below; but the upper surface bears tufts of silky hairs, and a close inspection reveals the fact that it is the crown of a small fleshy spineless cactus which has been cut off and dried. The cactus in question, *Lophophora williamsii*, when entire, resembles a carrot or radish rather than a mushroom, and when cut into longitudinal slices or irregular pieces, would never be mistaken for a fungus. For this reason the drug prepared in the latter form was not recognized in southern Mexico as the same as the discoid form, and it was called *peyotl* by the Aztecs, while the name *nanacatl* was applied to the latter.

IDENTITY WITH THE NARCOTIC PEYOTL

Sahagun, who described the drugs of the ancient Mexicans from specimens brought to him by Indian herb doctors, failed to recognize the identity of the *teonanacatl* and *peyotl* of the *Chichimecas*, although he attributes similar narcotic properties to each. The latter he describes as follows:

"There is another herb, like tunas⁹ of the earth; it is called *peiotl*; it is white; it is produced in the north country; those who eat or drink it see visions either frightful or laughable; this intoxication lasts two or three days and then ceases; it is a common food of the *Chichimecas*, for it sustains them and gives them courage to fight and not feel fear nor hunger nor thirst; and they

⁹ *Tuna*, the Spanish name for the fruit of the *Opuntia*, or prickly pear.

say that it protects them from all danger."¹⁰

The plant itself was described by Hernandez as follows, under the heading *De Peyotl Zacatecensi, seu radice molli et lanuginosa*.

"The root is of nearly medium size, sending forth no branches nor leaves above ground, but with a certain wooliness adhering to it on account of which it could not be aptly figured by me. Both men and women are said to be harmed by it. It appears to be of a sweetish taste and moderately hot. Ground up and applied to painful joints it is said to give relief. Wonderful properties are attributed to this root (if any faith can be given to what is commonly said among them on this point). It causes those devouring it to be able to foresee and to predict things; such, for instance, as whether on the following day the enemy will make an attack upon them; or whether the weather will continue favorable; or to discern who has stolen from them some utensil or anything else; and other things of like nature which the Chichimecas really believe they have found out. On which account this root scarcely issues forth but conceals itself in the ground, as if it did not wish to harm those who discover it and eat it."¹¹

From the above description, which applies perfectly to the plant from Zacatecas shown in fig. 2, it follows that the *Peyotl zacatecensis* of Hernandez is identical with *Lophophora williamsii*. Specimens of the drug collected at Zacatecas by the late Dr. Edward Palmer are shown in fig. 3. They bear little resemblance to the mushroom-like buttons shown in fig. 1, and it is not surprising that they should have been supposed to be distinct from the *teonanacatl* by the early Spanish writers.

RAIZ DIABOLICA, OR DEVIL'S ROOT

By this name it was designated by Padre José Ortega, who tells of its use by the Cora Indians in his *Historia del Nayarit*, published anony-

mously at Barcelona in 1754, and republished under his own name in 1887. In describing their nocturnal dances he writes as follows:

"Close to the musician was seated the leader of the singing whose business it was to mark the time. Each of these had his assistants to take his place when he should become fatigued. Nearby was placed a tray filled with *peyote* which is a diabolical root (*raiz diabolica*) that is ground up and drunk by them so that they may not become weakened by the exhausting effects of so long a function, which they began by forming as large a circle of men and women as could occupy the space of ground that had been swept off for this purpose. One after the other went dancing in a ring or marking time with their feet, keeping in the middle the musician and the choir-master whom they invited, and singing in the same unmusical tune (*el mismo descompasado tono*) that he set them. They would dance all night, from 5 o'clock in the evening to 7 o'clock in the morning, without stopping nor leaving the circle. When the dance was ended all stood who could hold themselves on their feet; for the majority from the *peyote* and the wine which they drank were unable to utilize their legs to hold themselves upright."¹²

The early missionaries were opposed to the drug not so much on account of its physiological effects upon the Indians but because of its connection with certain superstitious rites connected with their primitive religion. Eating the *teonanacatl*, or *peyotl*, was declared by the padres to be almost as grave a sin as eating human flesh. In a little religious manual published by Fray Bartholomé García in 1760, for the use of the missionaries to the Indians of San Antonio, Texas, the following questions, to be used in the confessional, are printed:

"Has comido carne de gente?" (Hast thou eaten flesh of man?)

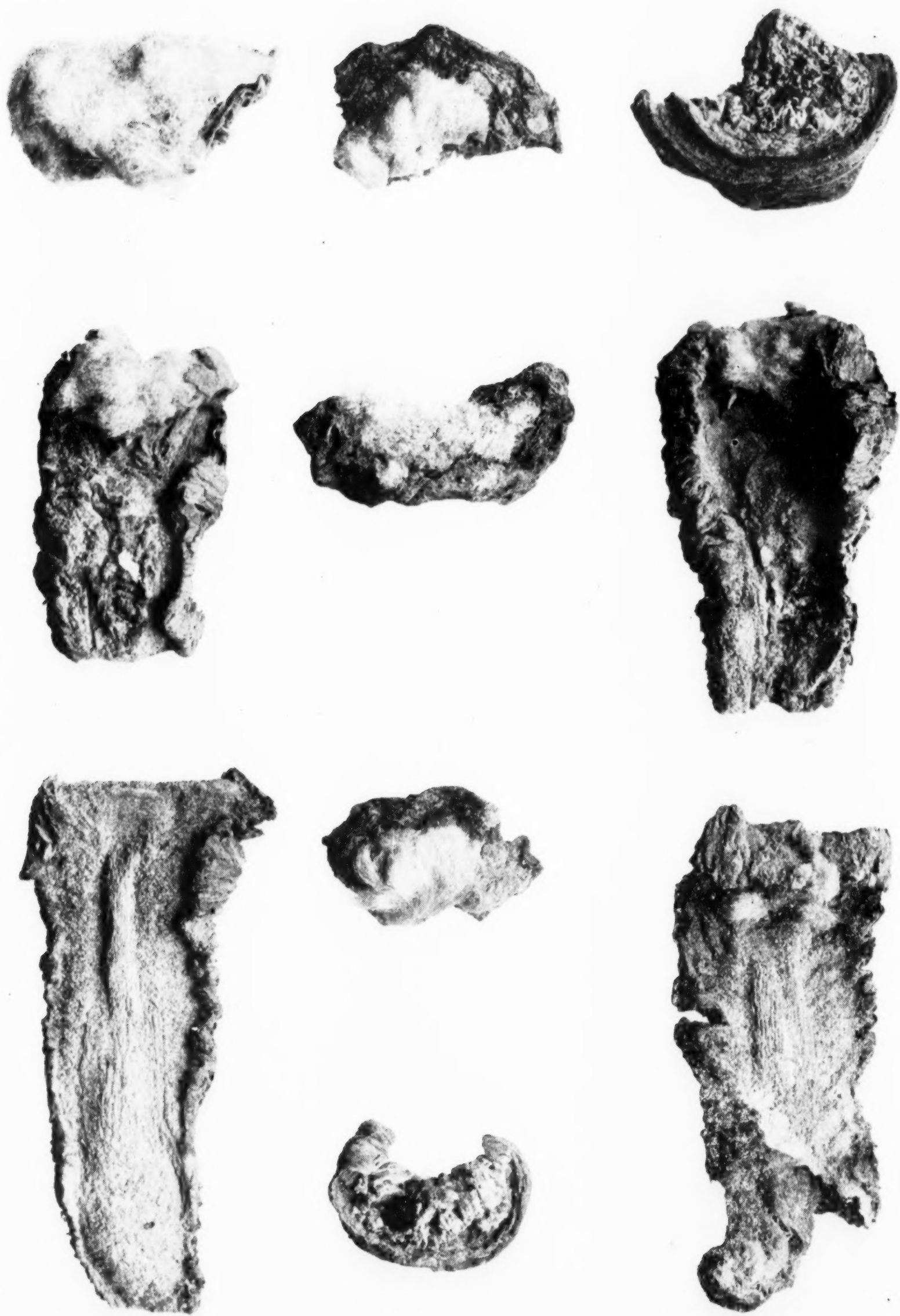
"Has comido el peyote?" (Hast eaten the peyote?)¹³

¹⁰ Sahagun (1499-1590). *Hist. general de las cosas de Nueva España* (ed. Bustamente) 3:241. 1830.

¹¹ Hernandez (1514-1578). *De Hist. Plant. Nov. Hisp.* 3:70. 1790.

¹² Ortega, Padre José (d. 1700). *Hist. del Nayarit*, pp. 22-23 (new ed.) 1887.

¹³ García, Fr. Bartholomé. *Manual para administrar los Santos Sacramentos etc.* p. 15. 1760.



PEYOTE OF ZACATECAS, *Lophophora williamsii*

This form of the narcotic drug was called by the early Spanish missionaries "Raiz diabolica," or Devil's Root. Photograph of material in the Economic Collection, U. S. Department of Agriculture, collected at Zacatecas, Mexico, by the late Edward Palmer. (Fig. 3.)

The name *teonanacatl* is now obsolete. The drug is called by various names among the Indians using it: *xicori* by the Huicholes of Jalisco; *hikori*, or *hikuli*, by the Tarahumaris of Chihuahua; *huatari* by the Cora Indians of the Tepic mountains; *kamaba* by the Tepichuanes of Durango; *ho* by the Mescalero Apaches of New Mexico, who formerly ranged as far south as Coahuila; *seni* by the Kiowas; and *wokowi* by the Comanches, some of whom formerly lived in the state of Chihuahua. The name *peyote* has survived as a general commercial term; and the mushroom-like discs from the Rio Grande region are now widely spread among the northern Indians of the United States under the misleading names of "mescal buttons" or "mescal beans," as well as under the Nahuatl name *peyote*.

This name is of Aztec origin, derived from *peyotl*, the Nahuatl word for "cocoon." That its application to *Lophophora* was not general in early times is shown by the fact that Dr. Leonardo Oliva, professor of Pharmacology at the University of Guadalajara, declared it a singular thing that the *peyote* was regarded by the Mexicans as a plant having the virtue of giving unusual endurance to those using it, and the power of walking great distances without tiring. The only plant known to him by this name was a yellow-flowered Composite, with velvety tuberous roots, which from their form and indument might easily be likened to the cocoon of a moth.¹⁴ As a matter of fact this name is still commonly applied to several species of *Cacalia*, the principal one of which, *Cacalia cordifolia*, is common in the vicinity of Guadalajara, Jalisco, in the drug markets of which the root is offered for sale under the name *peyote*.

CACALIA ALSO CALLED PEYOTL

The genus *Cacalia* belongs to the section *Senecioneae*, which includes *Arnica*, *Tussilago*, and other medicinal plants. To this genus should be referred the *Peyotl xochimilcensis* and the *Nanacace* of Hernandez, both of which are composites endemic in the neighborhood of Xochimilco, in the valley of Mexico, having

a single stem growing from the middle of a cluster of nut-like tubers, with a terminal cluster of yellow-flowered rayless heads subtended by a scarious involucre. They should not be confused with the narcotic cactus called *peyotl* or *peyote*.

The *peyote* of Guadalajara, *Cacalia cordifolia*, was first described botanically by Kunth from specimens collected by Humboldt and Bonpland at Santa Rosa, Mexico. Its tubers, about the size of walnuts or hickory nuts, are covered with soft woolly hairs. From the center one of the cluster rises a single smooth terete stem bearing alternate, thickish, conspicuously net-veined leaves. The lower leaves are long-petioled, the upper ones, near the terminal inflorescence, are short-stemmed and much smaller. The blades are roundish or broadly ovate, cordate at the base and angled on the margin. The flower heads are arranged in the form of a corymb, with many tubular 5-toothed flowers crowded on a naked flat receptacle, subtended by an involucre cupshaped in form, composed of many narrow acute teeth. There are no marginal ray-flowers. The disc-flowers have both stamens and pistils, the latter with an exserted forked stigma. The pappus is pilose, somewhat resembling thistle-down when mature.

Fig. 4 shows the woolly tubers, reticulate leaves, and mature inflorescence of *Cacalia cordifolia*, photographed from material in the United States National Herbarium, collected by the writer in February, 1907, in the vicinity of Guadalajara, state of Jalisco, Mexico.

Other specimens in the herbarium are from the Pedregal, or lavabeds, near Tlalpan, in the Federal District of Mexico, corresponding very closely with the descriptions of *Peyotl xochimilcensis* of Hernandez; and from Alvarez, state of San Luis Potosi, where the tubers, locally known as *cachan*, are offered for sale in the drug-markets as an aphrodisiac and a remedy for sterility.

THE GENUS LOPHOPHORA

The genus *Lophophora* was based by Coulter upon a small plant described in 1845 by Lemaire, in the *Allgemeine Garten-Zeitung*, under the name *Echinocactus williamsii*. This plant, though suggesting certain echinocacti by its form differs essentially from all species of that genus in its fruit, which is devoid of scales, and resembles the smooth club-shaped "chilitos" of the *Mamillarias*. The plant is also devoid of spine-bearing areoles. In 1886 it was referred to the genus *Anhalonium*, which it resembles in its flowers and fruits, but from the type of which it differs in several important features.

The genus *Anhalonium*, defined by Lemaire in 1839, proved to be identical with the genus *Ariocarpus* previously established by Scheidweiler, the type of which, *Ariocarpus retusus*, described in 1838, is specifically identical with the plant described the following year by

¹⁴ "Es singular que los mexicanos miraban el *Peyote* (el que conozco es de las Compuestas . . .) como un medicamento propio para dar aptitud á andar sin cansarse . . ." Oliva, *Lecc. de Farmacologia* 2:392. 1854.



PEYOTE OF JALISCO, *Cacalia cordifolia*, H. B. K.

A member of the Composite, or daisy family, bearing velvety tubers; closely allied to the *Peyotl Xochimilcensis* of Hernandez. The tubers, called *peyotl* ("cocoons"), have medicinal properties, but they are not narcotic. Photograph of specimen in the U. S. National Herbarium collected near Guadalajara in 1907 by W. E. Safford. Photograph natural size. (Fig. 4.)

Lemaire as *Anhalonium prismaticum*.¹⁵ This fact was recognized in 1845, by Salm-Dyck, who, however, adopted the generic name *Anhalonium*.¹⁶ On account of the laws of priority the generic name *Ariocarpus* must be retained and its synonym *Anhalonium* be dropped.

In the genus *Ariocarpus* (*Anhalonium*) the tubercles are very prominent, usually more or less triangular or pyramidal in shape, and imbricating somewhat like the scales of an artichoke. The lower and upper parts are very different, the former comparatively thin and flat, while the upper exposed triangular part is very thick and hard. The lower surface of the tubercles is smooth and keeled, the upper surface is plane, as in *Ariocarpus retusus*; or convex and irregularly mamillate, with the acuminate apex bearing a woolly pulvillus, as in *Ariocarpus fursuraceus*; or more or less fissured and presenting a warty appearance, as in *Ariocarpus fissuratus*. One of these species is figured by Lumboltz under the name of *hikori sunami*,¹⁷ and it is said by him to be more powerful than the common *hikori sunami* (*Ariocarpus williamsii*), but he offers no evidence that it has narcotic properties. The Indians declare that if you wear this plant as an amulet the bears cannot harm you nor the deer run away from you. The latter superstition is also held in connection with the closely related *Ariocarpus kotschubeyanus*, commonly called "pezuña de venado," (fig. 5) probably on account of the close resemblance of its tubercles to the hoof of a deer.

In the genus *Lophophora* the tubercles are quite unlike those of *Ariocarpus* (*Anhalonium*), being devoid of a differentiated upper part and having the lower part broad and rounded. Instead of being developed into pyramidal or triangular projections the tubercles often coalesce into broad continuous vertical or somewhat spiral ribs (fig. 7), and in young specimens the plant appears almost smooth, with the tubercles separated by shallow impressed lines (fig. 9).

