

## TAXONOMIC OVERVIEW OF THE GENUS *COLOGANIA* (FABACEAE, PHASEOLEAE)

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### ABSTRACT

A taxonomic overview of the mostly Mexican genus *Cologania* is provided. Ten species are recognized, one of which, *C. hintoniorum* B. Turner, is described as new. All of these occur in México, but two (*C. broussonettii* and *C. procumbens*) extend throughout much of South America. *Cologania broussonettii* (including *C. ovalifolia*) also extends into the southwestern U.S.A.; atypical populations of this have been called *C. pallida*. Complete synonymy is given for all of the taxa and, when appropriate, comments are made regarding typification. A key to the ten species is constructed along with maps showing their distribution.

KEY WORDS: Fabaceae, Phaseoleae, *Cologania*, México

*Cologania* is a widespread highly variable genus of perennial, mostly twining vines or less often low, trailing to erect herbs. The species are largely confined to montane habitats extending from the southwestern U.S.A. to Argentina in South America. México is clearly the center of diversity for the genus, all of the species confined to, or emanating out of this region (cf. Figures 2-5).

Natural variability among species in the genus has been compounded by the occurrence of cleistogamy, especially when following interspecific hybridization. This has been nicely documented by Fearing (1959) in his unpublished monographic study of the genus. After obtaining his doctorate and joining the biological faculty at Trinity University, San Antonio, Texas, Dr. Fearing essentially ignored *Cologania*, his passport to Academia. This in spite of the fact that his thesis was a sound production for its time, being based upon considerable field work and examination of several thousand specimens on loan from eighteen or more institutions.



In his doctoral thesis Fearing recognized ten species of *Cologania*, one of these, *C. cordata*, newly proposed. These were arranged numerically, according to their perceived morphological nearness, as follows.

- |                           |                            |
|---------------------------|----------------------------|
| 1. <i>C. procumbens</i>   | 6. <i>C. hirta</i>         |
| 2. <i>C. cordata</i>      | 7. <i>C. biloba</i>        |
| 3. <i>C. capitata</i>     | 8. <i>C. pallida</i>       |
| 4. <i>C. angustifolia</i> | 9. <i>C. broussonettii</i> |
| (with two varieties)      |                            |
| 10. <i>C. ovalifolia</i>  | 5. <i>C. obovata</i>       |

It is unfortunate that Fearing's study was not published, mainly because he had made considerable taxonomic sense out of a jumble of specimens from over a large region. He attempted to resolve the nomenclature by examination of type materials and constructed distribution maps for all of the included taxa. The only individual to add significantly to the taxonomy of *Cologania* since his study has been McVaugh (1987), who in treating *Cologania* for his *Flora Novo-Galiciana* recognized most of Fearing's taxa, including *C. cordata* Fearing *ex* McVaugh. He did not, however, recognize Fearing's submergence of *C. jaliscana* into *C. angustifolia*, nor did he accept the recognition of *C. ovalifolia*, at least as occurring within the area of Novo-Galiciana.

Numerous (*i.e.*, at least ten or more) workers, over the 30 years since Fearing completed his thesis have xeroxed his entire study or else abstracted material from it. Indeed, it has been about the only source for reliable taxonomic information regarding *Cologania*, yet none of this is available in published form. Because of this I have taken the opportunity to read critically, once again, his entire thesis, and study all of the collections assembled at LL, TEX since his work, including selected materials at MICH, for the loan of which I am most grateful. In the overview that follows I have attempted to render a reasoned and just account of the group as if I had studied the genus from my 40+ years of taxonomic activity, including field work in the area concerned. My work was made much easier by the considerable accumulation of new material since Fearing's study, but more so by the careful manner in which he documented typification: clear black and white photographs of most of the types concerned.

In my present revised and updated account of Fearing's work I also recognize ten species, but some of his proposed taxa have been submerged, one or two resurrected, and one newly described taxon proposed. The following key and comments will account for the taxa recognized; in addition, I have provided distribution maps for all of the North American taxa based upon both Fearing's records and those assembled since.

Where my treatment differs from those of Fearing or McVaugh, I have explained my stance. Additionally, I have given a formal account of the names



proposed for the genus, including typification, all of this looked at afresh and every attempt made to recognize meaningful morphogeographical units (*i.e.*, biological species as inferred from morphological, ecological, and geographical data).

Fearing's study provided both meiotic and somatic chromosome counts for the following taxa of *Cologania*:

<i>C. angustifolia</i>	$n = 22$ pairs	$2n = 44$
<i>C. broussonettii</i>	$n = 22$ pairs	$2n = 44$
<i>C. obovata</i>		$2n = 44, 88$

### *Cologania* Kunth

Perennial usually twining herbaceous vines or, less often, merely erect or trailing herbs. Tap roots large, ligneous or woody, fusiform or clavate, deeply buried and usually forming new stem growth each year from the crown. Leaves mostly trifoliate, less often unifoliate, rarely 5 foliate, the petiolule of the middle leaflet of trifoliate leaves longer than those of lateral leaflets. Stipules linear to asymmetrically lanceolate. Flowers axillary or terminal, solitary, in pairs, or several or more in congested or loose subfasciculate clusters, or clearly racemose, the flowers bracteate or not. Calyx (in chasmogamous flowers) tubular, gibbous at the base, the sepals 5, united for  $2/3$  of their length, the upper two lobes variously united. Corolla purple to magenta, or reddish to reddish purple, the banner prominent, usually notched at the apex, the claw ca.  $1/3$  the length of the blade; wings auriculate, often sharply so, the claw  $1/2$  as long or more than the blade; keel auriculate, the claw ca. as long as the blade. Stamens 10, diadelphous, enclosed in the keel. Style filiform, gradually curved so as to form an angle of 10-60 degrees with the extended axis of the ovary. Fruit (from chasmogamous flowers) a linear to falcate pod, at maturity terete and usually producing 6-12 seeds. Cleistogamic flowers and fruits are usually quite different from those of chasmogamous flowers and fruits. In general, cleistogamic flowers are much reduced throughout, the calyx tube markedly narrowed below, scarcely gibbous and fertilization occurs at an early developmental stage, the resulting pods also much reduced and atypical. Base chromosome number,  $x = 11$ .

Lectotype species, *Cologania angustifolia* Kunth.

### Key to species (based upon chasmogamous flowers)

1. Leaves unifoliate. .... 2



2. Leaves cordate; Jalisco. .... *C. cordata*
2. Leaves linear lanceolate to lanceolate, or elliptic lanceolate to elliptic, rarely broadly ovate but never cordate; widespread. *C. procumbens*
1. Leaves 3(-5) foliolate. .... 3
  3. Leaflets linear to linear lanceolate, rarely narrowly ovate, mostly 3 times longer than wide or more. .... 4
    4. Flowers arranged in axillary bracteate clusters of 5-10, the pedicels 2-4 mm long; Nayarit. .... *C. capitata*
    4. Flowers single in the axils or in groups of 2-3, the pedicels mostly 5-10 mm long; widespread. .... *C. angustifolia*
  3. Leaflets ovate to obovate or oval, mostly 1.0-2.8 times as long as wide. .... 5
    5. Petioles 1-5 mm long; leaflets sessile or nearly so; stems procumbent or trailing, not twining. .... *C. obovata*
    5. Petioles 10 mm long or more; leaflets clearly stalked; stems twining. .... 6
      6. Flowers borne in distinct racemes; pedicels subtended by distinct bracts. .... 7
        7. Banners red, 30-40 mm long (measured from the base of calyx to banner tip); bracts of the raceme ovate, 12-14 mm long, 3-4 mm wide. .... 8
          8. Leaflets sharply acute; near Michoacán and Guerrero. .... *C. hintoniorum*
          8. Leaflets broadly obtuse to rounded; Oaxaca. *C. hirta*
        7. Banners lavender purple to violet, 18-30 mm long; bracts of the raceme mostly linear to linear lanceolate, 4-6 mm long, 0.5-1.0 mm wide. .... 9
          9. Racemes mostly 6-12 cm long, evenly floriferous, the flowers mostly 20-25 mm long (measured from the base of calyx to apex of banner); Durango, Nayarit, and Jalisco along western sierras. .... *C. racemosa*
          9. Racemes mostly 1.5 cm long, unevenly floriferous, the flowers mostly 26-30 mm long; Hidalgo to Oaxaca along eastern sierras. .... *C. biloba*
    6. Flowers axillary, mostly 1-2 or in groups of 3-4, but never distinctly racemose; pedicels without bracts. .... 10
      10. Leaves pallid (pale green); leaflets mostly 1-3 cm long; U.S.A. and closely adjacent México. .... *C. pallida*



