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BOTANY.—*Cosmos sulphureus*, the *xochipalli* or flower paint of the Aztecs. WILLIAM EDWIN SAFFORD, Bureau of Plant Industry.

Vegetable dyes were used by the aborigines of all parts of America for ornamenting their utensils, staining their bodies, or coloring their baskets and fabrics. Many of the textiles found in the prehistoric graves of Peru are remarkable for their beautiful and permanent colors. Few of these, unfortunately, can be traced to the plants from which they were derived. The introduction of foreign dyes has been disastrous. Their cheapness and the facility with which they can be transported has caused them to be widely adopted in place of native dyes, the preparation of which is fast becoming obsolete. The ancient Mexicans made use of a number of beautiful pigments, mostly vegetable, for the picture-writing of their celebrated codices. Nearly all of their colors can be identified. A crimson was obtained from the cochineal insect, reared upon a cactus (*Nopalea cochenillifera*). This they called *nocheztli*, or "prickly-pear-blood." With it they sometimes combined other ingredients, especially the leaves of a Melastomataceous plant called *tezoatl*, or *texhuatl*. From the reddish-yellow aril of the seeds of *Bixa orellana* they derived a pigment called *achiotl*. This is now widely used throughout the world, and is known commercially as *annatto*, or *arnotto*. A bright yellow was obtained from a leafless parasitic plant, *Cuscuta tinctoria*, called *zacatlaxcalli*. From logwood *Haematoxylon campechianum*, and the closely allied *Hae-*

matoxylon brasiletto, called uitzquauitl, or huitzcuahuitl, they obtained a purple, and other shades, resulting from various additional ingredients. The use of this wood is now world wide. From the twisted pods of *Caesalpinia coriaria*, called nacascalotl, they obtained a fine black. These pods, known commercially as cascalote or dividivi, are now an important source of tannin. Another dye-plant, interesting on account of its old-world affinities, was their xiuhquilitl, *Indigofera suffruticosa*, more commonly known as *Indigofera anil*, and very closely allied to *Indigofera tinctoria*, from which most of the commercial indigo is derived; and another beautiful blue, called mohuitli, was obtained from *Jacobinia mohintli* and *J. umbrosa*.

One of their colors, however, which all writers on Mexico mention, has hitherto remained unidentified. This was called xochipalli, or "flower-paint," a name also applied to the plant itself. It is the object of the present paper to announce its rediscovery and to give a description, by means of which the plant can be identified with certainty. The most remarkable fact in connection with this plant is that, although it was described and figured more than three centuries ago, it has remained hitherto unidentified. It is widely spread in Mexico. In the present State of Guerrero there is a town, Xochipalla, the name of which signifies "the place where the xochipalli abounds."¹ The celebrated traveller, Gemelli-Careri, who visited this town in 1697, while en route from Acapulco to Cuernavaca, passed through a neighboring district where the girls gathered xochipalli flowers and made of them a cosmetic paste. The Proto-Medico, Dr. Francisco Hernandez, who was sent by his sovereign Philip II in 1570 to New Spain to study its resources, gave the following description of this plant, illustrated with a rude drawing, a fac-simile of which is here shown (fig. 1).

"Xochipalli is an herb six cubits in length, with sinuous (pinatifid) leaves somewhat like those of *Artemisia*, stems a finger thick, flowers resembling those of the cempoalxochitl [*Tagetes erecta* L.], but smaller and of a reddish yellow color, and roots slender and long. It is widely spread in the *tierras calientes*,

¹ See Robelo, *Diccionario de Aztequismos*, pp. 444, 447, 449. 1904.

and is an herb well known to everybody. Only the flower is used, the which is moderately hot and of an agreeable odor and taste, comforting the heart, curing maladies of the womb and ulcers, especially those of the mouth. But the chief use of the flowers is for dyeing wool and painting images and objects of a yellow color which in a certain manner verges to red, for which object they are boiled in water together with an alkali, after which the juice is expressed and strained, yielding a color which is used by painters and dyers, for the purposes we have indicated.”²

A search for the name xochipalli, or its modern variant, suchipal, in Ramirez and Alcocer's *Sinonomia vulgar y cientifica de las plantas Mexicanas* was without result, nor could it be found in the *Nueva farmacopea Mexicana*. In Siméon's monumental *Dictionnaire de la langue Nahuatl*, however (p. 701) the importance of this plant is attested by the following definitions: “Xochipalli ou Xuchipalli, Herbe dont la feuille ressemble a celle de l'artémise et sert à teindre les étoffes en jaune rouge; couleur rouge, rose. RR. *xochitl*, *palli*.” Robelo, also, in his *Diccionario de Aztequismos* (p. 444) refers to it as follows: “Suchipal (Xochipalli: *xochitl*, flor; *palli*, color: ‘flor-color,’ ó ‘color de flor’). Yerba cuya hoja se parece á la artemisa, y sirve para teñir las telas de amarillo, rojo ó naranjado.” On page 447, note 23, he says: “Esta planta no está clasificada;” and on page 449, under geographical names, he includes “Xochipala (xochi-pal-la: *xochi-palli*, ó *xuchi-palli*, *suchipal*; *la*, variante de *tla*, particula abundancial):” “Donde abunda el suchipal.”

