Notes RBG Edinb. 44(1):105–140 (1986)

A REVISION OF THE BRAZILIAN SPECIES OF CORDIA SUBGENUS VARRONIA (BORAGINACEAE)

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ABSTRACT. A formal taxonomic revision is provided for the 30 species of *Cordia* subgenus *Varronia* which occur in Brazil, with a key, species descriptions, floral illustrations and specimen citations. Four new species, *C. dardani* Taroda, *C. leucomalloides* Taroda, *C. mayoi* Taroda and *C. harleyi* Taroda are described.

The genus *Cordia*, with an estimated 250 species (Shaw, 1973), has a major centre of diversity in the New World and is particularly well represented in Brazil where almost half of the c.65 species (Taroda, 1984; Taroda & Gibbs 1986) belong to subg. *Varronia*.

Browne (1756) originally recognized *Varronia* for two species from Jamaica and the genus was accepted and enlarged by various early authors, e.g. Linnaeus (1759), Jacquin (1760), Aublet (1775) and Lamarck (1791). However, the majority of systematists have followed either Brown (1810) or Chamisso (1830) in treating *Varronia* as a section or subgenus of *Cordia* and this view had prevailed in recent times although Nowicke & Ridgway (1973) have advocated splitting *Cordia*, including the reinstatement of *Varronia* as a distinct genus, on the basis of pollen heterogeneity. The characters involved and the arguments for and against splitting *Cordia* have been discussed by Taroda & Gibbs (1986) and a new infrageneric classification proposed which includes retention of *Varronia* within *Cordia* as a subgenus.

Certainly, species of subg. *Varronia* are distinctive in that whilst other Cordias are trees, often with conspicuous flowers, Varronias are shrubby plants mostly having small flowers of less than 1 cm. However, as pointed out by Taroda & Gibbs (1986) the distinctions between *Cordia* and *Varronia* are not clear-cut: *Cordia* sect. *Myxa* contains a number of species with small flowers (less than 1 cm), whilst some species of subg. *Varronia* (*C. grandiflora*, *C. paucidentata*, *C. leucocephala*) have large flowers (3·5–5 cm) which overlap with those of the largest flowered Cordias, e.g. *C. superba* and allies (sect. *Superbiflorae*).

It is unfortunate that the pioneer revision of *Cordia* for Brazil by Fresenius (1857) in Martius' *Flora brasiliensis* provided an unsatisfactory treatment of the genus, particularly with regard to the Varronia group. This stems largely from the fact that Fresenius' infrageneric classification was influenced by Augustin De Candolle's account of *Cordia* in the *Prodromus* (1845) in which the latter ignored all previous studies and chose to use the name *Varronia* for a generic split comprising three unrelated species of *Cordia*.

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On the other hand, any modern study of *Cordia* in the New World is greatly indebted to the impressive series of papers by Johnston (1930, 1935a & b, 1940, 1948, 1949a & b, 1950 & 1956) which have illuminated our knowledge of this genus. Johnston's studies are invaluable not only for the additional 43 species which he recognized, but also for his meticulous methodology (the establishment of types for species, with lucid discussions of problems encountered, full citation of synonymy and specimens seen, etc.) and for his clear delimitation of the infrageneric classification. It remains a drawback that Johnston's studies are so fragmented and deal with a sequence of not always overlapping geographical areas. Also, as a natural consequence of working with a group for 20 years his taxonomic views on some species limits and affinities changed, partly a consequence also of sometimes having to take taxonomic decisions which were based on very limited collections. Nevertheless, these problems are minor compared with his massive contribution to the classification of the genus, and Johnston's work remains a solid foundation on which all modern studies must be based.

Subgenus **Varronia** (Browne) Cham. in Linnaea 5:115 (1830).

Syn.: *Varronia* Browne, Civ. nat. hist. Jamaica, 202 (1756).
Cordia sect. *Varronia* Brown, Prod. Fl. Nov. Holl. 1:348 (1810).
Cordia sect. *Dasycephalae* H.B.K., Nov. Gen. et Sp. [ed. quarto] 3:76 (1818).
Cordia sect. *Sebestena* subsect. *Varronia* Endl., Gen. Pl. 644 (1839).
Cordia sect. *Myxa* subsect. *Spicaeformes* DC. in A.D.C., Prodr. 9:488 (1845).
Cordia sect. *Myxa* subsect. *Subcapitatae* DC., ibid. 9:493 (1845).
Cordia sect. *Myxa* subsect. *Dasycephalae* (H.B.K.) DC., ibid.: 496 (1845).

Mostly shrubs of less than 2 m but some species form small trees up to 5 m. Leaves petiolate or sessile, membranaceous or chartaceous in texture; margin serrate, dentate or crenate, occasionally entire; venation craspedodromous (brochidodromous in *C. longifolia* and *C. poliophylla*). Flowers in congested inflorescences (spicate, capitate or glomerulate) or sometimes in small, loose panicles. Calyx mostly campanulate, 5-toothed, teeth deltoid to long-acuminate, internally glabrous. Corolla white, variable in shape, villous below the point of the insertion of the stamens. Stamens 5, usually inserted at the same level on the corolla tube (at different levels in *C. grandiflora*, *C. leucocephala* and *C. paucidentata*). Ovary pyriform, glabrous, usually containing a single functional ovule. Fruit initially with a fleshy, usually red, mesocarp but finally (i.e. when dry) conical or cylindrical, coarsely verrucose in at least the basal half, but also with a longitudinal, slightly striate band. Pollen spheroidal to oblate spheroidal, 3-porate, exine reticulate.

Varronia species occur in a variety of habitats in Brazil ranging from forests, or more usually forest margins, to cerrado and caatinga vegetation. A number are rather weedy species of open or disturbed habitats. It is not known whether the cerrado species have the specialized underground organs (xylopoda) which tends to be characteristic in such vegetation but this is likely to be the case.

In common with other Cordias most species of subg. *Varronia* have distylous flowers indicating the presence of heteromorphic self-incompatibility. Opler et al. (1975) have demonstrated the presence of this breeding

system in some Costa Rican species but have also shown that breakdown occurs to give self-compatibility or functional dioecy in some taxa. Experimental work is lacking for Brazilian species.

Myrmecophilous associations which are found elsewhere in *Cordia* seem to be lacking in subg. *Varronia*.

KEY TO THE BRAZILIAN SPECIES OF CORDIA SUBG. VARRONIA.

1. Inflorescence spicate, elongate, more than three times longer than broad 2
\+ Inflorescence variously capitate, glomerulate, elongate-cylindrical or clavate or sometimes in small, loose panicles 7
2. Petioles of the leaves decurrent on the peduncles of the inflorescence and young side branchlets 3
\+ Petioles of the leaves not decurrent on either the peduncles of the inflorescence or side branches 4
3. Leaves distinctly dentate or crenate; spike generally stout and densely flowered; calyx teeth usually acuminate ..... **1. C. multispicata**
\+ Leaves entire, undulate or at most inconspicuously denticulate; spike slender, very elongate and laxly flowered; calyx teeth triangular **2. C. schomburgkii**
4. Leaves triangular-ovate, base truncate; corolla lobes more or less rounded and shallow, only slightly reflexed. ..... **3. C. dardani**
\+ Leaves elliptical, elongate, base attenuate or acute; corolla lobes more or less triangular, strongly reflexed 5
5. Stem very densely hirsute; leaf upper surface densely tomentose; calyx densely hirsute ..... **4. C. intonsa**
\+ Stem glabrate-puberulent or with rather rigid, appressed hairs; leaf upper surface glabrate or densely strigose, sometimes sparsely villosulous; calyx puberulent or uniformly hirsute 6
6. Leaf upper surface mostly glabrate; calyx teeth acute; corolla with wrinkled lobes ..... **5. C. curassavica**
\+ Leaf upper surface with abundant strigose-setose hairs; calyx teeth acuminate; corolla lobes smooth ..... **6. C. campestris**
7. Flowers 2·5 cm or more 8
\+ Flowers 2·0 cm or less 10
8. Calyx teeth lacking a long, filiform apex ..... **9. C. leucocephala**
\+ Calyx teeth prolonged in a long, filiform apex 9
9. Leaves sessile, oblanceolate or obovate; calyx puberulent at the base, densely hirsute towards the teeth ..... **7. C. paucidentata**
\+ Leaves petiolate, triangular-ovate; calyx uniformly long setaceo-strigose ..... **8. C. grandiflora**
10. Calyx funnelform; corolla 15–20 mm, salverform, with broadly expanded, deeply divided lobes 11
\+ Calyx campanulate-obconical; corolla 4–15(–18) mm, tubular-cylindrical, funnelform (salverform in *C. harleyi* and *C. leucomalloides*) with shallow, inconspicuous, undivided lobes 12
11. Stem, leaves on both surfaces and calyx glabrous ... **10. C. longifolia**
\+ Stem, leaves and calyx pubescent ..... **11. C. poliophylla**
12. Leaves sessile or subsessile with the petiole 2 mm or less 13
\+ Leaves evidently petiolate, petiole 3 mm or more 16

13. Inflorescence clearly elongate-cylindrical, twice as long as broad **13. C. villicaulis**
+ Inflorescence capitate or clavate, sometimes short-cylindrical but always less than twice as long as broad 14
14. Stem densely hirsute with spreading hairs; leaves narrowly to broadly lanceolate, upper surface hirsute or more or less villous; calyx teeth usually prolonged in a filiform apex ..... **14. C. sessilifolia**
+ Stem with appressed, setose or strigose hairs; leaves usually ovate or obovate, sometimes elliptical, upper surface appressed setose or strigose; calyx teeth acuminate 15
15. Calyx glabrate-puberulent below, becoming hirsute towards the teeth; corolla funnelform with the limb reflexed. ..... **15. C. truncata**
+ Calyx uniformly rigid-strigose; corolla tubular-cylindrical, limb not reflexed ..... **16. C. bracelinae**
16. Calyx teeth prolonged in a long, filiform apex 17
+ Calyx teeth lacking a filiform apex 22
17. Stem, leaves and calyx with stipitate glands 18
+ Stem, leaves and calyx without stipitate glands 19
18. Calyx sparsely strigose; corolla limb not reflexed; inflorescence less than 1 cm diam. ..... **18. C. corchorifolia**
+ Calyx densely whitish-hirsute, at least on the teeth; corolla limb reflexed; inflorescence more than 1 cm diam. ..... **19. C. caput-medusae**
19. Inflorescence usually elongate-cylindrical or clavate, occasionally spherical; stem robust and few branched, densely hairy **17. C. calocephala**
+ Inflorescence spherical or globose; stem slender, much branched, usually sparsely hairy 20
20. Leaves with upper surface glabrous (very rarely sparsely appressed-puberulent), margin usually entire, occasionally serrulate; inflorescence mostly axillary ..... **26. C. buddleioides**
+ Leaves with upper surface conspicuously strigose or hirsute, margin distinctly serrate or serrulate; inflorescence internodal or terminal . 21
21. Corolla tubular-cylindrical ..... **20. C. globosa**
+ Corolla funnelform ..... **12. C. setigera**
22. Lower surface of the leaves distinctly whitish-floccose; stem and calyx with fine, whitish hairs 23
+ Lower surface of the leaves variously hairy but never whitish-floccose; stem and calyx lacking fine, whitish hairs 24
23. Leaves $8 \times 3{\cdot}5$ cm or more ..... **21. C. leucomalla**
+ Leaves 5×2 cm or less ..... **22. C. leucomalloides**
24. Corolla salverform with well-developed and reflexed limb; inflorescence clavate, congested ..... **23. C. harleyi**
+ Corolla tubular-cylindrical with the limb not reflexed; inflorescence capitate-glomerulate or laxly paniculate 25
25. Corolla c.12 mm; calyx exceeding 5 mm, whitish sericeous-tomentose **24. C. mayoi**
+ Corolla c.5 mm or less; calyx less than 5 mm, hirsute, strigose or puberulent 26
26. Calyx glabrous or puberulent at the base, becoming hirsute towards the teeth 27

\+ Calyx uniformly hairy (*C. polycephala* group, species 27–30) 28
27. Leaves with upper surface densely strigose, hirsute or villosulous, margin distinctly serrate; calyx teeth acute to acuminate, never with a filiform apex ..... **25. C. guazumaefolia**
\+ Leaves with upper surface glabrous except for the midrib (rarely appressed puberulent), margin usually entire; rarely remotely serrulate; calyx teeth usually with a filiform apex ..... **26. C. buddleioides**
28. Inflorescence internodal and so not subtended by a leaf/bract **29. C. monosperma**
\+ Inflorescence axillary, subtended by a leaf/bract, or terminal 29
29. Flowers in capitate-glomerulate heads which are usually in racemes or panicles, sometimes solitary ..... **27. C. polycephala**
\+ Flowers in small panicles, sometimes rather densely so 30
30. Stem densely hirsute; inflorescence borne on a robust, straight, distinctly axillary peduncle; calyx usually hirsute ..... **30. C. urticifolia**
\+ Stem mostly appressed strigose or strigillose; inflorescence mostly terminal (very rarely with some additional inflorescences which are internodal or axillary); calyx usually puberulent. ..... **28. C. discolor**

1. Cordia multispicata Cham. in Linnaea 4:490 (1829). Fig. 1a.

Syn.: *C. bahiensis* DC. in A.D.C., Prodr. 9:489 (1845). Type: Brazil, Bahia, without precise locality, 1830, *Salzmann* 376 (G-DC, P).

Branchlets covered by a mixture of strigose, incurved hairs and slender, soft hairs, occasionally with dense, stiff-appressed pubescence. Leaves (6–)7–10(–13) × (3–)4–5(–7·5) cm, ovate or sometimes almost orbicular; base acute or abruptly attenuate; apex acute or acuminate; upper surface strigose to strigillose, tuberculations present and variously developed, rarely absent; undersurface tomentose; margin dentate or crenate. Petiole (3–)5–7(–15) mm, decurrent on the peduncle of the inflorescence or young branchlets. Inflorescence spicate, usually stout and densely flowered, axillary or terminal, solitary or in cluster of two or three; peduncles (1–)2–6(–9) cm. Calyx 3–5 mm, obconical-campanulate, hirsutulous towards the apices; teeth acuminate. Corolla 5–6 mm, funnelform with lobes slightly emarginate and reflexed. Stamens c.2 mm, filaments slender. Ovary c.1·5 mm; style c.2 mm in shortstyle and c.4 mm in longstyle flowers. Fruits conical.

Type: Brazil, without precise locality, *Sellow* (GH, photo).

Distribution: N and NE of Brazil.

ALAGOAS: banks of Rio São Francisco, near Piacabuçu, iii 1838, *Gardner* 1365 (K). AMAZONAS: beach at Prainha, 26 xi 1873, *J. W. Traill* 564 (K). BAHIA: 16 km de Itabuna (mun. de Ilhéus), 19 i 1965, *Belém & Mendes* 172 (UB); Bom Jesus, 1 i 1929, *Hoehne* 24015 (GH); without precise locality, 1831, Salzmann (E, K, MO); mun. de Alagoinhas, i 1944, *Schery* 481 (GH, MO); Vittoria, *Sellow* (GH); Nazaré, collector unknown (K). MARANHÃO: Ilha de São Luís, Rio Anil, 13 i 1951, *Froés* 26847 (A). PARÁ: Belém, 11 xi 1942, *Archer* 7805 (K); Belém, 2 i 1943, *Archer* 8097 (K); without precise locality, 16 xii 1907, *Baker* 41 (P); without precise locality, 30 xii 1829, *Burchell* 9987 (GH, K); Belém, iii–v 1929, *Dahlgren & Sella* 413 (GH); Belém, Vila Maguary, 17 xii 1936, *Druoet* 2088 (GH); Belém, 21 x 1940, *Ducke* 588 (MO); Marafarum, Marudá, 18 iii 1960, *Egler* 1376 (UB); Tapaná, 25–29 x 1929, *Killip & Smith* 30237 (A); Ilha do Mosqueiro, 3–9 xi 1929, *Killip & Smith* 30403 (GH); Belém, área do Instituto Agronômico do Norte, 3 xi 1959, *Kuhlmann & Jimbo* 388 (F); Jararaca, xi 1931, *Costa* 147 (GH); banks of Una creek, 15 viii 1848, *Spruce* 199 (K). PARAIBA: Escola de Agronomia do Nordeste, Areia, 13 vii 1953, *Moraes* 913 (A). PERNAMBUCO: without precise locality, 18 iv 1918, *Curran* 51 (GH).

