

## BRYOPHYTES FROM THE FIJI ISLANDS, II. AN ACCOUNT OF THE GENUS *COLURA*, WITH A DESCRIPTION OF *C. VITIENSIS* SP. NOV.

TAMÁS PÓCS & JENS EGGERS

**Abstract.** Six species of *Colura* were known from the Fiji Archipelago, to which *C. crispiloba* Ast, *C. cristata* Ast, *C. queenslandica* B. Thiers and *Colura vitiensis* Pócs & Eggers *sp. nov.* are added here. The new taxon belongs to the section *Harmophyllum* Grolle. A key to the presently known ten Fijian species of *Colura* is supplied.

**Key words:** *Colura*, Fiji, Melanesia, Lejeuneaceae, Pacific

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### INTRODUCTION

Since Miller *et al.*'s (1983) prodromus on the liverworts of the Pacific tropical islands, only Hürlimann's (1998) series on the Hepaticae of the South Pacific (summarized in Part XIV therein) has added significantly to our knowledge of Fijian hepatic flora. The Hattori Botanical Laboratory organized a bryological expedition to New Caledonia and Fiji in 1982 (Iwatsuki & Kitagawa 1985). From its results, mostly the mosses and Anthocerotae were published, and from the hepatics only members of the genera *Frullania* and *Porella* (Hattori 1984, 1985, 1986). Since that time, from the South Pacific area, covering the Fiji Islands, the genera *Herbertus* (So 2003), *Metzgeria* (So 2002), *Plagiochila* (So 2000; So & Grolle 2000) and *Telaranea* (Engel & Merrill 2004) have been revised.

Jens Eggers visited Fiji in September 1999, collecting bryophytes, mostly liverworts, on Viti Levu and Taveuni Islands; Sarolta and Tamás Pócs collected on Viti Levu, Taveuni and Kadavu Islands in August–September 2003. The first record of their collection, a new species of *Lopholejeunea*, was published by Sass-Gyarmati (2005), and the first mosses by Pócs (2007), starting a planned new

series of papers on Fiji bryophytes. The second part of this series, the present paper, covers the genus *Colura* Dumortier. For this genus, Miller *et al.* (1983) enumerates *Colura ari* (Steph.) Steph., *Colura conica* (Sande Lac.) K. I. Goebel, *Colura corynephora* (Nees) Trev., *Colura leratii* (Steph.) Steph., *Colura pluridentata* Ast and *Colura superba* (Mont.) Steph. from the Fiji Islands. Hürlimann (1987) added a new record of *Colura superba*.

### ENUMERATION

Our collection contained 26 specimens of *Colura* from the Fiji Islands, representing eight taxa, four of which proved to be records new to the islands, including one new to science.

All specimens collected by S. and T. Pócs are deposited in the Herbarium of Eszterházy College (EGR), with duplicates in the South Pacific Regional Herbarium (SUVA) and the Field Museum (F). The specimens collected by J. Eggers are in his private herbarium. If not otherwise stated, the specimens were collected on living leaves, as epiphylls.

***Colura ari* (Steph.) Steph.**

ILLUSTRATION: Jovet-Ast (1954: 255, Fig. 32), Zhu & So (2001: 235, Fig. 90).

SPECIMENS SEEN: TAVEUNI I. MT. DES VOEUX, 950 m. In rainforest, with *Leptolejeunea subacuta*, *Drepanolejeunea pentadactyla*, *Radula tjibodensis*, *Cololejeunea* cf. *vitiensis* and *Frullania leratii*, *J. Eggers* FID 3/173.

DISTRIBUTION. Widespread Indomalaysian-Pacific species.

***Colura conica* (Sande Lac.) K. I. Goebel**

Figs 1 & 2b–d

*C. acutifolia* Ast

ILLUSTRATION: Jovet-Ast (1954: 281, as *C. acutifolia*, Fig. 50), Zhu & So (2001: 245, Fig. 95).

SPECIMENS SEEN: VITI LEVU I.: W part of island, at N edge of NAUSORI HIGHLANDS, in submontane rainforest W of Bukuya village, at 670 m, *S. & T. Pócs* 3253/U. – On the southern ‘Coral Coast’, in lowland rainforest, 1.2 km N of Korolevu, at 34 m, *S. & T. Pócs* 3256/M. – Central Viti Levu, in mossy elfin forest at NE edge of RAIRAIMATUKU PLATEAU, above Naqelewai village, S of ‘Barclay’s Point’, at 855–945 m, *S. & T. Pócs* 3273/CD. – On the ridge of Rairaimatuku Plateau 10 km SSE of Navai at 990–1010 m, *S. & T. Pócs* 3274/BE. – TAVEUNI I.: BOUMA NATIONAL HERITAGE PARK, Tavoro Waterfalls, 250 m, rainforest near falls, accompanied by *Cololejeunea cordiflora*, *J. Eggers* FIG 2/21. – NE part of island. On the ridge between Qeleni and Welagi villages, in submontane rainforest with many tree-ferns along brook at 500 m, *S. & T. Pócs* 3281/AA. – E side of Taveuni I. around the first Tavoro Waterfalls, above Korovou (Bouma) village, at 10–100 m, *S. & T. Pócs* 3282/BA. – Lowland rainforest in Wainibau Stream valley on SE coast of Taveuni Island, below the gorge of Wainibau Waterfalls, at 1–15 m, *S. & T. Pócs*, 3286/AD. – Central part of island. Along the road from Wairiki to Des Voeux Peak, montane rainforest rich in epiphytes on NW slopes at 600–700 m and at 715–750 m, *S. & T. Pócs* 3289/BF & 3288/CT. – NW coast in SW part of island. Taveuni Estates above Saqulu, epiphyllous in degraded submontane rainforests in the foothills of Mt. Uluigalau, at 360 m, *S. & T. Pócs* 3290/BA.

NOTES. There is an interesting variation of the valve cells, especially in specimens from Taveuni Island, where the number of median valve cells

can be as few as 8–12 and that of the surrounding hyaline cells 12–16. In average specimens these numbers used to be 16–20 and 15–16. As at the same place we observed intermediates between the two types, we do not want to attribute major taxonomic significance to this difference.

DISTRIBUTION. Widespread Indomalaysian-Oceanian species known from Sri Lanka to China to the Philippines, Australia and New Caledonia, the Carolines and to Samoa (Zhu & So 2001). In Fiji the species was known from Ovalau Island (Miller *et al.* 1983).

