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To cite this version:

Daniel Cahen, Marine Toussirot, Yohan Pillon. A revision of Ventilago (Rhamnaceae) in New Caledonia and Vanuatu with notes on dyeing properties. Willdenowia, Direktion des Botanischen Gartens und Botanischen Museums, Berlin, ALLEMAGNE 2020, 50 (2), pp.253-266. 10.3372/wi.50.50211. hal-03127465

HAL Id: hal-03127465
https://hal.inrae.fr/hal-03127465
Submitted on 1 Feb 2021

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A revision of Ventilago (Rhamnaceae) in New Caledonia and Vanuatu with notes on dyeing properties

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Source: Willdenowia, 50(2) : 253-266

Published By: Botanic Garden and Botanical Museum Berlin (BGBM)

URL: https://doi.org/10.3372/wi.50.50211
A revision of Ventilago (Rhamnaceae) in New Caledonia and Vanuatu with notes on dyeing properties

Abstract: The climbing genus Ventilago Gaertn. (Rhamnaceae) is revised in New Caledonia and Vanuatu. The description of V. pseudocalyculata Guillaumin was based on four gatherings (syntypes). The name is lectotypified with a specimen from Lifou, and the species is now considered to be restricted to the Loyalty Islands, while the specimens from Grande Terre (the main island of New Caledonia) are treated as a new species, V. tinctoria Cahen, Toussirot & Pillon. A total of four endemic species are therefore recognized in New Caledonia: V. buxoides Baill., V. neocaledonica Schltr. and V. tinctoria from Grande Terre and V. pseudocalyculata from the Loyalty Islands. The plants from Vanuatu, often identified as V. neocaledonica, are treated here as a new species, V. vanuatuana Cahen, Toussirot & Pillon, endemic to that archipelago.

Key words: dye, island, lectotype, Melanesia, New Caledonia, new species, Rhamnaceae, taxonomy, tinctorial plants, tropical climbers, ultramafic, Vanuatu, Ventilagineae, Ventilago

Introduction

Rhamnaceae are represented by about ten species in seven genera in New Caledonia (Morat & al. 2012; Munzinger & al. 2012+). The most complete overview for New Caledonia is a short summary of the family with identification keys and description of new species by Guillaumin (1926). A short description of the family and a key to species was also included in Flore analytique et synoptique de la Nouvelle-Calédonie (Guillaumin 1948a). Recent work has included the lectotypification of Emmenosperma pancherianum Baill., a species once thought to be endemic to New Caledonia and discovered in 2005 in Queensland (Bean 2013). A molecular phylogenetic study (Hopkins & al. 2015) has indicated that Alphitonia erubescens Baill. and A. xerocarpa Baill. were misplaced in the genus Alphitonia Reissek ex Engl. and were accommodated in a newly described genus Jaffrea H. C. Hopkins & Pillon, endemic to New Caledonia. This study also included the lectotypification of these two species names, along with A. neocaledonica Schltr. A phylogenetic and biogeographic
analysis of Alphitonia and of related Emmenosperma F. Muell., Granitites Rye and Jaffrea supports the currently applied taxonomy in these genera (Hauenschild & al. 2018). The genera Colubrina Rich. ex Brongn. (Johnston 1971) and Rhannella Miq. (= Dallachya F. Muell.; Smith 1943) are each represented by a single non-endemic species: Colubrina asiatica (L.) Brongn. and Rhannella vitensis (Benth.) A. C. Sm.

No taxonomic treatment of Ventilago Gaertn. or Gousania Jacq. in New Caledonia has been published since Guillaumin (1926, 1948a). However, recent work on Ventilago in neighbouring regions was published (Cahen & Utteridge 2017), and the closely related genus Smythea Seem., which occurs in Vanuatu, was revised (Cahen & Utteridge 2018). Ventilago and Smythea are the only members of tribe Ventilagineae Hook. f., unique in Rhamnaceae in its members’ fruits having a pronounced apical appendage. Generic delimitation between Ventilago and Smythea is based on the shape of the seed chamber of the fruit: conspicuously globose and clearly differentiated from the wing in Ventilago, compressed and gradually flattened into the wing (when present) in Smythea (Cahen & Utteridge 2018). Ventilago is a genus of about 30 species of tropical climbing shrubs, lianas and, rarely, small trees, absent from the Neotropics, easily recognized by their fruits having the combination of an oblong wing-like apical appendage and a conspicuously globose seed chamber (Suessenguth 1953; Medan & Schirarend 2004; Cahen & Utteridge 2018). The traditional use of Ventilago plants as a source of dyes in New Caledonia and Vanuatu and potential further uses were documented in Blanc (2008), Cardon (2007) and Cardon & al. (2010). Three species of Ventilago were considered to be native to New Caledonia (Morat & al. 2012; Munzinger & al. 2012+): V. buxoides Baill., V. neocaledonica Schltr. and V. pseudocalyculata Guillaumin. An additional species, V. tinctoria Cahen, Toussirot & Pillon is recognized here. The abundance of ultramafic soils in New Caledonia, which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island) acts as an ecological filter affecting species which cover one-third of the surface of Grande Terre (the main island).

