

THE STATUS AND DISTRIBUTION OF *FICUS HISPIDA* L.f. (MORACEAE) IN SINGAPORE

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ABSTRACT. — *Ficus hispida* L.f. (Moraceae), the hairy fig or rough-leaved stem-fig, is unlike most other Singapore *Ficus* species in that it has opposite leaves. It is a pioneer species and commonly found in secondary forest and wasteland vegetation. It was reported to be absent in the south of Peninsular Malaysia but recently recorded in Singapore at the Bukit Timah Nature Reserve, Gambas Avenue, Labrador Nature Reserve, and Pasir Panjang Road. The presence of young plants near fruiting trees in abandoned areas suggests that *Ficus hispida* is capable of reproducing in Singapore. We propose that *Ficus hispida* be categorised as an exotic plant in an early phase of naturalising in Singapore.

KEY WORDS. — *Ficus hispida*, Moraceae, Singapore

INTRODUCTION

Ficus hispida L.f., commonly known as the hairy fig or the rough-leaved stem-fig, is a shrub or tree that can grow up to 15 m tall (Fig. 1). It has hairy twigs and opposite leaves, unlike most other Singapore *Ficus* species which have alternately or spirally arranged leaves. The leaf blades are papery, elliptical with toothed margins (Fig. 2A), and bear prominent veins below (Fig. 2C). At the proximal end of the petiole, there is also a pair of waxy glands. The branches, leaves and syconia are covered in white to brown hairs (Fig. 2B–E).

Ficus hispida is a dioecious species with each individual producing either female syconia that contain female flowers that may develop into single-seeded fruits, or male syconia that contain pollen-bearing and gall flowers. The single or paired syconia are often observed on long, leafless, clustered shoots from the trunk (Fig 3A), even though some syconia



Fig. 1. *Ficus hispida* individuals at the edge of Bukit Timah Nature Reserve: A, tree; B, shrub. (Photographs by: Ong Kwan Han [A] and Lee Si Hui [B]).

