

## *Ficus subulata*, a new record for Singapore

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**ABSTRACT.** A new record for Singapore, *Ficus subulata* Blume, has been discovered growing in several small patches of secondary forest on Pulau Ubin. It is described here based on observations of the plant on Pulau Ubin along with notes on its habitat. A key to the Singapore species of *Ficus* subgenus *Sycidium* section *Palaeomorphe*, to which *F. subulata* belongs, is given. Male and female individuals of a *Kradibia* pollinating fig wasp species were found within a syconium of a plant specimen. They were collected and vouchered and are illustrated here.

**Keywords.** Habit, habitat, pollinator, Pulau Ubin, seed dispersal

### Introduction

The genus *Ficus* L. is pantropical, more rarely warm temperate, and comprises > 800 species (Clement et al., 2020), with centres of diversity on the islands of Borneo and New Guinea (Berg & Corner, 2005; Clement et al., 2020). Singapore has c. 50 native species. Most species occur mainly in the lowlands and up to the sub-montane zone with only a few species recorded over 3000 m altitude. About half of the *Ficus* species are monoecious and the other half gynodioecious (functionally dioecious).

### Infrageneric classification

Berg (in Berg & Corner, 2005) classified the genus *Ficus* into six subgenera, of which the species in *Ficus* subg. *Pharmacosyceae* (Miq.) Miq. and *F.* subg. *Urostigma* (Gasp.) Miq. are monoecious, those of *F.* subg. *Ficus*, *F.* subg. *Sycidium* (Miq.) Mildbr. & Burret and *F.* subg. *Synoechia* (Miq.) Miq. are gynodioecious, and *F.* subg. *Sycomorus* (Gasp.) Miq. has both monoecious and gynodioecious species. Recent molecular studies (see Clement et al., 2020 and references cited therein), however, have suggested that only the last three of these subgenera are monophyletic, while the first three are not. Infrageneric relationships are yet to be resolved, with many relationships not well supported. In contrast, the sections and subsections established on morphology for the genus throughout its range were largely supported (Clement et al., 2020).

*Ficus subulata* Blume, a gynodioecious species, has been classified in *Ficus* subg. *Sycidium* (Miq.) Mildbr. & Burret sect. *Palaeomorpha* King (Berg & Corner, 2005). Species belonging to this section are typically creepers, straggly lianas, hemi-epiphytes and shrubs/treelets with short aerial adventitious roots on stems and branches; twigs are solid (not hollow); leaves are distichously arranged, often asymmetric, base oblique, one side often lobed or auriculate, cystoliths are present on both sides of the lamina or just below with waxy glands present at the axils of basal veins, often unilateral; stipules are semi or fully amplexicaul; figs are ramiflorous, cauliflorous and axillary, usually 1 cm in diam. or less with lateral bracts mostly absent, internal hairs are absent or sparse; tepals are whitish, pink or red; fruit achenes are lens-shaped and weakly keeled.

### Key to *Ficus* subg. *Sycidium* sect. *Palaeomorpha* in Singapore

- 1a. Leaves smooth and glabrous on both surfaces, not hispidulous or scabrid, margins entire, occasionally lobate; figs sub-globose to sub-pyriform ..... *F. subulata*
- 1b. Leaf surfaces slightly to distinctly hispidulous or scabrid on one or both sides, margins crenate to dentate (or lobate) to entire; figs sub-globose to ovoid or ellipsoidal ..... 2
- 2a. Leaves somewhat hairy on both surfaces, hispidulous and scabrid above, below brownish to whitish, puberulous to sub-tomentose, sparsely hispidulous on veins; figs sub-globose to ovoid ..... *F. scaberrima*
- 2b. Leaves glabrous and smooth above, scabrid below; figs sub-globose to ellipsoidal ..... 3
- 3a. Leaves sub-coriaceous, midrib impressed above, margins entire, sometimes revolute; figs sub-globose ..... *F. heteropleura*
- 3b. Leaves sub-coriaceous to coriaceous, midrib raised above, margins of the apical part somewhat crenate-dentate, basal part entire to lobate; figs sub-globose to ellipsoidal ..... *F. sinuata*