10. Leaves green to dark green, never pallid; leaflets mostly 3-10 cm long; widespread. . . . . *C. broussonettii*

*COLOGANIA ANGUSTIFOLIA* Kunth. Distribution map Figure 2.

*Cologania angustifolia* Kunth, *Mimoses* 209. pl. 58. Jun 1824; H.B.K., *Nov. Gen. & Sp. Pl.* 6 [folio]: 325; 6 [quarto]:44. Sep 1824. *Amphicarpaea angustifolia* (H.B.K.) Taubert, in Engler & Prantl, *Natur. Pflanzenf.* 33:359. 1894. TYPE: MEXICO. Hidalgo: "prope La Magdalena, between Real del Moran and Actopan," May-Jun 1803, *Humboldt & Bonpland* 4115 (HOLOTYPE: P; Photoholotype: TEX!).

*Cologania intermedia* H.B.K., *Nov. Gen. & Sp. Pl.* 6 [quarto]:414. Sep 1824. TYPE: MEXICO. Hidalgo: "Crescit prope Real del Monte," May-Jun 1803, *Humboldt & Bonpland* 4080 (HOLOTYPE: P; Photoholotype: TEX!).

*Cologania mexicana* Zucc., *Abhandl. Akad. Muench.* 1:339, pl. 14 & 15. 1832. *Neurocarpon mexicanum* (Zucc.) Steud., *Nomenclator Botanicus*, ed. 2, 2:193. 1840. TYPE: "Crescit in imperii mexicanum regionibus calidioribus," w/o date, *D. Keerl s.n.* (HOLOTYPE: M, not examined, but as noted by Fearing, the description and illustrations leave little doubt as to its synonymy here).

*Galactia radicata* DC., *Prodr.* 2:238. 1825. TYPE: MEXICO. State not known: Based upon a collection of *Sessé & Moçino s.n.* (*Sessé & Moçino* illustration: G; Photo of type illustration: TEX!). This name was not accounted for by Fearing, but the illustration leaves little doubt as to its identity.

*Cologania longifolia* A. Gray, *Pl. Wright.* 2:35. 1853. TYPE: U.S.A. New Mexico: Grant Co., "Hills near the copper mines," Aug 1851, *C. Wright* 959 (LECTOTYPE [selected here]: GH!; Photolectotype: TEX!). Gray cited several of Wright's collection numbers in his protologue, assigning subscripts to each and referring to these as leaf "forms." Fearing annotated *Wright* 959a as "holotype," which is redesignated here as a lectotype.

*Cologania martia* S. Wats., *Proc. Amer. Acad. Arts* 17:345. 1882. TYPE: MEXICO. San Luis Potosí: "Sandy places about San Luis Potosi," w/o date, *Schaffner* 802 (LECTOTYPE [selected here]: GH!). In the protologue Watson cited two additional collections, 191 and 193 of *Parry & Palmer*.



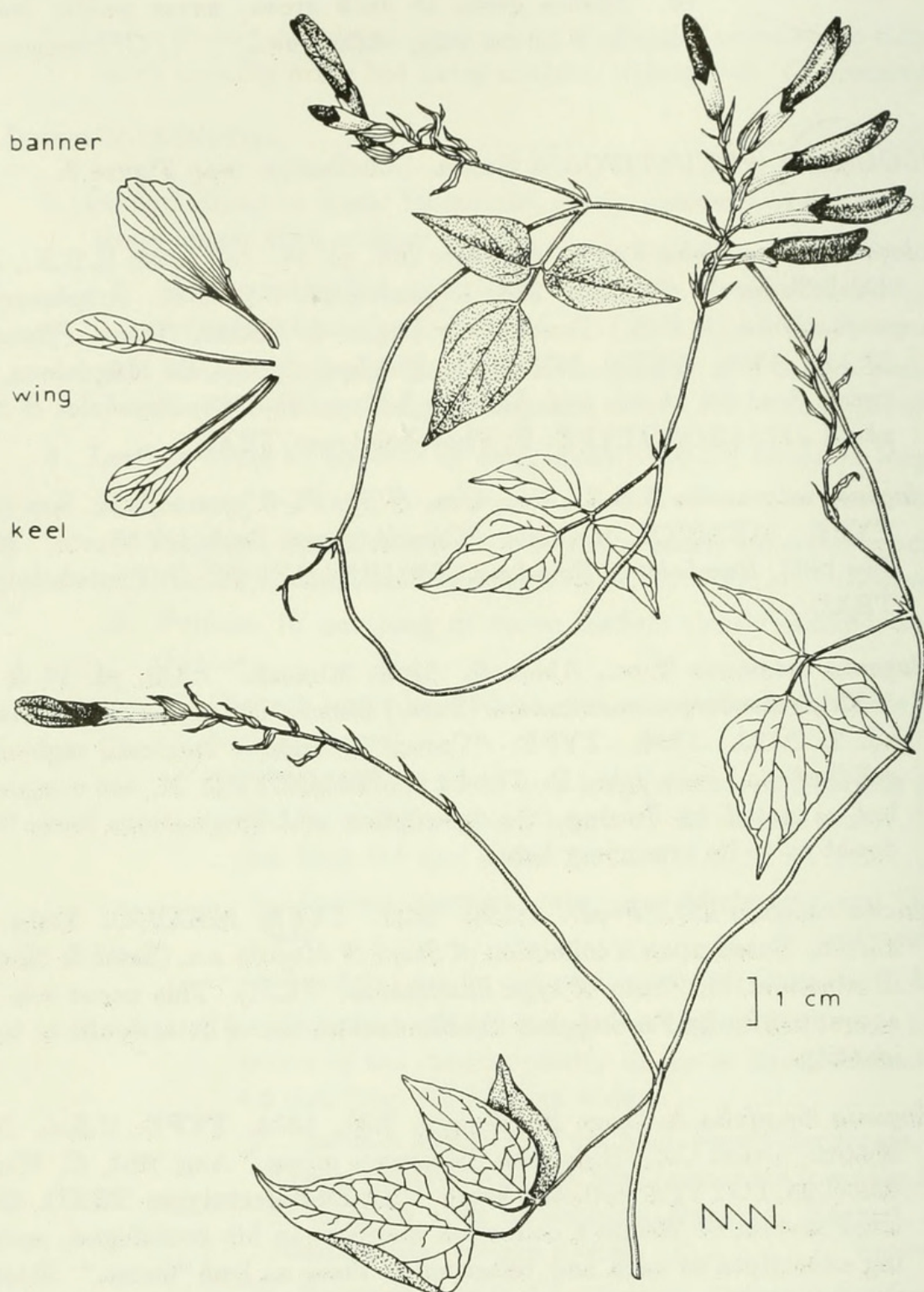


Fig. 1. *Cologania hintoniiorum*, from holotype.