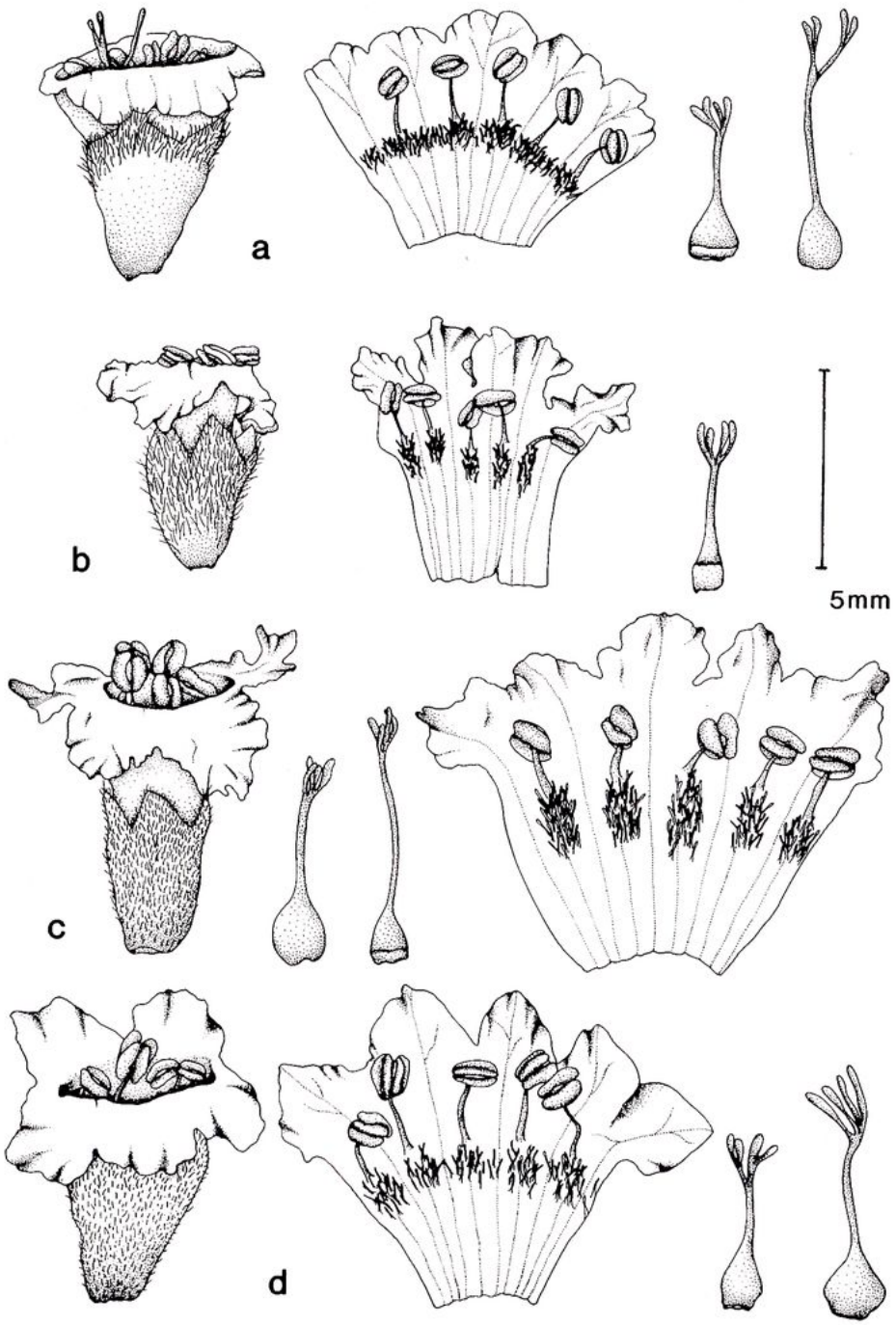

FIG. 1. Flowers, dissected corollas and gynoecia of *Cordia* subg. *Varronia:* a, *C. multispicata*, longstyle morph (*Archer* 8079, K), shortstyle gynoecium (*Drouet* 2088, GH); b, *C. intonsa*, homostyle morph (*St. Hilaire* 662, P); c, *C. curassavica*, shortstyle morph (*cult.*, STA), longstyle gynoecium (*Reitz & Klein* 12, G); d, *C. campestris*, shortstyle morph (*Eiten & Eiten* 10014, US), longstyle gynoecium (*Irwin et al.* 18906, MO).

Among the Brazilian spicate Varronias, *C. multispicata* is one of the most distinctive species. The spike is very stout and the leaf petiole is decurrent on the peduncle of the inflorescence and branchlets. *C. multispicata* differs from *C. schomburgkii*, the only other species to have this characteristic, in having stout, densely flowered spikes, in contrast to the long, laxly flowered spikes of *C. schomburgkii*.

C. bahiensis DC. is a clear synonym of *C. multispicata* since the type material is virtually identical to the type specimen of the latter.

2. Cordia schomburgkii DC. in A.DC., Prodr. 9:490 (1845).

Branchlets finely tomentose, frequently with a mixture of strigillose hairs. Leaves (4–)6–8(–10·5) × (2–)3·5–5(–7·5) cm, ovate, ovate-lanceolate or sometimes orbicular; base generally rounded; apex acute; upper surface minutely strigillose, tuberculations generally present; undersurface finely tomentose, hairs mainly on the veins; margin entire, occasionally serrate or serrulate. Petiole 6–10 mm, decurrent on the peduncle of the inflorescence or branchlets. Inflorescence spicate, very elongate, slender, loosely flowered, axillary or terminal, solitary or in clusters of two or three; peduncle (2–)4–6(–10) cm. Calyx c.4 mm, campanulate or funnelform, puberulent; teeth with acute apices. Corolla c.5 mm, funnelform with lobes very shallow, slightly reflexed. Stamens c.2 mm. Ovary 1·5 mm; style c.2 mm in shortstyle and c.3·5 mm in longstyle flowers. Fruits conical.

Type: British Guiana, without precise locality, 1838, *Schomburgk* 406 (holo. G-DC; iso. K, BM, P).

Distribution: N and WC Brazil. Forest margins and river banks.

GOIÁS: Araguaina, Belém-Brasília highway, 2 i 1970, *Eiten & Eiten* 10146 (US); ibid., 12 iii 1968, *Irwin, Maxwell & Wasshausen* 21067 (E, MO, UB). RORAIMA TERRITORY: Rio Aures, near Auaris, 9 ii 1969, *Prance et al.* 9765 (MO).

3. Cordia dardani Taroda, **species nova** *C. curassavicae* (Jacq.) Roem & Schultes, *C. intonsae* Johnston et *C. campestri.* Warm. forma corollae similis est sed foliis ovato-triangularibus et spicis laxis praesertim differt. Fig. 5a.

Branchlets densely and finely hirsutulous. Leaves 2·4–4 × 1·5–2·0 cm, triangular-ovate, ovate; base truncate; apex acute; upper surface abundantly minute strigillose; undersurface densely tomentose; margin serrulate. Petiole 5–10 mm. Inflorescence spicate, slender, somewhat lax, terminal; peduncle 2·0–3·5 cm. Calyx c.3·5 mm, obconical-campanulate, uniformly densely hirsutulous; teeth apices acute. Corolla c.6 mm, rather funnelform with lobes somewhat rounded and emarginate, slightly reflexed. Stamens c.2 mm. Ovary 1·5 mm; style c.3·5 mm in longstyle flowers (shortstyles not observed). Fruits cylindrical.

Type: Brazil, Pernambuco, estrada Salgueiro–Carqueja, Serra de São Gonçalo, 23 v 1971, *E. P. Heringer et al.* 862 (holo. UB).

Distribution: NE Brazil. Caatinga vegetation.

PERNAMBUCO: entre Carnaubeira–Belém de São Francisco, 17 v 1971, *E. P. Heringer et al.* 807 (UB).

Although *C. dardani* is known only from the type and one other collection, these specimens show clear differences which separate them from all the other spicate Varronias, viz. small triangular-ovate leaves with the upper

surface minutely strigillose and the inflorescences laxly flowered. In *C. dardani* the corolla is similar to that of *C. curassavica*, *C. intonsa* and *C. campestris*. However, these latter species have distinctly lanceolate leaves which clearly distinguish them from *C. dardani*. This species is dedicated to the memory of Dr Dardano Andrade-Lima, distinguished Brazilian botanist and specialist in the flora of the caatinga vegetation of Pernambuco and neighbouring states.

4. Cordia intonsa Johnston in Contr. Gray Herb. 92:28 (1930). Fig. 1b.
Syn.: *C. hirsuta* Fresen, Mart. Fl. bras. 8(1):19 (1857), non *C. hirsuta* Willd. (1798).

Branchlets densely soft hirsute. Leaves 4–10 × 1·2–3 cm, lanceolate to elliptic-lanceolate; base cuneate to long attenuate; apex acute; upper-surface very densely tomentose, tuberculate; undersurface densely tomentose; margin serrate to serrulate. Petiole 2–10 mm. Inflorescence spicate, densely flowered, terminal or internodal; peduncle 2–4 cm. Calyx c.4·5 mm, obconical-campanulate, densely hirsute; teeth apices acute. Corolla c.7 mm, somewhat salverform with the lobes more or less triangular and strongly reflexed, wrinkled. Stamens c.1·5 mm. Ovary 1·5 mm; style c.3 mm in longstyle flowers (shortstyle flowers and fruits not seen).
Type: Brazil. Minas Gerais, between Salgado and Vão do Paranan, ix 1818, *Martius* (B)—fide Johnston (1930).
Distribution: SE Brazil.
MINAS GERAIS: Contendas, 1816–1821, *St. Hilaire* 662 (P); Coração de Jesus, 26 xii 1963, *Jesus* 79 (UB).

The present species, formerly described by Fresenius as *Cordia hirsuta*, was correctly renamed by Johnston (1930) as *Cordia intonsa*. *C. hirsuta* Fresen. is a later homonym of *C. hirsuta* Willdenow (1798) which is a synonym of *C. nodosa* Lam. (sect. *Myxa*). *C. intonsa* very closely resembles *C. curassavica* from which it can only be distinguished by the conspicuous and densely-hirsute indumentum. The Martius type specimen at Berlin-Dahlem was probably destroyed, in which case the specimen *St. Hilaire* 662 should be chosen as neotype.

5. Cordia curassavica (Jacq.) Roem. & Schultes, Syst. Veg. 4:460 (1819). Fig. 1c.
Syn.: *Varronia curassavica* Jacq., Enum. Pl. Carib. 14 (1760).
V. macrostachya Jacq., Enum. Pl. Carib. 14 (1760). Type: not traced.
Cordia macrostachya (Jacq.) Roem. & Schultes, Syst. Veg. 4:461 (1819).
C. verbenacea DC. in A. DC., Prodr. 9:491 (1845). Type: Brazil, Rio de Janeiro, 1834, *Gaudichaud* 532 (G-DC).
C. salicinia DC. in A. DC., Prodr. 9:492 (1845). Type: Brazil, Rio de Janeiro, 1833, *Vauthier* 204 (G-DC, G, P).

Branchlets usually puberulent, sometimes strigillose or hirsutulous. Leaves (4–)6–7(–12.5) × (1–)1·5–2·5(–3) cm, varying in shape from lanceolate or ovate-lanceolate to oblong-elliptic; base long- to short-attenuate; apex acute to obtuse; upper surface commonly glabrous occasionally strigillose or hirsutulous, tuberculate; undersurface sparsely to

very dense tomentose; margin serrulate, serrate or crenulate. Petiole (2–)3–4(–10) mm. Inflorescence spicate, usually densely flowered, internodal or terminal; peduncles (1·5–)2–6(–12) cm. Calyx 3–5 mm, obconical-campanulate, puberulent, occasionally hirsutulous; teeth apices acute. Corolla 5–8 mm, funnelform or somewhat salverform; lobes deeply divided, wrinkled, strongly reflexed. Stamens 1·5–3 mm. Ovary c.2·5 mm; style c.3·6 mm in shortstyle and c.5·2 mm in longstyle flowers. Fruits conical.

Type: not traced.

Distribution: widely distributed throughout Brazil (N, NE, WC, SE, S): found in a wide range of habitats, e.g. cerrado, restinga and forest.

AMAZONAS: Rio Cauamé, afluente Rio Branco, 6 ix 1943, *Ducke* 1311 (F, GH); São Carlos, Rio Negro, 1853–54, *Spruce* 3012 (E, K). BAHIA: Barreiras, 24 xii 1954, *Black* 54-17780 (A); without precise locality, v 1866, *Blanchet* 3608 (GH, K, MO); without precise locality, 29 v 1928, *Bondar* 23566 (GH); Porto Seguro, 21 iii 1974, *Harley et al.* 17224 (K, MO); Itacaré, near the mouth of Rio das Contas, 31 iii 1974, *Harley et al* 17584 (MO); Serra do Sincorá, Lagoa Encantada, 19 km NE of Ibicoara near Brejão, 1 ii 1974, *Harley* 15790 (MO); 20 km E of Camaleão, on the Itiuba–Cansacão road, 21 ii 1974, *Harley* 16456 (MO); Serra da Água Rega, 22 km N of Seabra road to Água Rega, 26 ii 1971, *Irwin, Harley & Smith* 31109 (UB); Valley of the Rio das Ondas, c.4 km N of Barreiras, road to Sta Rita de Cassia, 5 v 1971, *Irwin, Harley & Smith* 31583 (UB); Serra do Tombador, Morro do Chapéu, c.6 km S of town of Morro do Chapéu, 18 ii 1971, *Irwin, Harley & Smith* 32447, (UB), mun. de Almadina, 18 vii 1978, *Mori, Hage & White* 10259 (UEC); Esplanada, xii 1944, *Schery* 712 (GH, MO); mun. Itabuna, 25 km of Buerarema, 10 vii 1964, *Silva* 58349; Caldeirão, x 1906, *Ule* 7263 (G, K). ESPÍRITO SANTO: Cachoeira do Itapemirim, 8 ii 1973, *Hatschbach* 31374 *& Ahumada* (K); c.60 km NW of Colatina, Vale de Pancas, 8 ix 1977, *Shepherd et al.* 5874 (F, UEC); 60 km S of Vitória, between Anchieta & Piuna, 9 ix 1977, *Shepherd et al.* 5880 (F, UEC). GOIÁS: Monte Alegre de Goiás, 13 iii 1973, *Anderson* 6979 (E, MO, UB); 50 km N of Corumbá de Goiás on road to Niquelândia, in valley of rio Maranhão, 24 i 1968, *Irwin, Maxwell & Wasshausen* 19119 (K, MO). MINAS GERAIS: c.8 km N of Gouveia on road to Diamantina, 4 ii 1972, *Anderson, Stieber & Kirkbride* (UB); Serra do Cipó, 17 ii 1972, *Anderson, Stieber & Kirkbride* 36076 (K, UB); mun. Sta Luzia, 25 x 1945, *Assis* 35 (A, GH, MO); ibid., 13 xii 1945, *Assis* 238 (GH); mun. Nova Lima, Serra da Mutuca, 10 ii 1945, *Assis* 5726 (GH); without precise locality, iv 1840, *Claussen* (K); near Paraopeba, 28 xii 1976, *Fonsêca & Fonsêca* FF6 (E, UB); S'Ana do Riacho, 25 x 1964, *Hatschbach* 35334 *& Koczicki* (MO); Paraopeba, 28 ii 1955, *Heringer* 3717 (UB); Belo Horizonte, *Holway* 1323 (A); Serra do Cipó, 135 km N of Belo Horizonte, 20 ii 1968, *Irwin et al.* 20556 (A, MO, UB); c.28 km SW of Diamantina on road to Gouveia, 15 i 1969, *Irwin et al.* 21992 (UB); Serra do Espinhaço, c.8 km W of Grão Mogol, 16 ii 1969, *Irwin et al.* 23364 (GH, MO); base of Serra da Piedade, c.35 km E of Belo Horizonte road to Caeté, 13 i 1971, *Irwin et al.* 30266 (UB); Ituiutaba, 23 i 1949, *Maciel* 2033 (MO); Belo Horizonte, 8 xi 1932, *Mello Barreto* 5139 (A); Belo Horizonte, 7 vii 1940, *Mulford & Forster* 554 (GH); mun. Jaboticatubas, km 126 Lagoa Santa–Conceicão do Mato Dentro, 14 xii 1971, *Semir & Sazima* 552 (UEC); ibid., 15 xii 1973, *Semir & Lima* 4822 (UEC); Santo Hipolito–Diamantina km 45, 30 xi 1976, *Shepherd et al.* 3834 (UEC); road Curvelo-Sete Lagoas km 40, 2 xii 1976, *Shepherd 3994* (E, UEC); Belo Horizonte, 4 iii 1945, *Williams & Assis* 5976 (GH, K); 10 km N of Belo Horizonte, 16 iii 1945, *Williams & Assis* 6041 (GH). PARANÁ: mun. Matinhoe, 5 vii 1975, *Dziewa* 151 (UEC); mun. Guaratuba, Praia do Medanha, 27 xii 1964, *Hatschbach* 12060 (K); Paranagua, 21 i 1974, *Hatschbach* 33702 (MO); ibid., 31 iii 1939, *Foster* (A); ibid., Ilha do Mar, 29 ii 1980, *Kummrow* 1363 (UEC); mun. Guaíra, Sete Quedas, 24 iii 1977, *Hatschbach* 39819 (MO, UEC); ibid., 24 i 1967, *Lindeman & Haas* 4428 (K). RIO GRANDE DO SUL: Vila Manresa, near Porto Alegre, 22 ix 1948, *Rambo* 37730 (GH); Toca do Tigre, 27 ix 1950, *Rambo* 48851 (K); without precise locality, 1832, *Tweedie* (GH). RIO DE JANEIRO: Cabo Frio, 16 x 1938, *Alston-Lutz* 27 (A); without precise locality, *Banks* 1768 (A); Nova Friburgo, 1918, *Curran* 729 (A); Niterói, 25 xii 1901, *Dusén* 144 (G, MO); Magé-Mauá beach on Guanabara bay, 20 xi 1966, *Eiten & Eiten* 7846 (US); Rio de Janeiro, *Glaziou* 4963 (A); Jacarepaguá, 29 ii 1962, *Lanna* 521 (F); Rio de Janeiro, x 1832, *MacGillivray* 323 (K); Barra da Tijuca, 7 vi 1960, *Martins* 158 (F); Guanabara, 17 viii 1961, *Martins* 224 (F); Rio de Janeiro, *Riedel* (A); Niterói, Morro do Cavalão, 17 iv 1929, *Smith & Brade* 2318 (A); Campos–Morro do Coco, 8 xii 1964, *Trinta* 1028 *& Fromm* 2104 (M); Rio de Janeiro, 1844, *Widgren* (MO). SANTA CATARINA: Itajubá, 6 i 1974, *Conrad* 2089 *& Dietrich*

