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Two new species of *Quintinia* (Paracryphiaceae) with notes on the species from New Caledonia and Vanuatu

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Abstract

The taxonomy of *Quintinia* (Paracryphiaceae) in New Caledonia and Vanuatu is reviewed. All names validly published in *Quintinia* in the two archipelagos are discussed and lectotypified where necessary. Two new species are described: *Q. hyehenensis* and *Q. sessiliflora*. Six species are thus recognized in New Caledonia: *Q. hyehenensis*, *Q. major*, *Q. minor*, *Q. oreophila*, *Q. sessiliflora*, and *Q. media*; the latter also extends to Vanuatu. Sexual systems are discussed and it seems that contrary to previous reports, *Quintinia* is almost entirely dioecious on these islands. The moderately high manganese concentration in the leaves of *Q. sessiliflora* is discussed.

Keywords: *Dedeia*, dioecy, hyperaccumulator, endemic, ultramafic

Introduction

Quintinia Candolle (1830: 5) is a genus of shrubs and trees that has traditionally been placed in Saxifragaceae, but also in Escalloniaceae, or as the sole member of Quintiniaceae. Molecular phylogenetic studies (Bremer *et al.* 2002; Lundberg 2001; Tank & Donoghue 2010) have indicated affinities with *Paracryphia* Baker f. (in Rendle *et al.* 1921: 306) and *Sphenostemon* Baillon (1875: 53) and these three genera now form Paracryphiaceae, the sole family of the order Paracryphiales, which is the sister group of Dipsacales (Campanuliids, APG III 2009; APG IV 2016). It should be noted that there has been disagreement regarding the placement of another genus previously placed in Saxifragaceae, *Polyosma* Blume (1825: 658). This genus is now considered a member of Escalloniaceae (APG III 2009), since phylogenetic studies based on plastid markers placed it as sister to the rest of this family (e.g. Lundberg 2001). However, mitochondrial markers suggest instead that *Polyosma* may be the sister group of *Quintinia* (Soltis *et al.* 2011). This discrepancy seems better explained for now as a case of horizontal gene transfer (Soltis *et al.* 2011). The four genera mentioned above are all little-known and a critical morphological comparison between them is desirable.

Quintinia has not been revised recently and there are 27 species names in IPNI (2019), and 25 species according to Dickison & Lundberg (2016). It occurs in New Guinea, from where most species have been described, the Philippines, Sulawesi, eastern Australia, New Zealand, New Caledonia and Vanuatu. There is apparently no record from the Solomon Islands or Fiji. The genus was first described by Alphonse de Candolle based on a single Australian species, *Quintinia sieberii* Candolle (1830: 5) and named after “La Quintinie”, presumably Jean-Baptiste de la Quintinie (1626–1688), a gardener and the creator of the “Potager du roi” in Versailles (Délias 2015). Two fossils genera, *Bertilanthus* Friis & Pedersen (2012: 320) and *Silvianthemum* Friis (1990: 7) from late Cretaceous deposits in Sweden have some morphological affinities with *Quintinia* (Friis *et al.* 2013). *Quintinia tasmanensis* Jordan (1997: 61) is a fossil species from the Pleistocene of Tasmania, where the genus no longer occurs.

Baillon described the genus *Dedeia* Baillon (1879) in the family Saxifragaceae based on material from New Caledonia, which he compared mostly to *Polyosma* but not to *Quintinia*. The names *Dedeia*, *Dedeia major* Baillon (1879), *Dedeia media* Baillon (1879) and *Dedeia minor* Baillon (1879) were apparently presented at the congress of the “Association française pour l’avancement des sciences” (7th session) in 1878 and then published twice in print in the proceedings (« compte-rendu ») of this congress in 1879 (exact publication date unknown) and in the journal

Adansonia (volume 12, October 10th 1879). The two texts are identical, but it is not clear which one was published first. Schlechter (1914) did not consider *Dedeia* different from *Quintinia* and transferred its species, except *D. media*, to the latter. His conclusions are followed here. Guillaumin (1939) published the last treatment of New Caledonian *Quintinia*, as part of his revision of Saxifragaceae, where he also placed the genera *Argophyllum* Forster & Forster (1776: 29) and *Polyosma*; all three groups have been little investigated. A taxonomic synopsis was recently published for *Polyosma* (Pillon 2018) and an update of *Quintinia* is provided here. All specimens housed at P and NOU have been examined and some type specimens in other institutions were viewed online.