***Colura corynephora* (Nees in Gottsche *et al.*) Trev.**

ILLUSTRATION: Jovet-Ast (1954: 300, Fig. 61 & 301, Fig. 62), Zhu & So (2001: 240, Fig. 92).

DISTRIBUTION. Indomalaysian-Pacific species, eastwards to the Mariana Islands and Fiji.

***Colura crispiloba* Ast**

Fig. 3

ILLUSTRATION: Jovet-Ast (1984: 206, Pl. I).

SPECIMENS SEEN: VITI LEVU I.: central part, NE escarpment of RAIRAIMATUKU PLATEAU, above Nakelewai village, at 700–720 m. Ramicolous in secondary montane rainforest, *S. & T. Pócs*, 03272/P.

DISTRIBUTION. New to Fiji Islands, known only from Australia, Queensland: Cardwell (Jovet-Ast 1984) and from Cape Tribulation area, Gap Creek (Pócs & Streimann 2006).

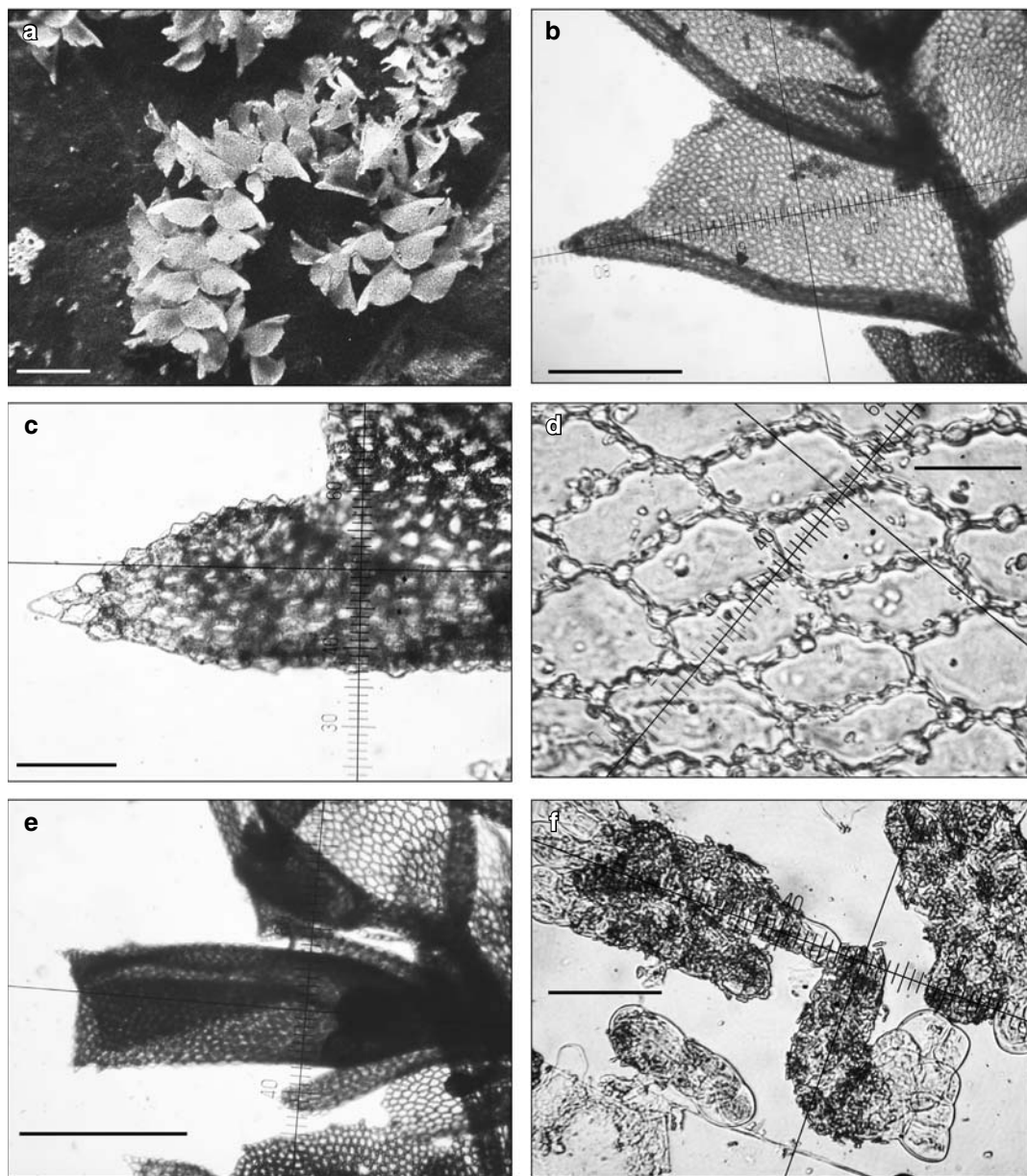
***Colura cristata* Ast**

Figs 2e & 4

ILLUSTRATION: Jovet-Ast (1954: 292, Fig. 57).

SPECIMENS SEEN: KADAVU I.: Western part, 2 km NE of Tavuki village, in dry, microphyllous forest on ultrabasic soil, with emergent *Gymnostoma vitiense* L. A. S. Johnson (Casuarinaceae) trees, many creeping *Flagellaria* and with *Schizaea dichotoma* and Cyperaceae common in the ground layer, at 170–200 m, on fern, mostly on *Schizaea* leaves, *S. & T. Pócs* 3304/AA & 3309/BA.

DISTRIBUTION. New to Fiji Islands, previously known only from Borneo and from Malaysia (Jovet-Ast 1954, 1958).