(MO); Florianópolis, 15 vii 1951, *Rambo* 50304 (A); Laguna, 19 ix 1951, *Reitz & Klein* 41 (GH); Laguna, 3 vii 1952, *Reitz & Klein* 277 (GH); mun. Itajaí, 28 vi 1954, *Klein* 788 (A); ibid., 15 vii 1953, *Reitz & Klein* 822 (A); ibid., 1 x 1953, *Reitz & Klein* 1090 (A); Araguaria, Barra do Sul, 10 viii 1953, *Reitz & Klein* 915 (A); Araguari, 2 i 1954, *Reitz & Klein* 1478 (A); Palhocça, 24 ix 1953, *Reitz & Klein* 981 (A); ibid., 5 xi 1953, *Reitz & Klein* 1221 (A, G); ibid., 18 xii 1952, *Reitz* 4877 (A); Sai-Guaçu, S. Francisco, 3 i 1954, *Reitz & Klein* 1469 (A). SÃO PAULO: Santos, Ilha Queimada, 5 iv 1920, *Amaral & Domingues* 13 (A); ibid., 3 xi 1920, *Gehrt* 4530 (A); Guarujá, 17 ii 1924, *Bailey & Bailey* 942 (A); between Caraguatatuba and Ubatuba, 22 viii 1976, *Davis et al.* 59886 (E, UEC); Ilha do Cardosa, 7 ix 1976, *Davis et al.* 60653 (E, UEC); ibid., 8 ix 1976, *Davis et al.* 6071 (E, UEC); São Paulo-Cananeia, 16 ii 1965, *Eiten & Clayton* 6150 (MO, US); São Sebastião-Bertioga, 10 xi 1976, *Gibbs et al.* 3517 (UEC); Ubatuba, 1 v 1977, *Joly et al.* 6791 (UEC); ibid., 24 ix 1978, *Gibbs & Joly* 8440 (UEC); Iguape, 21 ix 1929, *Hoehne* 24269 (A); Atibaia, 6 ix 1939, *Foster* (A, US); Itanhaen, 13 ix 1894. *Loefgren & Edwall* 11307 (A); Ilha dos Alcatrazes, x 1920, *Luederwaldt & Fonseca* 11281 (GH); Guarujá, 9 i 1961, *Pedersen* 5768 (A); Ubatuba, 12 ii 1976, *Taroda* 2171 (UEC); Guarujá, 13 i 1907, *Usteri* 11280 (A).

Curiously, *C. curassavica* has never previously been cited from Brazil. Johnston (1930) in his extensive study of Brazilian Cordias did not include this species, but in his treatment of *C. verbenacea* he pointed out the close relationship of this latter species to *C. curassavica* and *C. macrostachya*; and Johnston (1935a), in a study of *Cordia* in NE South America, suggested that *C. verbenacea* should best be treated as a mere *forma* of *C. macrostachya*.

Subsequently, Johnston (1949b), when dealing with the Mexican Varronias, discussed at length the early history of *C. curassavica* and provided a long list of synonyms for this species which included *C. macrostachya*, but with no mention of *C. verbenacea*. In this discussion of *C. curassavica*, Johnston argued that *C. macrostachya* should be regarded as a 'mesophytic phase' of the species (i.e. presumably a shade-form ecotype). In fact, the broader and more membranaceous leaves described for *C. macrostachya* intergrade with the typical narrower and chartaceous leaves of *C. curassavica*.

Unfortunately, the type specimen of *C. curassavica* has not been traced, so that it is not possible to make comparison with the type material of *C. verbenacea*. However, a critical comparison of a range of material referred to *C. curassavica* from the Caribbean with specimens previously referred to *C. verbenacea* or *C. macrostachya* has not revealed any substantial character differences. It is therefore proposed to treat *C. verbenacea* and *C. macrostachya* as synonyms of the widespread species *C. curassavica*.

6. Cordia campestris Warm. in Kjoeb. Vidensk. Meddel. 1867:12, fig. 2 (1868). Fig. 1d.

Branchlets hirsute or tomentose. Leaves (4·5–)9–13(–18) × (2–)3–4(–6) cm, usually broadly elliptical, sometimes lanceolate to ovate-lanceolate; base long attenuate, somewhat oblique; apex acute; upper surface generally strigose-hirsutulous or at times hairs rigid-appressed with tubercles usually present; undersurface tomentose; margin irregularly dentate. Petiole (2–)3–7(–9) mm. Inflorescence spicate, elongate and densely flowered, terminal or occasionally internodal; peduncle 2–6 cm. Calyx 4–5·5 mm, uniformly hirsute, rarely hirsutulous, and then only distally, or puberulent; teeth with acuminate apices. Corolla 5–7 mm, funnelform to somewhat salverform; lobes more or less deeply oblong and reflexed. Stamens 2–3 mm. Ovary c.1·5 mm; style c.3 mm in shortstyle and c.6 mm in longstyle flowers. Fruits conical.

Type: Brazil, Minas Gerais, Lagoa Santa-Pinhões, 28 i 1866, *Warming* (holo. C).

Distribution: N, WC & SE Brazil. Predominantly in Minas Gerais and Goiás; cerrado vegetation.

GOIÁS: mun. de Posse, 220 km from Formosa, 8 i 1965, *Belém & Mendes* 92 (UB); mun. de Porangatu, 67 km N of Santa Tereza de Goiás, 25 xii 1969, *Eiten & Eiten* 9982 (US); mun. de Gurupi, 26 xii 1969, *Eiten & Eiten* 10014 (US); without precise locality, 1896, *Glaziou* 21781 (K); 70 km N of Corumbá de Goiás on road to Niquelândia, 20 i 1968, *Irwin, Maxwell & Wasshausen* 18906 (MO, UB); c.15 km S of Niquelândia, 22 i 1972, *Irwin et al.* 34767 (MO). MINAS GERAIS: between Várzea de Palma and Pirapora, 31 i 1965, *Belém & Mendes* 439 (UB); without precise locality, 1838, *Claussen* 221 (P); c.25 km W of Montes Claros, road to Água Boa, 23 ii 1969, *Irwin et al.* 23717 (UB); c.48 km W of Montes Claros, road to Água Boa, 26 ii 1969, *Irwin et al.* 23944 (UB); Serra do Cabral, c.3 km E of Cantoni, 10 ii 1970, *Irwin et al.* 27723 (K, UB); c.5 km SE of Paracatú, 6 ii 1970, *Irwin et al.* 26212 (UB); Formigas, 1816–1821, *St. Hilaire* (P); Lagoa Santa, 1868, *Warming* (P). PARÁ: Belém, 3 xii 1963, *Silva* 57801 (UB).

The species shows strong affinities to *C. curassavica*, but is easily distinguished by its long acuminate calyx. *C. campestris* also resembles *C. multispicata* in leaf size and dentation, but is easily distinguished since the latter species has the peduncle of the inflorescence decurrent on the petiole of the subtended leaf.

7. Cordia paucidentata Fresen., Mart. Fl. bras. 8(1):25 (1857). Fig. 2a.

Syn.: *C. sessilifolia* var. *macrantha* Cham., Linnaea 8:130 (1833).

Branchlets densely hirsute, mixed with appressed, strigose hairs. Leaves 3·5–8·5 × 1·3–2·3 cm, oblanceolate; base long-attenuate; apex acute; upper surface densely strigose, usually with well-developed tuberculae; undersurface densely strigose; margin dentate to crenate. Petiole lacking. Inflorescence capitate globose, congested, terminal or internodal; peduncle 2·5–10 cm. Calyx c.11 mm, obconical-campanulate, puberulent at the base, densely hirsute towards the apex; teeth each prolonged into a long filiform apex. Corolla c.3 cm, funnelform, the lobes very shallow. Stamens c.6 mm, inserted at different levels on the corolla tube. Ovary c.2 mm, style c.18 mm (longstyle). Fruits cylindrical.

Type: Brazil, without precise locality, *Sellow* (K).

Distribution: WC and S Brazil, extending westwards to Paraguay where it has been more frequently collected.

MATO GROSSO DO SUL: mun. Rio Brilhante, 16 ii 1970, *Hatschbach* 23620 (MO); mun. Rio Brilhante, 24 i 1971, *Hatschbach* 26095 (K). RIO GRANDE DO SUL: without precise locality, 1816–1821, *St. Hilaire* 2586, 2667 & 2697 (P).

Fresenius (1857) based his new species on *C. sessilifolia* var. *macrantha* Cham., which is specifically distinct from *C. sessilifolia* as is particularly evident in the conspicuous difference in corolla size (3 cm versus 1·3 cm in *C. sessilifolia*).

Cordia paucidentata is distinctive among the large-flowered Brazilian Varronia species in having sessile leaves. There is some variation in the indentation of the leaf margin and the shape of the calyx teeth, but otherwise the species is unexceptional. Insufficient material was available for dissection to determine the length of the style of the shortstyle morph.

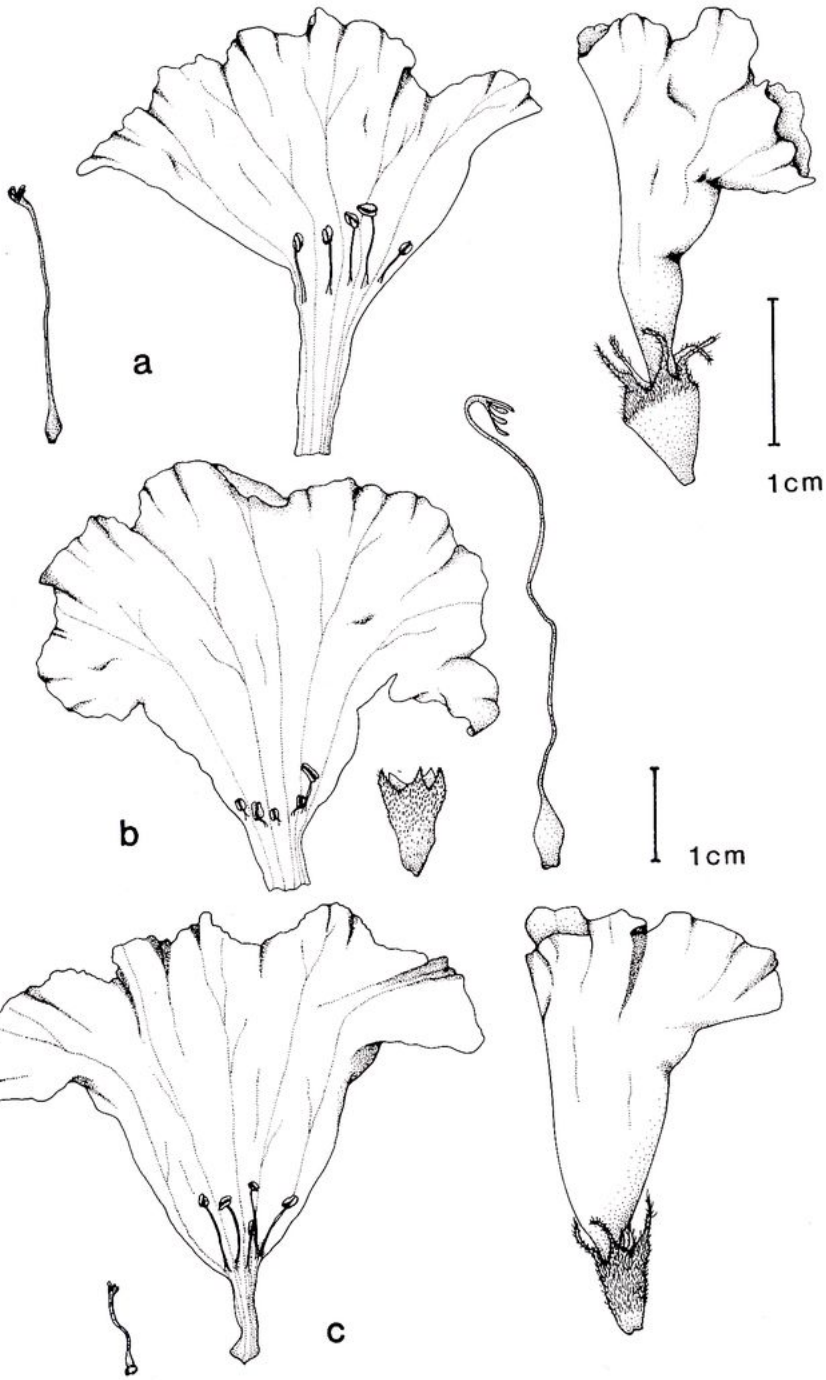

FIG. 2. Flowers, dissected corollas and gynoecia of *Cordia* subg. *Varronia:* a, *C. paucidentata*, longstyle(?) morph (*Hatschbach* 23632, MO); b, *C. leucocephala*, longstyle morph (*Eiten & Eiten* 10851, US); c, *C. grandiflora*, shortstyle(?) morph (*Rusby & Squires* 14, GH).

8. Cordia grandiflora (Desv.) H.B.K., Nov. Gen. et sp. [ed. quarto] 3:77 (1818). Fig. 2c.

Syn.: *Varronia grandiflora* Desv. in J. Bot. (Desvaux) 1:273 (1809).

Branchlets more or less densely long-strigose or with appressed setaceous hairs. Leaves (6–)7–9(–11) × (2·5–)3·5–5(–6) cm, triangular-ovate; base abruptly attenuate; apex acute or slightly acuminate, mucronate; upper surface densely setaceous-strigose; undersurface tomentose; margin crenate. Petiole 1–2 cm. Inflorescence capitate globose, densely flowered, terminal or sometimes internodal; peduncles 4–10 cm. Calyx 10–20 mm, cylindrical-campanulate, densely appressed setaceous-strigose; teeth each prolonged into a very long filiform apex. Corolla 3·5–5 cm, funnelform with a narrow cylindrical tube 8–10 × 2–2·5 mm which expands to a throat 2–2·7 × 1·2–1·6 cm; lobes very shallow and emarginate. Stamens 5–10 mm, inserted at different levels on the corolla tube. Ovary c.3·5 mm; style c.7·5 mm (shortstyle). Fruits cylindrical.

Type: Venezuela, Rio Apure, *Humboldt & Bonpland* 805 (P).

Distribution: In Brazil the species is known only from Pará.

PARÁ: Cacaual grande, Canal Maroja Netto, Rio Amazonas, 10 ii 1952, *Black* 52-15617 (A); Cacaual grande, Santarém, 19 xi 1949, *Murça Pires* 1811 (A); Óbidos, xii 1849, *Spruce* 515 (E, G, K).

Cordia grandiflora is distinctive in having the largest flowers of the species of subg. *Varronia*. The combination of white, funnelform flowers of 3·5–5 cm, setaceous-pubescent calyx with a long filiform apex and triangular-ovate leaves with abruptly attenuate base and crenate margin render this species easily recognizable. Insufficient flowers were available for dissection to determine the length of the longstyle morph.

9. Cordia leucocephala Moricand, Pl. Nouv. Amér. 148, t. 88 (1846). Fig. 2b.

Syn.: *C. leucocalyx* Fresen., Mart. Fl. bras. 8(1):22, t. 7 (1857). Type: not traced. However, the illustration (t. 7) provided by Fresenius (1857), clearly shows this to be a synonym of *C. leucocephala*.

C. affinis Fresen., Mart. Fl. bras. 8(1):22 (1857). Type: Brazil, Bahia, cachoeira, 1819, *Martius* (iso. B)—fide Johnson (1930).

C. nivea Fresen., Mart. Fl. bras. 8(1):26 (1857). Type: Brazil, Bahia, Serra do Assuruá, 1838, *Blanchet* 2854 (K, BM).

Branchlets with dense, minute, canescent hairs mixed with sparse, hirsute or appressed, strigose hairs. Leaves 7–11 × 3·5–5·5 mm, ovate to ovate-lanceolate; base obtuse to rounded, slightly oblique; apex acute to acuminate; upper surface strigose and finely puberulent; undersurface sparsely tomentose; margin finely and irregularly serrulate. Petiole 10–20 mm. Inflorescence capitate, globose-congested, terminal or internodal; peduncles 3·5–6 cm. Calyx c.8 mm, obconical-campanulate, finely and densely tomentose at the apex mixed with sparse strigose or hirsute hairs; teeth shortly apiculate. Corolla 2·5–3·5 cm, funnelform; lobes very shallow, emarginate. Stamens 2–4 mm. Ovary c.4 mm, style c.3 cm (longstyle). Fruits not seen.

