

## Notes on the bryophytes of Madagascar 4. *Campylopus cuspidatus* ssp. *frahmii* ssp. nov.

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**Abstract:** Pócs T. (2021): Notes on the bryophytes of Madagascar 4. *Campylopus cuspidatus* ssp. *frahmii* ssp. nov. *Frahmia* 23:1-7.

A moss at the shore of a subalpine pond on the Marojezy Mountain summit plateau, Madagascar, proved to be a cucullate variant of *Campylopus cuspidatus* (Hornsch.) Mitt., a species hitherto known only from the Neotropics. As it differs in several features from *Campylopus cuspidatus* var. *dicnemioides* (Müll.Hal.) J.-P.Frahm, it is described as ssp. *frahmii*.

### 1. Introduction

The publication of the African and tropical American revisions (Frahm 1985a, 1991) were important milestones in the research of the genus *Campylopus* and of *Campylopoideae*. Together with some other publications (Bizot & Kilbertus 1979, Frahm 1979, 1980, 1982a, 1982b, 1985b, 1994, 2000, 2021, Frahm & Ho 2009, Frahm & O'Shea 1996, Magill 1981, Marline et al. 2012, Stech 1999) the taxonomy of this group became very easy to survey. I recently composed a paper on our *Campylopoideae* collection from the East African islands, in which the known number of species here was raised from 30 to 34 (Pócs 2021a).

During the identification of the *Campylopoideae* of Madagascar I came across a very strange plant collected on the summit plateau of Marojezy mountain (figs 1-2), intermixed in the cushions of *Campylopus introflexus*. The shiny, blackish brown mosses were also cushion forming on the sandy shore of subalpine ponds surrounded by *Sphagnum* mires. It had broad, cucullate leaves with relatively narrow, slightly branching costa occupying about 1/6–1/10 of the leaf width, strongly incrassate, pitted lamina cell walls and collenchymatous, deeply pigmented alar cells. The leaf structure suggested a Pterobryaceae but living on wet sand, it seemed to be very unprobably. Careful examination of the transversal section of costa revealed that this plant is another *Campylopus* species, hitherto unknown from Africa and using the monograph of neotropical *Campylopoideae* of Frahm (1991), proved to be a cucullate leaved variant of *Campylopus cuspidatus* (Hornsch.) Mitt. Such variants are already described as ecotypes of different *Campylopus* species living on wet ground. In case of *Campylopus cuspidatus* this variant is named var. *dicnemioides* (Müll.Hal.) J.-P.Frahm, because of superficial similarity to Dicnemonaceae species. It grows in swamps and wet páramos above the forest line in South America. *Campylopus cuspidatus* has a unique character among all *Campylopus* species: the relatively narrow costa (only 1/3–1/5 of leaf width) has short, acute side nerves, as pointed out by Frahm (1991: 82–83). Both the neotropical var. *dicnemioides* and our Madagascar plant share this character. Anyway, the Madagascar plant differs in several

aspects from *var. dicnemioides*, therefore it seemed to be necessary to distinguish it at the subspecies level, being allopatric and morphologically quite different.



Fig.1: Morning clouds on Marojejy massif



Fig.2: Tarns on plateau behind the summit

## 2. Description of *Campylopus cuspidatus* (Horsch.) Mitt. *spp. nov. frahmii* Pócs

**Diagnosis:** It differs from *Campylopus cuspidatus* (Hornsch.) Mitt. by its wide lanceolate leaf shape with cucullate apex, not ending in a hair tip. It differs also from *var. dicnemioides* (Müll.Hal.) J.-P.Frahm by the dark blackish brown color including the shoot apex, by the mostly erect, spreading apical leaves, not adhering to the stem. Costa only 1/6–1/10 of leaf width (1/3–1/5 by *C. cuspidatus* and its *var. dicnemioides*), by the very much thickened, pitted cell walls all over the lamina with a 7–16 cells wide hyaline margin (1–2 cells wide in *var. dicnemioides*) at the base and finally by the often bitten off (praemorsus) or split leaf apex.