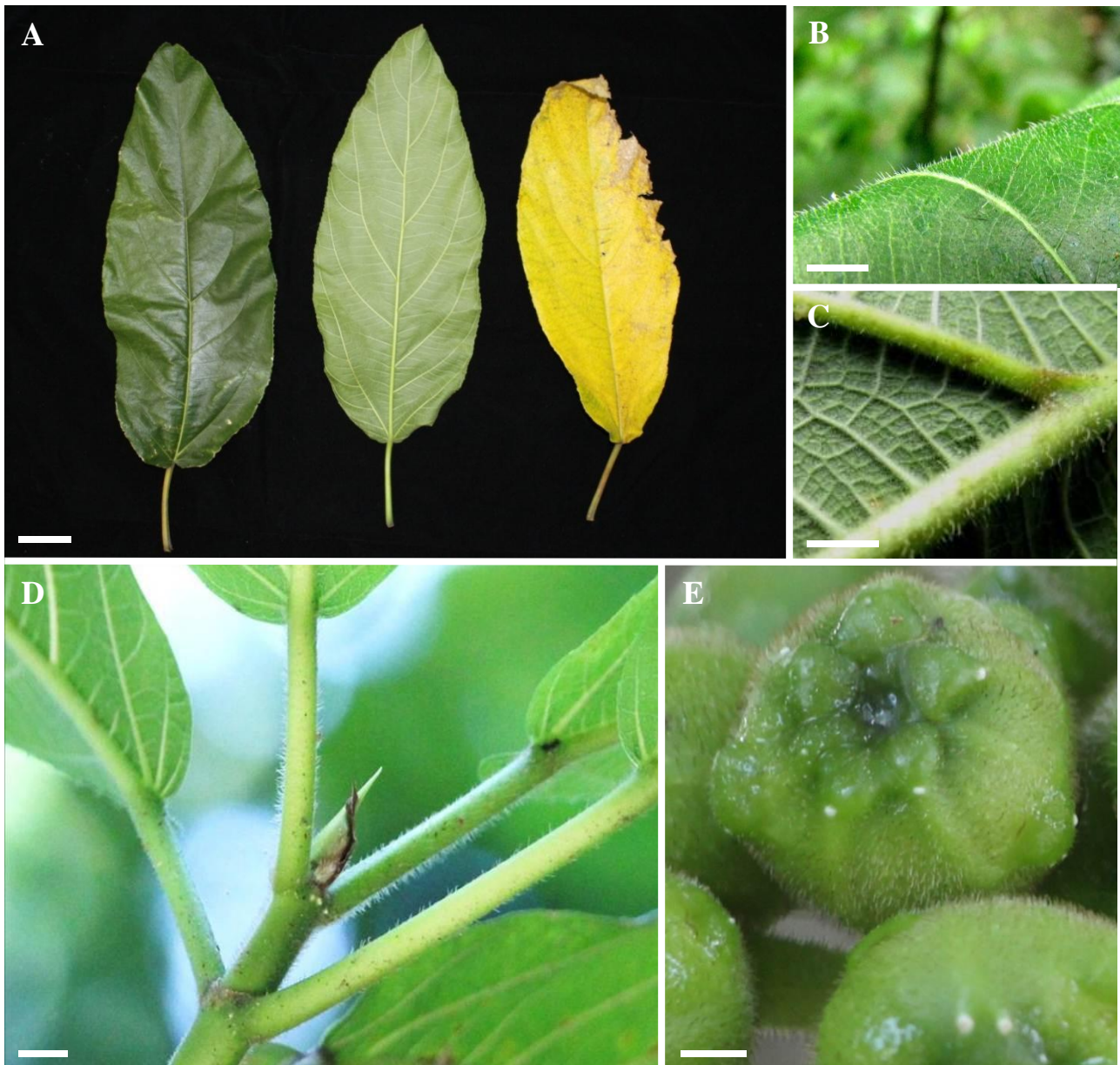


Fig. 2. *Ficus hispida*: A, leaves, from left, top and underside views of leaves, and withered leaf, respectively; B, hairs on upper side of the leaf blade; C, hairs on underside of the leaf blade which has prominent veins; D, withered stipule at the branch tip and circular stipular scars at the nodes as is typical of *Ficus* species; E, hairs on syconia with some droplets of latex from injured parts. Scale bars = 10 cm (A); 0.5 cm (B, C, E), 5 cm (D). (Photographs by: Koh Choon Yen [A], Tony O'Dempsey [B, C], and Lee Si Hui [D, E]).

also occur on the branches (Fig. 3B). *Ficus hispida* fruits throughout the year (Corlett, 2006; Kuaraksa et al., 2012), although individuals experience asynchronous fruiting, such that at any given time period there are both receptive male and female syconia (Patel, 1996). The syconia are continuously produced on the same plant. Both ripe and unripe syconia in various stages can be found on the same branch (Fig. 3A, C). The syconia can grow up to 3.5 cm wide (Berg & Corner, 2005).

The pollinator of *Ficus hispida* is the fig wasp, *Ceratosolen solmsi marchali* Mayr (see Yang et al., 2002). Most male pollinators will dig holes through the gall flower walls containing unhatched females in order to copulate, but a small portion of the males will start digging holes on the fig wall for the females to exit once they emerge (Patel & Hossaert-McKey, 2000). The emerged females crawl over the anthers and collect pollen before exiting the fig to look for other receptive figs (Yang et al., 2002). The females are attracted to the nearby receptive figs by the odour, which has been found to contain linalool and dichloromethane (Song et al., 2001; Chen & Song, 2008).

Male and female syconia of *Ficus hispida* produce different odours during their various developmental stages, but the odours produced at the receptive stage will become alike (Proffit et al., 2008). This chemical mimicry prevents the



Fig. 3. Syconia: A, on long, leafless, clustered shoots from the trunk; B, on leafy branches; C, a cluster of syconia of different ripeness on the same branch. Scale bars = 1 cm. (Photographs by: Lee Si Hui).

female wasps from differentiating between the male or female syconia, so almost half of each batch of fig wasps will enter the female syconia for pollination (Patel et al., 1995; Patel & Hossaert-McKey, 2000; Yang et al., 2002), thus sustaining the fecundity of their host tree. Upon pollination or egg-laying by the fig wasps, the syconia will undergo chemical changes that will make them less attractive to the fig wasps (Song et al., 2001; Hu et al., 2009). The length of time a syconium remains attractive is therefore affected by the number of female wasps that enters it (Hu et al., 2009).

As the syconia ripen from green to yellow after pollination (Fig. 3C), they produce a strong odour which attracts fruit bats (Mammalia: Chiroptera: Pteropodidae), such as the lesser short-nosed fruit bat (*Cynopterus brachyotis*), greater short-nosed fruit bat (*Cynopterus sphinx*), and Leschenault's rousette (*Rousettus leschenaultii*; see Tang et al., 2005; Corlett, 2006; Hodgkison et al, 2007; Tang et al., 2007). While fruit bats may react to the change in brightness of the fruit upon ripening, they rely more on the odour of the ripe fruit to decide on a landing or feeding attempt (Hodgkison et al, 2007). It is likely that fruit bats help in the long-range dispersal of the seeds. However, it has been shown by Tang et al. (2007) that the effect of digestion has little impact on the seed germination rate or percentage for *Ficus hispida*. In addition to fruit bats, plantain squirrels (*Callosciurus notatus*) have also been observed to feed on the ripe syconia on mature trees in Singapore (S. H. Lee, pers. obs.).