Notes on sexual systems in *Quintinia* in New Caledonia and Vanuatu

According to Dickison & Lundberg (2016), the flowers of *Quintinia* can be bisexual or unisexual. When he described the genus *Dedeia* and the three species within it, *D. major*, *D. media*, and *D. minor*, Baillon (1879a; b) clearly distinguished male and female flowers. Schlechter (1906) described three additional species from New Caledonia, *D. oreophila*, *D. parviflora*, and *D. resinosa*. He also mentioned *D. major*, for which he cited material he collected himself, and *D. minor*, but did not make any reference to *D. media*. He wrote that *D. oreophila* differs from the other taxa by being hermaphroditic and that *D. parviflora* was similar to *D. oreophila* in having bisexual flowers. He distinguished male and female flowers in *D. resinosa* for which he made a collection of each sex with flowers at anthesis and fruits. It is particularly easy to distinguish the sex of flowers in this taxon since the female ovary typically has a conical shape that gives the male and female flowers a distinct appearance. Schlechter cited a single specimen for each of *D. oreophila* and *D. parviflora* and for both species, he described the style as having the shape of a cylindrical column. Since the specimens in both cases are in bud, the sexual system cannot be confidently determined. Guillaumin (1931) described *D. neoebudica* from Vanuatu as having bisexual flowers, but the single collection he cited, *Kajewski 866*, has flowers lacking a stigma (see below) and so they can be considered as male.

In this study, having looked at all available material of *Quintinia* from New Caledonia and Vanuatu at P and NOU, all specimens except two (*Munzinger 6180* and *McPherson 3400*) bore only functionally male or female flowers and thus almost all individuals are unisexual and the species are dioecious. The flower structure of all *Quintinia* species from New Caledonia and Vanuatu is relatively uniform. Flowers are usually pentamerous (occasionally tetramerous), the calyx having (4–)5 short sepals and the corolla (4–)5 petals. The stamens are alternate to petals and occasionally, tufted hairs can be observed at the base of the stamens. Male flowers have (4–)5 functional stamens, each with a short, broad filament and an introrse basifixed anther with 2 divergent locules largely opening longitudinally at maturity. A rudimentary columnar style with a pointed apex is present and often quickly and more or less partly caducous. Female flowers have (4–)5 stamens very similar to the functional ones of male flowers, each with a short, broad filament and a basifixed anther with 2 linear divergent locules showing a line of longitudinal dehiscence. The broad conical style clearly displays dehiscence lines and is topped by a distinctly lobed stigma. Except for the putatively hermaphroditic specimens cited above, whenever a flower displayed an apparently functional pistil, at whatever stage of maturity, none of the stamens had opened, and they are thus likely to be staminodes. Likewise, whenever a flower with apparently functional stamens was observed, the style was thin, columnar, and often partly caducous. No fruits were observed on any male specimens, all parts of the flowers being caducous in the end.

Useful characters for species recognition

Both Schlechter (1906) and Guillaumin (1939) stressed the sexual system to distinguish species, but as stated above, all species from New Caledonia and Vanuatu are considered here as dioecious or largely so. Hairs are occasionally present at the base of the stamens, mostly in male flowers, but this character is inconsistent in several species, and occasionally present in *Q. major* and *Q. minor*, contrary to what was stated by Guillaumin (1939) in his key. Several characters of the fruits are used here for the first time (FIG. 1), including their size and shape and the number of carpels (number of stigma lobes, number of dehiscence slits). There is little variation in the shape of the vegetative organs, and sterile material cannot always be identified to species level.



FIGURE 1. Diversity of fruits in the species of *Quintinia* from New Caledonia. From left to right: *Q. media* (Guillaumin 12776), *Q. sessiliflora* (McPherson 19370), *Q. hyehenensis* (Pillon 349), *Q. minor* (Veillon 1042), *Q. oreophila* (Morat 6770), and *Q. major* (MacKee 37576).

