

## A STUDY OF MANIHOT IN NORTH AMERICA

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*With one text-figure*

THIS paper aims at presenting a preliminary account of the North American species of *Manihot* Mill. which have been confused in herbarium and in the literature as *M. carthagenensis* Jacq. The species so confused exceed ten in number, and the uncertainty as to their limits and distribution is now so great that all classification outside of the limits of a critical work has become impossible.

The difficulties in the path of a taxonomic treatment of *Manihot* are notorious. The foliage of the genus is polymorphous, the flower seldom very revealing, and the material available even in the best herbaria often incomplete or misleading, because seeds of different species often become mixed at mounting. In addition, the progress of speciation among forms of the same group is comparatively weak, so that related species are connected by intergrades which can be placed with much difficulty or not at all when field-notes are lacking. I have been fortunate in having loans of much needed specimens from the Curators of the U. S. National Herbarium, the University of California, the New York Botanical Garden, the University of Arizona, and the Gray Herbarium of Harvard University. These specimens are cited, respectively, under the abbreviations US, UC, NY, UA, and GH, the additional reference AA connotating specimens in the herbarium of the Arnold Arboretum of Harvard University.

Several of the specimens loaned from the U. S. National Herbarium bears manuscript names which have been neglected by their own and all subsequent authors. These names are of indifferent value, some having been superseded, others being doubtfully good. To simplify the citations, which in a work of this nature should be reduced as far as possible, I have consistently disregarded these *nomina nuda*.

In view of the generally accepted belief that *Manihot* as well as *Jatropha*, including *Cnidoscolus*, have flowers with a calyx but no corolla, it seems pertinent to emphasize the fact that so early an author as Pohl (Pl. Bras. Ic. Descr. 1: 17, 56. 1827) correctly interpreted the perianth of these genera, stating that these structures have *a corolla but no calyx*. Authors like Pax & Hoffmann (Pflanzenr. 44 (iv. 147. ii): 22. 1910; Engl. & Prantl, Nat. Pflanzenf. ed. 2. 19(c): 164, 174. 1931), who hold to the opinion that *Manihot* and *Jatropha* (with *Cnidoscolus*) have a calyx but no corolla, cannot appraise the significance of the relics of the calyx which appear in certain species of this alliance, and are thus liable to misunderstand the morphology and phylogeny of the Euphorbiaceae Jatrophaeae and Manihoteae.

The very nature of the plants under study and the difficulty of securing fully comparable specimens, even from large collections, make it impossible to prepare a truly workable key. The reader is referred to Fig. 1, in which typic outlines of leaf-lobes are illustrated and the species are grouped according to their foliar habit.