Material and methods

Herbarium specimens from CANB, K, L, MPU, NOU, P and Z were studied; an exclamation mark (!) is used to show that a specimen has been seen, whereas “image!” is used to show that an image of the specimen has been seen. Hair density terms are defined as follows: sparse when hairs are scattered enough not to touch when pressed toward each other, abundant when hairs are close enough to touch if pressed toward each other, dense when hairs are so close to each other that they hide the surface of the organ they grow on. Leaf anatomy terms used are from Hickey (1979) and other morphology terms follow Beentje (2010). GeoCat (Bachman & al. 2011) was used to calculate Extent of Occurrence (EOO). All examined specimens appear in the Appendix (see Supplemental content online), sorted alphabetically first by species and then by collector’s name.

Results and Discussion

Notes on dyeing properties

Natural dyes are an integral component of cultural heritage worldwide, and the use of plant-derived dyes in the Pacific Ocean is the subject of ongoing research (e.g. Cardon 2007; Cardon & al. 2010; Toussirot & al. 2012, 2014). The phytochemical study of Ventilago species shows that the colours obtained from them are often due to a rich mixture of quinones (Cardon & al. 2010). Three anthraquinones in particular, emodin, physcion and chrysophanol, are found in the bark and roots (Blanc 2008; Toussirot 2014).

Studies conducted with the University of New Caledonia examined the dyeing and biological properties of the Ventilago species present in New Caledonia and Vanuatu (Blanc 2008; Cardon & al. 2010; Toussirot 2014). A climber from Vanuatu, named laba (Apma language, central Pentecost) is of great cultural significance in some islands of north-central Vanuatu, where the bark of its root is used to prepare the red dye of ceremonial mats. Bourdy & Walter (1986) described its use in Pentecost and had already noted the need for an in-depth taxonomic as well as ethnological study of this plant. The laba climber was at
the time identified as *V. neocaldonica*. However, significant colour differences were observed following dyeing tests carried out with different species (including among the species from New Caledonia, Fig. 8). The experimental protocols of these tests, including the mordanting methods and types of fibres used, as well as colorimetric and colour absorption measurements, are documented by Blanc (2008). Furthermore, subsequent analyses of the chemical profile of the specimens revealed qualitative and quantitative differences in their anthraquinone composition (Blanc 2008). The differences in colour and in quinone composition suggested that *lab>a* and *V. neocaldonica* could be different species of *Ventilago*, and at this stage it was hypothesized that *lab>a* was *V. vitensis A. Gray* rather than *V. neocaldonica* (Blanc 2008; Cardon & al. 2010). The taxonomic work presented here shows that *lab>a* is actually morphologically different from both *V. neocaldonica* and *V. vitensis* and represents a distinct, hitherto undescribed species: *V. vanuatuana*.

This shows the potential benefits of interdisciplinary scientific research allowing analyses to complement one another. In this case, the study of the traditional use of dyes eventually led to the hypothesis of an undescribed species, which was confirmed here by study of herbarium specimens. Alternatively, improved taxonomic knowledge could refine studies of the traditional uses of these plants, for example by determining whether separate species previously believed to be the same have slightly different properties and therefore uses.

**Key morphological characters**

All species of *Ventilago* in New Caledonia and Vanuatu are woody climbers, sometimes growing as scandent shrubs, and are easily recognized when in fruit, as the fruits have a distinct wing-like apical appendage and a conspicuous, globose basal portion enclosing the seed chamber (Fig. 4A, K; Fig. 6A, K). These characters help distinguish *Ventilago* species from all other *Rhamnaceae* genera occurring in the region: species of *Alphitonia* in New Caledonia and Vanuatu are all trees or shrubs with unwinged capsular fruits; *Emmenosperma pancherianum* is a shrub with capsular fruits and red seeds persisting after the pericarp has fallen; species of *Jaffrea* are trees and shrubs with conical flowers and late-dehiscent beaked fruits; *Rhamnella vitensis* is a shrub with flowers in umbel-like cymes, and drupaceous fruits. Among the climbing genera, *Colubrina asiatica* (occasionally scandent) is distinct in the 3-seeded capsules with the outer pericarp irregularly breaking away and leaves with only 2 or 3 secondary veins (vs 4–8 in *Ventilago*); *Gournia* is distinct in the presence of tendrils and fruits that are 3-winged schizocarps; *Smythea lanceata* is distinct in the crustaceous inflated wingless fruits (see Remarks for *V. vanuatuana* for further distinguishing characters). Morphological differences between *Alphitonia*, *Emmenosperma* and *Jaffrea* are discussed in Hopkins & al (2015) and genus-level morphological descriptions in *Rhamnaceae* are available in Medan & Schirarend (2004).