Type: Brazil, Bahia, Pouco d'Areia near Jacobina, *Blanchet* 3880 (holo. G; iso. P, BM).

Distribution: NE Brazil. In caatinga vegetation and on sandy soils.

BAHIA: Serra Assuruá, Rio São Francisco, 1838, *Blanchet* 2854 (BM, G, K); Pouco d'Areia, vi 1844, *Blanchet* 3879 (G); BA630 highway, 23 km S of Aracatatu between Vitória da Conquista and Brumado, 13 i 1974, *Harley* 15021 (K); 64 km N of Senhor do Bonfim on BA130 highway to Juazeiro, 25 ii 1974, *Harley* 16311 (K); 26 km NW of Lagoinha on side road to Minas do Mimoso, 7 iii 1974, *Harley* 16904 (K); road Petrolina–Remanso, 25 iv 1971, *Heringer et al.* 361 (UB). PARAÍBA: Baia da Traição, 6 ii 1933, *Ihering* 14 (BH). PERNAMBUCO: mun. de Araripina, 6 iii 1970, *Eiten & Eiten* 10851 (K, US). PIAUÍ: Boa Esperança, vii 1839, *Gardner* 2265 (BM, K).

The combination of characters of minutely serrulate leaf margin, calyx with felty, whitish pubescence mixed with coarser hairs and teeth which lack a long, linear apex differentiates *C. leucocephala* from the other two related large-flowered *Varronia* species, *C. grandiflora* and *C. paucidentata*. Although *C. leucocephala* is not a particularly variable taxon, Fresenius (1857) in his treatment of the Brazilian Cordias described three 'splinter' species related to this taxon. The present account agrees with Johnston (1930) in treating these as synonyms of *C. leucocephala*. As with *C. paucidentata* and *C. grandiflora*, insufficient flowers were available on the specimens studied to permit dissections to determine the length of the style in both morphs.

10. Cordia longifolia A.DC., Prodr. 9:495 (1845). Fig. 4b.

Branchlets glabrous, puberulent on the young parts. Leaves 9–20 × 2–5 cm, lanceolate elliptic; base acute; apex acuminate to caudate; upper surface glabrous, occasionally sparsely tuberculate; undersurface glabrous; margin entire, undulate. Petiole 3–10 mm. Inflorescence capitate slightly elongate, densely flowered, terminal or internodal; peduncles 4–7 mm. Calyx c.7 mm, funnelform, glabrous-puberulent; teeth apices acute. Corolla c.2 cm, salverform with lobes deeply divided, wrinkled. Stamens c.2 mm and inserted at the top of corolla tube. Ovary c.2 mm; style c.6 mm. Fruits cylindrical.

Type: Brazil, Bahia, 1834, *Blanchet* 1739 (holo. G-DC; iso. BM, G, K).

Distribution: known only from Bahia.

BAHIA: without precise locality, *Blanchet* 268 (G); without precise locality, 1840, *Blanchet* 3190 (G); Muritiba, 1847, *Blanchet* 3986 (G, K, MO); Feira de S. Ana, *Blanchet* (G); Almadina, 17 vii 1978, *Mori, Hage & White* 10275 (F).

Cordia longifolia is very distinct since it is the only species of subg. *Varronia* which is almost totally glabrous. It most closely resembles *C. poliophylla*: both species have a funnel-shaped calyx and corolla with a very narrow tube which expands abruptly into a well-developed limb with deeply divided lobes, and also stamens with very short filaments inserted in the mouth of the corolla tube (see also observations under *C. poliophylla*.) It is not known whether the species is heterostylous.

11. Cordia poliophylla Fresen., Mart. Fl. bras. 8(1):26 (1857). Fig. 4c.

Branchlets densely covered with short, incurved hairs. Leaves 7–13 × 1·9–3 cm, lanceolate or elliptic; base acute or cuneate; apex acute; upper surface subglabrous, sparsely strigillose or strigose, sometimes tuberculate; undersurface finely and densely tomentellose or tomentose; margin subentire or very sparsely serrate, usually slightly revolute. Petiole 3–10 mm. Inflorescence capitate globose, occasionally slightly elongate, densely flowered, terminal or internodal; peduncles 2·5–3·5 cm. Calyx c.7 mm,

funnelform, puberulent or sericeous-canescent; teeth apices acuminate. Corolla 1·5–2 cm, salverform; lobes deeply divided, emarginate. Stamens c.2 mm, inserted at the top of corolla tube. Ovary c.2 mm; style c.8 mm. Fruits not seen.
Type: Brazil, 'in silvarum Oceano conterminarum margine et in saepilus inter Victoria et Bahiam': *Sellow* (G photo.).
Distribution: NE Brazil. Known only from Bahia, in forests.
BAHIA: between Itirucu and Maracás, 22 i 1965, *Belém & Mendes* 227 (UB); Belmonte, 6 vii 1966, *Belém & Pinheiro* 2468 (UB); ibid., 31 i 1967. *Belém & Pinheiro* 3226 (UB); without precise locality, *Blanchet* (G); c.26 km SW of Belmonte along road to Itapebi, 25 iii 1974, *Harley* 1736 (K).

Cordia poliophylla and *C. longifolia* differ from the other Brazilian species of subg. *Varronia* in having brochidodromous rather than craspedodromous leaf venation. This character gives a marked difference to the appearance of the leaves and the plants as a whole. The flowers in these two species are also distinctive because of the deeply divided corolla lobes: in the other large-flowered Varronias (*C. grandiflora*, *C. leucocephala* and *C. paucidentata*) the corolla lobes are shallow. Furthermore, these latter species have staminal filaments which are inserted at different levels in the corolla tube whereas in *C. poliophylla* and *C. longifolia* the stamens are all inserted at the top of the corolla tube. Because of these features *C. longifolia* and *C. poliophylla* stand apart from the other species of subg. *Varronia*. However, they do share capitate-globose to shortly cylindrical inflorescences and 3-porate, reticulate pollen grains with the other species. Insufficient flowering material was available to determine whether *C. poliophylla* is heterostylous.

12. Cordia setigera Johnston in J. Arnold Arb. 16:176 (1935).

Branchlets strigillose. Leaves 2·5–6·5 × 1·0–2·5 cm; elliptic; base and apex acute; upper surface sparse to densely strigose and conspicuously tuberculate; undersurface densely strigose; margin serrate. Petiole 1·5 mm. Inflorescence capitate globose, more or less densely flowered, terminal or internodal; peduncles 1–7 cm. Calyx c.6 mm, tubular-campanulate, uniformly appressed strigose; teeth each prolonged into a filiform apex. Corolla 1·5–1·8 cm, funnelform.
Type: Brazil, Minas Gerais, near fazenda Bom Jardim, rio Jequitinhonha, 1817, *St. Hilaire* B[1] 1478 (holo. P).
Distribution: known only from the type specimen.

Although only known from the type collection *Cordia setigera* seems to be a good species. Some specimens of *C. paucidentata* resemble *C. setigera* in leaf shape and distinctly tuberculate leaf upper surface, but the slender habit, and uniformly sparsely strigose calyx of *C. setigera* clearly distinguish it from *C. paucidentata*.

The type material is very sparsely flowered and a dissection could not be made. Johnston (1935b) did not give any information with regard to the stamens, ovary and style of this species.

13. Cordia villicaulis Fresen., Mart. Fl. bras. 8(1):24 (1857). Fig. 3a.
Syn.: *C. villicaulus* var. *tomentosa* Chodat & Hassler in Bull. Herb. Boiss. sér. 2, 5:481 (1905). Type: Paraguay, rio Corrientes, Yerbales, sierra de Maracayú, *Hassler* 5848 (G, BM).

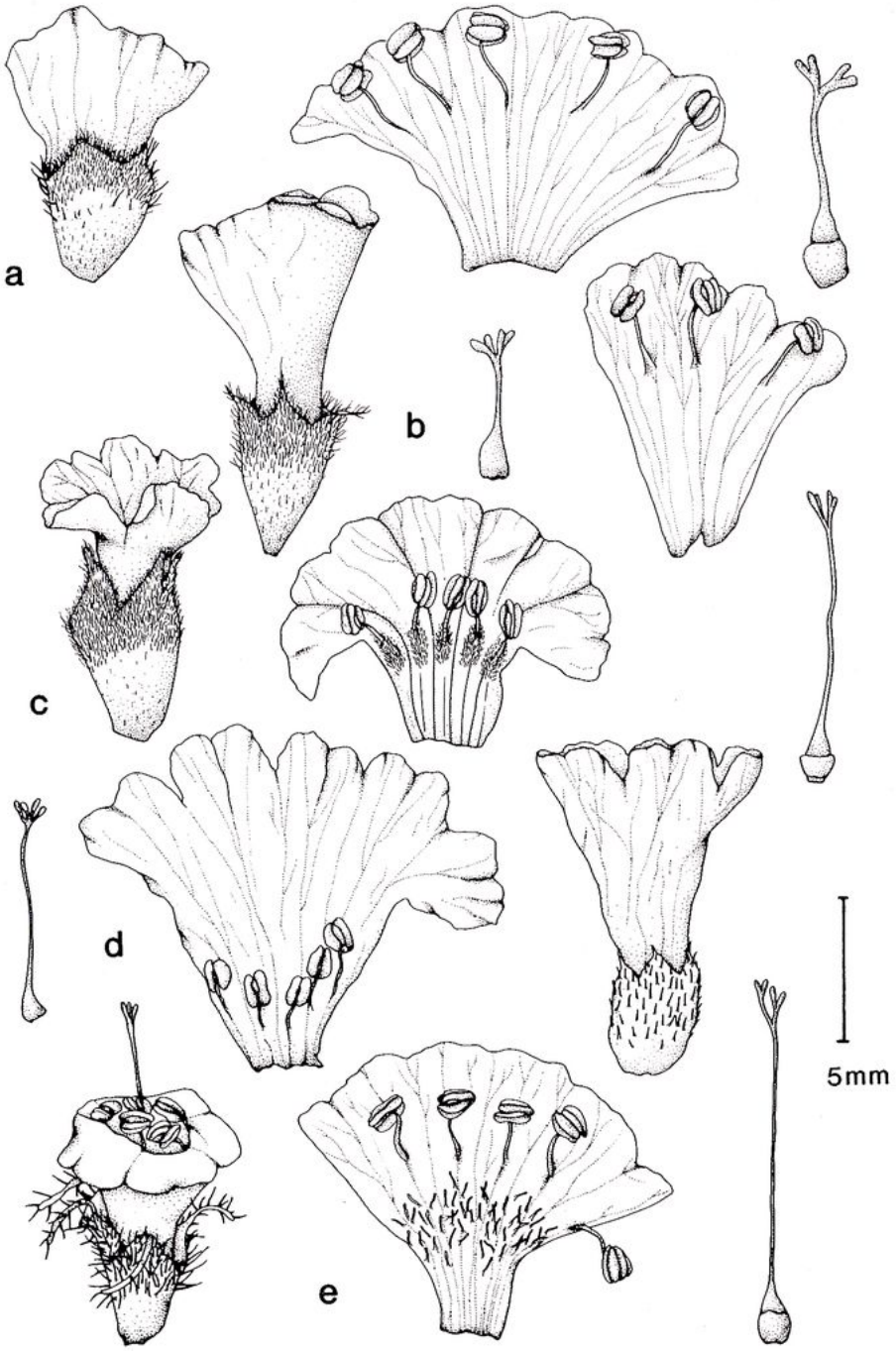

FIG. 3. Flowers, dissected corollas and gynoecia of *Cordia* subg. *Varronia:* a, *C. villicaulis*, homostyle(?) morph (*Dusén* 10936, MO); b, *C. sessilifolia* (fragment of dissected corolla), shortstyle morph (*Sellow* s.n., K); c, *C. truncata*, longstyle morph (*Tax. class of UB* 538, UB); d, *C. bracelinae*, longstyle morph (*Mexia* 5617, G); e, *C. calocephala*. longstyle morph (*Philcox et al.* 3141, MO).

C. caaguazuensis Chodat in Bull. Soc. Bot. Genève, sér. 2, 12:216 (1920). Type: Paraguay, Caaguazú, 5 x 1905, *Hassler* 9108 (G, BM, K).

C. sessilifolia var. *tomentosa* (Chodat & Hassler) Johnston in Contr. Gray Herb. 92:39 (1930).

Branchlets densely strigose or hirsute. Leaves 4–9 × 2·5–5·5 cm, generally broadly elliptic or obovate; base obtuse or cuneate; apex obtuse or rounded; upper surface with sparsely to densely appressed setaceous hairs; lower surface very densely villosulous; margin crenate. Petiole c.2 mm or lacking. Inflorescence capitate elongate-cylindrical, densely flowered, terminal; peduncles 3–6 cm. Calyx c.7 mm, obconical-campanulate, teeth apices acute; puberulent at the base, becoming densely brownish-hirsute towards the apex. Corolla c.10 mm, funnelform; lobes very shallow and inconspicuous. Stamens c.4 mm. Ovary c.3·5 mm, style c.5·5 mm. Fruits not seen.
Type: Brazil, Goiás, serra de São Pedro, near rio Paranaíba, *Pohl* 1740 (K).
Distribution: EC Brazil (type locality in Goiás State) extending to Paraná (S), and also, according to Johnston (1980) the SE (São Paulo State) and westwards to Paraguay. A very poorly collected species despite this extensive distribution.

PARANÁ: between Tingés and Itararé, 10 xii 1910, *Dusén* 10936 (GH, K, MO).

Cordia villicaulis, together with *C. villicaulis* var. *tomentosa* was treated by Johnston (1930) as a synonym of *C. sessilifolia* var. *tomentosa* on the grounds that *C. villicaulis* was merely a broad-leaved variety of *C. sessilifolia*. However, although *C. villicaulis* resembles *C. sessilifolia* s. str. in general features and floral morphology they can be distinguished by a number of characters: the inflorescence, in *C. villicaulis*, is distinctly elongate, the calyx teeth lack filiform apices and the leaves are usually broader (i.e. more than 3 cm wide) and have crenate margins; in contrast, *C. sessilifolia* has a globose inflorescence, in most specimens the calyx teeth are prolonged into filiform apices, and the leaves are generally narrow (1–2·6 cm wide) with serrate margins. Type material of *C. caaguazuensis* has been examined and since this falls completely within the range of variation of *C. villicaulis* it must be regarded as a synonym of this species.

14. Cordia sessilifolia Cham. in Linnaea 4:488 (1829). Fig. 3b.

Syn.: *C. sessilifolia* var. *micrantha* Cham. in Linnaea 4:129 (1933). Type: not traced.

Branchlets densely hirsute. Leaves 4–10 × 1–2·6 cm, generally narrowly lanceolate but sometimes broadly so; base cuneate or acute; apex acute or obtuse; upper surface usually densely hirsute but in some specimens the hairs become somewhat appressed; undersurface densely hirsute or tomentose; margin irregularly serrate. Petiole lacking. Inflorescence capitate globose, very rarely slightly elongate, congested, terminal; peduncles 1–5 cm. Calyx c.8 mm, obconical campanulate, puberulent at the base, densely hirsute towards the apex; teeth usually prolonged into filiform apices but sometimes merely long-acuminate. Corolla c.1·3 cm, funnelform; lobes very shallow, emarginate. Stamens c.2 mm. Ovary c.2 mm; style c.4 mm in shortstyle and c.12 mm in longstyle flowers. Fruits cylindrical.
Type: Brazil, Minas Gerais, Quartel de S. Antonio, 1818, *Sellow* B1562, C.655 (GH phototype).

Distribution: WC and SE Brazil. In cerrado vegetation.

GOIÁS: Serra Geral do Paraná, 3 km by road S of São João da Aliança, 23 iii 1973, *Anderson* 7845 (UB); Chapada dos Veadeiros, Alto de Paraíso, 21 iii 1969, *Irwin et al.* 24825 (UB). MINAS GERAIS: 7·5 km by road W of Rio Pandeiros on road from Januária to Serra das Araras, 18 iv 1973, *Anderson* 9048 (UB); Pirapora, 19 vii 1937, *Burret, Brade & Mello Barreto* 1-155 (GH); without precise locality, *Gaudichaud* 1778 (P). SÃO PAULO: without precise locality, 18 iv 1848, *Regnell* III 910 (P). INDEFINITE: 1816-1821, *St. Hilaire* (P); *Sellow* (K, P).