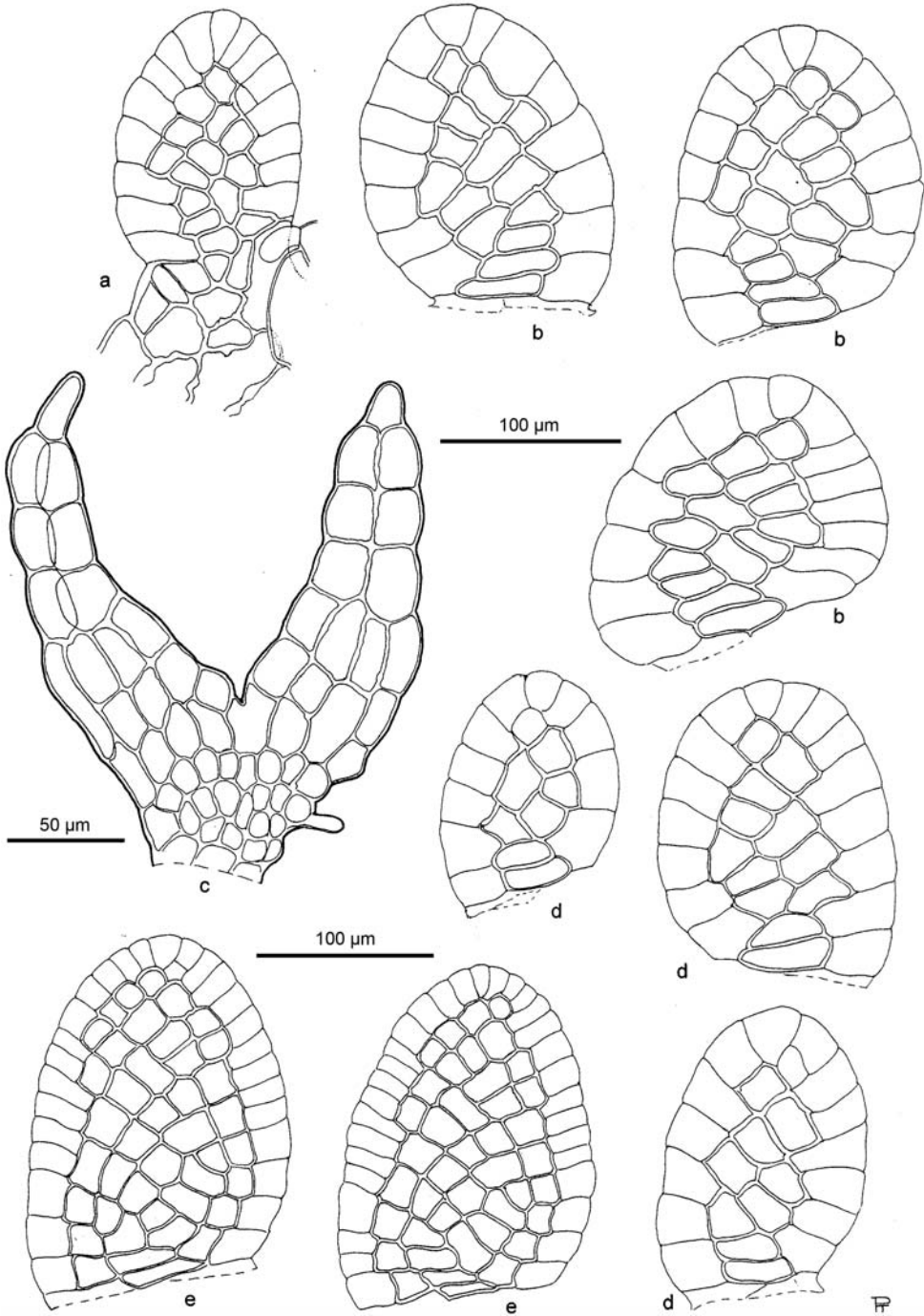
**Fig. 1.** *Colura conica* (Sande Lac.) K. I. Goebel. a – habit, dorsal view (scale bar = 2 mm), b – habit, ventral view (scale bar = 500 μm), c – apex of lobule sac (scale bar 100 μm), d – median lobe cells (scale bar = 25 μm), e – female branch with perianth (scale bar = 50 μm), f – spores germinating in mature capsule (scale bar = 50 μm). ‘a’ photographed from S. & T. Pócs 3286/AD, all others from S. & T. Pócs 3290/BA.

***Colura leratii*** (Steph.) Steph. Figs 2a & 5

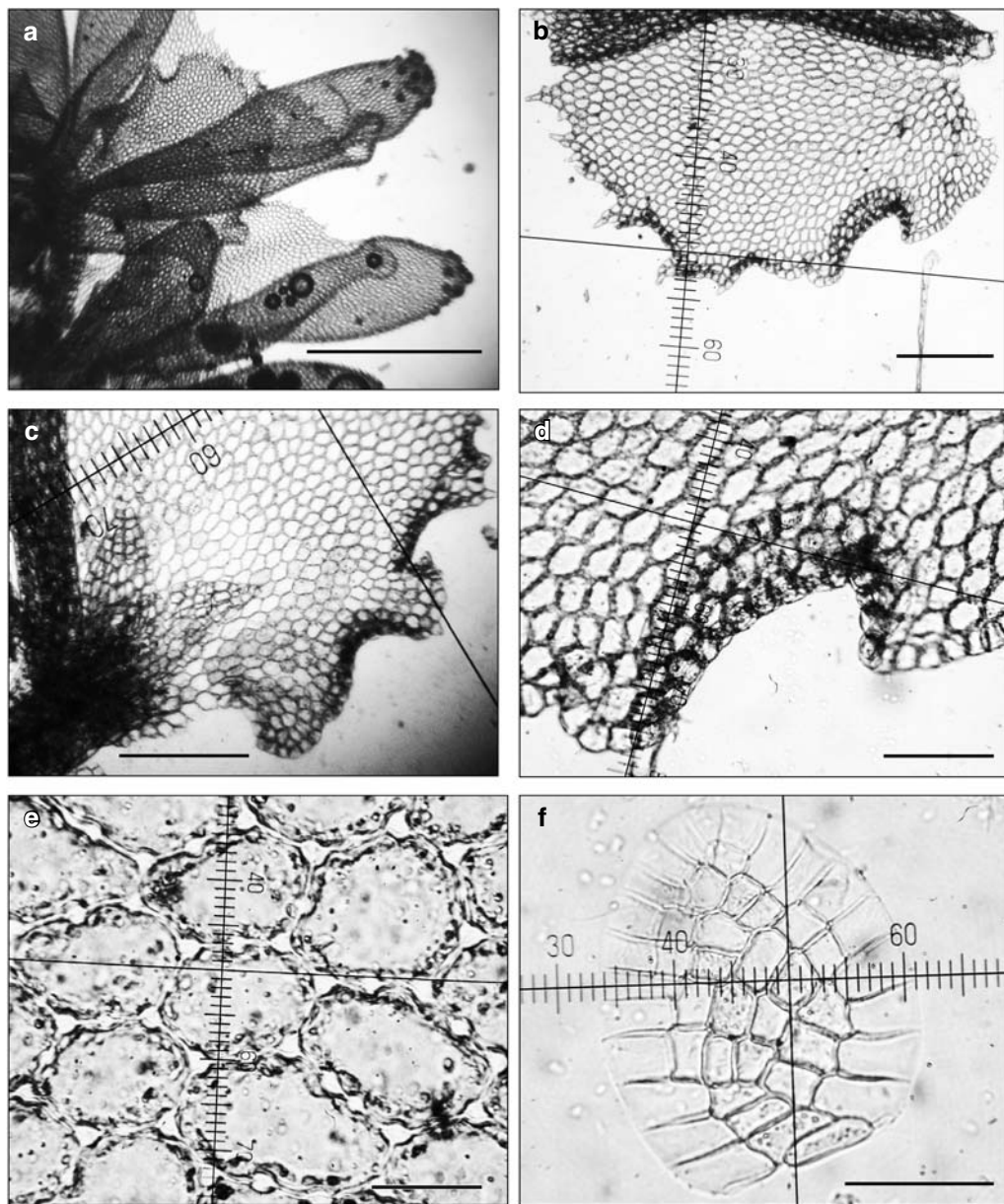
*Colura apiculata* (Schiffn.) Steph., nom. inval. based on the unpublished *Colurolejeunea apiculata* Schiffn.