**Leaves**

In all *Ventilago* species of New Caledonia and Vanuatu, leaves are simple, alternate, ± symmetric, usually subcoriaceous, glabrous to subglabrous, and have a single medial primary vein serving as the origin for 4–8 upwardly notched secondary veins gradually diminishing apically inside the margin (“camptodromous venation” sensu Hickey 1979) (Fig. 4A; Fig. 6A). *Ventilago buxoides* differs from all other species in the small (0.5–3.5 × 0.3–2 cm vs 2.2–13 × 1.2–8.5 cm) often apically notched leaves (vs unnotched). Leaf margin and lamina shape characters are useful to distinguish the remaining species: margin crenate to serrate in *V. vanuatuana* (Fig. 6B, F); entire to weakly serrate in *V. neocaldonica*; entire, obscurely repand in both *V. pseudocalyculata* and *V. tinctoria*, but lamina broadly ovate to (broadly) elliptic in *V. pseudocalyculata* vs (narrowly) elliptic in *V. tinctoria* (Fig. 4A, E).

**Inflorescences and flowers**

In New Caledonia and Vanuatu, *Ventilago* flowers are arranged in cymes congested into fascicles (Fig. 4G; Fig. 6H). In *V. buxoides*, leaves subtending fascicles of open flowers are usually persistent. In all other species, subtending leaves are mostly fugaceous so that the fascicles of open flowers are arranged in racemiform thyrses (Fig. 4F; Fig. 6G), and often enough leaves are fugaceous for the thyrses to be arranged in a panicule. Flowers in *Ventilago* species of the area are remarkably homogenous: all are bisexual, c. 3 mm wide when open, with 5 triangular adaxially keeled sepals (Fig. 4F; Fig. 6J), 5 clawed apically notched petals each enclosing a stamen, a 2-locular ovary partially immersed in a smooth glabrous subpentagonal disk, and a bifid style (Fig. 4J; Fig. 6J). *Ventilago neocaldonica* can be distinguished from *V. pseudocalyculata*, *V. tinctoria* and *V. vanuatuana* in the inflorescence rachis, pedicels and abaxial surface of the calyx being glabrous to densely hairy (the hairs may be close enough to touch each other but are usually not so close as to hide the surface they grow on) vs almost always densely hairy (the hairs are so close to each other that they hide the surface they grow on). *Ventilago vanuatuana* differs from *V. pseudocalyculata* and *V. tinctoria* in the indumentum of mostly spreading hairs on most parts of the plant, including the inflorescence rachis, pedicels and abaxial surface of the calyx (Fig. 6H) vs indumentum mostly appressed antorse (Fig. 4G, H).

**Fruit**

All *Ventilago* species of New Caledonia and Vanuatu have fruits with a distinct wing-like apical appendage
and a conspicuous globose basal portion enclosing the seed chamber (see Introduction) (Fig. 4A, K; Fig. 6A, K). The dimensions of the wing are quite homogenous among species of the area (from c. 3 × 0.7 cm in *V. buxoides* to c. 3.5 × 0.8 cm in *V. neocaldonica* and *V. pseudocalyculata*). The only species with glabrous fruits are *V. buxoides* and *V. neocaldonica*, which are distinguished from each other in leaf and inflorescence characters (see above). All other species have densely hairy fruits, and *V. vanuatuana* is recognized in the hairs being mostly spreading (vs mostly appressed antrorse in *V. pseudocalyculata* and *V. tinctoria*). The fruit wing of *V. pseudocalyculata* is usually slightly curved and often ± trullate, distinctly narrower at the base, vs oblong in all other *Ventilago* species in the area. The species is further distinguished from *V. tinctoria* in the pedicel being usually swollen in fruit, gradually widening into the calyx, vs remaining slender in fruit, suddenly expanding into the calyx (Fig. 4K).

### The species of *Ventilago* in New Caledonia and Vanuatu

1. Leaf lamina small, to c. 3.5 cm long, apex rounded, often notched; inflorescences with usually 1 flower left per fascicle at anthesis; leaves subtending fascicles of open flowers and fruits usually persistent...

   - Leaf lamina longer, apex rounded to attenuate, not notched; inflorescences with usually several flowers left per fascicle at anthesis; leaves subtending fascicles of open flowers and fruits usually fugaceous so that fascicles are arranged in racemiform thyrses, thyrses often arranged in a panicle...

2. Fruit glabrous; inflorescence rachis, pedicels and abaxial surface of calyx glabrous to densely hairy, hairs may be close enough to touch each other but are usually not so close as to hide surface they grow on...

   - Fruit hairy; inflorescence rachis, pedicels and abaxial surface of calyx usually densely hairy, hairs are so close to each other that they hide surface they grow on...

