



## *Novitates neocaledonicae VI: Acropogon mesophilus* (Malvaceae, Sterculioideae), a rare and threatened new species from the mesic forest of New Caledonia

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### Abstract

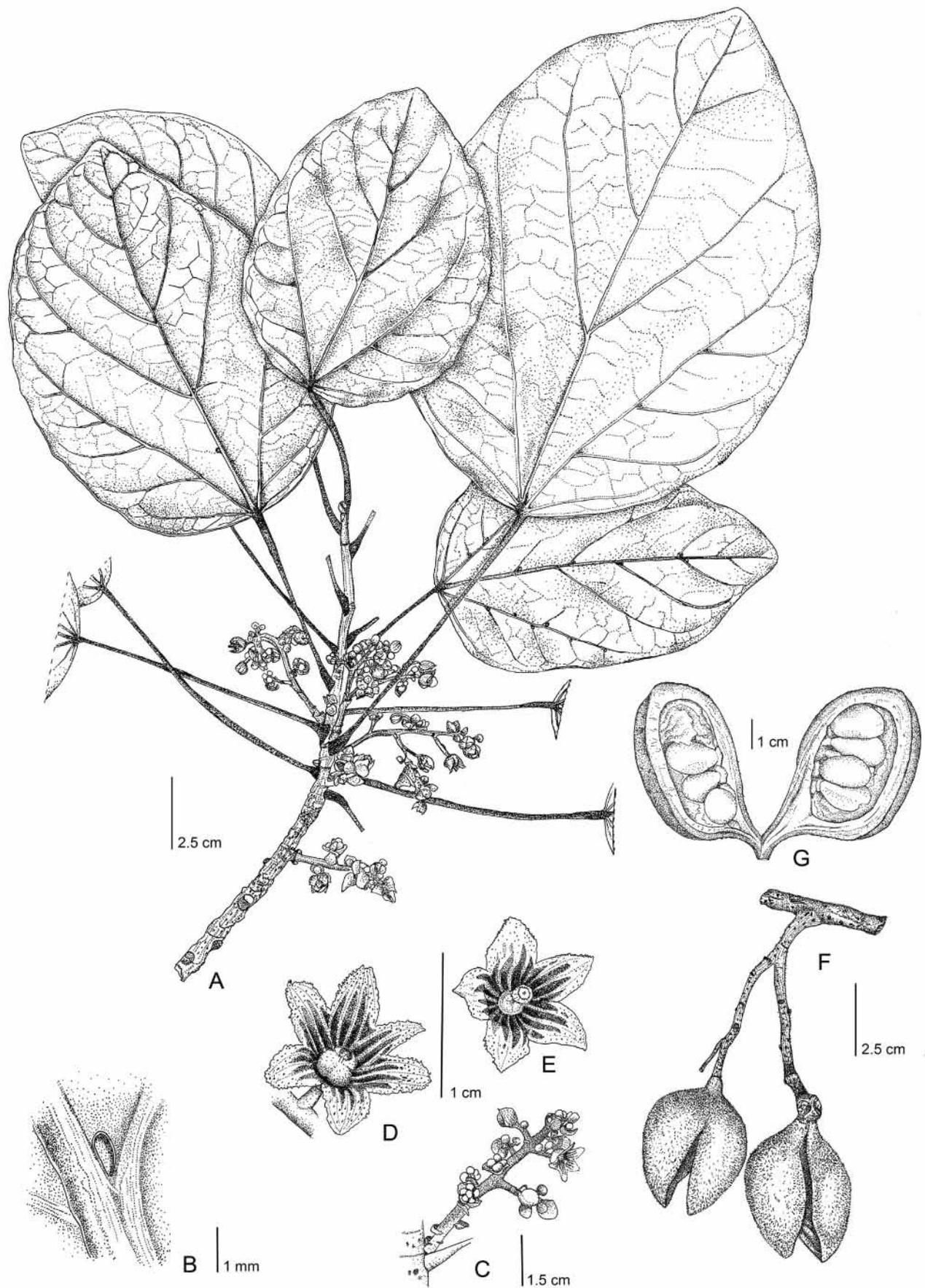
A new species, *Acropogon mesophilus* Munzinger & Gâteblé (Malvaceae, Sterculioideae), is described from New Caledonia. This species is endemic to non-ultramafic areas, along the southwestern coast of Grande-Terre. The species has large leaves, widely ovate to ovate, and entire, and might be confused with only two other endemic species, namely *A. bullatus* (Pancher & Sebert) Morat and *A. veillonii* Morat. However, *A. mesophilus* differs from the other two species most evidently by its leaves 3-nerved, flat, and with truncate to rounded bases, versus leaves 5-nerved, bullate, and with cordate bases. A line drawing and color photos are provided for the new species, along with a discussion of its morphological affinities and a preliminary risk of extinction assessment of Endangered.