ILLUSTRATION: Jovet-Ast (1954: 311, Fig. 68, under *C. apiculata*)

SPECIMENS SEEN: VITI LEVU I.: W part of island,



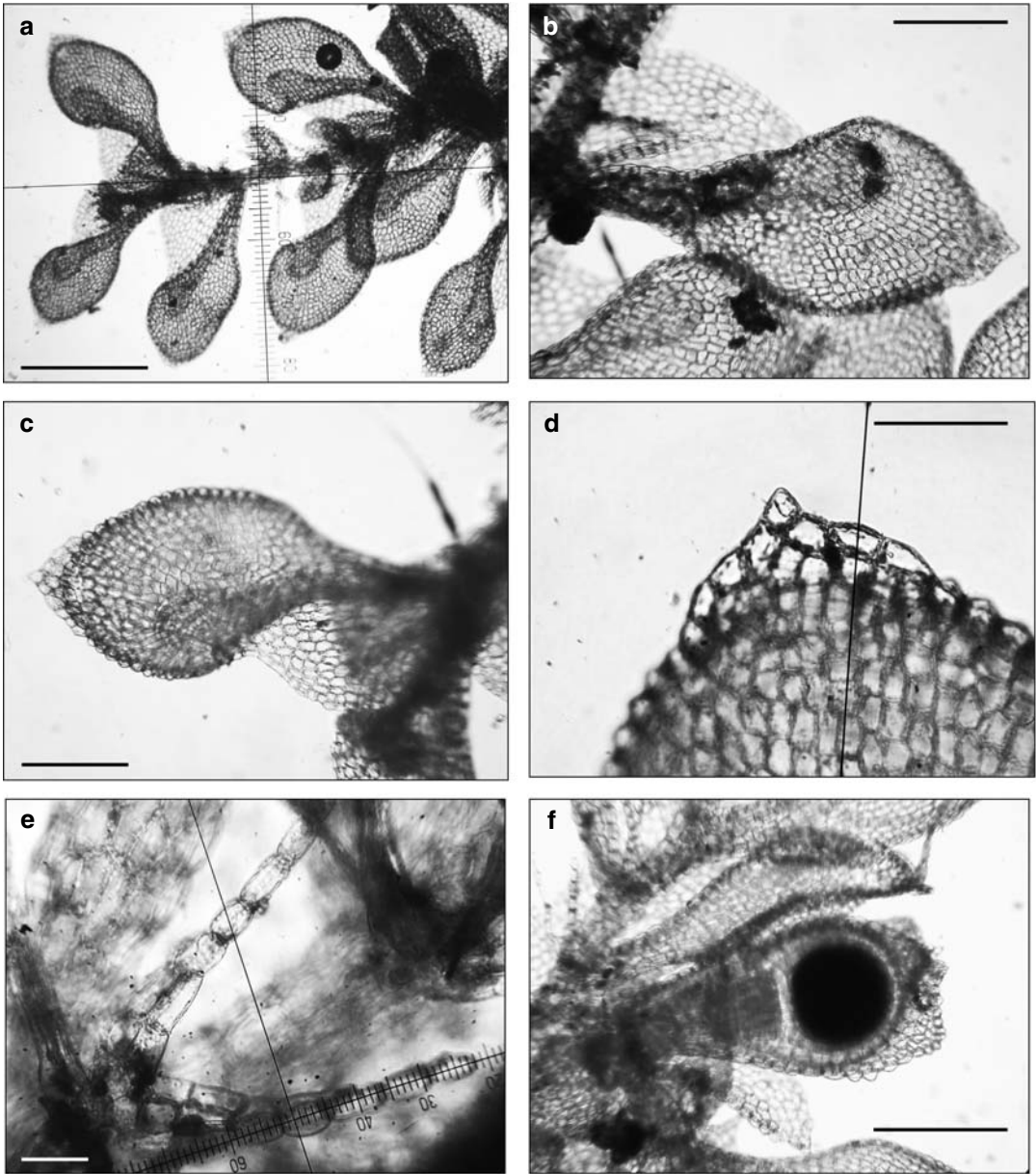
**Fig. 2.** *Colura leratii* (Steph.) Steph.: a – valve; *Colura conica* (Sande Lac.) Goebel: b – larger valves, c – underleaf, d – smaller valves; *Colura cristata* Ast: e – valves ('a' drawn from S. & T. Pócs 3271/AD, 'b' from S. & T. Pócs 3289/BF, 3282/BA & 3253/Q, 'c' from S. & T. Pócs 3290/BA, 'd' from S. & T. Pócs 3288/CT, 3273/CP & S. & T. Pócs 3290/BA, 'e' from S. & T. Pócs 3309/BA).