LOPHOPHORA WILLIAMSII

Lophophora williamsii (*Anhalonium williamsii* Lemaire) is a succulent spineless cactus, usually shaped like a turnip or carrot with a depressed-globose or hemispherical head bearing low inconspicuous tubercles and a tapering tap root. The tubercles occur normally in longitudinal ribs, but in some forms of the plant they are arranged spirally or irregularly. In the center of each tubercle there is a flower-bearing areole with a dense tuft of erect hairs, from the midst of which the flower issues. When mature the tuft of hairs persists as a pulvillus in the form of a pencil or brush of hairs. Unlike the plants of the genera *Echinocactus* and *Mamillaria* there is no spine-bearing areole. The flower (fig. 6) is very much like

that of an *Ariocarpus*, without a well-defined calyx, but with the outer floral leaves sepal-like and the inner ones petal-like and rose-tinted, with a darker median line on the back of each, giving to it a feather-like appearance. The stamens are numerous, with white filaments and bright yellow anthers; and the style bears four pale yellow stigmas projecting above the mass of stamens. The ovary is devoid of scales, in which respect it differs from that of the genus *Echinocactus*, and the smooth crimson or rose-colored club-shaped fruit resembles that of a *Mamillaria*. The plants grow either solitary, or, more frequently, in clusters of several from a common base.

Lophophora williamsii is quite variable, sometimes its ribs instead of being vertical are more or less diagonal or spiral, and instead of being separated by straight grooves the latter are sinuous; or the tubercles may be irregularly arranged. One form was described by Hennings as a distinct species under the name *Anhalonium lewinii*,¹⁸ but the type plant described and figured by him was a boiled up "mescal-button" obtained from Parke, Davis & Co., of Detroit, Michigan, in all probability gathered in the vicinity of Laredo, Texas. In this form the ribs are usually thirteen in number separated by strongly sinuous grooves (fig. 9). Sometimes there are twelve ribs or even as few as nine; while in the typical *L. williamsii* there are usually eight ribs separated by straight or almost straight lines, or sometimes as many as 10. It has been wrongly asserted that the petals of *L. lewinii* are yellow: typical plants of this form now blooming in the cactus house of the United States Department of Agriculture (May, 1915) have rose-tinted flowers in no way distinguishable in form or color from those of *L. williamsii*. Indeed, in specimens collected by Lloyd in Zacatecas typical plants of *L. williamsii* and *L. lewinii* are to be found in the same cluster growing from a common base. Another form (fig. 10) departs from the typical *L. williamsii* even more than the plant figured by Hennings. It has the tubercles more or less irregularly arranged and separated into angular areas by intersecting lines. In young plants the surface is smooth, but in older plants (fig. 8) the tubercles are often prominent. At first the writer was inclined to separate this form from both *L. williamsii* and *L. lewinii*, but after carefully comparing a number of specimens the three types seem to be connected by intermediate forms, and they cannot, therefore, be specifically distinct. Indeed as they sometimes grow from the same base it would be improper even to designate them as varieties.

GEOGRAPHICAL DISTRIBUTION

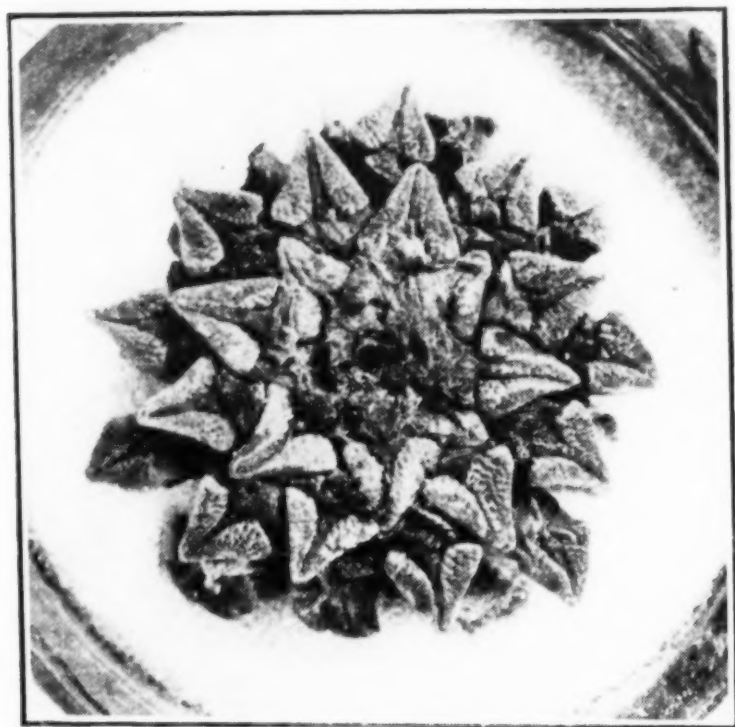
The general range of the genus *Lophophora* is from southern Texas

¹⁵ See Scheidweiler, Bull. Acad. Royale des Sciences de Bruxelles 5:492, 1 pl. 1838. Lemaire, Cact. 1, 1839.

¹⁶ See *Anhalonium retusum* Salm-Dyck, Cact. Hort. Dyck. 15. 1845.

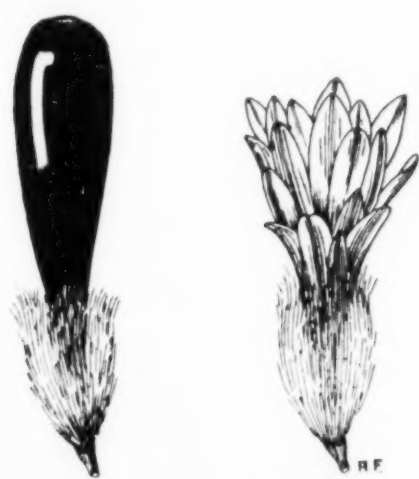
¹⁷ Scribners Magazine 16:451. 1894.

¹⁸ See Hennings, Gartenflora 37:410, figs. 1-4. 1888.



DEER-HOOF CACTUS

Ariocarpus kotschubeyanus, a plant with supposed magic properties, highly prized by Indians of northern Mexico, who declare that if the hunter wears this cactus (here shown natural size), the deer can not run away from him. It probably owes this prestige to the resemblance of its tubercles to the hoofs of a deer. (Fig. 5.)



FRUIT AND FLOWER

Flower of *Lophophora williamsii* (at the right) with rose-tinted petals, issuing from a tuft of hairs, while the fruit (shown at the left) is pink or crimson. Drawing natural size. (Fig. 6.)

along the valley of the Rio Grande, from the mouth of the Pecos River south-eastward, to southern Querétaro, Mexico. Definite localities in which plants have been collected are the following:

Texas.—Mouth of the Pecos River, *William Lloyd*; vicinity of Laredo, *Mrs. Anna B. Nickels* (specimens now growing in the cactus house of the U. S. Department of Agriculture); near Ojuelos, *C. Ochoa* (dried specimens in

the form of "mescal buttons" in the economic collection of the U. S. Department of Agriculture); near Aguilares (specimens sent by parcel post to the Menominee Indians, now in possession of the Bureau of Chemistry).

Tamaulipas.—In the vicinity of Nuevo Laredo, *Mrs. Anna B. Nickels*; near Camargo, south shore of the Rio Grande at the mouth of the Rio San Juan, *E. A. Goldman*, of the U. S. Biological Survey.

Nuevo Leon.—Vicinity of Monterrey, *Professor Emilio Rodriguez*, (specimens growing in the cactus garden of the Colegio Civil, at Monterrey).¹⁹

Coahuila.—Cerro del Pueblo, near Saltillo, *Dr. Edward Palmer* (living plants in cactus house, U. S. Department of Agriculture; dried plants in economic collection).

Chihuahua.—Near Jimenez, in the Sierra de Amole (locality in which the Tarahumari Indians collect their supply for ceremonial purposes); near Santa Rosalía de Camargo, in the Sierra de Amargosa (also visited by the collecting expeditions of the Tarahumari Indians, as stated by Lumholtz).

San Luis Potosi.—Vicinity of Real de Catorce as cited by *Diguet* (locality whence the Huichol Indians obtain their supply).

Zacatecas.—Vicinity of Cedros, near Mazapil, near northern boundary, *Professor F. E. Lloyd* and *Dr. E. Chaffey* (living plants in the cactus house of the U. S. Department of Agriculture; also dried specimens from the market of the city of Zacatecas in the economic collection).

Querétaro.—Near Higuierillos, not far from the city of Querétaro, *Dr. J. N. Rose* (specimen in cactus house of the Department of Agriculture).

CHEMICAL HISTORY OF THE DRUG

Attention was called to the use of this plant as an intoxicant by the Indians by *Mrs. Anna B. Nickels* of Laredo, Texas, who collected material for Parke, Davis and Co., of Detroit, Michigan, and for other wholesale dealers in drugs. *Mrs. Nickels* sug-

¹⁹ See Safford, W. E., "Cactaceae of Northeastern and Central Mexico," in Smithsonian Report for 1908, p. 528 pl. 3, fig. 5. 1909.

gested that a chemical and therapeutic study of the plant be made, and stated that the plant was also used for "breaking fevers," and that the tops cut off and dried were locally known as "mescal buttons." The accompanying photograph of this veteran cactus-lover and assiduous collector, in her cactus garden at Laredo, was taken by David Griffiths of the U. S. Department of Agriculture.

A serious study of its properties was first begun in 1888, by Dr. L. Lewin of Berlin, who used for the purpose specimens obtained from Parke, Davis, and Company. It was afterwards studied by Dr. Arthur Heffter of the Pharmacological Institute of the University of Leipsic; and, in the United States, by a group of persons at Washington, centering in the Bureau of American Ethnology, and including as associates the Division of Chemistry of the Department of Agriculture for chemical analysis; Drs. D. W. Prentiss and Francis P. Morgan of the department of Materia Medica and Therapeutics of the Columbian University, for the study of its physiological properties; and the Botanical Division of the Department of Agriculture for the settlement of botanical questions. The material for the studies carried on in this country was supplied by James Mooney of the Bureau of American Ethnology. The chemical analysis was made by Ervin E. Ewell, who announced his results in a paper entitled "The Chemistry of the Cactaceae," read before the Washington Section of the American Chemical Society, April 9, 1896.²⁰

Dr. Lewin obtained from the drug an alkaloidal substance which he called anhalonin. This substance was a brown, syrup-like liquid, having an intense alkaline reaction. From it Heffter obtained three alkaloids; the first, which he called anhalonin, was in the form of brilliant, colorless, needle-shaped crystals; the second was in the form of non-lustrous, white rhombic tables; the third was an amorphous and very poisonous alkaloid left behind by the mother liquor.

Mr. Ewell found, in addition to the alkaloids, at least two resinous bodies, and a wax-like substance insoluble in cold alcohol but soluble in hot alcohol, petroleum ether, and chloroform. The resinous bodies, of a dark brown color and thick consistency, have the characteristic taste and odor of the moistened drug itself. It was suggested that the drug's activity might be due to these resinous bodies rather than to the alkaloids. One marked peculiarity of the plant is that about one-half its ash proved to be potassium chloride—a proportion greater than that hitherto found in any other plant.²¹

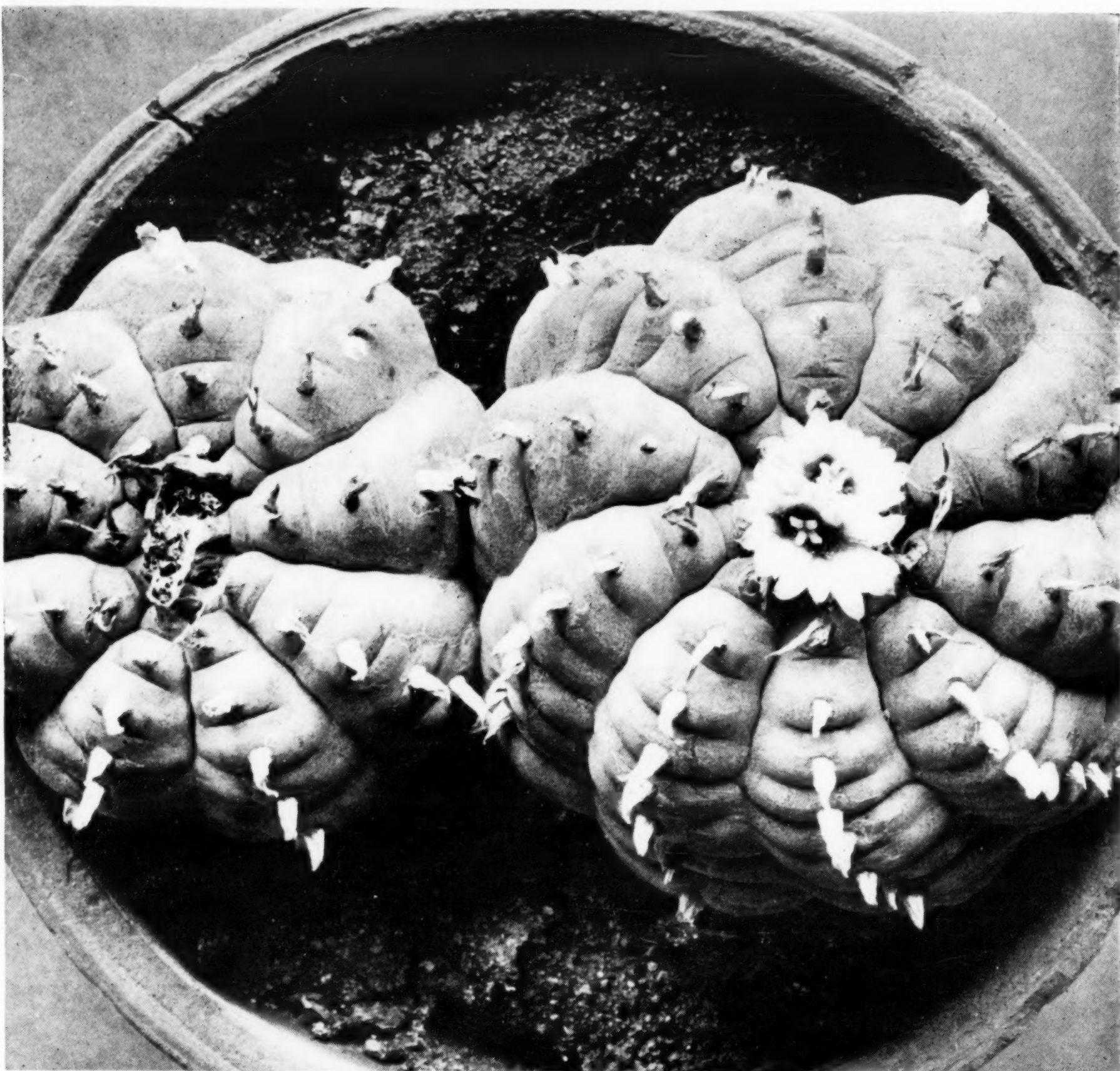
PHYSIOLOGICAL ACTION

Further investigations are about to be made in the Bureau of Chemistry by Dr. Lyman F. Kebler, chief of the division of drugs, and Dr. Francis P. Morgan, whose work in this drug has already been referred to.

The various accounts of the effects of *Lophophora* differ considerably; but nearly all of those who have experimented with it, including Dr. S. Weir Mitchell, agree in the statement that it produces beautiful color visions. The pupil becomes dilated and remains in this condition for some time, often for twenty-four hours, and at the same time there is a slight loss of the power of accommodation and consequent disturbance of vision. Depression of the muscular system has been observed as one of its effects, either well marked or indicated only by inactivity and lazy contentment; and sometimes this was followed by partial anesthesia of the skin after the effects of the drug began to disappear. Sometimes the patient was seized with nausea and vomiting, caused perhaps by the bitter and unpleasant taste of the drug when first put into the mouth. In some cases there was a marked loss of the sense of time. The effects of the drug have been compared with those of Indian hemp (*Cannabis indica*), which has found its way from the Eastern Hemisphere to Mexico and the southwest United States, where it is known as *marihuana*;

²⁰ See Ewell, Ervin E., "The Chemistry of the Cactaceae," in Journ. Amer. Chem. Soc. 18: 624-643, 1896.

²¹ Prentiss, D. W. and Morgan, Francis P., in Therap. Gazette 19, Sept. 16, 1895, p. 579.