Taxonomy

Quintinia Candolle (1830: 5). Type species: *Quintinia sieberi* Candolle.

= *Curraniodendron* Merrill (1910: 177). Type species:—*Curraniodendron dedeaeoides* Merrill.

= *Dedeia* Baillon (1879a: 338, b: 695). Lectotype (designated by Hutchinson 1967: 29):—*Dedeia major* Baillon.

Quintinia major (Baillon) Schlechter (1914: 125). *Dedeia major* Baillon (1879a: 339, b: 695). Type:—NEW CALEDONIA. Versant occidental du Kougui, September 1869, *Balansa 1781* (holo-: P00537641!, iso-: K000618791, P00537642!, P00537643!).

In his description, Baillon (1879a; b) cited a single collection, *Balansa 1781*. A single sheet at P bears the handwritten name “*Dedeia major* H. Bn.” in Baillon’s hand and is treated as the holotype.

Quintinia media (Baillon) Guillaumin (1939: 277). *Dedeia media* Baillon (1879a: 341, b: 697). Lectotype (designated here):—NEW CALEDONIA. Mont Mou, March 1870, *Balansa 2814* (P00537644!, isolectotypes: P00537645!, P00537646!).

Quintinia parviflora (Schlechter) Schlechter (1914: 125). *Dedeia parviflora* Schlechter (1906: 115), **syn. nov.** Lectotype (designated here):—NEW CALEDONIA. Auf den Bergen bei Oubatche, 900 m, 23 December 1902, *Schlechter 15542* (B100715465!, isolectotypes: BR0000006998103!, E00346924!, HBG515576!, G00341775, G00341776, K000618786, L0035138!, P00537653!, S09-11220!).

Quintinia neobudica (Guillaumin) Guillaumin (1948: 23). *Dedeia neobudica* Guillaumin (1931: 250), **syn. nov.** Type:—VANUATU. Aneityum island: Anelgauhat Bay, Saddle Peak, 5 March 1929, *Kajewski 866* (holotype, P00709681!, isotypes, B100715392!, BISH1005026!, BRI-AQ0379471!, K000618792, NY00185864!, US00097021!).

Notes:—Baillon (1879a; b) cited two collections in his description of *D. media*, *Pancher* (Kougui, 800 m) and *Balansa 2814* (Mont Mou). Only two sheets of *Balansa 2814* at P bear the handwritten “*Dedeia media* H.Bn.”, presumably in Baillon’s hand, and one is chosen here as the lectotype. The collection *Pancher Mus. Néocal. N°544* (P00537647!; P00537648!) that bears the locality “Cougui—800m” or “baie du Prony” (P02582327!), belongs to *Q. minor* and is therefore excluded from being a syntype.

When he described *Dedeia parviflora*, Schlechter (1906) cited a single collection, *Schlechter 15542*, for which duplicates exist in several herbaria. Most of his duplicates typically bear the annotation “n. sp.” in his own hand, but he did not annotate any of them with the word “type” or “holotype”. It is probable that he used all the duplicates to describe the new taxon before he distributed them. Following McNeill (2014), the duplicate at B, where Schlechter

worked, should not be considered by default as the holotype, but is here designated as the lectotype. He did not critically compare this new taxon with the previously described *D. media*, and since we did not find any morphological differences between them, we consider these names to be synonyms.

Guillaumin (1931) cited a single collection when he described *Dedeo neoebudica*: *Kajewski 866*. Several duplicates of this collection exist, but none at A (D. Hanrahan, comm. pers.), and only the sheet at P bears the handwritten name “*Dedeo neo-ebudica* Guillaum. sp. nov.”, presumably in Guillaumin’s hand, and so this is here considered as the holotype. Guillaumin stated that this taxon was close to *D. oreophila* and *D. parviflora* because of its bisexual flowers, but *Kajewski 866* is clearly from a male plant since its flowers lack stigma. He added that it differs from the other two species he mentioned because of “its racemes much exceeding the leaves and naked from the base to about the middle”. The relative length of the inflorescences to the leaves is variable within the species of *Quintinia* in New Caledonia and within Vanuatu. Close examination of *Kajewski 866* reveals that there are many scars in the lower half of the inflorescence axes, indicating that they are not naked but rather that the flowers have simply fallen.