**Type:** Madagascar, Antsiranana prov., Sava reg., Marojejy National Park. Behind the main summit on the plateau at 2063 m, 14°27'02"S, 49°43'52"E. On wet sand around the tarns with *Cyperaceae* and *Sphagnum* bogs, 2 species of *Drosera*, among pillows of *Bazzania praerupta* (Reiwnw. et al.) Trevis., *Conoscyphus trapezioides* (Sande Lac.) Schiffn., *Herbertus juniperoideus* (Sw.) Grolle, *Sphagnum* spp., *Campylopus flexuosus* *var. incacorrallis* (Herz.) J.-P.Frahm and *C. introflexus* (Hedw.) Brid.

Coll.: T. Pócs 90118/D, in the company of C. LaFarge England, R.E. Magill and Armand Randrianasolo from the Tsimbazaza Botanical Garden, Antananarivo, 28.March 1990. (Holotype: TAN, isotypes: ALTA, B, BP, BM, BR, EA, EGR, G, JE, KRAM, MO, NY, PC).

**Etymology:** The African subspecies is named to honour the monographer of the genus, the late Professor Jan-Peter Frahm, who dealt also with the infraspecific taxa of *Campylopus cuspidatus*.

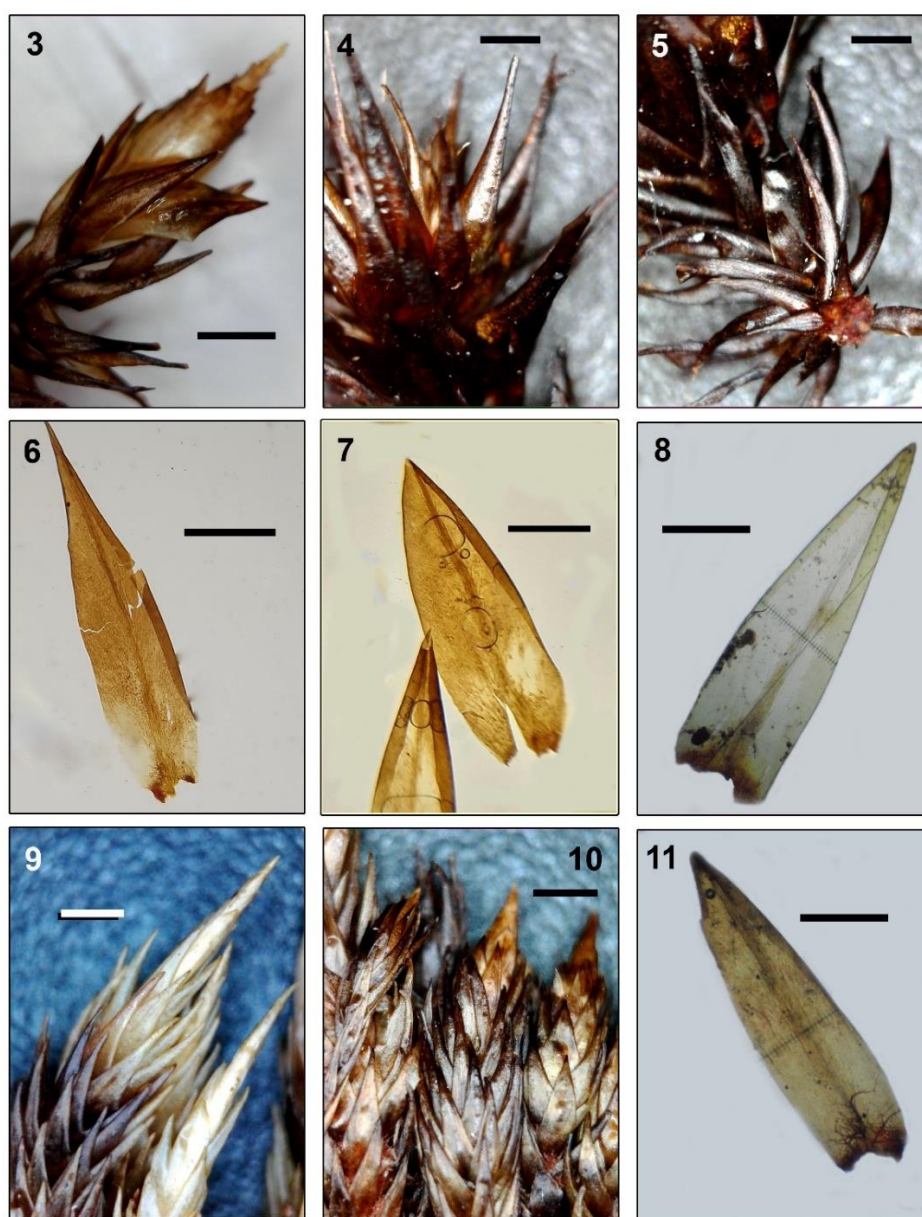
**Description:** 2–4 cm tall, erect, blackish brown plants growing in cushion, forming mats or scattered among other *Campylopus* species on wet sand of mires above the forest line, similarly to the neotropical *C. cuspidatus* *var. dicnemioides*. **Stem** 250–350 µm thick, mostly not or only scarcely branching, with pale brown rhizoids only at its base. Cortex built up of 2–4 layers of yellow substereids with cells 8–10 µm in diameter. Medulla consists mostly of red or brownish pigmented stereids, turning orange inside, of 10–20 µm diameter and thick walls. There is a central strand up to 10 cells of wide lumen and thin, colorless walls, which disappears with age. **Leaves** erect, spreading about at an angle of 45°, even on the shoot apex, dark blackish brown all over the shoot. Size ovate-lanceolate with acute, cucullate, concolorous apex without hyaline tip and often bitten off or split or broken. Costa at the base 1/6–1/10 leaf width, percurrent, with 3–6 short (200–500 µm