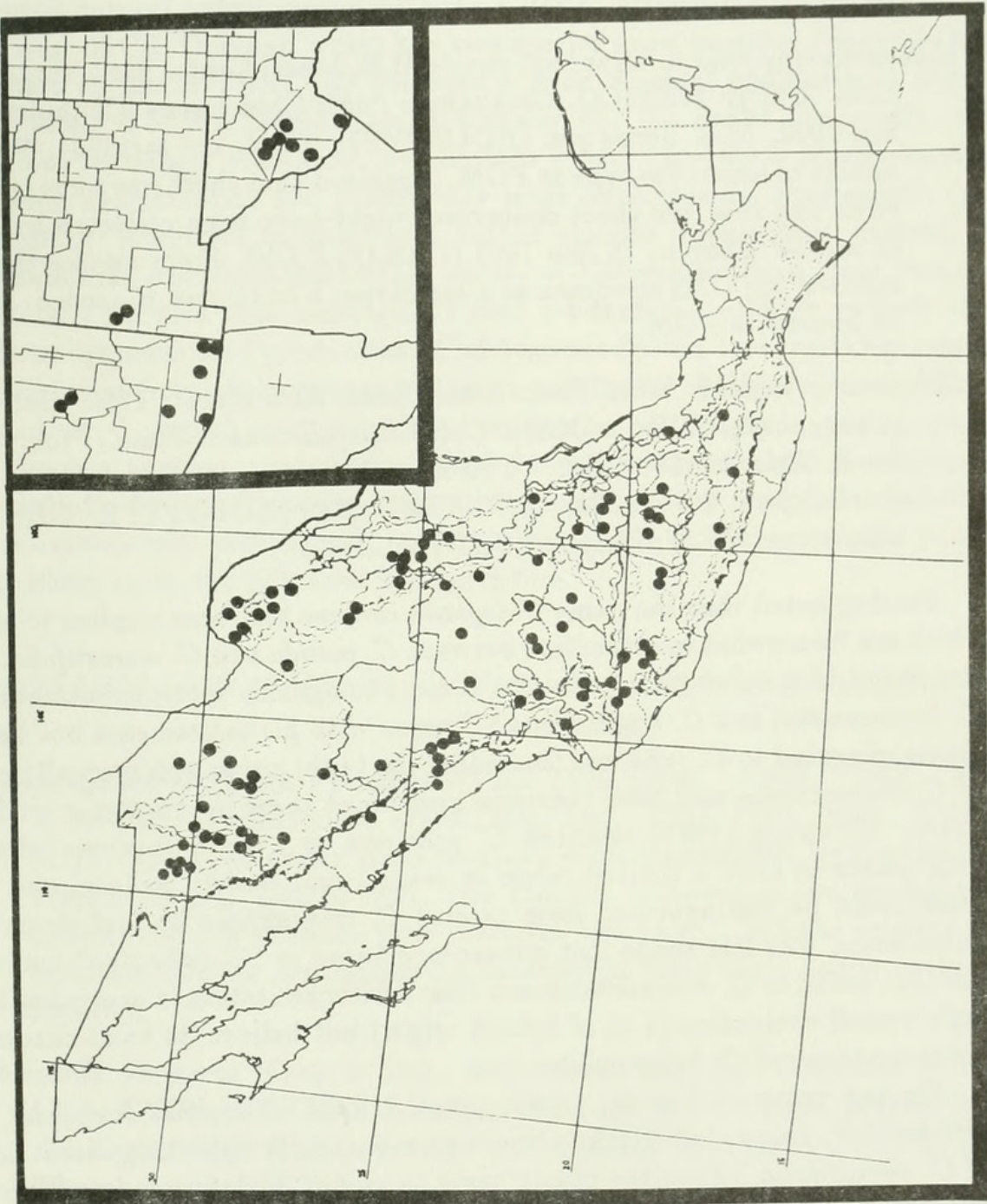


Figure 2. Distribution of *Cologania angustifolia* in México (inset, U.S.A.).



*Cologania confusa* Rose, Contr. U.S. Natl. Herb. 8:37. 1903. TYPE: U.S.A. Texas: El Paso Co., 1851, *C. Wright* 958 (HOLOTYPE: US; Photoholotype: TEX!; Isotype: GH!).

*Cologania longifolia* A. Gray var. *stricta* M.E. Jones, Contr. West. Bot. 12:12. 1908. TYPE: MEXICO. Chihuahua: "near Chuichupua [Chuhuichupa]," Sep 1903, *M.E. Jones* s.n. (HOLOTYPE: POM, not located). Fearing, unable to locate the type at POM, suggested that there was some labeling error and that the sheet concerned might have been collected by Jones in Soldier Canyon, 16 Sep 1903 (CAS,DS,F,US). From among these he selected the CAS specimen as a lectotype; a lectotype, if needed, should be housed at POM.

*Cologania pringlei* S. Wats, Proc. Amer. Acad. Arts 25:147. 1890. Not *Cologania pringlei* S. Wats. (1888). *Cologania jaliscana* S. Wats., Proc. Amer. Acad. Arts 26:136. 1891. TYPE: MEXICO. Jalisco: hillsides near Guadalajara, 2 Jul 1889, *C.G. Pringle* 2788 (HOLOTYPE: GH!; Photoholotype: TEX!; Isotypes: F,MO,UC,US).

Fearing noted that the name *Cologania confusa* had been applied to plants which are "somewhat intermediate between *C. pallida* and *C. angustifolia*." He also noted that "*Cologania jaliscana* is morphologically intermediate between *C. broussonettii* and *C. angustifolia*." I agree with his assessments but believe plants relegated to *C. jaliscana* (including the type) are morphologically closer to *C. broussonettii* and have therefore positioned these in synonymy with the latter. McVaugh (1987) retained *C. jaliscana* as a good species, believing such plants to have a limited range in central and eastern Jalisco, and that these could be distinguished from typical *C. angustifolia* by leaf shape and pubescence. The leaf shape and pubescence found in "*C. jaliscana*" are much like that found in *C. broussonettii* and I have little hesitation in accepting Fearing's overall evaluation (i.e., of hybrid origin) but believe its total characters are more those of *C. broussonettii*.

Fearing recognized a var. *stricta*, based upon *Cologania longifolia* var. *stricta* M.E. Jones, but I take these to be but early sprouting, erect forms of *C. angustifolia*, before the plants begin to twine. Such forms occur through most of the range of *C. angustifolia* and appear to have no other characters to distinguish these from the more typical twining forms.

Fearing noted that the name *Cologania intermedia* has been applied to plants "which exhibit characters intermediate between *C. angustifolia* and *C. broussonettii*," which appears to be the case. He also noted that *C. longifolia* (largely recognized by its glabrate upper leaf surfaces) appears to be but sporadically occurring forms of *C. angustifolia*.

As treated by Fearing, *Cologania angustifolia* is a widespread, highly variable taxon. Its infraspecific variation has probably been compounded by oc-



casional interspecific hybridization with other taxa. Indeed, Fearing has documented natural hybridization between *C. angustifolia* and *C. obovata* in the area west of Cd. Durango where the two species grow together (documentary vouchers on file at TEX). He observed a wide range of populational phenotypes along a 56 km transect along highway 40. No doubt the locally variable, but seemingly stabilized, populations reflect the effects of cleistogamy: following hybridization and presumably some backcrossing, cleistogamic (self pollinating) forces act to form local, rather uniform populations. Indeed, after examining numerous herbarium sheets of *Cologania* over a wide range of habitats, I surmise that cleistogamic seed production probably exceeds that of chasmogamous seed production. Cleistogamic flowers and fruits are readily distinguished from chasmogamous flowers and fruits, both by size and shape. Regardless, I suspect that any time two species of *Cologania* grow together or near one another, an occasional hybrid or backcross might be expected. Populations derived from such intermixing need not be recent, for ancestral hybridization with cleistogamic stabilization of this or that genotypic pool is more likely to be the rule than the exception.