In Vanuatu, *Quintinia* has so far only been collected from two islands that are relatively distant from each other: Santo (6 collections) and Anatom (= Aneityum, 3 collections). Most of the collections from Santo (*Cabalion 442*, *Munzinger 3805*, *Pillon 556*, *Suprin 296*, *Veillon 4012*) fit well morphologically with the material of *Q. media* from New Caledonia. *Kajewski 866* (type of *Q. neoebudica*) and *Bernardi 13019*, both from Anatom, are somewhat different, having larger leaves that are more obtuse at the apex, secondary veins that are more distinct, and more numerous terminal inflorescences. However, *Cabalion 1988*, also from Anatom, does not display these characters and is similar to plants from Santo and New Caledonia. The sixth collection from Santo, *McPherson 19495*, displays a combination of small leaves, similar to those of other plants from this island, and numerous inflorescences, as in the type of *Q. neoebudica*. The variation observed within *Quintinia* in Vanuatu does not correlate with geography and the existence of intermediates does not support a distinction between *Q. neoebudica* and *Q. media*, which share the characteristic of an ovary with three stigma lobes. These names are therefore treated as synonyms.

Quintinia minor (Baillon) Schlechter (1914: 125). *Dedeo minor* Baillon (1879a: 339, b: 695). Lectotype (designated here):—NEW CALEDONIA. Mont Mi, 20 February 1869, *Balansa 1004* (P00537649!, isolectotypes: K000618790 [without collection number], P00537650!, P00537651!).

Quintinia resinosa (Schlechter) Schlechter (1914: 125). *Dedeo resinosa* Schlechter (1906: 115), **syn. nov.** Lectotype (designated here):—NEW CALEDONIA. Auf den Bergen bei Paita, 400 m, 3 October 1902, *Schlechter 14894* (P00537655!, isolectotype: BR0000006998417!, E00177014!, HBG515558!, G00341779, G00341780, K000618788). Syntypes: auf den Bergen bei Paita, 400 m, 3 October 1902, *Schlechter 14893* (B100715463!, E00177013!, G00341781, G00341782, K000618789, K00061893, P00537654!).

Notes:—Baillon (1879a; b) cited two collections in his description of *D. minor*: one by Pancher and the other was *Balansa 1004* (Mont Mi). No collection of *Q. minor* by Pancher could be located at P, except *Mus. Néocal. N°544* (P002582327!, P0537647!, P00537648!) from “Cougui—800 mètres” or “Baie du Prony”, which was also cited as a syntype of *media*. Two sheets of *Balansa 1004* at P bear the name “*Dedeo minor* H.Bn.” in Baillon’s hand, and one is here chosen as the lectotype.

Schlechter (1906) cited in the protologue of *Dedeo resinosa* two specimens apparently collected in the same location and on the same day, one from a male plant (*Schlechter 14893*) and the other from a female one (*Schlechter 14894*). Since fruiting material is more informative in *Quintinia*, we choose the sheet of *Schlechter 14894* at P as the lectotype; there is apparently no duplicate of this collection at B. This plant falls in the morphological range of *Q. minor*, with which it shares the typical cylindrical fruit, and the name *Q. resinosa* is thus treated as a synonym.

Quintinia oreophila (Schlechter) Schlechter (1914: 125). *Dedeo oreophila* Schlechter (1906: 114). Lectotype (designated here):—NEW CALEDONIA. Auf den Bergen am Ngoye, 800 m, *Schlechter 15378*, 19 November 1902 (B100715464!, isolectotypes: BR0000006997779!, E00177015!, HBG515560!, G00341777, G00341778, K000618787, P00537652!, S09-11218!).

Notes:—When he described *Dedeo oreophila*, Schlechter (1906) cited a single collection, *Schlechter 15378*, and the duplicate at B is here designated as the lectotype (see *D. parviflora* for justification).