LOPHOPHORA WILLIAMSH

Typical form with defined ribs. Photograph of specimen in the Cactus House of the U. S. Department of Agriculture, collected in 1910, on the Hacienda de Cedros, near Mazapil, state of Zacatecas, Mexico, by Dr. Elswood Chaffey. Photograph natural size. (Fig. 7.)

but instead of the exciting effect of the latter, *Lophophora* produces rather a state of ideal content, with no tendency to commit acts of violence.

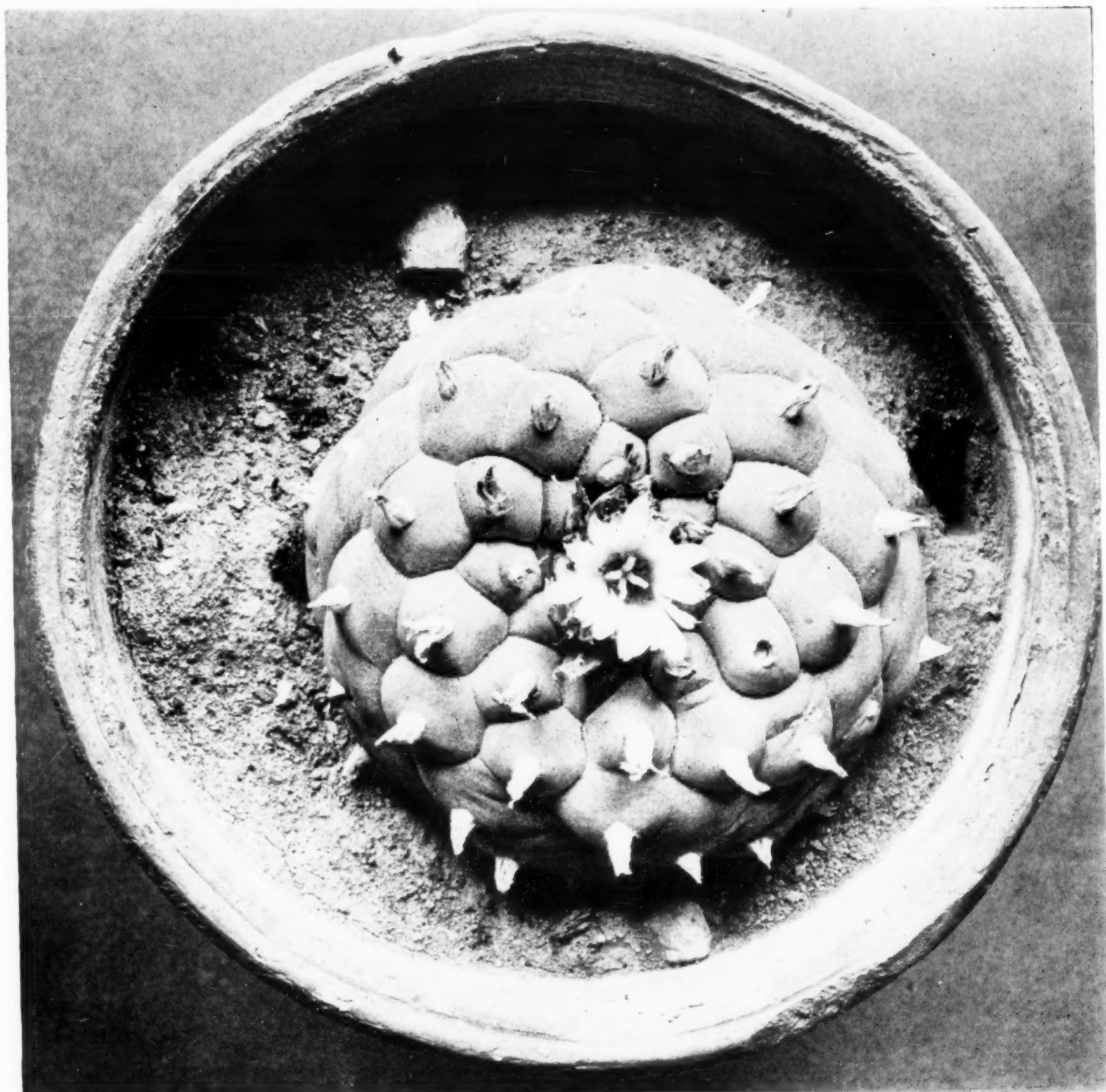
A detailed account of the experiments of Drs. Prentiss and Morgan was published in the *Therapeutic Gazette* of September 16, 1895, pp. 580-585.²²

CEREMONIAL USE BY THE INDIANS

The first to bring to public notice the ceremonial use of this narcotic by existing tribes of Indians was James

Mooney of the Bureau of American Ethnology, in a paper read before the Anthropological Society of Washington on November 3, 1891. His attention had been directed to it while making investigations among the Kiowas, who are descendants of one of the tribes known to the Aztecs by the name of "Chichimecas." Mr. Mooney found that these Indians attribute divine powers to the drug and the ceremony attending its use is of the nature of a religious rite

²² See also Prentiss and Morgan. "Therapeutic uses of Mescal Buttons." *Therap. Gazette* 20:4. 1896.



ANOTHER TYPE OF LOPHOPHORA

Form described by Hennings as a distinct species, *Anhalonium lewinii*, but often occurring in the same cluster with the typical form, growing from the same root. Photograph of specimen in the Cactus House of the U. S. Department of Agriculture, collected in the state of Zacatecas, Mexico, in 1908, by F. E. Lloyd. Photograph natural size. (Fig. 8.)

in which all the tribes of the southern plains take part.

The Kiowas and other Indians of Oklahoma receive the greater part of their supply of the drug from traders who bring it from the vicinity of Laredo, Texas, in the form of "mescal buttons," which are identical with the *teonanacatl* of the ancient Mexicans. Like the ancient Mexican feasts referred to above, their meetings are nocturnal, usually beginning Saturday night. A summary of Mr. Mooney's account was published in the

Therapeutic Gazette of September 16, 1895. A more detailed description was published by Mr. Mooney the following January, in the same journal, from which the following extracts are taken.

"The ceremony occupies from twelve to fourteen hours, beginning about 9 or 10 o'clock and lasting until nearly noon the next day. Saturday night is now the time usually selected, in deference to the white man's idea of Sunday as a sacred day and a day of rest. The worshipers sit in a circle around the inside of the sacred tipi, with a fire

blazing in the center. The exercises open with a prayer by the leader, who then hands each man four mescals, which he takes and eats in quick succession, first plucking out the small tuft of down from the center. In eating, the dry mescal is first chewed in the mouth, then rolled into a large pellet between the hands, and swallowed, the man rubbing his breast and the back of his neck at the same time to aid the descent. After this first round the leader takes the rattle, while his assistant takes the drum, and together they sing the first song four times, with full voices, at the same time beating the drum and shaking the rattle with all the strength of their arms. The drum and rattle are then handed to the next couple, and so the song goes on round and round the circle—with only a break for the baptismal ceremony at midnight, and another for the daylight ceremony—until perhaps 9 o'clock the next morning. Then the instruments are passed out of the tipi, the sacred foods are eaten, and the ceremony is at an end . . . The dinner, which is given an hour or two after the ceremony, is always as elaborate a feast as the host can provide. The rest of the day is spent in gossiping, smoking, and singing the new songs, until it is time to return home."²³

AMONG THE TARAHUMARIS

Lumholtz, in his account of the plant-worship of the Tarahumari Indians of the southwestern Chihuahua, mentions several kinds of cacti which they regard with superstitious veneration; but there is no evidence that any of these have narcotic properties except the "hikori huanami," which is the typical *Lophophora williamsii*. A species of *Ariocarpus* (probably *A. fissuratus*) was sold to him under the name of "hikori sunami," and was declared by the vendor to have certain magical powers; but he did not see it used as an intoxicant. Much that Lumholtz relates in connection with the ceremonial use of the narcotic hikori appears extravagant and fanciful; but it is undoubtedly true

that the Tarahumari Indians, like their more southerly neighbors the Coras and Huicholes, have been led by the wonderful visions induced by the plant to attribute to it supernatural powers. Even the Christians among them salute it and make the sign of the cross when approaching it, and it is often carried by them as a charm or amulet. They declare that Hikori sits next to God and is called "uncle," because it is God's brother.

It will be shown later that a similar superstition is common among some of the Indian tribes of the United States who pay to the plant divine homage. In some of their religious societies there is a ceremony of baptism in which the candidate is sprinkled with an extract of the plant, and also a kind of communion in which the plant is eaten as an incarnation of the Deity, or the flesh of God.

Lumholtz gives an account of the expeditions of the Tarahumaris in quest of hikori, describing their consecration with copal incense before starting out, their ten-days' journey to the land of the Hikori, the erection of a cross on their arrival, the superstitious observances attending the gathering of the plant, which recall the stories of the early European herbalists regarding the mandrake and other magic plants, and the ceremonies attending their return.

The Indians of the village go out with music to welcome the travellers, bearing their precious burden; and at night there is a festival of teswin-drinking and dancing in honor of the plant. The hikori is piled in a heap at the foot of a cross, and is sprinkled with teswin, which is grateful to it; and the next day a sheep or even an ox or two goats are sacrificed in its honor. The wild heathen Indians living in caves or under overhanging cliffs in the barrancas, when they hear of the return of the expedition, come to buy supplies of the hikori for their own use. "One plant," says Lumholtz, "costs a sheep, and the buyer holds a feast in honor of his

²³ Mooney, James. "The Mescal Plant and Ceremony." *Therap. Gazette* 20: 7. 1896.

purchase, and repeats the feast at the same time every year."²⁴

USE BY THE HUICHOLAS OF JALISCO

The ceremonies attending the acquisition and use of the drug by the Indians of the Nayarit mountains of Jalisco and Tepic were described by Léon Diguët in 1899. These Indians belong to the tribes known as Huicholes, Coras, Tepehuanes, and Tepecanos. The Coras, whose use of the *raiz diabolica*, as described by Padre Ortega, has already been noted, now obtain their supply from the Huicholes. The latter send expeditions across the state of Zacatecas to Catorce in San Luis Potosi, where the plant is endemic. The specimens from Zacatecas in the Economic Collection of the Bureau of Plant Industry are not at all mushroom-like, but resemble dry pieces of radishes or carrots sliced longitudinally, or small, terminal fragments covered with silky wool, such as those described by early writers as "*peyote de Zacatecas*." (See fig. 3.) By the Huicholes the drug is known neither as *peyote* nor *teonanacatl*, but as *xicoli*, or *hicuri*, which is identical with the name *hikori* applied to it by the Tarahumari Indians.

According to Diguët the Huicholes collect the plant in October. The expedition lasts about one month, and its return is an occasion for celebration. "Those who take part decorate their hats and their hair with feathers and paint on their faces the distinctive attributes of their caste and of their gods. After having made an offering of peyote upon their altars they distribute pieces of it to all those they meet; a supply of peyote is kept for the feasts which will take place during the course of the year; the rest is sold to those who did not take part in the expedition."

"In eating the peyote the Indians chew the pulp of the plant, which has been cut up into small pieces, and at first spit out the saliva which at the beginning dissolves a bitter principle having a very disagreeable taste, then



TEXAS TYPE

Specimens of *Lophophora* from the vicinity of Laredo, Texas; the upper one a typical *L. williamsii*, with eight ribs separated by straight grooves; the lower one identical with "*L. lewinii*," with 13 ribs separated by sinuous grooves. Photographs from plants growing in Cactus House of U. S. Department of Agriculture; natural size. (Fig. 9.)

they absorb the active principle which dissolves little by little in the saliva."²⁵ According to Diguët the Indians regard the drug as food for the soul, and revere it on account of its miraculous properties. The manifestation of the hallucinations which it produces a little after the absorption of its active principle is held to be a supernatural grace by which men are permitted to communicate with the gods; and, moreover, "in using the drug with moderation the partaker is endowed with

²⁴ See "Tarahumari Dances and Plant-worship." Carl Lumholtz, in *Scribner's Magazine*, October, 1894. Vol. 16, pp. 438-456.

²⁵ Diguët, Léon. "La Sierra du Nayarit et ses Indigènes." *Nouvelles Arch. Missions Scientifiques* 9: 622-24. 1899.

energy which permits him to overcome great fatigue and to endure hunger and thirst for five days."²⁶

PRESENT USE IN THE UNITED STATES

Efforts have been made to prevent the spread of the drug among the Indians of the United States, and action has been taken in the courts to prosecute those who have been instrumental in procuring it and furnishing it. One of the most recent cases is that of the United States versus an Indian named Nah-qua-tah-tuck, alias Mitchell Neck, of the Menominee Indian Reservation, Wisconsin, accused of furnishing intoxicants to certain Indians, in violation of the law. Dr. Francis P. Morgan, of the Bureau of Chemistry, was summoned as a Government expert. The trial developed the following facts:

On March 15, 1914, the accused brought a supply of the drug in a dress suit case to the house of an Indian family named Neconish, situated a short distance north of the village of Phlox, Wisconsin, near the western boundary of the Menominee Reservation, at which place there was a meeting of a religious nature. The drug had been received by parcel post from Aguilares, Texas. The participants first made a line about the house to keep out the evil spirits, and then invoked God, begging him to make all of them good and to keep them from evil. The peyote was next distributed, and when it was eaten caused the partakers to see the evil things they had done and showed them the good things they ought to do.

The ceremony began about 9 o'clock in the evening. One witness testified that shortly after having eaten four buttons he could see pictures of various kinds when his eyes were shut. First he saw God, with a bleeding wound in his side. This vision vanished when he opened his eyes, but reappeared when he closed them again. Then he saw the devil with horns and tail, of the color of a negro. Then he saw bad things which he had done before, bottles of whiskey which he had drunk, a watermelon which he had stolen, and

so many other things that it would take all day to tell of them. Then he saw a cross with all kinds of colors about it, white, red, green and blue. He was not made helpless. He stated that he could have walked had he wished to do so, but that he preferred to sit still and look at the pictures.

Another witness testified that he ate the peyote so that his soul might go up to God. The witnesses who testified at this trial declared that the peyote helped them to lead better lives and to forsake alcoholic drinks. The defendant was acquitted on the ground that the meeting was one of a religious nature.

THE PEYOTE SOCIETY

Thomas Prescott of Wittenberg, Wisconsin, testified that there is a regularly organized association among the Indians called the Peyote Society, also known as the Union Church Society, of which he had been a priest for seven years. In the weekly ceremonies of this society the peyote is either eaten or taken in the form of tea. In his opinion the effect of the peyote is to make better men of the Indians. Many of them were formerly common vagabonds, liable to commit all sorts of crimes when under the influence of alcohol. After becoming members of the peyote society, however, they gave up drink, established themselves in regular homes, and lived sober and industrious lives. In relating his personal experience he made the following statements:

"We boys, before we got this peyote, was regular drunkards; so when I was drunk I was lying on the road somewhere sometimes, and I got no home nor nothing. Before I got this I did wrong and everything else. Now, since I got this peyote, it stopped me from drinking, and now, since I used this peyote, I have been sober, and today I am sober yet . . . I see a good and a bad when I eat that peyote. When I eat that peyote then it teaches me my heart; I know anything that is right and what is wrong. That is the way peyote works for good and works for God, and that is how we worship. . . . When

²⁶ Diguët, Léon. loc. cit. p. 621.

I took this peyote I could see myself when I used to be drunk; I could see the bottles which used to have my whiskey and alcohol in; I could see myself lying drunk in the road. That is the way it shows us the bad and teaches us the good. . . . We could have our meetings without this peyote; but we see some more coming—a new person—he wants to use it—when he takes this peyote then he believes God. That is why we use it for. Without this, why, they would not believe anybody."²⁷

Dr. Morgan gave to the court an account of his experiments bearing upon the physiological action of the drug administered in his presence to several young men who had volunteered for the purpose. The chief effect noticed was the production of visions of various kinds: of moving objects, constantly changing designs and figures of landscapes, friezes, balls of beautiful colors in constant motion. Suggestions of definite objects also brought up visions of that object. These visions were seen only when the eyes were closed. The pupil of the eye was made larger, and this enlargement lasted till the following day; the pulse became slower at first but increased when a greater quantity of the drug was taken; there was evidence of muscular depression with a disinclination to exertion of any kind; and there was a loss of conception of space and time and, in some cases, symptoms of dual personality, not unlike that caused by hashish (*Cannabis indica*). The after effects, however, were insomnia, while hashish eating is usually followed by sleep. In this respect it also differs from opium and somewhat resembles the active principles of coffee and coca (*Erythroxylon coca*). Dr. Morgan further testified that as far as he knew no therapeutic or remedial value of the drug had been established.