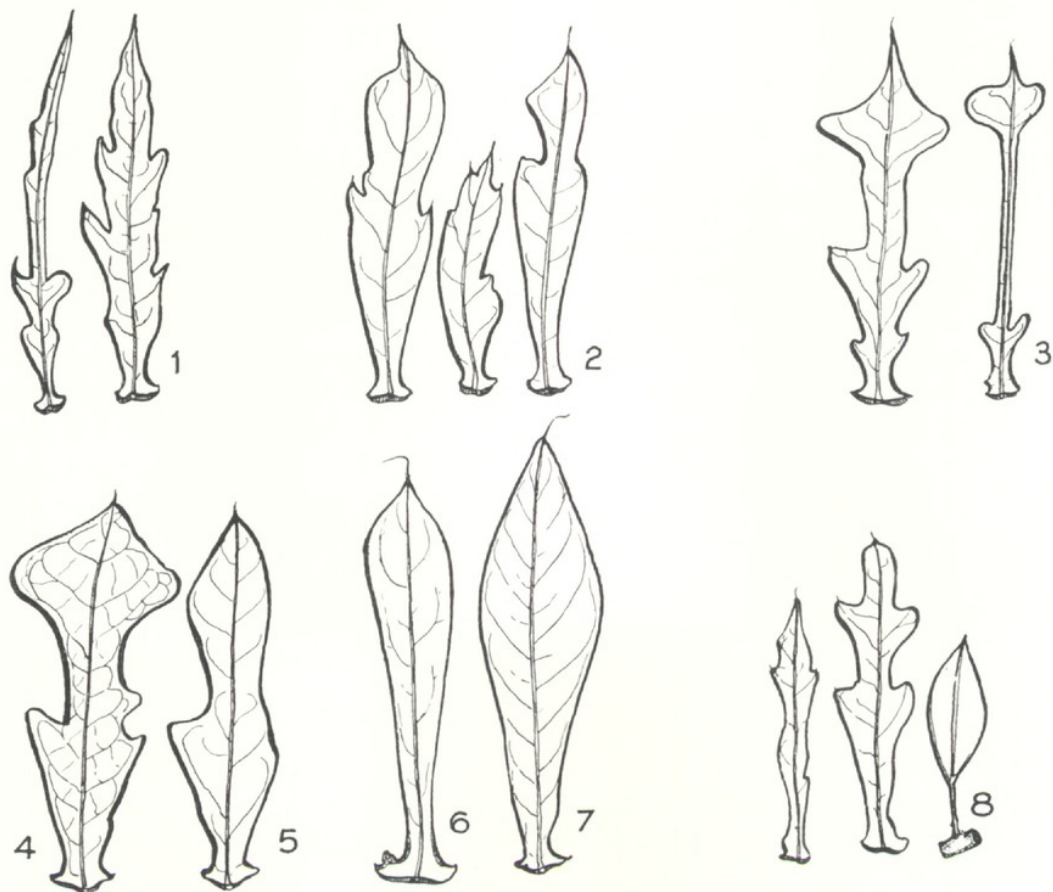


Figure 1

Typical leaf-lobes of *Manihot* spp.; 1. as occurring in *M. angustiloba* Muell.-Arg. (Arizona, Sonora, Chihuahua), *M. mexicana* Johnst. (Sinaloa, Jalisco, Aguascalientes, Guanajuato, Queretaro, Mexico, Morelos), and *M. parvicocca* Croiz. (Chiapas, Nicaragua, San Salvador); 2. of *M. chlorosticta* Standley & Goldm. (Baja California, Sinaloa); 3. of *M. Davisiae* Croiz. (Arizona); 4. of *M. intermedia* Weath. (Guerrero); 5. of *M. colimensis* Croiz. (Colima); 6. of *M. rubricaulis* Johnst. (Durango, Sinaloa) and *M. isoloba* Standley (Sonora, Chihuahua); 7. of *M. aesculifolia* Pohl (Honduras, Vera Cruz, Guerrero); 8. of *M. ludibundus* Croiz. (Nicaragua).

***Manihot carthagenensis*** (Jacq.) Muell.-Arg. in DC. Prodr. 15(2): 1073. 1866; Pax & Hoffmann, Pflanzenr. 44 (iv. 147. ii): 81. 1910.

*Janipha carthagenensis* Jacq. Select. Stirp. Amer. Hist. 256, Pl. 162, Fig. 1. 1763.

Pax & Hoffmann have little understanding of the distribution of this species, and *Palmer 1027a*, which they cite under it, is *M. colimensis* Croiz., a species that bears to *M. carthagenensis* but superficial resemblance. It is altogether probable that authors who report *M. carthagenensis* north of



Costa Rica are in error, and this species is *certainly* to be excluded from the flora of the United States.

The classic locality is "Passim Carthagenae," and I have so far seen but one specimen which I can safely bring under Jacquin's binomial, *Elias* 1546: Colombia, El Palmar, region of Barranquilla, 1937 (AA), distributed as *M. dulcis* var. *diffusa*. In this specimen are found the costulate lobes and perianth of the ♂ flower illustrated by Jacquin and the disc with a deep lobulation (the sinuses being fully to 2 mm. deep) which prompted Jacquin to describe a disc with stamens "E receptaculo inter nectarium radios adscendentia." The range of *M. carthagenensis* remains to be defined, as the plant of eastern Venezuela may not be this species.

***Manihot gualanensis*** Blake, Contr. U. S. Nat. Herb. **24**: 13. 1922.

A photograph of the holotype (*Blake* 7688, US) is available here. It is unfortunate that all the available material lacks fruits, and that it proves impossible to decide whether Blake's species is in some measure conspecific with *M. aesculifolia* H.B.K. For the present, I identify as *M. gualanensis* the following two collections: *Maxon, Harvey & Valentine* 7192: Nicaragua, Ameyá, Dept. Chinandega, 1923 (NY), originally distributed as *M. aesculifolia*, and *Gentle* 2539: British Honduras, Cayo District, Vaca, 1938 (AA), identified in herbaria as *M. carthagenensis*. The leaves are comparatively large and full for a species of this group.

***Manihot aesculifolia*** (H. B. K.) Pohl, Pl. Bras. Ic. Descr. **1**: 55. 1827; Muell.-Arg. in DC. Prodr. **15**(2): 1065. 1866; Pax & Hoffmann, Pflanzenr. 44 (iv. **147**. ii): 58. 1910; Standley, Contr. U. S. Nat. Herb. **23**: 645. 1923.

*Janipha aesculifolia* H. B. K. Nov. Gen. & Sp. **2**: 107. Pl. 109. 1817.

