FLORISTIC RECORDS IN RUBIACEAE FROM THE UPPER SEPIK OF PAPUA NEW GUINEA: *AIROSPERMA GRANDIFOLIA* AND *PSYCHOTRIA AUGUSTAFLUSSIANA SP. NOV.*

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Abstract. *Psychotria augustaflussiana* is described from remote environments in Papua New Guinea's upper Sepik drainage. Taxonomic and distributional notes are provided for *Airosperma grandifolia*, a frequent associate of the new species but otherwise rarely represented in herbarium collections.

Keywords: distributional records, Kaiserin-Augusta-Fluss Expedition, new species

Although its generic conspectus is subject to continuing debate and refinement, the rubiaceous flora is undoubtedly one of the most diversified and endemic components of the Papuasian vegetation (Davis et al., 2009). *Psychotria* L. is by far the largest element, with an estimated 120 fruticose/arborescent species in New Guinea and adjacent islands, but the family also includes many small and poorly understood genera. *Airosperma* K. Schum. & Lauterb. is one of these obscure groups. The following discussion presents previously unknown details for the most distinctive species in the latter genus, drawing from observations on newly discovered populations. An unusual *Psychotria* is also described from the same habitats.

MATERIALS AND METHODS

Taxonomic descriptions are based on the attributes from dried specimens. Characters determined in situ from living plants are reported separately as "field characters."

Silica-dried leaf samples from *W. N. Takeuchi, D. Ama & A. Gambia 25061* (*Airosperma grandifolia*) have been inserted with the A, K, and L duplicates. Similarly prepared leaf samples from *W. N. Takeuchi, D. Ama & A. Gambia 24926* (*Psychotria augustaflussiana*) are included with the A, CANB, and K duplicates. Ethanol-preserved flowers in a Nalgene© bottle are with the LAE duplicate for *W. N. Takeuchi, D. Ama & A. Gambia 25061*.

TAXONOMY

Airosperma grandifolia Valeton (1912: 760). TYPE: INDONESIA. Jayapura District: Beguwri River, 02°58'23"S, 140°57'18"E, ca. 170 m, 29 June 1910, *K. Gjellerup 239* (Holotype: BO [1887340]). Figs. 1–5.

Additional specimens examined: PAPUA NEW GUINEA. West Sepik Province: upper Sepik basin, alluvial forest in steep-sided valley, 04°37'16"S, 141°43'42"E, 630 m, 3 December 2009, *W. N. Takeuchi, D. Ama & A. Gambia 25061* (A, BO, CANB, K, L, LAE); streambed in lowland hill forest, 04°37'16"S, 141°41'23"E, 420 m, 13 December 2009, *W. N. Takeuchi, D. Ama & A. Gambia 25334* (A, K, L, LAE); *W. N. Takeuchi, D. Ama & A. Gambia 25336* (A, LAE); riverbed in lowland hill forest, 04°38'45"S, 141°47'41"E, 380 m, 3 February 2010, *W. N. Takeuchi, D. Ama & A. Gambia 25437* (A, LAE); riverine forest, 04°43'25"S, 141°47'13"E, 355 m, 19 February 2010, *W. N. Takeuchi, D. Ama & A. Gambia 25788* (A, L, LAE).

There are very few specimens of this species, and essentially nothing was previously known of its ecology or in situ occurrences. For his synopsis of the genus, Darwin (1980) was able to examine a single specimen, which (like the type) had only insect-damaged flower buds. The fruits of *Airosperma grandifolia* had not been seen until the 2009–2010 surveys of the upper Sepik.