At a meeting of the Lake Mohonk Conference in October, 1914, several papers relating to the effects of this drug upon the Indians were read and affidavits from two Omaha Indians were

quoted. From one of the latter, I take the following extracts:

AMONG THE OMAHA INDIANS

At the meetings of the Society "before they sing they pass the peyote around. They begin taking this medicine along about dark, and when they pass it, ask you how many you want, and they often try to persuade you to take more than you want. The medicine does



THE SOUTHERN TYPE

Young plant of *Lophophora* from Higuerillos, state of Queretaro, Mexico, the southern limit of the genus. Collected in 1905 by Dr. J. N. Rose. Photograph natural size. (Fig. 10.)

not work right away, but after it begins to take effect along toward midnight they begin to cry and sing and pray and stand and shake all over, and some of them just sit and stare. I used to sit in their range right along, and ate some of their medicine, but after I ate it the first time I was kind of afraid of it. It made me feel kind of dizzy and my heart was kind of thumping and I felt like crying. Some of them told me that this was because of my sins. It makes me nervous, and when I shut my eyes I kind of see something like an image or visions, and when my eyes are open I can't see it so plain. One of these fellows took twelve beans, or twelve peyote, sitting with some girls . . .

²⁷ From ms. report of the case of the United States versus Nah-quah-tah-tuck, alias Mitchell Neck, in the archives of the Bureau of Chemistry. 1914.

After I have taken twelve peyote I saw a mountain with roads leading to the top and people dressed in white going up these roads. I got very dizzy and I began to see all kinds of colors, and arrows began to fly all around me. I began to perspire very freely. I asked to be taken out of doors. At that time it was 20° below zero. I felt better when I got out of doors. When I went in again I began to hear voices just like they came from all over the ceiling and I looked around in the other room and thought I heard women singing in there, but the women were not allowed to sing in the meetings usually, and so this was kind of strange. . . . After eating thirty-six of these peyote I got just like drunk, only more so, and I felt kind of good, but more good than when I drink whiskey, and then after that I began to see a big bunch of snakes crawling all around in front of me, and it was a feeling like as if I was cold came over me. The treasurer of the Sacred Peyote Society . . . was sitting near me, and I asked him if he heard young kittens. It sounded as if they were right close to me; and then I sat still for a long time and I saw a big black cat coming toward me, and I felt him just like a tiger walking up on my legs toward me, and when I felt his claws I jumped back and kind of made a sound as if I was afraid, and he asked me to tell him what was the matter, so I told him after a while. I did not care to tell at first; but I made up my mind then, after what I saw, that I would not take another one of these peyotes if they gave me a ten dollar bill. . . . In this Sacred Peyote Society they have a form of baptism and they baptize with the tea made from stewing the peyote, and they baptize 'in the name of the Father, and the Son, and the Holy Ghost,' the Holy Ghost being the peyote. Then you drink some of the tea and they make signs on your forehead with the tea and then take an eagle's wing and fan you with it. I heard an educated Indian and he said in a meeting on

Sunday morning, 'My friends, I am glad I can be here and worship this medicine with you; and we must organize a new church and have it run like the Mormon Church.' ''²⁸

USE IN ANCIENT MEXICO

From the preceding description of a meeting of the Sacred Peyote Society held by the Winnebagos and Omahas in 1914 I turn back to the first account we have of the *Teonanacatl* feasts of the Aztecs, written by Padre Bernardino Sahagun in the sixteenth century—before Sir Francis Drake set out upon his voyage round the world—before tobacco which, under the name of *piciatl*, the Mexicans also worshipped, was first brought to England.

"The first thing eaten at the party was certain black mushrooms which they call *nanacatl*, which intoxicate and cause visions to be seen, and even provoke sensuousness. These they ate before the break of day, and they also drank cacao (chocolate) before dawn. The mushrooms they ate with syrup (of Maguey sap), and when they began to feel the effect they began to dance; some sang; others wept because they were already intoxicated by the mushrooms; and some did not wish to sing, but seated themselves in their rooms and remained there as though meditating. Some had visions that they were dying and shed tears; others imagined that some wild beast was devouring them; others that they were capturing prisoners in warfare; others that they were rich; others that they had many slaves; others that they had committed adultery and were to have their heads broken as a penalty; others that they had been guilty of a theft, for which they were to be executed; and many other visions were seen by them. After the intoxication of the mushrooms had passed off they conversed with one another about the visions which they had seen."²⁹

The following description of a religious meeting in July, 1626, at which sacred mushrooms were administered in the

²⁸ Daiker, F. H., "Liquor and Peyote a Menace to the Indian," in Report of the Thirty-second Annual Lake Mohonk Conference, October, 1914, pp. 66, 67.

²⁹ Sahagun, Bernardino. Hist. Nueva España (ed. Bustamante) 2: 366. 1829.



MRS. ANNA B. NICKELS IN HER CACTUS GARDEN

This veteran cactus lover, a resident of Laredo, Texas, called attention to the narcotic properties of *Lophophora*, and supplied to Parke, Davis & Co. material with which to investigate the drug. Photograph by David Griffiths, U. S. Department of Agriculture. (Fig. 11.)

form of communion, is related by Padre Jacinto de la Serna, at that time beneficiary of Tenantzingo.

"To this meeting had come an Indian, native of the pueblo of Tenango (about 25 kilometers from Toluca) and grand master of superstitions, named Juan Chichiton (or "John Little-dog"), who had brought some of the mushrooms that are gathered in the *monte*, and with these he had performed a great idolatry. But before proceeding with my story I wish to explain the nature of the said mushrooms, which in the Mexican language are called *Quauhtlananacatl* ("wild mushrooms"). When I asked

the *licenciado* Don Pedro Ponce de Leon what they were like, he said that these mushrooms were small and yellow, and that they were collected by priests and old men, appointed as ministers for these impostures, who would proceed to the place where they grow and remain almost the whole night in prayer and in superstitious conjuring; and at dawn, when a certain little breeze known to them would begin to blow, then they would gather the narcotic, attributing to it deity, with the same properties as *ololiuhqui* or *peyote*, since when eaten or drunk, they intoxicate those who partake of them, depriving them of

their senses, and making them believe a thousand absurdities.³⁰

"This man, Juan Chichiton, brought these mushrooms one night to a house where there was a gathering for the celebration of a saint's feast. The saint stood on the altar and below the altar were the mushrooms, with some pulque, and fire. All night long the *teponaztli* (wooden drum made from a hollowed log) kept time to the singing, and after the greater part of the night had passed, the said Juan Chichiton, who was the priest of that solemnity, administered to all those congregated at the feast mushrooms and pulque after the manner of communion, winding up the celebration with an abundant quantity of pulque; so that the mushrooms on their part and the pulque on its, took away their reason, which was a pity. The said Juan Chichiton fled soon afterward, nor could I obtain information about the others who took part, in order to chastise them, with the exception of Leonor Maria, whom I kept as a prisoner in my house for having joined in the idolatry which they performed with the mushrooms.

"I asked the said *licenciado* Don Pedro Ponce de Leon in what manner these creatures perform their acts of witchcraft in working harm to others; and he told me that in making their threats and menaces they strike themselves on the breast as at the *Sanctus* with the tips of their fingers and then, opening their hand, they make a gesture as if hurling something in the direction of the person whom they are menacing or wish to bewitch, saying: 'You shall pay me for that, as you will see!' But concerning other words and things which they say and do by order of the devil in these *embustes*, never or scarcely ever could anything be ascertained; though it stands to reason that they

must have them as a pact with the devil; and he, who is the author of all, closes their mouths, so that there may be no means of remedying the evil."³¹

SUMMARY

After comparing the preceding accounts of the use of narcotics by the ancient Mexicans and by the Indians of the present day, separated in time by three centuries and in space by thousands of miles, there can remain no doubt that the mushroom-like peyote used by our own Indians in the United States, which we know to be identical with the sacred *hikuli*, or *hicori*, of the Sierra Madre Indians, is the same drug which was called *teonanacatl*, or "sacred mushroom," by the Aztecs. According to the earliest writers, it was endemic in the land of the Chichimecas, the early home of our Apaches, Comanches, and Kiowas, which is also the source of the modern supply. The ancient Mexicans, like the Huicholes and Tarahumaris of the present day, obtained their supply of the drug through the medium of messengers, consecrated for the purpose, who observed certain religious rites in collecting it, and who were received with ceremonial honors on their return. Although the Indians on our northern reservations now receive it through the medium of the parcel post; yet they attribute to it the same divine properties as the ancient Mexicans and like them combine its worship with the religion they have received from Christian missionaries. It is only natural that those who are engaged in the work of Christianizing and uplifting our Indians should try, like the early Spanish missionaries, to stamp out its use. On the other hand many of the Indians who use the narcotic declare that they take it as a kind of sacrament or communion, and that it helps them

³⁰Lumholtz gives a somewhat similar account of the expeditions of the Huichol *hikuli*-seekers: their prayers before starting forth on their journey, their priestly character, their worship of the God of Fire, the importance attached to their dreams while on the road, the ceremonial shooting of arrows on their arrival in the *hikuli* country, their votive offerings, their prayers to the five winds, and their petition to the *hikuli* not to make them crazy, the gathering of the sacred plants and of the discharged arrows covered with dew, and the return home with its attending ceremonies. Lumholtz, Carl—Unknown Mexico 2: 126-136. 1902.

³¹Jacinto de la Serna, "Manual de los Ministros para el conocimiento de sus idolatrías y extirpación de ellas," in Documentos inéditos para la Historia de España, vol. 104, p. 61. Madrid, 1892.

to turn from wickedness and lead good lives.

A knowledge of botany has been attributed to the Aztecs which they were far from possessing. Their plant names show that their classification of plants was not based upon real affinities, and it is very probable that they had not the slightest notion of the difference between a flowering plant and a fungus. Certainly they applied the names *nanacatl* and *nanacace* to both fungi and flowering plants and the name *peyotl* to both the narcotic cactus, *Lophophora*, and to the tuber-bearing composite, *Cacalia*. The botanical knowledge of the early Spanish writers, Sahagun, Hernandez, Ortega, and Jacinto de la Serna, was perhaps not much more extensive: their descriptions were so inadequate that even to the present day the chief narcotic of the Aztecs, *Ololiuhqui*, which they all mention, remains unidentified.³² They knew

these narcotic drugs only in their dry state; and the general appearance of the *peyotl* brought from the vicinity of Zacatecas (fig. 3) was so very different from the *teonanacatl* from the more northerly region inhabited by the Chichimecas (fig. 1) that the two forms might easily have been regarded as coming from distinct plants.

As far as the author knows, this is the first time that the identity of the "sacred mushroom" of the Aztecs with the narcotic cactus known botanically as *Lophophora williamsii* has been pointed out. That it should have been mistaken by the early Spaniards for a mushroom is not surprising when one notices the remarkable resemblance of the dried buttons to peltate fungi, and also bears in mind that the common potato (*Solanum tuberosum*) on its introduction into Europe was popularly regarded as a kind of truffle, a fact which is recorded by its German name, *Kartoffel*, or *Tartuffel*.

³² Sahagun describes two plants bearing the name *Ololiuhqui*: one, which is not narcotic, with a fleshy turnip-like root, leaves like those of a *Physalis*, and yellow flowers; the other, also called *Coaxoxouhqui*, or "green snake," with highly narcotic seeds. (Op. cit. vol. 3, pp. 264, 241.) Hernandez describes the latter as round like those of Coriander, and says that they are produced by a twining plant called *Coaxihuitl*, or "snake-weed," which has fibrous roots and longish white flowers (Hern. ed. Recchi, p. 145); while Serna does not describe the plant, which he probably never saw, but compares the form of the seeds to that of lentils: "semilla a modo de lentejas que llaman Ololiuhqui." (Op., cit. p. 163.) Hernandez thought the plant might be the same as the *Solanum maniacum* of Dioscoroides. Dr. Manuel Urbina, of the National Museum of Mexico, declared it to be *Ipomoea sidaefolia* of Choisy; but this identification, while agreeing with Hernandez's illustration, lacks confirmation through investigation of the chemical properties and physiological action of the seeds of this species; and it is not known that any of the Convolvulaceae are narcotic, though many of the Solanaceae, which have somewhat similar flowers, are highly so. It is very strange that Mexican botanists living in the country of the *Ololiuhqui* have not solved the mystery of its identity.

Mulattoes in the United States

Elaborate statistics regarding the Negroes in the United States are given by the Bureau of the Census in its recently-issued bulletin 129, compiled by Dr. Joseph A. Hill. "Of the 9,827,763 Negroes enumerated in 1910, 7,777,077 were reported as 'black' and 2,050,686 as 'mulatto.' In 1850 the percentage reported as mulatto was 11.2. It had advanced but little in 1870, being only 12%, but since 1870 the proportion of mulattoes in the Negro population appears to have increased very materially, reaching 15.2% in 1890 and 20.9 in 1910. Considerable uncertainty necessarily attaches to this classification, however, since the accuracy of the distinction made depends largely upon the judgment and care of the enumerators. Moreover, the fact that the definition of the term 'mulatto' adopted at the different censuses has not been entirely uniform may affect the comparability of the figures to some degree. At the census of 1910 the instructions were to report as 'black' all persons who were 'evidently full-blood Negroes' and as 'mulatto' all other persons 'that have some proportion or perceptible trace of Negro blood.' "

SWEET CHERRY BREEDING

Scientific Improvement only Beginning—Breeders in Ignorance as to Nature of Material with Which They Are Dealing—Needs of Growers—Self-sterility of Cultivated Varieties.¹

V. R. GARDNER

Professor of Pomology, Oregon Agricultural College, Corvallis, Ore.

AT THE present time the sweet cherry varieties grown in this country number among the hundreds. A large percentage of these varieties are of old world origin. Though seedlings of American origin were named and introduced at a comparatively early period in the history of American pomology, it is only within recent years that American varieties of commercial importance have appeared. Among a number of reasons for this is the fact that while the sweet cherry has not proved to be particularly well adapted to much of the territory east of the Rocky Mountains, at the same time it has not practically refused to grow there, like certain other fruits of European origin. Consequently, there has not been the same amount of effort devoted to its breeding in Eastern America, as the many good qualities of the fruit would seem to warrant. On the other hand, the last fifty or seventy-five years have shown that the sweet cherry reaches a high degree of perfection on the Pacific Coast; and with the rapid development of a commercial cherry industry there, new varieties of more or less promise have appeared.

With the hundreds of European varieties upon which to build an industry it might seem that there would be little need of breeding new varieties for the section in question, especially since such a large percentage of those in existence seem to do as well here as in the countries of their origin. In fact such a need has not been felt until comparatively recently—as market demands have come to be more exacting.

Today certain sections have come to cater to particular markets. Only by being able to send a particular type of cherry to particular markets at certain seasons can competition with other sections be largely avoided and the largest profits be realized. For instance, certain California sections are mainly interested in an extra-early firm shipping variety that can be placed upon the Eastern markets in late April and early May; certain eastern Oregon and Washington valleys are desirous of growing very late shipping varieties that can be placed upon those same markets in late July and early August; still other sections desire a light colored canning variety that can be grown with the Napoleon to lengthen the harvesting season for the cannery. Many other "vacant places," if such they may be called, might be mentioned in our present catalogue of cherry varieties; but enough have been indicated to suggest the nature of the practical problems presented to the breeder by the cherry industry.

OBSTACLES TO BREEDING

It would seem that these objects not only ought to be possible of attainment, but that many of them ought to prove comparatively simple problems for the plant breeder. However, when the situation is investigated it is found that the breeder has very little in the way of detailed information regarding the materials with which he must work. With but few exceptions nothing is known regarding the ancestry of present day varieties. Most of them originated as chance seedlings. When

¹ Report to the committee on research in plant-breeding, American Genetic Association. Submitted by the committee.

supposed parentage is given for some of them in standard pomological works it is often found that there is only circumstantial evidence to indicate such parentage. Perhaps the seedling sprang up near a tree of some other known variety and hence was assumed to be its offspring.