***Quintinia hyehenensis* Pillon & Hequet, *sp. nov.* (FIG. 2).**

Type:—NEW CALEDONIA. Mt Panié, 1330 m, 8 April 2006, *Pillon & al.* 349 (holotype: P03320276!, isotype: NOU011629!).

Diagnosis:—This species is most similar to *Quintinia media* (Baillon) Schlechter from which it differs by its thick petiole, its leaf apex, which is rounded and often retuse, and by the number of carpels (4–5, vs 3).

Shrub or tree, 1.5–11 m. Young parts including buds glabrous and resinous. Stipules absent. Leaves simple, alternate, petiole (1–)2–3 cm × 1–3.5 mm; leaf blade (3–)5–10 × 1.5–3.5 cm, elliptic, base broad to acute, apex generally rounded to retuse, sometime broadly acute, coriaceous, glabrous, covered with black glandular dots on the lower surface, folded in two along midvein when young; margin entire, minutely revolute; venation brochidodromous, not very distinct, primary venation impressed on the upper side, (5–)9–13 pairs of secondary veins barely distinct from higher order veins. Inflorescence glabrous, an axillary raceme 4.5–11 cm long, with 20–40(–60) flowers (resinous when young), bracts 1.5–2.5 mm, fugaceous. Flower pentamerous; pedicels 1.5–3 mm. Sepals, triangular, 0.8 × 0.5 mm, glabrous, free and persistent on fruit. Petals free, ovate, 1.5 × 1 mm, glabrous, white. Stamens in a single whorl, with curly white hairs at the base of the filaments, filaments subulate, 0.5 mm long, anthers basifixed, dithecal, longitudinally dehiscent, 0.5 mm long. Ovary inferior, 4–5 locules, hypanthium shortly obconical in flower, style in male flowers columnar, narrow, 0.5–1 mm long, quickly caducous, in female flowers capitate with 4 (5) lobes and broadly based. Fruit: a septicial capsule, glabrous, placentation parietal, unilocular at maturity, broadly obovoid, 2 × 2 mm, minutely ridged longitudinally. Style persistent, 0.5–1 mm long, dividing in fruit with stigma lobes alternate to sepals and dehiscence slits opposite to sepals. Seeds unknown.



FIGURE 2. *Quintinia hyehenensis* Pillon & Hequet. **A.** Branch with fruits; **B.** Female flower; **C.** Male flower; **D.** Fruit. **A & D:** *Pillon et al.* 349; **B:** *MacKee 24460*; **C:** *McPherson 19087*. Scale bars: **A:** 1 cm; **B, C, D:** 0.5 mm.

Distribution and habitat:—This species occurs in high elevation shrublands and forests between 600 and 1500 m elevation, on Mounts Panié, Ignambi and Colnett and on roches Ouaïème (FIG. 4). This species may also be present on Mount Aoupinié, from where a single collection in bud, *McPherson 3400* (NOU!, P!), matches *Q. hyehenensis* with its coriaceous and retuse leaves, but further material (flowers at anthesis or fruits) is desirable to confirm its presence in this location, which is much further south than the other collection localities.

Etymology:—This species is named after the village of Hyehen (alternative spelling of Hienghène), where the type collection was made.

Conservation status:—This species was assessed as “Endangered” (EN B1+2ab(ii,iii,v)) using the Red List Categories and Criteria (IUCN, 2012) during a workshop of the New Caledonia Plant Red List Authority on 26th October 2018.

Paratypes:—New Caledonia. Mt Panié, 1500 m, 16 January 1981, *McPherson 3550* (P02582288!); *ibid.*, 20°36'82"S 164°44'40"E, 1253–1530 m, 1 November 1999, *McPherson & van der Werff 17858* (P02582632!, NOU-014422!); Mt Colnett, 20°30'13"S 164°42'52"E, 1070 m, 30 October 2003, *McPherson, Swenson & Mouly 19087* (P02582630!, NOU004348!); *ibid.* 1250 m, 13 October 2006, *Pillon & Munzinger 629* (NOU015229!); Mt Ignambi, 19 August 1965, *Schmid 580* (NOU040486!); *ibid.*, 20°27'35"S 164°35'41"E, 1150 m, 4 May 2002, *Lowry et al. 5769* (P04358490!); Roches Ouatième, 850 m, 22 December 1977, *MacKee (leg. J.-F. Cherrier) 24460* (P02582310!); *ibid.*, 20°38'23.8"S 164°52'16.9"E, 592 m, 4 November 2010, *Munzinger 6180* (P01063266!, NOU063357!).

