

SYNOPSIS OF SUBGENUS KIRGANELIA

Subgenus II. **KIRGANELIA** (Juss.) Kurz, J. As. Soc. Bengal 42(2): 238. 1874. *Kirganelia* Juss.,

Gen. Pl. 387. 1789. TYPE: *Phyllanthus kirganelia* Willd. [= *Phyllanthus casticum*

P. Willemet]

Phyllanthus subg. *Eucicca* Kurz (nom. illeg.), *ibid.* *Phyllanthus* subgenus *Cicca* (L.) G. L. Webster,

J. Arnold Arb. 37: 344. 1956. TYPE: *Phyllanthus acidus* (L.) Skeels

Monoecious or dioecious trees or shrubs; branching phyllanthoid (ultimate deciduous, floriferous axes subtended by cataphylls on penultimate axes); inflorescences axillary, sometimes cauliflorous; flowers in axillary glomerules or on racemoid axes with reduced leaves; sepals (4) 5 or 6, free, imbricate, entire; staminate disk dissected (less commonly entire); stamens (3-) 4—6, filaments free or the longer 2 or 3 connate; anthers dehiscent longitudinally, usually muticous (rarely apiculate); pollen grains \pm spheroidal, 3- (4-) colporate, colpi most marginate, often meeting at poles, usually with one germ pore (less commonly with 2); exine reticulate to vermiculate (rarely pilate); pistillate sepals mostly persistent in fruit; disk annular to cupular, sometimes lobed; ovary 3—10-locular; styles usually free and bifid; fruits dehiscent or indehiscent, sometimes baccate; seeds smooth or striate, sometimes thick-walled with invaginated hilum.

This large subgenus with 7 sections and about 40 species is best represented in Africa and Madagascar. Only one species, *Phyllanthus pseudocicca* Griseb.(sect. *Ciccopsis*), is known from the New World; and its affinities remain uncertain. Willem Punt, in a number of publications (especially Meewis and Punt, 1983), and J. Brunel (1975) have made a crucial contribution to the classification of the subgenus by critical study of the African species and comparisons with those from Asia; their conclusions are reflected in the following arrangement of sections.

The circumscription of subgenus *Kirganelia* as adopted here has been modified greatly from my earlier treatments (Webster, 1957; Webster and Airy Shaw, 1971). It now appears that subgenus *Cicca* should be included within subgenus *Kirganelia*; the drupaceous fruits of *Phyllanthus acidus* are not fundamentally different from the indehiscent fruits of some species of sect. *Floribundi*.

1. Sepals and stamens 6; staminate disk annular; pollen colpi not marginate; pollen grains spheroidal, 3-colporate, colpi not marginate, exine reticulate; fruits capsular, seeds with invaginated hilum.

Sect. 1. **Chorisandra**

1. Monoecious; sepals and stamens mostly 4 or 5; staminate disk dissected; pollen grains with distinctly marginate colpi; fruits capsular or baccate.

2. Fruits dehiscent, < 1.5 cm in diameter; seeds not invaginated at hilum; pollen colpi often with 2 germ pores; ovary 3-locular.

3. Styles connate into column, branches dilated; anthers dehiscing vertically.

Sect. 2. **Pseudomenarda**

3. Styles free, branches slender; anthers deflexed or dehiscing transversely.

4. Stamens 5; fruiting calyx accrescent; fruit c. 1 cm in diameter.

Sect. 3. **Menarda**

4. Stamens 3; fruiting calyx not accrescent; fruit < 0.5 cm in diameter.

Sect. 4. **Ciccopsis**

2. Fruits baccate or drupaceous; ovary (3-) 4-10-locular.

5. Fruits baccate; monoecious; stamens 4 or 5.

6. Pistillate sepals deciduous; ovary 3—6-locular.

7. Inflorescences (at least in part) mostly racemiform, cauliflorous; pollen grains syncolporate, colpi marginate and sunken, exine

vermiculate or reticulate; styles bifid.