Of course the cherry breeder can make large numbers of crosses between varieties he thinks might combine to give him the particular qualities he desires, but in this he would be very largely dependent upon chance for his results. No body of facts is available which will enable him to select parents that he can depend upon for transmitting certain qualities. It would seem that one of the first things for the cherry breeder to do is to make a careful analysis of the varieties now in his possession, to determine if possible what is the nature of their gametic constitution, what really are the unit characters or factors, or the combinations of unit characters or factors, that they possess; and to determine how these factors or combinations of factors are transmitted. This is not essentially different from the

work that is necessary when starting breeding studies with other plants; but the problems associated with an analysis of his materials are somewhat more difficult than usual for the cherry breeder, because at least a large percentage, if not all, of the varieties with which he would work are self sterile. The inter-sterility of a number of the apparently more promising varieties still further complicates the whole question. A certain amount of progress in this direction is being made, but it will probably require many years to acquire the data that are really fundamental to scientific cherry breeding work. This is not stating that valuable varieties will not originate as chance seedlings within the near future, just as Lambert, Bing and a number of others have originated during recent years. It is to be expected that valuable additions to our cherry list will come in that way. Furthermore, varieties of merit are almost certain to appear incidental to the careful experimental work necessary in studying the inheritance of characters in the sweet cherry group.

Race Betterment Conference

The second Race Betterment Conference will be held at San Francisco August 5-8 inclusive. Arrangements are in charge of a committee with David Starr Jordan as chairman, Dr. Herbert Stolz of Lane Hospital, San Francisco, as secretary.

NEW PUBLICATIONS

THE GREAT SOCIETY—A PSYCHOLOGICAL ANALYSIS, by Graham Wallas, London School of Economics and Political Science. Pp. 382, 8vo., price \$2. New York, The Macmillan Company, 66 Fifth avenue, 1914.

"This book is written with the practical purpose of bringing the knowledge which has been accumulated by psychologists into touch with the actual problems of present civilized life." It should be particularly helpful to eugenists, now that they are coming generally to realize that the success of their propaganda depends largely on the expertness with which they use applied psychology. The author himself is in warm sympathy with the biological study of the question, declaring that "social psychology can never lead men to wise practical conclusions unless it keeps in view its relation to that science of human breeding which Sir Francis Galton named Eugenics." He analyses the important human dispositions in an extremely readable way, showing how they can be used for the improvement of the organization of society. A perusal of it would tend to broaden and clarify the ideas of almost every social worker.

BLACK AND WHITE AYRSHIRES

Colors as Old as the Breed—Rare in America but Much More Common Abroad—
No Indication of Mixed Ancestry—Possible Origin of the Breed.

A. H. KUHLMAN

Department of Animal Husbandry, University of Wisconsin, Madison, Wis.

BLACK and white cattle are well known to all Americans interested in dairying, because of the popularity of the Holstein-Friesian breed, but those colors are not commonly associated with Ayrshires in this country, and it is a surprise to most travelers to find black and white cattle in the Ayrshire district of Scotland. My attention was first attracted to them at the Kilmarnock (Scotland) Show in April, 1914, where several of them were on exhibition, one of which (Fig. 12), was among the prize winners. The black and white Ayrshire cattle as the illustrations (Figs. 12 and 13) show, have the typical Holstein markings in that the black and white are distinctly separated and there seems to be a tendency for the spotting to occur in large patches rather than in numerous small spots as commonly seen in Ayrshires.

In the scale of points as adopted in 1906 by the Ayrshire Cattle Herd Book Society of Great Britain and Ireland, the following description is given of the color of the breed:

"Red of any shade, brown or these with white, mahogany and white, black and white; or white; each color distinctly defined."

The description of the color of the breed as given in the Herd Book in 1884, however, shows that black and white was not always popular with the members of that organization as is shown by the following reference to it:

"Color, red of any shade, brown, or white, or a mixture of these, each color being distinctly defined. Brindle or black and white is not in favor."

William Bartlemore in describing¹ his

ideal of the breed in 1889, makes the following statements:

"As regards the color, it is much a matter of fancy. The prevailing one is flecked brown and white, but there are many splendid animals all brown while the leading show yard color during the last ten years has been white, with brown or dark brown sides of head. Few dairies in Scotland of any size at the present day are without their flecked black and white Ayrshire and strange to say, that color is much in demand by gentlemen who keep a few cows for family use."

AMERICAN STANDARD

The American and Canadian Ayrshire breeders have adopted a uniform scale of points which closely resembles the British, but does not recognize the black and white cattle. It refers to color as follows:

"Color. Red of any shade, brown or these with white; mahogany and white, or white; each color distinctly defined."

Very few black and white Ayrshires have been imported into this country, because American buyers think the color shows the presence of Holstein blood.

The red color of the Ayrshire is apparently a different kind of red than that of the Shorthorn or the Red Polled cattle. It seems to be a peculiar red which usually shades into a mahogany or wine colored tinge producing a color commonly recorded as brown in the Ayrshire Herd Book. The term brown as used in this way, includes many shades of red ranging from a bright red to a very dark brown.

Further observation and inquiry in

¹ Speir, J., Early History of the Ayrshire Breed of Cattle, Glasgow, Aug. 13, 1909.



BLACK AND WHITE AYRSHIRE PRIZE WINNER

Heifer exhibited at the Kilmarnock (Scotland) show, 1914. As will be noticed, her markings are quite like those of a typical Holstein. Black and white are almost unknown colors in an American Ayrshire, but this prejudice against them is not founded on reason. (Fig. 12.)

Scotland showed that many of the leading breeders of pure bred Ayrshires have one or more black and white animals in their herds. It is claimed by many that they are better producers than the white, brown, or brown and white animals. Some also claim that a black and white Ayrshire cow from a black and white dam, always produces calves of that color even if bred to a bull that is white and brown.

A count of several hundred animals in the local markets showed that from 3 to 4% of the grade Ayrshires were black and white. Grades of this color are considered good producers and

often bring a higher price on the market than grades of the more usual color. Some breeders who do not admit the superior milking qualities of the black and white cows, keep them for "good luck" as they say or for the contrast they add to the color of the herd.

A study of several volumes of the herd book, brought out some interesting details. Volume 8 of the Ayrshire Herd Book, published in 1885, is the first one in which any mention is made of the color of the individual animals recorded in it and in Volume 9 this record is not complete, for the color of about one hundred cows entered in it

is not given. However, it does show that even at that time black and white cattle were accepted for registration.

Brown as used in these tabulations includes all shades of red and likewise, for convenience, red and white animals are tabulated with those that are brown and white. It may be assumed that the terms brown or white as used in the herd book do not always refer to a self brown or self white, but rather to animals that would ordinarily be called brown or white by the casual observer. For example, some of the so-called white cows have brown eye lashes and dark colored eyes which would not be present in a true self white. The designations brown and white, and white and brown are freely used in the herd books, the former apparently referring to animals appearing more brown than white and the latter to those showing

more white than brown, but it would seem as if there would be many cases in which it would be hard to determine which should be used.

A comparison of Tables I and II shows a decrease from 1886 to 1913 of about 10% in the number of white and brown cows. Table II shows a remarkable similarity in the per cent. of cows and bulls of the different colors, which is not the case in Table I. It is probable that this difference may be largely due to greater care being exercised in the later registration work. Table II also shows that there are only about one-half as many black and white cows as either red or white.

Table III shows in more detailed form the marking of the bulls referred to in Table II, as they are entered in the herd book. It brings out an interesting point that is well known among Ayrshire breeders and exporters, namely,

TABLE I

Summary of Registration in Vol. 9, of the Ayrshire Herd Book

Color	Cows		Bulls	
	Number	Per cent.	Number	Per cent.
White.....	53	13.35	26	23.64
Brown.....	59	14.86	10	9.09
Black and white.....	9	2.26		
Brown and white.....	191	48.12	38	34.55
White and brown.....	85	21.41	36	32.72
Total.....	397	100.00	110	100.00

TABLE II

Summary of Registration in Vol. 36, Published 1913

Color	Cows (pedigreed)		Bulls	
	Number	Per cent.	Number	Per cent.
White.....	176	3.91	54	5.42
Brown.....	145	3.22	32	3.21
Black and white.....	67	1.48	15	1.50
Brown and white.....	4119	91.39	896	89.87
Total.....	4507	100.00	997	100.00

TABLE III
Summary of Bulls Registered in Vol. 36

Color	Number	Per cent.
White.....	54	5.42
Brown.....	32	3.21
Black and white.....	15	1.50
Brown and white.....	339	34.00
White and brown.....	418	41.93
White, brown cheeks.....	79	7.93
White, brown neck.....	27	2.71
White, dark cheeks.....	20	2.00
White, dark spots.....	8	.80
Flecked.....	3	.30
Marked.....	2	.20
	997	100.00

the tendency to select sires with much white (Figs. 14 and 15) to satisfy popular fancy. It shows that of almost 1,000 bulls registered in that volume, 34% were brown and white, 41.93% were white and brown and 12.64% had the brown restricted to the head and neck. The latter form of marking is one of the most popular at the present time. Almost all of the black and white bulls now used for service are marked in this way and it is doubtful if very many bulls marked like the black and white cows (Figs. 12 and 13), are kept for breeding purposes today, but bulls with black or very dark jaws or cheeks are very popular. It is interesting to note that by careful selection the color pattern of a spotted breed can be greatly changed.

The so-called "White horse with black eyes,"² is a striking illustration of what may be accomplished along this line. By careful selection from brown and white spotted animals, a strain of horses was produced in Denmark and also at Hannover which are entirely white in color of hair and skin, but are distinguished from albinos in that the eyes always remain black.

The Ayrshire Herd Book Society is one of the very few breed associations that still makes provision for the registration of animals not the offspring of recorded ancestors. All animals en-

tered in the Herd Book are divided into three groups: (1) those entered with a number or in the Herd Book proper, (2) those entered in Appendix A, and (3) those entered in Appendix B. Subject to the approval of the committee in charge of this work, a cow or heifer becomes eligible for entry in Appendix B, on one of the first three following conditions in addition to the fourth:

1. The sire of such a cow or heifer must be entered in the herd book.

2. She must be an individual of high merit, as shown by winning a prize at an agricultural show in a class for Ayrshires.

3. She must be able to attain a high standard of production by producing an authentic milk yield within one year and in addition an examining committee must declare that she possesses the true characteristics of the Ayrshire breed.

4. In addition to fulfilling one of these three requirements, the owner and breeder must sign a statement declaring that she is a pure bred Ayrshire.

The female offspring of a dam entered in Appendix B, sired by a recorded bull, is eligible for entry in Appendix A. Cows entered in either Appendix A or B are entered by name but without a number. No bulls can be entered in either Appendix A or B.

An animal is eligible for entry in the Herd Book proper, that is with a

² Walther, A. R., Beiträge zur Kenntnis der Vererbung der Pferdefarben, 1912.



CHARACTERISTIC COLOR DISTRIBUTION

In the black and white Ayrshires, the colors usually occur in large patches, and are distinctly separated. Other colors in the Ayrshire more usually occur as numerous small spots. The cow here shown is the dam of the heifer illustrated in Fig. 12. (Fig. 13.)

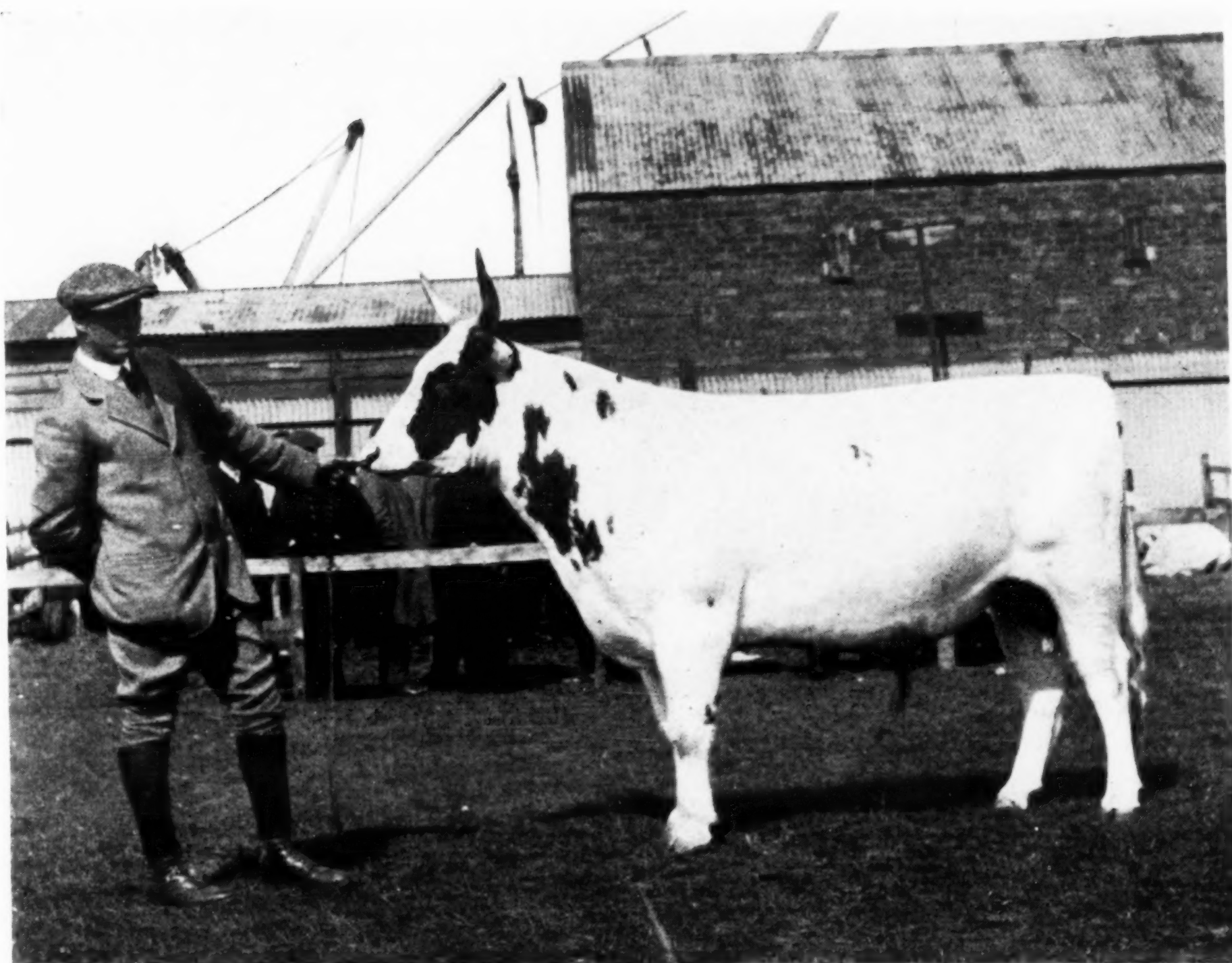
number, if both sire and dam are entered with numbers, or if the sire is recorded and the dam is entered in Appendix A of any volume.

BREED IS KEPT PURE.

Under these provisions it is possible for the progeny of many animals that have been bred pure for many years to qualify for registration in the herd book. That Ayrshire breeders are taking advantage of these provisions is shown by the numbers recorded in Vol. 36, in which 4,507 cows and 895 bulls are entered with numbers, 1,128 cows are entered in Appendix A, and 1,848 cows in Appendix B. This seems like introducing a large amount of new blood into the breed every year, but it must be remembered that these animals, for all practical purposes, have exactly the same kind of breeding as the pedi-

greed animals. Then, too, this breed is confined to a rather small area into which comparatively few animals of other breeds have been introduced for breeding purposes for several centuries. Confinement to such a small section has the further advantage that the committees in charge can very easily obtain reliable information about the breeding of any herd.

Table IV shows that the per cents. of black and white cows in Appendices A and B are considerably higher than those shown in the preceding tables, but that does not prove that the black and white color is introduced into the breed by this method of registration, for Table I shows that Vol. 9 contained 2.26% black and white cows, which would tend to indicate that black and white was present in the breed in the early stages of its development.



