Element Stewardship Abstract

for

Ficus microcarpa

I. IDENTIFIERS

GNAME: *Ficus microcarpa* L.f.

Synonyms : *Ficus retusa* sensu auct., non. L.; *F. nitida* sensu auct., non. Thunb.; *F. retusa* L. var. *nitida* auct. non.

GCOMNAME: Indian Laurel; Chinese Banyan; Curtain Fig; Malay Banyan; Glossy-Leaf Fig

GRANK: None.

GPESTWEED: Category I (Florida Exotic Pest Plant Council, 1995).

EOSPECS: *Ficus microcarpa* became naturalized in Hawaii following the introduction of its pollinator wasp in the early 1920s. It is now present there on most of the larger islands. It was first recorded as naturalizing in south Florida in the early 1970's in Dade County; it has now been documented as an escapee throughout peninsular Florida. It is a large banyan fig which recruits either epiphytically, epipetrically or terestrially in a wide range of habitats. While still not an abundant species, it as a high potential to invade natural communities and alter community structure as one of the few hemiepiphytes in Hawaii and south Florida ecosystems.

DIAGCHARS: Large monoecious evergreen tree, 6-15 m high; usually several trunks developed equally (300-500 mm diameter); large, often near-horizontal branches give tree a span of 16-30 m; often an abundance of aerial roots; leaves arranged alternately and helically; small; lamina elliptical or slightly obovate; obtuse rounded apex usually with short rounded or pointed tip; base acutely tapering; petiole short, 10 mm (8-11) and 1 mm thick; mean leaf size 65 mm (56-71) x 32 mm (28-36); lamina flat and smooth, coriaceous; margin entire; midrib prominent and distinct but lateral veins neither prominent nor distinct (number difficult to assess); cystoliths amphigenous; twigs much divided, smallest ones about 1-2 mm thick; lenticels abundant and prominent; internodes 5-20 mm long; terminal bud stipules long and slender, 10-20 mm long; figs borne in axillary manner, singly or in pairs, in leaf axils; fig stipule very small and lost by the time a fig reaches a diameter of 1-2 mm; figs sessile; globose or slightly subglobose, at all stages, but very young figs may be more obovate, but with a slightly tapering base; ripe figs sized 8-10 mm x 8-10 mm; figs pale green with white spots, becoming pink, red, purple and finally black; most insects emerge at the pale green or pink stages; texture smooth and glabrous; basal bracts well developed triangular structures, persistent; figs appear to sit on top of the bracts, rather than the bracts sitting flush underneath them; male flowers scattered throughout cavity; sessile; filamentous; single but with double anther sacs; perianth of three or four purple cup-shaped tepals which cover the anthers until the final stage of ripening when the filament elongates slightly; gall flowers mostly stalked; perianth usually of three more or less separate tepals, slightly cup shaped, which cover the ovary even to maturity; insect emerges at apex of ovary between the tepal tips; stigma filamentous; style about 0.25 mm long; female flowers mostly sessile; perianth as in gall flower; style 0.6-0.8 mm; seed discoid, or almost subconical in shape; yellow; 1.0-0.9 mm. About 40 male flowers, 150 gall flowers, and 150 female flowers produced. (adapted from Hill 1967).

II. STEWARDSHIP SUMMARY

The old world *Ficus microcarpa* has spread extensively in the new world as a result of cultivation and the subsequent release and spread of its pollinator wasp. It is now known as an escapee in Hawaii, Florida, Bermuda, Mexico, Central America, the Lesser Antilles, Colombia, and Guiana. It is probable that it's numbers will increase in areas where it has escaped, and also will continue to spread to new geographic areas. Its potential impact on natural areas is unknown but as a hemiepiphyte it has the ability to kill host trees and to displace native canopy species.

III. NATURAL HISTORY

GRANGECOM: *Ficus microcarpa* has one of the largest natural ranges of any *Ficus*. It's natural range includes S China, S & SE Asia through Malesia to Australia, Micronesia, the Solomon Islands and New Caledonia.

In Hawaii it is present on most of the main islands (Wagner et. al. 1990). In Florida *Ficus microcarpa* has escaped from cultivation in Broward, Charlotte, Collier, Dade, Hillsborough, Indian River, Lee, Manatee, Martin, Palm Beach, Sarasota, and St. Lucie counties. (G. Gann & K. Bradley, pers. obs.; Wunderlin et. al. 1995; Nadel et. al. 1992; J. Broder, pers. comm.). *Ficus microcarpa* has also been reported as escaped from cultivation in Bermuda, Mexico, Central America, Colombia (McKey 1989), Guiana (Gorts-van Rijn 1992), and several islands in the Lesser Antilles (Howard 1988).