**Fig. 3.** *Colura crispiloba* Ast. a – leaves, ventral view (scale bar = 1 mm); b – leaf lobe (scale bar = 250 µm); c – base of lobe and underleaf (scale bar = 250 µm); d – detail of crispate lobe margin (scale bar = 100 µm); e – median lobe cells (scale bar = 25 µm); f – valve (scale bar = 100 µm). All photographed from *S. & T. Pócs, 03272/P*.

at N edge of NAUSORI HIGHLANDS, in submontane rainforests: ENE of Nausori village, at 600–620 m, *S. & T. Pócs 3252/BA*; – W of Bukuya village, at 670 m, *S. & T. Pócs 3253/S*. – On the southern ‘Coral Coast’, in lowland rainforest, 1.2 km N of Korolevu,

at 34 m, *S. & T. Pócs 3256/L*. – Central Viti Levu, below NE escarpment of RAIRAIMATUKU PLATEAU, 1 km NW of Naqelewai village, in Naboubuco River Valley, lowland rainforest, at 250 m, *S. & T. Pócs 3271/AD*. – TAVEUNI I.: Bouma National Heritage

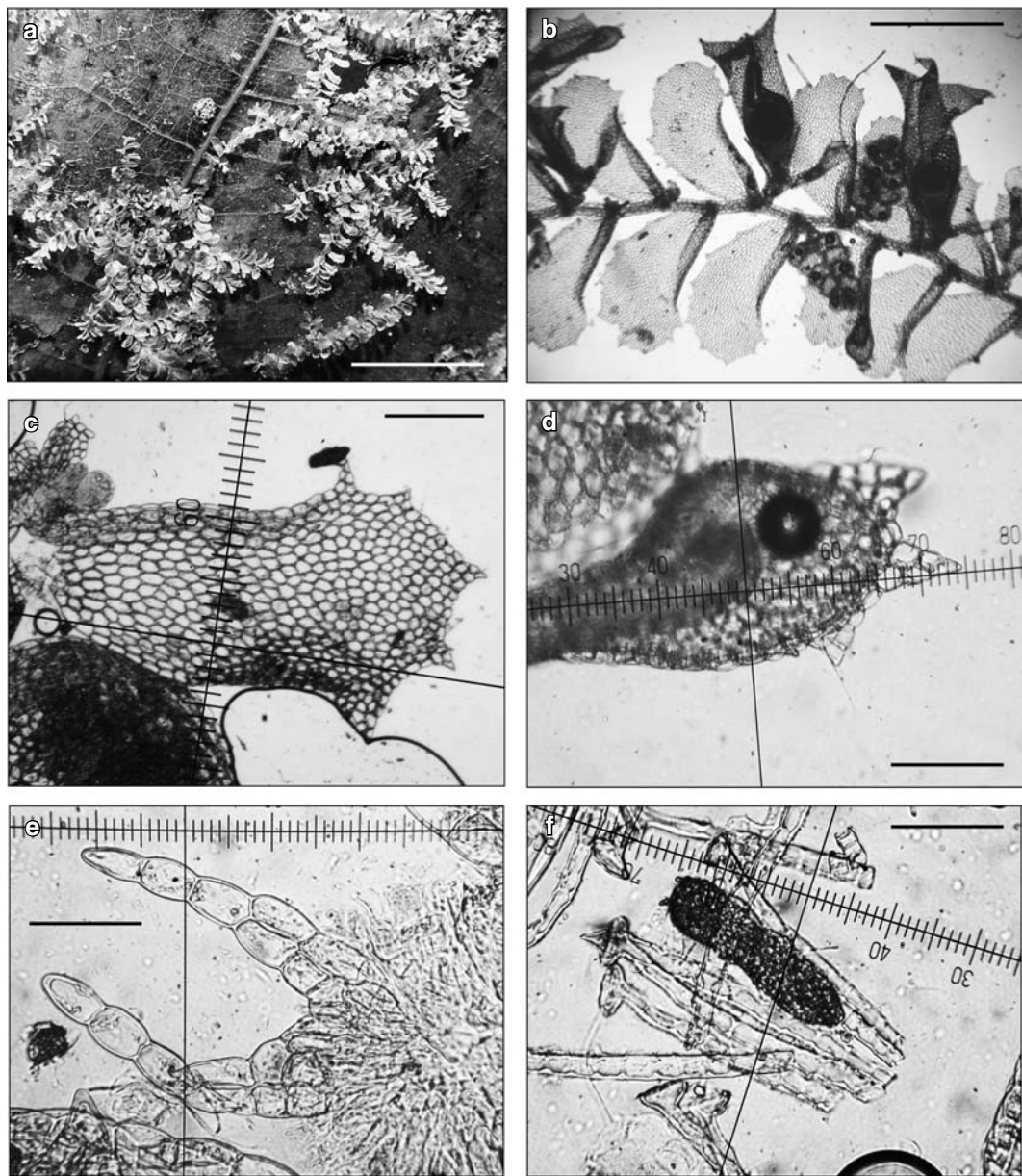


**Fig. 4.** *Colura cristata* Ast. a – habit, ventral view (scale bar = 250 µm); b – leaf, ventral view (scale bar 100 µm); c – leaf, dorsal view (scale bar 100 µm); d – crested apex of lobule sac (scale bar = 50 µm); e – underleaf (scale bar 25 µm); f – perianth with innovation (scale bar = 250 µm). (All photographed from S. & T. Pócs, 3309/BA).

Park, near Taworo Waterfalls, at 250 m, *J. Eggers FID 2/23*. – SE coast of island, below the gorge of Wainibau Falls, at 1–15 m, *S. & T. Pócs 3286/AC*. – SW part of Taveuni, at SW end of the central mountain range, between Salialevu and Naqarawalu

villages, in degraded lowland rainforest, at 100–200 m, *S. & T. Pócs 3296/BA*.

**DISTRIBUTION.** Malesian-Pacific species known from Java to New Caledonia and Fiji.



**Fig. 5.** *Colura leratii* (Steph.) Steph. a – habit, dorsal view (scale bar = 1 cm); b – habit, ventral view (scale bar = 1 mm); c – leaf with rudimentary lobule (scale bar = 100  $\mu$ m); d – crested sac at apex of fully developed lobule (scale bar = 100  $\mu$ m); e – underleaf (scale bar = 50  $\mu$ m); f – spore with elaters (scale bar 50  $\mu$ m). All photographed from S. & T. Pócs 3271/AD.

