Mapania multiflora, a distinctive new species of Cyperaceae (Mapanioideae) from Borneo

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Mapania multiflora, a distinctive new species of Cyperaceae (Mapanioideae) from Borneo

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Summary: *Mapania multiflora* is described and illustrated. It is vegetatively similar to taxa with broad leaves and pseudopetioles, such as *Mapania cuspidata*. However, it is reproductively similar to sect. *Thoractostachyum* with a paniculate inflorescence and furrowed fruit. The DNA is similar to *M. bancana* in sect. *Thoracostachyum,* in the three sampled cpDNA regions: *atpH-F, trnL-F* and *psbA-trnH*. However, it is identical to none of these due to its unique combination of vegetative, reproductive and molecular characteristics.

Key words. Borneo, conservation, Cyperaceae, *Mapania*, new species, taxonomy.

Introduction

The cosmopolitan sedge family Cyperaceae is the third-largest family in the monocots, after orchids and grasses, with 106 genera and c. 5400 species (Govaerts *et al.* 2007). A wide variety of habitats are occupied by sedges, from swamps to sand-dunes and tropical forests to high arctic tundra (Smith *et al.* 2009). Several species are ubiquitous weeds which occur in a variety of environments, others are endemic, narrowly distributed and of conservation concern (Naczi & Ford 2008). The family Cyperaceae comprises two subfamilies, Mapanioideae and Cyperoideae (Simpson *et al.* 2007; Muasya *et al.* 2009). Two tribes are assigned under Mapanioideae, namely Hypolytreae and Chrysitricheae. *Mapania* Aubl., a genus in tribe Hypolytreae contains a group of mostly forest-dwelling sedges which are widely distributed throughout the tropics (Simpson 1996). Borneo and Peninsular Malaysia are considered to be centres of diversity for *Mapania* with 25 and 16

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species recorded respectively (Simpson 1992) and new species continue to be discovered (Shabdin *et al.* in press). Fifty percent of the species in Borneo are endemic.

During fieldwork in Batu Berkarang, Limbang, northern Sarawak, specimens of *Mapania* were collected which did not match the morphology of any of the previously described species. There is little information on reproduction, breeding behaviour or population biology of *Mapania* on which biological species might be based. Therefore we describe a new species based on its distinctions under the morphological / taxonomic species concepts (Cronquist 1978) and in its sampled DNA sequences.

Materials and methods

Morphology. Macromorphological features were recorded using a conventional ruler calibrated in millimeters. Dissections of inflorescence parts were made by soaking an inflorescence in warm water in a Petri dish for 5 – 10 minutes, transferring it to a white glazed tile and then carefully teasing out the parts using mounted needles under a Leica Microsystems S6D binocular photomicroscope. Microscopic features were recorded using a calibrated eyepiece graticule in the microscope and also photographed. Data were recorded into a Microsoft Excel® spreadsheet.

DNA sequencing. Total DNA was extracted from material collected in silica gel (Table 1). The modified CTAB method of Doyle & Doyle (1987) was used but extractions were precipitated in isopropanol for one week. The *trnL-F* intergenic spacer, together with the *psbA-trnH* and *atpH-F* plastid genes were amplified as one complete piece using the following forward and reverse primers: *trnL-F* (Taberlet *et al.* 1991), *psbA-trnH* (Sang *et al.* 1997) and *atpH-F* (Lahaye *et al.* 2008). Standard polymerase chain reaction (PCR) protocols were followed. After some experimentation optimum results were achieved using 2µl of template DNA, 1 x NH4 buffer (Bioline), 2mM $MgCl_2$, 0.2mM of dNTPs, 0.2 mg/ml BSA, 0.35µM of each primers and 1.5 units of *Taq* DNA polymerase per 50µl reaction. The thermal cycling (Applies Biosystems, Foster City, CA, USA) comprises 30 cycles of 30 seconds denaturation at 94˚C, 1 min annealing at 48˚C, and an extension of 1.30 mins at 72˚C. A final extension at 72˚C was also included. PCR products were sent to Macrogen (Korea) for purification and sequencing. Sequences were assembled and

edited in Seqman II version 2.04 (DNAStar, Madison, WI, USA) before being exported to BioEdit version 7.0 for Clustal V alignment followed by manual adjustment. The data are part of a broad phylogenetic study of Southeast Asian *Mapania* (Shabdin 2012).

Results

A full morphological description of the new species is given below.

