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Cadia multifoliolata Nusb. & Labat (Fabaceae, Papilionoideae), a new species from Madagascar

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Abstract

NUSBAUMER, L. & J.-N. LABAT (2008). Cadia multifoliolata Nusb. & Labat (Fabaceae, Papilionoideae), a new species from Madagascar. *Candollea* 63: 189-195. In English, English and French abstracts.

Cadia multifoliolata Nusb. & Labat *(Fabaceae, Papilionoideae)*, a new species from NE Madagascar, is described, illustrated and compared with the other seven species in the genus. This new species differs from the six other endemic species of Madagascar by the large number of leaflets and the morphology of the flowers. With its high leaflet number, *Cadia multifoliolata* is close to the North-East African and Arabian species *Cadia purpurea* (G. Piccioli) Aiton, but presents several differences with its shorter inflorescence bracts and its shorter hypanthium. *Cadia multifoliolata* is only known from the locality in the Daraina (Loky-Manambato) region in North-East Madagascar. This area is localized at the crossroads of four main phytogeographic units of Madagascar and presents a very steep environmental gradients.

Key-words

FABACEAE – *Cadia* – Madagascar – Taxonomy

Résumé

NUSBAUMER, L. & J.-N. LABAT (2008). Cadia multifoliolata Nusb. & Labat (Fabaceae, Papilionoideae), une nouvelle espèce de Madagascar. *Candollea* 63: 189-195. En anglais, résumés anglais et français.

Cadia multifoliolata Nusb. & Labat *(Fabaceae, Papilionoideae)*, une nouvelle espèce du NE de Madagascar, est décrite, illustrée et comparée aux sept autres espèces du genre. Cette nouvelle espèce se différencie des six autres espèces endémiques de Madagascar par un nombre élevé de folioles et par la morphologie de ses fleurs. Par son nombre élevé de folioles, *Cadia multifoliolata* est proche de l'espèce du Nord-Est de l'Afrique et d'Arabie *Cadia purpurea* (G. Piccioli) Aiton, mais s'en différencie par ses bractées de l'inflorescence et son hypanthium plus courts. *Cadia multifoliolata* n'est connue que de la localité du Daraina (Loky-Manambato) dans le Nord-Est de Madagascar. Cette zone est localisée au carrefour de quatre principaux domaines phytogéographiques de Madagascar et présente de forts gradients environnementaux.

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Introduction

The genus *Cadia* Forssk. is placed in the subfamily *Papilionoideae* of the *Fabaceae*. The genus is composed of shrubs or small trees with actinomorphic white to purple flowers morphologically intermediate between the *Caesalpinioideae* and the *Papilionoideae* (Tucker, 2002). Molecular data clearly place this genus in the genistoid clade of the *Papilionoieae* (Doyle & al., 1997). *Cadia* was included in the tribe *Sophoreae*, a formal but not monophyletic group was indicated by diverse datasets studied in recent years (Pennington & al., 2005). A recent phylogenetic study shows that the genus *Cadia* is monophyletic and sister to the *Podalyrieae*. Data of the study also indicate that the actinomorphic flowers may be interpreted as an apomorphy (Boatwright & al., 2008). The genus *Cadia* was revised by Van der Maesen (1970), Peltier (1972), and recently by Du Puy & al. (2002). Theses authors recognised 7 species in the genus, 6 being endemic to Madagascar. The remaining species, *C. purpurea* (G. Piccioli) Aiton, occurs in East & North-East Africa and Arabia. All Malagasy species, except *C. ellisiana* Baker from the eastern humid submontane forests, are rare and poorly known. The type specimen of the new species described here has been collected in the Daraina (Loky-Manambato) region during an ongoing vegetation study conducted in the North of Madagascar. This region is located at the crossroads of four main phytogeographic units and exhibits very strong environmental gradients especially regarding rainfall and elevation. Several different forest types were recognized (Gautier & al., 2006) and several new species have been discovered. Some of them have already been described, including a new species of *Coffea* L. (Davis & Rakotonasolo, 2001), a new *Secamone* R. Br. (Klackenberg, 2005), a new *Dalbergia* L. f. (Bosser & Rabevohitra, 2005), a new *Aspidostemon* Rohwer & H. G. Richt. (Van der Werf, 2006), two new *Calyptranthera* Klack. (Klackenberg, 2007b), two new *Impatiens* L. (Fischer & Rahelivololona, 2007), two new *Pentopetia* Decne. (Klackenberg, 2007a; Klackenberg & Meve, 2007), a new *Plectranthus* L'Hér. (Ranirison & Philipson, 2007) and a new *Artabotrys* R. Br. (Deroin & Gautier, 2008). The discovery of the present species confirms the role of Madagascar as the centre of diversity for the genus *Cadia*.

