

its reducing action on any material containing iron oxides with which it comes in contact, provided the temperature is sufficiently high. At low temperatures, on the other hand, and with abundant access of atmospheric oxygen, no appreciable reduction is to be expected.

BOTANY.—*The Australian Fugosias*.¹ F. L. LEWTON, National Museum.

While engaged in a critical study of the species of *Gossypium* the writer has become convinced that the Australian shrubs assigned by von Mueller and by Todaro to that genus and placed by Bentham under the name *Fugosia* should be given another designation, as in his opinion neither of the genera named is represented on the Australian continent except by cultivated plants.

A study of the relationships of the twelve species of *Fugosia*, so called, which have been described from Australia is rendered very difficult by the incomplete description of many of the older species and by the meager representation of plants in American herbaria. The writer has, however, received herbarium specimens of three species directly from Australia and in addition has studied carefully all the material belonging to this group to be found in the United States National Herbarium, the herbarium of the Academy of Natural Sciences of Philadelphia, the combined herbaria of the New York Botanical Garden and Columbia University, the Gray Herbarium of Harvard University, the Field Museum of Natural History and the herbarium of the Missouri Botanical Garden. His conclusions as to the relationships, names and synonymy of these twelve Australian plants are here presented.

As already pointed out by Garcke² and by Todaro,³ the name *Fugosia* was proposed without any justification by Jussieu⁴ in

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² *Bonplandia* 8: 148. 1860.

³ *Relazione sulla cultura dei cotonei in Italia*, pp. 86-87. 1878.

⁴ *Gen. Pl.* 274. 1789.

1789 as a substitute for Cienfuegosia, published three years earlier by Cavanilles,⁵ who gave the name in honor of Bernard Cienfuegos, a Spanish botanist of the sixteenth century, to a plant collected by Adanson in Senegal. In spite of a partial restoration of the older name by Willdenow⁶ and by Sprengel,⁷ and its complete restoration by Bartling;⁸ Persoon,⁹ DeCandolle¹⁰ and Endlicher¹¹ used Jussieu's abridged form of Cavanilles' name and were followed by later systematic writers, especially Bentham, Hooker, and von Mueller.

The Australian shrubs described by von Mueller and by Bentham as species of *Fugosia*, when compared with the American and African plants assigned to that genus, appear so distinct in habit and gross anatomy as to warrant their being excluded from the genus, the type species of which is, as above stated, a native of Africa. Furthermore, the Australian species are easily divisible into two groups, already indicated in the *Flora Australiensis*. Even a very cursory examination of the plants is sufficient to convince one that these two groups have very little in common. In the writer's view they represent two distinct genera, here discussed separately.

THE GENUS NOTOXYLINON

The larger group of Australian *Fugosias* comprises eight species: *F. australis* Benth., *F. flaviflora* von Muell., *F. latifolia* Benth., *F. populifolia* Benth., *F. robinsonii* von Muell., *F. thespesoides* Benth., *F. punctata* Benth., and *F. pedata* Bailey; which have all, at one time or another, excepting the last, been placed in the genera *Hibiscus*, *Cienfuegosia*, or *Gossypium*. They differ from the African and American species of *Fugosia*, as the genus is commonly defined, in having the involucre 3-bracted and the black oil glands not restricted to the sepals and capsules but

⁵ Monodel. *Classis Diss.* Decem. 174, *pl.* 72, *fig.* 2. 1786.

⁶ *Sp. Pl.* 3: 723. 1800.

⁷ *Syst. Veg.* 3: 64. 1826.

⁸ *Ord. Pl.* 346. 1830.

⁹ *Syn. Pl.* 2: 240. 1807.

¹⁰ *Prod. Syst. Veg.* 1: 457. 1824.

¹¹ *Gen. Pl.* 983. 1840.

found in all parts of the plant except the cotyledons. In all the American and African species assigned to *Fugosia* the black glands are arranged in rows on the sepals, while these Australian plants agree in having the black glands scattered promiscuously over the surface of the calyx and involucre. From the genus *Gossypium* they differ, principally, in the total absence of the black oil glands from the cotyledons.