Sect. 5. **Floribundi**

7. Inflorescences axillary, glomerular; pollen grains reticulate;
styles entire.

Sect. 6. **Flueggeopsis**

6. Pistillate sepals persistent; pollen grains similar but exine reticulate, lumina without
granules.

Sect. 6. **Anisonema**

5. Fruits drupaceous; sepals and stamens 4; pistillate pollen grains syncolporate,

Sect. 7 **Cicca**

Sect. 1. **Chorisandra** (Wight) Müll. Arg., Linnaea 32: 2. 1863 (as sect. *Chorizandra*); DC. Prodr. 15(2):

333. 1866. *Chorisandra* Wight, Ic. Pl. Or. 6: 12, pl. 1994. 1853. TYPE: *Chorisandra pinnata*

Wight [= *Phyllanthus pinnatus* (Wight) G. L. Webster]

Monoecious trees or shrubs; stipules persistent; sepals 5; stamens 5, filaments free

An Old World section of perhaps three species. Airy Shaw (1971) noted a resemblance between *Phyllanthus orientalis* and *P. jullienii* Beille from Indo-China. However, that species has been removed to the genus *Flueggea* (Webster, 1984) and noted as a possible connecting link between *Flueggea* and *Phyllanthus*. It now appears that sect. *Chorisandra* may be the sister group not only to subgenus *Kirganelia* but to all of the subgenera with phyllanthoid branching.

SPECIES INCLUDED: ARICA, INDIA, CEYLON: *Phyllanthus pinnatus* (Wight) G. L. Webster. MADAGASCAR: *P. coluteoides* Baillon. THAILAND: *P. orientalis* (Craib) Airy Shaw.

Sect. 2. **Pseudomenarda** Müll. Arg., J. Bot. 2: 329. 1864. TYPE: *Phyllanthus purpureus* Müll. Arg.,

Monoecious glabrous shrub, axes purplish; leaves linear-lanceolate; flowers in axillary glomerules; staminate sepals 5, disk segments 5, fleshy; stamens 5, filaments free; anthers dehiscent

longitudinally; pollen grains \pm spheroidal, 3- (4-) colporate; colpi narrow, with irregular margins, not meeting at poles; pores often 2 per colpus; exine irregularly reticulate; pistillate sepals 5; disk crenate or lobed; ovary 3-locular; styles connate, tips bifid and dilated; fruits capsular; seeds trigonous, smooth.

The single species of this section is endemic to Angola. The pollen is notable in the occurrence of colpi with 2 pores, a feature not otherwise recorded for subg. *Kirganelia*. The section appears to be close to sect. *Menarda*, a relationship perceptively detected by Mueller; both sections have a similar pollen type, and may have to be combined when the Madagascar taxa are better known.

Sect. 3. **Menarda** (Comm. ex A. Juss.) Müll. Arg., *Linnaea* 32: 2. 1863. *Menarda* A. Juss., *Tent. Euphorb.*

23, pl. 6, fig. 18. TYPE: *Menarda cryptophila* Comm. ex A. Juss. [= *Phyllanthus cryptophilus* (Comm. ex A. Juss.) Müll. Arg.]

Monoecious or dioecious shrubs; leaves on branchlet opposite or alternate; flowers in axillary glomerules; sepals 5 (6); staminate disk segments 5; stamens 5, filaments free; anthers dehiscing longitudinally; pollen grains 3-colporate, colpi with 1 or 2 pores, exine reticulate; pistillate sepals 5 (6), accrescent in fruit; disk annular; ovary 3-locular; styles free, bifid; fruits capsular; columella persistent; seeds striate.

This section is here defined more narrowly than in the treatment by Müller (1866), who included species now classified in sections *Chorisandra* and *Pentandra*. It is not certain how many species from Madagascar belong here, as the pollen of most of them has not been classified.

REPRESENTATIVE SPECIES: *Phyllanthus cryptophilus* (A. Juss.) Müll. Arg., *P. geayi* Leandri, *P. humbertianus* Leandri.

Sect. 4. **Ciccopsis** G. L. Webster, *Contr. Gray Herb.* 176: 57. 1955. TYPE: *Phyllanthus pseudocicca* Griseb.

