

# *Ficus benghalensis*

Indian banyan tree

Moraceae

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## OVERVIEW

*F. benghalensis* is one of about 60 species of *Ficus* that has been introduced to Hawai'i (Wagner et al. 1999). Each *Ficus* species needs a specific pollinating wasp in order to reproduce and spread (Ramirez 1970). The pollinator wasp for *F. benghalensis* is *Eupristina masoni* and has not yet been introduced to Hawai'i, though it has been introduced to Florida, where *F. benghalensis* is now invasive. Other *Ficus* species that have had their wasps introduced are spreading on Maui. These include *F. microcarpa*, *F. macrophylla*, and *F. cf. platypoda* (Wagner et al. 1999, Oppenheimer and Bartlett 2000). These three species are currently invading both disturbed and native ecosystems where they are capable of germinating in native host trees, such as koa (*Acacia koa*) and ohia (*Metrosideros polymorpha*), where they grow as epiphytes, eventually destroying their hosts. The pollinator wasp for *F. benghalensis* and all other *Ficus* species should be prohibited from introduction to Hawai'i to minimize the chance for this species to spread by placing them on the injurious species list.

## TAXONOMY

**Family:** Moraceae (Mulberry family) (Wagner et al. 1999).

**Latin name:** *Ficus benghalensis* L. (Bailey and Bailey 1976).

**Synonyms:** *Ficus indica* L. (Bailey and Bailey 1976).

**Common names:** Indian banyan tree, banyan tree, East Indian fig tree, vada tree (Bailey and Bailey 1976, Neal 1965).

**Taxonomic notes:** The genus *Ficus* is made up of about 1,000 species from pantropical and subtropical origins (Wagner et al. 1999). Plants in the genus are all woody, ranging from trees and shrubs to climbers (Neal 1965).

**Nomenclature:** The tree is named for the Hindu traders, called Banyans, who favored the tree (Neal 1965).

**Related species in Hawai'i:** *F. benghalensis* Cv. 'Krishnae' [syn. *F. krishnae* C. DC.] (Krishna-Bor, Krishna's butter-cup), with cup shaped leaves, is a cultivar of *F. benghalensis* (Bailey and Bailey 1976). About 60 species of *Ficus* have been introduced to Hawai'i for cultivation and reforestation (Wagner et al. 1999).

## DESCRIPTION

"Wide spreading banyan with copious aerial roots. Leaves broadly ovate, obtuse, the base cordate; lamina 10-30 cm long, 7-20 cm wide, very coriaceous, puberulous beneath; lateral veins 5-7 pairs, the basal pair prominent, reaching 1/3 of lamina length; petiole 1.5-7 cm long, 5 mm wide, puberulous; stipules thick, 1-1.5 cm long and wide,

puberulous. Figs paired, sessile, puberulous, depressed-globular, 1.5-2 cm diam., maturing orange to red; ostiole broadly unbonate, enclosed by 3 flat apical bracts; basal bracts 3, foliaceous, obtuse, 3-7 mm long, 10-15 mm wide, puberulous. Male flowers pedicellate; tepals 2 or 3. Female flowers sessile; tepals 3 or 4. Gall flowers pedicellate; tepals 3 or 4." (Chew 1989).

## **BIOLOGY & ECOLOGY**

**Cultivation:** *F. benghalensis* is widely cultivated in the tropics (Bailey and Bailey 1976). It is cultivated in Hawai'i and has not had its associated wasp introduced and therefore has not yet spread from initial plantings. *F. benghalensis* is the world's largest tree in terms of its spread (Riffle 1998) with some old trees covering over an acre of ground. The tree's name "banyan" refers to the merchants who set up shop under the spreading trees (Riffle 1998). One of the most popular banyan trees, *F. benghalensis*, on Maui, located on Front St. in Lahaina, is a meeting place for tourists, artists, children, and folks selling their goods. In addition to the large spreading growth form, trees also have attractive red fruits and aerial roots which hang from limbs.

**Invasiveness:** Though *F. benghalensis* is not invasive in Hawai'i yet due to the absence of its associated pollinator wasp (*Eupristina masoni*), this species is invasive in Florida where the associated pollinator wasp was introduced. In Florida, seedlings were first observed in Miami in 1986 (Stange and Knight 1987) and have since been found on walls and in soil. In Florida, *F. microcarpa* is considered more invasive than *F. benghalensis* (McKey and Kaufmann 1989). *F. microcarpa* is more likely than other invading *Ficus* species to colonize natural habitats in large numbers due to the large number of trees present and the small size of fruit which are taken by a larger number of vertebrates. Though *F. benghalensis* is not widely planted on Maui, there are a few locations, such as Lahaina and Kahului, where there are probably enough trees to support a population of wasps. Should the associated wasp arrive in Hawai'i, there would be the potential for *F. benghalensis* to begin to spread on its own.

*Ficus* species that are known to naturalize in Hawai'i include *F. microcarpa*, *F. macrophylla*, and *F. cf. platypoda* (Wagner et al. 1999, Oppenheimer and Bartlett 2000). These species commonly germinate in other trees, fenceposts, rocks, bridges, buildings, and other unwanted structures, eventually engulfing their hosts. *Ficus* species threaten many natural areas on Maui, including both wet and dry habitat, by germinating on many native host trees such as koa (*Acacia koa*), ohia (*Metrosideros polymorpha*), wiliwili (*Erythrina sandwicensis*), and others, and eventually killing them as they spread. Invasive characteristics include a widespread distribution due to popularity among the public who use the plant for an ornamental, large seed set, the presence of non-native fruit eating birds that spread the seeds, and difficulty in controlling epiphytic plants on native hosts. Should *F. benghalensis* begin to spread on Maui, invasive characteristics would probably be similar to those of other invasive *Ficus* species listed above.