For obvious logistical reasons, biological exploration of the cross-border region (the interval from Jayapura in Indonesian Papua, to West Sepik Province in PNG) has been historically confined to the coast and nearby environments. Interior forests of the major basins, especially at the Central Divide, are practicably accessible only by helicopter. From recently concluded surveys, it has become increasingly apparent that many species once thought to be rare or possibly even extinct (e.g., *Christensenia aesculifolia* (Blume) Maxon, *Diospyros fusicarpa* Bakh.,

The Sepik botanical surveys of 2009–2010 were supported (in part) by the Arnold Arboretum and the Harvard University Herbaria. Francis Crome (ornithologist) was the senior investigator and principal planner for the terrestrial studies. Our colleagues in the field also included Ken Aplin (mammalogist), Chris Müller (entomologist), Stephen Richards (herpetologist), Michael Sale (Coffey Natural Systems liaison), and Iain Woxvold (ornithologist and team leader).

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FIGURE 1. *Airosperma grandifolia* Valeton. Photograph of the holotype. From *K. Gjellerup 239* (BO). Photograph by D. Arifiani.

FIGURE 2. *Airosperma grandifolia* Valeton. Ascending stalks, ca. 1 m tall. From *W. N. Takeuchi, D. Ama & A. Gambia 25061*. Photograph by W. N. Takeuchi.

FIGURE 3. *Airosperma grandifolia* Valeton. Vegetative structures. **A**, apical view of branched shoot; **B**, stipules. Valeton (1912) had described the stipules as early-falling, but in all individuals examined in the field they are persistent. A–B from *W. N. Takeuchi, D. Ama & A. Gambia 25061*. Photographs by W. N. Takeuchi.

FIGURE 4. *Airosperma grandifolia* Valeton. **A**, cauline inflorescences at ground level; **B**, ascending stems (3 shown) developed from a surface runner. A–B from *W. N. Takeuchi, D. Ama & A. Gambia 25061*. Photographs by W. N. Takeuchi.