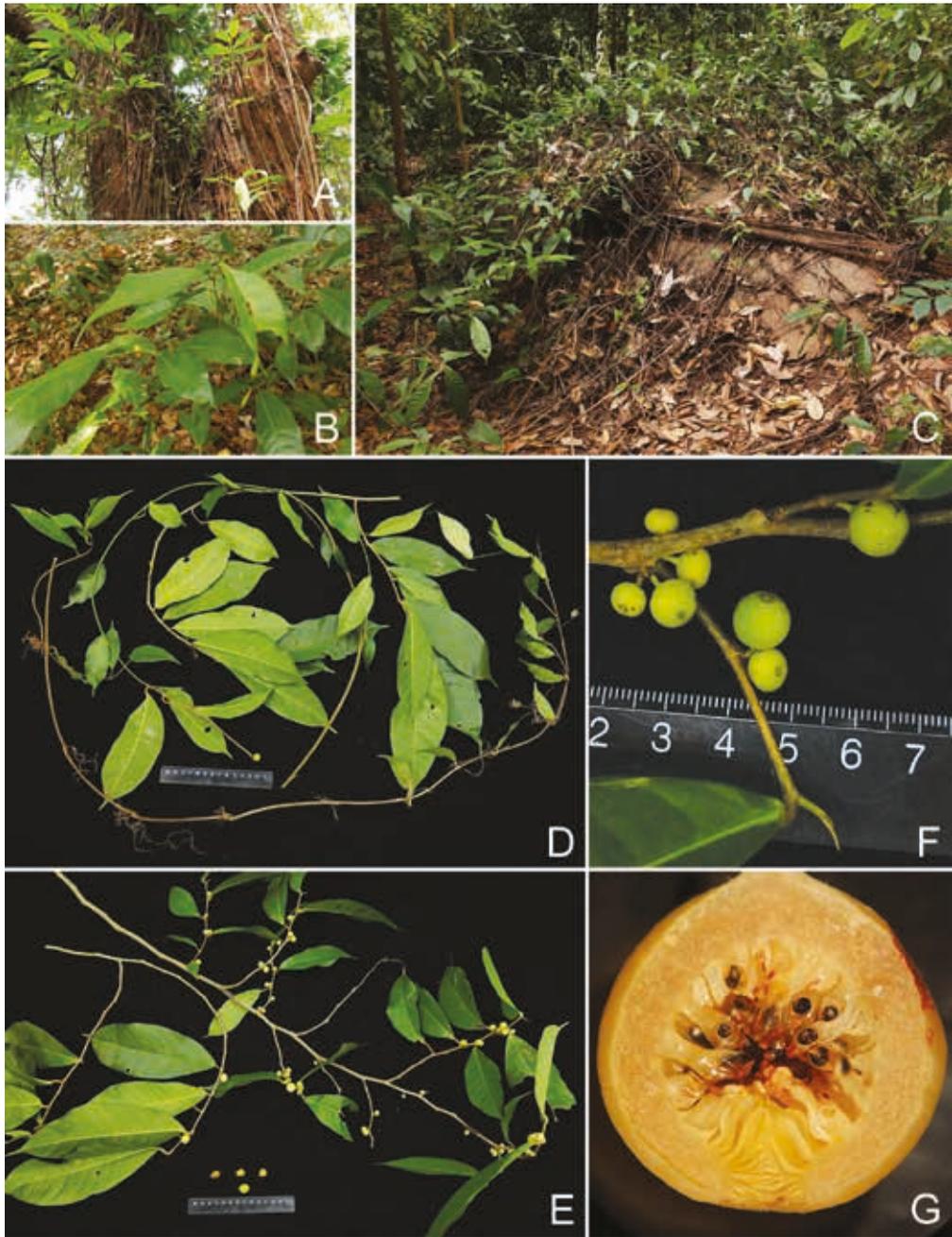
### Taxonomy

*Ficus subulata* Blume, Bijdr. Fl. Ned. Ind. 461 (1825); Ridley, Fl. Malay Penins. 3: 329 (1924); Corner, Gard. Bull. Singapore 21: 76 (1965); Kochummen, Tree Fl. Malaya 3: 158 (1978); Turner, Gard. Bull. Singapore 47: 354 (1997 ['1995']); Berg & Corner, Fl. Males., ser. 1, 17(2): 290 (2005); Kochummen & Go, Tree Fl. Sabah & Sarawak 3: 245 (2000). – TYPE: [Indonesia, Java], G. Parang, *Blume 1268* (lectotype L [L0040316], designated by Kochummen & Go (2000); isolectotype L [L0040317]). (Fig. 1)