A CHAMPION AYRSHIRE BULL

Hobsland Perfect Peace, champion Ayrshire bull at Kilmarnock, Scotland, in April, 1914, and also at the National Dairy show in Chicago in October, 1914. His color is nearly white, the brown markings being almost exclusively confined to head and neck; and he represents very well the prevailing fashionable type of Ayrshire bull in this country. (Fig. 14.)

The study of the early history of the Ayrshire breed leads to several theories explaining the appearance of this black color as shown by the investigations of John Speir. Even though the Ayrshire is one of the most recent breeds, its origin is as great a mystery as any of the older ones. The original cattle of Scotland were black in color, small in size and had short horns. The Roman invasion brought other types of cattle into the country. The resulting fusion may have formed the basis for some of the later breeds.

As a much larger number of the Ayrshire cattle of today are white or almost white, when compared with the numbers of the early days some people think that the white color of the Ayrshire is a reversion to the color of

some white ancestor like the wild white cattle of Cadzow Forest. It seems unlikely that the Ayrshire is in any way related to the Cadzow Forest cattle. Speir states that between 1865 and 1880 several bulls, mostly white in color, became noted prize winners. As a result they became very popular and in a few years their progeny was widely distributed. This easily accounts for the prevalence of many Ayrshires at the present time that are mostly white.

Other suppositions suggest Norwegian or Spanish origin, but nothing has ever been found to substantiate these claims. That Dutch cattle were used in the early formation of the British breeds is quite probable. Writers of the fifteenth and sixteenth centuries fre-

TABLE IV
Summary of Cows Registered in Appendix A and B of Vol. 36

Cows Registered in Appendix A			Cows Registered in Appendix B	
Color	Number	Per cent.	Number	Per cent.
White.....	44	3.90	51	2.75
Brown.....	55	4.88	90	4.86
Black and white.....	39	3.45	111*	6.05
Brown and white.....	530	46.99		
White and brown.....	460	40.78	1596	86.34
	1128	100.00	1848	100.00

* This number included 13 black cows.

quently mention red and white, and black and white, but do not give any direct mention of Dutch cattle. No writer before 1600 mentions any breed that even remotely resembles the Ayrshire breed, but before 1800 the breed had spread over the county of Ayr and surrounding districts.

Before and during this period there was close connection and much trade with Holland. It is not unlikely that many of the cattle of that country were imported before 1600. That most of the Ayrshires are red and white instead of black and white, may be due to the fact that more of the former color were imported from Holland. For example, many red and white cattle are still found in some sections of Holland, and red and white seems to have been the common color of Dutch cattle before 1750. It may be that most of the British importations were selected from such cattle. It is true that there are many differences between the Dutch and the Ayrshire cattle of today, but these differences might be expected from differences in selection, food and environment during a period of several centuries.

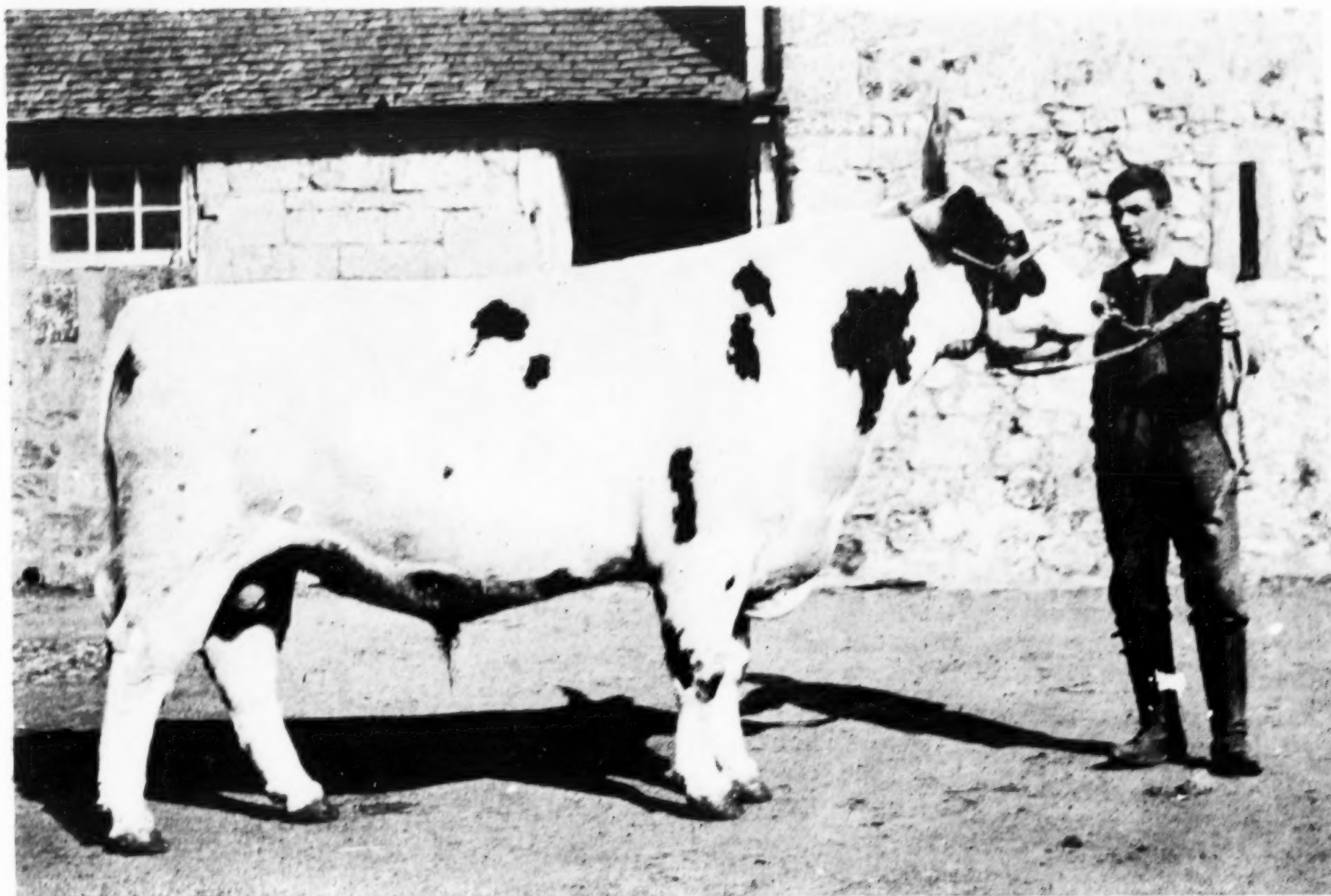
Speir also states that the Dutch paintings between 1600 and 1750 usually represent cattle as red and white in color, but after 1750 black and white seems to have become the popular color.

Brody³ in a very interesting discussion of the Ayrshires, also refers to the color and origin of the breed. The following free quotations are taken from his paper:

"The tendency towards partial albinism is quite pronounced in Ayrshires. This is rather remarkable for the breed originally was very dark colored, but systematic selection for color, as practiced by the breeders, probably accounts for the change in color. During the eighteenth century only a few white markings were usually found, but as early as 1811 Aiton⁴ found that there was a decided tendency towards a mixture of white and brown markings. That the darker colored animals were previously more common is also shown by the reproductions of the Ayrshires of the latter part of the eighteenth century as well as by the method of designating the white spotted animals that were employed by the breeders. Cows with a white face were called 'bassened,' those having white on the neck 'hawked,' those having white along the back or loin 'rigged' and if the switch of the tail was white they were called 'tagged.' This would seem to indicate that if white was present at all, it was confined to comparatively small areas and found on one part of the body only. Since that time a decided change has occurred with reference to

³ Brody, Dr. Ladislaus, Die Ayrshires. Mitteilungen der Landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien. Aug. 18, 1914.

⁴ Aiton, William., General view of Agriculture of the County of Ayr, 1811, Glasgow.



CHAMPION AT THE AYR SHOW

Howie's Sir Hugh, champion bull at the Ayr show in Scotland in 1914 and 1915. Most of the prominent sires now in use in herds of Ayrshires resemble this bull in being mostly white; but the preference for a predominantly white bull seems to have no sound genetic basis. (Fig. 15.)

the distribution of the color pattern in the Ayrshire."

The results of Brody's investigations of the color of the breed are given in the following table:

Color of Animals	Per cent.
Almost wholly or mostly white.....	35.24
Equally white and brown.....	33.34
Almost wholly or mostly brown.....	25.70
Black or black and white.....	5.72
	100.00

As nothing is said about registration in this connection, it may be assumed that this tabulation was made without considering it and it is very probable that similar results could be obtained in many sections of the Ayrshire district.

Among the many theories that are advanced as to the origin of the breed, he enumerates the following:

1. A local theory is that the breed was imported.
2. Some claim the breed was developed locally.

3. John Speir claims that the breed is of Dutch origin.

4. Professor Wallace thinks it descended from the *Bos longifrons*.

5. Sanson designates it as a hybrid

breed tracing to the celtic cattle and showing certain resemblances to the Kerry.

From a study of the history of the British Isles as well as the skulls and other characteristics of the Ayrshire, Brody assumes that the breed is of celtic origin, had been bred pure for a long time and was brought into Scotland when the Celts were forced to withdraw before the Romans and later before the Anglo-Saxons. Of course these cattle resembled the present day

breed very little, and many changes have occurred since that time. Brody accepts Aiton's view of the later development of the breed.

"Aiton reports that the cattle of Ayrshire formerly were mostly black, with a white stripe along the back, white in the flank or face and had horns that were turned upwards and inwards."

"The present day breed was developed by introducing other blood, better care and selection. He states that about 1740 to 1800 a large number of Dutch as well as Shorthorn cattle were introduced and crossed with the native cattle. Which of the two were used more freely, is not certain, but as the Shorthorn was even then famous on the Island and also easier to obtain, this fact leads to the assumption that perhaps more Shorthorns than Dutch cattle were used. The striking feature

about it is that as a result of such unsystematic introduction and crossing, such a remarkably uniform breed was obtained which for many decades has maintained its individuality. Two things may have aided in this—(1) the introduction of foreign blood may have been confined to a relatively short period and (2) as the work of development was probably begun in the large herds the smaller breeders soon fell into line and followed their example. Then, too, information about the merits of any animal or system of breeding would be quickly disseminated in such a small section as that in which the breed was developed."

Whatever may have been the origin of the black in Ayrshires, it is certain that this color is as old as the breed itself and black and white Ayrshires are just as pure as those that show other colors.

ANNUAL MEETING OF THE ASSOCIATION

THE American Genetic Association will hold its annual meeting at Berkeley, California, August 2-6, inclusive. The sessions now scheduled are as follows:

Monday afternoon, August 2, joint session of the American Genetic Association with section for Animal Husbandry, American Association for the Advancement of Science.

Tuesday morning, August 3, opening session A. G. A.

Tuesday afternoon, August 3, second session A. G. A.

Wednesday, August 4, joint sessions with A. A. A. S. at Stanford University: "The Role of Variation and Heredity in Evolution."

Thursday morning, August 5, meeting of plant-breeding section, A. G. A.

Friday morning, August 6, joint meeting with section for Horticulture, A. A. A. S.

Friday afternoon, August 6, closing session of A. G. A.

This program is subject to change. **The complete outline of the meetings will be published about July 15, and a copy will be sent to any member who requests it.** Address the secretary at Washington, or Professor E. B. Bab-

cock, University of California, Berkeley, California.

All meetings of the association will be open to the public. There will be an opportunity for discussion of each paper.

Following is an incomplete list of the papers to be presented, embracing probably two-thirds of the whole. The titles of these papers are subject to change.

E. D. Ball and Byron Adler of the Utah Experiment Station, "Is Egg-laying in the White Leghorn a Unit Character?". Results of tests extending over number of years and designed to show in what way the capacity of high egg-laying is inherited will be presented.

E. E. Barker, Cornell University, "Color Studies in the Morning Glory."

S. Boshnakian, Cornell University, "A Better Method for Representing Mendelian Segregation," and "A Coefficient of Squarehead Form Necessary for the Statistical Study of Density in Wheat."

Leon J. Cole, University of Wisconsin, will describe some of the experimental breeding done there to determine the facts of inheritance in pigeons.

G. N. Collins and J. H. Kempton of the Bureau of Plant Industry will describe crosses of *Tripsacum* and *Euchlaena*, two grasses, which may throw light on the ancestry of cultivated maize.

B. O. Cowan, Santa Monica, California, "Inbreeding."

R. A. Emerson, Cornell University, "Genetic Correlation between Plant Colors and Aleurone and Endosperm Colors in Corn."

Albert F. Etter, Briceland, California, will describe his methods of strawberry breeding. Professor Roy E. Clausen of the University of California will show lantern slides of the subject.

Irving Fisher, professor of economics at Yale University, has promised to speak on the relation between eugenics and sociology.

A. C. Fraser, Cornell University, "Heredity in *Phaseolus*."

E. F. Gaines, Pullman, Wash., "The Inheritance of Qualitative Factors in Small Grains;" results obtained at the Washington State Experiment Station.

Alexander Galbraith, DeKalb, Ill., "Inbreeding," a description of his experience with Clydesdale horses and other stock.

R. Ruggles Gates, University of London, "On Successive Duplicate Mutations" and "The Modification of Characters by Crossing."

A. W. Gilbert, Cornell University, "Color Inheritance in *Phlox drummondii*."

Frank M. Harding, secretary American Shorthorn Breeders Association, Chicago, Ill., "Inbreeding."

H. Hayward, Delaware Experiment Station, "Inbreeding."

A. C. Hottes, Cornell University, "Multiple Hybrids, with Special Reference to the Genus *Gladiolus*."

David Starr Jordan, Chancellor of Leland Stanford Junior University, "The Long Cost of War."

Wilhelmina E. Key, Hartland, Wis., "Creating a Eugenic Conscience."

H. E. Knowlton, Cornell University,

"Studies in Pollen Germination."

Samuel C. Kohs, House of Correction, Chicago, Ill., "Eugenics and the Unconscious."

Isabel McCracken, Stanford University, "Notes on Silkworm Heredity, with Special Reference to the Moricaud Race."

C. L. Redfield, Chicago, Ill., "Dynamic Evolution."

G. P. Rixford, Bureau of Plant Industry, San Francisco, Cal., "The Pistacio Nut in the Southwest and Some Morphological Features in the Development of the Embryo."

A. J. Rosanoff, Kings Park State Hospital, Long Island, N. Y., "Preliminary Report of a Study of the Offspring of the Insane."

A. D. Shamel, Bureau of Plant Industry, Riverside, Cal., "Problems of the Navel Orange."

R. R. Slocum, Bureau of Animal Industry, Washington, D. C., "Poultry Breeding;" illustrated with motion pictures.

W. B. Swift, Boston State Hospital, Boston, Mass., "The Possibilities of Voice Inheritance."

W. T. Swingle, Bureau of Plant Industry, Washington, D. C., "Plant Breeding in Japan."

Ethel H. Thayer, Mendocino State Hospital, Talmage, Cal., "Cacogenic Problems in California."

C. C. Thomas, Cornell University, "Preliminary Observations on Variations in *Trillium grandiflorum* and *Podophyllum peltatum*."

E. N. Wentworth, Kansas State Agricultural College, Manhattan, Kans., "Sex-limited Inheritance."

G. L. Tundel, Cornell University, "Evolution of Celery" and "Disease Resistance in Celery."

The Surgeon General, U. S. Public Health Service, has promised to detail one of his assistants to speak on immigration through the port of San Francisco, as it bears on eugenics.

Several motion picture films will be shown, including one illustrating the horse breeding work of the U. S. Department of Agriculture.

A number of the papers will be illustrated with the stereopticon.

ETTERSBURG STRAWBERRIES

Successful Hybridizing of Many Species and Varieties in Northern California
Leads to Production of New Sorts Which Are Apparently Adapted
to Meeting Almost All Requirements.

ROY E. CLAUSEN

Instructor in Genetics, College of Agriculture, University of California, Berkeley, Calif.