Monoecious trees or shrubs; branches often with spur-shoots; sepals 6; staminate disk segments 6; stamens 3, filaments free; anthers deflexed; pollen grains 3-colporate, angulaperturate, exine reticulate; pistillate disk 3-angled; ovary 3-locular; styles free, bifid; fruit capsular.

This monotypic section shows similarities with African taxa of subg. *Kirganelia*, especially species of sect. *Floribundi*.

Sect. 6. **Pentandra** G. L. Webster, J. Arnold Arb. 48: 333. 1967. TYPE: *Phyllanthus pentandrus* Schumach. & Thonn.

Monoecious shrubs or herbs; cataphyllary stipules not auriculate; flowers in axillary cymes, the proximal staminate or bisexual, the distal pistillate; sepals 5; staminate disk of 5 segments; stamens 5, filaments free, anthers dehiscing obliquely or horizontally; pollen grains \pm prolate, (3-) 4-colporate, pores longitudinal, exine tectate-reticulate; pistillate sepals 5; disk annular; ovary 3-locular; styles free or basally connate, bifid; fruits capsular, seeds papillose.

This section of about 5 African species is controversial both in its systematic placement and in its composition. Meewis and Punt (1983) indicated three different pollen types within the section, although the species appear similar in other characters. Those two authors also argued that *Phyllanthus pentandrus*, with pollen of the “amarus” type, might not belong to the same section with the other species. The resolution of these questions must await a critical revision of sect. *Pentandra*.

A greater problem than the palynological heterogeneity within the section is its subgeneric relationship. Meewis and Punt correctly point out that the inflorescence pattern in sect. *Pentandra*, with staminate flowers at proximal axils of the branchlet and pistillate at the distal axils, is characteristic of sect. *Phyllanthus*. It appears, therefore, that assignment of sect. *Pentandra* to subg. *Phyllanthus* is justified on phylogenetic grounds.

Sect. 5. **Floribundi** Pax & K. Hoffm., Pflanzenw. Afr. 3(2): 22. 1921. TYPE: *Phyllanthus*

floribundus Müll. Arg. (nom. illeg., non *P. floribundus* Kunth) [= *Phyllanthus muelleranus* (Kuntze) Exell]

Monoecious or dioecious trees or shrubs; inflorescences \pm cauliflorous, racemoid, fasciculate, sometimes also with axillary glomerules; sepals (4) 5 (6); staminate disk segments mostly 5; stamens (4) 5, filaments free, sometimes of unequal lengths; anthers muticous, dehiscing longitudinally; pollen grains spheroidal, 3-syncolporate, colpi marginate, exine reticulate with granules in lumina or vermiculate to

pilate; pistillate sepals usually 5; disk annular; ovary (3) 4- or 5-locular; styles bifid (rarely unlobed); fruits indehiscent, exocarp papery to fibrous; seeds smooth, sometimes excavated at the hilum.

KEY TO SUBSECTIONS OF SECT. FLORIBUNDI

1. Fruits capsule-like, inflated, with thin papery walls; lumina of pollen exine reticulum lacking granules;

subsect. 1. *Inflati*

1. Fruits thick-walled, fleshy or fibrous; lumina of pollen exine reticulum with granules, or exine vermiculate to pilate.

subsect. 2. *Muelleriani*

Subsect. 5.1. *Inflati* G. L. Webster, subsect. nov.: fructibus indehiscentes, muri non carnosii. TYPE:

Phyllanthus inflatus Hutch.

Monoecious; stipules not spinescent; inflorescences cauliflorous (at least in part); stamens 5, filaments free; pollen grains 3-colporate, colpi narrowly marginate, exine reticulate, lumina somewhat irregular, lacking central granules; ovary 3-locular; fruits with thin paper walls, not regularly dehiscent; seeds smooth, 6—8 mm long.

This group of west African species is distinguished by its distinctive bladderly fruits and pollen (“archboldianus type” of Meewis & Punt, 1983) that is slightly different from species of subsect.

Muelleriani.

REPRESENTATIVE SPECIES: *Phyllanthus inflatus* Hutch., *P. physocarpus* Müll. Arg., *P. profusus* N. E.

Br.

Subsect. 5.2 *Muelleriani* G. L. Webster, subsect. nov.: fructibus baccatis. TYPE: *Phyllanthus*

muellerianus (Kuntze) Exell.