***Quintinia sessiliflora* Pillon & Hequet, *sp. nov.* (FIG. 3).**

Type:—NEW CALEDONIA. Mt Kouakoué, 21°57'34"S, 166°31'58"E, 1260 m, 27 April 2006, *McPherson et al. 19370* (holotype: P03320287!, isotypes: MO, NOU014898!).

Diagnosis:—This species is unique within the genus *Quintinia* A.DC. because its flowers and fruits are sessile. It is most similar to *Q. media* (Baillon) Schlechter, from which it also differs because its female flowers and fruits have 4 carpels (vs. 3).

Shrub or tree, 2–6 m, circumference of trunk up to 17.5 cm (*vide Munzinger et al. 3425*). Young parts including buds glabrous and resinous. Stipules absent. Leaves simple, alternate, petiole 1–2 cm × 1.5–2.5 mm, leaf blade 4–8 × 2–4.2 cm, coriaceous, elliptic to slightly obovate, base acute, apex broad, often with a somewhat broad mucro, glabrous, covered with black glandular dots on the lower surface, margin entire, minutely revolute; venation brochidodromous, not very distinct, primary venation impressed on the upper side, 6–10 pairs of secondary veins. Inflorescence resinous, an axillary spike 3–6 cm long with 12–20 flowers. Bracts 3 × 1 mm. Flowers sessile or with a very short pedicel (< 0.5 mm), tetramerous or pentamerous, glabrous. Flower buds 1.5 mm long × 1 mm in diameter. Flowers at anthesis unknown. Fruit: a septicidal capsule, glabrous, 4–5 locules, unilocular at maturity, placentation parietal, subglobular, 1.5–2.5 mm long, 2.5–3 mm in diameter, longitudinally ridged. Sepals free, 4–5, tongue-shaped, 1.2–1.5 × 0.5 mm, erected and persistent on fruit. Style persistent, 1.5 mm long, stigma capitate with 4 papillose lobes separating in opening fruits, alternate to sepals. Seeds c. 20 per fruit, flat, ellipsoid c. 1 × 0.2–0.3 mm, truncate at the base, pointed to truncate at the apex.



FIGURE 3. *Quintinia sessiliflora* Pillon & Hequet. **A.** Branch with fruits; **B.** Fruit; **C.** Fruit; **D.** Seeds. **A, B & D:** *McPherson et al. 19370*; **C:** *Munzinger et al. 1648*. Scale bars: **A:** 1 cm; **B & C:** 0.5 mm; **D:** 100 µm.

Distribution and habitat:—This species is found in rain forest on slopes, between 850 and 1260 m elevation on Mounts Kouakoué and Koghis, and on Montagne des Sources (FIG. 4). It may also be present further north, on Mount Boulinda. A single collection from there, *Jaffré 465* (NOU!, P!), has sessile male flowers but its leaves differ from the rest of the material of *Q. sessiliflora* in being smaller and somewhat retuse. Further collections, particularly of fruiting material, are desirable to confirm this locality.

Etymology:—The name of this species refers to its sessile flowers and fruits, which distinguish it from all other species of the genus.

Conservation status:—This species was assessed as “Near Threatened” (NT, close to VU B1+2ab(ii,iii,v)) using the Red List Categories and Criteria (IUCN, 2012) during a workshop of the New Caledonia Plant Red List Authority on 26th October 2018.