15. Cordia truncata Fresen., Mart. Fl. bras. 8(1):25 (1857). Fig. 3c.

Branchlets generally appressed-setose but occasionally becoming somewhat hirsute with spreading hairs towards the apex. Leaves (2·4–)5·5–7·5(–10) × (1–)2–3(–4) cm, usually obovate or ovate, sometimes lanceolate; base cuneate to long cuneate; apex obtuse to acute; upper surface more or less appressed setose; undersurface tomentose or somewhat villous (rarely, the hairs rigid and bristle-like); margin dentate to serrate or finely serrate. Petiole lacking. Inflorescence capitate clavate, shortly cylindrical or occasionally spherical, congested, terminal or sometimes internodal; peduncles 2–7 mm. Calyx c.7 mm obconical-campanulate, teeth with acuminate apices, puberulent at the base, densely hirsute towards the apex. Corolla c.10 mm, funnelform; lobes very shallow and emarginate; limb reflexed. Stamens 2–3 mm. Ovary c.2 mm; style c.4 mm in shortstyle and c.9 mm in longstyle flowers. Fruits conical.

Type: Brazil, Goiás, Serra dos Cristais, *Pohl* 1741 (holo. K).

Distribution: WC and SE Brazil. In cerrado vegetation.

FEDERAL DISTRICT: fazenda Água Limpa, 22 i 1980, *Cesar* 51 (E, UB); Brasília, 17 ii 1975, *Hatschbach et al.* 36213 (MO); ibid., 30 i 1975, *Heringer* 14445 (UB, UEC); ibid., xi 1967, *Lima* 28 (UB); ibid., 17 x 1965, *Sucre* 861 (UB); ibid., x–xi 1971, *Taxonomy class of UB* 298 (UB); ibid., 16 x 1977, *Taxonomy class of UB* 538 (UB). GOIÁS: Rio Cristal, 44 km by road SE of Cristalina, 6 iv 1973, *Anderson* 8285 (UB); Chico-Lobo-Rio Torto, 19 xi 1894, *Glaziou* 21779 (G, K, P); Portolândia, 15 ii 1974, *Hatschbach* 34238 (MO); Serra do Rio Petro, 16 xi 1965, *Irwin, Souza & Santos* 10306 (UB); ibid., 19 xi 1965, *Irwin, Souza & Santos* 10545 (UB); Serra dos Cristais, 6 ii 1966, *Irwin et al.* 13609 (UB); ibid., 3 km W of Cristalina, 3 xi 1965, *Irwin, Souza & Santos* 9835 (UB); ibid., 10 km W of Cristalina, 5 v 1966, *Irwin et al.* 13457 (UB); Contraforte Central, Serra do Facão, 25 i 1970, *Irwin et al.* 25346 (K, UB); Morro da Igrejinha, c. 5 km SE of Planaltina, 18 ii 1970, *Irwin et al.* 26371 (UB). MATO GROSSO DO SUL: Campo Grande–Aquidauana highway, 25 i 1979, *Leitão Filho et al.* 9315 (UEC). MINAS GERAIS: without precise locality, iii 1839, *Claussen* 220 (G, GH, P); Paraopeba, 3 xi 1954, *Heringer* 3669 (UB); Serra dos Óculos, c. 70 km N of Patrocínio, 1 ii 1970, *Irwin et al.* 25843 (UB); Serra da Anta, 3 ii 1970, *Irwin et al.* 25854 (GH, MO, UB); mun. Ituiutaba, 6 xi 1948, *Macedo* 1331 (MO); mun. Brejo das Almas, Serra do Catuni, 10 xi 1938, *Markgraf* 3228, *Brade & Mello Barreto* (GH). SÃO PAULO: mun. Botucatu, 17 ii 1972, *Gottsberger* 89R-17272 (K).

Cordia truncata seems to be a well delimited species. A few specimens which have spherical rather than the more typical clavate or shortly cylindrical inflorescence and also lanceolate rather than obovate to ovate leaves approach *C. sessilifolia*. However, these specimens retain the appressed hairy stem and soft, whitish pubescence of the calyx of *C. truncata*, in contrast to the distinctly hirsute stem and rigid, brownish pubescence of the calyx of *C. sessilifolia*.

16. Cordia bracelinae Johnston in J. Arnold Arb. 16:177 (1935). Fig. 3d.

Branchlets abundantly appressed strigose. Leaves 2–4 × 0·1–1·6 cm, obovate or elliptic; base long-attenuate; apex obtuse to rounded; upper surface sparsely but uniformly rigid-strigose, usually distinctly tuberculate; lower surface also sparsely and uniformly rigid-strigose; margin serrate.

Petiole lacking. Inflorescence capitate globose, more or less densely flowered, terminal; peduncle 2–7·5 cm. Calyx c.5 mm, obconical-campanulate, puberulent at the base and appressed rigid-strigose towards the apex; teeth apices shortly subulate. Corolla c.1·2 cm, funnelform; lobes emarginate. Stamens 2–3 mm, two of them inserted at a lower, two at an intermediate and one at a higher level. Ovary 1·5 mm; style c.6·5 mm. Fruits cylindrical.

Type: Brazil, Minas Gerais, Corinto beyond Retiro, fazenda do Diamante, 14 iv 1931, *Mexia* 5617 (holo. GH; iso. A, K, G, MO).

Distribution: known only from the type collections.

Cordia bracelinae is a distinctive species because of its much branched, low, spreading habit and its uniformly short, rigid-strigose leaves. It resembles *C. paucidentata* in the sparsely dentate leaf margin but not in any other characters. Apparently it is heterostylous but there is insufficient material to verify this.

17. Cordia calocephala Cham. in Linnaea 4:488 (1829). Fig. 3e.

Branchlets dense hirsute or softly hirsutulous. Leaves (4–)5–8(–10) × (2·5–)3·5–5(–6) cm, usually broadly ovate, rarely elliptical; base abruptly shortly attenuate; apex rounded or obtuse; upper surface commonly villosulous, but occasionally the hairs become appressed and more rigid; lower surface usually densely tomentose, sometimes hirsute or villosulous, canescent; margin dentate or serrate. Petiole (0·5–)0·7–1·2(–3) cm. Inflorescence capitate-clavate or cylindrical, sometimes spherical, very congested, terminal; peduncles (1·5–)4–7(–9) cm. Calyx 5–6 mm, obconical, glabrous at the base, densely hirsute towards the apex. Corolla 10–12 mm, funnelform; lobes very shallow and emarginate, the limb strongly reflexed. Stamens c.4 mm. Ovary c.2·5 mm; style c.9 mm in shortstyle and c.15 mm in longestyle flowers. Fruits cylindrical.

Type: Brazil, without precise locality, *Sellow* 5611 (GH, photo.).

Distribution: WC and SE Brazil. In cerrado vegetation.

FEDERAL DISTRICT: Brasília, 3 ii 1960, *Irwin et al.* 12227 (MO); GOIÁS: Chapada dos Veadeiros, 21 xii 1968, *Harley & Barroso* 11444 (K); ibid., 6–7 km E of Alto Paraíso, 13 iii 1973, *Anderson* 6997 (E, MO); ibid., 5 km from Alto Paraíso, 24 i 1979, *Gates & Eastbrook* 15 (UB); ibid., at 10 km, 18 iii 1976, *Semir* 993 (UEC); ibid., Alto Paraíso, *Barroso & Lima* 820 (UB); ibid., 12 km S of Cavalcante, 9 iii 1969, *Irwin et al* 24166 (UB); between Chico-Lobo and Rio Torto, 19 xi 1894, *Glaziou* 21780 (K, P); Serra Dourada, 19 i 1966, *Irwin, Souza & Santos* 11785 (K, UB); near Almas, 1839, *Gardner* 3366 (K); without precise locality, *Gardner* 3912 (K); ibid., 1841, *Gardner* 3913 (K). MATO GROSSO: Serra do Roncador, mun. Barra do Garças, 6 xii 1969, *Eiten & Eiten* 9776 (UB); ibid., c.1 km SE of km 264, Xavantina–Cachimbo road, 19 xi 1967, *Philcox, Ramos & Souza* 3141 (MO). MINAS GERAIS: without precise locality, 1838, *Claussen* 222 (GH, P); Caldas, 27 xii 1862, *Regnell* III 213 (MO); without precise locality, 1816–1821, *St. Hilaire* C[1] 298 (P); Lagoa Santa, *Warming* (P). SÃO PAULO: without precise locality, *Breice* (P). INDEFINITE: *Burchell* 6699, 8300 (K); *Lund* s.n. (GH).

Cordia calocephala can be distinguished by the following combination of characters: robust habit; extremely congested, usually elongate, more or less cylindrical inflorescence; calyx teeth prolonged into long filiform apices; and leaves which are broadly ovate and densely hairy. *C. villicaulis* resembles *C. calocephala* in the elongate, brownish inflorescence, but the former species is readily distinguished by its sessile or subsessile leaves and absence of filiform calyx teeth.

18. Cordia corchorifolia A.DC., Prodr. 9:496 (1845). Fig. 5c.

Branchlets finely and densely covered by stipitate glands, mixed with sparse, hirsute indumentum. Leaves 2·3–5 × 1–2 cm, commonly ovate; base truncate or obscurely cordate; apex acuminate; upper surface strigillose or strigose mixed with an abundant covering of stipitate glands; undersurface sparsely strigose and strigillose, usually with abundant stipitate glands although in some specimens these are restricted to the midrib and veins; margins serrate, rarely subentire. Petiole 3–12 mm. Inflorescence capitate globose, lax to densely flowered, terminal or internodal; peduncle 6–25 mm. Calyx c.5 mm, campanulate with the teeth prolonged into rather long filiform apices, sparsely strigose and densely glandular, the margin barbellate. Corolla c.7 mm, funnelform; lobes shallow, inconspicuous. Stamens c.2 mm long. Ovary c.2 mm; style c.3·5 mm. Fruits not seen.
Type: Brazil, without precise locality, *Douville* (holo. G-DC).
Distribution: NE Brazil.

ALAGOAS: banks of Rio S. Francisco near Penedo, iii 1838, *Gardner* 1364 (BM, G, K). BAHIA: without precise locality, 1833, *Blanchet* 1073 (DC); ibid., *Blanchet* 2073 (G); ibid., 1856, *Blanchet* (G).

Flowers apparently heterostylous but insufficient flowering specimens available to determine this.

19. Cordia caput-medusae Taub. in Bot. Jahrb. 15(38):15 (1893).
Syn.: *Varronia caput-medusae* (Taub.) Friesen in Bull. Soc. Bot. Genève, sér. 2, 24:149 (1933).

Branchlets finely covered by stipulate glands mixed with some sparse hirsute hairs. Leaves 4–7 × 2–3 cm, ovate; base shortly truncate or slightly cordate; apex acute to acuminate; upper surface densely hirsute mixed with stipitate glands; undersurface less densely hirsute also mixed with stipitate glands; margin irregularly serrate. Petiole 5–15 mm. Inflorescence capitate-globose, congested, terminal or axillary; peduncles 2–3·5 cm long. Calyx obconical-campanulate with the teeth prolonged into filiform apices. No flowers were available for dissection.
Type: Brazil, Minas Gerais, Gandarela, *Glaziou* (iso. K).

Known only from the type collection. *C. caput-medusae* has the distinctive finely stipitate-glandular indumentum which is found only in *C. corchorifolia* and both species also have a similar leaf morphology. *C. caput-medusae* is distinguished by its larger, congested multiflowered inflorescence and the densely hirsute (puberulent in *C. corchorifolia*) calyx.

20. Cordia globosa (Jacq.) H.B.K., Nov. Gen. et Sp. [ed. quarto] 3:76 (1818).
Syn.: *Varronia globosa* Jacq., Enum. Syst. pl. 14 (1760).

Branchlets appressed strigose or hirsute, mixed with very short and fine hairs. Leaves 1·5–9·2 × 0·8–3·5 cm, usually ovate or narrowly elliptic; base acute to truncate; apex acute to obtuse; upper surface strigose or hirsute and sometimes distinctly tuberculate; undersurface hirsute; margin serrate to serrulate. Petiole 3–4 mm. Inflorescence capitate globose, densely flowered, terminal or internodal; peduncle 1–5 cm. Calyx 4–6 mm, obconical, puberulent at the base, softly appressed hirsute towards the apex, becoming

denser at the margins of the teeth, which are prolonged into filiform apices. Corolla 6–10 mm, funnelform; lobes very shallow, emarginate. Stamens c.2 mm. Ovary c.1·5 mm; style c.4 mm in shortstyle and c.8·5 mm in longstyle flowers. Fruits globose.

Type: Not traced; according to Johnston (1949b) the type of *Varronia globosa* Jacq. is not preserved.

Distribution: NE Brazil. In caatinga vegetation.

ALAGOAS: without precise locality, 1838, *Gardner* 1367 (K). BAHIA: Serra de Itiúba about 6 km E of Itiúba, 19 ii 1974, *Harley et al.* 16194 (K); 64 km N of Senhor do Bonfim on the BA130 highway to Juazeiro, 25 ii 1974, *Harley et al.* 16345 (K). CEARÁ: Serra do Poicinho, 16 ii 1957, *Guédes* 421 (UB). PERNAMBUCO: without precise locality, ii 1838, *Gardner* 1367 (K); vicinity of Petrolina, 18 iv 1971, *Heringer et al.* 94 (UB); Tapera, 30 iii 1932, *Pickel* 2966 (GH); Tapera, 18 vii 1932, *Pickel* 3048 (GH, P). FERNANDO DE NORONHA TERRITORY: 20 viii 1887, *Ridley & Ramage* 89 (K).

According to Johnston (1949b) this is a wide-ranging species distributed through Florida, Central America, Caribbean islands and Northern South America. Johnston (1949b) recognized two varieties but only the typical variety occurs in Brazil. The Brazilian material which has been studied in the present account is relatively homogeneous, varying only slightly in the length of the filiform apex of the calyx.

21. Cordina leucomalla Taub. in Bot. Jahrb. 15(38):14 (1893).

Branchlets hirsute, with a dense admixture of fine whitish hairs towards the apex. Leaves 8–12 × 3·5–5 cm, ovate to elliptic; base abruptly short-attenuate; apex acute to acuminate; upper surface densely hirsute-tomentose; undersurface white-floccose, with sparse hirsute hairs on the veins; margin crenate-denate. Petiole 5–10 mm. Inflorescence capitate subglobose to shortly clavate, densely flowered; peduncles 5·5–7·5 cm. Calyx c.4 mm, whitish-floccose, mixed with brownish stiff hairs; teeth with acute apices. Corolla c.6 mm salverform, with the lobes strongly reflexed and wrinkled.

Type: Brazil, Rio de Janeiro, Laranjeiras, *Glaziou* 4146 (iso. K).

Distribution: known only from Rio de Janeiro.

RIO DE JANEIRO: Copacabana beach, ii 1841, *Gardner* 5563 (K, BM); Pedreira, vii 1878, *Miers* 3931 (K); Morro do Flamengo, 1879, *Miers* (BM).

No flowers were available for dissection and, consequently, it is not known whether the species is heterostylous.

C. leucomalla is quite distinctive on account of its conspicuous leaves (at least 8 × 3 cm) and the whitish, floccose hairs on the undersurface of the leaves and young stems.

22. Cordia leucomalloides Taroda, **species nova** *C. leucomallae* Taub. valde affinis, sed foliis multo minoribus (minus quam dimidium longitudinis) et capitulis axillaribus differt. Fig. 5b.

