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RESEARCH ARTICLE

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A new species of *Chingia* (*Thelypteridaceae*) from Vanikoro, Solomon Islands

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Key words

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Abstract A new species of *Chingia*, known only from Vanikoro in the Solomon Islands, is described and illustrated. It is distinctive in having flat, thickened, tortuous stipe scales. It is most closely related to an accession of *Chingia clavipilosa* from Mount Kinabalu, from which it is distinguished by its lack of hyaline acicular hairs on the abaxial laminar axes. Other *Chingia* species in the Solomon Islands are distinguished by having abundant stiff, terete stipe scales.

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INTRODUCTION

The genus *Chingia* Holttum includes 25 species, as recognized by Fawcett & Smith (2021). It is most diverse in Malesia, but its geographic range extends to include Polynesia, Australia (Queensland), and Thailand (Holttum 1977, 1982, 1986). The genus was described and monographed by Holttum (1971, 1974), who was the first to recognize its species as belonging to a natural group. *Chingia* species tend to be quite large, often growing as tree ferns, plants attaining heights of up to 5 m. The blades are usually ovate, not gradually tapered proximally, and the pinnae are not reduced to auricles or subtended by peg-like aerophores (Fig. 1b). Typically, the sori are exindusiate, and borne along the costae and costules, and the mature spores are black or dark brown (Fig. 1b). The pinnae of most species have at least one pair of anastomosing veins between adjacent segments, with an excurrent veinlet running to an elongate, cartilaginous sinus-membrane (Fig. 2a, d). Most species have distinctive stipe and rachis scales, which may be terete, spine-like, or flattened and thickened. The genus includes many narrow endemics, with eight of the 18 species treated by Holttum (1982) for the Flora Malesiana known only from the type or the type and one or two other collections. Recent work (Game et al. 2018) suggests that widespread species, such as *C. ferox* (Blume) Holttum and *C. longissima* (Brack.) Holttum, may be too broadly circumscribed, but a more detailed understanding of diversity within the genus has been limited by a lack of herbarium collections. Two species will be transferred to *Chingia* by Fawcett & Smith (2021) based on morphological study and molecular phylogenetic analyses by Fawcett et al. (in press); the bipinnate *Plesioneuron marattioides* (Alston) Holttum, from N.E. New Guinea (Holttum 1975), and *Amphineuron lindleyi* W.N.Takeuchi (Takeuchi 2005), described from New Ireland.

As a result of recent collecting efforts of the members of an international collaboration, the 'Census and Classification of Plant Resources in the Solomon Islands' project, conducted from 2012 to 2017, over 10 000 new collections were made, and these included specimens of more than 400 species of ferns and lycophytes. Among these were several collections from the islands of Vanikoro, an isolated archipelago in the Santa Cruz Island group that is separated from the major islands by 118 km and has an area of 173 km^2. Collections from Vanikoro included a specimen initially identified as *Pneumatopteris* sp. 1 by Chen et al. (2017). After additional morphological study, and the inclusion of the sample in a global phylogenomic analysis of the *Thelypteridaceae* (Fawcett et al. in press), we conclude that it represents a new species of *Chingia*, and describe it here, in advance of the publication of 'An annotated checklist of the Lycophytes and ferns of the Solomon Islands' (Chen et al. in review).

Chingia tortuosa S.E.Fawc., C.W.Chen & A.R.Sm., *sp. nov.* — Fig. 1, 2

A newly recognized species of *Chingia*, distinctive in having tortuous stipe scales (Fig. 2b), abaxial laminar indument of stipitate glands (but not hyaline acicular hairs) (Fig. 2c), and pinnae incised less than halfway to the costae (Fig. 2d). — Type: *Cheng-Wei Chen, Tien-Chuan Hsu & Moffat Fanerii SITW 11087* (holo BSIP!; iso TAIF! 498969, 498970, 498971, 498972, TNM!, UC! 2048647), Santa Cruz, Solomon Islands, Vanikoro, Banie Island, Ngarabu camp to end road stream, primary forest, riverside, S11°37'45.8" E166°53'18.5", 600 m elevation, 27 June 2016.

Etymology. Named for its distinctive tortuous stipe scales.