3. Leaf lamina margin crenate to serrate; hairs of branchlets, petioles, inflorescence and fruit mostly spreading...

   - Leaf lamina margin (sub)entire; hairs of branchlets, petioles, inflorescence and fruit mostly appressed antrorse...

4. Leaf lamina broadly ovate, base symmetric, rounded; petiole 0.5–1 cm long; fruit wing usually slightly curved, often distinctly tapering at base; pedicel usually swollen in fruit, gradually widening into calyx...

   - Leaf lamina elliptic, base slightly asymmetric, cuneate; petiole 0.3–1.5 cm long; fruit wing oblong; pedicel remaining slender in fruit, suddenly expanding into calyx...

### 1. *Ventilago buxoides* Baill. in Adansonia 11: 268. 1874.

- Type citation in protologue: “[...] in Austro-Caledonia, ubi cl. Deplanche (exs. n. 272) in insula Taule in ramis isidem florumet fructigeramque legit (Herb. Mus. par. et alior.).”

- **Lectotype (designated here):** New Caledonia, North Province, Île Tanlé, 1861–1867, Deplanche 272 (P! [P06886610]; isolecotypes: K! [K001342513], P! [P06886607, P06886609]).

**Ventilago 'buxifolia',** orthographical variant in Guillaumin (1926).

**Description** — Woody climber, to at least 4 m long. *Indumentum* sparse at base of branchlets, dense at distal end of branchlets and inflorescence rachis, hairs mostly whitish to sometimes fulvous, straight to slightly curved, mostly spreading. **Branches** slender, terete, smooth; branchlets often deeply ridged. *Stipules* fugaceous, though often persisting past flowering at distal end of branchlets, c. 1 mm long, narrowly deltoid to subulate. **Leaves:** petiole 1–2 mm long, densely hairy; lamina dark green, shiny adaxially, broadly to narrowly ovate, 0.5–3.5 × 0.3–2 cm, subcoriaceous, subglabrous, sparsely hairy abaxially along primary vein, base usually slightly asymmetric, rounded to cordate, margin entire or broadly crenate to serrate, obscurely near base, serrations topped by callosities, apex rounded, often notched; secondary veins 4–8, often not readily discernible from tertiary veins, remaining separate near margin or joining each other and forming loops near margin; tertiary venation not conspicuously scalariform. **Inflorescence** of cymes congested in fascicles in axils of leaves, fascicles sometimes arranged in racemiform thyrses when leaves subtending fascicles are fugaceous, flowers up to 6 per fascicle when in bud, usually only 1 left per fascicle by anthesis, racemiform thyrses usually less than 2 cm long. **Flowers** bisexual, c. 3 mm wide; pedicel c. 2 mm long when fully developed, pedicel and abaxial side of hypanthium sparsely hairy, with hairs spreading to appressed, white, straight to slightly curved, c. 0.1 mm long; sepal lobes 5, triangular, c. 1.2 mm long, adaxially keeled with an apical protuberance; petals 5, obcordate, c. 0.9 mm long, glabrous, base clawed, apex notched; stamens 5, each opposite and enclosed by a petal, filaments c. 0.7 mm long, anthers dorsifixed; disk subpentagonal, filling hypanthium, fleshy, smooth, glabrous; ovary immersed in to sometimes more than ½ exserted from disk, slightly hairy at level of exsertion from disk, glabrous distally, locules 2; style 2-fid. **Fruit** glabrous, with a conspicuous globose basal portion enclosing seed chamber and a distinct wing-like apical appendage, oblong, reaching c. 3 × 0.7 cm at maturity; apex rounded with style remains forming a distinct mucro; persistent calyx annular at base of fruit to slightly cupular and enclosing less than ¼ of globose part of fruit.

**Distribution and ecology** — This species is found in scrubland (maquis) and possibly forest at low elevation...
on the western side of New Caledonia, from Mt Mou and the Tontouta valley to Île Art. It has been collected on ultramafic substrate, probably on serpentine in most cases. Fig. 1.

Conservation status — This relatively widespread species (Extent of Occurrence: 8350 km²) has been evaluated as Least Concern (LC) according to the IUCN criteria (2012, 2017) during the workshop of the New Caledonia Plant Red List Authority of 24 Oct 2019.

Remarks — *Ventilago buxoides* is recognized by its small and often apically notched leaves. It also differs from *V. neocaledonica* and *V. tinctoria* in the inflorescences with usually one flower left per fascicle at anthesis and leaves subtending fascicles of open flowers and fruits usually persistent; the flowers are more rarely in a racemiform thyrs when the distal leaves fall off. The venation pattern is distinctive, with the tertiary venation not conspicuously scalariform, and the secondary veins often not readily discernible from the tertiary veins and sometimes forming loops near the leaf margin.