The aligned sequence data for *Mapania* (Shabdin 2012) showed *M. bancana* to have the most similar DNA sequences to our new species and the vegetatively similar *M. cuspidata* (Miq.) Uittien to be more divergent. The final aligned *trnL-F* sequence data for *M. bancana*, *M. cuspidata* and the new species consists of 940 base pairs, with 26 nucleotide substitutions. Aligned *atpH-F* sequence data consist of 650 base pairs with 10 nucleotide substitutions whereas aligned *psbA-trnH* sequence data consist of 867 base pairs with 33 nucleotide substitutions. The DNA sequences of the new species most closely resemble those of *M. bancana*, but differ in all three cpDNA regions tested (*trnL-F, atpH-atpF, psbA-trnH*) in 26, 10 and 33 nucleotide substitutions respectively. Tables 2 – 4.

Taxonomy

Mapania multiflora *Shabdin* **sp. nov.** Type: Malaysia, Sarawak, Limbang Division, Batu Berkarang, Jalan Merapok – Lawas, 7 Feb. 2009, *Shabdin, Z., Meekiong, K., Shabdin, M.L., Zaidi, I.* ZINN 48 (holotype SAR!; isotypes K!, RNG!).

Moderately robust, rhizomatous; rhizomes 4 – 5 mm diameter, stilt roots sometimes present. Cataphylls ovate to lanceolate, 3 – 10 x 2 – 5 cm, acute to obtuse, fibrous when dried. Culms several, lateral, 37 – 54 cm long. Leaves basal, several, up to 100 cm long; leaf-blade linear, linear-oblong or oblong, 15 – 30 x 4.5 – 6 cm, apex abruptly narrowed, acute to rounded, cuspidate to long-cuspidate, tip 2.5 – 4 cm long, margins serrate; base gradually to abruptly narrowed into a narrowly canaliculate, 21 – 55 x 0.2 – 0.3 cm pseudopetiole, coriaceous, light green, yellowish-green to green and dark green; sheath ovate to lanceolate, 5 – 10 x 3 – 4 cm, apex narrowed or abruptly narrowed, light green or yellowish-green, mid-brown to light brown or greenish-brown. Involucral bracts 4-6,

glumaceous, ovate to lanceolate, 10 – 40 x 2.4 mm, acute; basal bract obtuse, thickly coriaceous, glabrous, light brown. Peduncle 15 – 30 cm long, glabrous, light green and paler toward the base. Inflorescence arising from rhizome or axil of basal-most leaves, 2 – 5, lateral, paniculate, 16 – 30 cm, composed of 6 – 18 spikes; spike elliptic to lanceolate, 8 – 10 x 2 – 3 mm, apex gradually acute or blunt on the tip, greenish-brown, spicoid bract lanceolate, 8 – 10 x 2 – 3 mm, apex attenuate, light greenish brown, coriaceous, glabrous, nerves indistinct, floral bracts 6, free, staminate flowers 1 per spicoid, anthers linear, 1 mm long, whitish, filament 3.5 – 4 mm long, stigma branches 3, style 0.4 cm. Fruit ellipsoid, 4 x 2 mm, apex apiculate, base stipitate, glabrous, indistinctly furrowed, chocolate brown and grey at the base. Figs 1 – 2.

RECOGNITION. Related to *M. bancana* except that the culms are lateral (vs central in *M. bancana*); the leaf-blade is 4.5 – 6 cm wide (vs 0.8 – 1.8 cm wide), a pesudopetiole is present (vs absent) and the involucral bracts are glumaceous (vs foliaceous). Vegetatively similar to *M. cuspidata* and only reliably separated when in flower, *M. multiflora* having a paniculate inflorescence (vs inflorescence a single spike or capitate).

DISTRIBUTION. Endemic to Borneo.

SPECIMENS EXAMINED. SARAWAK. 5th Division: Limbang District, Jalan Merapok – Lawas, Batu Berkarang, 7 Feb. 2008, *Shabdin, Z., Meekiong, K., Shabdin, M.L. & Zaidi, L.,* ZINN 48 (holotype SAR!; isotypes K!, RNG!).

HABITAT. Terrestrial herb or sometimes a lithophyte on the thick humus of rock surfaces in kerangas forest, mixed lowland and hill dipterocarp forest, frequently on wet and damp places near to small streams; alt. 50 m.

CONSERVATION STATUS. This species was found growing abundantly at the type locality only. The plants are not immediately threatened by farming activities. However, vegetation in the vicinity of the site largely consists of secondary forest and the site is located close to several small villages. The species may be at risk from clearing for development or agriculture. Further surveys are urgently needed to establish the geographical extent and conservation status of this remarkable species. Based on the data currently available we classify this species as Vulnerable (VU D1+2) following the IUCN (2001) categories and criteria.