***Colura queenslandica* B. Thiers**

ILLUSTRATION: Thiers (1987: 176, Figs 1–8).

SPECIMENS SEEN: VITI LEVU I. COLO-I-SUVA

FOREST PARK, in rainforest with small waterfalls, at 200 m, J. Eggers FID 1/131.

NOTE. It agrees in all characters with the species described by Thiers from the eastern coast

of Australia. Although the specimen from Fiji is fragmentary, the leaf and lobule shape and the fused, ligulate valve is typical for this species.

**DISTRIBUTION.** New to Fiji Islands, known only from Australia, Queensland, Cooloola (Great Sandy) National Park (Thiers 1987).

### *Colura pluridentata* Ast

**ILLUSTRATION:** Jovet-Ast (1954: 265, Fig. 38).

**SPECIMENS SEEN:** VITI LEVU I. COLO-I-SUVA FOREST PARK, in rainforest with small waterfalls, at 200 m, growing together with *Cololejeunea cordiflora*, *Ceratolejeunea belangeriana*, *Drepanolejeunea pentadactyla* and *Aerobryopsis* spec., *J. Eggers FID 1/31*.

**DISTRIBUTION.** Rare Palaeotropic species known only from Borneo (type locality), Fiji (Miller *et al.* 1983) and from the Seychelles (Grolle 1978).

### *Colura superba* (Mont.) Steph.

**ILLUSTRATION:** Jovet-Ast (1954: 280, Fig. 40).

**DISTRIBUTION.** Malesian-Pacific species (from Sumatra to Vietnam and to Society Islands), with a doubtful record from Réunion Island.

### NEW SPECIES

### *Colura vitiensis* Pócs & J. Eggers, *sp. nov.* (Sectio *Harmophyllum* Grolle) Figs 6–8

*Planta epiphylla seu ramicola surculis 1–2 cm longis et 1.5–2.5 mm latis, foliae imbricatae vel contiguae, 0.75–1.3 mm longae et 0.4–0.7 mm latae, lobis dimidiato-ovatis marginibus irregulariter dentatis, papillois, lobulis clavatis sacculis rotundatis, acute papillois. Clypeus minutus, 36–42 µm longus et 34–36 µm latus, cellulibus 6–10 medianis et 10–12 hyalinis compositae, basi cellula mediana unica. Amphigastriae V-formia lobis ad basin 4–6 cellulae latis. Gemmae disciformes, 40–44 cellulares. Androecia rarissima, paucijugata. Probabiliter dioicous, perianthium cylindricum, tricarinatum, acute papillosum, 1.2–1.4 mm longum et 0.5 mm latum bracteis leviter bilobis, obtusis, denticulatis ad dimidium perianthii attingens. Capsula sphaerica, diametro ad 500 µm, elaterae luteae, ad 150 µm longae, trabeculatae.*

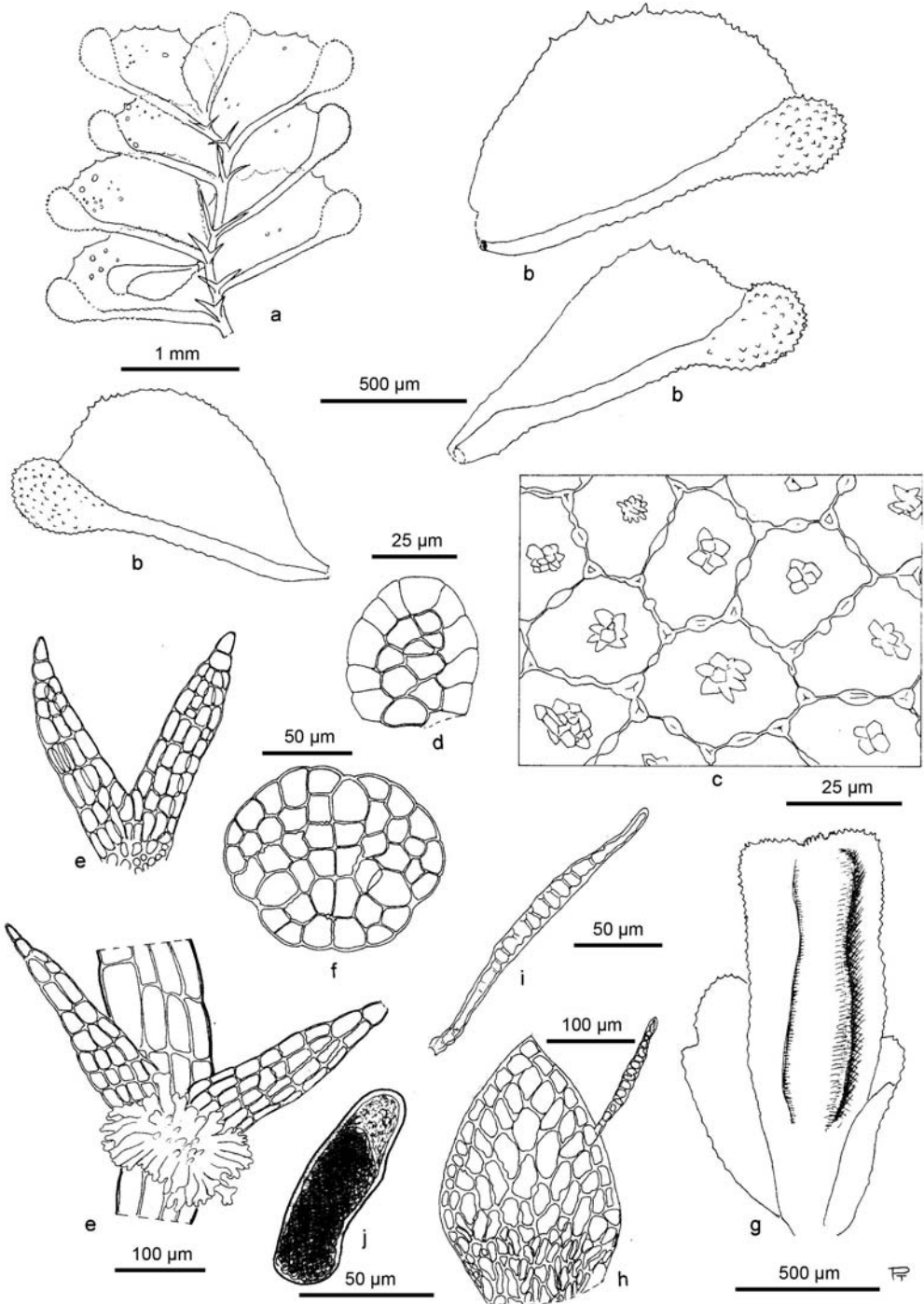
*Sporae atrovirides, unicellulares, ad 80 µm longae et 25 µm latae.*