*Description of plant collected from Pulau Ubin.* Creeper, lithophyte, shrub or root climber to c. 8 m high on a host tree. **Stem** terete, greyish-brown; creeping stem rhizome-like, c. 1 cm in diam., with adventitious anchoring roots at various nodes, scrambling across forest floor, becoming lithophytic on boulders along its path; climbing stem with short aerial roots, lianescent, of varying width, 1–4 cm in diam., strung around much of the host's tree trunk but not strangling it. **Branchlets** plagiotropic, lateral to somewhat pendent, sometimes whip-like with long internodes and roots on nodes, greyish-brown, faintly lenticillate, glabrous to sparsely hairy. **Stipules** semi-amplexicaul, persistent, dark brown when dry, sparsely hairy, c. 1.3 cm long. **Apical leaf-bud** subulate, c. 1.3 cm long. **Leaves** distichous, of varying sizes, especially small in young creepers and apical dangling branchlets of lianescent climbers, 4.5–22.5 cm × 1.5–8 cm, petiole 0.4–2 cm, 6–8 leaves per branchlet, young leaves flush pinkish-brown, maturing thinly coriaceous, bright to dark green above, paler below, midrib raised on both sides, venation visible but not prominent (more prominent on underside when dried), secondary veins 9–11, lamina glabrous on both sides, somewhat oblique, oblong to obovate, apex acuminate to caudate, base oblique, one side sometimes slightly auricled, abaxial side with one or more waxy glands at the axil between lateral vein and midrib, usually two or three veins above basal-most vein; cystoliths present on both sides, margins entire to slightly undulating. **Figs** ramiflorous, axillary, arising from a spur, singly, paired or in cluster up to c. 4, peduncular bracts ovate, overlapping, 4 or 5, slightly fimbriate, peduncle c. 0.5 cm, figs sub-globose to sub-pyriform, pale green, ripening orange-ochre, sparsely hairy on the surface, ostiole c. 2 mm across, ostiolar bracts ovate, slightly fimbriate, figs 0.8–1 cm in diam., 0.6–1.5 cm long; staminate flowers ostiolar, calyx with 4 lobes, stamen 1, calyx of gall flower similar to male flower, ovary globose, stigma short. Female syconium not seen.

*Distribution.* This species is widespread. It is native to Bangladesh, Northeast India to Southern China, Nicobar Islands, Myanmar, Thailand, Vietnam, throughout Malesia to New Guinea and the Solomon Islands. It has, however, been noted that it has not been recorded from Johor, Singapore, Riau Archipelago, Banka, Flores and Timor (Corner, 1965; Berg & Corner, 2005). This is hence the first record for Singapore.

*Ecology.* Across its range, in lowland mixed dipterocarp and mature secondary to lower montane forests, including limestone forests, up to 1700 m. In Singapore only known from near sea level. The habitat on Pulau Ubin is mature secondary forest with undulating ground interspersed by occasional large granite boulders. The forest canopy is approximately 10–15 m high with several taller trees of up to 25 m. The understorey is generally sparse with small treelets and saplings of mature tree species, mainly of cultivated durian (*Durio zibethinus* L.). The forest floor is covered with a thin layer of leaf litter, contributed mainly by the dominant tree species, with occasional exposure of the clayey soil below. This species was seen growing over an area of about 25 m<sup>2</sup>.



**Fig. 1.** *Ficus subulata* Blume. **A.** Lianescent habit. **B.** Shrubby habit. **C.** Lithophytic habit on a boulder. **D.** Leaves of varying sizes. **E.** Specimen laden with figs of varying sizes. **F.** Figs. **G.** Cross-section of fig showing staminate and short-styled pistillate gall flowers with wasps (dark brown) within. From *Lua et al. SING2021-259*. (Photos: P.K.F. Leong)

*Habit.* *Ficus subulata* was found growing in filtered light, creeping on the forest floor and scrambling in an untidy mess across the surrounding vegetation with its horizontal creeping stem. An occasional stand-alone small shrub has also been seen with figs produced when only about 1 m tall. It was also seen to scramble up a large boulder, rooting on humus and debris accumulated in a trough of the boulder, becoming lithophytic. However, it seems to thrive best as a climber, seen on two large durian trees the trunks of which it seemingly favoured, possibly because of the suitable rough bark that supports its adventitious roots. Its orthotropic stems, varying 1–4 cm in diam., were seen draped around much of the tree trunk (but not of a strangling nature), climbing to about 8 m tall, putting forth lateral plagiotropic branchlets and bearing figs. Occasionally, a whip-like pendent branch with long internodes may be produced, rooting at its nodes and these could, upon contact with a substrate, continue to creep or climb.