*COLOGANIA BILOBA* (Lindl.) Nicholson. Distribution map Figure 3.

*Cologania biloba* (Lindl.) Nicholson, *Ill. Dict. Gard.* 1:363. 1887. BASIONYM: *Glycine biloba* Lindl., *Bot. Reg.* 17:pl. 1418. 1831. TYPE: MEXICO. Type grown from Mexican seeds transmitted by George Ackermann to Mr. Tate in 1827, and brought to flower in the greenhouse. Fearing did not examine type material, nor have I, but the original description and its accompanying illustration leave little doubt as to its identity.

*Cologania purpurea* Mart. & Gal., *Bull. Acad. Roy. Sci. Bruxelles* 10:191. 1843. TYPE: MEXICO. Hidalgo: "dans les bois de Regia, pres de Real del Norte," 6500 ft, Jun-Oct 1840, *H. Galeotti* 3346 (HOLOTYPE: BR; Photoholotype: TEX!).

*Cologania nelsonii* Rose, *Contr. U.S. Natl. Herb.* 8:40. 1903. TYPE: MEXICO. Oaxaca: mountains about Yalalag, 1300 m, 1 Aug 1894, *F.W. Nelson* 976 (HOLOTYPE: US!).

*Cologania grandiflora* Rose, *Contr. U.S. Natl. Herb.* 8:41. 1903. TYPE: MEXICO. Distr. Federal: valley of México, Aug 1896, *C.G. Pringle* 7264 (HOLOTYPE: US; Photoholotype: TEX!; Isotypes: F, GH).

The seed from which the type of *Cologania biloba* was grown apparently came from the environs of México City, or perhaps elsewhere along the eastern



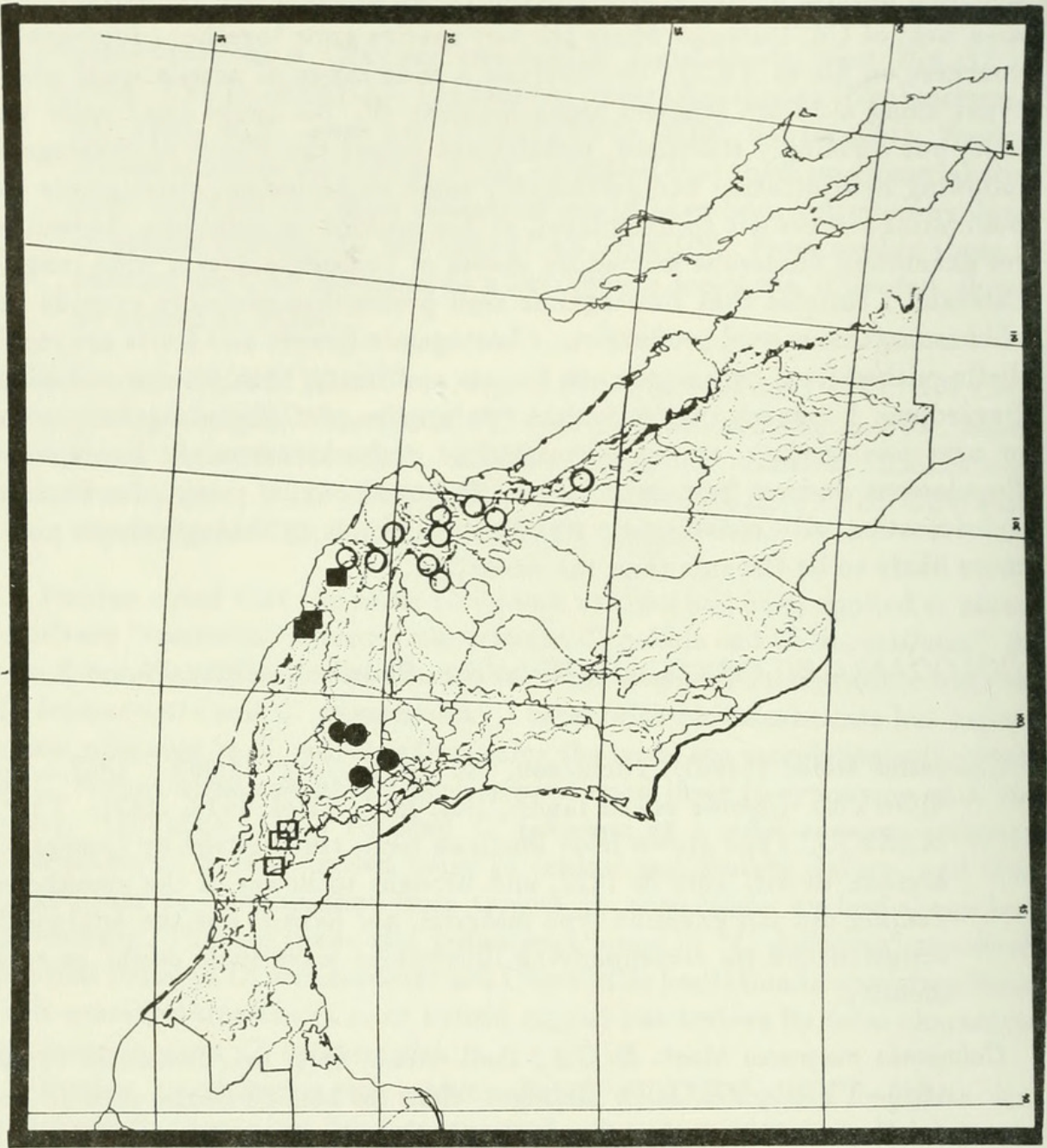


Figure 3. Distribution of *Cologania biloba* (closed circles), *C. hintoniorum* (closed squares), *C. hirta* (open squares), and *C. racemosa* (open circles).



sierras. I could not locate information relating to the whereabouts of George Akermann in 1827, at least the plant illustration along with the type description matches well material from the eastern sierras, but not that of material here referred to as *C. racemosa* or *C. hintoniorum*. From the former it differs in having longer corollas; from the latter by its violet or purple corollas (vs. red).

Fearing (1959) positioned *Cologania grandiflora* within his concept of *C. ovalifolia* (= *C. broussonettii* of the present treatment), but the type appears to be in all ways like *C. biloba*, except that the raceme is much shortened so as to superficially resemble the axillary flowers characteristic of *C. broussonettii*.

Other than the types cited above, I have examined the following collections: MEXICO. Morelos: barrancas, Cuernavaca, 28 Jul 1896, *Pringle* 7250 (MICH). Tlaxcala: Amaxac de Guerrero (near Sta. Cruz), 20 Aug 1944, *Hernández X. s.n.* (LL).

*COLOGANIA BROUSSONETTII* (Balb.) DC. Distribution map, Figure 4.

*Cologania broussonettii* (Balbis) DC., *Prodr.* 2:237. 1825. BASIONYM: *Clitoria broussonettii* Balbis, *Cat. Taur.* 26. 1813. TYPE: CHILE(?). w/o specific locality, collector and date unknown. (HOLOTYPE: TO; Photoholotypes: F,GH,TEX!). McVaugh (1987) noted that De Candolle, in his transfer of this species, calls to the fore that Balbis published the present name with a double n; the holotype material, however, is annotated with the spelling having a single n, as adopted by most workers.