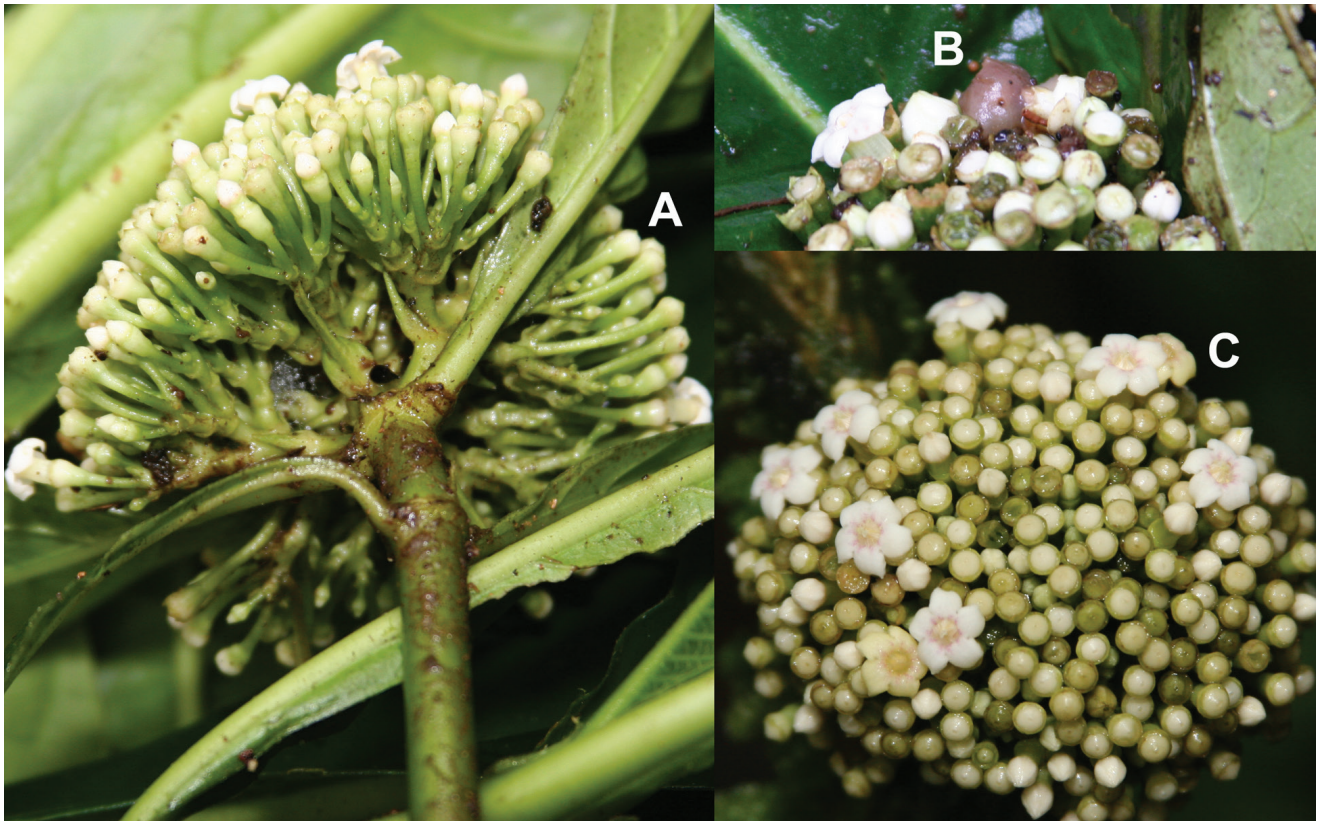

FIGURE 5. *Airosperma grandifolia* Valeton. **A**, proximal view of a terminal head; **B**, submature fruit (purple); **C**, anthetic corollas in frontal perspective. A, C from *W. N. Takeuchi, D. Ama & A. Gambia 25061*; B from *W. N. Takeuchi, D. Ama & A. Gambia 25334*. Photographs by W. N. Takeuchi.

Dischidia torricellensis (Schltr.) P. I. Forst., *Discocalyx pygmaea* Kaneh. & Hatus., *Rheopteris cheesmaniae* Alston), are actually common plants of these remote inland habitats. Historical perceptions of rarity are primarily the result of narrow endemics being first discovered at their geographic limits. *Airosperma grandifolia* can be added to this expanding list of misunderstood plants.

Despite the many knowledge gaps associated with *A. grandifolia*, large populations were recorded at nearly every lowland bivouac on the Sepik surveys. Although described as monocaulous by Valeton (1912: 760) the species often occurs as a gregarious tangle of stems, with individual stalks (unbranched or not) developed from surface runners or from trailing/leaning axes which can extend for several meters along the ground (Figs. 2–4). The distinctive inflorescences are produced from apical axils or from old wood near ground level (Figs. 4–5). Less frequently the heads are also terminal on short lateral shoots. Anthetic flowers are heterostylous, with staminate and pistillate forms on separate individuals. In long-styled (pistillate) flowers the stigmatic lobes are well developed (1.5 mm long in bottled material) and slightly exserted. The androecium is comprised of barren stamens attached inside the hair ring. In short-styled (staminate) flowers the included style is greatly reduced (shorter than the corolla tube), and with contracted stigmatic lobes (0.5 mm long). The polleniferous stamens are clearly larger. In his description of the type, Valeton (1912) was obviously working from a short-styled specimen. Functional dioecy had been established earlier (in Darwin, 1980) for the sympatric *Airosperma psychotrioides* K. Schum. & Lauterb. but was previously impossible to evaluate for *A. grandifolia*.

Unlike its congeners, *A. grandifolia* is a riparian species associated with closed overstories. Hundreds of sightings were made during the 2009–2010 expeditions; always a short distance from flowing water and usually within the surge zone around streams. The umbrophilous communities populated by *A. grandifolia* are collectively among the largest formations in the Sepik Foothill Zone, encompassing many thousands of hectares and including vast forest tracts never subjected to scientific scrutiny. Significant range extensions can be expected as future investigators venture further into the upper basin.