Cadia multifoliolata Nusb. & Labat, **spec. nova** (Fig. 1)

Typus: Madagascar. Province de Diego-Suarez/Antsiranana: sous-préfecture de Vohemar, commune rurale de Daraina, forêt d'Antsahabe, 13°11,40'S 49°32,46'E, 580 m, orientation 340 degrés, pente 12 degrés, 5.V.2004, fl., *Ranirison, P. PR 823* (holo-: G!; iso-: P!, MO!, K!, TEF, herbier de recherches de DARAINA).

Arbuscula 1,5 m alta; ramulis annotinis dense brunneo-pubescentibus, vetustioribus glabris. Foliis alternis imparipinnatis, (30-)45-103 mm longis, 16-22 mm latis, petiolis 0,5-1(-2,5) mm longis; stipulae 1 mm longis; rhachidibus supra canaliculatis pubescentibus; foliolis (29-) 41-53(-63), sessilibus alternis vel suboppositis, emarginatis, coriaceis, supra glabris viridibus (viridi-nigris in sicco), oblongis 7-12 × 2.5-3 mm (1-2 paribus infimis 4-7 mm longis, foliolis terminalibus 13-17 mm longis). Floribus 1-2, axillaribus; bracteis pubescentibus lanceolatis, 0.9-1.3 mm longis; pedunculo 5-6 mm longi; pedicellis 15-18 mm longis; hypanthio 5-6 mm longo; receptaculo breviter obconico; calyce membranaceo roseo, dentibus subaequalibus 6-8 mm longis, 5-6 mm latis; corolla candida (fulva in sicco), 24-25 mm longa; ovario glabro. Fructus incognitus. Ab omnibus congeneribus in Madagascaria foliolis magis numerosis (29-)41-53(-63) (nec non 5-31) distinguitur.

Shrub much-branched, plagiotropic, flowering along with mature leaves. *Shoots* long, leafy, mainly unbranched, hell brown to yellowish, glabrescent, the bark smooth with shallow longitudinal ridges; branchlets of the current year dark brown-pubescent. *Leaves* alternate, distichous, subsessile (petiole 0.5-1(-2.5) mm), imparipinnate, (30-)45-103 mm long, 16-22 mm broad; rachis canaliculate with a groove 0.3 mm deep, densely pubescent especially when young, covered with 0.3-0.5 mm long brown hairs; stipules small (≤ 1 mm), pubescent, often hidden by indumenta, deciduous, stipels absent. *Leaflets* (29-31-)41-53(-63) alternate or opposite, subsessile (petiolule 0.7 mm long, fat, finely pubescent), coriaceous, oblong, mainly 7-12 × 2.5-3 mm (the 2 basal leaflets with an asymmetrical base, 4-7 mm long, terminal leaflet 13-17 mm long), glabrous, slender and blackish when dry above, thinly puberulous (hairs scattered, 0.2 mm long, white, caducous) and glaucous-green below, the base obtuse and mainly symmetrical, the margin decurved, emarginate apically. *Flowers* in 1-2-flowered axillary racemes which are shorter than the leaves; bracts minute (0.9-1.3 mm long) brown and triangular, covered with brown to ferruginous pubescence. Flower pendent; peduncle greyish-green, 5-6 mm long, covered with brown to ferruginous pubescence; pedicel greyish-green, 15-18 mm, with 2 very small bracteoles at the base; hypanthium pink, 5-6 mm long; pedicel and hypanthium covered with a thin brown to ferruginous pubescence. *Calyx* pink, whitish at the apex of teeth, 17-19 mm long, bell-shaped, with 5 sub-equal triangular teeth (8 mm long, 6 mm broad at the base); short, scattered hairs present along with tufts of glandular, bright yellow epithelium with dense hairs at the teeth sinuses. *Petals* 5, equal, symmetrical, white to cream (we suspect that the colour of the petals changes during the flowering season, as in *C. purpurea*), fulvous when dry, 24-27 mm long, 13 mm broad at the apex, gradually narrowing towards the base, slightly truncated apically. *Stamens* 10, free, the filaments slightly shorter than the petals (22 mm long), pale green, the anthers small, pale yellow. *Ovary* shortly stipitate, 16 mm long, pale green; style 2-3 mm long; stigma terminal. *Pods* unknown.

