On the distinction of *Atractocarpus heterophyllus* (Montrouz.) Guillaumin & Beauvis. and *A. bracteatus* Schltr. & K.Krause (Rubiaceae): in search of the correct name for the type species of *Atractocarpus* Schltr. & K.Krause

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ABSTRACT

*Atractocarpus* Schltr. & K.Krause is an Australian and Pacific genus of Gardenieae (Rubiaceae) which includes c. 40 species. The genus was initially described for a species bearing fusiform fruits, and occurring in the southern part of New Caledonia, viz. *A. bracteatus* Schltr. & K.Krause. Another species, *A. heterophyllus* (Montrouz.) Guillaumin & Beauvis. with oblong leaves and oblong ovoid fruits was described for New Caledonia, but initially under *Gardenia* Ellis and this for the North of the archipelago. During later revisions and supplementary descriptions of species in the genus, both species carrying heteromorphic leaves were reconsidered. The name *A. bracteatus* was placed in synonymy of *A. heterophyllus*; while keeping a delimitation of the species restricted to the southeastern populations. This situation ended in the re-description of the northern species, named *A. balansaeanus* Guillaumin. The results of the present work, based on the examination of herbarium specimens and literature, disentangles the collusion for *A. heterophyllus* vs *A. bracteatus*. Hence, the correct name typifying *Atractocarpus* is *A. bracteatus*. In regard to the destruction of the holotype for *A. bracteatus* in Berlin (B) and of two of the syntypes for *A. heterophyllus* in Lyon (LYJB), typifications for these species names are proposed. To clarify their taxonomy, complete descriptions, lists of specimens and illustrations are provided for both species.

KEY WORDS

Gardenieae, nomenclature, New Caledonia, taxonomy, typification.
INTRODUCTION

_Atractocarpus_ Schltr. & K.Krause (Rubiaceae) is currently the most species-rich Australian and Pacific genus of Gardenieae (Rubiaceae), comprising c. 40 species. Consequent to phylogenetic investigations by Puttock & Quinn (1999) in a study of the tribe Gardenieae, Puttock (1999) enlarged the generic concept of _Atractocarpus_ to _Neofranciella_ Guillaumin, _Sukunia_ A.C.Sm., _Sulitia_ Merr. and _Trukia_ Kaneh. This broad circumscription of _Atractocarpus_ has been recently criticized (Wong 2004; Robbrecht & Manen 2006), independently, _Gustafsson_ & _Persson_ (2002) restricted the pantropical genus _Randia_ L. to a narrow group of Central American spiny taxa. Amongst the Pacific “_Randia_” species awaiting a new generic placement, several ones belong to _Atractocarpus_ sensu Puttock (1999). The Pacific Gardenieae consequently require deep systematic studies to circumscribe genera, among which _Atractocarpus_, and to allocate species to valid genera.

Initially, _Atractocarpus_ was described to accommodate a single southeastern New Caledonian species, _A. bracteatus_ Schltr. & K.Krause, with heteromorphic leaves (Schlechter & Krause 1908). The genus took its name (“_atraktos_”: a spindle, “_carpos_”: a fruit) from this species characteristic fusiform berries. Later, seven New Caledonian species were described in _Atractocarpus_ and one was transferred to it (Guillaumin & Beauvisage 1913; Moore 1921; Guillaumin 1930), of which several ones do not share the “typical” fusiform fruits. In their taxonomic treatment, Gustafsson & Persson (2002) restricted the pantropical genus _Randia_ L. to a narrow group of Central American spiny taxa. Amongst the Pacific “_Randia_” species awaiting a new generic placement, several ones belong to _Atractocarpus_ sensu Puttock (1999). The Pacific Gardenieae consequently require deep systematic studies to circumscribe genera, among which _Atractocarpus_, and to allocate species to valid genera.

