

the free sulphur and the sulphur remaining after the extraction, reporting the sum of the two quantities as the total sulphur. This procedure eliminates the troublesome effect of the free sulphur upon the determination of the total sulphur.

BOTANY.—*Glaucothea*, a new genus of palms from Lower California. O. F. COOK, Bureau of Plant Industry.

The type of the new genus is *Glaucothea armata* (S. Wats.),¹ commonly known in cultivation as the "blue palm," on account of its extremely glaucous foliage. The peculiar color is due to the presence of an unusually thick coating of wax, and may be considered as an adaptive specialization to desert conditions. *Glaucothea* is known in a wild state only from the interior of the northern part of Lower California, about sixty miles below the international boundary. It is the nearest neighbor of *Washingtonia filifera*, the only native palm of California, found in the canyons along the eastern base of the San Jacinto Mountains, in the Salton Basin.

The new genus is separated from *Erythea*, whose type is *Erythea edulis* (Wendl.) S. Wats., a native of Guadelupe Island, off the coast of Lower California. The difference in habitat appears significant when *Erythea* and *Glaucothea* are observed in cultivation. *Erythea*, being a maritime palm, is entirely at home in the cool climate of the Coast Belt of California, flowering and fruiting with great regularity after the proper age has been reached. *Glaucothea* makes rather slow growth in the Coast Belt, seldom produces flowers, and does not fruit, probably for lack of sufficient heat. Though planted in large numbers in California, the supply of seed is still limited and precarious, being obtained only from the wild palms in the canyons of Lower California. But there is no apparent reason why seed should not be produced eventually by the palms that have been planted in recent years in the drier and warmer interior districts of southern California and Arizona, as at Riverside and Phoenix.

¹ *Brahea* (?) *armata* S. Wats. Proc. Am. Acad. 11: 146. 1876.

Erythea armata S. Wats. Bot. Calif. 2: 212. 1880.

Glaucothea appears to be well adapted to these arid regions, and as hardy as *Washingtonia filifera*, which produces fruit in abundance in the Salt River valley of Arizona, as well as in southern California, though not near the coast.

Glaucothea shares with *Washingtonia* the habit of not producing flowers when young, or until the trunk has attained a height of 15 or 20 feet, while *Erythea edulis* commonly flowers at 5 or 6 feet. Another point of agreement between *Washingtonia* and *Glaucothea* is the production of very long slender inflorescences, extending far beyond the leaves. These are in striking contrast with the inflorescences of *Erythea edulis*, which hardly exceed the petioles of the leaves. The massive trunk and heavily armed petioles of *Glaucothea* afford further analogies with *Washingtonia* and obvious contrasts to *Erythea*.

Though more closely allied in its botanical characters to *Erythea*, the new genus may be distinguished at once, in any stage of development, by the color of the foliage. The floral structures are similar to those of *Erythea*, but definite specializations are shown. As in many desert plants, the flowers are reduced in size and of thicker texture, and the buds are protected by relatively larger and more fleshy sepals. The petals are attached close to the rim of the staminal cup and are not opened widely at the time of flowering, which no doubt reduces the danger of drying the stigma and thus preventing pollination. These and other differences are summarized in the following diagnosis:

Glaucothea Cook, gen. nov.

Distinguished from *Erythea* by the very robust trunk, strongly armed petiole, thin, papery ligule, decurved midrib, narrow median segments and glaucous, wax-covered leaf-surfaces; inflorescences slender, elongate, greatly exceeding the leaves, the lower primary branches subtended by spathes, the others without spathes; sepals thick and fleshy; petals broadly triangular, rounded at the apex, attached close to the broadly sinuate rim of the staminal cup.

The type species, as already stated, is *Glaucothea armata* (S. Wats.), from the northern part of Lower California. The generic name was suggested by the relationship with *Erythea*, though not derived in the same manner. *Glaucothea* means "Gray Goddess," and may be

considered as allusion to Minerva, whose familiar Greek name was "Athene Gray-eye." The olive tree, with its glaucous foliage, was sacred to Athene, and this palm has a similar claim to distinction among the members of its order. The foliage is of a very peculiar, pearly grayish-green, sometimes with a slight tinge of purple. Well-grown individuals are extremely beautiful, and strikingly different from any other fan-palms that have been introduced into the United States.