IMPACTS: *Ficus microcarpa* invades a wide variety of ecosystems. It has the potential to displace native canopy species if recruiting terrestrially and kill host plants if recruiting epiphytically.

GHABCOM: In its native range *F. microcarpa* is a tree of humid forests from sea level to at least 1600 m, often near the coast along the edges of mangrove forest. In Hawaii it is primarily an invader in rocky coastal systems including lowland mesic shrubland, lowland mesic forest, lowland wet forest, and lowland wet shrubland (L. Loope, pers. comm.; TNC 1996) and developed areas, particularly irrigation ditches. In Florida *Ficus microcarpa* has been found recruiting in a wide assemblage of ecosystems. Plants have been found recruiting epiphytically on cabbage palm (*Sabal palmetto*), saw palmetto (*Serenoa repens*), wild tamarind (*Lysiloma latisiliquua*), live oak (*Quercus virginiana*), gumbo limbo (*Bursera simarouba*), date palm (*Phoenix* spp.), and other exotic palms both on landscape plants and in natural areas (G. Gann & K. Bradley pers. obs; R. Hammer pers. comm.). Plants have also been seen recruiting terestrially in sand pine scrub, hardwood hammocks, and mesic flatwoods. It also recruits frequently on rock walls and on buildings.

GECOLCOM: The method of pollination in figs is highly specialized. Each species of fig is believed to be pollinated by a specific species of wasp. The pollen laden female wasp enters the syconium, or fig, which is an urn shaped inflorescence which is lined with male and female flowers. Flowers are pollinated as the wasp lays her eggs into the ovaries of the female flowers through the styles. The wasp then dies. The offspring feed within galls in the ovaries until the male flowers mature, when they emerge into the fig chamber. The wingless males emerge first and cut a hole into the galls of the females and inseminate them. One or more males chew through the figs which the females exit after being passively dusted with pollen (Galil & Eisikowitch 1968, 1969). The length of receptivity of the female phase of the syconia has been little studied. Khadari et. al. (1995) found the duration of receptivity in the distantly related *F. carica* and *F. aurea* to be 2 - 3 weeks if unpollinated. Other experiments show that this long period of receptivity may be widespread in *Ficus* (Bronstein 1987, 1988; Patel [unpublished, see Khadari et.al. 1995]). Syconia were also found to remain receptive for several days after visited by a single wasp (Khadari et. al. 1995), allowing other females to enter maximizing fig reproductive success.

The pollinator of *F. microcarpa* is *Parapristina verticillata* (Hymenoptera: Chalcidodea: Agaonidae). It was intentionally released in Hawaii in 1920-1921 as part of a reforestation project (Condit 1969). It was first recorded in Florida in the early 1970's, possibly from Hawaii (Strange & Knight 1987). It appeared in Bermuda, Mexico, and Central America within the last 15 years (McKey & Kaufmann 1991).

For wasp populations to persist the *Ficus* population size must be at or above a critical level. The critical population size of *Ficus natalensis* was estimated at 95 trees for a population of pollinators to persist for 4 years (Bronstein et al 1990). Critical levels of other species have not been estimated. In Florida *F. microcarpa* is a common landscape plant and McKey & Kaufmann (1991) recorded 44 trees in a census of 37.7 km of streets in the Coral Gables area. Also, fig production must occur with low seasonality to insure a year round food supply for wasps (McKey 1989, Bronstein 1989). ***F. microcarpa* is probably one of the world's most widespread figs because of its highly low reproductive seasonality, a population or a tree producing figs of several age classes throughout the year.**

The most detailed observations of the reproductive potential of *Ficus microcarpa* have been made in Hong Kong. Trees did not begin to reproduce until they were approximately 20 years old. Four crops of figs were produced per year, with crops often overlapping, and the largest crop recorded was approximately 100,000 figs (Hill 1967).

Conflicting accounts of frost tolerance exist and may be explained by different genotypes. While some authors have reported high tolerance to freezes, others have recorded that trees suffer greatly from frost (Condit 1969). Bronstein & Patel (1992) report from experiments involving *F. aurea* and *F. citrifolia* in Florida that fig wasps may be the limiting factor in the northern range of *Ficus* species because they may not overwinter easily.

