Analysis: 0.3325 g. substance consumed 10.1 cc. of 0.1 N acid equivalent to 4.25 per cent N. Theory for $2C_7H_7N\,Br_2 \cdot ZnCl_2$ = 4.20 per cent N.

3, 5-Dibromo-o-toluidine cadmium bromide 2:1.—Two and five-tenths grams of cadmium bromide and 5 grams of the substituted toluidine were dissolved in 50 cc. of alcohol and refluxed for several hours on the steam bath. Upon cooling, the addition compound separated in white velvety needles. The substance was recrystallized from alcohol. It did not melt below 225°C.

Analysis: 0.1290 gram substance consumed 3.1 cc. of 0.1 N HCl equivalent to 3.36 per cent N. Theory for $2C_7H_7N\,Br_2 \cdot Cd\,Br_2$ = 3.49 per cent N.

3, 5-Dibromo-o-toluidine cadmium chloride 2:1.—This double salt was prepared by the general procedure previously outlined. It was obtained as a colorless microcrystalline powder, quite soluble in cold alcohol, and rapidly assumed a red color upon exposure to light and air. It did not melt below 200°C.

Analysis: 0.1484 gram substance consumed 4.2 cc. of 0.1 N acid equivalent to 3.96 per cent N. Theory for $2C_7H_7N\,Br_2 \cdot Cd\,Cl_2$ = 3.92 per cent N.

SUMMARY

3, 5-Dibromo-o-toluidine combines with metallic halides to give addition compounds containing two molecules of base to one molecule of metallic salt.

The mercuric chloride, zinc chloride, cadmium bromide, and cadmium chloride 2:1 addition compounds have been prepared and analyzed.

The presence of the metals did not adversely affect the nitrogen results as determined by the official method.

BOTANY.—*The value of certain anatomical characters in classifying the Hibisceae.* FREDERICK L. LEWTON, U. S. National Museum.

The classification of genera and species of the Mallow family bearing capsular fruits, which are usually considered as comprising the tribe Hibisceae, has presented more or less difficulty to workers in systematic botany when preparing formal descriptions, tables of relationships, and keys.

The writer believes that the difficulties met with largely result from the choice of certain variable and inconstant anatomical characters

which heretofore have been believed to be of prime importance in distinguishing between genera and species.

Dr. Otto Kuntze in 1891 called attention to the fact that the genera of the Hibisceae are poorly separated, and stated as follows[1]: "I know of no single character in *Gossypium* which one may not also find in *Hibiscus*." He then proceeded to add to the already bulky and overloaded genus *Hibiscus* all the species of the genera *Gossypium*, *Fugosia*, *Sturtia*, *Thurberia*, and *Thespesia*.

An examination of the principal standard systematic works shows that the anatomical characters which have been considered of most value and most frequently used by authors in describing the several genera of the tribe Hibisceae, and to some extent their species also, are the following: (1) The numerical divisions of the style and ovary; (2) the length of the style branches; (3) the shape and size of the involucral bracts; (4) the number of nectaries on the underside of the leaves; (5) the presence or absence of petal spots; (6) the covering of seed.

None of the characters mentioned are constant or exclusive for a single one of the genera heretofore included in the tribe, and in delimiting the genera of this group other descriptive characters must be sought for.

ANATOMICAL CHARACTERS WHICH ARE OF LITTLE VALUE OR WHICH HAVE BEEN MISUSED

An examination of the use in the principal systematic works of the commonly accepted descriptive characters listed above will show the cause of much of the confusion and difficulty in the classification of these plants, and bears evidence of the dependence placed on these anatomical distinctions by a number of well-known systematic writers.

1. *Numerical divisions of the style and ovary.*—With the possible exception of the genus *Hibiscus*, the divisions of the ovary vary from 3 to 5 in practically all the genera which have been placed in the Hibisceae, and in some genera almost every plant, when examined, may be found to bear capsules having 3, 4, or 5 cells. In spite of the variableness in the number of cells of the ovary, many authors use a definite number in the sense of a descriptive character in limiting genera and preparing analytical keys. Bentham and Hooker[2] state that *Fugosia* (*Cienfuegosia*) has 3 to 4-celled capsules and *Gossypium*, 5-celled. Whereas there are several species of *Fugosia* which commonly have 5-celled capsules and only the highly selected and well

[1] KUNTZE, Rev. Gen. Pl. 1: 67. 1891.