Following are more extended descriptions of *Glaucothea* and *Erythea*, with the contrasting characters stated in greater detail.

GENERIC DESCRIPTION OF GLAUCOTHEA

Trunk large and very robust, tapering gradually from a thick, somewhat bulbous base.

Leaves very numerous, nearly circular in general form, composed of many numerous deeply divided segments; leaf-sheaths recurved only near the end; petioles armed along the margins with numerous strong, hooked spines; ligule thin, without cushions of tomentum; midrib distinctly developed, decurved somewhat as in *Inodes*, and with several of the median leaf-segments reduced in size; leaf surfaces rendered glaucous by a thick coating of wax.

Inflorescences slender, erect, greatly exceeding the leaves, the axis enclosed in numerous, slender, naked spathes, 3 to 5 of these borne on the elongated base of the inflorescence, below the branches; primary branches of two classes, the lower 4 or 5 large and subtended by spathes, the others small, numerous and without spathes, together forming a terminal panicle like one of the large primary branches; flowering branchlets simple, very long and slender, with the flowers solitary or in clusters of 2 or 3.

Flowers minute, dull purplish, only slightly opened; sepals thick and fleshy to the end, scarious only on the margins; petals broadly triangular, with a rather blunt apex, strongly thickened within, the stamens accommodated by deep excavations; staminal cup with entire, broadly sinuate margins between the abruptly broadened bases of the filaments, bearing the petals near the rim of the cup; pistils set compactly together. Fruit rather small, with a thin pericarp.

SPECIFIC DESCRIPTION

The following details may be added to Watson's brief description of the species, which gave no information regarding the inflorescence or flowers.

***Glaucothea armata* (S. Wats.) Cook.**

Trunk in robust specimens attaining a circumference of about 11 feet, or a diameter of over 3 feet, the height said to attain 40 feet and upward in the wild state, but most of the cultivated individuals still under 20 feet.

Leaves very numerous, forming a large crown, the basal sheath becoming everted only near the end, but much farther up than in *Erythea*, the petioles thus appearing shorter; surface of petioles beset with small deep purplish-brown scales, these more numerous in the lower part, but much less abundant than in *Erythea*; margins of petioles indurated, ivory white, armed with strong, curved white teeth, these extremely variable in form and distribution; ligule thin and papery, not densely tomentose-spongy as in *Erythea*; rachis evident, distinctly decurved; several of the median segments distinctly narrowed, and also some of the basal segments, but much fewer than in *Erythea edulis*.

Spathes green and glaucous when young, without pubescence or scurf except on narrow lines along the margins; lowest spathe about 2 feet long and 3 inches broad, split on both sides at apex, the others split on only one side.

Flowers dull purplish in color instead of creamy white as in *Erythea edulis*, smaller in size and much less conspicuous at the time of flowering, not opened widely; buds also of different shape, more rounded at apex and relatively wider at base because of the large fleshy sepals; flower-clusters subtended by minute bracts less conspicuous than those of *Erythea*.

The descriptions of the inflorescences and flowers are based on material taken from a living palm in the collection of Mr. C. B. Hale at Santa Barbara, California, July 7, 1913. The specimens are in the U. S. National Herbarium, under numbers 694866 and 694867.

CONTRASTING CHARACTERS OF ERYTHEA²

Trunk rather slender, in comparison with *Glaucothea*, columnar, scarcely thickened at the base.

Leaves fewer and broader than in *Glaucothea*; leaf-sheaths recurved well below the end, the recurved portion distinguished by the fibers along the margins, functioning with the petiole and increasing its apparent length; margins of petiole denticulate near the base, often

² For the original description of *Erythea*, see Watson, S., *Botany of California*, 2: 211. 1880.

smooth above; ligule with large, spongy cushions of tomentum; midrib rudimentary, scarcely decurved, only a few of the median segments narrowed; leaf-surfaces vivid green, not concealed by a covering of wax.