**Keywords:** *Acropogon*, Malvaceae, mesic forest, New Caledonia, new species, Sterculioideae, taxonomy, threatened species

### Introduction

Forests in New Caledonia are currently more or less arbitrarily divided into sclerophyll (or dry) and dense humid forests, the latter being further separated into two main types depending on edaphic conditions, i.e., on ultramafic versus non-ultramafic substrate (Jaffré *et al.* 2012, Ibanez *et al.* 2014). These dense humid forests are currently being studied in more detail (e.g., Birnbaum *et al.* 2015), but the intermediate vegetation, the “mesic forest” (currently included within the dense humid forests *sensu* Jaffré *et al.* 2012) still needs to be more clearly characterized (Jaffré *et al.* 2008). This type of vegetation mostly occurs at the base of the western massifs, in the valleys or on the forested slopes between the sclerophyll and dense forests “*sensu stricto*” (viz. excluding mesic forest). The plains of the West are mostly used for extensive pasture, with the very limited remaining vegetation of either dry forest *sensu stricto* or with relicts of mesic forests along the rivers within or outside the sclerophyll forests. These areas where mesic forests still occur are usually on private property or under tribal control, and hence are often difficult to access. However, recent botanical work, done with proper authorization, has led to the discovery of novelties such as *Planchonella cauliflora* Munzinger & Swenson (2009: 177), huge populations of thousands of individuals of *Ixora* (N.Hallé 1973: 197) *margaretae* Mouly & B.Bremer (2009: 702) (Mouly *et al.* 2016) previously only known from a few collections and considered as Vulnerable (Mouly 2007, Hequet 2010, Verhaegen *et al.* 2013), a rare new taxon of *Oxera* Labill. (Gâteblé pers. obs.), a new disjunct locality for the critically endangered *Canavalia favieri* I.C.Nielsen (1993: 347), and a new narrowly endemic species of *Psychotria* L. (Barrabé pers. comm.), among others. Thus, there is no doubt that this neglected vegetation type is worthy of further study.

The endemic New Caledonian genus *Acropogon* Schltr. (Malvaceae Juss., subfam. Sterculioideae Burnett) comprises 25 currently recognized species (Morat *et al.* 2012, Callmander *et al.* 2015). The genus is recognized as differing morphologically from *Cola* (Schott & Endlicher 1832: 33) and *Sterculia* (Linné 1753: 1007) by the combination of the following characters: (2–)3(–4) carpels, ring arrangement of the stamens, exalbuminous seeds, fleshy cotyledons, and germination epigeal (Schlechter 1906, Morat 1986 publ. 1987, Bayer & Kubitzki 2003, Morat & Chalopin 2003, 2005, 2007). Its monophyly appears confirmed by phylogenetic data (Wilkie *et al.* 2006), although this study included only two accessions of *Acropogon*, *A. bullatus* (Pancher & Sebert 1874: 214) Morat (1986 publ. 1987: 361), and *A. dzumacensis* (Guillaumin 1920: 122) Morat (1986 publ. 1987: 361).