Branchlets abundantly hirsute, mixed with dense, fine, whitish hairs, towards the apex. Leaves 2·5–4·0 × 1·0–1·5 cm, ovate to elliptic; base acute; apex obtuse to acute; upper surface tomentose or abundantly soft-hirsutulous; undersurface densely floccose, mixed on the veins with sparse, hirsute hairs; margin crenulate. Petiole 3–4 mm. Inflorescence capitate globose, densely flowered, axillary or terminal; peduncle 6–20 mm. Calyx

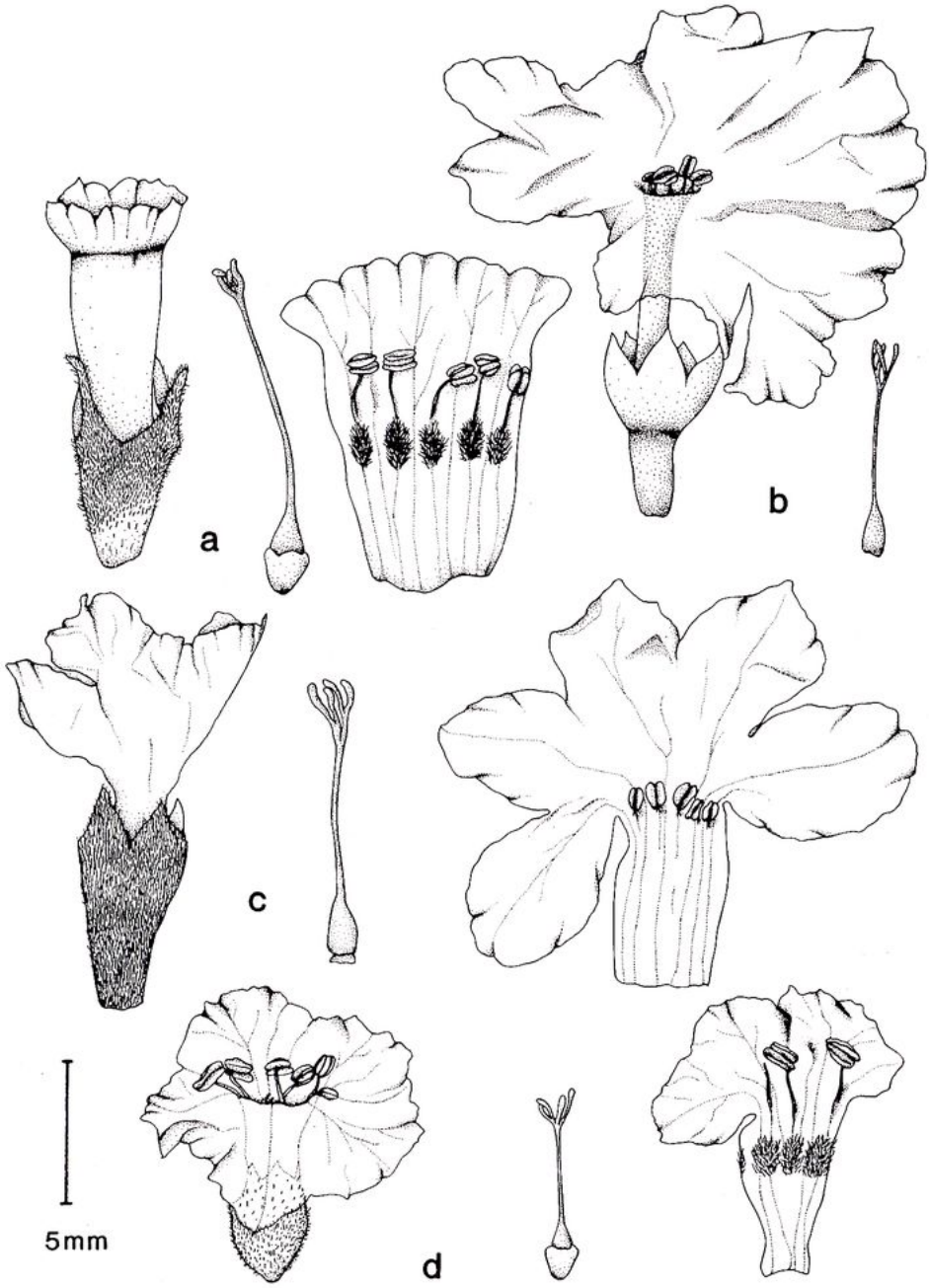

FIG. 4. Flowers, dissected corollas and gynoecia of *Cordia* subg. *Varronia*: a, *C. mayoi*, longstyle morph (*Harley et al.* 18983, K); b, *C. longifolia*, shortstyle(?) morph (no dissected corolla) (*Hage & White* 10275, F); c, *C. poliophylla*, longstyle(?) morph (*Belem & Mendes* 227, UB); d, *C. harleyi*, shortstyle(?) morph (*Harley et al.* 22749, K).

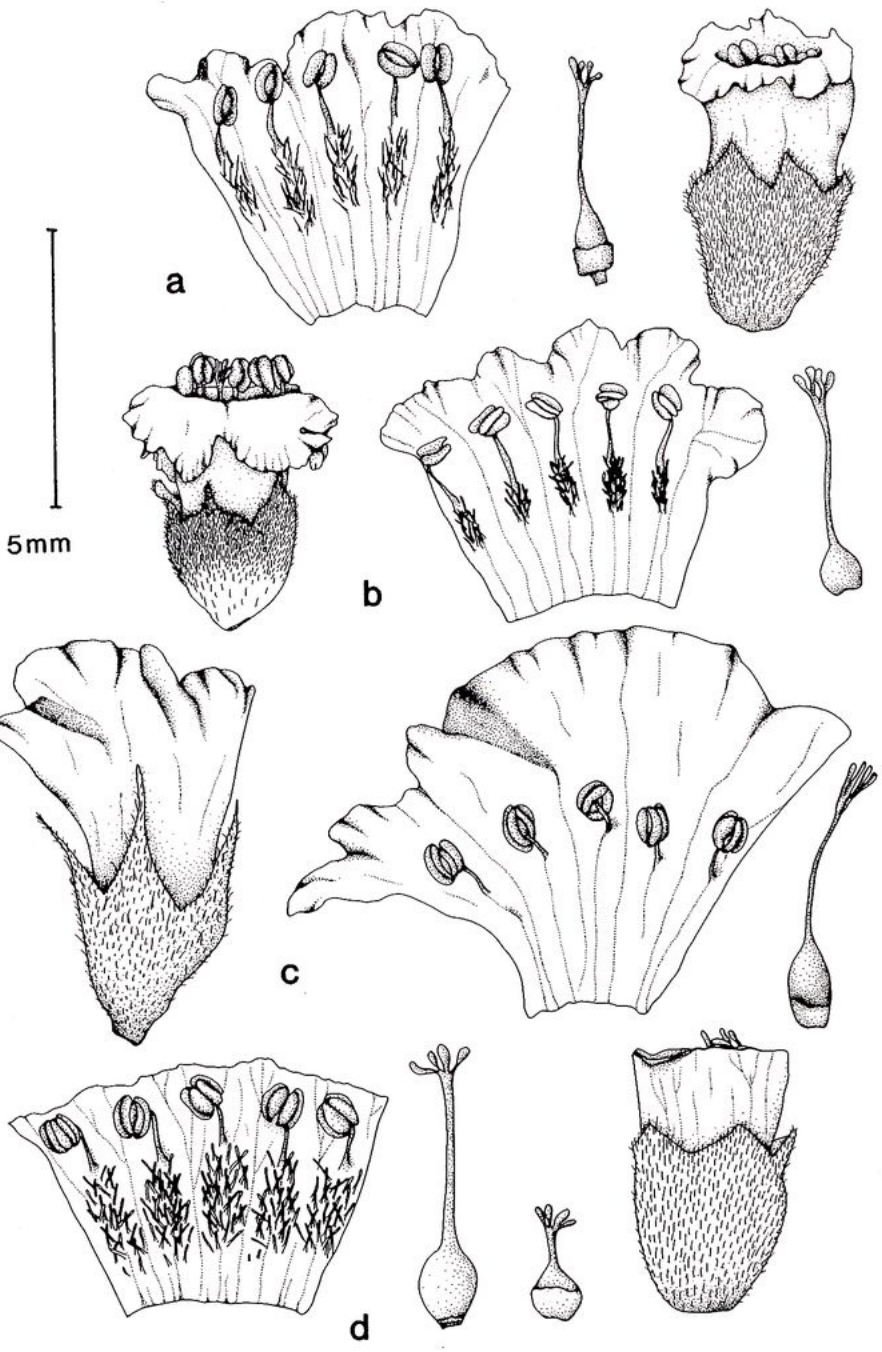

FIG. 5. Flowers, dissected corollas and gynoecia of *Cordia* subg. *Varronia*: a, *C. dardani*, homostyle morph (*Heringer et al.* 862, UB); b, *C. leucomalloides*, longstyle(?) morph (*Morais* 1875, A); c, *C. corchorifolia*, longstyle morph (*Gardner* 1364, G); d, *C. monosperma*, longstyle morph (*Gibbs et al.*, UEC), shortstyle gynoecium (*Usteri* 11309, GH).

c.3 mm, campanulate, very densely whitish floccose; teeth apices acuminate. Corolla c.5 mm, salverform; lobes triangular, strongly reflexed and wrinkled. Stamens c.1 mm. Ovary c.1 mm; style c.3 mm. Fruits not observed. Insufficient material available to determine whether heterostyly is present; flowers examined all homostylous.

Type: Brazil, Bahia, 6 km from Filadelfia on the road BA 385 to Itiúba, 18 ii 1974, *Harley 16143* (holo. CEPAC; iso. E, K).

Distribution: NE Brazil. In caatinga vegetation.

PARAÍBA: Areia, Escola de Agronomia do Nordeste, 12 vi 1953, *Morais* 813 (P); Areia, 18 x 1958, *Morais* 1875 (A).

Cordia leucomalloides from NE Brazil resembles *C. leucomalla* from Rio de Janeiro and the two taxa are probably vicariads. Although probably closely related, *C. leucomalloides* has been described as a distinct species on account of its smaller leaves (less than half the size of those of *C. leucomalla*) and regular presence of axillary inflorescences in contrast to the strictly terminal inflorescences of *C. leucomalla*.

23. Cordia harleyi Taroda, **species nova** *C. truncatae* Fresen. capitulis clavatis similis est sed foliis petiolatis et supra minute strigillosis, calicibus minute tomentosis et corollis hypocrateriformibus statim dignoscenda. Fig. 4d.

Branchlets minute strigillose, puberulent. Leaves 2·5–4·5 × 1·5–3·5 cm, ovate or ovate-triangular; base truncate; apex obtuse or rounded; upper surface sparsely puberulent and minutely, inconspicuously strigillose; undersurface densely villosulous; margin crenate or dentate. Petiole 4–7 mm. Inflorescence capitate clavate, densely flowered, terminal or internodal; peduncles 2·3–7 cm. Calyx obconical, densely and finely minute-tomentose, whitish at the base, brownish at the teeth; teeth with acute apices. Corolla 11 mm, salverform (limb very broad); lobes very shallow, emarginate. Stamens c.1 mm. Ovary 2–1·5 mm; style c.6·5 mm in shortstyle and c.8 mm in longstyle flowers. Fruits globose.

Type: Brazil, Bahia, Morro de Chapéu, c.8 km SW of the town Morro do Chapéu, to the W of the road to Utinga, 3 iii 1977, *Harley, Mayo, Storr, Santos & Pinheiros* 19312 (holo. CEPEC; iso. E, K).

Distribution: known only from Bahia.

BAHIA: Serra do Rio das Contas, Pico das Almas, c. 25 km NW of the town of Rio das Contas, 22 i 1974, *Harley et al.* 15409 (K); 19·5 km SE of the town Morro do Chapéu, on the BA 052 road to Novo Mundo, 2 iii 1977, *Harley et al.* 19241 (E, K). Serra dos Lencóis, munic. Palmeiras, 24 v 1980, *Harley* 22527 (K); Morro do Chapéu, c.8 km SW of the town of Morro do Chapéu, to the W of the road to Utinga, 30 v 1980, *Harley et al* 22749 (E, K).

Cordia harleyi is a very distinct species, resembling only remotely *C. truncata* in the shape of clavate inflorescence. Otherwise they are dissimilar, particularly because of the evidently petiolate leaves of *C. harleyi*. This new species is easily recognized by the following combination of characters: the minute and almost inconspicuous pubescence of the upper surface of the ovate leaves; clavate inflorescence; calyx finely minute-tomentose; and the salverform corolla with a rather well-developed limb. This species is dedicated to its collector Dr Raymond Harley, RBG Kew, whose studies and collections have greatly enriched our knowledge of the flora of the state of Bahia in NE Brazil.

24. Cordia mayoi Taroda, **species nova** species propria, calicis dentibus longiacuminatis et pubescentia sericeo-villolosa canescenti et corolla longissima (ultra 7 mm) tubuloso-cylindrica dignoscenda. Fig. 4a.

Branchlets finely, densely villosulous. Leaves 2–6 × 0·8–4·5 cm, ovate; base truncate; apex acute to rounded; upper surface abundantly sericeous-tomentose, canescent; lower surface finely and densely villosulous; margin irregularly serrate. Petiole 3–5 mm. Inflorescence capitate globose or somewhat elongate, more or less densely flowered, terminal or internodal; peduncle 10–20 mm. Calyx c.8 mm, campanulate, finely and densely canescent sericeous-villosulous; teeth with long acuminate apices. Corolla c.12 mm, tubular-cylindrical; lobes very shallow. Stamen c. 3 mm. Ovary c.2 mm; style c.10 mm (probably longstyle morph). Fruits unknown.

Type: Brazil, Bahia, 1·5 km of São Inácio on Gentio do Ouro road 24 ii 1977, *Harley, Mayo, Storr, Santos & Pinheiros* 18983 (holo. CEPEC; iso. E, K).

Distribution: known only from Bahia.

BAHIA: Serra do Assuruá, 1830, *Blanchet* 2909 (G, K); Serra do São Inácio, ii 1907, *Ule* 7549 (G, K).

The recent collection by *Harley et al.* agrees with older material collected by *Ule* in the same locality and from another collection in Bahia by *Blanchet* and confirms the status of this new species. *Cordia mayoi* is characterized by a calyx with long acuminate teeth with a sericeous-villosulous indumentum and by a distinctly long tubular-cylindrical corolla, more than 7 mm. The species is dedicated to one of its collectors Dr Simon Mayo, RBG Kew, who has collected in Bahia and worked on the Brazilian flora.

25. Cordia guazumaefolia (Desv.) Roem. & Schultes, Syst. 4:463 (1819). Fig. 6a.

Syn.: *Varronia guazumaefolia* Desv. in J. Bot. (Desvaux) 1:276 (1809).

C. patens var. *monocephala* Cham. in Linnaea 4:486 (1829). Type: Brazil, without precise locality, *Sellow* (K, BM).

C. patens var. *polycephala* Cham., ibid. 4:486 (1829). Type: Brazil, without precise locality, *Sellow* (K).

C. axillaris Johnston in Contr. Gray Herb. 92:35 (1930). Based on *C. patens* var. *monocephala* Cham.

C. axillaris var. *gymnocarpa* Johnston in Contr. Gray Herb. 92:35 (1930). Type: Brazil, Minas Gerais, without precise locality, 1840, *Claussen* (K).

Branchlets generally densely ferrugineous-hirsute. Leaves (3–)5–9(–13) × (1·5–)2·5–4(–6) cm, elliptical, elliptical-oblong or sometimes ovate; base cuneate, obtuse to rounded; apex acute to acuminate; upper surface usually densely strigose-hirsute, sometimes somewhat strigose-villosulous, usually tuberculate; undersurface tomentose to very densely tomentose; margin evidently to remotely serrate. Petiole (3–)4–7(–12) mm. Inflorescence capitate globose, sometimes shortly-clavate, densely flowered, axillary or terminal; peduncle (1–)3·5–6(–8) cm. Calyx c.4 mm, campanulate, glabrous or puberulent at the base, becoming densely hirsute towards the tip; teeth with acute apices. Corolla 4–5 mm, tubular cylindrical; lobes shallow and inconspicuous. Stamens c.2 mm. Ovary 2 mm; style c.2·5 mm in shortstyle and c.4 mm in longstyle flowers. Fruits globose.

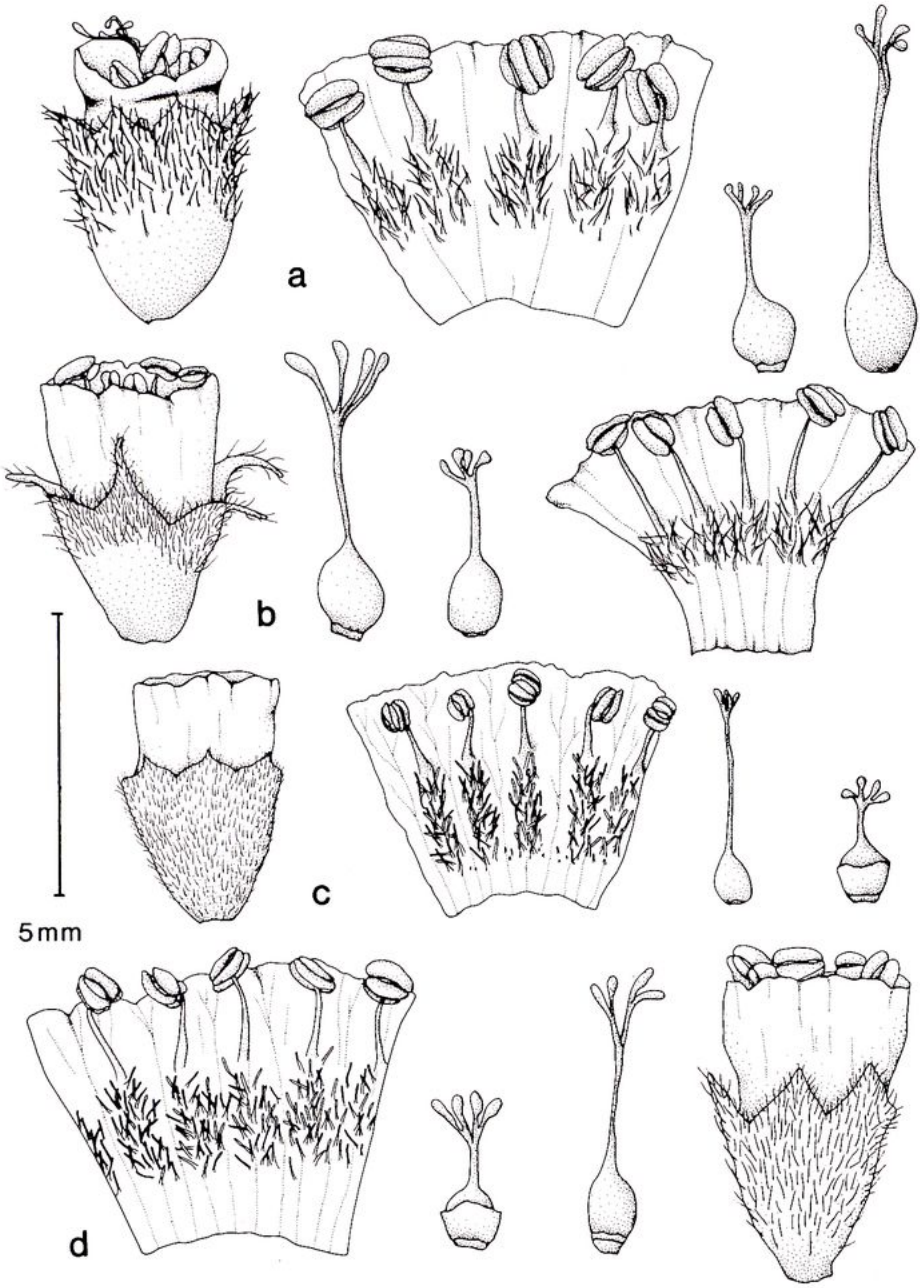

FIG. 6. Flowers, dissected corollas and gynoecia of *Cordia* subg. *Varronia*: a, *C. guazumaefolia*, longstyle morph (*Davis et al.* 59884, E), shortstyle gynoecium (*Loefgren & Edwal* 11313, GH); b, *C. buddleioides*, shortstyle morph (*Marin* 1714, P), longstyle gynoecium (*Wurdack* 2502, F); c, *C. polycephala*, longstyle morph (*Gardner* 3368, K), shortstyle gynoecium (*Zerny* 882, W); d, *C. urticifolia*, shortstyle morph (*Sucre* 1190, UB), longstyle gynoecium (*Irwin et al.* 30538, UB).

