A Key to the Tropical African species of *Campylopus*, with a generic key for Dicranaceae: Campylopodioideae

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Taxonomic summary - Dicranaceae: Campylopodioideae

Seven genera of Campylopodioideae sensu Brotherus (1924) occur in Africa: *Atractylocarpus, Bryohumbertia, Campylopus, Dicranodontium, Microcampylopus, Pilopogon* and *Sphaerothecium*. According to a cladistic and phenetic study, *Microcampylopus* is better regarded as a genus of Dicranelloideae (Frahm, 1991a), but is included here in the Campylopodioideae for practical reasons. All genera with the exception of *Dicranodontium* have been revised recently (see below under each genus).

This subfamily is characterized by acrocarpous plants with (1) lanceolate, erect-spreading or appressed, straight or homomallous leaves and (2) a broad costa filling 1/3 to 4/5 of the leaf width. The colour of the plants varies from light- to dark-green to almost blackish. The height of the plants varies from 3 mm to 15 cm. The leaves may have a percurrent or excurrent costa ending in a concolorous or hyaline tip. The basal laminal cells are thin-walled and hyaline or incrassate and concolorous, and the upper laminal cells vary between quadrate and elongate. The costa shows bands of ventral and dorsal stereids, dorsal stereids and ventral hyalocysts or no stereidal bands at all. The seta is 3 - 15 mm long and is straight or cygneous. The capsule is globose to cylindrical, erect or inclined and curved, strumose or not, smooth or furrowed. The operculum is more or less longly rostrate, rarely conical. Spores vary in size between 13 µm and 25 µm but are usually 13-15 µm. The calyptra is always cucullate but entire or fringed at the base.

Key to the genera of Campylopodioideae in Africa

1	Plants with sheathing base, abruptly contracted into a fine acumen. Plants *Anisothecium*-like, but differing in cygneous setae	*Microcampylopus*
	Leaves without sheathing base, gradually narrowed into the acumen. Plants not*Anisothecium*-like	2
2	Capsule on 3-4 mm long seta inserted in the perichaetial leaves. Spores 21-25 µm in diameter	***Sphaerothecium***
	Capsule exserted on 5-15 mm long seta. Spores 12-15µm in diameter	3
3	Seta straight when moist, more than 1 cm long	4
	Seta cygneous when moist, less than 1 cm long	6
4	Lower half of the seta surrounded by perichaetial leaves	***Pilopogon***
	Seta not surrounded by perichaetial leaves	5
5	Capsule straight. Plants regularly foliate	*Atractylocarpus*
	Capsule curved. Plants comose or interruptedly foliate	*Bryohumbertia*
6	Upper laminal cells elongate rectangular (6 or more times longer than wide)	***Dicranodontium***
	Upper laminal cells quadrate, oval or short rectangular (2-4 times longer than wide)	*Campylopus*

Atractylocarpus *Mitt.*

Atractylocarpus was revised by Padberg & Frahm (1985), and is a genus of nine species, of which *A. alticaulis*(Broth.) Williams and *A. madagascariensis* (Thér.) Padberg & J.-P. Frahm occur in Africa. *A. alticaulis* (Broth.) Williams (*A. flexifolius* Dix., *A. capillifolius* Dix.) is confined to the mountains of central and eastern Africa (Ruwenzori, Kahuzi, Karisimbi, Mt. Kenya and Mt. Kilimanjaro). *A. madagascariensis* was known previously only from the type locality in Madagascar and a later record from Réunion (Townsend, 1987), but is now recorded from Malawi (Frahm & O'Shea, 1996). A third species described from Africa, *A. capillifolius*, was not treated in the revision by Padberg & Frahm (1985) but placed into synonymy of *A. alticaulis* by Frahm (1993).

The species of *Atractylocarpus* resemble those of *Dicranodontium* in appearance and anatomical details, but are distinguished from the latter by erect, not cygneous setae.

Bryohumbertia *P.de la Varde & Thér.*

The genus *Bryohumbertia* was based originally on a single African species, *B. metzlerelloides* P. Varde & Thér., and regarded as monotypic. Frahm (1982) included the neotropical *Campylopus filifolius* (Hornsch.) Mitt. in this genus and introduced *B. flavicoma* (C. Müll. ex Broth.) J.-P. Frahm as an earlier name for *B. metzlerelloides*. Later, the S.E.-Asian *Campylopus walkeri* (Mitt.) Jaeg. was recognized as belonging to this genus (Frahm *et al.*, 1985), for which the older name *Campylopus subcomosus* Dix. was combined into this genus as *B. subcomosa* (Dix.) J.-P. Frahm (Frahm, 1989).