**FIGURE 1.**—*Acropogon mesophilus* Munzinger & Gâteblé *spec. nov.* **A.** Flowering branch **B.** Details of domatia on abaxial leaf surface. **C.** Inflorescence. **D.** Female flower. **E.** Male flower. **F.** Infructescence. **G.** Detail of an open follicle. **A–E,** *Le Borgne 58* (NOU), **F–G,** *Le Borgne 57* (NOU). Drawings by Laurence Ramon.

Material of an undescribed species of *Acropogon* was recently collected in mesic forests of the southwestern Grande-Terre. In this paper, we describe this imposingly tall, new *Acropogon* species as a further example of the overlooked richness of this threatened habitat type. We provide a risk of extinction assessment based on the IUCN Red List Categories and Criteria (IUCN 2012), along with line drawings and color photos, a comparison of its morphological features to the most similar members of the genus, *A. bullatus* and *A. veillonii* Morat (1988: 99), and a distribution map of the three taxa.

## Materials and Methods

Careful examinations and measurements, *in vivo* and *in herb.*, were conducted on morphological characters already used by previous authors (Schlechter 1906, Morat 1986 publ. 1987, Morat & Chalopin 2003, 2005, 2007) as specific for the genus, to determine whether the species is new, and which are its closest morphological relatives. Herbarium specimens of *A. bullatus*, *A. veillonii* and undetermined specimens from P, NOU, MPU were studied, as well as scans from MEL of the holotype specimen of *Sterculia oliganthera* F. Muell. (1886: 49), a synonym of *A. bullatus* fide Morat (1986 publ. 1987). The new species was also observed in the field five times at three month intervals, and under cultivation. Descriptions of color pertain to colors *in vivo*, unless otherwise noted. The Royal Horticultural Society's color chart (RHS 2001) was used to describe the subtle differences in flower and inflorescence axis colorations. Some insects were captured and deposited in IAC. Insect identification was provided by Christian Mille (*Chrysocoris*) and Thierry Salesne (*Euproctis*). Area of occupancy (AOO) was calculated using a 2x2 km grid.