In the protologue, Baillon (1874) cited a single gathering, *Deplanche 272*. Baillon worked in Paris and there are three specimens of *Deplanche 272* in P, but only one of them bears the handwritten “*Ventilago buxoides* H. Bn.”, presumably in Baillon’s hand, and is therefore chosen as the lectotype.


**Description** — Woody climber, to at least 3 m long. **Indumentum** very sparse to sometimes dense at distal end of branchlets, inflorescence rachis and calyx, hairs mostly whitish to sometimes fulvous, slightly curved, mostly appressed antorse, hairs usually denser on calyx. **Stipules** slender, terete, smooth; branchlets often densely pubescent. **Leaves** mostly whitish to sometimes fulvous, slightly curved, end of branchlets, inflorescence rachis and calyx, hairs very sparse to sometimes dense at distal end of branchlets. **Inflorescence rachis** and calyx, hairs whitish to fulvous slightly dense, at least at distal end of branchlets and branchlet axes. **Fruit** — This relatively widespread species (Extent of Occurrence: 14950 km²) has been evaluated as Least Concern (LC) according to the IUCN criteria (2012, 2017) during the workshop of the New Caledonia Plant Red List Authority of 24 Oct 2019.

**Remarks** — **Ventilago neocaledonica** is recognized by its glabrous fruits. It most resembles **V. tinctoria** in the flower fascicles in racemiform thyrses, often arranged in panicles, and ovate leaf shape, but differs in the glabrous fruits, the sparser indumentum throughout, smaller leaves with a sometimes serrated margin and calyx usually enclosing more of the globose part of the fruit. **Ventilago buxoides** also has glabrous fruits, but has smaller leaves with a notched apex and open flowers and fruits most often inserted singly in the axils of persistent leaves.

In the protologue, Schlechter (1906) cited a single gathering, Schlechter 14905. The specimen in B was presumably destroyed in World War II (no specimen of Schlechter 14905 is currently in B, Robert Vogt, pers. comm.), but several duplicates of this gathering have been found with the indication “**Ventilago neocaledonica** Schlr. n. sp.”, probably in Schlechter’s hand, and the better-preserved specimen in K is chosen as a lectotype.


**Description** — Woody climber, to at least 3 m long. **Indumentum** dense, at least at distal end of branchlets and inflorescence rachis; hairs whitish to fulvous slightly

—— This relatively widespread species...
curved, mostly appressed antrorse. Branches slender, terete, smooth; branchlets often deeply ridged. Stipules fugaceous, often persisting by fruiting stage, c. 0.8 mm long. Leaves: petiole 0.5 – 1 cm long, subglabrous; lamina green and shiny on both surfaces, broadly ovate to (broadly) elliptic, 5 – 13 × 2.5 – 8.5 cm, chartaceous to subcoriaceous, glabrous, base ± symmetric, ± perpendicular to petiole, margin entire, obscurely repand with sometimes a minute black callosity on undulation lobes, apex rounded to attenuate; secondary veins 5 or 6, clearly discernible, remaining separate, gradually curving upward and diminishing near margin; tertiary venation conspicuously scalariform. Inflorescence of cymes congested in fascicles with subtending leaves mostly fugaceous so that fascicles are arranged in racemiform thyrses, thyrses often arranged in an inflorescence of cymes congested in fascicles with subtending leaves mostly fugaceous so that fascicles are arranged in racemiform thyrses, thyrses often arranged in a panicule, flowers up to 7 per fascicle at anthesis, racemiform thyrses to 8 cm long. Flowers bisexual, c. 2 – 2.5 mm wide; pedicel 2 – 3 mm long when fully developed, pedicel and abaxial side of hypanthium densely hairy with hairs subappressed, whitish to fulvous, slightly curved, c. 0.1 mm long; sepal lobes 5, triangular, c. 1 mm long, adaxially keeled with an apical protuberance; petals 5, obcordate, c. 0.6 mm long, glabrous, base clawed, apex notched; stamens 5, each opposite a petal, filaments c. 0.5 mm long, anthers dorsifixed, slightly exerted above enclosing petal apex; disk subpentagonal, filling hypanthium, fleshy, smooth, glabrous; ovary c. ½ immersed in disk, densely hairy, locules 2; style 2-fid. Fruit very densely appressed hairy, with a conspicuous globose basal portion enclosing seed chamber and a distinct wing-like apical appendage, usually slightly curved, often ± trullate, distinctly narrower at base, sometimes oblong with edges parallel, to at least 3.5 × 0.8 cm; apex rounded with style remains forming a distinct mucro; pedicel swollen in fruit, gradually widening into calyx; persistent calyx cupular, enclosing basal c. ⅓ of globose part of fruit.

Distribution and ecology — This species has been collected only in the Loyalty Islands, on Lifou and Maré, in forest or forest edge on limestone. It may be present on other Loyalty Islands (Ouvéa and Tiga). Fig. 3.