Plants terrestrial, > 1 m tall. *Rhizomes* stout, erect caudices > 2 cm thick, clothed in brown, tortuous scales (Fig. 1d). *Fronds* fasciculate, arching to erect, monomorphic (Fig. 1c). *Stipes*

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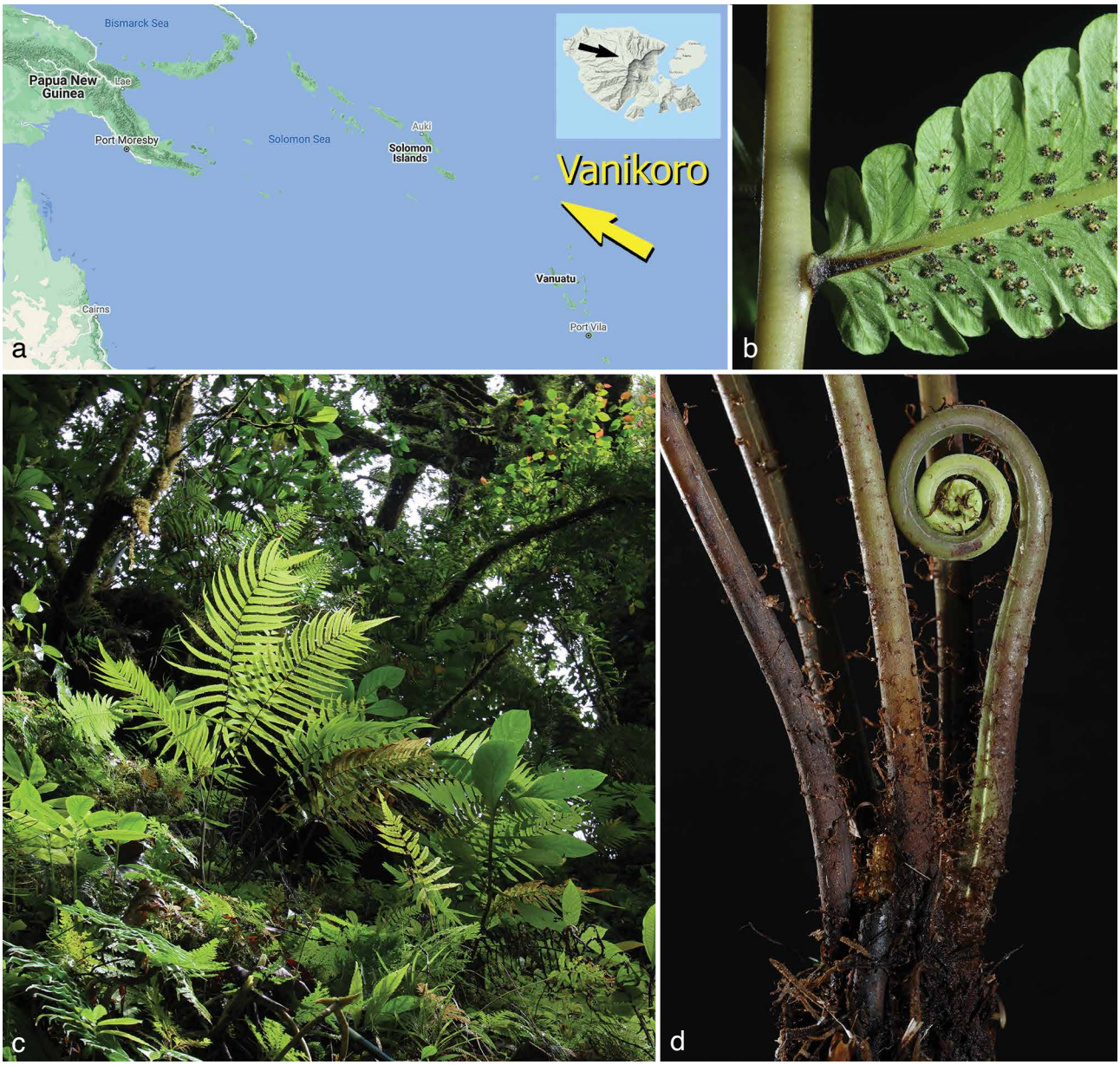

Fig. 1 Location and plant details of *Chingia tortuosa* S.E.Fawc., C.W.Chen & A.R.Sm. a. Map, with arrows indicating location of Vanikoro, and the locality of the type collection on Vanikoro (modified from Google Maps); b. pinna base, abaxial view, showing swollen aerophore; c. habitat and habit of type; d. rhizome apex and stipe bases of mature and developing fronds. — Photos b–d of the type gathering (*Cheng-Wei Chen et al. SITW 11087*). — Photos by Cheng-Wei Chen.