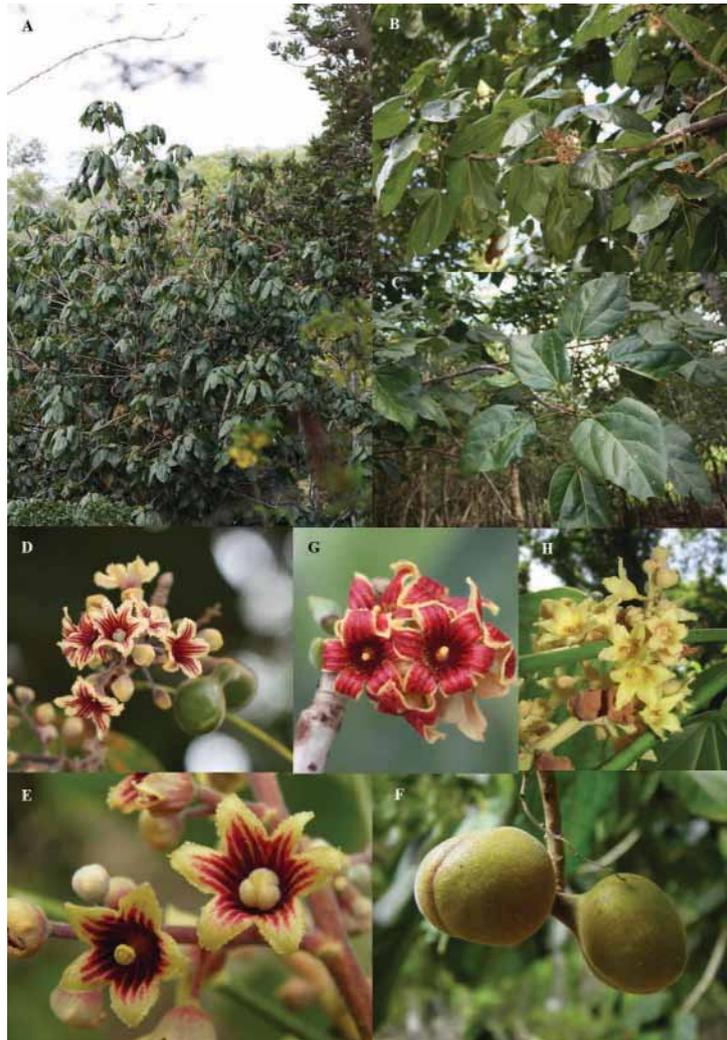
## Taxonomy

*Acropogon mesophilus* Munzinger & Gâteblé, *spec. nov.* (Figs. 1, 2)

Type:—NEW CALEDONIA. Province Sud: Boulouparis, Camp Brun, le long de la Diahot, 130 m, 21°49'29.85"S, 165°54'50.71"E, 30 September 2015, *Gâteblé 711* (holotype P-01069417!; isotypes G!, K!, MEL!, MPU-028533!, MO!, NOU-081994!, NOU-081995!, P-01069418!).

Diagnosis:—*Acropogon mesophilus* Munzinger & Gâteblé differs from *A. bullatus* and *A. veillonii* by its flat, ovate leaf blade, with base truncate to rounded, three main palmate veins and many evident domatia, and by its yellow sepals with 2–4 grayish-purple stripes per calyx lobe.

Monoecious tree to 15 m tall, well branched with usually a main trunk of up to 45 cm in dbh; bark gray, with evident petiole and scales scars on terminal branches. Leaves usually clustered at the apex of branches, these 3.5–8 mm in diameter; petioles light green to yellow–orange (dark green to blackish in herb.), strongly discolorous to the branch, glabrous, (30–)50–90(–170) mm long, (1–)2(–3) mm in diam., usually longer and wider on vegetative shoots, and shorter and narrower on fertile ones, elliptical in cross section (on fresh material), enlarged (3–5 mm) proximally and distally, these pulvini generally pruinose on fresh material; blades simple, unlobed to slightly (rarely strongly as in *Gâteblé et al.* 685) trilobed, usually widely ovate, flat (i.e., not bullate), papyraceous to coriaceous, (81–)100–170(–230) mm in length, (52–)70–150(–220) mm in width (usually larger on sterile shoots, and smaller on fertile ones), base truncate to rounded, apex broadly acute to rounded, slightly discolorous, glabrous on both surfaces; generally with 3 strong primary (+ 2 smaller ones) palmate veins, primary and secondary veins prominent on both surfaces, reticulum visible abaxially, 3–5 pairs of secondary veins; tertiary veins inconspicuous; round or elliptic hole-like domatia visible on the lower surface of the leaf, generally present in the angles between the primary and secondary veins, sometimes also in the angles between secondary and tertiary veins. Inflorescence axillary within, above or just below the terminal bouquet of leaves and up to 6.5 cm long, axes grayish-purple [group 183A–D of RHS 2001] to green covered with grayish–yellow tomentum, bracts covered with gray tomentum adaxially (sometimes glabrous and grayish-purple), always covered with gray tomentum abaxially. Pedicels (1–)4(–5) mm long, 0.5 mm wide at widest part, covered with grayish–yellow tomentum, articulated 0.1–0.5 mm below the calyx. Flowers ♀ appears less numerous than ♂, and seems randomly distributed in the inflorescence.



**FIGURE 2.**—*Acropogon mesophilus* Munzinger & Gâteblé spec. nov. (A–F), *A. bullatus* (G) & *A. veillonii* (H): **A.** Overview of a single big tree. **B.** Flowering branch. **C.** Leaves. **D.** Inflorescence. **E.** Male (left) and female (right) flowers. **F.** Follicles. **G–H.** Inflorescences. *Gâteblé 711* (A–B), *Gâteblé et al. 685* (C), *Gâteblé 719* (D), *Le Borgne 58* (E–F), *Gâteblé & Butaud 733* (G), photos by G. Gâteblé (A–D & G), T. Le Borgne (E–F) & J.-F. Butaud (H).