[2] BENTHAM & HOOKER, Gen. Pl. 1: 209.

cultivated varieties of *Gossypium* have a large percentage of 5-celled fruits. K. Schumann, in his key to the Hibisceae, states[3]:

"Ovary 5-celled..... *Gossypium;*
Ovary 3-celled..... *Ingenhouzia;*
Capsule consisting of 5 carpels..... *Thespesia;*
Capsules mostly consisting of 3 carpels..... *Cienfuegosia.*"

Garcke[4] states that one will as soon find a 5-celled *Cienfuegosia* as a 3-celled *Hibiscus*, yet *Cienfuegosia drummondii* was described by Dr. Gray as having a 5-celled, rarely a 4-celled, capsule. Saint-Hilaire nearly 100 years ago noted how little dependence could be placed upon the numerical division of the ovary. He said[5]: "If the genus *Hibiscus* did not contain already such a large number of species we would not hesitate to include in it the genus *Fugosia* because a careful comparison gives as a definite result only one difference of little importance; that of the number of the stigmas and of the cells. Also among the species of *Gossypium*, which have so many affinities with *Hibiscus* and *Fugosia*, we see these same parts presenting indifferently the numbers 3 or 5."

2. *Length of the style branches.*—The descriptive terms most often used in separating the genera *Hibiscus*, *Cienfuegosia*, and *Gossypium* are "Style branches long," and "Style simple, clavate or parted into short erect branches." In many of these plants, depending upon the age of the flower, the divisions of the style may be spreading, or erect and connivent, and appearing as if clavate. This was one of the reasons given by Saint-Hilaire for not recognizing Ventenat's genus *Redoutea*. Moreover the length of the style branches varies, and it is often difficult to decide between "long" and "short." Most systematic works still recognize under the genus *Hibiscus* species having a simple, clavate style.

3. *Shape and size of involucral bracts.*—In the cultivated cottons the shape and size of the involucral bracts are almost as variable as the leaves, and in the published species of *Cienfuegosia* the bracts vary from none to 12 or 15, and in form from a few bristle-like hairs to large cordate or toothed bracts. Still, the number, shape, and size of the involucral bracts are used by Bentham and Hooker,[2] and by Schumann[3] in their analytical keys to separate closely related genera belonging to this group. Hochreutiner,[6] who has given much study to this group of the Malvaceae, assigns *Gossypium sturtii* F. v. M. to the genus *Cienfuegosia* because of its entire involucral bracts even though it otherwise has the habit of *Gossypium;* and Prof. G. E. Mattei[7] of the Botanic Garden at Palermo, quotes Hochreutiner as ascribing to the genus *Cienfuegosia* all species of *Gossypium* having entire, instead of

[3] Schumann, K., in Engler & Prantl, Nat. Pflanzenf. 3[6].
[4] Garcke, Bonplandia 8: 150. 1860.
[5] Saint-Hilaire, Fl. Bras. Merid. 1: 251–252. 1825.
[6] Hochreutiner, B. P. G., Ann. Conserv. Jard. Bot. Genève 6: 56. 1902.
[7] Mattei, G. E., Boll. Real Giar. Col. Palermo 1: 224. 1914.

laciniate, involucral bracts. Ulbrich, remarking on a Mexican plant which he makes the type of his genus *Selera*, says[8]: "This plant resembles a species of *Gossypium;* it possesses, however, an involucre of entire, ovate, cordate bracts and seeds so slightly hairy that it can not be included in that genus."

4. *Number of leaf nectaries.*—The older descriptions of species of *Gossypium* always gave the number of nectaries to be found on the veins of the lower side of the leaves. The species *Gossypium eglandulosum* Cav. was considered distinct from other cottons because no nectaries were found on the leaves. The number of these glands on the leaves of any one plant or species usually depends upon the number of lobes of the leaf and whether the leaf is situated on a branch or on the main stem. The uselessness of the number of nectaries on the leaf as a varietal or specific character was long ago pointed out by Von Rohr[9] and Medicus.[10] Leake,[11] working with certain Indian species, notes the varying number of leaf nectaries, and states that it is possible to recognize forms within the species in which the leaves are all eglandular. *Gossypium tomentosum* Nutt., a native Hawaiian species, is without any nectaries on its leaves, as is also a cultivated Indian variety of *Gossypium nanking* Meyen, grown by the writer out of a row of 130 plants of which but one plant bearing leaf nectaries was produced.