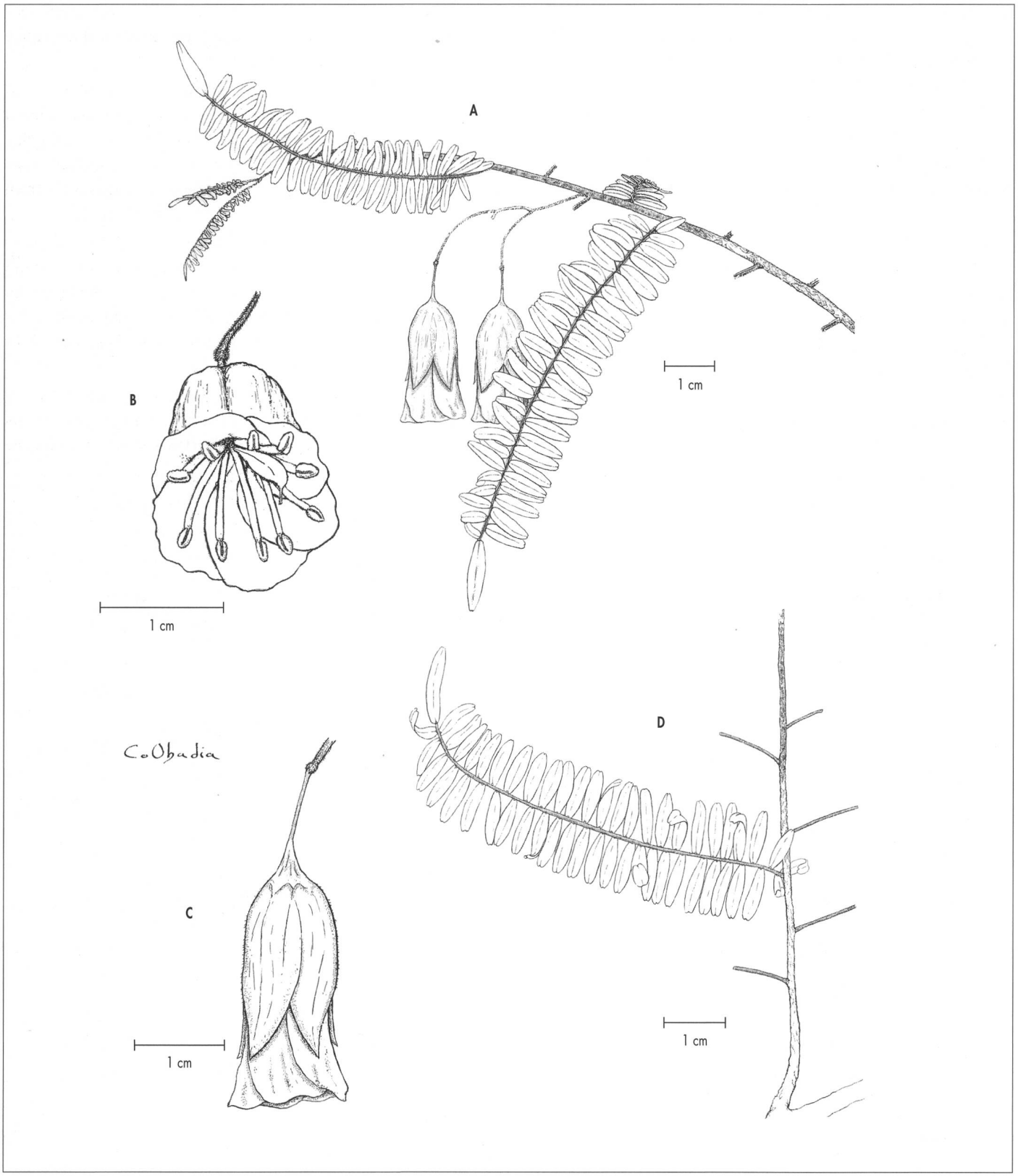

Fig. 1. – *Cadia multifoliolata* Nusb. & Labat. **A.** Part of a flowering shoot; **B.** Flower viewed from beneath; **C.** Flower viewed from the side; **D.** Shoot and leaf adaxial view. [*Ranirison PR 823*, G] [Drawn by C. Obadia]