In 1875 Ferdinand von Mueller¹² stated that these species should in his judgment be placed in the genus *Gossypium*, and three years later Todaro¹³ placed them in subdivisions of *Gossypium* which he named *Thespesiastra* and *Hibiscoidea*. The species of the first group were characterized as having small deciduous bracts and a 5-toothed calyx, and those of the *Hibiscoidea* as having linear, persistent bracts and the calyx 5-parted. The distinctions between deciduous and persistent bracts and between a 5-toothed and a 5-parted calyx can hardly be regarded as of primary importance in this case, since between species which must undoubtedly be classed as true members of *Gossypium* these same differences actually occur.¹⁴

It seems to the writer, therefore, that the eight species above mentioned constitute a well-marked group of generic rank for which the name *Notoxylinon*¹⁵ is appropriate; the new genus to include Todaro's two sections, *Thespesiastra* and *Hibiscoidea*. The type of *Notoxylinon* will be *Gossypium australe* F. von Mueller,¹⁶ which was the first of the included species to be described and is probably the most common in herbaria.

***Notoxylinon* Lewton, gen. nov.**

Shrubs or undershrubs with the habit of *Gossypium*, glabrous, except on young parts, or tomentose throughout, more or less glandular-dotted. Leaves entire, lobed or pedately parted, with a nectary below near the base of the midvein. Flowers borne on short, extra-axillary branches; peduncle thickened upwards with 3 nectaries at its summit. Involucre of 3 distinct bracteoles, these linear-lanceolate

¹² *Fragm. Phyt. Austr.* 9: 127. 1875.

¹³ *Relazione sulla cultura dei cotonei in Italia*, pp. 97-98. 1878.

¹⁴ Compare *Gossypium harknessii*, *G. irenaeum* and *G. hirsutum*.

¹⁵ From νότος, the south wind, and ξύλινον, the cotton plant.

¹⁶ *Fragm. Phyt. Austr.* 1: 46. 1858.

or subulate, sometimes reflexed or deciduous. Calyx 5-lobed or 5-parted, conspicuously gland-dotted. Corolla large and showy, yellow or pink, usually with a reddish-purple spot at the base of the petals. Ovary 3- or 4-celled, with 3 or more ovules in each cell. Style undivided, thickened upwards, slightly 3-lobed; stigmas sulcate. Capsule woody, orbicular or ovate. Seeds woolly.

The genus *Notoxylinon* may be distinguished from *Hibiscus* by the undivided style and the presence of black glands; from *Cienfuegosia* by the irregular distribution of the black glands and the 3-bracted involucre; from *Gossypium* by the absence of the black glands from the cotyledons.

The species of *Notoxylinon* may be recognized by means of the following key:

Calyx truncate; lobes or teeth small.

Plant glabrous; bracteoles persistent 1. *N. populifolium*.

Plant more or less tomentose; bracteoles deciduous.

Leaves orbicular-ovate, acute entire; bracteoles subulate 2. *N. thespesioides*.

Leaves rhomboid, 3-lobed; bracteoles setaceous 3. *N. flaviflorum*.

Calyx 5-parted or deeply lobed; lobes acuminate.

Plant glabrous or slightly tomentose.

Leaves 3-lobed 4. *N. robinsonii*.

Leaves ovate, entire.

Petioles less than 1 inch long 5. *N. punctatum*.

Petioles 1 inch or more long 6. *N. latifolium*.

Plant soft hairy or tomentose.

Leaves entire or 3-lobed, densely short tomentose 7. *N. australe*.

Leaves pedately 5-parted, coarsely stellate hairy 8. *N. pedatum*.

1. *Notoxylinon populifolium* (Benth.) Lewton.

Fugosia populifolia Benth. Fl. Austr. 1: 221. 1863.

Gossypium populifolium F. von Muell. Fragm. Phyt. Austr. 9: 127. 1875.

Hibiscus populifolius Kuntze, Rev. Gen. Pl. 1: 69. 1891.

Cienfuegosia populifolia Hochr. Ann. Conserv. Jard. Bot. Genève 6: 57. 1902.

2. *Notoxylinon thespesioides* (Benth.) Lewton.

Hibiscus thespesioides R. Br. in herb.

Fugosia thespesioides Benth. Fl. Austr. 1: 220. 1863.

Gossypium thespesioides F. von Muell. Fragm. Phyt. Austr. 9: 127. 1875.