*Cologania ovalifolia* H.B.K., *Nov. Gen. & Sp. Pl.* 6:412 [quarto]. Sep 1824. *Falcata ovalifolia* (H.B.K.) O. Ktze, *Rev. Gen. Pl.* 3(3):63. 1898. *Amphicarpaea ovalifolium* (H.B.K.) Seckt., *Fl. Cordoba*, Cordoba, 1927-30. TYPE: PERU. Prov. Bracamorencia: "Crescit ad repam flumiris Amazonum, prope Tomependam, alt. 200 hex.," Aug 1802, *Humboldt & Bonpland s.n.* (HOLOTYPE: P; Photoholotype: TEX!).

*Cologania pulchella* H.B.K., *Nov. Gen. & Sp. Pl.* 6:413 [quarto]. Sep 1824. *Amphicarpaea pulchella* (H.B.K.) Taubert, in Engler & Prantl, *Nat. Pflanzenf. Abt.* 3(3):359. 1894. TYPE: MEXICO. Michoacán: near Patzcuaro, Sep 1803, *Humboldt & Bonpland* 4348 (HOLOTYPE: P; Photoholotype: TEX!).

*Cologania affinis* Mart. & Gal., *Bull. Acad. Roy. Sci. Bruxelles* 10:188. 1843. TYPE: MEXICO. Veracruz: near Mirador, "3,000 pieds," Jun-Oct 1840, *H. Galeotti* 3283 (HOLOTYPE: BR; Photoholotypes: F,GH,TEX!).



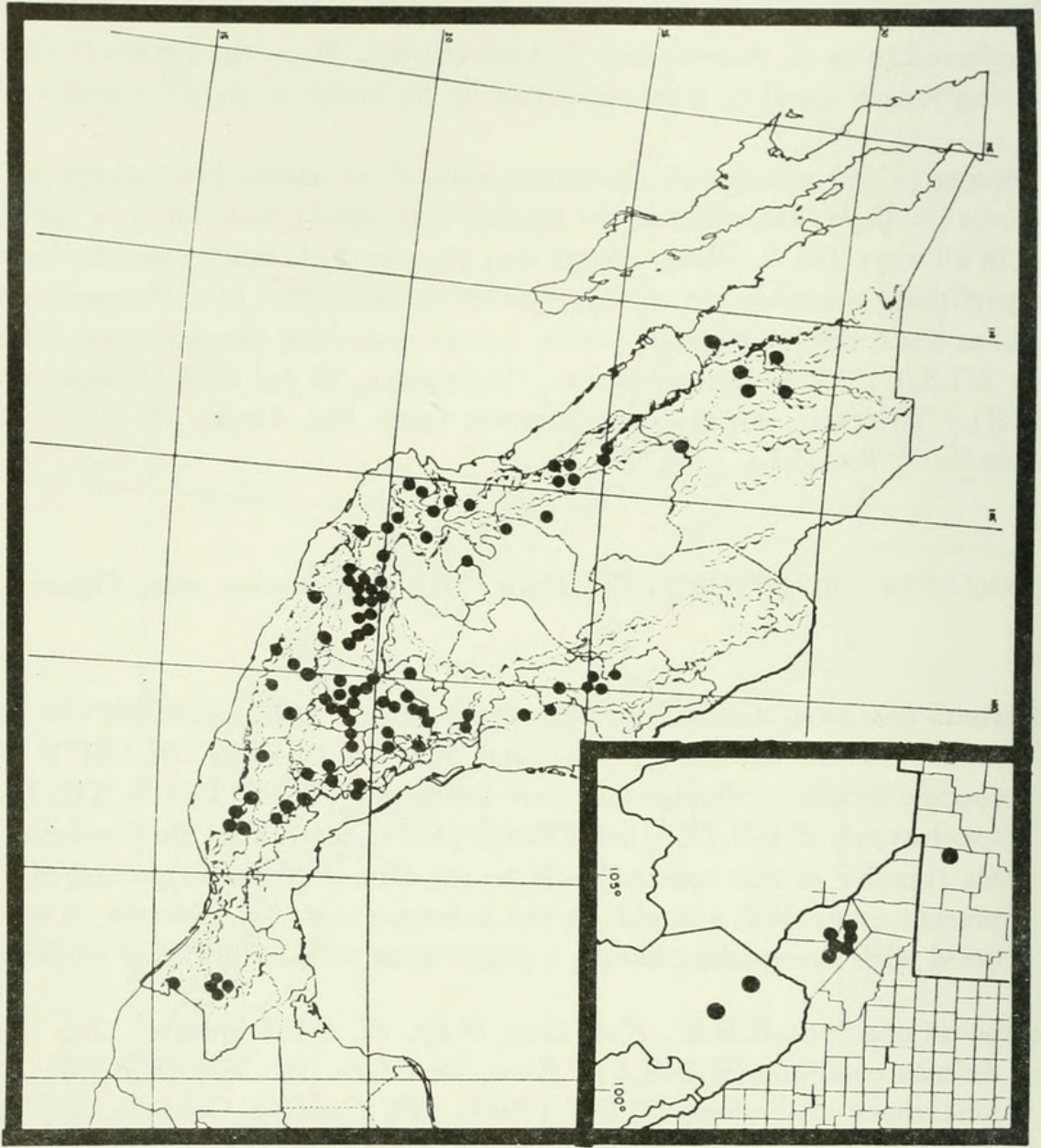


Figure 4. Distribution of *Cologania broussonettii* in México (inset, population types referred to as *C. pallida*).



- Cologania australis* Griseb., in Goett., Abh. 19:124. 1874. TYPE: ARGENTINA. Tucumán: Siambon, Sierra de Tucumán, Feb 1874, *P.G. Lorentz & Hieronymus* 779 (HOLOTYPE: LIL; Photoholotypes: F,TEX!).
- Cologania jaliscana* S. Wats., nom. nov., Proc. Amer. Acad. Arts 26:136. 1891. *Cologania pringlei* S. Wats., Proc. Amer. Acad. Arts 25:147. 1890. Not *Cologania pringlei* S. Wats., 1888. TYPE: MEXICO. Jalisco: hillsides near Guadalajara, 2 Jul 1889, *C.G. Pringle* 2788 (HOLOTYPE: GH!; Isotypes: F,MO,UC,US).
- Cologania grandiflora* Rose, Contr. U.S. Natl. Herb. 8:41. 1903. TYPE: MEXICO. Distr. Federal: valley of México, Aug 1896, *C.G. Pringle* 7264 (HOLOTYPE: US; Photoholotypes: TEX!; Isotypes: F,GH!).
- Cologania glabrior* Rose, Contr. U.S. Natl. Herb. 8:38. 1903. TYPE: GUATEMALA. Jalapa: Laguna de Ayarza(?), 1892, *E.T. Heyde* 454 (HOLOTYPE: US; Photoholotype: TEX!).
- Cologania rufescens* Rose, Contr. U.S. Natl. Herb. 8:38. 1903. TYPE: GUATEMALA: Quiche: in Chiul, Sep 1890, *Heyde & Lux* 4460 (HOLOTYPE: US; Photoholotype: TEX!; Isotype: US; Photoisotype: TEX!).
- Cologania congesta* Rose, Contr. U.S. Natl. Herb. 8:312. 1905. TYPE: MEXICO. México: Toluca, 4 Sep 1903, *Rose & Painter* 6768 (HOLOTYPE: US!).
- Cologania tenuis* Rose, Contr. U.S. Natl. Herb. 10:100. 1906. TYPE: MEXICO. Morelos: near El Parque, 21 Sep 1903, *J.N. Rose* 7233 (HOLOTYPE: US; Photoholotype: TEX!; Isotype: GH!).
- Cologania lozanii* Rose, Contr. U.S. Natl. Herb. 10:100. 1906. TYPE: MEXICO. Nuevo León: near Monterrey, 7 Sep 1904, *Pringle & Lozano* 13425 (HOLOTYPE: US; Photoholotype: TEX!).