Psychotria augustaflussiana W. N. Takeuchi, *sp. nov.* TYPE: PAPUA NEW GUINEA. West Sepik Province: upper Sepik drainage, lowland hill forest, 04°38'47"S, 140°47'47"E, 355 m, 2 February 2010, *W. N. Takeuchi, D. Ama & A. Gambia 25405* (Holotype: A; Isotypes: BO, CANB, K, L, LAE). Figs. 6–8.

Affinis Psychotriae leucococcae Valeton sed lobis stipulis filiformibus foliis chartaceis nec rugosis inflorescentiis et fructibus pilosis persistentibus differt.

Subshrubs 55–110 cm tall, sparingly-branched (or monoaxial). *Basal stems* cylindrical, (2–)3–5 mm diameter, periderm pale brown, smooth to inconspicuously furrowed, without lenticels (rarely with elliptic lenticels 0.5–4 mm long). *Branchlets* compressed, 0.8–3 mm wide, planate or not, opposed, divaricate, pithy, longitudinally wrinkled, light brown, abscission scars absent, surfaces obscured by hairs; indument pilose (or hirsute), usually 1–1.5 mm long, septate, crispate, dense, persisting, tawny to yellow brown; internodes 5–40(–62) mm long. *Leaves* equal, divergent, pilose; stipules deltate-ovate, (2.5–)5–13 × (0.7–)2–4 mm, parted to the middle, paired, free, persisting, papery, bifacially marked by linear raphides, adaxially appressed-barbate at the base, otherwise glabrous on the inside, lobes filiform, 2.5–5.5(–8) mm long; petioles 3–12(–18) × 0.4–1 mm, planoconvex or subcylindrical, concolorous with branchlets, not articulated; leaf-blades linear-elliptic, (22–)64–110(–122) × 4–22(–28) mm, chartaceous; base cuneate (or obtuse), symmetrical; margin entire; apex acute to attenuate, often curved to one side; lamina surfaces inconsistently pustulate; adaxially fuliginous-nigrescent, abaxially brunnescent, granulate; cystoliths linear, discolorously pale, infrequent; domatia absent; venation brochidodromous, secondary veins 7–15 per side, at the lamina center with divergence angles of 45–60(–80)°, (2–)4–9 mm apart, arcuate, uniting by commissural looping nerves 0.2–2 mm from the margin, anastomosing beyond the loops or not; reticulum obscure, filiform, irregular, coarsely areolate; midribs adaxially flat or nearly so, abaxially prominent; higher order venation invisible above, weakly raised beneath. *Inflorescence* terminal, condensed, 9–13 × 7–12 mm, dichasial, cernuous, shaggy, black; peduncle 2.5–5 × 0.3–1 mm, compressed; bracts linear, 2–4.5 × 0.1–0.3 mm, caducous; pedicels 1–1.5 × 0.2–0.4 mm. *Flowers* (measurements from bottled material) heterostylous, pentamerous, 3–9 together, obtuse in bud, externally villous; calyx funnelform, united in the lower 1.7–2 mm, glabrous inside, lobes triangular, 0.8–1.2 × 0.8–1 mm; corolla tube cylindrical, 2.8–4 × 1.5–2 mm, lobes elliptic, 2.5–4 × 1–1.6 mm, reflexed at anthesis, throat barbate; stamens alternipetalous, filaments 1.5–1.7 × 0.2–0.3 mm, attached inside the 1–1.5 mm wide hair-ring, anthers oblongoid, 1.2–1.4 × 0.2–0.3 mm, basifixed, exserted; disk dome-shaped, fleshy, smooth; style (in short-styled flower): ca. 2.5 × 0.2 mm, stigmatic lobes ca. 0.5 mm long, included, not reaching the filaments; long-styled form (seen in bud only): style longer than corolla tube, stigmatic arms exserted. *Drupes* ellipsoid-obovoid, 6.5–10 × 4.5–7.5 mm, pilosulous, ebracteate, jet black (or light brown), copiously set with pale raphides, crowned by the disk; fruiting calyx early-falling (or with linear segments 0.5 mm long); pyrenes 2, hemispherical; endocarp crustaceous, 3(–4)-ridged on the back, commissural face planate; preformed germination slits (2) marginal, extending halfway to the apex; seed without ethanol soluble pigments, endosperm ruminate.