Cienfuegosia thespesioides Hochr. Ann. Conserv. Jard. Bot. Genève 6: 58. 1902.

3. **Notoxylinon flaviflorum** (F. von Muell.) Lewton
Fugosia flaviflora F. von Muell. Fragm. Phyt. Austr. **5**: 44. 1865.
Gossypium flaviflorum F. von Muell. op. cit. **9**: 127. 1875.
Hibiscus flaviflorus Kuntze, Rev. Gen. Pl. **1**: 69. 1891.
Cienfuegosia flaviflora Hochr. Ann. Conserv. Jard. Bot. Genève
6: 56. 1902.
4. **Notoxylinon robinsonii** (F. von Muell.) Lewton.
Fugosia robinsonii F. von Muell. Fragm. Phyt. Austr. **9**: 126. 1875.
Gossypium robinsonii F. von Muell. loc. cit.
Hibiscus robinsonii Kuntze, Rev. Gen. Pl. **1**: 69. 1891.
Cienfuegosia robinsonii Hochr. Ann. Conserv. Jard. Bot. Genève
6: 57. 1902.
5. **Notoxylinon punctatum** (Benth.) Lewton.
Hibiscus punctatus A. Cunn. in herb.
Fugosia punctata Benth. Fl. Austr. **1**: 220. 1863.
Gossypium cunninghamii Todaro, Relaz. Cult. Cotoni Italia, 110.
1877.
Cienfuegosia benthamii Hochr. Ann. Conserv. Jard. Bot. Genève
6: 55. 1902.
6. **Notoxylinon latifolium** (Benth.) Lewton.
Fugosia latifolia Benth. Fl. Austr. **1**: 221. 1863.
Gossypium costulatum Todaro, Relaz. Cult. Cotoni Italia, 109.
1877.
Hibiscus latifolius Kuntze, Rev. Gen. Pl. **1**: 69. 1891.
Cienfuegosia latifolia Hochr. Ann. Conserv. Jard. Bot. Genève
6: 57. 1902.
7. **Notoxylinon australe** (F. von Muell.) Lewton.
Gossypium australe F. von Muell. Fragm. Phyt. Austr. **1**: 46.
1858.
Sturtia hibiscoides F. von Muell. op. cit. **3**: 6. 1862.
Fugosia australis Benth. Fl. Austr. **1**: 220. 1863.
Cienfuegosia australis K. Schum. in Engl. & Prantl. Nat. Pflanzen-
fam. **3**⁶: 50. 1890.
Hibiscus australis Kuntze, Rev. Gen. Pl. **1**: 69. 1891.
8. **Notoxylinon pedatum** (Bailey) Lewton.
Fugosia pedata Bailey, Queensland Agric. Journ. **25**: 286, *pl. 28*,
fig. 1. 1910.

THE GENUS ALLOGYNE . 6

The two species of succulent seaside shrubs constituting the smaller group of the Flora Australiensis, *Fugosia hakeaefolia* and *F. cuneiformis*, have been placed at different times in at least three genera, but at no time were they in agreement with the other species of these genera as regards several of their easily observed taxonomic characters. In 1863, Dr. Friedrich Alefeld

proposed the genus *Allogyne*¹⁷ for *Fugosia hakeaefolia*, and although mistaken in stating that the involucre is wanting, he was correct in separating this species from *Hibiscus*, where it had been placed when first described by Giordano¹⁸ in 1834. With *F. hakeaefolia* are to be associated three nearly related species, *Hibiscus multifidus* Paxton, *H. lilacinus* Lindley, and *Fugosia cuneiformis* Benth., the four constituting the genus *Allogyne*.

Allogyne Alefeld.

Succulent, glabrous seaside shrubs, sometimes gland-dotted. Leaves cuneate or spatulate and entire or lobed, or deeply divided into terete or flattened, sometimes deeply toothed segments. Flowers borne on thickened peduncles, showy, not evanescent, persisting several days. Involucre a shallow 5- to 7-toothed cup, situated 3 to 5 mm. below the calyx, the ovary thus appearing stipitate. Calyx deeply 5-parted, its base (within the involucre) covered with nectar-secreting hairs. Sepals lanceolate, not completely valvate, only partially enclosing the bud. Corolla white, blue, or lilac, usually with a crimson-purple eye in the throat. Ovary 4- or 5-celled; style 1; stigma 1, slightly 4- or 5-lobed. Capsule 4- or 5-celled, usually covered with appressed silky hairs. Seeds bristly with spreading hairs, not downy.