Monoecious or dioecious; stipules often spinescent; stamens 4 or 5, filaments usually free but sometimes of unequal lengths; pollen grains variable; ovary 3--4- (5-) locular; fruits with thick fibrous or fleshy exocarp; seeds smooth, 5—10 mm long.

This African section of about 10 species is perplexingly difficult to classify. According to Meewis and Punt, there are four pollen types represented: (1), the “maritimus type”, with prominent colpar margins and granules in the lumina of the exine reticulum; (2) the “archboldianus type”, with prominent to indistinct margins and exine transitional from vermiculate to pilate; and (3) the “dinklagei” and “klainei” types, transitional from vermiculate to fully pilate (in *Phyllanthus dinklagei*). Brunel (1977) has proposed a new section *Brazzaeani* based on the unusual pilate pollen of *Phyllanthus dinklagei*. Unfortunately, several species are still known only from incomplete material, and there do not appear to be any consistent morphological difference that would permit a subdivision that reflects the differences in pollen.

REPRESENTATIVE SPECIES. AFRICA. Group 1: *Phyllanthus delpyanus* Hutch., *P. engleri* Pax, *P. muellerianus* (Kuntze) Exell. Group 2: *Phyllanthus polyanthus* Pax, *P. tessmannii* Hutch. Group 3: *Phyllanthus dinklagei* Pax, *P. klainei* Hutch.

Sect. 6. **Flueggeopsis** Müll. Arg., *Linnaea* 32: 2. 1863; DC. Prodr. 15(2): 348. 1866. TYPE: *Phyllanthus glaucus* Wall. ex Müll. Arg. üü

Hemicicca Baillon, Étude Gen. Euphorb. 645. 1858. *Phyllanthus* sect. *Hemicicca* (Baillon) Müll. Arg., DC. Prodr. 15(2): 324. 1866. *Phyllanthus* sect. *Cicca* subsect. *Hemicicca* (Baillon) Müll. Arg., *Linnaea* 32: 52. 1863. TYPE: *Hemicicca japonica* Baillon [= *Phyllanthus flexuosus* (Siebold & Zucc.)

Monoecious shrubs; inflorescences of axillary glomerules; sepals 4 or 5--6; staminate disk segments 4—6; stamens 2—5, filaments free; anthers dehiscing longitudinally; pollen grains 3-colporate, colpi marginate, exine reticulate; pistillate disk annular (sometimes lobed); ovary 3—4 (5-) locular; styles free, nearly entire (emarginate apically); fruit baccate; seeds smooth.

Two species of eastern Asia. This section is in many ways intermediate between sections *Floribundi* and *Anisonema*, having the deciduous pistillate sepals of the first and axillary inflorescences of the latter.

REPRESENTATIVE SPECIES: INDIA, NEPAL, BHUTAN: *Phyllanthus glaucus* Wall. ex Müll. Arg. CHINA & JAPAN: *Phyllanthus flexuosus* (Siebold & Zucc.) Müll. Arg..

Sect. 7. **Anisonema** (A. Juss.) Griseb., Fl. Br. W. Ind. 34. 1859. *Anisonema* A. Juss., Euphorb. Tent.

19. 1824. *Kirganelia* sect. Airy Shaw & G.L. Webster, *Anisonema* Baillon, Étude Gen. Euphorb.
613. 1858. TYPE: *Anisonema reticulatum* (Poir.) A. Juss. [= *Phyllanthus reticulatus* Poir.]

Monoecious or dioecious trees or shrubs (sometimes scandent); branchlets often fasciculate; stipules sometimes spinescent; inflorescences of axillary glomerules; staminate sepals, disk segments, and stamens (5 or 6; filaments free or connate, often of unequal lengths; anthers muticous, dehiscing longitudinally; pollen grains ± spheroidal, 3-syncolporate, colpi usually marginate, exine irregularly reticulate to vermiculate, lumina without granules; pistillate sepals 5 or 6, deciduous or persistent in fruit; disk annular; ovary 3—10-locular; styles bifid to nearly unlobed; fruits baccate; seeds smooth.