Etymology: The epithet commemorates the historic Kaiserin-Augusta-Fluss Expedition (1912–13) to the upper Sepik.

Additional specimens examined: PAPUA NEW GUINEA. West Sepik Province: upper Sepik drainage, premontane forest, 04°39'03"S, 141°43'14"E, 945 m, 30 November 2009, *W. N. Takeuchi, D. Ama & A. Gambia 24923* (A, BO, BRI, CANB, K, L, LAE); *W. N. Takeuchi, D. Ama & A. Gambia 24926* (A, BO, CANB, K, L, LAE); ridgeline in lowland hill forest, 04°39'05"S, 141°48'08"E, 300 m, 4 February 2010, *W. N. Takeuchi, D. Ama & A. Gambia 25452* (A, K, L, LAE).

FIGURE 6. *Psychotria augustaflussiana* W. N. Takeuchi. Habit, 0.5 m subshrubs (two shown) in forest understory. From *W. N. Takeuchi, D. Ama & A. Gambia 24923*. Photograph by W. N. Takeuchi.

FIGURE 7. *Psychotria augustaflussiana* W. N. Takeuchi. Vegetative structures. From *W. N. Takeuchi, D. Ama & A. Gambia 25405*. Photographs by W. N. Takeuchi.

FIGURE 8. *Psychotria augustaflussiana* W. N. Takeuchi. **A**, immature fruits; **B**, mature fruit; **C**, pre-anthetic flowers. A from *W. N. Takeuchi, D. Ama & A. Gambia 25405*; B–C from *W. N. Takeuchi, D. Ama & A. Gambia 24923*. Photographs by W. N. Takeuchi.

Field characters: Understory subshrubs, gregarious; all parts densely white-pilose; branches opposed, horizontal, fragile; stipules white; leaf-blades chartaceous, adaxially mid-green, abaxially pale green; inflorescence/infructescence erect or nodding, axes green; fruits spongious, dull white, irregularly shaped, globular, 13–15 × 13–14 mm in vivo; endosperm white with brown ruminations from the margins.

Distribution: Throughout the colline zone in West Sepik Province, near historical localities of the Kaiserin-Augusta-Fluss Expedition of 1912–13 (Fig. 9).

Habitat and ecology: A dominant understory species in lowland and premontane forests from 300–945 m.

Phenology: Flowering and fruiting in November and February.

The new species is the latest addition to an informal complex of congeners centered around *Psychotria leucococca* K. Schum. & Lauterb. and comprised of small montane shrubs with commensurately reduced structures and white fruits (the "*leucococca* group" sensu Sohmer, 1988). The most common members of the alliance are *Psychotria dieniensis* Merr. & L. M. Perry, *P. dolichosepala* Merr. & L. M. Perry, *P. giluwensis* Sohmer, *P. magnasepala* Sohmer, *P. murmurensis* Sohmer, *P. nanifrutex* Sohmer, and *P. valetoniana* Sohmer. Species circumscriptions within this assemblage are often problematic and will probably require future adjustment.

The overwhelming majority of Papuasian *Psychotria* are glabrous or obscurely puberulent. Within the *leucococca* facies, *Psychotria dolichosepala*, *P. frodinii* Sohmer, and *P. murmurensis* are unusually hairy (reddish-brown) on most parts, recalling the dense hair-covering on *P. augustaflussiana* (the latter tawny- or yellowish-pilose). The similarity in indument is coincidental—hairy representatives of the complex can be easily separated from *P. augustaflussiana* by their much thicker (rugose) leaves and by fruits persistently crowned by large calyces.