RÉSUMÉ

_De la distinction entre Atractocarpus heterophyllus (Montrouz.) Guillaumin & Beauvis. et A. bracteatus Schltr. & K.Krause (Rubiaceae): vers un nom approprié pour l’espèce type d’Atractocarpus Schltr. & K.Krause._

In search of the correct name for the type species of *Atractocarpus* Schltr. & K.Krause documented in herbaria. Based on examined specimens, the diagnostic characters to species were listed (Table 1) and the plants were illustrated (Figs 1-3). Two morphologically distinct groups corresponding to species were identified. These two groups were geographically vicariant (Fig. 4), one restricted to the northern archipelago and the other to the southern area of New Caledonia.

**DISCUSSION**

Guillaumin (1930) recognized nine species of *Atractocarpus*. Amongst these species, two are very distinctly heterophyllous: one called *A. heterophyllus* (syn. *A. bracteatus* following Guillaumin & Beauvisage 1913; with fusiform fruits and vegetative leaves with a basally attenuate lamina) and another one described as *A. balsanensis* Guillaumin (with ovoid fruits and vegetative leaves with basally rounded lamina). *Atractocarpus heterophyllus* sensu typo (Montrouzier 1860: as *Gardenia heterophylla*), occurs in the northern part of the archipelago. Morphological aspects of the original description of *A. heterophyllus* suggest that the species have oblong-ovoid fruits and two different kinds of leaves: large oblong vegetative ones with a rounded base of the lamina and small subcircular cordate inflorescential ones. Montrouzier (1860)

**METHODS AND RESULTS**

The herbarium material of the New Caledonian *Atractocarpus* was identified (mainly from NOU and P; see the systematic section) and the species delimited according to the types and/or protologues of names. The original material was destroyed in Berlin (B) for *A. bracteatus* and part of it in Lyon (LYJB) for *A. heterophyllus* (number of Montrouzier’s collections were burned at the University of Lyon, France; comm. from LYJB). According to this, typifications of names are proposed and lectotypes chosen among syntypes when possible (note: numbers indicated for Montrouzier’s collections are those used and added on sheets by Beauvisage and not initially given by the collector himself). The taxa treated in the present study were well gathered and documented in herbaria. Based on examined specimens, the diagnostic characters to species were listed (Table 1) and the plants were illustrated (Figs 1-3). Two morphologically distinct groups corresponding to species were identified. These two groups were geographically vicariant (Fig. 4), one restricted to the northern archipelago and the other to the southern area of New Caledonia.

<table>
<thead>
<tr>
<th>Features</th>
<th><em>A. heterophyllus</em> (A. heterophyllus sensu typo)</th>
<th><em>A. bracteatus</em> (A. heterophyllus sensu Guillaumin &amp; Beauvisage 1913)</th>
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<tbody>
<tr>
<td>Morphological traits</td>
<td>Lamina base: Rounded</td>
<td>Attenuated</td>
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<tr>
<td></td>
<td>Petiole: 25-46 mm long</td>
<td>16-22 mm long</td>
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<td></td>
<td>Female inflorescence: Uniflorous</td>
<td>Uniflorous to Triflorous</td>
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<td></td>
<td>Male inflorescence: Triflorous</td>
<td>Tri-Pentaflorous</td>
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<td></td>
<td>Fruit: Oblong-ovoid</td>
<td>Fusiform</td>
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<tr>
<td>Ecology</td>
<td>Environment: Opened and forested areas</td>
<td>Forested areas</td>
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<td></td>
<td>Preferences: Riparian</td>
<td>Non obligatory riparian</td>
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<tr>
<td></td>
<td>Soil: Limestones and serpentine</td>
<td>Ultramafic and calcareous</td>
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<td>Distribution</td>
<td>New Caledonia</td>
<td>North of the archipelago</td>
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<td></td>
<td></td>
<td>South of the archipelago</td>
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</tbody>
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**TABLE 1. — Useful morphological, ecological and distributional features for Atractocarpus Schltr. & K.Krause species A. bracteatus Schltr. & K.Krause (Rubiaceae) and A. heterophyllus (Montrouz.) Guillaumin & Beauvis. recognition.**
placed it in his section *Oxyphylodium*, together with *Gardenia arvensis* Montrouz. bearing rounded fruits. After a careful examination, the gathering Montrouzier 179, syntype of *Atractocarpus heterophyllus*, corresponds morphologically to the species concept given by Guillaumin (1930) for *A. balansaeanus*. Consequently, the species currently called *A. balansaeanus* has to be named *A. heterophyllus* (Table 1; Figs 3, 4).