The classic locality is "In litore sinus Champecensis." *Bangham* 300: Honduras, San Pedro Sula, 1939 (AA) is a perfect match of Kunth's plate. The leaf with 7 lobes and with the outer 2 lobes definitely reflexed, illustrated in the Nova Genera and exhibited by the *Bangham* collection, is not common in this species. In most cases the outline of the leaf is rounded toward the base on account of the failure of the two lowest lobes to develop. The median lobes are seldom pandurate, and if so, not deeply. In addition to the *Bangham* sheet already cited, I identify under this species: *Purpus* 8448, Vera Cruz, Barranca de Panoya, 1919 (UC, NY); *Hinton* 6486, Guerrero, Coyuca, "on cliffs, 1.5 m. high," 1934 (NY). The inflorescence is borne apically, and is subspicate to racemose, up to about 20 cm. long, the capsule when nearly ripe is globose, the columella about 8 mm. long, and the seed, not quite ripe, about 9 mm. long and 7 mm. broad.

The range of Honduras, Vera Cruz, and Guerrero is peculiar. Usually, the Euphorbiaceae of the east coast of Mexico are much more widely distributed than those of the west coast, and are seldom found to cross over from the coast of the Atlantic to that of the Pacific. *Hinton* 6486 cannot at present be classified otherwise than as *M. aesculifolia*, but a critical study of the distribution of this species should be undertaken as soon as possible.



**Manihot rhomboidea** Muell.-Arg. *Linnaea* **24**: 205. 1865; in DC. *Prodr.* **15**(2): 1064. 1866; Pax & Hoffmann, *Pflanzenr.* 44 (iv. **147**. ii): 55. 1910; Millspaugh, *Field Mus. Publ. Bot.* **1**: 375. 1898; Standley, *Contr. U. S. Nat. Herb.* **23**: 645. 1923.

Millspaugh cites *Schott 518* twice, under both *M. carthagenensis* and *M. rhomboidea*, noticing under the last that Schott spells the local name *Xcaxe*. *Schott 518* (US) is certainly conspecific with *Gaumer 1142* (AA, NY), and very likely the same as *Purpus 6112*: Baños del Carrizal, Vera Cruz, 1912 (UC). That one species is involved here seems well established, and Millspaugh errs in identifying it as *M. carthagenensis*, for the *Schott* material has in the ♂ flower a somewhat inflated and subentire disc, which does not agree in the slightest with the peculiarly lobate disc of Jacquin's Colombian plant. The type of *M. rhomboidea* cannot be seen, and I accept the collections cited under this binomial from description, finding in the material at hand characteristically minute basal lobes, which agree with Mueller's note: "Lobi infimi foliorum reliquis multo breviores."

**Manihot ludibunda** sp. nov.

Fruticulus videtur totus glaberrimus, caulibus novellis herbaceis gracilibus, vetustioribus ligneis crassitie pennae anserinae. Foliis ludentibus, ambitu totis nec ultra 5–6 cm. magnis, raro 1–3-lobatis, plerumque 5-lobatis; lobis 2–4 cm. longis, spatulato-oblongis vel (basalibus) oblanceolatis, mediis saepissime constricto-panduratis, apice dilatato-quadrangulatis, breviter acuminatis subsetulosis, laminae parte integra vix 2–3 mm. magna, inde lobis fere ad petioli radicem liberis; petiolo gracili, 1.5–5 cm. longo, stipulis minimis vel nullis. Inflorescentia gracili, apicali vel laterali, 3–5 cm. longa. Flore ♂: pedicello gracillimo 7–10 mm. longo, stipulis persistentibus nullis; perianthio ca. 10 mm. longo, lobis ovato-acuminatis vix 3–3.5 mm. longis, totidem latis, disco cum pistillodio, margine (videtur) profundius 2-lobulato ca. 2 mm. magno, staminibus (videtur) 10 in serie duplici, longioribus ad 8, brevioribus ad 5–6 mm. longis, filamentis gracillimis. Flore ♀: (vix maturo) lobis 5, liberis, lanceolato-ellipticis, ca. 4 mm. longis, 1.5 mm. latis, ovario costulato 2 mm. longo, 1.75 mm. lato, disco carnosio 2 mm. lato, 1 mm. longo, stylis carnosius more generis ramosis.

GUATEMALA, Dept. Huehuetenango, Uaxackanal, 1300–1400 m., C. & E. Seler 2814, July 1896 (NY, TYPE).