In the new *Psychotria*, vegetative characters (stature, leaf size, internode length) vary inversely with elevation. Lowland populations for example, have leaf-blades (64–)80–110(–122) × 12–22(–28) mm, but at the premontane transition the blades are (22–)31–68(–88) × 4–12(–18) mm. The characteristic indument remains constant however, throughout the plant's elevational range. Although montane populations of *P. augustaflussiana* can have a superficial resemblance to *Amaracarpus* Blume, the flower and pyrene characters are undoubtedly indicative of *Psychotria* as defined by modern study of the Psychotrieae (cf. Davis and Bridson, 2001, 2004; Davis et al., 2001; Sohmer and Davis, 2007). The stamens inserted within the corolline hair-ring, and pyrenes with marginal germination slits (2) provide conclusive support for the generic assignment.

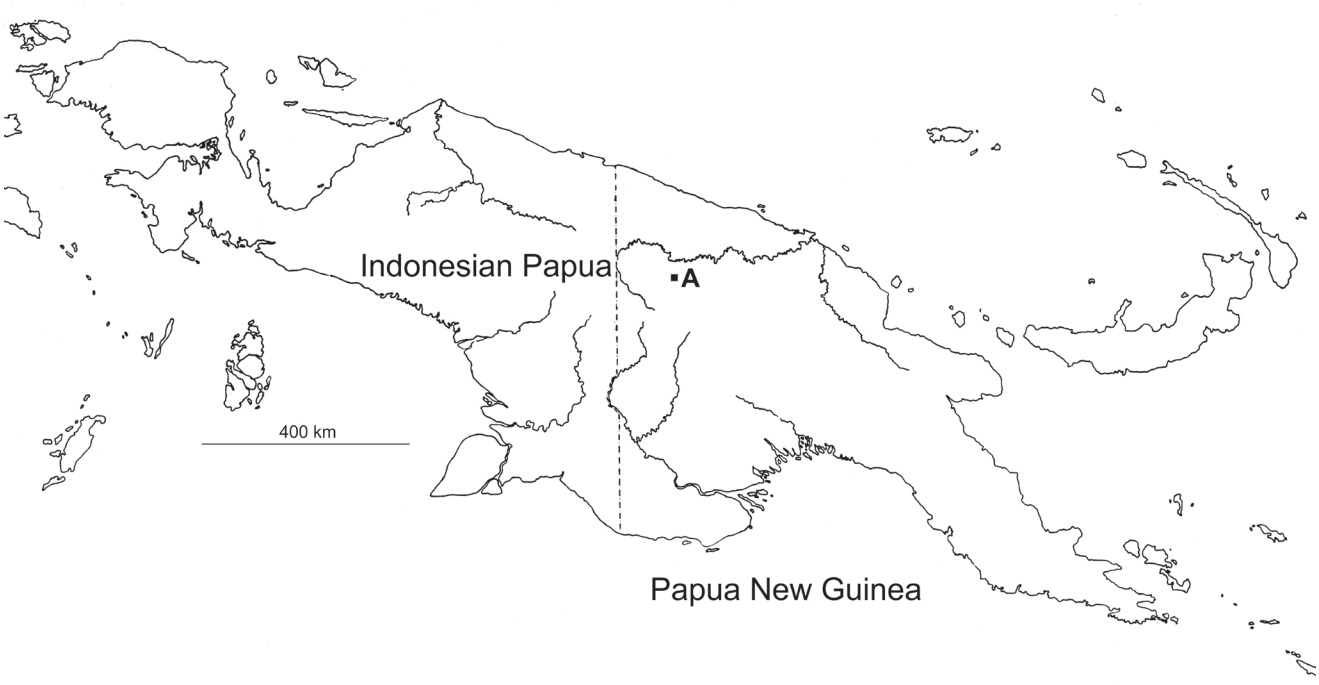

FIGURE 9. Island of New Guinea. **A**, location of the 2009–2010 surveys of the upper Sepik.

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