The genus *Allogyne* may be distinguished from *Hibiscus* by the undivided style, the aestivation of the sepals, and the presence of black glands; from *Notoxylinon* by its succulent character, epidermal covering, and extra-floral nectary; from *Cienfuegosia* by the distribution of the black glands and the extra-floral nectary; from *Gossypium* by the absence of black dots from the cotyledons; and from all the above-named genera by the form of the involucre and the persistent character of the flowers.

The species of *Allogyne* may be recognized by the following key:

- Leaves undivided or occasionally lobed, cuneate or spatulate; flowers white 1. *A. cuneiformis*.
 Leaves bipinnate or deeply parted; flowers blue, lilac, or purple.
 Leaf segments flat; corolla without crimson-purple eye 2. *A. lilacina*.
 Leaf segments terete; corolla with crimson-purple eye.

¹⁷ Oesterr. Bot. Zeitschr. 13: 12. 1863. (Here the name of the genus is spelled *Alyogyne* and on the opposite page *Alyogone*, both evidently printed in error for *Allogyne*, from ἄλλος, different, and γῦνη, stigma.)

¹⁸ Atti del real istituto d'incoraggiamento alle scienze naturali, 5: 252. 1834.

- Involucre conspicuous; corolla lilac-purple 3. *A. hakeaefolia*.
 Involucre almost wanting; corolla azure-blue 4. *A. multifida*.
1. **Allogyne cuneiformis** (DC.) Lewton.
Hibiscus capriodorus A. Cunn. MSS. in Herb. Hook.
Hibiscus cuneiformis DC. Prod. **1**: 454. 1824.
Lagunaria cuneiformis G. Don. Syst. **1**: 485. 1831.
Fugosia cuneiformis Benth. Fl. Austr. **1**: 219. 1863.—Curt. Bot. Mag. pl. 5413. 1863.
Fugosia cuneifolia F. von Muell. Fragm. Phyt. Austr. **9**: 127. 1875.
Cienfuegosia cuneiformis Hochr. Ann. Conserv. Jard. Bot. Genève **6**: 56. 1902.
2. **Allogyne lilacina** (Lindley) Lewton.
Hibiscus lilacinus Lindley, Edwards' Bot. Reg. pl. 2009. 1837.
Lagunaria lilacina Walpers, Bot. Rep. **1**: 311. 1842.
Hibiscus coronopifolius Miquel in Lehm. Pl. Preiss. **1**: 239. 1845.
Fugosia hakeaefolia var. *coronopifolia* Benth. Fl. Austr. **1**: 220. 1863.
Fugosia lilacina G. Don, ex Loud. Encyc. Pl. Suppl. **2**: 1426. 1866.
Cienfuegosia hakeaefolia var. *lilacina* Hochr. Ann. Conserv. Jard. Bot. Genève **6**: 56. 1902.
3. **Allogyne hakeaefolia** (Giordano) Alefeld, Oesterr. Bot. Zeitschr. **13**: 12. 1863.
Hibiscus hakeaefolius Giordano, Att. Real Inst. Sci. Nat. **5**: 252. 1834.
Fugosia hakeaefolia Hooker, Curt. Bot. Mag. pl. 4261. 1846.
Allogyne hakeifolia Alefeld, Oesterr. Bot. Zeitschr. **13**: 12. 1863.
Cienfuegosia hakeaefolia var. *genuina* Hochr. Ann. Conserv. Jard. Bot. Genève **6**: 56. 1902.
4. **Allogyne multifida** (Paxton) Lewton.
Hibiscus multifidus Paxton, Mag. Bot. **7**: 103. pl. 1840.

ZOOLOGY.—*The correlation of phylogenetic specialization and bathymetrical distribution among the recent crinoids.*¹ AUSTIN H. CLARK, National Museum.

In the recent crinoids there are thirty-seven pairs of obvious contrasted characters which are commonly employed in distinguishing the various genera and families, and which are similarly used in their fossil representatives.

The two contrasted characters in each pair always differ in that one represents a higher grade of phylogenetic specialization

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