Bryohumbertia is separated from *Campylopus* by differences in areolation of the leaves, the presence of an annulus, a very long operculum as long or longer than the urn, and straight setae, as well as the smooth inner surface of the peristome teeth, and spores with a warty surface.

Campylopus *Brid.*

Campylopus is a genus in which more than 1000 species have been described. The authors of the Index Muscorum (Wijk et al., 1959) listed about 720 legitimate species. As a result of numerous regional revisions, only about 150 species are accepted at present. The genus was revised for Africa by Frahm (1985), who recognised 50 species. Of these species, *C. subchlorophyllosus* C. Müll. ex Rabenh. proved to be a species of *Sphaerothecium* (Frahm, 1986),*C. leucochlorus* (C. Müll.) Par. has been made a synonym of *C. hildebrandtii* (C. Müll.) Jaeg. and *C. paludicola* Broth. a synonym of *C. pyriformis* (Schultz) Brid. (Frahm, 1994a), and *C. cardotii* Thér. and *C. stenopelma* (C. Müll.) Par. have both been made synonyms of the neotropical *C. controversus* (Hampe) Jaeg. (Frahm, 1994b). Recently, the American *C. carolinae* Grout was reported from Rwanda (Frahm, 1993). This results in a total of 48 species in Africa, with 40 of these in the tropics. Of these species, 24 (plus one variety) have now been recorded from Malawi, and all are discussed in Frahm & O'Shea (1996). In contrast, 65 species are known from the Neotropics (Frahm, 1991b) but only 25 from S.E.-Asia (Frahm, 1992). The phytogeography of the African species of *Campylopus* was treated by Frahm (1990).

Within the Campylopodioideae, *Campylopus* is distinguished by short (< 10 mm), cygneous setae, and leaves not sheathing at base. The capsules may be erect and symmetric (sect. *Homalocarpus*) or curved and strumose or not (sect. *Campylopus*). The genus is known for the great plasticity of the anatomy of the costa between species, which shows ventral and dorsal stereid bands (as usual in the Dicranaceae), ventral hyalocysts and dorsal stereids or no stereids at all with many intergradations.

There are illustrations and descriptions of all African *Campylopus* species in Frahm (1985).

Key to African *Campylopus* species

(Revised from Frahm (1985), this key does not include *C. clavatus*, which occurs only on Marion Islands. *C. clavatus*would key out as *C. carolinae* in this key.).

1	Basal laminal cells hyaline, thin-walled	2
	Basal laminal cells chlorophyllose, incrassate	25
2	Costa excurrent in a hyaline hairpoint	3
	Costa not ending in a hyaline hairpoint	14
3	Hairpoint (moist or dry) straight	4
	Hairpoint (moist or dry) reflexed or recurved	13
4	Costa smooth on dorsal side	5
	Costa lamellose or ridged on dorsal side	6
5	Upper laminal cells elongate-oval, 6:1	***C. brevipilus***
	Upper laminal cells shorter, subquadrate or rhomboid, <2:1	***C. eximius***
6	idged or with lamellae 1 cell high	7
	Costa lamellose with lamellae 3-4 cells high	12
7	Upper laminal cells oval	8
	Upper laminal cells subquadrate, oblique or shortly oval	***C. catarractilis***
8	Costa with ventral stereids	***C. carolinae***
	Costa with ventral hyalocysts	9
9	Costa filling 3/4 of leaf width at leaf base, alar cells protruding into the costa	***C. kivuensis***
	Costa filling 1/2 - 2/3 of leaf width at leaf base; alar cells hardly differentiated, not protruding into the costa	10
10	Costa with small ventral hyalocysts, hardly larger than the median cells	11
	Ventral hyalocysts of the costa larger than the median cells (see also forms intermediate between *C. pilifer* and *C. introflexus* under *C. pilifer*)	***C. johannis-meyeri***
11	Hyaline hairpoint serrate. Plants golden-brownish, not dichotomously branched	***C. aureus***
	Hyaline hairpoint nearly smooth. Plants bright green, dichotomously branched (often several times)	***C. smaragdinus***
12	Leaves with obtuse apex	***C. julaceus***
	Leaves with acute apex	***C. pilifer***
13	Hairpoint recurved	***C. aureonitens***
	Hairpoint reflexed	***C. introflexus***
14	Leaf apex narrowly cucullate	***C. bicolor***
	Leaf apex not cucullate	15
15	Upper laminal cells short (<2:1)	16
	Upper laminal cells more than twice as long as wide	18
16	Upper laminal cells quadrate	***C. fragilis***
	Upper laminal cells shortly rectangular	17
17	Ventral hyalocysts of the costa larger than the median cells	***C. hildebrandtii***
	Ventral hyalocysts of the costa as large as or smaller than the median cells	***C. cambouei***
18	Upper laminal cells rectangular	***C. pyriformis***
	Upper laminal cells oval or elongate	19
19	Leaf apex smooth	20
	Leaf apex serrate	21
20	Costa with large ventral hyalocysts, smooth on the dorsal side	***C. perichaetialis***
	Costa with small ventral hyalocysts, ridged on the dorsal side	***C. pseudobicolor***
21	Leaves distinctly homomallous	***C. dicranoides***
	Leaves erect	22

