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A new generic affiliation for New Guinean *Paracroton sterrhopodus* (Euphorbiaceae, Crotonoideae) as a member of recently described Indonesian *Weda*

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Abstract

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New Guinean *Paracroton sterrhopodus* (Airy Shaw) Radcl.-Sm. & Govaerts (*Euphorbiaceae*), known only from its type collection, shows an enormous distributional disjunction from the rest of that genus found from India to West Malesia. Morphologically the species is also distinct from *Paracroton* Miq. as it lacks stipules (present in *Paracroton*), shows dendritic hairs (versus absent) and has a structurally different inflorescence, a bisexual cyme with two subopposite large bracts (instead of a unisexual thyrses). In reevaluating the affiliation of *P. sterrhopodus* we found these morphological characters perfectly match with the recently described *Weda* Welzen, from the island of Halmahera (North Maluku, Indonesia). Therefore, the new combination as *W. sterrhopoda* (Airy Shaw) Welzen is made here. This new generic affiliation extends the distribution of *Weda* by 1500 km, although each of the constituent species has a very narrow known range.

Keywords

EUPHORBIACEAE – *Fabrenheitia* – *Paracroton* – *Weda* – New Guinea – New combination

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Introduction

The genus *Weda* Welzen (VAN WELZEN et al., 2021) from North Maluku (Indonesia) was recently described as a member of Euphorbiaceae subfamily Crotonoideae with two nearly sympatric species. The taxa were surprising discoveries from recent floristic work in the Weda area of Halmahera Island, which is under intense commercial mining interest for its vast nickel resources. *Weda* is characterised by stellate to somewhat lepidote to dendritic hairs; absence of stipules; two subopposite large bracts underneath the cymose inflorescence which basally splits dichotomously, first with a single central pistillate flower, then, after fruit set, followed by scorpioid branching with staminate flowers; flowers with corolla, many short stamens, apparently lacking a disc, ovary 3-locular, stigmas smooth above; fruit capsular; and seeds naked, marbled. Both species occur on ultramafic soil rich in nickel and appear to be hyperaccumulators of manganese. They are highly endangered species and likely will soon be extinct as nickel mining started in the Weda area (i.e. Weda Bay Mine) in autumn 2019, where they are endemic. Molecular phylogenetic evidence (VAN WELZEN et al., 2021) showed that *Weda* is part of Crotonoideae, tribe Ricinocarpeae, a mainly Australian/New Caledonian clade of 11 genera that are united by a suite of morphological synapomorphies and notably mostly lack stipules (for a discussion see VAN WELZEN et al., 2021). Among the genera of Ricinocarpeae, *Borneodendron* Airy Shaw (North Borneo) and *Weda* are the western outliers and of special biogeographic interest.

AIRY SHAW (1974) described the enigmatic *Fabrenheitia sterrhopoda* Airy Shaw from New Guinea based on a staminate specimen only (*Kostermans & Soegeng Reksodihardjo 85*). Although the holotype label indicates that five duplicates were distributed, only those in A, G, K and L were traced, not the one to US, nor any in BO, the herbarium that sponsored the fieldwork and where the primary set is expected. BALAKRISHNAN & CHAKRABARTY (1993) showed that the generic name *Fabrenheitia* Rchb. & Zoll. ex Müll. Arg. was first published by ZOLLINGER (1857), but that author indicated doubt about its status, which renders the name provisional and therefore invalid following Art. 36.1(a) of the International Code of Nomenclature (TURLAND et al., 2018). The name was finally validated by MÜLLER ARGOVENSIS (1866). However, earlier MIQUEL (1859) had already published the congeneric *Paracroton* Miq. BALAKRISHNAN & CHAKRABARTY (1993) made all new combinations under *Paracroton* for the three Indian to West Malesian species, but not for *Fabrenheitia sterrhopoda*, which was later transferred by RADCLIFFE-SMITH & GOVAERTS (1997) without comments on its unusual morphology. The Indian and West Malesian taxa of *Paracroton* will be revised by H.-J. Esser for Flora Malesiana.