IN THE early seventies a Captain Cousins, in command of a freighter plying between North and South American Coast points, brought from Callao, Peru, to Eureka, California, some plants of the sand strawberry, *Fragaria chiloensis*, indigenous to that region. He turned these plants over to A. J. Monroe of Eureka, and from him Albert F. Etter of Briceland, California, obtained the strain of Peruvian Beach strawberry which he has since used so successfully in his strawberry breeding work. This strawberry crossed with an inferior third generation seedling of Sharpless x Parry gave, among twelve others, his first superior seedling, Rose Ettersburg. Since then Mr. Etter has made numerous other crosses, using not only the wild Peruvian beach strawberry, but the beach strawberries native to California as well, the wood strawberry of the interior of California, the Alpine strawberry, and in later times others in addition to these. Some 10,000 seedlings have been fruited in the course of the twenty years following the production of the Rose Ettersburg strawberry, and the success that has been achieved well merits the attention here given it.

Mr. Etter's success is unquestionably due to the skilful way in which he has united the advantageous characteristics of a number of distinct species and forms, and cannot, therefore, be considered intelligently without giving due attention to these forms. In the course of his work he has made a considerable collection of strawberry varieties and species, including a large number of the

varieties grown commercially in the United States and several from French sources, besides the strictly wild species of which a number are represented.

The first and foremost of the species which Mr. Etter has used is *F. chiloensis*, the sand or beach strawberry. This strawberry is native to the Pacific Coast of the Americas and is distributed from South American points well up into Alaska, and has also been collected at Argentine points on the east coast of South America. In this region it is strictly coastal in its habitat, growing at most perhaps not more than 2 miles inland. It grows on the bleakest and most wind swept situations, enduring alike the sterile soil of the beach and the salt spray of the ocean. Even in Alaska, Georgeson¹ writes of it thus:

THE BEACH STRAWBERRY

"The species is known as *Fragaria chiloensis*. It grows along the coast from Muir Glacier to Prince William Sound and probably also in other places, but throughout this region it is quite abundant. Its favorite soil is the sand and gravel along the old beach line just above the reach of high water. It here disputes the possession of the surface with grasses and weeds of many kinds and is quite able to hold its own against them."

In fact wherever found it appears to be a notable characteristic of *F. chiloensis* that it is able by virtue of a deep rooting system and hardy foliage to endure the most unfavorable conditions with respect to the fertility of the soil and the available supply of moisture.

¹ Georgeson, C. C. An. Rept. Alaska Expt. Sta., 1909, p. 11.



STRAWBERRIES FOR LAWN PLANTING

The beach or sand strawberry (*Fragaria chiloensis*) which occurs almost from one end to the other of the Pacific coast, is so hardy and resistant to all sorts of unfavorable conditions, that it is often used in that region to cover slopes or exposed places, in landscape gardening. This photograph shows it so used, and flowering freely, on the university campus at Berkeley, California. (Fig. 16.)

But aside from these general characteristics of the sand strawberries of the Pacific Coast, the species shows a remarkable diversity of forms, so much so as to lend considerable support to the tendency of some systematists to sub-divide the group still further. Mr. Etter has growing at Ettersburg half a dozen strains of *F. chiloensis* from Chilean, Peruvian, and Californian sources and all of them possess distinct characteristics which would unmistakably separate them from one another, and all appear to present notable differences from the Alaskan form

which Georgeson has used so successfully in his plant breeding work. Thus for example we have forms with light green foliage and petioles covered with a dense coarse pubescence. The California forms for the most part have glossy dark green leaves practically free from any pubescence. Some forms have characteristically long fruiting trusses, while in others the trusses are short. In some forms the berries are nearly white in color, while others bear distinctly red berries. The differences extend to every character, and they are mentioned here because they serve as



HYBRIDS ARE NOTED FOR VIGOR

The center row in this photograph is a collection of ordinary commercial varieties of strawberry; while on either side are rows of hybrids produced by Albert F. Etter. It is well known that, in general, hybridization tends to increase the vigor of plants and animals, and this fact is often turned to advantage in modern breeding. It is evident that the Ettersburg strawberries are much more vigorous growers than common commercial varieties which, although originally hybrids, have been propagated so long that they have lost most of the benefit accruing to them from their original hybridization. (Fig. 17.)

an indication of the extreme variability which consequently might be expected in the hybrids.

The two other species which have been used extensively in the hybrids thus far produced are *F. vesca semperflorens*, the Alpines, and *F. californica*, the native wood strawberry. Stock of the former was obtained by growing seedlings from seed supplied by John Lewis Childs of Floral Park, New York. Some of these seedlings bore red and others white berries, and some of the plants produced runners and others did not, as is characteristic of the Alpine strawberries. All of these forms were used in the hybridization work. The wood strawberry used was derived from local sources and displayed the char-

acteristics usual for that species, namely free production of very small inferior berries and a tendency towards winter growing. These three represent all the wild species concerned in the hybrids considered in this article. Others are now being used, among them *F. cuneifolia*, a distinct and somewhat peculiar type from Oregon, and *F. chinensis* varieties originally derived from Chinese sources.

GARDEN VARIETIES USED

As a foundation for the work a number of common garden varieties which have met with some favor in California have been used. Among these are the Sharpless and Parry, previously mentioned, and of the others,

Michel's Early, Senator Dunlap, Marshall, Chesapeake, Crescent, William Belt, Bederwood, Dornan, and Australian Crimson have yielded promising hybrids. It is unnecessary to go into the characteristics of these, because they are well known and further because these characteristics, except in so far as they are common to all the strawberry varieties in general cultivation, would lend but little aid to a study of the hybrids which have been produced from them. Suffice it to say that the garden varieties which are represented in the pedigrees of the best of Mr. Etter's productions are not there because they have displayed any particular value in this respect compared with garden varieties which are not represented.

The methods which Mr. Etter uses in his strawberry breeding work are very simple but admirably adapted to the material with which he is working. In many cases advantage is taken of the fact that pistillate strains exist within the species and forms with which he is working, and in almost all his crosses such pistillate strains and varieties have been used as the mother parents. Shortly after the blossoms on these selected mother plants open a flower of the desired male parent is bound over it with a strip of muslin, and the pollen then is scattered over it by the thrips which work around in the blossoms and also by the mere contact of the two flowers. In case the desired female parent is perfect flowering the stamens are, of course, removed before pollination. The strip of muslin with the label attached to it remains over the fruit until it is ripe. When the fruits are ripe they are picked and enclosed in little muslin bags. They are then mashed together and hung up to ferment for a few days, after which the pulp is washed away from the seeds as thoroughly as possible. The seeds are sown immediately in specially prepared seed boxes in which spaces are marked off for each different cross, and there the young seedlings remain until they are strong enough to be transplanted to the field. No particular attempt is made to hasten germination, conse-

quently under these conditions most of the seeds germinate the second year after sowing. Obviously these methods do not enable us to be absolutely sure of the parentage of the seedlings, but any doubt as to their hybrid nature would be soon dispelled by a study of the seedlings and their parent plants.

THOROUGH TESTS GIVEN

The second feature of Mr. Etter's methods lies in the thorough test to which all seedlings thus secured are subjected. They are first transplanted to the trial patch where they are planted in hills, usually three in each hill. Here they remain until they fruit. Those which prove inferior from the start are soon rooted up while those which seem to possess desirable qualities are given Ettersburg numbers and subjected to a further test in four to ten hill units. There they may be compared directly with previous selections which have made good and, if found especially worthy, they are further subdivided and propagated. Mr. Etter has no faith either in his own or anybody else's ability to pick out the varieties which will be successful by any other method than that of a thorough trial; and in the same way in selecting his parents for hybridization, he is guided only by the dictates of experience.

The selections which Mr. Etter has made have been based almost entirely on the commercial value of the characteristics that the seedlings have displayed under trial. The endeavor has been made to improve the strawberry in vigor, in quality of fruit with respect to texture, flavor, color, etc., in productiveness, and in such other characteristics as might increase its commercial value. A few freaks have been produced in the course of the work but they are merely by-products and very few of them have been retained. In the work several objects have been held in mind, such as the production of strawberry varieties particularly suitable to the home garden, the production of others suitable for canning, and the production of still other varieties suited to more or less special demands. Perhaps these

features may be best brought before the reader by a specific consideration of a few of the varieties which have been retained.

Rose Ettersburg, the first successful variety, is a hybrid of a third generation Sharpless x Parry seedling by Peruvian Beach. It is a strong, vigorous grower and produces large berries, always true to shape, and of a light pink or rose color, thus indicating its Peruvian Beach parentage. It is remarkable for its quality and fragrance, the flavor is decidedly different from other strawberries, and on that account desirable or undesirable according to individual tastes. It possesses the usual extreme vigor of the Beach hybrids, and has produced at the rate of 8 tons per acre on Mr. Etter's place without irrigation. Its light color and rather peculiar flavor would probably be against it at the present time as a general commercial variety. It is a splendid variety, however, for the home garden.

Ettersburg No. 121 is supposedly a direct hybrid of the two species Alpine x Cape Mendocino Beach. Like Rose Ettersburg it is very vigorous and productive; unlike Rose Ettersburg the berries are deep glossy red in color and even the flesh is intensely red to the center. This is one of the many Ettersburg varieties that pick without the hulls like blackberries and with about as little abrasion, a characteristic which is derived from the Alpines. The variety is notable for high quality and solidity. It has a full, sweet flavor that could not fail to be attractive to anyone who likes strawberries. The profusion of blossoms which it produces makes it a beautiful sight when in bloom. This is a variety of considerable commercial promise.

A COMPLEX HYBRID

Ettersburg Trebla, formerly Ettersburg No. 222, in contradistinction to Ettersburg No. 121 possesses a very complex pedigree as shown in the following outline:

following outline:							
Ettersburg Trebla	{	Ettersburg No. 84	{	Seedling No. 3	{	Rose Ettersburg	
				Unnumbered seedling	{	<i>F. californica</i>	
	{	Ettersburg No. 114		{	Unnumbered seedling	{	Cape Mendocino Beach
		Alpine				Rose Ettersburg	

When the derivation of Rose Ettersburg, as given previously, is considered it can be seen how complicated this pedigree is and how many species and varieties are included in it.

Out of this mixed ancestry has been derived the variety which Mr. Etter considers his best variety thus far. This variety evidently considers its mission in life to be the production of fruit, and splendid fruit at that. The berries are of medium size, deep red, and solid to the center. Eaten fresh it is a berry that would not appeal to most people on account of its high acidity, but in canning it develops a remarkably rich and pleasant flavor. Like Ettersburg No. 121 it picks without the hull and with scarcely any abrasion. At Mr. Etter's place it has produced at the rate of 20 tons per acre. The plants present a peculiar appearance at fruiting time when the heavy foliage is mostly weighed down by the large quantities of fruit produced and only a few stiff leaves remain erect. We have here a variety which is apparently particularly suitable for canning. The solidity of the berry is such that it has no tendency to break down during the canning process, and the deep color, high flavor, productiveness, and ease with which it may be prepared for canning are other features which make it an especially desirable variety on which to build up a strawberry canning industry.

Ettersburg No. 200 is a cross between Senator Dunlap and the Peruvian Beach strawberries. It is merely a unique novelty. The berries are small to medium in size, and with only a very faint pink color, very nearly white. The achenes (seeds), however, are deep red in color and set in deep depressions in the surface of the fruit. A single plant has borne as many as 200 berries at one time. It is strongly Peruvian Beach in its characteristics and is certainly a strange strawberry.



TWO TYPES OF STRAWBERRY BLOSSOM

Commercial varieties of strawberries fall in two classes: those with perfect flowers, including both stamens and pistils (as shown at the top of the photograph) and those whose flowers lack the male element, and are called pistillate. A flower of this type is shown at the bottom of the photograph. It is obvious that if plants of the second type are grown exclusively, the flowers cannot be fertilized, and will produce no fruit. It is therefore necessary for every grower to have at least some plants of the perfect-flowering type, in order to pollinate the blossoms and ensure a crop. It is not advisable to limit a planting to a single variety, even if this have perfect flowers, because although they will produce an abundance of pollen, yet it has been shown by experiment that better results are secured when cross-pollination takes place from some other variety. Photograph by Fairchild. (Fig. 18.)

These are typical examples of the results which have followed Mr. Etter's strawberry breeding work, and they are only a few cases selected as illustrations of these results. The most remarkable general characteristic of the hybrids is their extreme vigor leading to the production of a deep rooting system and of stiff, leathery, heat resistant foliage unlike any of the common garden varieties. On this account it is actually necessary to grow some of the varieties under not too favorable conditions lest they expend their energy in the production of a rampant vegetative growth at the expense of the production of fruit.

DIVERSITY OF TYPE

This extreme vigor, perhaps an illustration of the stimulating effects of crossing, gives the strong foundation to which many other desirable features have been added. Some of the hybrids produce fruit which is nearly white in color and from them we have a continuous series of varieties with respect to color of fruit up to those which produce deep glossy red fruit with intensely red flesh. The flavors are even more extensive in range. Many of them are peculiar and not easy to describe, some resemble the flavors of other fruits, banana, muskmelon, Tartarian cherry, raspberry, and so on; and we would not greatly exaggerate if we were to compare the range of flavors found here with that occurring in the apple. In acidity the hybrids vary from those which are insipid, watery, and practically tasteless to those which are very acid, lemon sour in fact; and some are full, rich, and sweet. The texture and quality of the flesh is another item to which Mr. Etter has given special attention, particularly with reference to use in canning, and for this he has had a wide range of forms from which to make selections. Some of the hybrids seem to possess practically no substance, they are extremely watery like many of the common garden varieties, and on canning naturally break down into a purée mixture with little solid matter in it. There are others which are somewhat

firmer, but some of these do not possess the desired uniformity of texture—instead they are inclined to be fibrous. A few are firm and solid to the center with no suggestion of a core. These stand up well when canned. They remain firm and solid and retain their shape remarkably well. There is also naturally enough a large range of sizes and shapes from small to very large, from spherical to sorts which are very elongated or even irregular. Some of the varieties pick free from the hulls and others pick in the usual way, the former characteristic apparently representing a heritage from the Alpine race. This is a characteristic which is of considerable importance from a canning standpoint. In productiveness there are all degrees up to the 20 tons per acre limit of Ettersburg Trebla. A fairly large percentage of the varieties are imperfect flowering as might be expected on account of the use of such forms so extensively in the hybridization work; and some of these varieties have a tendency to produce irregular berries, apparently on account of imperfect fertilization. These then represent some of the variations found in the Ettersburg hybrid strawberries, and among the 200 or more which have been found worthy of further trial it is possible to please almost any taste or satisfy any demand.

WIDE ADAPTABILITY

The question naturally arises as to the adaptability of these hybrids to various environmental conditions, and on this question we unfortunately do not possess a very extensive knowledge as yet. Under the conditions obtaining in the northern coast region of California they have demonstrated their excellence and fitness. These conditions, however, are almost ideal for strawberry growing. The soil on which they have been grown is rich, newly cleared forest land, perhaps somewhat acid; the climate is mild, and there is sufficient rainfall to carry them through the fruiting season in good shape. The hybrids are being tested throughout California and at several experiment stations, and preliminary reports of

these trials are on the whole very encouraging. Thus in New York Taylor² has tested seventeen of the varieties which have been introduced, and even under the totally different conditions of that locality with respect to soil and climate he has found four of them good enough to include in his list of desirable varieties. It appears, therefore, that some will be found excellently adapted to other than the ideal conditions of Humboldt County. Their remarkable vigor and their deep rooting system and drouth resistant foliage would indicate an ability to withstand trying summer conditions with respect to heat and drouth, and such in fact is the case. The enduring qualities of *F. chiloensis* are, if anything, accentuated in the hybrids. The varieties undoubtedly deserve a wide and thorough trial, and the indications are that, when the story of that trial shall have been told, certain of the hybrids will have been found adapted to almost any condition under which strawberries are grown.