Distribution. – North-East Madagascar, only known from this present collection locality in Antsahabe forest in the Daraina (Loky-Manambato) region. The localisation of this species represents the northernmost extension of the genus in Madagascar; its distribution is well separated from the other species of *Cadia* (Fig. 2).

Habitat. – Transitional forest (evergreen - semi-deciduous), on deep soil at 580 m altitude, on a 12 degrees slope orientated NNW.

Flowering time. – May (Fig. 3 & 4).

Etymology. – The species epithet alludes to the large number of leaflets in comparison to all the other known Malagasy species of this genus.

Notes. – *Cadia multifoliolata* differs from all the other Malagasy species of the genus by its large number of leaflets, by the blackish colour of the leaflets when dry and by its long leafy shoots that lack ramifications. In its high leaflet number it most closely resembles the North-East African and Arabian species *C. purpurea*. This species presents several differences with *C. multifoliolata* especially by its longer inflorescence bracts and by its longer hypanthium.

The diagnostic characters of all species of *Cadia* are compared (Table 1). *Cadia rubra* R. Vig. and *C. ellisiana* cannot be confused with the new species. The four other Malagasy species of *Cadia* could be confused with the new species, however several differences permit the clear separation of it from these taxa in addition of the large number of leaflets.

Cadia commersoniana Baill. differs from *C. multifoliolata* by its bracts resembling reduced leaves or leaflets (9-10 mm long) vs. very reduced triangular bracts (0.9-1.3 mm long), by its glabrous leaf rachis vs. hairy rachis, by its hypanthium 12-25 mm long vs. 5-6 mm long, and also by by its shorter pedicel 8-15 mm long vs. 15-18 mm long.

Cadia pedicellata Baker differs from *C. multifoliolata* by its pedicel up to 30 mm long vs. 15-18 mm long, by its glabrous calyx vs. presence of short scattered hairs on the