This is a widespread variable species, especially in leaf shape. It ranges throughout most of the tropical and subtropical montane regions of western North America and South America (Fig. 2). Fearing (1959) recognized *Cologania ovalifolia* (including *C. australis* and *C. grandiflora*) as distinct, positioning this next to *C. broussonettii* but noted in his discussion that the two species are taxonomically the most difficult portions of *Cologania*. Comparison of herbarium materials shows that they exhibit almost complete intergradation of morphological characters. In South America these taxa are more sharply separated than these are in the northern portions of their range. However, with reference to the Mexican collections, their morphological characters are known to intergrade to such an extent that one is tempted to treat these two



taxa as members of a single variable species. The South American material, especially collections from Argentina, contains plants in which the morphological extremes are well marked. Because of the sharp distinction of these two taxa in the southern part of their range, they are treated as distinct, though it is apparent that their biological status can only be determined by detailed populational studies.

I have gone over much of the material examined by Fearing and much additional material assembled since his study and must conclude that I cannot recognize but a single taxon from among this complex. The hypothetical taxon, *Cologania ovalifolia*, has an almost identical range as that of *C. broussonettii* and its variation is such that one must be exceedingly arbitrary in assigning specimens to this or that taxon on the characters proposed by Fearing in his key to species. McVaugh (1987) came to a similar conclusion for the area covered in his study noting, "In Nuevo Galicia I cannot distinguish more than one species [of this pair]. Flowers and fruit of the supposed species are for all practical purposes identical. The stated differences between the two involve leaflet-shape, width of stipules, and length of the leaf – radius, peduncles, and pedicels ..." I concur with McVaugh's assessment regarding this matter and believe, further, that such observations hold throughout most of the range of the species concerned.

*COLOGANIA CAPITATA* Rose. Distribution map, Figure 5.

*Cologania capitata* Rose, Contr. U.S. Natl. Herb. 8:41. 1903. TYPE: MEXICO. Nayarit: near Santa Teresa, 13 Aug 1897, J.N. Rose 3459 (HOLOTYPE: US; Photoholotype: TEX!; Isotype: GH).

This taxon is a localized endemic of northern Nayarit. Except for its exceptional capitate inflorescence it is similar to *Cologania angustifolia*.

*COLOGANIA CORDATA* Fearing ex McVaugh. Distribution map, Figure 5.

*Cologania cordata* Fearing ex McVaugh, in *Flora Novo-Galiciana* 5:356. 1987. TYPE: MEXICO. Nayarit: near km 866, ca. 40 km SE of Tepic, 4 Sep 1957, R. McVaugh 18717 (HOLOTYPE: MICH).

McVaugh, in his publication of this taxon, discussed its distinctiveness, and provided an excellent illustration. More detailed study might show this species to be a population form of *Cologania procumbens*; occasional nearly cordate leafed forms of *C. procumbens* occur elsewhere (e.g., Oaxaca: Baldwin 14337, LL).



*COLOGANIA HINTONIORUM* B. Turner. Distribution map, Figure 3.

*Cologania hintoniorum* B. Turner, *sp. nov.* Fig. 1. TYPE: MEXICO. Michoacán: Distr. Coalcoman, S. Torricillas, oak woods, 2400 m, 16 Dec 1938, *George B. Hinton et al.* 12767 (HOLOTYPE: LL!; Isotype: MICH!).

*Cologaniae hirtae* (Mart. & Gal.) Rose similis sed foliolis majoribus tenuioribusque apicibus acutis (vs. obtusis vel rotundatis) differt.

Slender perennial twining herbs, the stems up to 2 m long. Stems pilose with retrorse or spreading hairs. Leaves trifoliate, the leaflets broadly ovate, rounded or obtuse at the base, the apices acute. Stipules linear, attenuate, 5-9 mm long, 1.0-1.5 mm wide; stipels filiform 1-3 mm long. Inflorescences racemose, axillary, the flowers rather evenly disposed along the axis, the latter 5-16 cm long. Pedicels of flowers mostly 5-10 mm long, the basal bracts persistent, lanceolate to narrowly ovate, 5-12 mm long, (1-)2-4 mm wide. Calyx thinly pilose, 18-22 mm long; bracteoles large, broadly ovate, mostly 8-10 mm long, 4-5 mm wide. Corollas red; standards 3-4 cm long, the banner 11-14 mm wide, retuse, hardly recurved at anthesis; wings and keel petals ca. as long or somewhat shorter than the standard. Fruits (chasmogamous) glabrous or nearly so, up to 7 cm long, 7 mm wide; mature seeds not examined.

ADDITIONAL SPECIMENS EXAMINED: MEXICO. Guerrero: Distr. Mina, Aguazarca-Filo, 8 Nov 1937, *Hinton et al.* 11262 (GH,LL,MICH,US); Distr. Montes de Oca, "San Antonio Buenos Aires," 21 Dec 1937, *Hinton et al.* 11694 (LL,MICH).

Fearing (1959) cites an additional collection of this taxon from Guerrero (Distr. Mina, 4 Dec 1939, *Hinton* 14947; GH,US) which I have not examined. MEXICO. Michoacán: steep mountainsides NW of Aguililla, ca. 7 km S of Aserradero Dos Aguas, 2000 m, 3 Mar 1965, *McVaugh* 22725 (MICH).

McVaugh (1987), in the description of *Cologania biloba* for his *Flora Novo-Galiciana*, essentially described *C. hintoniorum*, following which he noted:

Our plant evidently differs in some respects from typical *Cologania hirta* of central Oaxaca. The herbage is much less conspicuously hirsutulous, the leaflets are more strongly acuminate, the bracteoles are broadly ovate (linear and 1.5 mm wide in Oaxaca specimens seen), the blade of the standard is relatively narrower (up to 18 mm in typical *hirta*, according to Fearing), and the ovary and fruit are glabrous (not densely strigose). With its bright red flowers in axillary racemes, this is not only one of the most distinctive of our species of *Cologania*, but also one of the showiest.



*Cologania hintoniorum*, with its very large red corollas and narrowed standards, is markedly different from the smaller flowered *C. hirta*; in addition the leaves are quite different from the latter, having larger, thinner, more acute leaflets. The distributional relationships of this species pair is shown in Fig. 3, along with *C. biloba* and *C. racemosa*, all having racemose inflorescences, but each markedly distinct among themselves.

*COLOGANIA HIRTA* (Mart. & Gal.) Rose. Distribution map, figure 3.

*Cologania hirta* (Mart. & Gal.) Rose, Contr. U.S. Natl. Herb. 3:315. 1895. BASIONYM: *Galactia hirta* Mart. & Gal., Bull. Acad. Roy. Sci. Bruxelles 10:190. 1843. TYPE: MEXICO. Oaxaca: "dan les forets de chenes des regiones alpinas de la cordillera orientale d' Oaxaca, a 7,500 pieds [Cerro de San Felipe]," Sep-Apr 1840, *H. Galeotti* 3204 (HOLOTYPE: BR; Photoholotype: TEX!).

McVaugh (1987), while accepting *Cologania hirta* into his *Flora Novo-Galiciana*, nevertheless pointed out the distinction between his material and that from Oaxaca. I have provided the name *C. hintoniorum* for the plants of Novo Galicia, restricting *C. hirta* to those from the state of Oaxaca.