Montrouzier was aware of New Caledonian Gardeniae with fusiform fruits as he described a *Gardenia* section *Septocarpus* Montrouz. diagnosed by “fructus fusiformis”, for *G. edulis* Montrouz., a species related to southeastern species of *Atractocarpus* discussed here. The species hitherto considered as *A. heterophyllus* since Guillaumin & Beauvisage’s (1913) treatment, with attenuated lamina base and fusiform fruit, should consequently recover the name *A. bracteatus* (Table 1; Figs 1, 2, 4).

The confusion between *A. heterophyllus sensu* Montrouzier (1860) and *A. heterophyllus sensu* Guillaumin & Beauvisage (1913), originates from the wrong asignment by the latter authors of the type specimens of *A. heterophyllus* to the southeastern species. One may suggest that Guillaumin & Beauvisage (1913) recognized a sole broad species including specimens of both taxa. However, Guillaumin’s (1930) description of *A. balansaeanus*, using a sensibly proximate combination of characters than the one given for the *Gardenia heterophylla* protologue, shows that Guillaumin correctly evaluated the differences between the two New Caledonian species bearing highly heteromorphic leaves.

After all, the correct name typifying *Atractocarpus* is *A. bracteatus* instead of *A. heterophyllus*.

**SYSTEMATIC TREATMENT**

The following taxonomic treatment provides synonymy, full description, illustrations, and distribution map for *Atractocarpus bracteatus* and *A. heterophyllus*. Diagnostic features to species are listed in Table 1, pending an identification key in the complete revision of New Caledonian Gardeniae. To stabilise the use of these names, a nomenclatural treatment is proposed here for both species. Specimens examined are listed under species names.

**Genus Atractocarpus** Schltr. & K.Krause


**DESCRIPTION**

*Atractocarpus* is currently a genus of c. 40 species that occur in Australia, the Federated States of Micronesia, Fiji, Indonesia, New Caledonia, Papua New Guinea, Philippines, Solomon Islands, Society Islands, Tonga and Vanuatu, with the highest diversity in New Caledonia. The New Caledonian species are mostly riparian, living in mesic to humid forests, or more rarely in bushes. The Australian and other Pacific islands representatives occupy various mesic forests, swamp forests and maritime semi-deciduous thickets.

The diagnostic combination of characters for the genus, sensu Puttock (1999) is: flowers with subsesile anthers; styles completely included in the tube; patent corolla lobes; porate pollen grains in monads; ovary bilocular, placentation axile; berries moderate to large, spherical to fusiform, many-seeded; and seeds large with an extensive peripheral hilum. An interesting characteristic feature also noted by Puttock (1999) consists of the placental mass degenerating into a watery pulp, enclosing seeds. At the fruit stage, the locule limits and the placentation type become consequently not obvious in fruit-section (see Figs 2; 3).

*Atractocarpus bracteatus* Schltr. & K.Krause (Figs 1; 2)


**OTHER SPECIMENS EXAMINATED** — *New Caledonia*. Baie de Prony, fl., 1910, *d’Alleizette (leg. Godefroy)*
In search of the correct name for the type species of Atractocarpus Schltr. & K.Krause

Fig. 1. — Atractocarpus bracteatus Schltr. & K.Krause: A, view of a female individual in fruit; B, male inflorescence, and detail of a flower with ant; C, mature fruit. Scale bars: A, 10 cm; B, C, 1 cm. Based on pictures by Daniel & Irène Létocart (www.endemia.nc).
In search of the correct name for the type species of *Atractocarpus* Schltr. & K.Krause

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**Fig. 2.**— *Atractocarpus bracteatus* Schltr. & K.Krause: **A**, female flower; **B**, longitudinal section of a female flower (corolla and stamens detached from hypanthium); **C**, detail of stipules at branch apex; **D**, entire fruit and longitudinal section of a fruit; **E**, transversal section of a fruit; **F**, entire seed and its longitudinal section; **G**, embryo. Scale bars: A-C, 1.5 cm; D, 6 cm; E, 1.5 cm; F, 5 mm; G, 2 mm. Based on *Mouly 149* (P).