**Pollination:** The fruit (syconium or fig) and reproduction systems of species in the genus *Ficus* are unique. Each species of *Ficus* has an associated species of agaonid wasp (Hymenoptera: Chalcoidea: Agaonidae). *Ficus* species can only be pollinated by their

associated agaonid wasps and in turn, the wasps can only lay eggs within their associated *Ficus* fruit. For successful pollination and reproduction of *Ficus* species to occur, its associated pollinator wasp must be present. Conversely, for successful reproduction of agaonid wasps to occur, their associated *Ficus* species must be present (Janzen 1979). The pollinator wasp for *F. benghalensis* is *Eupristina masoni* Saunders (Nadel et al. 1991).

**Propagation:** *Ficus* species propagate from seed and many can be propagated from cuttings. Trees can begin life as epiphytes on other trees.

**Dispersal:** Plants are initially spread by humans who grow the plant for ornament and use the trees in reforestation. Because the pollinator wasp is not yet present, *F. benghalensis* seeds are not viable. Other species of *Ficus* that do have wasps present are spread by fruit eating birds. Various birds observed by the authors foraging and roosting in *F. benghalensis* trees on Maui include mynah birds (*Acridotheres tristis tristis*), blue faced doves (*Geopelia striata*), lace necked doves (*Streptopelia chinensis*), and house sparrows (*Passer domesticus*).

**Pests and diseases:** Brickell and Zuk (1997) report the following pests associated with *Ficus* species: mealybugs, scale insects, spider mites, root knot nematodes, and thrips occur under most environmental conditions, fungal and bacterial leaf spots, crown gall, twig dieback, and Southern blight.

## **DISTRIBUTION**

**Native range:** *F. benghalensis* is native to India where it grows from low altitudes to 2,000 ft (610 m), especially in dry regions (Neal 1965). Riffle (1998) reports that *F. benghalensis* is native to a wide area of Asia, from India through Myanmar (Burma), Thailand, Southeast Asia, southern China, and Malaysia.

**Global distribution:** *F. benghalensis* is cultivated widely in the tropics and naturalized in almost every wet tropical area of the earth (Riffle 1998). *F. benghalensis* is spreading from cultivation in Miami, Florida, where it has been found on walls and in soils (Nadel et al. 1992). *F. benghalensis* is cultivated in Hawai'i (Neal 1965). In Australia, *F. benghalensis* is reported to be naturalized in northeastern and central Queensland in mixed eucalypt woodland with monsoon scrub species (Chew 1989, PIER 2000). PIER (2000) also reports the distribution of *F. benghalensis* as cultivated in American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, Fiji, French Polynesia, and Kiribati.

**State of Hawai'i distribution:** *F. benghalensis* is cultivated in Hawai'i (Wagner et al. 1999, Neal 1965). The state wide distribution is not certain.

**Island of Maui distribution:** There are about a dozen sites on Maui where *F. benghalensis* is cultivated. One of the most well known sites is in Lahaina on Front St. This *Ficus* is a meeting place for people peddling their wares and is well publicized as an attraction to tourists. The tree is immense, covering about a block, with numerous aerial

roots that stretch down to the ground. Other *F. benghalensis* trees can be observed elsewhere in Lahaina, at the Maui Cultural Center and other sites in Kahului, at the Country Club in Sprecklesville, and at the gulch at Hali'imaile. Most trees are large specimens with many aerial roots.

## **CONTROL METHODS**

**Physical control:** It is uncertain if small seedlings on the ground or as epiphytes can be pulled. Control of *Ficus* species seems daunting. Often, trees will germinate on and grow as epiphytes on other desirable trees, concrete structures, and fenceposts. These are sometimes out of reach or on steep dangerous terrain. Care will need to be taken in order to successfully kill the unwanted *Ficus* while preserving the host. Without control, the host tree or structure is in danger of destruction through strangulation. Control of spreading *Ficus* trees in Hawai'i is just beginning to be explored. In Florida, Nadel et al. (1991) report that trials made in Bermuda of pruning large trees (about 30) during the off season to create a gap in syconial availability were not successful.

**Chemical control:** "Fig trees are particularly sensitive to triclopyr herbicides as a basal or cut-stump treatment. Trees found growing on concrete or rock structures should be treated with herbicide while young to avoid costly structural damage. Use extreme caution when applying herbicide to figs growing as epiphytes to ensure that the poison does not contact the host tree. When exotic figs germinate high in the branches of large trees in natural forest communities, it may be extraordinarily difficult to get close enough to the fig to treat it." (Hammer 1996).

**Biological control:** Nadel et al. (1991) report several pests that could be looked at for biological control potential including various ants which were seen carrying off pollinator wasps from *Ficus* fruits, Hymenoptera and mites that may be parasites of the pollinator wasps, and staphylinids which were seen entering *Ficus* fruits and eating the pollinator wasps.

**Cultural control:** The pollinator wasps should be prevented from entering Hawai'i in order to prevent spread of *F. benghalensis*.

**Noxious weed acts:** None.

## **MANAGEMENT RECOMMENDATIONS**

*F. benghalensis* is currently not spreading in Hawai'i due to the fact that its pollinator wasp has not yet been introduced. There are not a lot of trees present on Maui, but there are probably enough to support a population of wasps should they be introduced. *F. benghalensis* is currently spreading in Florida and it is not known how the wasp arrived. The large size of fruit and small population size may lead to a less invasive nature than that of the globally invasive, *Ficus microcarpa*, though this is not certain. For now, *F. benghalensis* is not spreading and the best way to keep it that way is to prevent the arrival of its associated pollinator wasp.

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