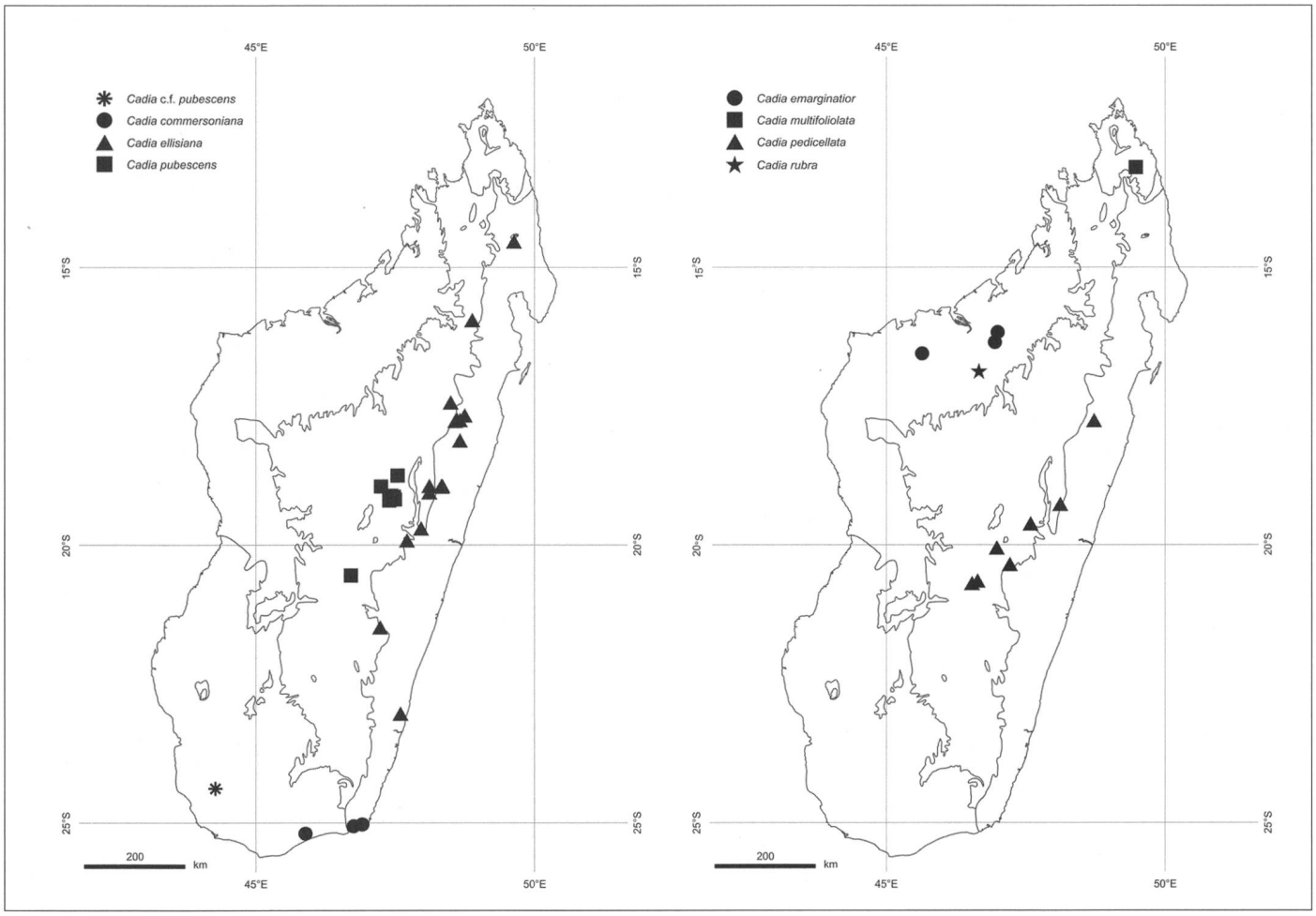

Fig. 2. – Current distribution maps of the different Malagasy species of *Cadia* Forssk.
[Drawn by P. Chesselet]

Fig. 3. – Flower of *Cadia multifoliolata* Nusb. & Labat, viewed from beneath on a flowering shoot; the abaxial surface of the shoot, leaf bases and leaflets are shown. [*P. Ranirison PR 823*, G] [Photo: P. Ranirison, project CJBG-Fanamby, 5.V.2004]

Fig. 4. – Flowering shoot of *Cadia multifoliolata* Nusb. & Labat, with the flower viewed from the side.

[*P. Ranirison PR 823*, G] [Photo: P. Ranirison, project CJBG-Fanamby, 5.V.2004]

calyx, by its broader leaflets 3-17 mm wide vs. leaflets 2.5-3 mm wide and also by its subglabrous to thinly pubescent rachis vs. pubescent rachis.

Cadia pubescens Baker differs from *C. multifoliolata* by its pink petals vs. the white to cream petals, by its bracts resembling reduced leaves or leaflets vs. very much reduced triangular bracts, by its leaflets pubescent above vs. glabrous.

Cadia emarginatior M. Peltier differs from *C. multifoliolata* by its smaller flowers (petals 16-19 × 7-8 mm, calyx 10-14 mm long) vs. bigger flowers (petals 24-27 × 13 mm long, calyx 18-20 mm long), by its glabrous or soon glabrescent rachis vs. pubescent rachis, by its broader leaflets 3-11 mm wide vs. leaflets 2.5-3 mm wide, by its longer inflorescence bracts (3 mm long) vs. shorter inflorescence bracts (0.9-1.3 mm long).

Cadia purpurea is the only non-Malagasy species of the genus and it is distributed in North-East Africa and Arabia. It differs from *C. multifoliolata* by the inflorescence with the quite long (3-5 mm) one or trifoliolate bracts vs. reduced triangular bracts of smaller size (0.9-1.3 mm long), by its longer hypanthium (12-15 mm) vs. shorter hypanthium (5-6 mm long), by its shorter calyx ((8-)10-14(-17) mm long) vs. larger calyx (18-20 mm long).