Conservation status — This species has been evaluated as Near Threatened (NT) according to the IUCN criteria (2012, 2017) during the workshop of the New Caledonia Plant Red List Authority of 24 Oct 2019.

Remarks — Ventilago pseudocalyculata resembles V. tinctoria from Grande Terre in the usually dense and mostly appressed antrorse hairs of branchlets, petioles, inflorescence and fruit and in the (sub-)entire leaf margin. It differs in the usually slightly curved fruit wing, often distinctly narrower at the base (vs oblong in V. tinctoria), the usually larger and more broadly ovate leaves, with a symmetric and rounded base (vs slightly asymmetric and cuneate base), and the pedicel usually swollen in fruit, gradually widening into the calyx (vs suddenly expanding into the calyx).

4. **Ventilago tinctoria** Cahen, Toussirot & Pillon, sp. nov.

- Fig. 4.


**Diagnosis** — *Ventilago tinctoria* is most similar to *V. pseudocalyculata* in the hairy fruits, in the usually dense and mostly appressed antrorse hairs of the branchlets, petioles, inflorescence and fruit, and in the (sub)entire leaf margin, but it differs in the oblong fruit wing (vs usually slightly curved and tapering at base in *V. pseudocalyculata*), usually smaller and more narrowly elliptic leaves (3–11.5 × 1.5–5.5 cm in *V. tinctoria* vs 5–13 × 2.5–8.5 cm in *V. pseudocalyculata*), usually slightly asymmetric and cuneate at the base (vs symmetric and rounded in *V. pseudocalyculata*), and in the pedicels remaining slender in fruit and suddenly expanding into the calyx (vs gradually widening into the calyx in *V. pseudocalyculata*).

**Description** — Woody climber, to at least 10 m long. *Indumentum* dense, at least at distal end of branchlets and inflorescence rachis; hairs yellowish-white to fulvous, slightly curved, mostly appressed antrorse. Branches slender, terete, smooth; branchlets often deeply ridged. Stipules fugaceous, rarely persisting by fruiting stage, c. 1 mm long, subulate. Leaves: petiole 0.3–1.5 cm long, subglabrous; lamina green and shiny on both surfaces, (narrowly) elliptic, 3–11.5 × 1.5–5.5 cm, chartaceous to subcoriaceous, glabrous, base usually asymmetric, (narrowly) cuneate, margin entire, obscurely reaped with sometimes a minute black callosity on undulation lobes, apex rounded to attenuate; secondary veins 4–6(or 7); clearly discernible, remaining separate, gradually curving upward and diminishing near margin; tertiary venation conspicuously scalariform. *Inflorescence* of cymes congested in fascicles with subtending leaves mostly fugaceous so that fascicles are in racemiform thyrses. Thyrses often arranged in a panicle, flowers up to 7 per fascicle at anthesis, racemiform thyrses to 6 cm long. Flowers fragrant, bisexual, c. 2.5 mm wide; pedicel c. 4 mm long when fully developed, pedicel and abaxial side of hypanthium densely hairy with hairs subappressed, whitish to fulvous, slightly curved, c. 0.1 mm long; sepal lobes 5, triangular, c. 1 mm long, adaxially keeled with an apical protuberance; petals 5, obcordate, c. 0.6 mm long, glabrous, base clawed, apex notched; stamens 5, each opposite a petal, filaments c. 0.7 mm long, anthers dorsifixed, slightly exserted above enclosing petal apex; disk subpentagonal, filling hypanthium, fleshy, smooth, glabrous; ovary c. ½ immersed in disk, densely hairy, locules 2; style 2-fid. Fruit very densely appressed hairy, with a conspicuous globose basal portion enclosing seed chamber and a distinct wing-like apical appendage, straight, oblong with parallel edges, c. 3 × 0.8 cm at maturity; apex rounded with style remains forming a distinct mucro; pedicel remaining slender in fruit, suddenly widening into calyx; persistent calyx annular, enclosing at most basal ¼ of globose part of fruit at maturity.

**Distribution and ecology** — This species has been collected in scrubland (maquis) and forest on ultramafic substrate in New Caledonia in the south and the eastern side of Grande Terre and on Île des Pins. Fig. 5.

**Etymology** — The specific epithet refers to the dyeing properties of this species (Blanc 2008; Cardon & al. 2010, cited as *Ventilago pseudocalyculata*).

**Conservation status** — Because its ecology and distribution are still imperfectly understood, this species has been evaluated as Data Deficient (DD) according to the IUCN criteria (2012, 2017) during the workshop of the New Caledonia Plant Red List Authority of 24 Oct 2019.