5. *Petal spots.*—Practically all of the species of this tribe which have never been cultivated bear a pink, crimson, or purple spot on the base of each petal. On the other hand a great many cultivated varieties of cotton have lost the petal spot, though in certain varieties it sometimes reappears in a few individuals. An example of this is found in the early Upland variety known as "King." In the cultivated species in which it normally occurs, such as Sea Island, Egyptian, and Kidney cottons (*G. barbadense* and *G. lapideum*), it is often quite variable in size and distinctness.

6. *Covering of the seed.*—Several writers, notably Von Rohr,[9] Rafinesque,[12] and Watt,[13] have attempted a classification of varieties and species of *Gossypium* based entirely upon the covering of the seed. The seeds of a few of the genera of the Hibisceae are devoid of a downy or fuzzy covering, but in most of the genera the wild species have their seeds covered with rusty down or fuzz. In the cultivated varieties of cottons, however, the color and amount of the fibrous covering is so variable within the species, and even within the variety, as to make this character of doubtful value in taxonomic work. Certain degenerate types of the common Upland fuzzy-seeded cotton not only have naked seeds but the bolls contain little or no lint.

[8] ULBRICH, E., Verhandl. Bot. Ver. Brandenburg **55**: 168. 1913.
[9] VON ROHR, J. P. B., Anmerkungen über den Cattunbau part 2. 1793.
[10] MEDICUS, F. K., Bot. Beob. **2**: 201. 1783.
[11] LEAKE, H. M., Journ. Genetics **1**: 239. 1911.
[12] RAFINESQUE, C. S., Sylv. Tellur. 14–19. 1838.
[13] WATT, GEO., *The wild and cultivated cotton plants of the world*, pp. 8, 56, 60. 1907.

A wild cotton found growing on the coast of Jamaica by Britton and Harris has both smooth and fuzzy-seeded forms growing side by side, a condition which is also found in certain Chinese and Transcaucasian forms of *Gossypium nanking*. Yet Watt does not hesitate to use the presence or absence of fuzz on the seed as a basis of classification of species, and believes the differences in the covering of the seed to be "almost sub-generic in value."[13] H. M. Leake[14] has called attention to this "new character" in Asiatic cottons. W. L. Balls gives his opinion of the dependence to be placed in the covering of the seed as a taxonomic character thus[15]: "Similarly the smoothness or 'fuzziness' of the seed, which has been ridden to death in some schemes of classification, is almost an accident; various forms of the accidental result happen to be commoner in some species than others, but the naked-seeded forms are known now in all the commercial cottons, having probably arisen as sudden sports."

ANATOMICAL CHARACTERS WHICH ARE OF VALUE IN CLASSIFYING THE HIBISCEAE

In place of the variable anatomical characters mentioned above, some of which are of taxonomic value when their limitations are known, other characters are here suggested which are believed to be more dependable for systematic classification. These may be listed as follows:

1. The extra-floral nectaries (excluding those on the leaves); position, number, shape, and size.
2. Black oil glands; presence or entire absence, distribution.
3. Fringe of hairs on valves of carpels.
4. Persistence of involucral bracts.
5. Adnation of bracts to each other.
6. Number of chromosomes.

A few examples of the use already made of these anatomical characters by systematists are offered in the paragraphs below, and practical application of them to the problem of classifying the already established genera and species of the Hibisceae is promised in further studies in this series.

1. *Extra-floral nectaries.*—The various species of *Gossypium* and related genera are usually provided with one or two sets of extra-floral nectaries in addition to the one or more nectaries usually found on the underside of the leaves.

In Professor Comstock's exhaustive study of cotton insects, Dr. William Trelease describes[13] the nectar secreted by the cotton plant and discusses its value in attracting certain insects which might aid in cross-pollination or act as guardians against the ravages of other insects.

[14] LEAKE, H. M., *Observations on certain extra-Indian Asiatic cottons.* Mem. Dept. Agr. India Bot. **4**: (5): 111. 1912.