robust, to 8 mm thick, stramineous, proximally scaly, scales deciduous, leaving darkened, ovoid scars. *Stipe scales* brown, linear-lanceolate, thick, the largest to 10 by 0.5 mm, translucent, tortuous, bearing spreading to erect hyaline acicular hairs (Fig. 2b). *Blades* pinnate-pinnatifid, ovate, not decrescent or abruptly reduced proximally, gradually reduced distally to a conform (pinna-like) apex. *Rachises* stramineous, adaxially grooved, with scattered, darkened, ovoid, stump-like scale scars present abaxially throughout, glabrous proximally, glandular medially, and with a mix of spreading, hyaline acicular hairs and scattered clear, stalked and sessile glands distally. *Pinnae* 14–20 by c. 2 cm, spreading, truncate, lacking auricles, distally with narrowly winged pinna-stalks, apices gradually attenuate, with 25–40+ segments, these incised less than halfway to costae. *Aerophores* present as darkened swellings at pinna bases (Fig. 1b). *Veins* simple and pinnate, steeply angled from costae (c. 45°), 6–9 pairs per segment, usually with 1 or 2 pairs anastomosing below the sinus at a steep angle (< 90°) to form an excurrent veinlet to a cartilaginous, elongate, adaxially concave sinus membrane (Fig. 2d). *Indument adaxially* of hyaline acicular hairs to 0.4 mm long, these primarily restricted to the costae, with a few scattered hairs on the veins. *Indument abaxially* of minute, stalked and sessile clear glands and sessile golden to amber coloured glands, hairs lacking. *Sori* oblong to round, borne adjacent to costae and costules, gradually decreasing in size toward segment apices, proximal sori slightly elongate along veins, indusia absent or vestigial. *Sporangia* bearing numerous minute, clear, sessile or short-stalked glands on capsule (Fig. 2c). *Spores* black.

Distribution — Known only from the type locality, Solomon Islands (Vanikoro) (Fig. 1a).

Habitat & Ecology — Recorded only from slopes along streams at c. 500 m (Chen et al. 2017).

Vernacular name — ‘Vanikoro Chingia’, proposed here.

Conservation status — During our expedition, only a single population, with fewer than 100 individuals, was encountered. According to the criteria used by the IUCN red list (IUCN 2012), this species should be assessed as Endangered based on its limited extent, which is restricted by island size (criterion C) and small population size (criterion D). Furthermore, Vanikoro has been the site of unsustainable logging for nearly 100 years (Bennett 2000). As logging operations continue unchecked,