A section of Africa and Madagascar. Despite morphological studies by Brunel (1975) and palynological analysis by Meewis and Punt (1983), the circumscription of sect. *Anisonema* still requires definition. As here defined, the section is heterogeneous in pollen morphology, with at least three different pollen types. Probably a number of additional species from Madagascar treated by Leandri (1958) may be referable to this section.

REPRESENTATIVE SPECIES: AFRICA: *Phyllanthus engleri* Pax, *P. muellerianus* (Kuntze) Exell, *P. ovalifolius* Forssk., *P. reticulatus* Poir. MADAGASCAR & MASCARENES: *Phyllanthus casticum* P. Willemet, *P. decipiens* (Baillon) Müll. Arg., *P. fusco-luridus* Müll. Arg., *P. seyrigii* Leandri. AUSTRALIA/NEW GUINEA/NEW HEBRIDES: *P. archboldianus* Airy Shaw & G. L. Webster, *P. caesius* Airy Shaw & G.L. Webster, *P. ciccoides* Müll. Arg., *P. novae-hollandiae* Müll. Arg. TAIWAN: *P. oligospermus* Hayata.

Sect. 8. **Cicca** (L.) Müll. Arg., Linnaea 32: 50. 1863. *Cicca* L., Mant. Pl. 124. 1767. TYPE: *Cicca*

disticha L. [= *Phyllanthus acidus* (L.) Skeels
Tricarium Lour., Fl. Coch. 557. 1790. TYPE: *Tricarium cochinchinense* Lour. [= *Phyllanthus acidus* (L.) Skeels]

Staurothyra W. Griffith, Notul. Pl. Asiat. 4: 476. 1854. TYPE: species not designated.

Monoecious or dioecious trees; flowers partly or entirely cauliflorous; sepals 4; staminate disk segments 4; filaments 4, free; anthers dehiscing longitudinally; pollen grains spheroidal, 3-syncolporate, colpi marginate, exine reticulate; pistillate sepals 4; disk lobed, segmented, or absent; staminodes sometimes present; ovary 3- or 4-locular; styles free, bifid; fruit indehiscent, with fleshy or woody exocarp; seeds mostly 1 per locule, smooth.

Although earlier treated as a distinct subgenus, *Cicca* now appears to be only a section of the inclusive subgenus *Kirganelia*. Section *Cicca* has been redefined (Webster, 2001) to include *Aporosella* as a subsection. This now results in a section that is represented both in Africa and in the New World.

Subsect. 8.1. ***Cheramela*** Kuntze, Lex. Gen. Phaner. 434. 1904 *Phyllanthus* subsect. *Eucicca* Müll. Arg.,

Linnaea 32: 50. 1863 (nom. illeg.). TYPE: *Phyllanthus acidus* (L.) Skeels

Monoecious (rarely dioecious); flowering glomerules both axillary and cauliflorous; staminate disk dissected, pistillate annular; ovary 3- or 4-locular; styles free; exocarp fleshy.

A monotypic section; the single species *Phyllanthus acidus*, very commonly cultivated in the tropics, is apparently African in origin.

Subsect. 8.2. ***Aporosella*** (Chodat) G. L. Webster, Contr. Univ. Michigan Herb. 2001.

Aporosella Chodat, Bull. Herb. Boiss. II. 5: 488. 1905. *Phyllanthus* sect. *Aporosella* (Chodat)

G. L. Webster, J. Arnold Arb. 38: 72. 1957. TYPE: *Aporosella hassleriana* Chodat [= *Phyllanthus chacoensis* Morong].

Dioecious; inflorescences entirely cauliflorous; sepals 4; disk absent; stamens 4; ovary 2- or locular, styles bifid or lacerate; exocarpy woody.

This small neotropical section of 2 species is clearly closely related to subsect. *Cheramela* in most characters. However, the dioecious flower production and absence of floral disk provide a clear morphological distinction.

REPRESENTATIVE SPECIES: CARIBBEAN AMERICA (Mexico to northern Venezuela):

Phyllanthus elsiae Urb. SOUTH AMERICA (Argentina and Paraguay): *P. chacoensis* Morong.