In response to letters of inquiry the writer received replies from several Mexican botanists, all of whom, following Hernandez's description, were disposed to refer the plant in question to the genus *Tagetes*, which includes the so-called “French” and “African” marigolds of our gardens, both of which are flowers of Mexican origin, held in high esteem by the Aztecs and used by them in certain religious rituals. Dr. B. P. Reko of Oaxaca referred it to *Tagetes patula* and Dr. C. Conzatti thought that it might possibly be *Tagetes multiseta*. In a letter dated July 5,

² See Ximenes' translation of Hernandez, Cuatro Libros, Libr. 3, cap. 36. 1615.

1918, Dr. Conzatti says that, although Hernandez declares the xochipalli to be an herb well known to everybody, no one could be found who knew it: even the oldest natives in the vicinity of

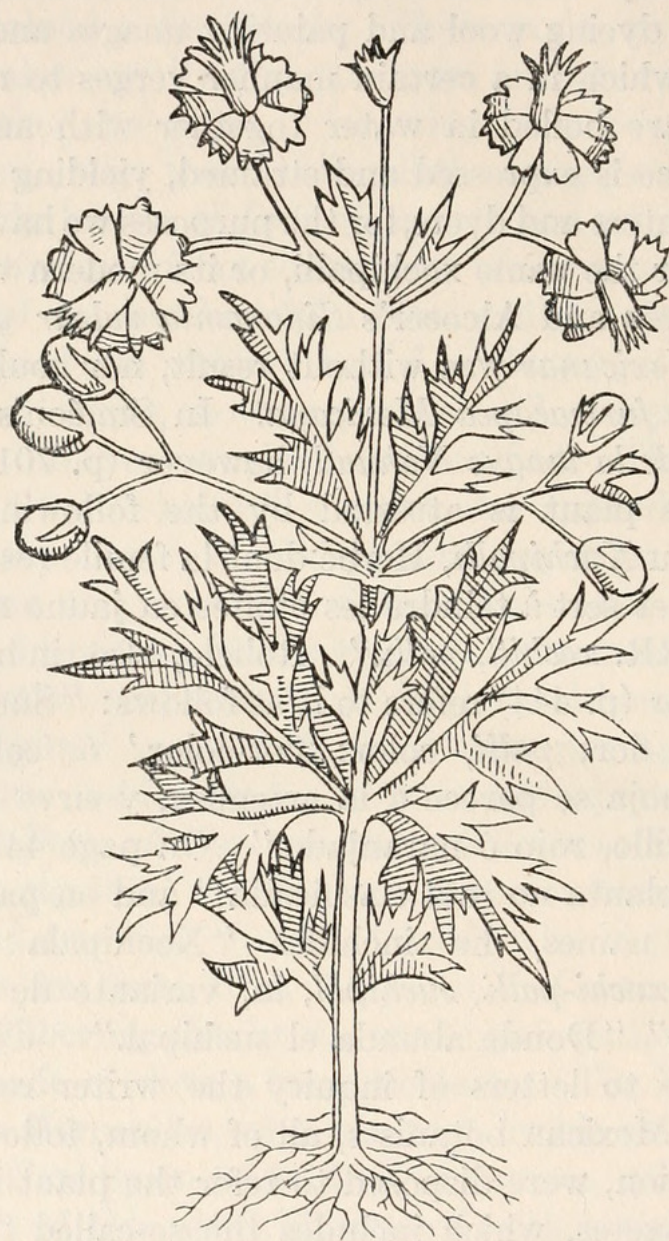


Fig. 1 Xochipalli (*Cosmos sulphureus* Cavanilles), the "flower-paint" of the Aztecs, as figured by Hernandez in 1576 and published in 1651.

Oaxaca were ignorant of such a plant. Since Hernandez described it as having "flowers resembling the cempoalxochitl (*Tagetes erecta*) but smaller," Dr. Conzatti was inclined to refer it to the smaller cempoalxochitl, *Tagetes multiseta*, a dried speci-

men of which he enclosed in his letter. That the plant in question could not possibly belong to the genus *Tagetes* was shown at once by the form of the involucre subtending the flower-head, which according to Hernandez's drawing, was not at all cup-shaped, or tubular like that of *Tagetes* but composed of several distinct linear bracts. A comparison of Hernandez's rude illustration (fig. 1) with herbarium specimens of *Tagetes* showed that the plant in question could not possibly be included in the same genus with them. His figure represents a composite with flower-heads not unlike those of a *Coreopsis*, but the accompanying leaves are artemisia-like as stated in the original description. The widely spread ray-flowers, few in number, are three-toothed at the apex. On one of the heads they have fallen off, indicating that they are not persistent like those of *Tagetes*. The disk flowers form an erect cylindrical bundle, while the entire head is subtended by an involucre not at all like that of the genus *Tagetes*, but composed of a few linear sepal-like bracts as stated above.