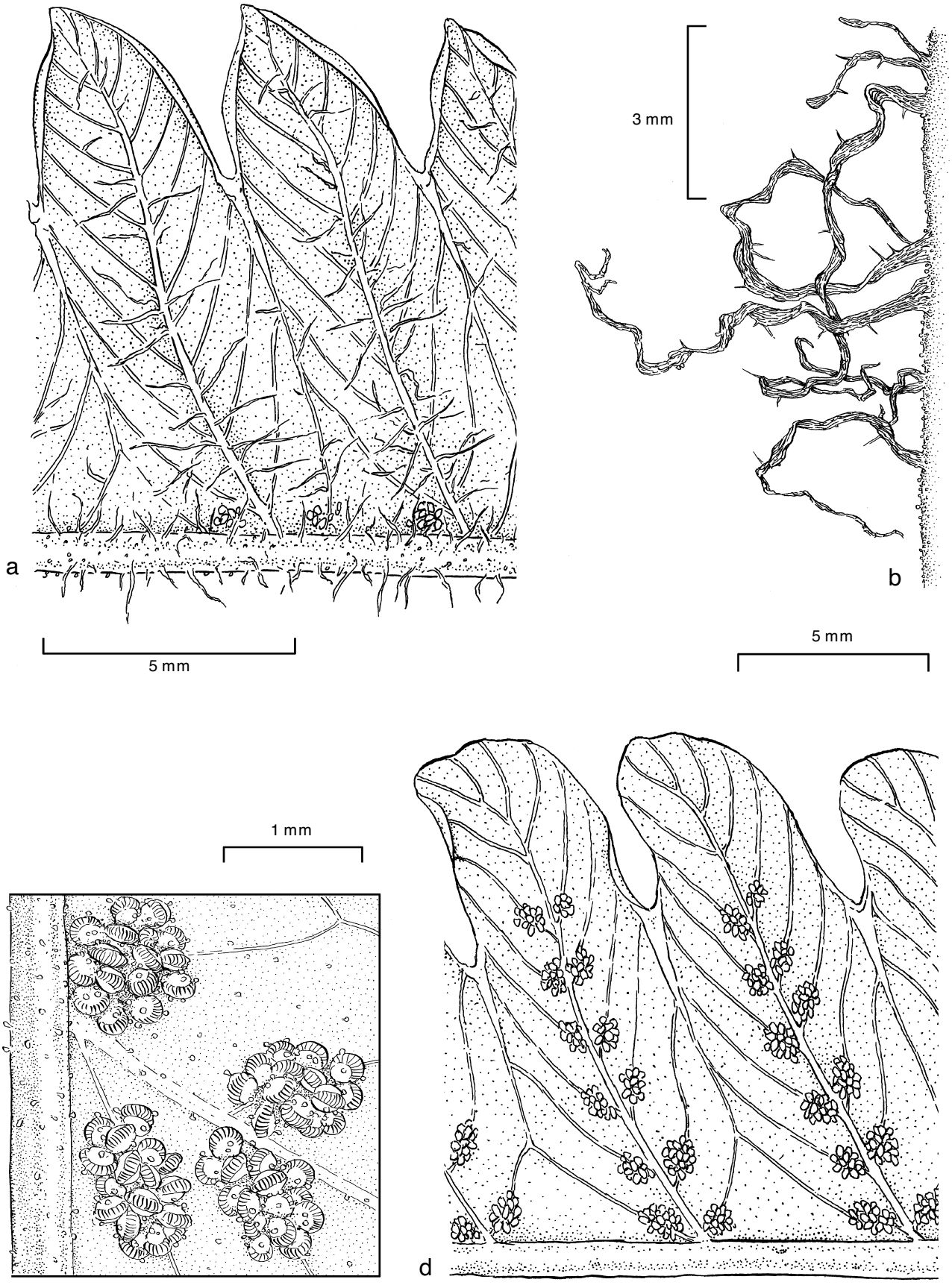

Fig. 2 a. *Chingia clavipilosa* Holttum. Abaxial pinna segments showing abundant acicular hairs. — b–d. *Chingia tortuosa* S.E.Fawc., C.W.Chen & A.R.Sm. b. tortuous stipe scales; c. sori; d. abaxial pinna segments (a: *Chen Wade 4658*, b–d: *SITW 11087*; all UC). — Illustrations by Susan Fawcett.

both the quality and extent of primary forests on the islands is in rapid decline. Unfortunately, we are aware of no formal conservation policy that has been adopted to protect the rich and unique biodiversity of the island.

Notes — Based on the molecular phylogeny of Fawcett et al. (2020, in press), which included 14 *Chingia* accessions represented by 407 nuclear loci, the type of *Chingia tortuosa* is sister to a collection of *C. clavipilosa* Holttum (*Chen Wade 4658*, UC 2072750) from Mount Kinabalu, the type locality of that species, with 100 % support, based on both maximum likelihood and coalescent analyses. The typical variety of *C. clavipilosa* shares the namesake stipitate glands (short, capitate hairs), but is easily distinguished from *C. tortuosa* by differences in indument. *Chingia clavipilosa* has abundant transparent spreading hairs on the pinna axes abaxially (Fig. 2a), in addition to the stipitate glands; similar glands are present, but such hairs are lacking in *C. tortuosa* (Fig. 2d). Many species of *Chingia* have terete, spine-like scales (e.g., *C. ferox*), while others have flattened scales, these usually thickened, stiff, and at most somewhat undulate, but not tortuous (but see *Chingia tenerior* Holttum, *BS (Ramos) 33066*, P (seen from photo), a Philippine endemic that may be distinguished from *C. tortuosa* by pinnae incised more than halfway to costae). In all species of *Chingia* examined, the deciduous stipe scales leave distinctive stump-like scars along the stipes and/or rachises.

Two additional species of *Chingia* occur on the Solomon Islands; these are *C. malodora* (Copel.) Holttum, and *C.* cf. *longissima*, both of which may be distinguished from *C. tortuosa* by their copious, erect, terete stipe scales. The stipe scales of *C. malodora* are noteworthy in emitting a foul odour when crushed (Holttum 1974).

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