long) side-nerves spreading at about 30° angle. Costa in transversal section near the base dorsally slightly ridged, with stereid bundles, guide cells about the same width as those of the ventral hyalocists. Lamina cells all over the leaf have strongly incrassated and brown pigmented, pitted walls with well visible median lamellae. Their lumen itself is usually narrower than the walls, 4–10 × longer than wide. Alar cells form very small auricles, narrower than the leaf base, consisting of brownish red or purple, very collenchymatous, square or short rectangular cells in 12–20 parallel rows. The basal lamina and often the auricle too, are bordered by 7–16 rows of hyaline cells with somewhat less incrassate walls than the other lamina cells. Sporophyte or ways of vegetative reproduction not known.

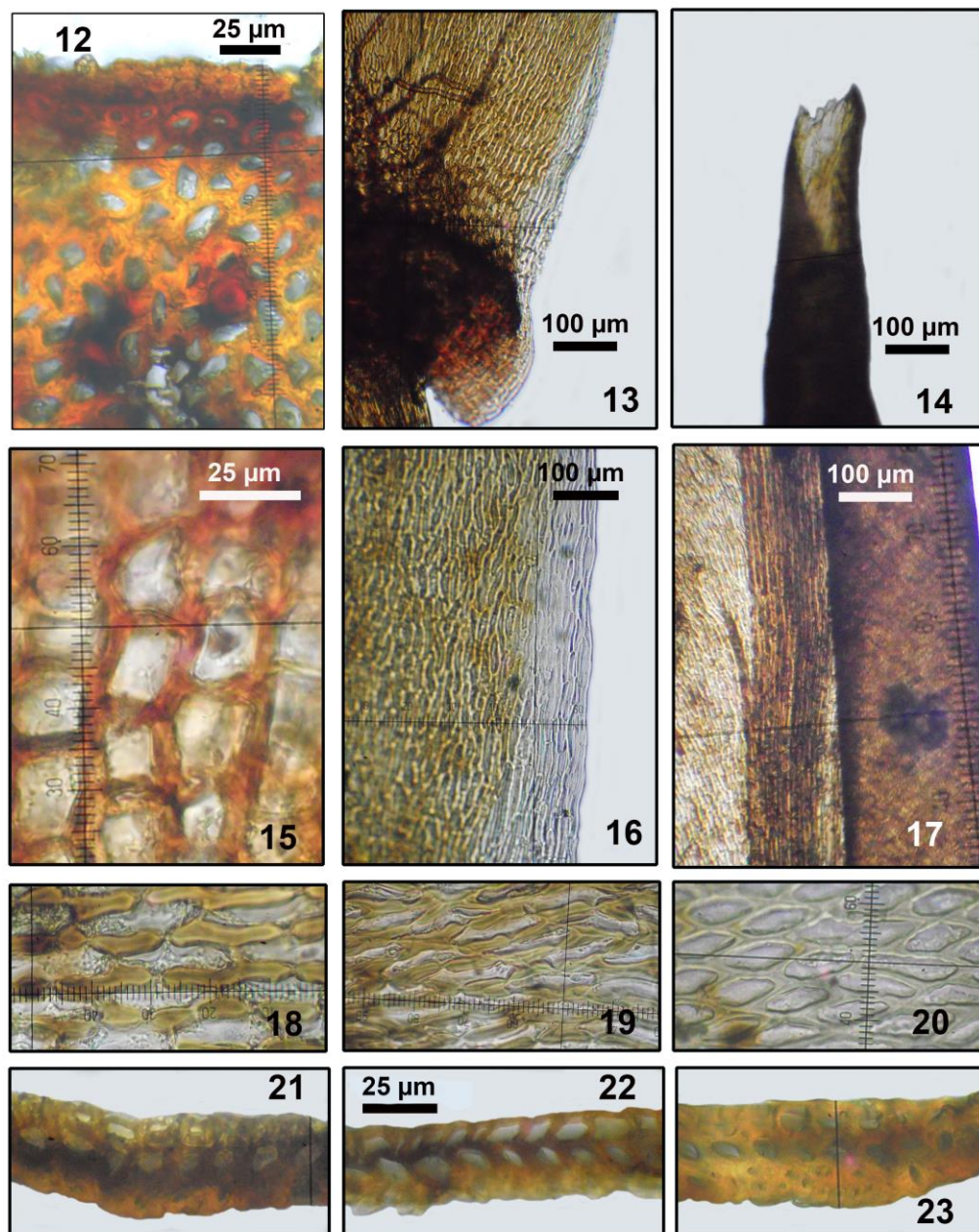
### 3. Discussion

Marojejy massif with its 55,500 ha National Park is very important to preserve one of the richest biodiversity hotspot in NE Madagascar. Its importance is emphasized by the fact that in the whole surrounding Sava region the forests are nowadays decimated by the illegal logging of rosewood (*Dalbergia greveana* and other species). This timber is highly demanded by the new Chinese elite as became very popular for fine furniture, what critically endangers the existence of this beautiful but slow growing rainforest tree. This way it became the “contemporary ivory”. The very rugged topography (Fig.1) and vegetation belts from tropical lowland rainforest to subalpine bush above the timberline resulted in a great variety of habitats. The area is very rich in Madagascar and local endemics, like the silky sifaka (*Propithecus candidus*) among the animals and 7 species of palms and other 7 species of tree ferns do not live outside the national park (Wikipedia). Among bryophytes we already know *Radula marojezica* E.W.Jones (Jones 1992) and *Cheilolejeunea renigastria* Pócs (Pócs 2021b) restricted to Marojejy area.