**Remarks** — *Ventilago tinctoria* differs from all other Grande Terre Ventilago species (*V. buxoides* and *V. neocaledonica*) in its hairy fruit. It resembles *V. pseudocalyculata* of the Loyalty Islands, but differs in having an oblong fruit wing (Fig. 4A, K), usually smaller and narrower leaves that are slightly asymmetric and cuneate at the base (Fig. 4A, B), and slender pedicels that suddenly expand into the calyx (Fig. 4K).

Three of the four gatherings that Guillaumin cited in the protologue of *Ventilago pseudocalyculata* were collected in Grande Terre and are now recognized as *V. tinctoria*. The fourth gathering, Deplanche 62, from Lifou, is designated here as the lectotype of *V. pseudocalyculata* (see Remarks for *V. pseudocalyculata*). Most herbarium material of *V. tinctoria* had previously been identified as *V. pseudocalyculata*, following Guillaumin (1926), but the Grande Terre specimens are morphologically distinct from those of Lifou, and *V. pseudocalyculata* as recognized here seems to be restricted to the Loyalty Islands.

Fig. 4. *Ventilago tinctoria* – A: habit; B: leaf node with base of inflorescence; C: stem indumentum; D: leaf venation, abaxial view; E: leaf margin, adaxial view; F: flower fascicles (hairs omitted); G: flower buds; H: flower, side view; J: flower, face view; K: fruit apex and base detail; L: fruit wing edge indumentum. – A, K, L from MacKee 34324 (P); B–E, G–J from McPherson 3293 (P); F from MacKee 13645 (P). – Drawn by Andrew Brown.
5. Ventilago vanuatuana
Cahen, Toussirot & Pillon, sp. nov. – Fig. 6.
Holotype: Vanuatu, Santo, Penaorou, parcelle 600-C, 14°58’0.22"S, 166°38’41.5”E, 600 m, 27 Oct 2006, Munzinger 3609 (P! [P06765295]); isotypes: CANB image! [CANB 00726521], K! [K001342515], MO, NOU, P! [P06765293], PVNH).

– Ventilago vitiensis sensu Cardon & al (2010), non A. Gray.

Diagnosis — Ventilago vanuatuana most closely resembles V. tinctoria in the hairy fruits with an oblong wing and in the flower fascicles being in racemiform thyrses, often arranged in panicles, but it differs in its narrower leaves with a crenate to serrate margin (vs margin entire, obscurely repand in V. tinctoria) and hairs of branchlets, petioles, inflorescence and fruit mostly spreading (vs hairs mostly appressed antrorse in V. tinctoria).

Description — Woody climber. Indumentum sparse to usually dense at distal end of branchlets and inflorescence rachis; hairs mostly yellowish-white to fulvous, slightly curved, mostly spreading. Branches slender, terete, smooth; branchlets often deeply ridged.
Leaves: petiole 3–6 mm long, with dense subapressed to mostly spreading hairs; lamina broadly to narrowly ovate, 3–10 × 1.5–4.7 cm, chartaceous to subcoriaceous, glabrous, sometimes hairy abaxially along primary and secondary veins, base ± symmetric, rounded to weakly cordate, margin crenate to serrate, serrations topped by callosities, apex rounded to attenuate; secondary veins 5 or 6, clearly discernible, remaining separate, gradually curving upward and diminishing near margin; tertiary venation conspicuously scalariform. Inflorescence of cymes congested in fascicles, with subtending leaves mostly fugaceous so that fascicles are arranged in racemiform thyrses, thyrses often arranged in a panicle, flowers up to at least 5 per fascicle at anthesis, racemiform thyrses to 9 cm long. Flowers bisexual, c. 3 mm wide; pedicel c. 2 mm long when fully developed, pedicel and abaxial side of hypanthium densely hairy with hairs subappressed to spreading, whitish to fulvous, slightly curved, c. 0.1 mm long; sepal lobes 5, triangular, c. 1 mm long, adaxially keeled with an apical protuberance; petals 5, obcordate, c. 0.9 mm long, sparsely hairy abaxially, base clawed, apex notched; stamens 5, each opposite and enclosed by a petal, filaments c. 0.8 mm long, anthers dorsifixed; disk subpentagonal, filling hypanthium, fleshy, smooth, glabrous; ovary c. ½ immersed in disk, densely hairy, locules 2; style 2-fid.
Fruit very densely mostly spreading hairy, with a conspicuous globose basal portion enclosing seed chamber and a distinct wing-like apical appendage, oblong, to at least 3 × 0.8 cm at maturity, wing straight; apex rounded with style remains forming a distinct mucro; persistent calyx cupular, enclosing basal c. ½ of globose part of fruit.

Distribution and ecology — This plant has been collected in forests in Vanuatu, on the islands of Santo, Malekula, Pentecost, Éfaté and Anatom. It probably occurs on other islands of the archipelago. Fig. 7.

Etymology — The plant is named after the country in which it is endemic, Vanuatu.