22	Upper laminal cells shortly oval. Costa with ventral stereids	***C. vesticaulis***
	Upper laminal cells elongate. Costa with ventral hyalocysts	23
23	Upper laminal cells oval	***C. nivalis***
	Upper laminal cells rectangular	24
24	Costa smooth at dorsal side, without dorsal stereids	***C. subnitens***
	Costa ridged at dorsal side, with dorsal stereids	***C. bartramiaceus***
25	Costa excurrent as hyaline awn, pilose	26
	Costa not excurrent as hyaline awn, epilose	31
26	Upper laminal cells rectangular. Leaves more than 1 cm long	***C. hensii***
	Upper laminal cells oblique, oval or elongate. Leaves less than 1 cm long	27
27	Inner basal laminal cells shortly rectangular	28
	Inner basal laminal cells elongate rectangular	30
28	Outer basal laminal cells hyaline, elongate	***C. flaccidus***
	Outer basal laminal cells quadrate	29
29	Costa with ventral stereids	***C. savannarum***
	Costa with ventral hyalocysts	***C. robillardei***
30	Basal laminal cells pitted	***C. crateris***
	Basal laminal cells smooth	***Sphaerothecium subchlorophyllosum***
31	Basal laminal cells pitted	32
	Basal laminal cells not pitted	38
32	Plants interruptedly comose foliate	33
	Plants equally foliate	34
33	Upper laminal cells almost quadrate	***C. trachyblepharon***
	Upper laminal cells elongate oval	***C. torrentis***
34	Costa excurrent in an almost entire subula	***C. megalotus***
	Costa excurrent in a serrate awn	35
35	Marginal basal laminal cells subquadrate	***C. chevalieri***
	Marginal basal laminal cells elongate	36
36	Upper laminal cells oblique rhomboid or oval	***C. controversus***
	Upper laminal cells subquadrate	37
37	Costa with ventral stereids	***C. arctocarpus***
	Costa with small ventral hyalocysts	***C. incacorralis***
38	Upper laminal cells elongate (>4:1)	***C. obrutus***
	Upper laminal cells shorter	39
39	Leaves up to 3 mm long	40
	Leaves longer	42
40	Costa without dorsal stereids	***C. decaryi***
	Costa with dorsal stereids	41
41	Costa filling 1/3 of leaf base	***C. nanophyllus***
	Costa filling 1/5-1/4 of leaf base	***C. perpusillus***
42	Leaf tip smooth	***C. arcuatus***
	Leaf tip serrate	43
43	Costa smooth on dorsal side	44
	Costa ridged and serrate on dorsal side	46
44	Leaves 7-12 mm long. Costa filling 4/5 of leaf width	***C. jamesonii***
	Leaves shorter than 7 mm. Costa narrower	45
45	Costa with ventral hyalocysts	***C. praetermissus***
	Costa with ventral stereids	***C. purpureocaulis***
46	Costa with ventral substereids	***C. flexuosus***
	Costa with ventral stereids	47
47	Upper laminal cells oblique or rhombic	***C. fuscolutescens***
	Upper laminal cells subquadrate	***C. arctocarpus***

Microcampylopus (Müll.Hal.)M.Fleisch.

Microcampylopus was revised by Giese & Frahm (1985), and is a genus with three species, one of which, *M. laevigatus*, occurs in Africa. The species of *Microcampylopus* as well as those of *Campylopodium* resemble species of *Anisothecium*, gametophytically with vaginate leaf bases and also sporophytically with capsule shape and spore size, but possess a cygneous seta. Both genera were commonly included in the Campylopodioideae by Brotherus (1924) because of the curved seta but are better included in the Dicranelloideae (Frahm, 1991a).

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