Epiphyllous or rarely ramicolous, vivid green, shoots 1–2 cm long and 1.5–2.5 mm wide, with imbricate to contiguous leaves. Stem approx. 80 µm thick. Leaves falcato-ovate, 0.75–1.3 mm long and 0.4–0.7 mm wide, with the lobes adhering to the substrate and with ascendent lobule. Lobe half moon shaped with irregularly dentate margin. Lobule club shaped with a globose apex. The sac acutely papillose, upper lobe surface with lower, in light microscope seen, as compound, rosette like papillae. Valve very tiny compared to other species, only 36–42 µm long and 34–36 µm wide, with 6–10 median cells (only 1 basal) and 10–12 hyaline cells. Underleaves V-shaped, lobes acute, 200–300 µm long and 40–60 µm wide, 4–6 cells wide at base. Disciform gemmae develop on the lobe surface, up to 120 µm in diameter, consisting of 40–44 cells. Probably dioicous, androecia very rare, consisting of few bracts. Perianths abundant, on short lateral branches, cylindric, tricarinate 1.2–1.4 mm long and 0.5 mm wide, acutely papillose, similarly to the saccate lobule apex. Capsules globose about 500 µm in diameter, valves with 1–2 yellowish, 130–150 µm long, trabeculate elaters. Spores at the opening of capsule unicellular, dark green, 80 µm long and 25 µm thick.

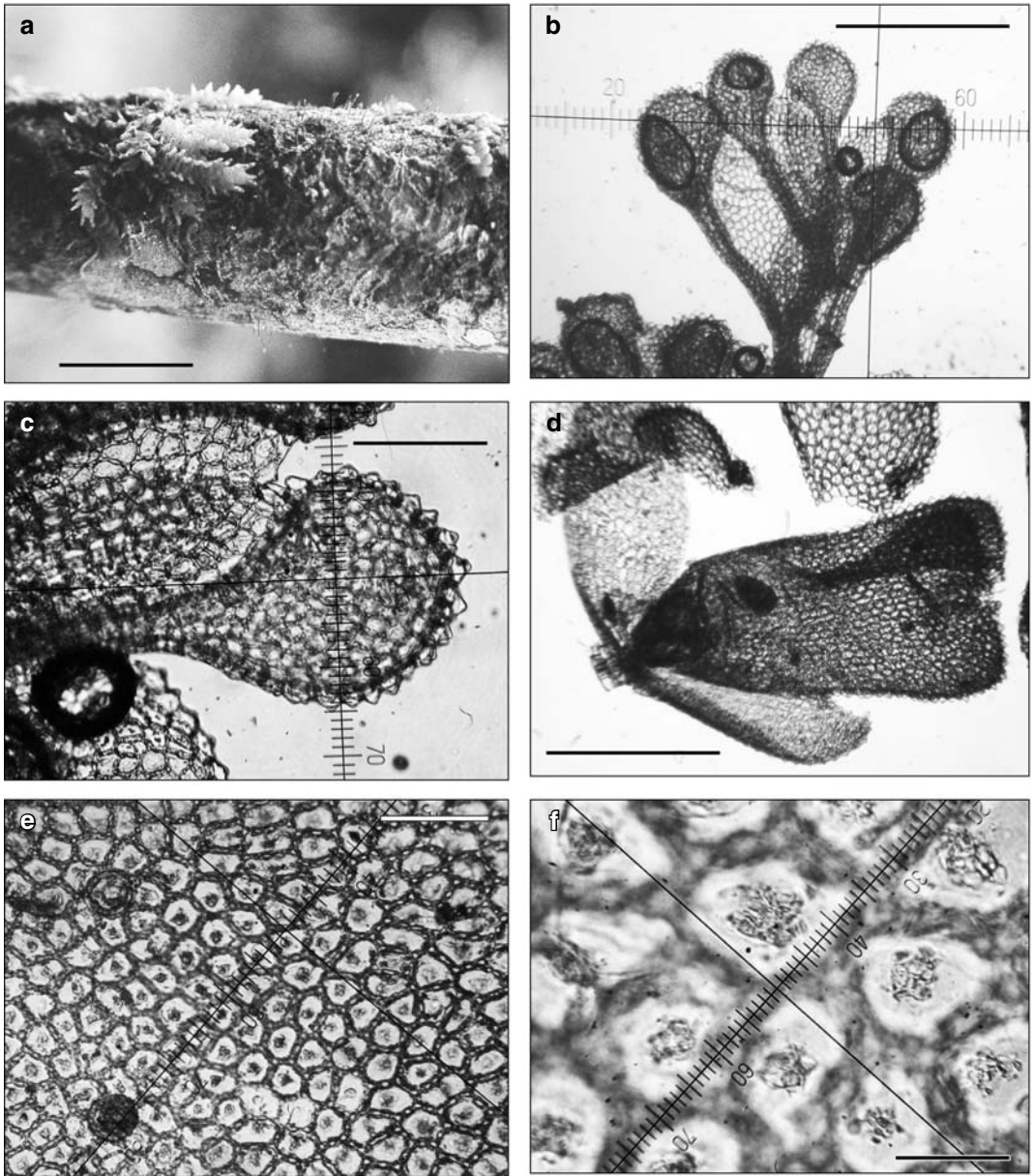
**HOLOTYPE:** VITI LEVU I. Southern coast of Viti Levu Island ('Coral Coast') in the high rainfall area. Near Nabukavesi village, 10 km N of Lombau, primary wet lowland rainforest, on rugged volcanic hills along a streamlet at 30–60 m, 18°07'–09'S/178°13.08'–13.23'E, epiphyllous, 20 Aug. 2003, *S. & T. Pócs 3261/BB* (EGR, ISOTYPES in F, G, SUVA).