[15] BALLS, W. L., *The development and properties of raw cotton.* 3. 1915.

[16] TRELEASE, W. in Comstock, J. H., *Report upon cotton insects.* U. S. Dept. Agr., 317–343. 1879.

Where these extra-floral nectaries have been mentioned by systematic botanists at all, they have usually been spoken of as "glands" without clearly distinguishing them from the floral nectary proper or from the black oil-glands to be seen so prominently in nearly all parts of the plant. But little attention to the extra-floral nectaries has been given by taxonomists, and their value as diagnostic characters in formal descriptions and keys has generally been overlooked.

Tyler has clearly drawn[17] the distinction between the four types of nectaries, and has indicated their value in the classification of the cottons and their nearest relatives. Stanford and Viehoever describe[18] the nectaries, and show that they differ morphologically from the internal black glands and have no connection with them.

2. *The black oil-glands.*—The chemistry of the black oil-glands, black dots, or internal glands, as they are called by various authors, which are found in all parts of the cotton plant, has been studied by Stanford and Viehoever,[18] who state that they have been noted within the Malvaceae only in certain genera of the subfamily Hibisceae, and that other genera appear not to possess glands of this type. The absence of these black internal glands from the cotyledons of the five species of Australian plants, placed by Fr. von Mueller first in the genus *Gossypium* and later *Fugosia* (*Cienfuegosia*), was noted by Todaro in his *Monograph of Gossypium*[19] and used by him to separate subgenera. The distribution and arrangement of these glands was noted by Cavanilles in characterizing his genus *Cienfuegosia*.[20]

3. *Fringe of hairs on the valves of the carpels.*—The most prominent character of the genus *Thurberia* as described by Gray[21] is a false dissepiment in each cell of the ovary which, upon the maturing of the capsule, breaks up into a fringe of long silky hairs along the edges of the carpels. These hairs seem to have a part in the ejection of seed from the open valves of the capsule in a manner somewhat analogous to the peristome on the capsule of certain mosses. Similar carpellary fringes are to be found on *Cienfuegosia heterophylla* (Vent.) Garcke, of southern Florida and the West Indies, *Cienfuegosia yucatanensis* Millsp., of Yucatan, *Gossypium harknessii* Brandegee, of Lower California, *Erioxylum palmeri* Rose, of Mexico, and numerous other species included in genera other than *Thurberia*. The edges of the carpels of the capsules of *Lagunaria patersoni*, a handsome ornamental

[17] TYLER, F. J., *The nectaries of cotton.* U. S. Dept. Agr. B. P. I. Bull. 131, pt. 5. 1908.

[18] STANFORD, E. E. & VIEHOEVER, A., *Chemistry and histology of the glands of the cotton plant, with notes on the occurrence of similar glands in related plants.* Journ. Agr. Research **13**: 419–435, *pl.* 42–50. May 20, 1918.

[19] TODARO, A., *Relazione sulla cultura dei cotoni in Italia* 98. 1878.

[20] CAVANILLES, A. J., Monad. Diss., Decem. 174, *pl. 72, f. 2.* 1786.

[21] GRAY, A., Pl. Wright. **1**: 23. 1852.

Australian tree, are provided with a thick fringe of very fine, stiff, golden, deciduous hairs pointing inwards and retarding the dissemination of the smooth seeds. Dr. E. W. Bick, Curator of the Brisbane Botanic Garden, Queensland, describes these as follows[22]: "Attached to the inner portion of the capsules are numerous short barbed hairs that will attach themselves to the skin, and are very irritating, being not unlike those of the velvet bean, *Mucuna pruriens*, commonly called cow-itch."

4. *The persistence of the involucral bracts.*—The deciduous nature of the involucral bracts of the so-called Australian cottons (*Notoxylinon*) and of species of the genera *Thespesia* and *Montezuma* has been made use of by several authors in formulating generic distinctions and analytical keys.

5. *The adnation of the involucral bracts to each other.*—Whether the bracteoles forming the involucre are free from each other or more or less united at their bases is a factor considered by Sir George Watt to be of value in the classification of cottons. His words are as follows[23]: "The most instructive characteristics are derived from the position and condition of the bracteoles; the presence or absence of nectar-yielding glands; and the nature of the floss and fuzz that surround the seed." However, this writer finally gives first place to the covering of the seed as a diagnostic character, the adnation of the bracteoles being stated as the second most important character in defining his sections of *Gossypium*.[24] Hochreutiner,[25] in his revision of the genus *Hibiscus*, considers this character of importance in classifying the large number of species belonging to that genus.