AIRY SHAW (1974) assigned his new species to *Fabrenheitia* and suggested similarities to *F. pendula* (Hassk.) Airy Shaw

(= *Paracroton pendulus* (Hassk.) Miq.). However, given the incomplete material lacking pistillate flowers, he was uncertain about its classification and even indicated that it might represent a new genus. *Paracroton sterrhopodus* is indeed very different from the other *Paracroton* species. These typically have only stellate hairs, possess stipules, have very long raceme-like thyrses, and the staminate flowers have outer stamens which are free and the inner united. The type of *P. sterrhopodus* appears to be congeneric with *Weda* as it lacks stipules and possesses dendritic hairs and the typical scorpioid staminate inflorescences with large bracts (no pistillate flowers or fruits known). Morphologically, *P. sterrhopodus* is distinct from the other species of *Weda*, especially in leaf features, but appears most similar to *W. fragarioides* Welzen (see key below). *Weda* spp. possess a variety of trichome morphologies including simple, stellate, lepidote and dendritic. Both *W. lutea* Welzen and *P. sterrhopodus* possess dendritic trichomes, although they are more abundant in the latter. The New Guinea specimen was checked by elemental analysis (following VAN WELZEN et al., 2021) for a possible accumulation of heavy metals, but none were present, nor even manganese, which was abundant in the two Halmahera species. However, the soil at the locality where the specimen was found was not ultramafic, thus the lack of manganese accumulation was expected. We attempted molecular work to resolve phylogenetic relationships, but a DNA extraction from the L specimen was too degraded for amplification and Sanger sequencing methods.

In this paper *Paracroton sterrhopodus* is transferred to the genus *Weda*. A detailed description of the species and a key to all species of the genus are provided.

Taxonomy

Weda sterrhopoda (Airy Shaw) Welzen, **comb. nov.**

= *Fabrenheitia sterrhopoda* Airy Shaw in Kew Bull. 48: 325. 1974. = *Paracroton sterrhopodus* (Airy Shaw) Radcl.-Sm. & Govaerts in Kew Bull. 52: 189. 1997.

Holotypus: INDONESIA. Papua: “West Irian, Sukarnapura (= Hollandia = Djajapura)” [Jayapura], 29.VII.1966, *stam. fl.*, *Kostermans & Soegeng Reksodihardjo 85* (K [K000959381]!; iso-: A [A02425000] image!, G [G00341700] image!, L [L 0157017]!).

Trees c. 8 m high, dbh 6 cm; flowering branches 4–5 mm in diam., full of leaf scars; outer bark smooth; indument dark brown stellate to predominantly small dendritic hairs. *Stipules* absent. *Leaves* alternate, simple, seemingly crowded at the end of branches; petioles 19–70 × 2–2.3 mm, basally widened, triangular but concave above, laterally compressed, striate when dry, regularly set with dendritic hairs, leaving distinct abscission scars; blades obovate, 8–21.5 × 2.5–6 cm, 3.3–4 times longer than wide, symmetric, coriaceous, base long