I know of no other species to which this plant can be assimilated. The lone simple leaf that appears on the type-specimen may be occasional, but it is worthy of notice as an indication of the tendency of *M. ludibunda* to have less than 5 lobes in each leaf. The ♂ perianth and the foliage agree neither with *M. parvicocca* nor with *M. rhomboidea*. The type was originally distributed as *M. carthagenensis*.

I treat *Manihot* as a name of the feminine gender to conform with Crantz's early usage of the genus (*Inst.* **1**: 167. 1766). Neither Miller (*Gard. Dict.*, Abridg. edit., 1754) nor Adanson (*Fam. Pl.* **2**: 356. 1763) lists binomials.

**Manihot parvicocca** sp. nov.

Fruticulus videtur, totus glaberrimus. Foliis profundissime lobatis, habitu primo intuitu dissectis, illis *M. angustilobae* simillimis; limbo



toto ad 16 cm. transverse magno, lobis 5-7, infimis 2 interdum minimis, quove sublineari longissime acutato, 10-20 vices longiore quam lato, majoribus ca. 10 cm. longis, 4-5 mm. latis, lobulis 1-2 saepissime incurvis auctis, minoribus linearibus vix ultra 2-3 cm. longis, elobulatis vel tantum leviter repandulis, petiolo ad 5-6 cm. longo. Inflorescentia terminali gracili ad 10 cm. longa. Perianthio ♂ campanulato ca. 10 mm. longo, 5-6 mm. lato, lobis ovato-triangularibus ca. 3 mm. longis totidemque latis, disco plus minusve lobulato (videtur) ad 3 mm. magno, staminibus in serie (videtur) duplici 7-9, 5-6 mm. longis. Perianthio ♀ ignoto; fructu capsulari globoso vix 8-10 mm. magno, epicarpio fungoso more generis secedibili, coccis delapsis 8-9 mm. longis, columella 3-4 mm. longa, semine scaraboides applanato, 5-6 mm. longo, 4.5 mm. lato, caruncula valida flabellata, erecta, 3 mm. lata, 1.5 mm. longa, arillo in semine maturo ochraceo vel cinereo, maculis longitudinalibus olivaceis paucioribus insignito.

MEXICO, Chiapas, Siltepec (south of the town of Chicomuselo, near the Guatemalan boundary), *Matuda 1665*, Aug. 1937 (TYPE, AA); Chiapas, near Montserrat, "on rocky mountains," *Purpus 10213* (NY, UC); Chiapas, Hacienda Montserrate, *Purpus 9233* (UC); Chiapas, top of ridge back of Tonala, alt. 1200-2500 ft., *Nelson 2899* (GH).

Probably here belong two other specimens from Central America, *Pittier 132*, Guatemala, Baja Verapaz, Cuesta de Cachil, alt. 1200-1600 m., 1905 (NY); *Calderón 1023*, San Salvador, Cerro de la Olla, 1922 (NY). The extension of the range of a Chiapas species to Guatemala, Dept. Baja Verapaz, is to be expected and I find nothing in the poor *Calderón* collection at hand which is incompatible with the characters of typical Chiapas material. *Manihot parvicocca* would seem to be the southern counterpart of *M. mexicana* Johnst., of which it has the small capsule. *Manihot mexicana*, however, has a much larger ♂ flower and leaves that are on the whole more lobulate-repand. The columella of *M. parvicocca* is remarkable for its shortness and bluntness, that of *M. mexicana* being about twice as long (up to 7 mm.) and not very blunt. The *Nelson* collection is cited with doubt by Johnston in the publication of *M. mexicana*.

***Manihot mexicana*** Johnst. Contr. Gray Herb. **63**: 90. 1923.

This proves to be a very important species, with affinities that are certainly not in the direction of *M. rubricaulis* Johnst. By its range and characters, *M. mexicana* connects *M. angustiloba* Muell.-Arg. (Arizona, Sonora, Chihuahua) with *M. parvicocca* Croiz. (Chiapas, Guatemala, San Salvador), the distribution of the complex thus involved being one of the largest.

To the numerous specimens cited by Johnston in the original publication the following may be added: *Palmer 222*, Sinaloa, Topolobampo, 1897 (US); *Rose 1608*, Sinaloa, between Rosario and Colomas, 1897 (US); *Rose & Rose 11190*, Queretaro, near Queretaro, 1906 (NY); *Rose & Hay 6201*, Aguascalientes, near Aguascalientes, 1901 (US); *Lyonnet 301*, Morelos, Cuernavaca, 1929 (NY); *Hinton 6188*, Mexico, Temascaltepec, 1934 (NY). None of these specimens is in fruit, so that the determinations are tentative. The extension of the range of *M. mexicana* to Sinaloa seems to be authenticated by *Rose 1608*, which quite agrees with typical material of the species. *Palmer 222*, on the contrary, is very close to the Guaymas



plant (*Palmer 233*), which the seed shows to belong to *M. angustiloba*. The plants from Aguascalientes and Queretaro may actually represent a strong variety. On the basis of the available material, *M. mexicana* would seem to occur in Jalisco (loc. class.: hillsides of Zapotlan), Sinaloa, Aguascalientes, Guanajuato, Queretaro, Morelos, Mexico. It is not impossible that the holotype of *M. mexicana* will prove to be a form on the outskirts of the biological limits of the species.