*Campylopus cuspidatus* ssp. *fracmii* is the vicariant of neotropical *Campylopus cuspidatus* var. *dicnemiooides* and lives among very similar conditions to its counterpart (Fig. 2). The type of var. *dicnemiooides*, described by C. Müller (1898) from the Serra do Itatiaia, Agulhas Negras was collected by Ule also in mires above the forest line, at 2400 m elevation. The specimen in EGR (*Frahm Camp. Bras. Exsicc. No.11* from the type locality) contains a few shoots of *Sphagnum*. Such bicontinental disjuncts between America and Africa are not rare among *Campylopus* species. As Frahm (1982) pointed out, 11 species occurs on both continents. In addition, *Campylopus arctocarpus* (Hornsch.) Mitt., *Campylopus julaceus* A.Jaeger and *Campylopus trachyblepharon* (Müll.Hal.) Mitt. evolved different vicariant subspecies on the two continents. What is even more interesting, these vicariant subspecies occur in Africa only on the Indian Ocean islands, except for *Campylopus julaceus* ssp. *arbogastii*, which has one isolated occurrence in South Africa. This phenomenon of Afro-American disjunction restricted to the East African islands is observed by a number of bryotaxa (Pócs 1999), like *Symbiezidium barbiflorum* (Lindenb. et Gottsche) A.Evans (Sass-Gyarmati & Pócs 2000), *Calymperes venezuelanum* (Mitt.) Broth. ex Pittier (Orbán 2000), *Phyllogonium fulgens* (Hedw.) Brid., *Phyllogonium viride* Brid., *Phyllogonium viscosum* (P.Beauv.) Mitt. or even *Adelothecium bogotense* Hampe (Crosby et al. 1983, Ochyra et al. 1992, Pócs 1999), which has only one isolated occurrence in the crystalline Eastern Arc of East Africa. With the new taxon the known number of *Campylopus* species from the Indian Ocean islands increased to 35, out of the 51 African species.



**Figs 3-7:** *Campylopus cuspidatus* (Horsch.) Mitt. *ssp. nov. frahmii* Pócs. 3-4: shoot apex. 5: shoot base. 6-7: leaves (all from the type). **Figs. 8-11:** *Campylopus cuspidatus* (Horsch.) Mitt. *var. dicnemioides* (Müll.Hal.) J.-P. Frahm. 8: leaf. 9: shoot apex, Ecuador, Prov. Loja, Parque Nac. Podpcarpus, Sendero el Mirador, subpáramo at 3050 m, on wet ground. Schäfer-Verwimp & Preussing, 15 Apr. 2003 (EGR ex Herb. Schäfer-Verwimp No. 23286). 10: shoot apex, 11: leaf, Brasil, Rio de Janeiro, Parque Nac. Serra do Itatiaia, Agulhas Negras, among *Sphagnum*, at edge of small ponds, 2400 m (type locality of *Dicranum dicnemioides* Müll.Hal. Frahm 24 July 1977 (EGR from Frahm: *Campylopodetes Brasiliae Exsiccatae* No. 11). All scale bars are 1 mm long.



**Figs. 12–19, 21–23:** *Campylopus cuspidatus* (Horsch.) Mitt. *ssp. nov. frahmii* Pócs. 12: Stem transversal section. 13: Leaf auricle, 14: bitten off, cucullate leaf apex, 15: alar cells, 16: hyaline margin of outer basal lamina, 17: side nerve of costa, 18: basal internal lamina cells, 19: upper lamina cells, 21–23: transversal sections of costa (all from the type). **Fig. 20:** *Campylopus cuspidatus* (Horsch.) Mitt. *var. dicnemiooides* (Müll.Hal.) J.-P. Frahm. Upper lamina cells. Scale of figures 18–23 all as that of fig. 22.