*COLOGANIA OBOVATA* Schlecht. Distribution map, figure 5.

*Cologania obovata* Schlecht., *Linnaea* 12:287. 1838. TYPE: MEXICO. Hidalgo: near "Mineral del Monte [Real del Monte]," Aug 1835, *C. Ehrenberg* 575 (HOLOTYPE: HAL; Photoholotype: TEX!).

*Cologania humifusa* Hemsl., *Diag. Pl. Nov.* 3:47. 1880. TYPE: MEXICO. San Luis Potosí: near San Luis Potosí, 1879, *Parry & Palmer* 194 (LECTOTYPE [selected here]: K!; Isolectotype: GH; Photoisolectotype: TEX!). As noted by Rose (1903) the protologue cites several collections; Fearing designated the lectotype, selected here, as an holotype (at least by inference).

*Cologania lemmonii* A. Gray, Proc. Amer. Acad. Arts 19:74. 1883. TYPE: U.S.A. Arizona: Cochise Co., Chiricahua Mts., 1882, *Lemmon* 2681 (HOLOTYPE: GH!; Photoholotype: TEX!; Isotypes: F,US).

*Cologania pringlei* S. Wats., Proc. Amer. Acad. Arts 23:271. 1888. TYPE: MEXICO. Chihuahua: base of Sierra Madre, pine woodlands, 9 Oct 1887, *C.G. Pringle* 1499 (HOLOTYPE: GH!).



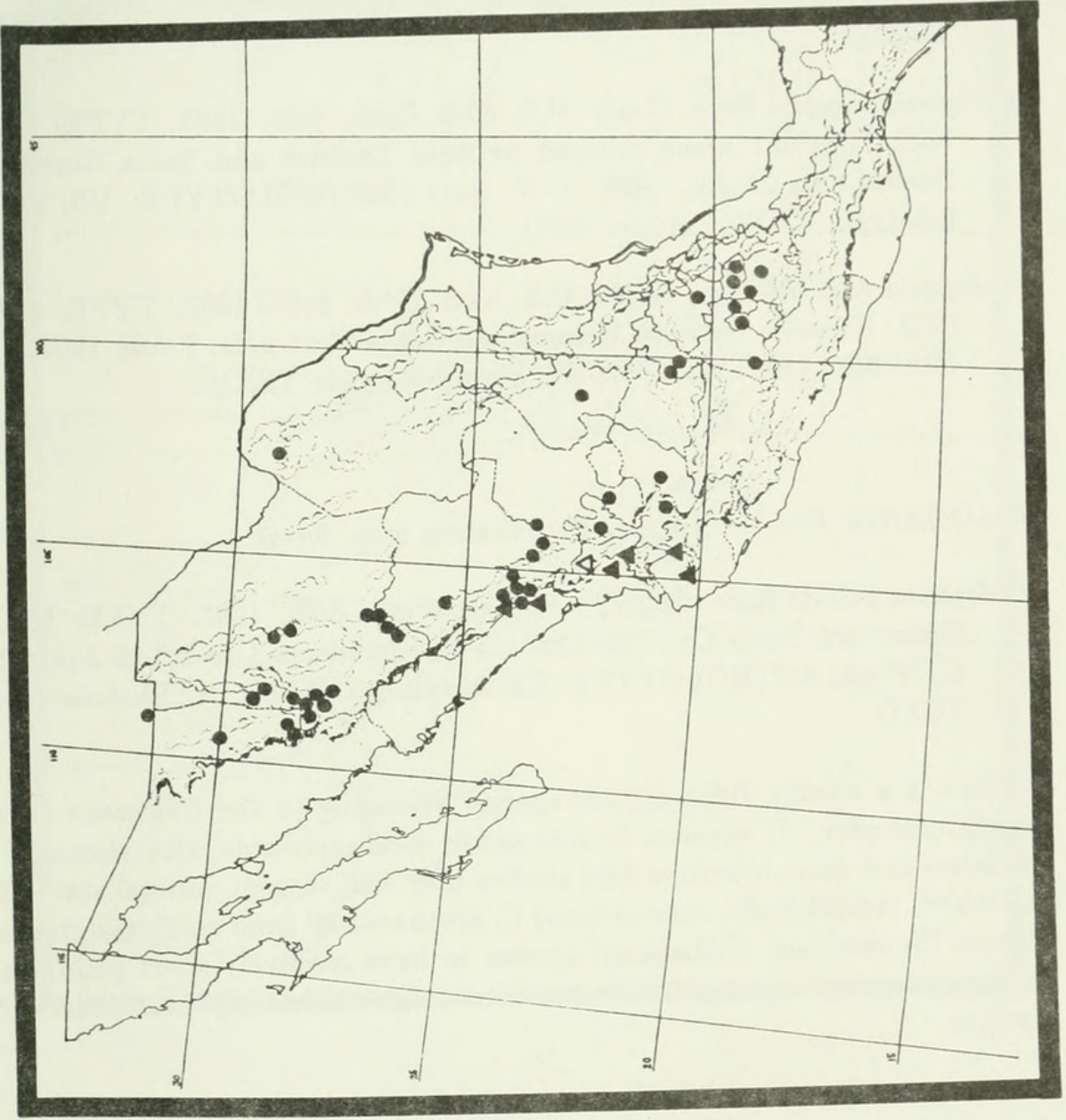


Figure 5. Distribution of *Cologania capitata* (open triangles), *C. cordata* (closed triangles), and *C. obovata* (closed circles).



*Cologania deamii* Fernald, Proc. Amer. Acad. Arts 26:492. 1901. TYPE: MEXICO. Morelos: near Cuernavaca, 7 Jul 1900, *C. Deam* 40 (HOLOTYPE: GH!; Photoholotype: TEX!; Isotype: MICH; Photoisotype: TEX!).

*Cologania houghii* Rose, Contr. U.S. Natl. Herb. 8:39. 1903. TYPE: MEXICO. Puebla: along railroad between Tepeaca and Santa Rosa, S of Puebla city, 27 Jun 1899, *J. N. Rose* 4737 (HOLOTYPE: US; Photoholotype: TEX!; Isotype: GH!).

*Cologania humilis* Rose, Contr. U.S. Natl. Herb. 8:40. 1903. TYPE: MEXICO. Nayarit: between Dolores and Santa Gertrudis, 7 Aug 1897, *J.N. Rose* 2042 (HOLOTYPE: US; Photoholotype: TEX!).

*COLOGANIA PALLIDA* Rose. Distribution map, figure 4.

*Cologania pallida* Rose, Contr. U.S. Natl. Herb. 8:38. 1903. TYPE: U.S.A. Texas: Jeff Davis Co., "Smiths' run to Providence Creek," 15 Jun 1851, *C. Wright* 957 (HOLOTYPE: US; Isotypes: GH,MO,UC; Photoisotypes: TEX!).

This is a weakly differentiated species belonging to the *Cologania broussonettii* complex. It appears to intergrade southeastwards with elements of the latter and more intensive field studies may well suggest varietal status for the taxon. Additionally, specimens of *C. broussonettii* from northwesternmost México (Sonora and Chihuahua) appear to have relatively short peduncled, axillary racemes and smaller leaves; these might ultimately prove varietally distinct.

*COLOGANIA PROCUMBENS* Kunth. Distribution map, figure 6.

*Cologania procumbens* Kunth, *Mimoses* 205. pl. 57. Jun 1874; H.B.K. *Nov. Gen. & Sp.* 6 [folio]:323. 12 Jul 1824; 6 [quarto]:412. Sep 1824. TYPE: COLOMBIA. "near Popayan, 912 hex," Oct-Nov 1801, *Humboldt & Bonpland* s.n. (HOLOTYPE: P; Photoholotype: TEX!).