*Gregg 198*, from an unknown locality but collected in 1848 or 1849, cited by Johnston in the publication of *M. mexicana*, is probably the same as the plant of Queretaro, Aguascalientes and Morelos, and there are good historical and botanical reasons to believe that it was also collected in this general region. Its ♂ flowers are small, apparently not as large as those of the plant of Jalisco.

***Manihot intermedia*** Weatherby, Proc. Am. Acad. **45**: 427. 1910, (Contr. Gray Herb. **2**: 427. 1910); Pax & Hoffmann, Pflanzenr. 44 (iv. **147**. ii): 101. 1910; Standley, Contr. U. S. Nat. Herb. **23**: 643. 1923.

A very distinct species, so far as known localized in Guerrero, Mexico. The larger lobes of the leaf are usually deeply pandurated, very glaucous, and pale green. The flowers in the holotype, *Pringle 13938* (loc. class., cañon near Iguala) are subtended by bristly persistent bracteoles and the perianth is deeply colored. The seed is scaraboid, that is, depressed in back and front, with sharp lateral keels, 10 mm. long, 8 mm. broad; the caruncle is very large, about 6 mm. broad and 2 mm. long, fan-shaped. Here belong: *Rusby 2*, Limon Mt. alt. 4000 ft., 1910 (NY); *Mexia 8778*, Sierra Madre del Sur, north of Río Balsas, Distrito Adama, "streamside, suffrutescent, 3.5 m. high, many stemmed," 1937 (NY). The seed on this specimen is brightly colored, shiny, with many fine dorsal mottlings from side to side.

***Manihot colimensis*** sp. nov.

Frutex videtur glaberrimus. Foliis pro more 5-lobatis, totis ad 11 cm. longis, 12–15 cm. latis, lobis fere ad petioli radicem partitis, saepissime oblongo-panduratis apice abrupte dilatatis, ad 11 cm. longis, 1–2.5 cm. latis, subtus plus minusve glaucis in sicco membranaceis fragillimis; petiolo gracili 4.5–7 cm. longo, stipulis nullis. Inflorescentiis apicalibus ad 10 cm. longis, bracteolis deciduis. Floribus ♂: perianthio 9–11 mm. longo, ca. 7 mm. lato, in lobis 5 ad 9 mm. longis partito, lobis ovato-triangularibus margine carnosus, disco in lobis 5, quove ad apicem retuso (inde disco duplicato-lobato) partito, ca. 4–5 mm. lato, staminibus 10 in serie duplici, 7–8, 10–11 mm. longis. Floribus ♀: perianthio ad basim partito, lobis 5 lanceolatis, ad 10 mm. longis, 2.5–3 mm. latis, ovario glabro ca. 2.5 mm. longo, 2 mm. lato, in sicco costulato, stylis multipartitis, disco in ovarii epicarpium more generis confluyente ad 3 mm. lato, 1 mm. longo. Capsula matura pedicello ultra 3 cm. longo fulta, coccis delapsis ad 15 mm. longis, semine ellipsoideo, facie ventrali praesertim depresso, brunneo, in dorso longitudinaliter striato, 14 mm. longo, 9 mm. lato, caruncula minima, vix 1.5 mm. lata, 1 mm. longa.

MEXICO: Colima, Manzanillo Bay, "on rocky points," *Ferris 6140*, 1925 (TYPE, AA); Manzanillo, *Palmer 1027*, *1027a*, 1890 (US, NY).

*Palmer 1027a* is cited by Pax & Hoffmann, as already noticed, under *M. carthagenensis*, which *M. colimensis* but superficially resembles. The



affinities of this new species are definitely toward *M. chlorosticta* Standl. & Gold., from which it is separated by the ellipsoid longer seed, a character which seems to hold good throughout, and by the range. *Manihot chlorosticta* bears to *M. colimensis* probably the same distributional and morphological relationship which *M. mexicana* bears to *M. parvicocca*. Critical forms between *M. chlorosticta* and *M. colimensis* may be looked for in Jalisco and Tepic.