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#### 5. Bibliography

- BIZOT, M., KILBERTUS, G. (1979). Les *Campylopus* africains subg. *lucidus* Biz. & Kilb. *Revue Bryologie et Lichénologie* 45: 61–95.
- CROSBY, M.R., SCHULTZE-MOTEL, U. & W. (1983). Katalog der Laubmoose von Madagaskar und den umliegenden Inseln. *Willdenowia* 13: 187–255.
- FRAHM, J.-P. (1979). Die *Campylopus* Arten Brasiliens. *Revue Bryologie et Lichénologie* 45(2): 127–178.
- FRAHM, J.-P. (1980). Synopsis of the genus *Campylopus* in North America north of Mexico. *The Bryologist* 83: 570–588.
- FRAHM, J.-P. (1982a). Grossdisjunktionen von Arealen suedamerikanischer und afrikanischer *Campylopus*-Arten. *Lindbergia* 8: 36–45.
- FRAHM, J.-P. (1982b). A reinterpretation of *Bryohumbertia* P.d.Vard. et Thér. *Cryptogamie, Bryologie et Lichénologie* 3(4): 365–369.
- FRAHM, J.-P. (1985a). Die afrikanischen *Campylopus*-Arten. *Bryophytorum Bibliotheca* 36: 1–216.
- FRAHM, J.-P. (1985b). *Campylopus aureus* Bosch & Lac. in the Hawaiian islands. *The Bryologist* 88: 359–360.
- FRAHM, J.-P. (1991). Dicranaceae: Campylopodioideae, Paraleucobryoideae. *Flora Neotropica monograph* 54: 1–238.
- FRAHM, J.-P. (1994). Taxonomische Notizen zur Gattung *Campylopus* XVI. *Nova Hedwigia* 59: 147–155.
- FRAHM, J.-P. (2000). New combinations in the genera *Atractylocarpus* and *Metzleria*. *Tropical Bryology* 18: 115–117.
- FRAHM, J.-P. (ed. Pócs, T.) (2021). East African Bryophytes XXXII. Campylopoideae Records. – *Frahmia* 22: 1–5.
- FRAHM, J.-P., O'SHEA, B.J. (1996). British Bryological Society Expedition to Mulanje, Malawi. 4. Dicranaceae: Campylopodioideae (*Atractylocarpus*, *Bryohumbertia*, *Campylopus*, *Microcampylopus*). *Journal of Bryology* 19: 119–134. <https://doi.org/10.1179/jbr.1996.19.1.119>
- JONES, E.W. (1992). African Hepatics XLII. *Radula marojejica* E.W. Jones, a new species from Madagascar. *Journal of Bryology* 17: 307–311.
- MAGILL, R.E. (1981). Bryophyta. Part 1. Mosses. Fasc. I. Sphagnaceae - Grimmiaceae in *Flora of Southern Africa* (ed. O.A. Leistner), Republic of South Africa.
- MARLINE, L., ANDRIAMIARISOA, R.L., BARDAT, J., CHUAH-PETIOT, M., HEDDERSON, T.A.J., REEB, C., STRASBERG, D., WILDING, N., AH-PENG, C. (2012). Checklist of the bryophytes of Madagascar. *Cryptogamie, Bryologie* 33: 199–255.
- OCHYRA, R., BEDNAREK-OCHYRA, H., PÓCS, T., CROSBY, M.R. (1992). The moss *Adelothecium bogotense* in Continental Africa, with a review of its world range. *The Bryologist* 95: 287–295.
- ORBÁN, S. (2000). *Calymperes venezuelanum*, a newly discovered American-African disjunct element in the flora of Madagascar. *The Bryologist* 103: 145–146.

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- PÓCS, T. (1999). Bryophyte speciation and diversity in the East African mountains. *Bryobrothera* 5: 237-245.
- PÓCS, T. (2021a). East African Bryophytes XXXIII. Campylopoideae (Leucobryaceae, Musci) from the Indian Ocean islands. *Acta Botanica Hungarica* 63(3–4): in press.
- PÓCS, T. (2021b). Notes on the bryophytes of Madagascar 3. Six new Lejeuneaceae species. *Cryptogamie, Bryologie*, in press.
- PADBERG, M., FRAHM, J.-P. (1985). Monographie der Gattung *Atractylocarpus* Mitt. *Cryptogamie: Bryologie, Lichénologie*. 4: 315-341.
- SASS-GYARMATI, A., PÓCS, T. (2002). A second species of *Symbiezidium* from Africa. *Cryptogamie, Bryologie* 23: 31-39.
- STECH, M. (1999). A reclassification of Dicranaceae (Bryopsida) based on non-coding cpDNA sequence data. *Journal of the Hattori Botanical Laboratory* 86: 137–159.