The adnation of the involucral bracts of certain tropical American cottons and species of the Old World has been suggested by O. F. Cook[26] as having a protective value, but he does not suggest its use for purposes of classification.

6. *Number of chromosomes.*—During the past year three investigators, H. J. Denham in England,[27] A. G. Nikolajeva in Russia,[28] and A. E. Longley in Washington, have studied, independently of each other, the chromosome numbers of different species of cottons and some related genera. Each of these investigators has pointed out that the species so far studied fall into two groups, one having 13 chromosomes and the other 26. These two groups have already been well defined as the Old World and the New World cottons.

[22] Bick, E. W., *Flowering tress of the Brisbane Botanic Garden.* Agr. Journ. Queensland **16**: 379–380. 1921.

[23] Watt, Geo., *loc. cit.* p. 60.

[24] Watt, Geo., *loc. cit.* pp. 61, 77, 163, 244, 316.

[25] Hochreutiner, B. P. G., *loc cit.* **4**: 23–191. 1900.

[26] Cook, O. F., *The weevil-resisting adaptations of the cotton plant.* U. S. Dept. Agr. B. P. I. Bull. **88**: 31, 32, 37. 1906.

[27] Denham, H. J., *Chromosome numbers of Old and New World cottons.* Ann. Bot. **38**: 433–438. July, 1924. Journ. Textile Inst. Manchester **15**: T1496–1500. Oct., 1924.

[28] Zaitev, G. S., Bull. Applied Bot. & Pl. Breeding (Russian) **13**[2]: 132. 1924.

Cytological studies of this kind have opened a new field of investigation which is sure to throw much light on the relationships of the important economic plants.

ENTOMOLOGY.—*The wasp* Nysson hoplisivora, *a parasitic relative of* Hoplisus costalis. EDWARD G. REINHARD, Canisius College, Buffalo, New York. (Communicated by S. A. ROHWER.)

It has been customary to extoll the solitary wasps as examples of altruism and industry. They are the industrious fossores, considered to be of a superior race above the ruder parasitic Hymenoptera. So they are, a very respectable clan, yet, like many noted families, they are not without a "black sheep" to stain the family honor. It was only recently that any wayward habits among the members of the Sphecoids have been brought to light. But information is accumulating, and the evidence points to a degenerate branch, the *Nyssonini*, as a set of parasites who revel in robbery and fratricide.

The *Nyssonini* had a clear record for centuries because no one had ever investigated their manner of life. In 1887 Handlirsch voiced the first suspicion by noting how similar in appearance some of them were to the species of bees who practised parasitism. Yet nothing definite was known about the life-history of any Nysson until 1901 when Ferton observed the behavior of *Nysson dimidiatus* in France, and found indications of parasitic habits.

Dr. William M. Wheeler, writing in 1919, thus summarizes the knowledge of Nysson's habits: "According to Ferton (1901) the Gorytid *Nysson dimidiatus* is a parasite of *Gorytes elegans*. The latter digs its burrow in the sand and provisions it with larval and adult Hemiptera; the Nysson finds it and often enters it during the absence of Gorytes. If the latter happens to be at home the Nysson waits motionless about a dozen centimeters away, with its head turned towards the nest, till the Gorytes departs. Adlerz (1910) observed very similar behavior on the part of *Nysson maculatus* towards *Gorytes lunatus*. Apparently both species of Nysson destroy the Gorytes egg attached to the prey and lay their own in its place."[1]

Neither Ferton nor Adlerz succeeded in finding the Nysson's egg or larva or any signs of parasitic depredations beyond the suspicious actions of the wasp and its forceful entry into the Gorytes' burrow. Barth in 1907 had made additional observations of which Dr. Wheeler was not aware. He saw in Wisconsin a *Nysson fidelis* (Cres.) rapidly

[1] *The parasitic Aculeata, a study in evolution.* Proc. Amer. Phil. Soc. **58**: no. 1: 15.