*Cologania erecta* Rose, Contr. U.S. Natl. Herb. 5:136. 1897. TYPE: MEXICO. Jalisco: "rocky hills near Guadalajara, 21 Jun 1893, *C.G. Pringle* 4401 (HOLOTYPE: US; Photoholotype: TEX!; Isotypes: F,MICH,MO,US).



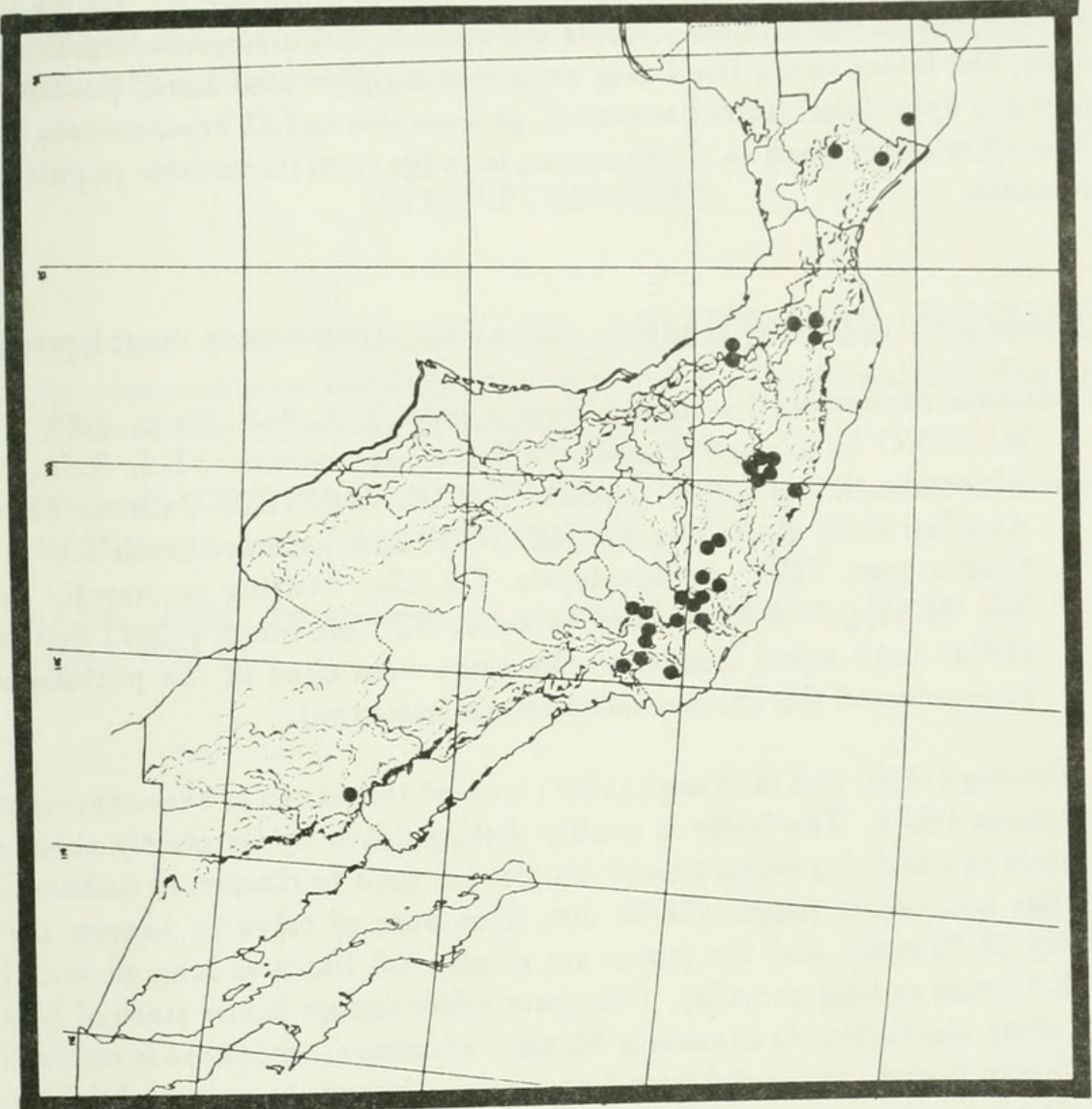


Figure 6. Distribution of *Cologania procumbens* in México.



McVaugh correctly noted, in my opinion, that this unifoliate, usually non-twining, herb may occasionally hybridize with yet other species, calling to the fore the possibility of such hybrids between it and *Cologania cordata*. Actually, the latter taxon itself may represent a rather stabilized, perhaps old, hybrid or hybrid derivative between *C. procumbens* and *C. broussonettii*, or yet some other taxon, such as *C. racemosa*, to judge from its variable populational structure.

*COLOGANIA RACEMOSA* (B.L. Rob.) Rose. Distribution map, figure 3.

*Cologania racemosa* (B.L. Rob.) Rose, Contr. U.S. Natl. Herb. 8:40. 1903. BASIONYM: *Cologania pulchella* H.B.K. var. *racemosa* B.L. Rob., Proc. Amer. Acad. Arts 29:315. 1894. TYPE: MEXICO. Jalisco: Tequila, Aug-Sep 1886, *E. Palmer 379* (LECTOTYPE [selected here]: GH!; Photolectotype: TEX!; Isolectotypes: DS,US). Fearing incorrectly noted the "holotype" of this taxon to be at US. McVaugh (1987) and Rose (1903) both noted that two collections were cited in the protologue; I have selected the Palmer collection as lectotype).

Fearing (1959) and McVaugh (1987) treated this taxon as synonymous with *Cologania biloba*. The latter is readily distinguished by its mostly shortened racemes in which (or along which) the flowers tend to cluster; in addition the corollas are mostly longer (28-30 mm from base of calyx to banner tip vs. mostly 15-25 mm), and the leaves are mostly 2-3 times as long as wide (vs. 1.5-2.0 times as long as wide). *Cologania biloba* occurs in the state of México and along the highlands of eastern México, whereas *C. racemosa* is confined to the Sierra Madre Occidental from Durango southwards to western Michoacán.

The following specimens have been examined: MEXICO. Durango: 28 road km S of Cd. Durango (ca. 23° 52' N, 104°46' W), 1800-2000 m, 18 Aug 1982, *Worthington 8980* (TEX). Jalisco: 12 mi S of Autlán, 1150 m, 26 Sep 1966, *Anderson & Laskowski 3756* (MICH); ca. 15 km E of Pihuamo, 1200-1300 m, 23 Oct 1963, *Dieterle 3013* (MICH); ca. 20 mi N of Tepatitlán, ca. 1450 m, 27-28 Aug 1958, *McVaugh 17418* (MICH); 10-12 mi SSE of Autlán, 1500-1800 m, 29 Sep 1960, *McVaugh 19587* (MICH). Nayarit: 22.7 km NW of Jesus María, ca. 1380 m, 23 Sep 1989, *Flores F. 1340* (MICH); 10 mi SE of Ahuacatlán, 1100-1300 m, 17-18 Nov 1959, *McVaugh & Koelz 773* (MICH). Michoacán: Coalcomán, 1000 m, 18 Sep 1938, *Hinton et al. 12204* (MICH).

Other than the type, Fearing examined only one of the above cited sheets (*Hinton et al. 12204*), the latter rather atypical. I believe had he access to the rather uniform suite of collections available today, he would have recognized the present taxon as distinct.



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