The work which Mr. Etter has done has great significance in practical strawberry breeding. Whether or not it has succeeded in producing varieties which are suitable for all the varied needs and conditions of strawberry growing is not so important as the fact that it has demonstrated the wonderful possibilities which lie in practical strawberry breeding, and has developed a method of attack of that problem which yields remarkable results. Most important of all is the demonstration of the fact that further hybridization of the common garden varieties of the strawberry, themselves supposedly largely *F. chiloensis* derivatives, with wild forms of that species results in a notable increase in vigor and in the production of new varieties superior in every respect to the commonly cultivated ones. George-

son,³ endeavoring to breed new varieties of strawberries suitable for Alaskan conditions by hybridizing their native *F. chiloensis* with a common garden variety, has found exactly the same thing to be true, and his enthusiastic accounts of the work remind one very much of the parallel results which Mr. Etter is securing under California conditions.

SECRETS OF SUCCESS

We have reported in this article the remarkable results which Mr. Etter has secured in thirty years of persistent and intelligent strawberry breeding. This success is due to the fact that he has become thoroughly familiar with the material with which he is working and has evolved a method of strawberry breeding which has proved very effective in the production of new, superior varieties. Essentially this method is the same as that which has been adopted by a number of successful plant breeders, namely that of hybridization followed by thorough trial and careful selection. The work of selection is of course simplified in the strawberry by the fact that vegetative propagation may be used to perpetuate any particularly excellent individual, and that perhaps with very little likelihood of any subsequent deterioration. The selection in effect has been made through several generations, as is usually necessary before the desired combinations of characteristics are secured. While the new varieties thus secured have not yet been thoroughly tested, present indications are that many of them will prove highly successful under a variety of conditions. At any rate a successful method of attack in strawberry breeding has been discovered, and these Ettersburg hybrid strawberries are a successful application of that method.

² Taylor, O. M., Strawberry Varieties. New York Geneva Sta. Bul. 401, pp. 165-192, 1915.

³ Georgeson, C. C. An. Repts. Alaska Expt. Sta., 1906-1913.

THE FIRST-BORN'S HANDICAP

Accumulation of Statistics Appears to Show That Eldest Members of a Family Are "Weighted"—Possible Explanations of the Fact.

REVIEW OF A BOOK BY KARL PEARSON

Director, Galton Laboratory for National Eugenics, University of London.

WHEN Karl Pearson, in 1907, published statistics which appeared to show that the first and second-born in any given fraternity or sibship were more likely to be attacked by tuberculosis and were, therefore, presumably constitutionally inferior, in that respect at least, to their later brothers and sisters, his conclusions did not lack assailants. The succeeding years have seen a good deal of work on the problem, the latest contribution being from Pearson himself.¹ Before its contents are considered, it may be of interest to recall Pearson's original contribution, which Schuster sums up as follows:

"The Crossley Sanatorium at Frodsham is filled with lower middle-class and working-class patients suffering from consumption, who come mostly from Manchester and, to a lesser degree, from Liverpool and its neighborhood. From the records kept of the family histories of the patients it is possible to tell how many came in each particular place in their families. It was then found that of 381 patients, 113 were first-born and 79 second-born. When the patients and all their brothers and sisters, living or dead, are taken together, it was found that in the 381 families there were 381 first-born and 366 second-born. Dividing these numbers by the average number of children per family, one arrives at the number of first-born and second-born which, according to the theory of probability, one would expect to find in a sample made up by picking one child at random from each family. The numbers are 67 and 64. The 381 sanatorium patients

may be regarded as a sample selected by consumption, one from each family and among them the corresponding numbers are 113 and 79—that is to say, about $1\frac{3}{4}$ times as many first-born and $1\frac{1}{4}$ times as many second-born, as in the random sample of the same size. As the differences are too large to be due to chance, they appear to show that consumption does not pick at random, but selects more particularly the first-born and second-born. With regard to the third and later born members the differences were reversed, there being fewer of these among the patients than would be the expectation if the latter were drawn by chance, one from each family."

Pearson contented himself with presenting the statistics, not attempting to explain them. His critics attacked them from two sides—first on purely statistical grounds, and second, by attempting to explain them away. Pearson's new paper on the subject is devoted largely to refuting those of his critics who attacked him on purely statistical grounds; and into this aspect of the case the reviewer will not go. Those who are interested in the mathematical theories involved may consult the original paper. Pearson also sums up the evidence in support of his contention, however, and brings forward new data which equally tend to indicate that the first-born members of a population are weighted. It may be of interest to review this data.

DIVISION OF THE PROBLEM

There are, it is evident, several ways in which a statistically demonstrated

¹ On the Handicapping of the First-born, by Karl Pearson, F. R. S. With frontispiece and four diagrams, pp. 68, price two shillings net. University of London, Galton Laboratory for National Eugenics, Eugenics Lecture Series X. London, Dulau and Co. Ltd., 37 Soho Square, W., 1914.

handicap of the first-born might be made up, and it is important for the reader to keep in mind these differences. If there were a lot of one-child families in the population, and if this single child in each case were inferior, it is obvious that he or she would be listed as first-born in an enumeration, and the first-borns as a whole would get a black mark from the bad record of these one-child families; whereas it is conceivable that the first-borns in large families might at the same time be as good as or better than any of their brothers or sisters.

It is by such an explanation that some of Pearson's critics attacked his statistics from the Crossley sanatorium, as will be later explained.

On the other hand, it might be that the first-born in a family was inferior to his or her own brothers and sisters. To demonstrate this would obviously require a different line of statistical attack; and the meaning of the results, from a eugenic point of view, would likewise be distinctly different. Following Pearson's original contribution, many investigators have adopted this second method of attack altogether. The problem it involves is the more interesting and perhaps likewise the more important, but Pearson contends, and with apparent justice, that both problems are worthy of solution, and that the eugenicist can not be content if the case is approached from either side alone.

In his new memoir he has worked out methods of analyzing his data from both points of view. Unfortunately his results are not easily followed in detail by a reader who lacks training in advanced statistical method. This is the more unfortunate, because in some instances a handicap is discernible by the one method of attack, but from the other viewpoint is found to be non-existent—thus in epilepsy, it appears that the greater number of first-born in asylums is due to the fact that they come from tainted stocks, and not to the fact that they are first-born.

This distinction must be kept in mind, whenever the problem of the first-born's handicap is studied, for without it an entirely erroneous result

will be reached, a result likely to cause needless anguish to some of the large number of first-born children in the world.

DANGERS AT BIRTH

Before attacking the problem from the conventional side, Pearson notes the dangers which meet the first-born even at birth. Ansell has given the still-births per 1,000 born alive, in order of birth for 48,843 births; the rate for the first-born is 40, for the second-born 20, for the third-born 15.5, for the fourth to sixth 17.4 and for the seventh and over 20.9. "It will be seen that still-births for the first-born are *double* those of later births. And this disadvantage follows the first-born into the first year of life." The infantile mortality of the professional and upper classes for 48,843 births, likewise compiled by Ansell, shows that in the first year, per 1,000 born alive, the following numbers die:

First-born.....	82.2
Second-born.....	70
Third-born.....	69
Fourth to sixth.....	78.3
Seventh and over.....	97.4

Confirmatory data collected by the Galton Laboratory from the manufacturing towns of northern England are given. In Sheffield, "it is not till we get to the eight or ninth birth that the mortality is as great as for the first-born." The health of the children follows a similar course—it is not until the thirteenth child, in about 4,400 cases from Sheffield, that we find as much delicacy as in the first-born. This inferiority in health, of course, to some extent wears off with age, but it would still appear to be appreciable at twelve and thirteen, according to statistics quoted from school inspections.

Physical evidence of the defect of the first-born is also found in statistics as to the weights and lengths of 2,000 babies, made at Lambeth Lying-in Hospital. The first-born, both in boys and girls, weighs less and is shorter than the subsequent children, who in general increase regularly in these respects in accordance with their order of birth. There is some reason to believe that this increase is correlated to the increas-

ing age of the mother. "We have, however, distinctly guarded ourselves from any expression of the source of the inferiority of the first-born till the data, slowly accumulating, suffices to determine how much the first-born pays for the juvenility and how much for the inexperience of its parents.

"It will be seen from the totality of the above results that physically, in the early months of life, the first- or earlier-born babies are inferior to any babies before at least the seventh or eighth. We have now to ask whether this inferiority persists to later life, and whether it shows itself also in congenital defects."

CONGENITAL DEFECTS

Idiocy or imbecility is the first defect considered.² No matter in what way the data are analyzed, it appears that there is a distinct bias against the first-born.

Weeks' American data on epilepsy are next analyzed. "We must, I think, conclude by recognizing that, while there is a weighting of the elder-born even in epilepsy, this is due to a selection of families rather than to a selection of the elder-born in each individual family." In other words, the statistical observation that there are more first-born than later-born epileptics in an asylum is of no significance except when a large population is considered—it does not mean that in any given family the first-born is likely to be inferior in this respect to his or her successors.

The data for insanity are said not to have been available for such full analysis as were data of other defects. They appear to show that there is a weighting of the elder-born in the case of insanity, but they do not furnish grounds for saying that this may not be due merely to the fact that the subjects observed come of defective stocks.

Pedigrees of 952 albinos of European race are next examined. There is marked excess of albinos among the first-born: 241 cases instead of the 216

expected by the theory of probability; the second-born have no excess and the last-born seem to show a slight defect. "I think there cannot be the least doubt," Pearson concludes, "of a quite significant weighting of the first-born in the matter of albinism."

Criminality, on the basis of Dr. Goring's figures, seems equally to be a prerogative of the elder members of the family. When expected and observed distribution of criminals in families of each size is computed, "the actually observed first- and second-born criminals amount together to 717 as against 557 which would be anticipated if the tendency to crime were divided equally among all members. There is a defect of both intermediates and of last-born criminals. The general bias against the elder-born appears amply substantiated on these data."

Statistics for the tuberculous are next considered, in a much more refined way than was attempted when the first study was made. Even when each family is considered individually, it is found that there is a heavy preponderance of tuberculosis in the case of the first-borns, and a defect in the case of the late-borns.

Pedigrees of fifty families with congenital cataract are finally taken up, and here too "the less robust members of a tainted stock—and such are the first-born—appear more likely to be affected."

CRITICISMS NOT VALID

In conclusion, Pearson holds "that the criticisms raised against the handicapping of the first-born are not valid. The first-born is very significantly handicapped, and this statistical result will coincide with a good deal of personal and individual experience."

At the risk of tiresome repetition, it must once more be pointed out that when the problem is demonstrated by statistics, the handicap of the first-born might be of two kinds: it might be that the first-born in each family is actually inferior to the later-born, or it might be that the first-borns, as a whole, in the

² The type of feeble-mindedness known as Mongolian is excluded from consideration, because it is already known to be associated with late births in large families. It is ordinarily attributed to "uterine exhaustion" of the mother.

population are an inferior group, because they come from inferior families. This point was particularly brought out by Dr. Alfred Ploetz of Munich, president of the International Society for Race Hygiene, in an address which he delivered before the First International Eugenics Congress (London, 1912). He said:

"Among the children of a number of marriages taken at random, there are a good many children of parents who died early, consequently there is a high proportion of children who represent early members in birth-rank, and principally first, second and third-born. Because of the death of one or both parents there could be no later born. First, second and third-born children therefore come in a far greater percentage from early deceased, that is on the average weaker parents, than do the later born, and they will therefore inherit in a higher degree the weaker constitution of their weaker parents."

"There is further another factor weighting small families," Pearson adds, "namely, they represent very frequently an exhausted virility in the parents. Certain types of parental degeneracy seem incapable of producing more than one or two children at most,³ and the children of such parents are themselves feeble. But, if any small families are thus selected, we shall increase the number of early borns in the diseased population, for such small families have no late-borns."

Furthermore, he suggests "that the growth of the first child is hampered by conditions [physiological in the mother] which exist to a far less extent for the following births; but these conditions will be much harder for the first-born child when its mother is forty than when she is twenty-five. But the resulting family in the former case is likely to be far smaller than in the latter case. In other words, the handicapping of the first-born in small families may be increased by the addition of many small families in which the first-born is also late-born."

Thus general statistics on the weighting of the first-born must carefully distinguish whether it is actually the individual, or the family, that is weighted; and in this fact lies comfort for first-born members of healthy families.

Early critics appeared to think that the whole problem of the handicapping of the first-born might be explained away by this fact that in many cases it is the family, rather than the individual, which is handicapped. Pearson's first statistics of the tuberculous were indeed vulnerable on this ground, but his re-analysis of the data takes both these factors into account and appears to show that in many cases at least the first-born are handicapped altogether apart from the recognized weighting of small families.

EVIL OF SMALL FAMILIES

If this be the case, it seems evident that, from a biological point of view, and entirely apart from its effect on upsetting the selective birth rate, the small family is detrimental to race progress. That, says Pearson, "is the reason why I have approached this subject at all. After this lecture was delivered, I was asked by an anxious mother: 'Why, even if the doctrine be true, should it be published to the world as it would only alarm and so further injure a class of the community already asserted to be handicapped?' My reply to that question is: 'Study in the first place the incidence rates of these abnormalities we are discussing, and you will see that it is only in mass-statistics that the handicapping becomes sensible.' Further, I must add that in the science of National Eugenics we have to consider what profits the nation at large, and I feel strongly convinced that the present tendency (exhibited so markedly in France),⁴ to make the first-born 50% instead of something less than 22% of the whole number of births, spells degeneracy. The individual feelings of the first-born,

³ This does not necessarily contradict the generally well established principle that degenerate stocks are as a rule very fertile.

⁴ The German birth-rate is notably high, but in Berlin the percentage of first-born in every 100 births had increased from eighteen in 1880 to thirty-three in 1906. The reader will recall that Cattell's statistics show American men of science almost habitually to have families of two children.

even if the handicapping were far more substantial than it is, cannot be considered to outweigh the national importance of the problem. If this principle of the handicapping of the first-born be true, as I have little doubt that it is—and if a similar principle holds for the last-born (to a lesser degree it is true) for some conditions like Mongolian imbecility—what must be the moral of the present lecture? Surely, that the better born are the intermediates in families from five to eight, and that when families are restricted to twos or threes, or extended to twelves and thirteens, there may be a quite appreciable tendency to increase the proportion of the less efficient in the community. I make no pretence at present to associate inferiority at beginning or end with too young parents or too old parents. I am only aware that we want much fuller data, so that we can correct for parental ages at marriage, and for period after marriage of the birth of each child. We want to study not only the order and number of children, but the interval between their births.

"The handicapping of the first-born is not, as some of my correspondents have supposed, subversive of any faith in heredity. It would not even be an argument against an hereditary Upper Chamber, except in so far as such a

chamber is based on primogeniture. Statistics of the failure of the eldest-born of peers and of the success of their younger brothers might from this standpoint be of real interest.⁵ The real argument against an hereditary chamber is the customary want of hereditary power in its members, *i. e.*, the neglect of the fact that a man has sixteen great-grandparents, and, possibly, only one of them may be of distinction—the man who won the title. As Galton wrote: 'An old peerage is a valueless title to natural gifts, except so far as it may have been furbished up by a succession of wise intermarriages. . . . I cannot think of any claim to respect, put forward in modern days, that is so entirely an imposture, as that made by a peer on the ground of descent, who has neither been nobly educated, nor has any eminent kinsman within three degrees.' The dearth of ability in the 'hereditary' peers of the present day is largely due to their neglecting marriage into able stocks, and in some cases quite possibly to a succession of eldest son inheritance—an evil which the whole community may bring upon itself, if it selects its surviving offspring in the same restricted manner. To criticize primogeniture is not to discard heredity."

⁵ In "Hereditary Genius" Galton presented the following statistics concerning the relative birth-order of the eminent men whom he studied:

Only sons.....	11%
Eldest sons.....	17%
Second sons.....	38%
Third sons.....	22%
Later sons.....	12%

Hotel Accommodations at Berkeley

Acting on the advice of its California committee, the American Genetic Association has designated Hotel Claremont, Oakland, California, as official headquarters during its annual meeting, August 2-7. This hotel is just across the line from Berkeley, and has excellent transportation facilities to the university. It has accommodations for about 1,000 guests, prices being as follows:

Single room with bath, \$3 per day (\$1.50 if two persons occupy room).

Single room without bath, \$1 per day; room for two without bath, \$1 per person.

The secretary will be glad to make reservations for members of this association. It is highly important that these should be made as soon as possible.