***Manihot chlorosticta*** Standley & Goldm. Contr. U. S. Nat. Herb. **13**: 375. 1911.

*Manihot carthaginensis* Standley, Contr. U. S. Nat. Herb. **23**: 643, *p. p.* 1923; non Jacq.

I cannot follow Standley in merging *M. chlorosticta* and *M. carthaginensis* as one species, believing that the entities involved under these binomials are obviously different geographically as well as morphologically. A photograph of the type (*Nelson & Goldman* 7401, US) is available here and this collection perfectly matches two topotypes, *Brandeggee* 550, Lower California, San José del Cabo, Sept. 1890 (UC); *Brandeggee s.n.*, San José del Cabo, Lower California, Nov. 1902 (UC). I cannot separate the plant from Lower California from the plant of Sinaloa, as the seed of *Ferris & Mexia* 5218, Sinaloa, vicinity of Labradas, "woody vine near the railroad tracks," 1925 (AA) is absolutely the same as the seed of *Brandeggee* 550, the agreement among the other characters being otherwise of the closest. Likewise, the robust and long peduncle of the capsule of *Ferris & Mexia* 5218 and *Brandeggee* 550 is fully matched by that of *Rose* 3266, Sinaloa, between Rosario and Concepción. 1897 (US). I believe that *M. chlorosticta* is further represented by the following six collections, all from Sinaloa: *Rose* 3204, foothills of the Sierra Madre near Colomas, 1897 (US); *Rose s.n.*, road between Acaponeta and Rosario, 1897 (US); *Brandeggee s.n.*, Culiacan, Aug. 1904 (UC); *Ortega* 5586, El Pozole, 1925 (US); *Ortega* 6345, Escamillas, Aug. 1926 (UC, US); *Gentry* 5026, Cerro east of Culiacan, basaltic hill-slope in Short-tree Forest, "long smooth-stemmed succulent vine on trees and shrubs," Nov. 1939 (NY). The *Brandeggee* collection from Culiacan is somewhat doubtful under this binomial and may yet represent a new species. Its seeds are smaller than those of the plant of Lower California, and the infructescence (unfortunately too young to allow a full comparison) is slightly different, manifestly racemose. It is possible, however, that the long and robust "peduncle" of the capsule of *M. chlorosticta* is in reality a persistent and accrescent section of the axis of the inflorescence which supports the lone fruit that ripens. The limits of *M. chlorosticta* in the direction of *M. intermedia* will bear close study.

***Manihot rubricaulis*** Johnst. Contr. Gray Herb. **68**: 90. 1923.

According to Palmer's field-notes transcribed by Johnston on the type (GH), the type number, *Palmer* 224 (also US, UC) was collected near Durango City, "on the east slope of Iron Mt.," and taken from a many-stemmed shrub 4–5 ft. high, with leaves borne at the tip of the reddish-barked twigs. A collection from Sinaloa, *Brandeggee s.n.*, Cerro Colorado, Culiacan (UC) probably belongs here, despite its having dehiscent cocci somewhat longer (15 mm.) than those of typical material of Johnston's



species (12–13 mm.). The material is too poor even to attempt a varietal disposition of Brandegee's plant.

*Manihot isoloba* Standley, discussed next, is quite near *M. rubricaulis* Johnst., although the two binomials are not manifestly synonymous. Both these species have a foliage with characteristically linear lobes, acute at the tip and here capped with a long bristle, the native name of *M. isoloba*, "pata de Gallo" (Rooster's foot), being very appropriate. The sinuses between the lobes are calloused and bear in many of the leaves of *M. rubricaulis* an abortive hydatode or gland.

Mueller Argoviensis gives of *M. microcarpa*, based upon a specimen of Karwinsky collected in Mexico without further indication of locality, a description (Flora 55: 42. 1872) which strongly suggests the characters of *M. rubricaulis*. In addition, Mueller compares the Karwinsky plant to *M. digitiformis* Pohl (Pl. Bras. Ic. Descr. 1: 36. Pl. 27. 1827), which is significant because Pohl's species has the foliage and the habit of *M. rubricaulis* and *M. isoloba*. It is probable that a study of the holotype of *M. microcarpa*, not now available, will prove that this species is synonymous with *M. rubricaulis*.

**Manihot isoloba** Standley, Field Mus. Publ. Bot. 17: 197. 1937.

The two collections cited by Standley in the original publication, *Gentry* 2372, Chihuahua, Guasaremos, Rio Mayo, 1936 (AA), and *Gentry* 1468, Sonora, Bakachaka, Rio Mayo (AA, UC, distributed as *M. angustiloba*), are available here. The foliage is almost identical to that of *M. rubricaulis*, differing from it, apparently, in the somewhat broader leaf-lobes, these being 5–8 in each leaf rather than 4–7, as in Johnston's species. The seed in *M. isoloba* is definitely less ellipsoid (10 mm. long, 8 mm. broad) than it is in *M. rubricaulis* (10 mm. long, 6.5 mm. broad), but the value of this character, given other close similarity between the two species, remains to be studied.