Ficus hispida is common in secondary forests, at the edges of swamps, and beside rivers (Berg & Corner, 2005). As a pioneer species capable of surviving in degraded land and drier climates (Yang et al., 2002; Xiang & Chen, 2004; Kuaraksa et al., 2012), it is a good framework species for forest restoration (Elliott et al., 2003). Saplings have been known to produce syconia within three years of planting, and syconium production is year-round (Yang et al., 2002; Kuaraksa et al., 2012), thus it may help to sustain faunal populations through the low-fruited season.

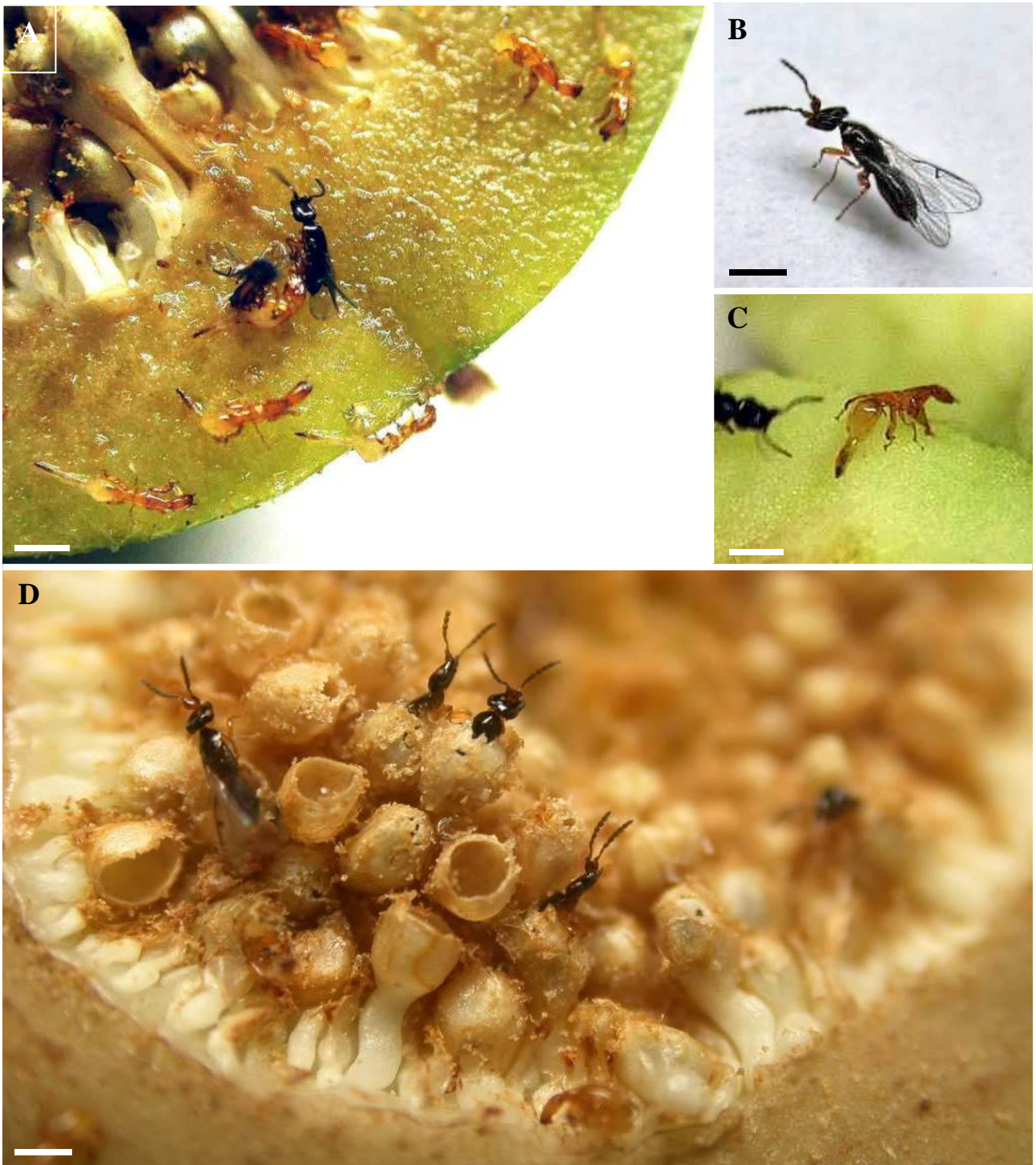


Fig. 4. Fig wasps of *Ficus hispida*: A, male and female fig wasps from mature fig; B, female fig wasps; C, wingless male fig wasp; and D, female fig wasps emerging from the gall flowers. Scale bars = 1 mm. (Photographs by: Angie B. C. Ng).