Dispersal of *F. microcarpa* seeds has been found to involve a two-phase dispersal mechanism (Kaufmann et. al. 1995). First, ripe syconia are dispersed by vertebrates (birds or mammals). Many vertebrates in Hawaii and south Florida have the capability to disperse syconia. McKey & Kaufmann (1991) recorded 11 species of birds and one mammal (Gray squirrel, *Sciurus caroliniensis*) consuming syconia in four hours of observation. The following bird species were observed by McKey & Kaufmann:

Common Name	Scientific Name	Family
Wood Warblers (4 spp.)		Parulidae
Mockingbird	*Mimus polyglottus*	Mimidae
White-Crowned Pigeon	*Columba leucocephala*	Columbidae
Blue Jay	*Cyanocitta cristata*	Corvidae
Red-Bellied Woodpecker	*Centurus carolinus*	Picidae
Wood Thrush	*Hylocichla mustelina*	Turdinae
Catbird	*Dumetella caroliniensis*	Mimidae
Boat-Tailed Grackle	*Cassidix major*	Embezeridae

Many other species of native and introduced birds are also likely to consume syconia. After syconia are eaten the drupes pass through the digestive system unharmed. The drupes are then collected by ants which are probably attracted by the lipid-containing exocarp. Two species of ants were observed to collect the drupes in south Florida, *Paratrechina longicornis* and the introduced fire ant (*Solenopsis invicta*) (Kaufmann et. al. 1991). McKey & Kaufmann (1991) in a census on the University of Miami, Coral Gables, Florida, found that the average seedling was found 109 meters from the nearest adult tree (n = 147).

IV. CONDITION

GTHREATCOM: In Hawaii threats have been recorded to the following rare plants: *Bonamia menziesii* (Endangered), *Hedyotis formosa, Exocarpus guadichaudii, Alectryon macrococcus* var. *macrococcus*, and *Claoxylon sandwicensis*. Ecosystems that are threatened include lowland mesic and wet shrubland and forests (TNC 1996). In Florida direct threats to rare native species have not yet been reported. It does, however, threaten many rare natural communities including rockland hammock, pine rockland, and sand pine scrub.

GSTATCOM: In Hawaii *F. microcarpa* is a serious pest only in Kapunakea (Nat. Park?) where it is estimated to infest 2% of the preserve area, although it is probably present on all of the main islands (Wagner et. al. 1990). It is becoming a common species in southern Florida. It is frequently encountered in

a variety of ecosystems as well as developed areas throughout the southern part of the peninsula. It is common in the urbanized areas of Dade county and has been found as far north on the east coast as Indian River County (Gann & Bradley pers. obs.; McKey and Kaufmann 1988; Nadel et. al 1992). It has also been observed in Collier, Lee, Charlotte, Manatee, Sarasota, and Hillsborough counties on the west coast (Gann & Bradley pers, obs.; Nadel et. al. 1992; Wunderlin et. al. 1995).

V. MANAGEMENT/MONITORING:

MGMT.PROG: The Metro-Dade County Parks and Recreation Department has successfully killed *Ficus microcarpa* using basal bark treatments of Garlon-4 with Penevator. In Bermuda attempts have been made to extirpate pollinators by pruning fig bearing trees. This attempt failed, probably because of the difficulty in finding every fruiting tree (McKey 1989; Nadel et al. 1991). Nadel et al. (1991) suggested that control efforts should be focused on finding antagonistic organisms which also inhabit figs.

MONIT.PROG: In Hawaii photo and quantitative monitoring is underway at Kapunakea (TNC 1996.) No formal monitoring is being conducted on the spread of *F. microcarpa* in Florida.

In south Florida seedlings have been found in cabbage palms (*Sabal palmetto*)adjacent to the Fakahatchee Strand State Preserve and Big Cypress National Preserve (G. Gann & K. Bradley pers. obs.). These preserves contain extensive forests dominated by cabbage palms. It is likely that these areas have been infested but are very difficult to reach by foot. It is necessary that these areas be surveyed to determine the extent of the infestation so that it can be managed before populations become larger.

VI. RESEARCH

GRSRCHNEED: Among global research needs the search for fig inhabiting antagonists could prove very useful. Since fig wasps may be very difficult to eradicate by chemical or mechanical means, and since *F. microcarpa* is such a well established landscape plant in many regions, finding an antagonistic organism to the fig wasp may be the most successful control method. Nadel et. al. (1992) report that many Hymenoptera, mites, and nematodes are probably parasites of agaonids. Other species compete for food resources within the syconia

VIII. INFORMATION SOURCES

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IX. DOCUMENTATION & MAINTENANCE

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