A collection represented by two sheets (US, NY) is *Townsend & Barber* 404, Chihuahua, Sierra Madre near Seven Mines, Sept. 1899. The material consists of detached leaves and seeds. The seed is a trifle bigger than that of *M. isoloba* (about 11 mm. long, 8 mm. broad, the difference being fairly noticeable at sight) and the lobes are up to 14 cm. long and 2 cm. broad, occasionally very shallowly repand. I find no reason at present to grant separate recognition to this plant, which may prove ultimately to be a variety of *M. isoloba* or of *M. rubricaulis* (= ? *M. microcarpa*). The ranges are: *M. rubricaulis* in Durango and Sinaloa; *M. isoloba* in Chihuahua and Sonora.

**Manihot angustiloba** (Torrey) Muell.-Arg. in DC. Prodr. 15(2): 1073. 1866; Pax & Hoffmann, Pflanzenz. 44 (iv. 147. ii): 83. 1910.

*Janipha Manihot* H. B. K. var. *angustiloba* Torrey in Emory's Rept., U. S. Mex. Bound. Surv. 2: 199. 1859.

Several species are manifestly included by Pax & Hoffmann in the range they give of this species, Oaxaca, Cuantla, Jalisco, New Mexico and, with doubt, "Acapulco in Peru." I have seen *M. angustiloba* only from Sonora, Chihuahua and Arizona, and suspect that the record from New Mexico is wholly based upon the erroneous label of *Wright* 1811. Wooton & Standley



exclude *Manihot* from their flora of this State (Contr. U. S. Nat. Herb. **19**, 1915), which I take to be correct. Tidestrom & Kittel overlook *M. angustiloba* in their recent flora of Arizona (Fl. Ariz. & New Mex. 718, 1941), listing only *M. carthagenensis* from the canyons of the Santa Catalina Mountains. This record applies in all probability to *M. Davisiae* Croiz., although it might include *M. angustiloba* to a very small extent. *Manihot acutiloba* Weatherby, cited by Pax & Hoffmann in the synonymy of *M. angustiloba*, has no status in nomenclature. In writing this binomial Weatherby intended to refer to *M. angustiloba*, the synonym taken up by Pax & Hoffmann thus proving to be a mere slip of the pen which is to be corrected as "a clearly unintentional orthographic error" (Art. 70, Intern. Rules Bot. Nomencl.) and otherwise disregarded. *Pringle 11318*, identified by the same authors as *M. angustiloba*, is *M. mexicana* Johnst., and is cited in the publication of this species.

Excluding the doubtful collection from "New Mexico" represented by *Wright 1811* (US, NY), which was probably taken on the Mexican side of the border in Sonora, I have seen the following material: (1) From Mexico — *Schott iii 8*, Sonora, Sierras oeste de Sta. Cruz y Tubac, 1855 (holotype, NY); *Schott s.n.*, Sonora, Potrero on the upper Sta. Cruz River (NY); *Palmer 233*, Sonora, Guaymas, 1887 (US, NY); *Gentry 2371*, Chihuahua, Guasaremos, Río Mayo, "One or two feet high, caespitose perennial with white flowers. On open knoll of thin gravel soil. Infrequent," 1936 (US, UC); *Wiggins 7155*, Sonora, 20 m. S.E. of Magdalena, 1934 (AA) — (2) From Arizona — *Lemmon s.n.*, Santa Catalina Mts. 1883 (US, UC); *R. E. Kunze s.n.*, Nogales, 1911 (US); *Thackery 487*, Baboquivari Flats, Pima Co., 1928 (AA, NY); *Peebles, Harrison & Kearney 4584*, Nogales, 1927 (US); *Harrison & Kearney 6031*, Nogales, 1929 (US); *Kearney & Peebles 8742*, Rincon Mts., 1932 (US, UC); *Harrison & Kearney 8904*, Santa Rita Mts., 1932 (US); *Kearney & Peebles 14928*, below Baboquivari Canyon, Pima Co., alt. 3100 ft., 1940 (NY).

All the Arizona and the majority of the Sonora and Chihuahua specimens are correctly determined. *Manihot angustiloba* reaches its northernmost distributional limits in southern Arizona, only one collection being reported from the Sta. Catalina Mountains; it is frequent in Sonora and rare in Chihuahua. Its affinities are with *M. mexicana*, but its seed is much larger.