ETYMOLOGY. The specific epithet *multiflora* refers to the inflorescence branching into a number of partial inflorescences (spikes).

NOTES. *Mapania multiflora* is recognised by its unique combination of a paniculate inflorescence and broad, pseudopetiolate leaves. Vegetatively it might easily be mistaken for broad-leaved, pseudopetiolate taxa, such as *Mapania cuspidata*, especially when seen from a distance. However, it differs in inflorescence structure (paniculate with 6 – 18 spikes in *M. multiflora*, a single spike or capitate in *M. cuspidata*).

The relationship with *Mapania bancana*, suggested by the DNA sequence, is of interest. The broad-leaved taxa in Southeast Asia were grouped together in a single clade by Simpson (1992) but recent molecular evidence suggests this grouping may not be monophyletic (Shabdin 2012). The DNA sequences reported here allow this species to be easily distinguished from other broad-leaved taxa even when in a purely vegetative state, using readily available laboratory techniques.

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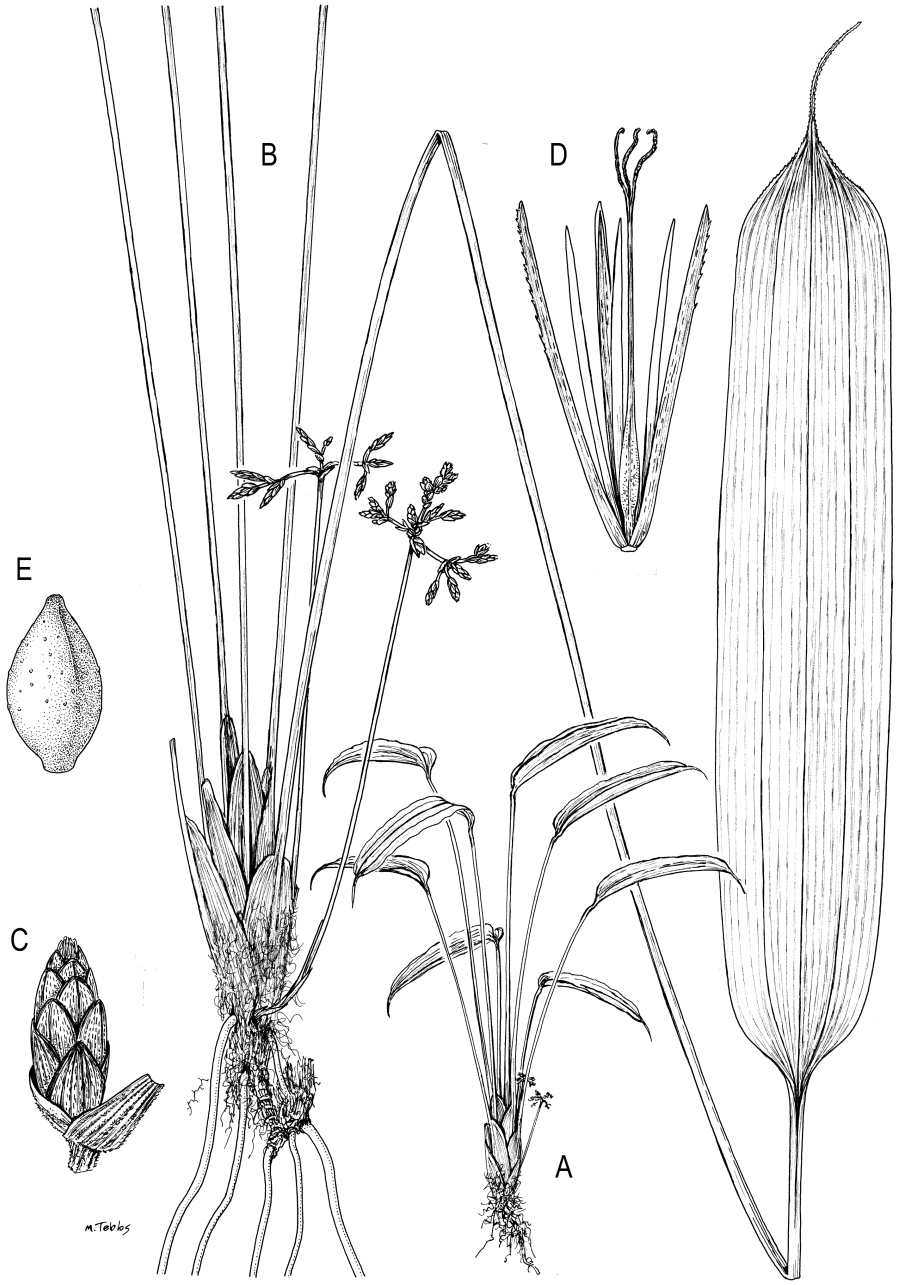
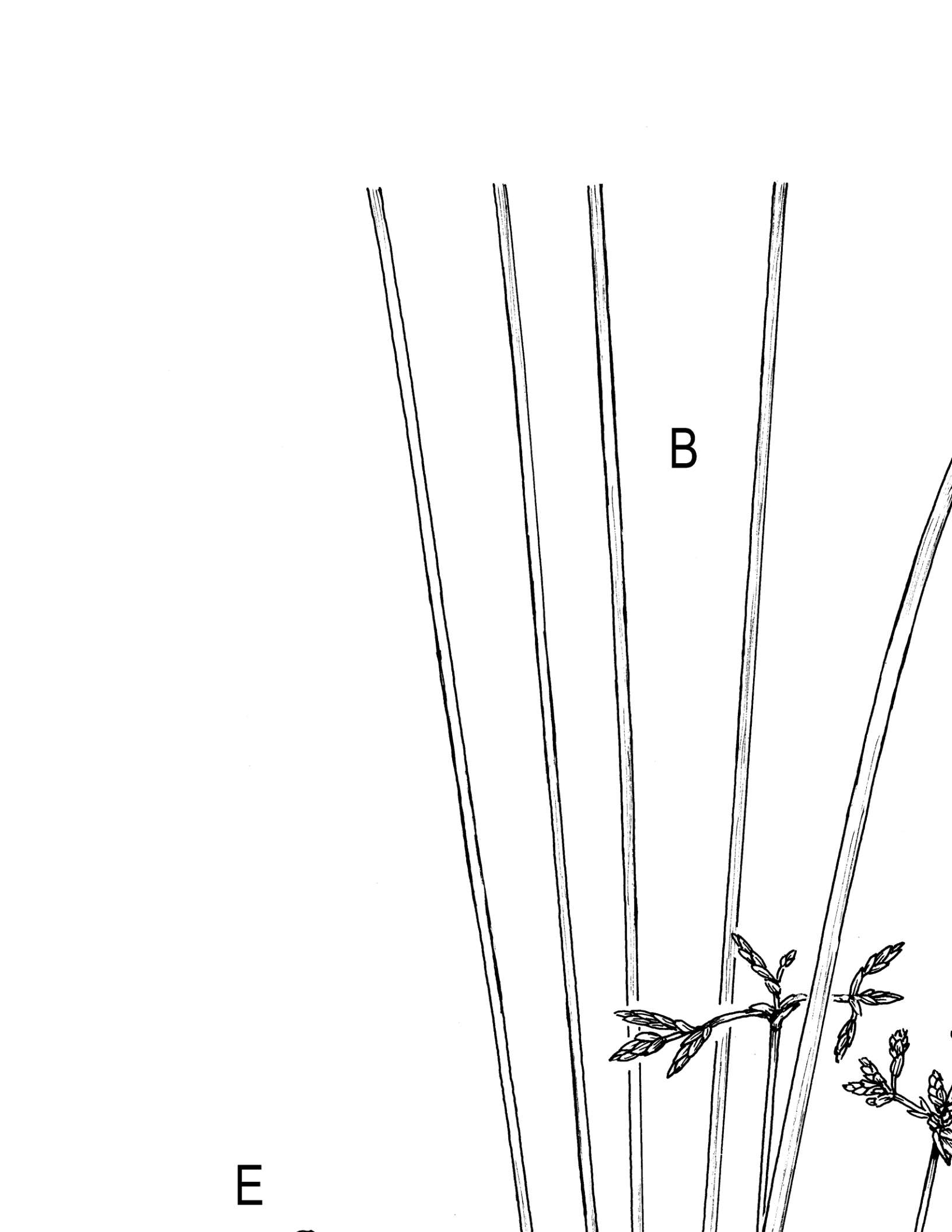


Fig. 1. *Mapania multiflora*. **A** habit; **B** base of plant, inflorescences, pseudopetiole, leaf; **C** spike; **D** spicoid; **E** fruit. All from the type. Drawn by Margaret Tebbs.

Fig. 2. *Mapania multiflora*. **A** whole plant; **B** inflorescence; **C** fruit; **D** type specimen. **A, B, D** photographed by Sekudan Tedong, **C** by Z Shabdin.


B
E