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Mouly A.

**Description**

Dioecious, slender tree 1-3 m high, monocaual or few stemmed. Stipules paired, imbricate, lanceolate, 12-21 × 3-5 mm. Leaves of non-flowering shoots elliptic to oblanceolate, glabrous; petioles 16-22 mm long; lamina 160-320 × 50-160 mm, apex acuminate, base attenuated, glossy dark green, dull grey-green below, coriaceous; secondary veins 12-14 pairs at 50-60° to the midvein. Inflorescences axillary, branch-like to 250 mm long, perennial in male individuals, flowers arranged in cymes, up to 5-florous in male, and solitary to 3-florous in female individuals, flowers subtended by modified leaves, cordate, 30-40 mm long; flowers ± sessile, 5-merous, with a slightly sexual differentiation. Hypanthium 9-12 mm long and linear in male, ovules aborted; 12-16 × 3-5 × 3-5 mm, centrally inflated in female individuals. Calyx tube obconical, 3-4 mm long; lobes triangular, 1.5-2 mm long. Corolla tube 18-28 mm long, urceolate, c. 5 mm diameter at the widest point, glabrescent outside, glabrous inside except where it is bearded below the anthers. Corolla lobes lanceolate, c. 18 × 7-10 mm, glabrous. Anthers bilocular, 7-10 mm long, dorsifixed, supramedifixed, attached 4-5 mm from their apices, sub sessile, inserted 5-6 mm below the sinus of the corolla lobes. Style included, c. 25 mm long; stigmatic lobes 2, c. 9 mm long. Ovary bilocular, elongate, c. 9 × 2 × 2 mm, placentation axile, each bearing many ovules in a longitudinal row. Fruit berry, solitary, fusiform, 120-310 × 30-35 mm, smooth narrowing towards the calyx tube; exocarp smooth, green when mature; placentas extending in a whitish pulp. Seeds c. 5 × 5 × 0.6 mm; hilum occupying c. 0.6 of the perimeter of seed; exotesta cells with a thickened ring around the inner tangential wall and occasional interstitial thickenings.

**Note on typification**

Herbaria where A. Le Rat collections are deposited (according to HUH Index of Botanists: [http://kiki.huh.harvard.edu/databases/botanist_index.html](http://kiki.huh.harvard.edu/databases/botanist_index.html)) were consulted, as well as institutions where F. R. R. Schlechter usually sent herbarium material. The holotype Le Rat 90 has been destroyed in B (B herbarium communication), and any duplicate has been found nor in P where most of Le Rat collection is, neither in other herbaria (A, BM, BR, E, G, H, K, L, S, U, W, WRSL). The gathering Le Rat 537, collected in the type locality by the same botanist and deposited at P, is designated as a neotype.

**Distribution, ecology, and habitat**

*Atractocarpus bracteatus* is endemic to southeastern New Caledonia and the Isle of Pines (Fig. 4). The species is a non obligatory riparian, and it grows mainly on ultramafic soils, calcareous rocks and occasionally on eroded elevated corals. The ant indicated in Figure 1, as observed in the field, is not an evidence of ant-pollination, but an indication that *A. bracteatus* nectar secretions attract ants, forming temporary colonies on plant individuals. Fruiting takes long time in the species, as observed on cultivated specimens in New Caledonia, necessitating more than two years to reach maturity.

**Note**

Two unpublished names, *Genipa semperflorens* and *Genipa xylopioides*, are present in annotations by Baillon on herbarium sheets in P. *Genipa* was at that time one of the few considered genera in Gardenieae, together with *Gardenia* and *Randia*. Both *Randia* and *Genipa* are now restricted to the Neotropics (Persson 2002; Gustafsson & Persson 2002), and New Caledonian Gardenieae species were never considered as potential *Genipa* species since then.

**Atractocarpus heterophyllus**

(Montrouz.) Guillaumin & Beauvis.