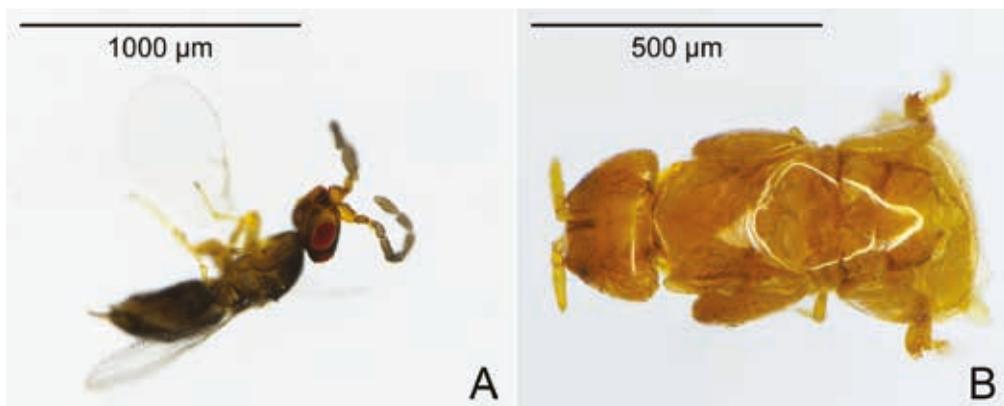
*Etymology.* Latin *subula*, referring to the awl-shaped leaf bud.

*Provisional IUCN conservation assessment.* This widespread species has been assessed as globally Least Concern (LC) following IUCN Standards and Petitions Committee (2019) guidelines. It is assessed here as Critically Endangered (CR/D) in Singapore as only several small patches of plants are found on Pulau Ubin and nowhere else in Singapore but it is a weedy species and the collection locality is fairly well protected so it is likely to spread.

*Specimens examined.* SINGAPORE: **Pulau Ubin:** off Jalan Ubin, 22 Aug 2005, *Ali* SING2020-308 (SING [SING0065726]); Jalan Jelutong, 2 Feb 2011, *Ali* SING2020-151 (SING [SING0164193]); Jalan Batu Ubin, 8 Jan 2020, *Ali & Lua* SING2020-172 (SING [SING0310297]); Jalan Batu Ubin, 5 May 2021, *Lua et al.* SING2021-259 (SING [SING0295062]).

*Notes on morphology.* Amongst the native *Ficus* species, the leaves of *F. subulata* are superficially similar and could be confused with *F. scortechinii* King and *F. rosulata* C.C.Berg, especially the former which several of the past collections from Pulau Ubin were wrongly identified as. The leaves of these two species, however, are somewhat slightly hairy as opposed to the glabrous leaves of *Ficus subulata*. *Ficus rosulata* is sparsely strigulose on the veins while the lamina of *F. scortechinii* is sparsely strigulose to puberulous below. Also, the leaf margins of these two species are sometimes slightly denticulate, especially near the apex. In the forest, they are less easily confused as *Ficus scortechinii* and *F. rosulata* are trees and not lianescent climbers (*F. rosulata* can grow to 20 m tall). The figs of both are cauliflorous rather than the ramiflorous figs of *Ficus subulata*. The figs of *Ficus rosulata* are borne on branchlets on its trunk to 60 cm long and those of *F. scortechinii* are on short woody tubercles near the base of the trunk.

*Notes on pollination and seed dispersal.* We revisited the Jalan Batu Ubin site on Pulau Ubin to study the plant in its natural habitat and the plant specimen *SING2021-259* was collected and vouchered on 5 May 2021. This specimen was collected from a mature lianescent plant that bore figs at the time. When dissected, its syconium exhibited staminate and gall flowers within, indicating that the specimen was collected from a ‘male plant’ of this gynodioecious species (we did not manage to collect a specimen from a female plant). In addition, male and female specimens of a wasp species were found within (Fig. 2). The male wasp measured about 0.7 to 0.8 mm long while the female was almost 1 mm long. Sometimes, a pollinating wasp species is associated with one *Ficus* species but occurrences of two ‘sister’ species of pollinators using the same fig and one wasp species pollinating more than one *Ficus* species are known (Wang et al., 2019). It has also been noted that small figs (syconia) usually have only one pollinator species occupying the available breeding site while larger figs can have more than one pollinator species (Berg & Corner, 2005). The wasp collected was identified as either *Kradibia subulatae* Hill or a closely related species. *Kradibia subulatae* is a known pollinator for *Ficus subulata*. The male or ‘gall fig’ at maturity has a less fleshy wall with a paler colour, generally less attractive to the frugivorous animals, while the female ‘seed fig’ is conversely more fleshy, darker in colour and more attractive at maturity (Berg & Corner, 2005). A study in Lambir Hills National Park in Sarawak found that seeds of *Ficus subulata* are dispersed by squirrels, tree-shrews and birds such as bulbuls and barbets (Shanahan, 2000).



**Fig. 2.** *Kradibia subulatae* Hill. **A.** Female wasp. **B.** Male wasp. (Photos: A, W. Lim & E.H. Yap; B, E.H. Yap)

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