Vernacular name — Called (butsu) laba in the Apma language (Pentecost), according to field notes on Aubert de la Rue s.n. and Bourdy & Walter (1986).

Conservation status — The distribution of this species is incompletely known because there are still few botanical collections from Vanuatu. The ecology is not well known, and it is not known if there are important threats. The spe-
Fig. 6. *Ventilago vanuatuana* – A: habit; B: leaf, adaxial view; C: leaf node with base of inflorescence; D: petiole indumentum; E: leaf venation, abaxial view; F: leaf margin, adaxial view; G: flower fascicles; H: flower buds; J: flower, face view; K: fruit apex and base detail; L: fruit wing edge indumentum. – A–F from *Munzinger 3609* (P); G–J from *Ramon 237* (P); K, L from *Munzinger 3609* (K). – Drawn by Andrew Brown.
cies is therefore assessed here as Data Deficient (DD). It is not clear if the use of the roots as a dye is sustainable or may represent a threat to the populations.

Remarks — *Ventilago vanuatuana* is the only known species of *Ventilago* to occur in Vanuatu. It was previously identified as *V. neocaledonica* on various herbarium sheets, but *V. neocaledonica* has glabrous fruits. It has also been suggested that material from this species could belong to *V. vitiensis* A. Gray, originally described from Fiji (Cardon & al. 2010), but *V. vanuatuana* has hairy fruits and a crenate to serrate leaf margin (vs glabrous fruits and an entire leaf margin in *V. vitiensis*). It differs from the other New Caledonian species *V. pseudocalyculata* and *V. tinctoria* in the narrower crenate to serrate leaves (Fig. 6A, B, F) and indumentum of mostly spreading hairs (Fig. 6C, D, H). It also differs from the Solomon Island *Ventilago* specimens, which seem to belong to *V. papuana* Merr. & L. M. Perry and which have wider leaves with an entire margin and flowers with densely hairy nectary disks.

*Smythea lanceata* (Tul.) Summerh., a mostly coastal species with a wide distribution, in a genus closely related to *Ventilago* (Cahen & Utteridge 2018), was recently observed and collected in Vanuatu (Éfaté-Mosso-Sounai, 0 m, 28 Sep 2014, Ramon 167 (P image! [P02434008]). When the crustaceous inflated wingless fruits are available it is easily distinguished from *V. vanuatuana*. The flowers are arranged in fascicles in the axils of persistent leaves (vs leaves fugaceous in *V. vanuatuana* so that the fascicles are in racemiform thyrses, the thyrses often arranged in a panicule). When sterile, it can be recognized by the leaves having 3–5 pairs of secondary veins (vs 5 or 6 in *V. vanuatuana*), well spaced along the primary vein, and in the conspicuous domatia, pockets often combined with tufts of hairs in the axils of the secondary veins (vs domatia absent in *V. vanuatuana*).

Selected specimens — **Vanuatu**: Pentecost, Vanmu, côté 50, 31 Dec 1935, Aubert de la Rüe s.n. (P! [P06886649] [sterile]); Pentecost, route Melsisi, Houbikou, 350–400 m, 4 Oct 1980, Cabalion 1196 (NOU! [080584], P! [P06886651]); Santo, Penaorou, 14°58’00”S, 166°38’15”E, 300 m, 16 Nov 2006, McPherson & al. 19426 (NOU! [062758]); Pentecost: Namaran, Dec 1976, Morat 5248 (NOU! [080585] [sterile]); Éfaté, Mangalliliu, 50 m, 14 Aug 2015, Ramon 237 (P! [P02434415], NY, PVNH); Malekula: Walla: endroit appelé Nimev, 20 m, 9 Nov 1980, Sam 35 (NOU! [080586] [sterile]); Vaté (Éfaté), Tututuk, 15 Nov 1974, Sam 5124 (NOU! [080587]); Anatom, SE, 20 Jul 1971, Schmid 3987 (NOU! [080588] [sterile]).

![Fig. 7. Distribution of *Ventilago vanuatuana* (●) in Vanuatu.](https://bioone.org/journals/Wildenowia){:target='_blank'}

![Fig. 8. Dyes on different fibres obtained with the three species of *Ventilago* from New Caledonia. Dyes from left to right: *V. buxoides*; *V. tinctoria*; *V. neocaledonica*. – Photo: M. Toussirot. – Dyes: B. Blanc, D. Cardon and M. Boulanger-Penduff.](https://bioone.org/journals/Wildenowia){:target='_blank'}
Acknowledgements

The authors thank the curators of NOU and P for their helpful assistance, Jürgen Kellermann and Timothy Utteridge for critically reading the manuscript and suggesting substantial improvements, and Andrew Brown for his excellent illustrations. The authors also thank Barbara Blanc, Pierre Cabalion, Dominique Cardon and Édouard Hnawia for their study of the dyeing properties of Ventilago species in New Caledonia and Vanuatu.

References