In the identification key to Malagasy species of *Cadia* (Du Puy & al., 2002: 314-315), *C. multifoliolata* would be clearly separated in the first couplet of the key which proposes either 6-11(-13) or 11-31 leaflets per leaf. It has (29-31-)41-53(-63) leaflets. It would otherwise key out most closely to *C. emarginatior*.

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Table. 1. – Diagnostic characters of all species of *Cadia* Forssk. The most important characters differentiating the morphology of the previously described specie

	Cadia multifoliolata **Nusb. & Labat**	***Cadia commersoniana*** **Baill.**	***Cadia pedicellata*** **Baker**	***Cadia pubescens*** **Baker**
Stipule size [mm]	< 1	1.5	**5**	1-2
Rachis of leaf	pubescent	**glabrous**	**subglabrous to thinly pubescent**	pubescent
Number of leaflets per leaf	***(29-31-) 41-53 (-63)***	**(15-)19-31**	**(7-)11-15(-19)**	**(11-)13-21(-23)**
Color of dried leaflets	***blackish-green***	**greyish green**	**olive**	**bottle green**
Leaflet length [mm]	7-12	7-28	8-37	10-25
Leaflet breadth [mm]	2.5-3	2-8	**3-17**	**5-12(-14)**
Terminal leaflet comparative size	***longer than the others (1.3x)***	**identical**	**identical**	**identical**
Leaflet upper surface pubescence	glabrous	glabrous	glabrous	**pubescent**
Flowering shoots	***long, without branching***	**short**	**short**	**short**
Inflorescence number of flowers	1-2	1-4	1-4	**2-3**
Inflorescence bract form	unifoliolate, triangular, narrow	**(1-)3(-5)-foliolate**	unifoliolate, triangular, narrow	**1-3-foliolate**
Inflorescence bract size [mm]	0.9-1.3	**9-10**	2	**9**
Lateral perules on the inflorescence bracts	absent	**present**	absent	**present**
Pedicel size [mm]	15-18	**8-15**	**up to 30**	8-10
Hypanthium size [mm]	5-6	**12-25**	1-3	3-5
Calyx length [mm]	18-20	**13-19**	15-17	15-20
Calyx pubescence	short scattered hairs	glabrous to short rare hairs	**glabrous**	sparsely pubescent
Petal length [mm]	24-27	20-30	20-23	17-23
Petal breadth [mm]	13	13-15	8-9	9-11
Colour of the fresh petals	white to cream	(no description)	**purplish**	**pink**

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rom C. multifoliolata are highlighted in bold. The diagnostic characters of the new species compared with most of the others are highlighted in italic-bold.

Cadia emarginatior **M. Peltier**	***Cadia ellisiana*** **Baker**	***Cadia rubra*** **R. Vig.**	***Cadia purpurea*** **(G. Piccioli) Aiton**
1	< 1	0.5	1
glabrous or soon glabrescent	**glabrous**	sparsely pubescent	pubescent
(17-)19-30	**(5-)6-11(-13)**	**7-11**	(9-)21-51(-69)
bottle green	**bottle green**	**greyish green**	**greyish green**
6-30	**30-115**	**25-80**	3-22
3-11	**15-45**	**8-22**	1-5
longer then the others (1.3x)	**identical**	longer than the others (1.3x)	**identical or shorter**
glabrous	glabrous	glabrous	glabrous
short	**long, without branching**	**short**	**short**
1-5	1-3-4-7 (-15)	1-3	1-3
unifoliolate, triangular, narrow	unifoliolate, triangular, narrow	unifoliolate, triangular, narrow	**1-3-foliolate**
3	0.5 (perule shape)	0.8-1.4	**3-5**
absent	absent	**present**	**present**
6-8	**20-30**	10-15	**3-6**
2-5	3-5	5-7	**12-15**
10-14	**14-18**	**13-15**	**8-10-14(-17)**
short scattered hairs	short hairs, rare	short hairs, rare	puberulous
16-19	22-28	(only seen in bud)	12-25
7-8	13-16	(only seen in bud)	9-15
yellowish to pale pink	**rose-red**	(only seen in bud)	white to pink to purple

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