cuneate; laminar glands 2, basal (acropetiolar), adaxial, elliptic, c. 1.3×0.8 – 1.3 mm, 0.8–1 mm high with long axis parallel with petiole; margin wavy, slightly reflexed, apex acuminate, acumen 8–12 mm long, adaxial surface glabrous, abaxial surface with few dendritic hairs mainly on midrib and less so on major veins, venation pinnate, slightly raised adaxially when dry, raised abaxially, secondary veins 8–11 up to apex, looped and united towards margin, basal pair under steeper angle with midrib, running close to margin, intersecondaries veins frequent, tertiary veins reticulate. *Inflorescences* single, axillary, basally cymose, staminate (evidence of pistillate phase not seen), branches scorpioid; peduncles 3.5–7.8 (–16, fide AIRY SHAW, 1974) cm long, similar to petioles, regularly set with dendritic (and stellate) hairs, apically with 2 (or rarely 3) subopposite leaf-like inflorescence bracts; these late caducous, with petioles 4–5 mm long, blades elliptic, asymmetric, 3.5 – 5.9×0.8 – 2 cm, base widely cuneate, without glands, margin entire, apex acuminate, upper surface with few mainly stellate hairs, lower surface with dendritic hairs, secondary veins 6–8 up to apex; scorpioid branches 2 or more together, up to 2 cm long, densely set with dendritic hairs, apically with developing staminate flowers; floral bracts small, triangular, less than 0.5 mm long, likely soon caducous (hardly visible as a fungus covers the specimen). *Staminate flowers* only seen in bud; pedicels 7–10 mm long, round, regularly set with dendritic hairs; sepals 5, ovate, 1.5 – $2 \times c. 1.7$ mm, imbricate, perpendicular to axis, outside with dendritic hairs on lower $\frac{2}{3}$, inside glabrous; petals 5, elliptic, c. 3×2.2 mm, white, thick and concave in bud, glabrous, apex acute; disc not seen; flower bottom with whitish stellate hairs; stamens 25–30, outer free, inner on androphore, filaments in bud short, anthers dorsifixed, 2-thecate, seemingly opening with extrorse lengthwise slits; pistillode absent. *Pistillate flowers* and *fruits* not seen.

Distribution. – Indonesia, Prov. Papua. It is only known from the type collection with a vague locality around Jayapura on the northern side of New Guinea. Jayapura is near the Papua New Guinea border and the species may also be expected to occur in that country. The type locality is nearly 1,500 km east of the two other species of *Weda* occurring on Halmahera Island.

Habitat, ecology and phenology. – Found in a valley at c. 100 m altitude; flowering in July.

Notes. – RADCLIFFE-SMITH & GOVAERTS (1997) indicate that the epithet is derived from Greek and means ‘stiff-footed’, seemingly referring to the stiff peduncle of the inflorescence.

Generally, *Euphorbiaceae* are characterized by the presence of stipules, but these are absent in the *Ricinocarpeae* (see VAN WELZEN et al., 2021, where also the circumscription of the *Ricinocarpeae* is changed). The *Ricinocarpeae* are part of the

C2 clade (VAN WELZEN et al., 2021), which also comprises other genera without stipules like *Blachia* Baill., *Codiaeum* Rumph. ex A. Juss., *Garcia* Vahl ex Rohr and *Strophoblachia* Boerl. These genera still show other typical *Euphorbiaceae* characters such as persistent columellas after fruit dehiscence. Most distinctive for *Weda* is the inflorescence structure with its pair of opposite leaf-like, anisophyllous bracts which resemble much smaller versions of the vegetative leaves differentiating each species. *Weda sterrhopoda* likely has an early developing pistillate phase but the specimens remain incomplete and only have staminate buds.

Weda sterrhopoda is mentioned in UTTERIDGE & JENNINGS (2021: 262) as *Paracroton sterrhopodus*. While the generic description provided is mostly typical for *Paracroton*, especially the inflorescence, the authors acknowledge that stipules can be absent.

Key to the species of *Weda*

1. Leaf blades peltate with marginal glands at base of peltation; margin with other occasional smaller glands; venation basally palmate; petals yellow *W. lutea*
- 1a. Leaf blades basally attached with 2 glands adaxially at petiole insertion; margin without glands; venation pinnate; petals white 2
2. Plants mainly with stellate to somewhat lepidote hairs; leaf petioles 5.5–12 cm long; blades ovate-oblong to elliptic-oblong, 10.5–30 cm long; North Maluku (Halmahera Island) *W. fragarioides*
- 2a. Plants mainly with dendritic hairs; leaf petioles 1.9–7 cm long; blades obovate, 8–21.5 cm long; Papua (formerly known as Irian Jaya) *W. sterrhopoda*

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