Type: Brazil, without locality, *Vandelli* 1790 (holo. P, iso. JU).
Distribution: WC, SE, S Brazil. Banks of rivers, forest margins or cerrado.
GOIÁS: Road between Tambaú and Cercados, 23 iii 1827, *Burchell* 5326 (K). MATO GROSSO DO SUL: Campo Grande, Br 163, Água Ruim, 14 viii 1970, *Hatschbach & Guimarães* 24626 (K); Rio Taquari, mun. Coxim, 30 viii 1973, *Hatschbach* 32500 (MO). MINAS GERAIS: São Tomé das Letras, 5 ii 1973, *Hatschbach 31317 & Almada* (K); Serra do Espinhaço, c.15 km N of São João da Chapada, 23 iii 1970, *Irwin et al.* 28131 (UB); base of Serra da Piedade, c.35 km E of Belo Horizonte, road to Caeté, 13 i 1971, *Irwin et al.* 30270 (UB); Uberaba, 2 ix 1948, *Regnell III* 909 (K); without precise locality, 1816–1821, *St. Hilaire* B[1] 285 (P); Grandahy, *Sellow* B 1565c 658 (GH). PARANÁ: Cerro Azul, Rio Ribeira, Barra do Turvo, 21 ix 1965, *Hatschbach* 12817 (K). RIO DE JANEIRO: Itatiaia, 2 x 1927, *Ginzberger* 71 (W); Rio de Janeiro, Boa Vista, 29 vii 1881, *Glaziou* 13038 (K, P); Itaperuma, 26 viii 1935, *Mello Barreto* 1962 (GH); without precise locality, 2 viii 1872, *Preston* (K); without precise locality, 1816–1821, *St. Hilaire* A[1] 904 (K), A[1] 504 (P). SÃO PAULO: between Ubatuba & Caraguatatuba, 22 viii 1976, *Davis et al.* 5884 (E, UEC); Taubaté, 9 ix 1892, *Loefgren & Edwal* 11313 (GH); Campinas, 24 viii 1977, *Yamamoto* 5665 (UEC). INDEFINITE: *Burchell* 5695 (K); *Sellow* 1564 (GH); *Sellow* 15 (GH), *Sellow* (E). [Sellow specimens are probably fragments from a single collection.]

Cordia guazumaefolia was first described by Desvaux under the genus *Varronia*, and subsequently accepted as a *Cordia* by Roemer & Schultes (loc. cit.) and Don (1837), although in each case these authors merely repeated the original diagnosis. A chain of confusion was begun when Chamisso (loc. cit.) created two varieties of *C. patens* H.B.K., var. *monocephala* and var. *polycephala*, without realizing these taxa were conspecific with *C. guazumaefolia*. Subsequently, De Candolle (1845) relegated *C. guazumaefolia* to a synonym of *C. urticifolia* and this treatment was followed by Fresenius (1857). Johnston (1930) treated *C. guazumaefolia* as a synonym of *C. corymbosa* (L.) Don, but he also described a new species, *C. axillaris*, which was based on *C. patens* var. *monocephala* Cham., and also described a new variety of *C. axillaris*, *C. axillaris* var. *gymnocarpa*.

Subsequently, after he had the opportunity to study the Desvaux type specimens in the Jussieu herbarium at Paris, Johnston (1935b) recognized *C. guazumaefolia* as a distinct species to which he relegated his *C. axillaris* var. *gymnocarpa*, although he maintained without comment *C. axillaris* as a distinct species.

A critical study of exsiccata of this group, including type specimens of *C. guazumaefolia*, *C. axillaris* and *C. axillaris* var. *gymnocarpa* has led to the conclusion that only a single species can be recognized for which the name *C. guazumaefolia* must be used. Some specimens, particularly from Minas Gerais, have the inflorescence obovate rather than spherical, a variation which is paralleled in other species of subg. *Varronia*.

26. Cordia buddleioides Rusby in Mem. Torr. Bot. Club. 6:83 (1896). Fig. 6b.

Branchlets generally densely ferrugineous-hirsute or rarely with appressed hairs. Leaves (4–)6–9(–16) × (3–)3·5–4·5(–6·5) cm, elliptic or elliptic-oblong; base acute; apex acute to acuminate; upper surface usually scabrous, glabrous except for the midrib, very rarely sparsely appressed-puberulent; undersurface hirsute; margin entire or remotely serrate. Petiole (3–)4–7(–10) mm. Inflorescence usually a raceme of globose, densely flowered capitulae (occasionally of solitary capitulae) axillary; peduncles (1–)3–4(–5) cm, decurrent with the petiole of the subtended leaf. Calyx c.3 mm

obconical-campanulate, glabrous or puberulent at the base, densely long-hirsute towards the teeth; teeth prolonged into filiform apices. Corolla c.6 mm, tubular-cylindrical, the lobes shallow or inconspicuous. Stamens c.2 mm, Ovary c.1·5 mm; style c.2·5 mm in shortstyle and c.4·1 mm in longstyle flowers. Fruits cylindrical.

Type: Bolivia, La Paz, Mapiri, vii–viii 1872, *Bang* 1530 (holo. NY, iso. K).

Distribution: N Brazil, Peru and Bolivia.

ACRE: Tarauacá, 23 ix 1968, *Prance, Ramos & Faria* 7486 (MO). AMAZONAS: Esperança, mouth of Rio Javari, *Ducke* 1129 (MO). BAHIA: *Blanchet* 2471 (MO).

Specimens of typical *C. buddleioides*, i.e. having calyx teeth with conspicuous filiform apices and leaves with the upper surface glabrescent, occur in Peru and northern Bolivia. In the few collections from Brazil these diagnostic characters lose their conspicuousness: the calyx teeth have shorter apices and the upper surface of the leaves are sparsely hairy. The Brazilian specimens of *C. buddleioides* approach *C. guazumaefolia* although the latter species remains distinguishable because of its densely hairy leaf upper surface and distinctly serrate margin. The distribution of *C. buddleioides* is odd in being vast but extremely disjunct, extending from Acre and Amazonas to Bahia. This species will require further study as new collections become available.

27. Cordia polycephala (Lam.) Johnston in J. Arnold Arb. 16:33 (1935). Fig. 6c.

Syn.: *Varronia polycephala* Lam., Tabl. Encycl. 1:418 (1792) excl. syn. 'Plukenet t. 328 fig. 5?'.

Cordia corymbosa (L.) Urban sensu Johnston in Contr. Gray. Herb. Harv. Univ. 92:30 (1930) pro parte, non *C. corymbosa* (Desv.) Don (1837).

Branchlets generally appressed-strigose or strigillose, very rarely hirsute. Leaves 5–9 × 1·5–4·5 cm, ovate to ovate-lanceolate; base acute to rounded; apex acuminate; upper surface usually appressed-strigose, occasionally strigillose or glabrescent, usually tuberculate; undersurface finely and minutely tomentose mixed with sparse coarse strigose hairs; margin distinctly to indistinctly serrate. Petiole (3–)4–5(–6) mm. Inflorescence panicles or racemes of relatively small, rather few-flowered glomerules (occasionally solitary), axillary or terminal; peduncles (1–)3–4(–6) cm. Calyx c.3 mm, obconical-campanulate, usually appressed pubescent or tomentose; teeth acute. Corolla 3·5–4 mm, tubular-cylindrical; lobes very shallow and inconspicuous. Stamens 1·5–2 mm. Ovary c.1 mm; style 1–1·5 mm in shortstyle and c.3·5 mm in longstyle flowers. Fruits conical.

Type: Not traced.

Distribution: N, NE, WC, SE Brazil. In forest, gallery forest and cerrado.

ACRE: mun. Tarauacá, 23 ix 1968, *Prance, Ramos & Faria* 7486 (MO); Rio Branco, ii 1909, *Ule* 7962 (G, K). CEARÁ: Lagoa Paburu, 20 xii 1935, *Drouet* 2697 (GH); Fortaleza, banks of Rio Maranguapinho, 22 xii 1935, *Drouet* 2709 (GH, MO). ESPÍRITO SANTO: Reserva Florestal de Sooretama, *Belém* 1525 (UB). FEDERAL DISTRICT: Brasília, 15 ii 1968, *Philcox & Onishi* 433 (K). GOIÁS: Serra Dourada, c.17 km S of Goiás Velho, c.6 km NE of Mossamedes, 9 v 1973, *Anderson* 9939 (E, MO, UB); Gurupi, 25 xii 1969, *Eiten & Eiten* 10002 (US); without precise locality, 1841, *Gardner* 3368 (E, G, K); c.1 km S of Araguaina, at Rio das Lontras, 15 iii 1968, *Irwin, Maxwell & Wasshausen* 21220 (UB); c.15 km S of Araguaina, 16 iii 1968, *Irwin, Maxwell & Wasshausen* 21277 (UB); c.27 km S of Paraíso, 23 iii 1968, *Irwin, Maxwell & Wasshausen* 21718 (GH, MO, UB). MARANHÃO: without precise locality, 12 vi 1909, *Lima* 2273 (UB). MATO GROSSO:

entroncamento des rodovias Cuiabá-Santarém–Porto Velho, 5 ii 1979, *Silva & Pinheiro* 4451 (UB, UEC). MINAS GERAIS: Lavras, 9 xii 1980, *Leitão Filho, Shepherd & Martins* 11690 (UEC). PARÁ: Marabá, Rio Tocantins, 9 vi 1949, *Froés & Black* 24345 (UB); Santarém, iii 1850, *Spruce* (E, G); Taperinha, Santarém, 15 vi 1927, *Zerny* 882 (W). RORAIMA TERRITORY: Serra da Lua, 12 i 1969, *Prance et al.* 9226 (GH, MO); Rio Mucajaí, vicinity of Mucajaí airstrip, 13 ii 1971, *Prance et al.* 10914 (GH, K, MO); Posto Mucajaí, Rio Mucajaí, 17 iii 1971, *Prance et al.* 11076 (GH, MO).

Johnston (1930) in his account of Cordias from Brazil, Paraguay, Uruguay and Argentina treated this species under the name *Cordia corymbosa* (L.) Don. The species concept accepted by Johnston for this taxon was a very wide one (some 16 synonyms were included under it) and in his use of the name *C. corymbosa* he followed Urban (1910) who cited *Lantana corymbosa* L. as a basionym.

Johnston (1935a) subsequently realized that the epithet *corymbosa* as employed by Urban was a later homonym of *C. corymbosa* (Desv.) Don. In a lengthy nomenclatural discussion Johnston (1935a) traced the history of *Lantana corymbosa* (see below), and he proposed that the earliest name for the widespread southern Brazilian–Argentinian species was *Varronia polycephala* Lam. which he transferred to *Cordia*. In later publications, however, Johnston (1949a, b) restricted his concept of *C. polycephala* (Lam.) Johnst. and excluded a number of taxa: *C. lineata* (L.) Roem. & Schultes, *C. bifurcata* Roem. & Schultes, *C. discolor* Cham., *C. urticifolia* Cham., *C. patens* H.B.K. and *C. boliviana* Gandoger. The criteria employed by Johnston to split his original *C. polycephala* into this series of segregates basically involved the nature of the inflorescence (axillary, internodal or terminal) and also geographical distribution.

In the present revision *C. polycephala* has been accepted in the restricted concept proposed by Johnston (1949a, b) and, accordingly, *C. discolor* and *C. urticifolia* are treated as distinct species. The extra-Brazilian segregate *C. bifurcata* seems to be a good species and was certainly accepted as such by Nowicke (1969) in her revision for the Flora of Panama. There is no recent reference to *C. boliviana* Gandoger and no specimens assignable to this taxon have been seen.

The remaining segregates split off by Johnston (1949a, b) were *C. lineata* and *C. patens*, both with distributions in the Caribbean, and their complicated nomenclature/taxonomy is partially entangled with *C. polycephala* (Lam.) Johnst. Lamarck (1792) described *Varronia polycephala* as follows: '*VARRONIA polycephala*. V. foliis ovato-lanceolatis, serratis; pedunculis lateralibus; spicis globosis. Ex America. Pluk. t. 328. *f. 5?*'. The Plukenet illustration 't. 328 f. 5', was also referred to by Linnaeus (1753) for his *Lantana corymbosa* as follows:

'*corymbosa* 6. LANTANA foliis alternis, floribus corymbosis. †
Periclymenum rectum, salviae foliis majoribus oblongis mucronatis subtus villosis alternatim sitis, flore & fructu minoribus. *Sloan. jam* 164. *hist.* 2. *p.* 83, *t.* 194, *f.* 3. *Raj. dendr.* 30.

Ulmi angustifoliae facie baccifera jamaicensis, foliis superne scabris, subtus villosis alternatim sitis, floribus parvis perpusillis, fructu botryoide monospermo. *Pluk. alm.* 393, *t.* 328. *f.* 5.
Habitat in Jamaica.

Refertur ex fide Sloanei; De floris structura nulla mihi certitudo.'

The illustrations by Plukenet t. 328 (1946) and Sloane, t. 194 (1692), depict rather different plants and Johnston (1949a) lectotypified *Lantana corymbosa* L. by the Plukenet plant and commented that the Sloane plant 'most suggested the *Cordia polycephala*'. However, since it was not possible to transfer Linnaeus' *Lantana corymbosa* to *Cordia*, Johnston accepted the name *Varronia lineata* L. as the next available epithet for the species in question. *Varronia lineata* was a substitute used by Linnaeus himself in 1759 for his *L. corymbosa* after he had accepted Browne's genus *Varronia*. In his study, therefore, Johnston (1949a, b) distinguished between *Cordia polycephala* (Lam.) Johnston and *Cordia lineata* (L.) Roem. & Schultes.

Stearn (1971), in a study of Jamaican Cordias, reinvestigated the nomenclatural history of *C. lineata* (L.) Roem. & Schultes and *Lantana corymbosa* L. In this paper, Stearn lectotypified *Lantana corymbosa* by the Sloane illustration, arguing that Linnaeus had particularly referred to this specimen '*refertur ex fide Sloane*', and he noted that the Sloane specimen 'belongs to the species later named *C. polycephala* (Lam.) Johnst.'. Stearn also pointed out that *Varronia lineata* was an illegitimate substitute by Linnaeus for his earlier *L. corymbosa* and as such could not be transferred to *Cordia*. He proposed, therefore, a new species *C. linnaei*, and thereby a description and type specimen for what was in effect 'a very old species'.

However, whilst studying material in the Paris herbarium, the present author (N.T.) encountered a specimen in the Humboldt & Bonpland Herbarium determined as *Cordia patens* from 'Caripé'. This specimen, which is almost certainly the type specimen of *C. patens* which was described from '*Novae Andalusiae, inter Guanaguana et coenobium Caripense*', strongly resembles plants of *C. linnaei* cited by Stearn (1971) from Jamaica and they are most likely to be conspecific.

From the above account, it can be seen that according to Johnston's (1949a) lectotypification of *Lantana corymbosa* L. by the Plukenet illustration this taxon becomes a synonym of *C. patens* H.B.K., whereas, according to Stearn's relectotypification of *L. corymbosa* by the Sloane illustration, *L. corymbosa* becomes a synonym of *C. polycephala*. The argument is an academic one since the epithet *corymbosa* cannot be taken into *Cordia*, but is of some interest because Lamarck cited the Plukenet t. 328. f. 5. with a query in his description of *Varronia polycephala*.