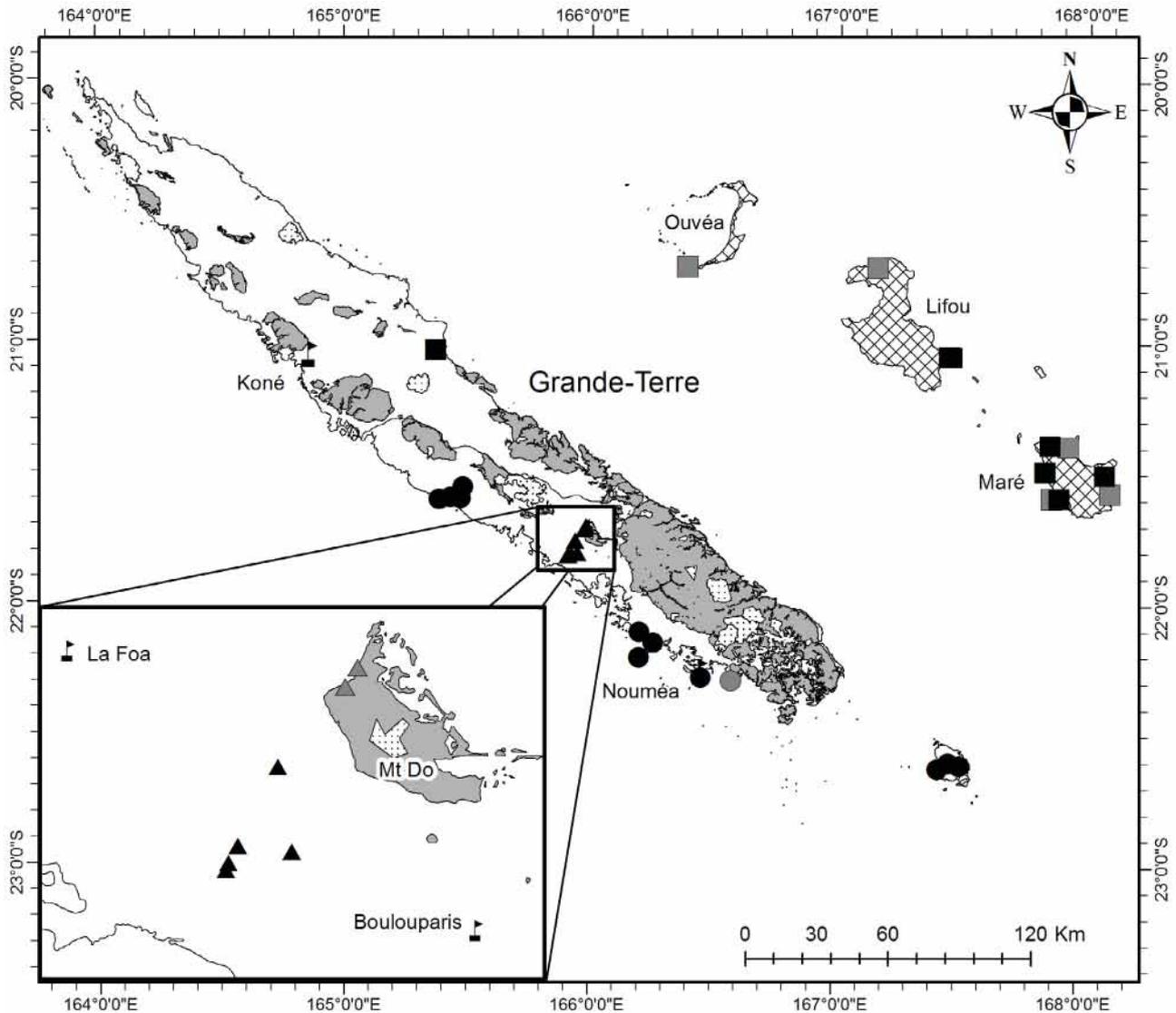
Flowers ♂ and ♀ of the same size and perianth. Calyx 8–12 mm long, 7 mm in diameter, yellow [group 10C–D of RHS 2001] with 2–4 grayish-purple [group 187A–D of RHS 2001] stripes per calyx lobe, fused basally ca. 5 mm, lobes (4–)5(–6), 4–5 mm long, triangular-fimbriated. Flowers ♂: androecium (3–)4(–5) mm long; androphore 3–4 mm long; stamens 5–7, 1–1.5 mm long, inserted at apex of androphore. Flowers ♀: Staminodes 5–7, sessile, ca. 0.5 mm long inserted at base of carpels. Gynoecium sessile 4–5 mm long; carpels 3–4, 3–4 mm long; styles ca. 1 mm long, covered with dense tomentum; stigmas ovoid.