Failing to find the plant in the genus *Coreopsis*, the writer carefully examined the plants belonging to allied genera. At last, in the genus *Cosmos*, he came upon a species corresponding in all respects with Hernandez's figure. The long sought Xochipalli proved to be *Cosmos sulphureus*, a species which, though figured the latter part of the eighteenth century by two eminent botanists, had never been associated with the dye-plant described and figured by the great protomedico a century previously. To verify the discovery, a decoction of the flowers was made for the writer by Dr. L. A. Hawkins, Plant Physiologist, of the Department of Agriculture. Almost immediately the water became suffused with an orange tinge, and on the addition of a very small quantity of alkali it changed to a rich orange-red, the color of the xochipalli described by Hernandez.

Though never hitherto connected with the classic "flower-color" used by the Aztecs in painting their codices, *Cosmos sulphureus* is not a rare plant. Specimens of it were lacking in the United States National Herbarium until 1886, when it was encountered by the veteran explorer Dr. Edward Palmer in the



Fig. 2. *Cosmos sulphureus* Cavanilles, a, disk flower; b, achene.

vicinity of Guadalajara, Jalisco; and five years later he collected it at Culiacan, Sinaloa, bringing back with him from this locality seeds from which plants were propagated at Washington. The account of its introduction into cultivation in the United States is told by Dr. J. N. Rose in *Garden and Forest* for December, 1895, where an excellent figure of it was published. It is now represented in the United States National Herbarium by specimens from many other parts of Mexico: from Durango, Sonora, Tepic, Colima, Oaxaca, Chiapas, Guerrero, and Morelos. It is interesting to note that this species, observed by Gemelli-Careri centuries ago while traveling between Acapulco and Cuernavaca, has been collected at both of these terminals, at Acapulco by Dr. Palmer, in 1894, and at Cuernavaca by Dr. J. N. Rose, in 1902. Seeds of this classic dye-plant of the Aztecs were recently obtained by the writer, and he now has a number of vigorous young plants of the true xochipalli growing in one of the green-houses of the United States Department of Agriculture.

DESCRIPTION

Cosmos sulphureus is a tall, rank, pubescent annual composite, growing usually about four to seven feet high, with stems as thick as the thumb and bipinnatifid or tripinnatifid leaves, not unlike those of the common *Artemisia vulgaris* in form. The flower heads, borne on long slender peduncles, are subtended by a calyx-like involucre composed of two series of eight bracts each, the outer bracts linear and green, the inner broader and scarious. The flowers vary in color from bright orange to deep reddish orange. The heads are composed of eight broadly ovate ray-flowers, three-toothed at the apex, spreading at right angles to the axis and soon falling off, and fertile tubular disk flowers forming a compact erect cylindrical bundle. The exerted anthers are black with orange tips, and the style is branched, terminating in two slender tips. The fruit is a linear akene nearly an inch long, including the slender barbed beaks, and the pappus consists of two slightly hispid awns.

REFERENCES

Cosmos sulphureus Cavanilles, Icon. Pl. 1: 56, pl. 79. 1791.
Rose, Gard. & For. 8: 484, fig. 66. 1895.

Coreopsis artemisiaefolia Jacquin, Icon. Pl. Rar. 595; Col. Suppl. 155. 1791.

Xochipalli . . . *folia ferens sinuosa, magna, et Artemisiae quadantenus similia*. Hernandez, in Nard. Anton. Recchi, Rerum Medic. Nov. Hisp. Lib. 7, Cap. 36. 1651.

In the accompanying illustration (fig. 2) the plant is shown, slightly reduced, accompanied by drawings of a disk flower (a) and an achene (b), the two latter enlarged about two diameters.

BOTANY.—*A new Polystichum from California*.¹ WILLIAM R. MAXON, National Museum.

In reviewing recently the *Polystichums* of the Pacific coast region of the United States as represented in the National Herbarium and in the very ample collections of the Dudley Herbarium of Leland Stanford Junior University, the latter lent for study through the courtesy of Professor LeRoy Abrams of that institution, it has been found that the plant of the Santa Cruz peninsula and of two or three localities not far northward which has commonly been referred to *Polystichum aculeatum* (or formerly to its "var. *angulare*") represents a new species. This is described below, being named in memory of the late William R. Dudley, for many years professor of botany in Leland Stanford Junior University.

***Polystichum Dudleyi* Maxon, sp. nov.**

Rhizome stout, decumbent, together with the numerous stipe-bases densely paleaceous, the inner basal scales mostly linear-lanceolate, attenuate, dark brown, dull, semiopaque, imbricate, those above spreading, larger and broader, narrowly oblong to ovate, long-acuminate, up to 2 cm. long, brown to fulvous, concolorous, translucent, membranous, distantly denticulate-ciliolate, extending well up the stipe but mostly deciduous above the basal third, underlaid by a dense series

¹ Published with the permission of the Secretary of the Smithsonian Institution.



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