The Guaymas plant has leaves and seeds that are a trifle larger than those of the form commonly found elsewhere. It remains to be seen whether these differences are important. A clue to the conditions of the specimens from Guaymas is given in a manuscript note on the sheet of the U. S. National Herbarium, reading: "Growing 2 or 3 ft. high, in the shade of high mountains above Guaymas." Under these conditions a large leaf is to be expected, and it is further probable that the plant from which the material was taken had grown in a habitat more favorable than the usual xerophytic or subxerophytic environment of the Arizona specimens.

***Manihot Davisiae* sp. nov.**

Frutex glaber, innovationibus herbaceis viridibus vel interdum levissime



pruinoso-glauculentibus. Foliis pro more 5-lobatis, majoribus ambitu toto ad 13–16 cm. magnis; lobis 2 infimis lanceolato-acutatis vel subabortivis quapropter magnitudine valde ludentibus, reliquis 4–9 cm. longis, 0.5–4 cm. latis, optime repandis, saepissime in lobis 2 dilatatis, quorum infero obtriangulari, 3 cm. lato vel minore, supero quadrangulato in apicem acutum vel subcaudatum brevissime aristulatum desinente ad 4 cm. lato, limbi parte communi integra 1 cm. tantum lata vel minore, inde lobis fere ad petioli radicem liberis; petiolo herbaceo 3–6 cm. longo, stipulis subsetaceis minimis. Inflorescentiis terminalibus herbaceis, gracilibus, ad 12–15 cm. longis, bracteolis linearibus sat persistentibus. Flore ♂: perianthio ca. 12 mm. longo, 6 mm. lato, lobis triangularibus sat acuminatis ca. 7 mm. longis, disco pistillodium minutum subtrigonum amplexente, 10-lobulato, margine incrassato, staminibus 10 in serie duplici, 6–8 vel 8–10 mm. longis. Flore ♀ ignoto. Capsula submatura ad 12–15 mm. magna, viva videtur globulosa, epicarpio sat tenui, semine haud optime maturo scaraboideo, haud applanato, basi ambitu paulo rotundato-inflato, inde seminis ipsius lateribus primo intuitu haud parallelis, 9 mm. longo, 7–9 mm. lato.

ARIZONA, Santa Catalina Mountains, *Lemmon s.n.*, Aug. 1883 (HOLOTYPE, US; isotype, UC); same locality, "Stony slope along Soldier's Canyon Trail, Soldier's Canyon," *Thorner s.n.*, 1910 (UA); same locality, The Basin, *Harris 16475* (US, NY); same locality, *Livingstons & Thorner s.n.*, Carillos Ranch, Nov. 1906 (UA); same locality, Sabino Canyon Trail, *Livingstons & Thorner s.n.*, 1908 (4 sheets, UA); Baboquivari Mts., *Peebles 8796*, 1932 (US).

The leaf of this plant is essentially different from that of *M. angustiloba* Muell. Arg. In *M. Davisiae* the leaf-lobes are dilated into 2 or 3 lobules, the apical lobule being especially noticeable; in *M. angustiloba*, on the contrary, the leaf-lobes are essentially linear or linear-acuminate in their general outline, being more or less irregularly lobulate only towards the base. This constant vegetative difference bespeaks in itself a specific difference which is so important as to remove *M. Davisiae* to an affinity (*M. chlorosticta*, as it seems) other than that of *M. angustiloba* (*M. mexicana*). In addition the two species differ in the seed. *Harrison & Kearney 8904* has a seed which is perfectly comparable to that of *Lemmon s.n.*, the holotype of *M. Davisiae*. The characters are: seed of *M. angustiloba*, 12 mm. long, 10 mm. broad, nearly oval in outline; seed of *M. Davisiae*, 9 mm. long, 7 to 9 mm. broad.

*Manihot Davisiae* has apparently the status of a relic-species, narrowly localized in the Santa Catalina Mountains, the classic locality, perhaps occurring much less frequently on the Baboquivari Mountains, the lowlands in this region being occupied by *M. angustiloba*. The distribution of these two entities would seem to follow altitudinal lines.

The specific epithet is for Mrs. Mary D. Davis of Tucson, Arizona, to whom I am indebted for data in connection with my work on this species.

At this writing, another *Manihot* sp. nov. from the range considered in this paper is in manuscript, ready for the press. This new species will be published by the Bulletin of the Torrey Club in the immediate future.





Croizat, Léon. 1942. "A Study of Manihot in North America." *Journal of the Arnold Arboretum* 23(2), 216–225. <https://doi.org/10.5962/p.185457>.

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