Infructescence 5–15 cm long, robust, on a peduncle 2–8 cm in length. Fruit 1–3 follicles with pedicels of 0.5–1 cm long and 0.3–0.4 cm in diameter at maturity, green prior to maturity and turning greenish–yellow–light purple at maturity, covered by sparse stellate hairs, each follicle ellipsoid to ovoid, 3.5–6 × (1.5–)2.5–3.5 cm, with a woody pericarp 0.3–0.4 cm in dry material (up to 6 mm in alcohol) in thickness, apex rounded, sometimes with a stipe up to 1 cm long and 0.5–0.7 cm in diameter. Seeds ellipsoid, light brown or black, 4–6(–8) per locule, 1.2–1.5 cm long × 7–10 mm in diameter.

**Distribution and Ecology:**—The tree is only known from the southwestern part of the Grande-Terre, around La Foa and Boulouparis (Fig. 3), where it grows in mesic forest along rivers.

**Phenology and notes regarding biology of the species:**—Flowering in *A. mesophilus* occurs during the dry season (September to December). Flowering begins in September, and at this first stage, all open flowers are male [*Gâteblé 711*]. By November, flowering is at its peak, and there are male and female flowers and even the first young fruits [*Gâteblé 719*]. Flowering ceases in late December, as fruits are increasing in size. Mature fruits are produced

mainly between May and July [Gâteblé *et al.* 685 & Gâteblé 686], i.e., during the cool wet season, when conditions should be ideal for the germination of these, potentially non-dormant, recalcitrant seeds (G. Lannuzel, pers. comm., from an experiment on *A. macrocarpus* Morat & Chalopin (2003: 198)). An adult of *Chrysocoris* aff. *sexmaculatus* (Leach1815: 36) (Scutelleridae) was observed foraging deeply in the male flowers and bearing pollen on its front legs and antennae. A caterpillar, probably belonging to the common endemic *Euproctis dimorphissima* (Holloway 1979: 363), was also observed consuming the flower buds.



**FIGURE 3.**—Distribution of *Acropogon bullatus* (circles), *A. mesophilus* (triangles) and *A. veillonii* (squares) in New Caledonia. Grey fill indicates ultramafic substrate, crosshatch fill indicates calcareous substrates. Protected areas are in dotted fill. Black symbols indicate localities from herbarium specimens [from specimens at G, NOU and P], while gray symbols indicate localities from observations, without voucher specimens [from Butaud (2014) for *A. veillonii*, Suprin (2008) for *A. bullatus*, and T. Le Borgne (pers. comm.) for *A. mesophilus*]. Localities for specimens from herbarium G gathered from GBIF.org.

**Notes in cultivation:**—When grown side by side under full sun in a non-watered, non-wind protected garden, *A. bullatus* thrives well, as it does in its native dry coastal forests even under sea-spray (Gâteblé 2015), while *A. mesophilus* stagnates in growth, since it is usually found in deep, well-watered soil, sheltered from the sun and wind, at least in its early stages of development.