Inflorescences robust, spreading, shorter than the leaves, the main axis enclosed in short, robust, shaggy, scale-covered spathes; primary branches 9 to 11, each subtended by a spathe, and with 1 or 2 additional spathes at the base; flowering branchlets simple, rather long and robust, the flowers in clusters of 3 to 6.

Flowers larger, more conspicuous and more widely opened than in *Glaucothea*; sepals fleshy at base, the upper half thin and scarious, with a reddish costa; petals triangular, with a rather thin, tapering and sharp-pointed apex, spreading wide apart at the time of flowering; staminal cup with deep sharp incisions between the broadly sloping bases of the filaments, each alternate filament subtended by a strong vertical carina on the inner face of the staminal tube.

Fruits large, the seed surrounded by a thick, firm pericarp, fleshy and edible when mature.

COMPARISON OF INFLORESCENCES

Perhaps the most striking differences between the two genera are those that determine the forms of the inflorescences. With respect to these characters *Erythea* might be compared with *Inodes*, while *Glaucothea* is more like *Washingtonia*, both with respect to the greater length of the inflorescences as a whole and the more elongate form of the individual spathes. In *Erythea* the flowers are borne on rather stiff, spreading branches and appear in large billowy masses inside the crown of leaves, while in *Glaucothea* they are carried out beyond the leaves and suspended on long drooping, tassel-like panicles. The inflorescence of *Erythea* is relatively unspecialized, with the numerous primary branches each subtended by a spathe, while the inflorescence of *Glaucothea* is specialized in two ways. Instead of having a short base with only one or two empty spathes below the branches, as in *Erythea*, there is a long, slender, stalk-like base with 4 or 5 tubular spathes. Following these are 4 or 5 other ensiform or spathulate spathes, subtending a like number of large primary branches. The remaining primary branches, to the number of 15 or more, are left without spathes; but they are much smaller than the others and all together form a large drooping panicle, like one of the larger branches that are provided with spathes. The total number of spathes is about

the same as in *Erythea*, but the spathes do not stand in the same relation with the branches. At the base of the inflorescence there are several spathes without branches, and at the end of the inflorescence many branches without spathes. The number of primary branches is greater in *Glaucothea*, not being limited by the number of spathes.

OTHER RELATED PALMS

The relationships of *Erythea* and *Glaucothea* lie on the one side with the fan-palms of the Pacific islands and on the other side with those of Mexico and Central America. In its very large fruits and thick exocarp, *Erythea* represents the extreme of the American series, and the nearest approach to the Pacific island fan-palms. The foliage is somewhat similar, and the very abundant scaly tomentum of the petioles and spathes is another common feature; but the sepals of the American genera are not thick and woody nor completely coalesced to form a deep cup, as in the Pacific island genus.³

The genus *Brahea* may be considered as the nearest Mexican relative of *Glaucothea*. It shares with *Glaucothea* the slender exserted inflorescence, with several empty spathes below the branches. But the species of *Brahea* are smaller and more slender palms, with small narrowly oval fruits, and the albumen grooved on one side like that of the date palm.

³ It has long been known that the name *Pritchardia* is incorrectly applied to the Pacific Island palms, but no satisfactory substitute seems to have been proposed. To supply this deficiency the new name **Styloma** is suggested, in allusion to the large indurated styles. The type species is **Styloma pacifica** (*Pritchardia pacifica* Seem. & Wendl.), from the Fiji Islands. Fifteen other species are known, as recognized in Beccari's revision of the genus (*Webbia*, 4: 220-240. 1913), nine of these being from the Hawaiian Islands, and six from other parts of Polynesia; all were described originally under *Pritchardia*. The Hawaiian species of *Styloma* are as follows: *S. hillebrandi*, *S. gaudichaudii*, *S. martii*, *S. arecina*, *S. rockiana*, *S. lanigera*, *S. eriostachys*, *S. eriophora* and *S. minor*. The remaining species are: *S. thurstonii*, from Fiji; *S. vuylstekeana* and *S. pericularum*, from Pomotu; *S. remota*, from Bird Island; *S. maideniana* doubtfully reported from Melanesia; and *S. insignis*, of unknown origin. Beccari also unites with *Pritchardia* the Cuban genus *Colpothrinax*, but this should be retained as distinct from *Styloma*.