The Plukenet illustration, showing solitary glomerules in an axillary position, is very similar to *C. linnaei* Stearn and undoubtedly referable to it. The illustration by Sloane represents most of the inflorescence in a position immediately above a leaf, perhaps implying an axillary position, but also with most of the glomerules in a somewhat paniculate arrangement. This plant (in spite of the 'pseudo axillary' inflorescence) resembles *C. polycephala* as here accepted, i.e. axillary or terminal panicles or racemes of glomerules (the glomerules occasionally may be solitary).

Lamarck's use of a question mark for the Plukenet illustration implies that he based his species on something else and doubted whether the Plukenet plant was the same species, but exactly what *Varronia polycephala* was based on is unknown since there is no specimen labelled *polycelphala* in the Lamarck herbarium (IDC microfiche 450–451). This lack of a firm link to a type specimen or illustration is unfortunate since Lamarck's descriptive phrase could apply equally well for a number of Carribbean *Varronia*

species. In the final analysis, the use of the name *Varronia polycephala* by Johnston (1949b) and accepted in the present account is based on traditional usage, and because there do not seem to be any good grounds for rejecting the epithet.

Despite the fact that *C. patens* H.B.K. as represented by the type in Paris (and also by the type of *C. linnaei* Stearn, and other materials cited for this species by Stearn) differs from *C. polycephala* as recognized in Brazil, a detailed study of these taxa throughout their range is still highly desirable. It is possible that such study could reveal that *C. polycephala* s.str. and *C. patens* are geographical vicariants in a wide-ranging species complex.

28. Cordia discolor Cham. in Linnaea 4:489 (1829).

Syn.: *C. hermanniifolia* Cham. in Linnaea 4:489 (1829). Type: Brazil, without precise locality, *Sellow* (K, BM, G).

C. hermanniifolia var. *calycina* Cham. in Linnaea 4:486 (1829). Type: Brazil, without precise locality, *Sellow* (K).

C. salzmannii DC in A.DC., Prodr. 9:494 (1845). Type: Brazil, Bahia, without precise locality, 1830, *Salzmann* 377 (G-DC).

C. salzmannii var. *lanceolata* Fresen., Mart. Fl. bras. 8(1):20 (1857). Type not traced.

Branchets usually appressed strigillose, sometimes hirsute. Leaves (3–)4–6(–7) × (1–)2–4(–4) cm, generally narrowly elliptical, lanceolate or ovate-lanceolate; base acute to rounded; apex acuminate; upper surface appressed strigose or strigillose and tuberculate; undersurface minutely and densely tomentose, mixed with coarse, strigose hairs which vary in abundance; margin usually serrulate, occasionally serrate. Petiole 3–5 mm. Inflorescence usually of small lax panicles, but occasionally with the branches very much reduced and becoming glomerulate, always terminal on the main and side branchlets (occasionally in a branch some axillary or internodal inflorescences may also occur); peduncle 1·5–3 cm. Calyx 3–4·5 mm, obconical-campanulate, puberulent or rigid-tomentose; teeth with acute apices. Corolla 4·5–5 mm, tubular-cylindrical; lobes very shallow, inconspicuous. Stamens 1–1·5 mm. Ovary c.1 mm; style c.1·5 mm in short-style and c.4·5 mm in longstyle flowers. Fruits conical.

Type: Brazil, without precise locality, *Sellow* (K, BM, G).

Distribution: NE, WC, SE and S Brazil. In capaoeira, restinga, cerrado and forest clearings.

BAHIA: without precise locality, *Blanchet* 841 (W). GOIÁS: Chapada dos Veadeiros, 6–7 km E of Alto Paraíso on road to Nova Roma, 7 iii 1973, *Anderson* 6586 (E, MO, UB). MINAS GERAIS: Porto Novo, i–ii 1932, *Frambach* 103 (GH); Serra do Espinhaço, c.27 km of Serro on road to Diamantina, 26 ii 1968, *Irwin, Maxwell & Wasshausen* 20937 (GH, MO, UB); Caldas, 17 ii 1847, *Regnell II* 908 (K, MO). RIO GRANDE DO SUL: Porto Alegre, 24 x 1897, *Czermak & Reineck* 143 (E, G); ibid., 11 iii 1892, *Malme* 256 (MO); Osório, 11 ix 1950, *Rambo* 48758 (MO). RIO DE JANEIRO: Rio de Janeiro, Tijuca, 21–23 vii 1882, *Ball* (K); Rio de Janeiro, 1768 m *Banks* (A, GH); Magé, 1837, *Casaretto* 1487 (G); Guanabara, Pedra Branca, 7 iv 1963, *Castelhanos* 23860 (F); Nova Friburgo, x 1842, *Claussen* 70 (G); ibid., 1818, *Curran* 730 (GH); Corcovado, 18 ii 1862, *Glaziou* 206 (P); without precise locality, 1838, *Martius* 125 (E, K, MO); Copacabana, vii 1878, *Miers* 3674 (K); without precise locality, 21 vii 1873, *Mosén* 23 (MO); Baia de Sepetiba, Ihla Furtada, 2 ii 1967, *Sucre* 1806 (UB); Alto da Boa Vista, 26 ii 1967, *Sucre* 1981 (UB); Itaperuma, faz. S. José, *Strang* 858 & *Castellanos* 26147 (K); without precise locality, 1858, *Weddell* 393 (G). PARANÁ: Serra do Mar, Volta Grande, 27 vii 1914, *Dusén* 756 a (MO); Jacarei, 28 ix 1908, *Dusén* 6624 (GH, K, MO): Adrianópolis, 26 ix 1962, *Hatschbach* 9282 (K); near

Altonia, mun. Xambrê, 10 xii 1965, *Hatschbach, Lindeman & Haas* 13310 (A); road from Praia do Leste to Morretes, 3 x 1966, *Lindeman & Haas* 2632 (K). SANTA CATARINA: without precise locality, 1832, *Gaudichaud* 161 (G); without precise locality, iv 1869, *Mueller* 306 (K); Camp do Massiambú, Palhoça, 16 vii 1963, *Reitz & Klein* 837 (UB); ibid., 24 ix 1963, *Reitz & Klein* 3492 (A); ibid., Pilões, 7 x 1956, *Reitz & Klein* 3637 (A); ibid., 28 ix 1956; *Reitz & Klein* 3803 (A); Ibirama, 18 vii 1956, *Reitz & Klein* 3492 (A); Minas Velhas, Garuva, S. Francisco do Sul, 5 x 1957, *Reitz & Klein* (A); ibid., Tres Barras, 3 x 1957, *Reitz & Klein* 4952 (A); without precise locality, *Tweedie* 981 (E, K). SÃO PAULO: Baueri, x 1914, *Brade* 7201 (GH); between São Paulo and Curitiba, 5 i 1974, *Conrad & Dietrich* 1988 (MO); between Iguapé and São Paulo, Registro road, 6 ix 1976, *Davis et al.* 60518 (UEC); 3–5 km E of Jacupiranga, 9 ix 1976, *Davis et al.* 60817 (E, UEC); between Juquiá and Piedade, 29 ix 1977, *Gibbs et al.* 6667 (F, UEC); Iguapé, 14 x 1894, *Loefgren & Edwall* 11310 (GH); Córrego Alegre, 3 i 1897, *Loefgren & Edwall* 11315 (GH); São Paulo, Ypiranga, 12 iii 1908, *Luederwardt* 11317 (GH). INDEFINITE: *Burchell* 1075, 1317, 4406 (K); *Marti* 1090 (K, MO).

Cordia discolor is rather variable in leaf size and shape and pubescence, and this variation has been the basis for a number of segregate taxa: *C. hermanniifolia*, *C. hermanniifolia* var. *calycina*, *C. salzmannii*, and *C. salzmannii* var. *lanceolata*. On the basis of isotypes and other material studied these are all considered to fall within the range of *C. discolor*.

29. Cordia monosperma (Jacq.) Roem. & Schultes, Syst. Veg. 4:463 (1819). Fig. 5d.

Syn.: *Varronia monosperma* Jacq., Pl. Rar. Hort. Caes. Schoembr. 1:18, fig. 39 (1797).
V. corymbosa Desv. in J. Bot. (Desvaux) 1:275 (1809), nom. illeg.
Cordia corymbosa (Desv.) Don., Gen. Syst. 6:383 (1837).

Branchlets appressed setulose, frequently hirsute. Leaves 3·2–6·5 × 1·7–3 cm, ovate, ovate-lanceolate to elliptic-oblong; base obtuse or somewhat rounded; apex acute to acuminate; upper surface usually appressed strigose and minute strigillose, tuberculate; undersurface finely and minutely tomentose mixed with abundant strigose hairs; margin distinctly to inconspicuously serrate. Petiole (3–)4–6(–7) cm. Inflorescence scorpioid-corymbose, lax or more or less glomerulate, internodal; peduncles 1·5–4 cm. Calyx 3–3·5 cm, obconical-campanulate, teeth with acuminate apices usually densely setulose, occasionally puberulent. Corolla 3–4·5 mm, tubular-cylindrical with shallow or inconspicuous lobes. Stamens 1–1·5 mm. Ovary c.1 mm; style c.3 mm in shortstyle and c.4 mm in longstyle flowers. Fruits ovate.

Type: not traced.

Distribution: NE, SE & S Brazil.

MINAS GERAIS: Caldas, 1865, *Regnell III* 908 (K, MO). PARAÍBA: Areia, Escola de Agronomia do Nordeste, 6 vii 1953, *Morães* 838 (GH); ibid., 19 vi 1953, *Moraes* 841 (GH). PARANÁ: Jaguariahyva, 14 v 1914, *Jonsson* 346a (GH, MO); mun. Dionísio Cerqueira, 23 ii 1957, *Smith & Klein* 11692 (GH). RIO GRANDE DO SUL: Barra do Ribeiro, 14 xi 1948, *Rambo* 37997 (G); near Nova Hamburgo, 12 viii 1949, *Rambo* 42887 (P). RIO DE JANEIRO: floresta da Tijuca, Bom Retiro, 18 vi 1960, *Coimbra* 5 (F). SANTA CATARINA: Bela Vista, 4 i 1962, *Reitz & Klein* 11531 (G). SÃO PAULO: Pirituba, 14 xii 1913, *Brade* 7202 (GH); Alferes Rodrigues, x 1899, *Edwall* 11316 (GH); mun. Souzas, c.20 km from Campinas, 20 xi 1982, *Gibbs* 82/5 (E, UEC); Campinas, 12 vi 1936, *Santoro* 637 (GH); São Paulo, 28 ii 1905, *Usteri* 11309 (GH). Without precise locality: *Burchell* 3895 (K).

This species was described by Jacquin (1797) as *Varronia monosperma* but was subsequently illegally renamed by Desvaux (1807) as *Varronia corymbosa* on the grounds that Jacquin's epithet referred to an attribute shared by all species of *Varronia*. Don (1837) transferred Desvaux's *Varronia corymbosa*

to *Cordia*, apparently unaware that Roemer & Schultes (1819) had previously transferred *Varronia monosperma* to *Cordia*. Johnston (1935a) relegated *C. monosperma*, together with a number of other species epithets, as synonyms under his wide concept of *C. polycephala*, but subsequently, Johnston (1948b) referred *C. monosperma* to *C. utricifolia*. Johnston seems to have misinterpreted *C. monosperma* (see discussion under *C. urticifolia*) since this appears to be a distinct species which agrees well with the original illustration provided by Jacquin, i.e. with the inflorescence clearly internodal with patent peduncles. Curiously, however, Jacquin (1797) cited his species as originating from Caracas. No material has been seen from northern South America.

30. Cordia urticifolia Cham. in Linnaea 4:483 (1829). Fig. 6d.

Branchlets densely to very densely hirsute-villose. Leaves 4–8 × 2–3·7 cm, commonly ovate, sometimes broadly oblong-elliptic; base obtuse; apex acute to acuminate; upper surface usually hirsute-tomentose, regularly appressed-setose or strigose, tuberculate; lower surface sparsely to densely hirsutulous; margin serrate. Petiole (3–)4–5(–6) mm. Inflorescence scorpioid-corymbose, lax or more or less glomerulate, axillary; peduncle 1–4·5 cm. Calyx 3·5–4 mm, obconical-campanulate, densely hirsute; teeth apices acute. Corolla 4·5–5 mm; lobes very shallow or inconspicuous. Stamens 1·5 mm. Ovary 1–1·3 mm; style c.2 mm in shortstyle, c.3·7 mm in longstyle flowers. Fruits conical.

Type: Brasilia tropica, *Sellow*—Photo (G); 'Rio de Janeiro (1814–15), Sumidoro, ex reliquii Sellowianus IB 397' (P ex B). See discussion below.

Distribution: SE, S Brazil.

MINAS GERAIS: Serra do Espinhaço, c.55 km E of Belo Horizonte, 17 i 1971, *Irwin et al.* 30583 (GH, UB). RIO DE JANEIRO: without precise locality, iii 1873, *Glaziou* 6053 (K); Morro de Leme, xi 1966, *Sucre* 1190 (UB). SANTA CATARINA: Cunhas, Itajaí, 23 vi 1955, *Klein* 1413 (A). SÃO PAULO: São José. xii 1833, *Lund* 1935 (DC).

Cordia urticifolia was originally treated by Johnston (1930) under his wide concept of *C. corymbosa* and subsequently regarded as conspecific with *C. polycephala* (q.v.). Johnston (1949b) split this broadly conceived *C. polycephala* and revalidated *C. urticifolia* stating that it 'is a coarsely strigose representative of the group in Brazil and Paraguay'. Unfortunately, he seems to have regarded *C. urticifolia* as having an 'extra-axillary inflorescence' which is a mistake, since Chamisso, the author of the species, described the inflorescence in an axillary position. This error in regarding the inflorescence as 'extra-axillary' led him to confuse the present species with *C. monosperma*. Probably influenced by Johnston's comments, Smith (1970), in his treatment of *Cordia* for the *Flora Catarinensis*, included *C. urticifolia* under *C. monosperma*.

In agreement with Johnston (1949b), *C. urticifolia* has been treated as a separate species in this account but one characterized by a clearly axillary inflorescence, i.e. excluding *C. monosperma*. This decision was confirmed by study of the specimen in P which was most likely that used by Chamisso to describe his *C. urticifolia*. Apart from being clearly axillary, the inflorescence is characteristically born on a rather robust straightish peduncle, and also it is generally lax, sometimes glomerulate but never capitate, rather of a scorpioid-corymbose type. The peduncle bifurcates two or three times into relatively well-developed branches.

Doubtful species

Cordia neowediana DC., in A.DC. Prodr. 9:498 (1845).

Syn.: *Varronia macrocephala* Nees & Mart., Beitr. Fl. Bras. 78 [Nova Acta Leop. 11:78] (1823), fide DC.; non *Cordia macrocephala* (Desv.) H.B.K. (1818).

According to Johnston (1935b) this is a distinct *Varronia* species with a large corolla similar to that of *Cordia paucidentata*. He mentioned that the type is at Brussels but did not cite this specimen or any other material for this species. No collections which fit either the original description by De Candolle or that by Johnston have been encountered in the specimens studied for the present revision.

Cordia crenatifolia Rizzini in Leandra 3–4(4–5):12 (1974).

This species was described from a single specimen and characterized as having crenate leaves and inflorescences as 'globose aggregate cymes disposed in lax panicles'. Rizzini (loc. cit.) observed that *C. crenatifolia* approached *C. salzmanni*, *C. discolor*, *C. hermaniaefolia* and *C. urticiifolia*. All of these taxa form part of the *C. polycephala* group *sensu* Johnston (1935a) and it is possible therefore that *C. crenatifolia* is merely a variant of one of the component species of this complex but unfortunately the type specimen has not been seen.

Cordia schottiana Fresen., Mart. Fl. bras. 8(1):7 (1857) and **Cordia intermedia** Fresen., ibid. 8(1):8 (1857).

These two species were cited as dubious synonyms of *C. superba* by Johnston (1930) who commented that he inferred this status solely from the descriptions of the two taxa. The type specimen of neither species has been traced.

Cordia acutifolia Fresen., Mart. Fl. bras. 8(1):11 (1857).

Johnston (1930) studied the type at Berlin (now no longer extant) and recognized this species, noting that it was related to *C. sellowiana*. However, no material referable to *C. acutifolia* was encountered during the present study.

Acknowledgements

Financial support by The British Council-Overseas Development Administration with Technical Cooperation Training Award for the years 1981–84 is gratefully acknowledged by N.T. We also thank the Directors of the following institutions for the loan of specimens or use of library facilities: Arnold Arboretum of Harvard University, Cambridge (A); The British Museum (Natural History), London (BM); Royal Botanic Garden, Edinburgh (E); Field Museum of Natural History, Chicago (F); Conservatoire et Jardin botaniques, Genève (G); Gray Herbarium of Harvard University, Cambridge, U.S.A. (GH); Royal Botanic Gardens, Kew (K); Missouri Botanical Garden, Saint Louis (MO); New York Botanical Garden (NY); Muséum National d'Histoire Naturelle, Paris (P); Institute of Systematic Botany, Utrecht (U); Fundação Universidade de Brasília (UB); Universidade Estadual de Campinas (UEC); United States National Herbarium, Smithsonian Institution, Washington (US); Naturhistorisches Museum, Botanische Abteilung, Wien (W).

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