Notes on manganese accumulation:—Measurements with a handheld X-Ray Fluorescence (XRF) spectrometer (Gei *et al.* 2018; Jaffré *et al.* 2013) indicate large amounts of manganese in the leaves of *Q. sessiliflora*: 812 $\mu\text{g g}^{-1}$ (Veillon 1372), 1770 (Schmid 4317), 1946 (McPherson 6417), 4653 (Munzinger *et al.* 3425), 6154 (McPherson *et al.* 19370), 6232 (McPherson *et al.* 19333), 6659 (Lowry *et al.* 6824) and 8316 (Munzinger *et al.* 1648). To confirm this observation with greater precision, a leaf was detached from each of three specimens, rinsed for 2 minutes in Alconox®1% (Faucon *et al.* 2007) with agitation and rinsed with distilled water. The leaves were ground to powder, digested in $\text{HNO}_3/\text{H}_2\text{O}_2$ and analysed by Microwave Plasma-Atomic Emission Spectrometer (MP-AES). The measurements observed for Mn were much lower with this method: 572 $\mu\text{g g}^{-1}$ (Schmid 4317), 1416 (Munzinger *et al.* 3425), and 1549 (Lowry *et al.* 6824). The XRF method gave values that were 3.1 to 4.3 higher, but this method is probably less accurate. The Mn concentrations found using either method are in any case much higher than the average level of 200 $\mu\text{g g}^{-1}$ observed in plants (Dunn 2007), but still below the 10,000 $\mu\text{g g}^{-1}$ threshold typically used to characterize Mn hyperaccumulation (van der Ent *et al.* 2013). According to Jaffré (1980), 21 % of the species growing on ultramafic substrates in New Caledonia have a leaf Mn concentration exceeding 1000 $\mu\text{g g}^{-1}$, thus, the Mn content of *Q. sessiliflora* is not unusual considering its ecology.



FIGURE 4. Distribution map of *Quintinia hyehenensis* (full circle) and *Q. sessiliflora* (empty square). Two questionable locations are indicated with question marks (see text). Shaded areas indicate ultramafic substrates.

Paratypes:—New Caledonia: Mt Kouakoué, 800–900 m, 16 November 1972, *Schmid 4137* (NOU040461!); *ibid.*, 1300 m, 17 November 1972, *Schmid 4318* (NOU040460!); *ibid.*, 21°57'28"S 166°32'20"E, 26 November 2002, *Munzinger et al. 1648* (P00354347!, NOU002834!); *ibid.*, 21°58'16"S 166°30'16"E, 1200 m, 7 November

2004, *McPherson, Munzinger & Labat 19333* (P00497355!, NOU012507!); *ibid.*, 21°57'49"S 166°32'07"E, 12 May 2006, *Lowry et al. 6824* (P03320284!, NOU042545!); *ibid.*, 12 May 2006, *Munzinger et al. 3425* (P03320312!, NOU012203!); Mt Koghis, 950–1000 m, 16 March 1984, *McPherson 6417* (P02582552!); Montagne des Sources, 850 m, 5 October 1967, *Veillon 1372* (P03320313!, NOU040459!).

Identification key to the species of *Quintinia* of New Caledonia:

[UM = ultramafic substrates; NUM = other substrates]

1. Low shrub, up to 1.5(–3) m tall, leaf blades small (< 2.5[–4] cm), secondary veins not very distinct, high elevation maquis (Humboldt, Kouakoué, Montagne des Sources), UM *Q. oreophila*
- Tall shrub or tree 2–12 m tall, leaf blades large (10–20 cm), pale underneath, secondary veins clearly visible, numerous and closely spaced at a right angle to the midvein, widespread, UM..... *Q. major*
- Tall shrub or tree, leaf blades medium-sized (4.5–10 cm), secondary veins more or less distinct and widely spaced, UM or NUM.2
2. Fruits cylindrical, much longer than wide, flowers with an inferior, conical ovary, South, UM..... *Q. minor*
- Fruits globose, flowers with a more or less globose, inferior ovary, UM or NUM3
3. Flowers and fruits sessile, UM *Q. sessiliflora*
- Flowers and fruits with a distinct pedicel, UM or NUM.....4
4. Leaves papery, pointed at the apex, petiole slender, carpels 3 (3 stigma lobes and 3 dehiscence slits), widespread, UM & NUM (also Vanuatu)..... *Q. media*
- Leaves more coriaceous, apex more or less rounded or sometime retuse, petiole thick, carpels 4 (5) (4[5] stigma lobes and 4[5] dehiscence slits), Panié range & Ouaième, NUM *Q. hyehenensis*

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