Ficus hispida is a plant associated with many uses. In India, it is commonly cultivated for its pharmacological properties such as antidiarrheal activity as well as neuroprotective and hepatoprotective effects (Ali & Chaudhary, 2011). It is also used as food fodder for farm animals in Nepal (Ripu et al., 2006). In Thailand, the rough leaves are used in preparing eels for cooking by effectively scraping off their mucilage (Kuaraksa et al., 2012). *Ficus hispida* is distributed from Sri Lanka to India, and from South China across Southeast Asia to Australia (Kochummen, 1978; Corner, 1988; Berg & Corner, 2005).

PAST AND PRESENT RECORDS

There are in total 66 *Ficus* species in Singapore, out of which eight species are presumed nationally extinct, 24 are critically endangered, four endangered, seven common, and 21 exotic (Chong et al., 2009), with *Ficus hispida* having been omitted. In Singapore, it has been found along Gambas Avenue and Pasir Panjang Road as well as at Labrador Nature Reserve, around the edges of Bukit Timah Nature Reserve near Hindhede Nature Park, and along Bukit Drive.

DISCUSSION

The discovery of *Ficus hispida* in Singapore is fairly recent and the earliest herbarium record in Singapore was made in 1999 (Table 1). To date, there are only four localities for which *Ficus hispida* has been found in Singapore, and only a few individuals are present at each site. All localities have faced human disturbance. The current localities, as well as the biogeographical and historical records of *Ficus hispida*, suggest that it is likely an exotic plant that was introduced. Given the many traditional uses of *Ficus hispida*, this species may have once been cultivated in the villages of Singapore, which are now overrun with secondary vegetation (Ng et al., 2005).

Table 1. Previous Singapore collections of *Ficus hispida* L.f. deposited in the Herbarium, Singapore Botanic Gardens (SING).

S/No.	Bar Code No.	Herbarium	Collector	Collector's No.	Year	Locality
1.	0019946	SING	J. Lai	547	1999	Gambas Avenue
2.	0019947	SING	J. Lai	547	1999	Gambas Avenue
3.	0162385	SING	I. Hassan	2011-212	2011	Labrador Nature Reserve

Fig wasps have been observed in the mature syconia of *Ficus hispida* (Ng et al., 2005), and saplings of varying heights were found near mature fruiting trees at both Gambas Avenue and the edge of Bukit Timah Nature Reserve. The presence of fig wasps, the closeness of the saplings to mature trees, and the localities having been abandoned and restricted from cultivation indicate that *Ficus hispida* has been self-reproducing over the years. Patel (1996) suggested that the asynchronous fruiting pattern of *Ficus hispida* allows it to thrive well in humid and aseasonal environments such as that of Singapore, since there are no seasonal limitations on resources for fruiting and reproduction. However, only a small number of new saplings have been observed near mature fruiting trees over the years, despite abundant fruit crops on mature trees. This could be because of the low survival rates of germinated seedlings in the wild, as germinated seedlings are susceptible to fungal infection during wet seasons (Kuaraksa & Elliott, 2013).

Chong et al. (2009) classified exotic plant species as naturalised, casual or cultivated only, depending on the ability to reproduce and form self-replacing populations (naturalised) or to survive outside of human care (casual). As an exotic, self-reproducing species in Singapore, we propose that *Ficus hispida* is in an early phase of naturalising in Singapore.

ACKNOWLEDGEMENTS

We would like to thank the staff of the Herbarium, Singapore Botanic Gardens (SING) and the Herbarium, Raffles Museum of Biodiversity Research, National University of Singapore (SINU), for kindly providing information on *Ficus hispida*. We would also like to thank Alex Yee Thiam Koon for his encouragement and invaluable advice; Chong Kwek Yan for his valuable insights; and Louise Neo, Pham Nguyet Minh, and Koh Choon Yen for their helpful comments and the use of his photograph.

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