**Etymology:**—The plant is named after the mesic forests where it grows.

**Species recognition:**—With its large leaves, entire or rarely trilobed (juvenile leaves) and its general architecture, *Acropogon mesophilus* is a species that could only be confused with two others, *A. bullatus* and *A. veillonii*. Table 1 compares the main characteristics of these three species. The leaf blade is generally flat in *A. mesophilus* while generally strongly bullate in *A. bullatus* and weakly bullate in *A. veillonii*, blade shape is generally oval in *A. bullatus*

and *A. veillonii* while ovate in *A. mesophilus*, with generally 3 main palmate veins in *A. mesophilus* versus generally 5 main palmate veins in the two other species. Flower color of this new species is intermediate between *A. veillonii*, which has yellow flowers with sometimes some red at the base of the calyx, and *A. bullatus*, which has red flowers with some yellow at the edges (Fig. 2 D–E & G–H). The follicles of the fruit have a smooth surface in *A. bullatus* and *A. mesophilus*, versus coarse in *A. veillonii*. There is no overlap in the ecology or distribution of these three species, with *A. veillonii* being restricted to some rainforests on calcareous substrates of the Loyalty Islands and East coast of Grande-Terre, *A. bullatus* occurring on some coastal dry forests, or littoral forests South of Poya on the West coast of Grande-Terre and Isle of Pines, and with *A. mesophilus* only known from some rare inland mesic forests between Boulouparis and La Foa (Fig. 3).

**TABLE 1.** Observations and morphological characters used to compare the three related species, *A. bullatus*, *A. mesophilus* sp. nov. and *A. veillonii*.

|                             | <i>A. bullatus</i>                              | <i>A. mesophilus</i>                            | <i>A. veillonii</i>  |
|-----------------------------|---|---|--|
| Size of adults              | Tree 4–12 m tall (up to 35 cm in dbh)           | Tree up to 15 m tall, (up to 45 cm in dbh)      | Tree 7–16 m tall (up to 40 cm in dbh)                                |
| Leaf blade                  | Strongly bullate                                | Flat  | Slightly bullate   |
| Blade shape                 | Oval to cordiform                               | Widely ovate to ovate                           | Oval to cordiform  |
| Blade size                  | (7–)12–16(–22) × (8–)12–16(–23) cm              | (8–)10–17(–23) × (5–)7–15(–22) cm               | (15–)19–22(–25) × (15–)19–23(–28) cm                                 |
| Blade base                  | Cordate   | Truncate to rounded                             | Cordate  |
| Venation                    | 5-nerved  | 3-nerved  | 5-nerved   |
| Domatia                     | Generally present but small and/or few          | Always present, easily visible and/or numerous  | Generally absent   |
| Petiole length              | (4–)6–10(–16) cm                                | (3–)5–9(–17) cm                                 | 9–20 cm  |
| Flower (calyx) inside color | Red with some yellow at the edges               | Yellow with 2–4 grayish-purple stripes per lobe | Yellow with some red at the base                                     |
| Flower size                 | 7–10 mm long × 8–9 mm in diameter               | 8–12 mm long × 7 mm in diameter                 | 9 mm long × 11–13 mm in diameter                                     |
| Follicles size              | 2–6 × 1–3.5 cm                                  | 3.5–6 × (1.5–)2.5–3.5 cm                        | 6 × 4 cm   |
| Follicles shape             | Ovoid   | Ellipsoid to ovoid                              | Globose  |
| Seeds                       | 12–15 × 6–9 mm                                  | 12–15 × 7–10 mm                                 | 20 × 12 mm   |
| Follicles surface           | Smooth  | Smooth  | Coarse   |
| Distribution                | West coast of Grande-Terre and Isle of Pines    | West coast between Boulouparis and La Foa       | Loyalty Islands and Northeastern coast of Grande-Terre (Ponérihouen) |
| Ecology                     | Sclerophyll forest or calcareous coastal forest | Lowland mesic forest                            | Rainforests on calcareous substrates                                 |

**Conservation status:**—With an Extent of Occurrence (EOO) of 24 km<sup>2</sup>, an Area of Occupancy (AOO) of 20 km<sup>2</sup>, and three subpopulations, all occurring outside of protected areas and with strong herbivore pressures [as detailed in Discussion], *Acropogon mesophilus* is assigned a preliminary status of Endangered (EN B1ab[i,iii,iv] + B2ab[i,iii,iv]) based on the IUCN Red List Categories and Criteria (IUCN 2012).