(Fig. 3)

Fig. 3. — Atractocarpus heterophyllus (Montrouz.) Guillaumin & Beauvis.: A, view of the apex of a female individual in fruit; B, detail of stipules at branch apex; C, transversal section of a fruit; D, longitudinal section of a fruit; E, developed placenta at fruit stage, in dorsal and ventral views; F, longitudinal section of a seed; G, embryo. Scale bars: A-E, 3 cm; F, G, 2 mm. Based on MacKee 26464 (P) and unpublished N. Hallé’s drawings of New Caledonian Rubiaceae in sched (P).
**Description**

Dioecious, small slender tree 1-2.5 m high, mono-caul, or few stemmed. Stipules paired, imbricate, lanceolate, 12.5-15 x 3-4 mm. Leaves opposite, of non-flowering shoots oblong-elliptic, glabrous; petioles 25-42 mm long; lamina 140-220 x 50-100 mm, apex acuminate, base rounded, glossy dark green, duff grey-green below, coriaceous; secondary veins 5-10 pairs at 55-65° to the midvein. Inflorescences axillary, branch-like to 140 mm long, consisting of 2 internodes, flowers arranged in cymes, 3-florous in male, and solitary in female individuals; flowers ± sessile, 5-merous, with a slight sexual differentiation, flowers subtended by modified leaves, cordate, 20-45 mm long. Hypanthium 9-10 mm long and linear in male, 11.14 x 3.5 x 3.5 mm, centrally inflated in female individuals. Calyx tube obconical, 2-3 mm long; lobes triangular, 1.5-2 mm long. Corolla tube c. 20 mm long, urceolate, c. 4 mm diameter at the widest point, glabrescent outside, glabrous inside, except where it is bearded below the anthers. Corolla lobes lanceolate, c. 15 x 7-10 mm, glabrous. Anthers bilocular, 7-10 mm long, dorsifixed, supramedifixed, attached 4-5 mm from their apices, subsessile, inserted 5-6 mm below the sinuses of the corolla lobes. Style included, c. 19 mm long; stigmatic lobes 2, c. 7 mm long. Ovary bilocular, elongate, c. 8 x 2 x 2 mm, placentation axile, each bearing many ovules. Fruit solitary, oblone-ovoid, 30-60 x 25-50 mm, smooth narrowing towards the calyx tube; exocarp smooth, green when mature; placentas extending in a whitish pulp. Seeds c. 4 x 4 x 0.5 mm; hilum occupying c. 0.5 mm of the perimeter of seed; exotesta cells with a thickened ring around the inner tangential wall and occasional interstitial thickenings.

**Note on Typifications**

Since Montrouzier never cited the original material in his Flora, possible syntypes are accepted from citations in Guillaumin & Beauvais (1913). As two of the three syntypes of *A. heterophyllus* (Montrouzier 94, 95) have been destroyed in LYJB, only one Montrouzier’s gathering (Montrouzier 179) remains available at MPU. Though without any annotation from Montrouzier as an author, the MPU gathering cannot be rejected as original material, being in agreement with the protologue and collected before the publication of the protologue. The collection Montrouzier 179 is thus designated here as lectotype for *A. heterophyllus*.

The lectotype of *Atractocarpus balansaeanus* was chosen from two original gatherings cited by Guillaumin (1930). The collection *Balansa 3212*, designated as lectotype, is well preserved and representative.
In search of the correct name for the type species of *Atractocarpus* Schltr. & K.Krause

ADANSONIA, sér. 3 • 2012 • 34 (1)

Distribution, ecology, and habitat

*Atractocarpus heterophyllus* is endemic to northern New Caledonia and Belep Islands (Fig. 4). This species is exclusively riparian, restricted to limestone and serpentine soils, on rocks and rock slides. On the main island, most of specimens collected belong to the western coast populations. The gathering *Balansa 2012* bears the label information “Canala” (southeastern coast), a locality poorly reliable for the species. Besides the gathering *Balansa 2012*, the two old collections made by Vieillard from the east are unclearly localized. Indeed, Vieillard indicated on labels the locality where he was based instead of the locality of the collection. The eastern coast is now well explored, and only one recent collection can be attributed to *A. heterophyllus*, in the Poindimié area. The few eastern populations are probably smaller and more threatened than the western ones.

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