**OTHER SPECIMENS SEEN.** VITI LEVU I.: COLO-I-SUVA FOREST PARK, in rainforest with small waterfalls, at 200 m. Epiphyllous, growing together with *Cololejeunea cordiflora* Steph. and *Drepanolejeunea pentadactyla* (Mont.) Steph., both new to Fiji Islands, *J. Eggers FID 1/22*. – At the type locality, also ramicolous, *S. & T. Pócs 3261/AN*. – Mossy elfin forest on the ridge of RAI RAIMATUKU PLATEAU 10 km SSE of NAVAL, at 900–1010 m, *S. & T. Pócs 3274/BD*. – TAVEUNI I.: Central part of island. NE side of Des Voeux Peak, at 950–960 m, *J. Eggers FID*





**Fig. 6.** *Colura vitiensis* Pócs & J. Eggers, *sp. nov.* a – habit, ventral view; b – leaves, ventral view; c – compound papillae on dorsal surface of lobe cells; d – valve; e – underleaves; f – discoid gemma; g – perianth with bracts; h – capsule valve (outer wall); i – trabeculate elater; j – spore. All drawn from the type.



**Fig. 7.** *Colura vitiensis* Pócs & J. Eggers, *sp. nov.* a – habit of a ramicolous plant (scale bar = 1 cm); b – shoot apex (scale bar = 500 µm); c – papillose apex of lobule sac (scale bar = 100 µm); d – perianth with bracts (scale bar = 500 µm); e – median lobe cells (scale bar = 100 µm); f – compound papillae on the dorsal surface of lobe cells (scale bar = 20 µm). ‘a’ photographed from *S. & T. Pócs*, 3361/AN, ‘b’ and ‘c’ from *J. Eggers*, FID 1/22 and the rest from the type.

3/200, *S. & T. Pócs* 3280/BG, and at 1040–1150 m, *S. & T. Pócs* 3279/AT. – NW coast in SW part of Taveuni Island. TAVEUNI ESTATES above Saqulu, rami-

colous on twigs, in degraded submontane rainforest in foothills of Mt. Uluigalau, at 360 m, *S. & T. Pócs* 3290/L.



**Fig. 8.** *Colura vitiensis* Pócs & J. Eggers, *sp. nov.* Cells from dorsal side of lobe with shrivelled cell walls and compound papillae (scale bar = 20 µm). SEM image was made in dry state from the type.

KEY TO SPECIES KNOWN FROM THE FIJI ISLAND<sup>1</sup>

- 1. Valve round ovate, connected to the lobule along a hinge. All leaves have a lobule, which ends in a sac ..... (Subgenus *Colura*) 2
- 1\*. Valve is not detachable, fused directly to the lobule, more elongated ..... (Subgenus *Glotta*) 8
- 2. Lobule broadens towards apex. Lobe is much broader than the lobule. Valve consists of maximum 40 cells, easily detachable ..... (Sect. *Harmophyllum*) 3
- 2\*. Lobule is broader than the lobe and in our species tipped by a triangular crest, consisting of 6–10 cells. Valve is fused to the hinge, not easily detachable, and consists of 50–75 cells. Underleaves with very narrow (2–3 cells broad) segments ..... (Sect. *Gamolepis*) *Colura cristata*
- 3. Lobule sac or at least its apex is rounded, not ending in an apiculus ..... 4
- 3\*. Lobule sac acute or apiculate ..... 7
- 4. Lobule club-shaped, sac is hemispherical, acutely papillose. Valve tiny, less than 40 µm broad ... *Colura vitiensis*
- 4\*. Lobule sac cylindrical or conical, smooth. Valve larger ..... 5
- 5. Lobe with crispate-undulate margin. Underleaf lobes 8–11 cells wide at their base ... *Colura crispiloba*
- 5\*. Lobe with flat margin, in most cases dentate. Underleaf lobes 4–8 cells wide at their base ..... 6

- 6. Valve with 2 median basal cells. Lobule elongated, conical. Underleaf lobes wide, up to 8 cells ... *Colura pluridentata*
- 6\*. Valve with 1 median basal cell. Lobule cylindrical to conical (seldom tipped by a tiny crest). Underleaf lobes narrower, 4–5 cells wide ..... *Colura superba*
- 7. Lobule sac small, less than 1/6 of lobe length, sharply turns away from the lobe ..... *Colura ari*
- 7\*. Lobule sac much larger, up to 1/3 of lobe length in the direction of leaf axis. Lobule apex tipped by a triangular point consisting of 3–8 cells ..... *Colura conica*
- 8. All leaves with club-shaped, saccate lobule. Sac inflated, smooth, without appendages. Lobe with entire margin. Underleaf lobes 4–6 cells wide at base ..... (Sect. *Glotta*) *Colura queenslandica*
- 8\*. Many leaves with only rudimentary lobules or none. Underleaf lobes 1–2 cells wide ..... (Sect. *Heterophyllum*) 9
- 9. Lobe with rough, irregular teeth on the margin. Lobule often tipped by a bidentate crest ..... *Colura leratii*
- 9\*. Lobe with entire margin. Very few leaves or none are lobulate; lobuli without crest, if present ..... *Colura corynephora*

DISCUSSION

Our knowledge of the *Colura* species of Fiji Islands is still incomplete, and collections from more islands will surely reveal higher diversity. The ten species on Fiji are comparable in number with those of Australia (14, Thiers 1987; McCarthy 2003; Pócs & Streimann 2006), and the Neotropics (13, Gradstein *et al.* 2001), but their number is lower than on the Malesian Archipelago (28, Pócs 1996) or Africa including the Indian Ocean Islands (21, Wigginton 2004). Its composition is dominated by the Malesian-Oceanian element, except for the two Australasian species, *Colura crispiloba* and *Colura queenslandica*. This modest but definite Australasian link can also be observed in other genera of the Fijian flora, as for example among the species of *Frullania* (own observation).

In terms of frequency, the most widespread among them is *Colura conica*, the second most frequent being *Colura leratii*. The rare *Colura cristata* seems restricted to the *Gymnostoma*

<sup>1</sup> In the key we follow the new subdivision of the genus given by Grolle and Zhu (2002).

*vitiense* L. A. S. Johnson (Casuarinaceae) forests of Kadavu Island, and *Colura crispiloba* and *Colura queenslandica* restricted to Viti Levu Island. The endemic *Colura vitiensis* is known from the wet rainforests of Viti Levu and Taveuni Islands, at altitudes from sea level to 1150 m.

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