**Additional specimens examined (Paratypes):**—NEW CALEDONIA. Province Sud: Boulouparis, Ouaménie, 55 m, 21°49′08.18″S, 165°56′55.78″E, 17 November 2011, *Gâteblé* (*leg. Létocart, Fogliani & Ounémoa*) 41 (NOU-082672!); *ibid. loc.*, 30 March 2012, *Munzinger, D. & I. Létocart, & Dubreuil* 6721 (NOU082939!); *ibid. loc.*, 2 October 2014, *Gâteblé, Barrabé, Fleurot, Létocart & Ounémoa* 545 (NOU-081993!); La Foa, Pocquereux, 150–200 m, 21°46′18.76″S, 165°56′29″E, 6 October 2014, *Le Borgne* 58 (NOU-052036!); *ibid. loc.*, 13 July 2013, *Le Borgne* 57 (NOU-083466!, NOU-083467!, NOU-083468!, P!); Boulouparis, Ouaménie, bord de piste, 23 October 2014, *Butin* 135 (NOU-084125!, P!); Camp Brun, le long de la Diahot, 180 m, 21°48′55.84″S, 165°55′09.70″E, 19 May 2015, *Gâteblé, Anger & Ounémoa* 685 (NOU-081991!, NOU-081992!, P!); Camp Brun, le long de la Diahot, 130 m, 21°49′29.85″S, 165°54′50.71″E, 19 May 2015, *Gâteblé* 686 (MPU-028532!); *ibid. loc.*, 17 November 2015, *Gâteblé* 719 (MPU-028531!, NOU-081990!, P!); Camp Brun, en contrebas de la maison de M. Laven, 110 m, 21°49′44.21″S, 165°54′46.76″E, 30 April 2016, *Gâteblé & Deschamps* 776 (NOU!).

**Discussion:**—During field work, feral pigs (*Sus scropha*) and invasive deer (*Rusa timorensis*) populations were regularly observed in these mesic forests. In all populations surveyed, there were no young *Acropogon* trees observed, only adults. Lack of regeneration is likely due to the strong herbivore pressures from deer and pig overabundance. This observation is also true for most of the species growing along with this new species. Some rat predation of immature

fruits and seeds directly on the trees was also observed (see predation marks on fruits of *Gâteblé et al.* 685), and black rat (*Rattus rattus*) predation of fruits is reported to be a threat for most *Acropogon* species, especially on *A. bullatus* (F. Brescia, pers. comm.).

## Acknowledgements

We thank Thomas le Borgne who made important collections and observations, and allowed us to use his photographs of the new species, Daniel and Irène Létocart, Jacqueline Ounémoa, Dominique Fleurot, Vaimoana Fogliani, Marc Deschamps, Laure Barrab and Nicolas Anger for enthusiastic help in the field, Jean-François Butaud for his picture of *A. veillonii* and for data related to this species. We are grateful to the team at the NOU herbarium (IRD, Nouméa) Sophie Van Ganse & Jacqueline Tinel, Giliane Karnadi-Abdelkader at IAC herbarium for mounting and computerizing the specimens, MEL for providing scans, P for access to collections, MPU for facilities, and to Laurence Ramon for providing the fine illustration. Thanks to Christian Mille and Thierry Salesne for insect identification, and to Fabrice Brescia, Guillaume Lannuzel and Philippe Morat for their personal communications. We thank the authorities of New Caledonia's Southern Province for providing collecting permits and for other courtesies, Luc & Yvelyne Daly and Maurice Laven for permission to access their private properties. Finally, we thank Gordon McPherson for improving our English.

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