Department of **Agriculture and Fisheries**
Biosecurity Queensland

Mexican bean tree

Cecropia spp.

Steve Csurhes

First published 2008
Updated 2016

Queensland Government

Contents

Identity and taxonomy

Taxa: *Cecropia* spp.

Common names: Snakewood, pumpwood, trumpet tree, wild pawpaw, tree of sandpaper (English); embauba, imbauba, bois trompette, grayumbe, grayumbo, trompette, yagruma, akowa, chancarpo, guarumbo, hormigo, hormiguillo, snakewood tree, pop-a-gun, tree-of-laziness, trompetenbaum, yaluma, ambiabo, ambai, palo lija (Central/South American).

Taxonomy: *Cecropia* (Moraceae: Cecropiaceae) comprises about 75 species (Mabberly 1987). The taxonomy of the genus is unclear, with many synonyms published for each species. For example, recent taxonomic work suggests that *C. peltata* L. (central America), *C. pachystachya* Trécul (South America) and *C. concolor* Willd (Amazon Basin) should be regarded as part of the *C. peltata* complex as they have strong morphological similarities. This is despite the fact that these species have somewhat distinct geographical and/or ecological ranges (Binggeli 1999). Similarly, *C. schreberiana* Miq. was recently distinguished from *C. peltata* L. (Howard 1988) and only recent publications use the new name.

The only known naturalised specimens of *Cecropia* in Queensland were detected on a single property near Mission Beach, North Queensland. These plants were destroyed as soon as they were found and, as a consequence, flowers could not be collected to obtain a formal identification to species level.

Description

Cecropia is the archetypal genus of neotropical pioneer trees found throughout tropical America (Brokaw 1998). They are rapidly growing trees, usually 10–20 m tall, but they can grow up to 25 m. Maximum stem diameters (dbh) of 60–75 cm have been recorded (Brokaw 1998). When growing in full sun, *Cecropia* can reach 20 cm dbh within four years (Scatena et al. 1996). *Cecropia* have distinctive hollow stems and large leaves resembling those of a paw-paw (Figure 1). Leaves are arranged alternately along the stems.

Figure 1. Leaf of unidentified *Cecropia* sp.

Two of the most commonly cultivated species are *C. palmata* and *C. peltata*. Descriptions of these species are provided below.

Leaf blades of *C. palmata* are 10–50 cm wide and usually 9–15-lobed. The lobes occasionally have several lateral lobes. The upper leaf-surface is scabridulous and sparsely arachnoid pubescent, while the lower surface is very pale to nearly white, minutely and usually densely puberulent. The silvery leaf undersides are conspicuous from a distance on windy days. Petioles are usually 23–30 cm long and stipules 7–11 cm long. The bark is smooth and grey with triangular leaf scars evident on younger branches. The wood is soft, weak and lightweight with a low specific gravity of 0.29 (Little & Wadsworth 1964). Stilt roots may descend from about 1 m up the trunk. The inconspicuous, yellow, staminate flowers are arranged in umbellate clusters of spikes (10–) 12–18 cm long in clusters of 3–9, spathes (11–) 12–20 cm long, 0.3–0.4 cm in diameter; pistillate flowers in spikes 17–30 cm long, ca. 0.5 cm in diameter at anthesis, enlarging to 0.6–0.9 cm in diameter in fruit, the spikes in clusters of 2–4, spathes 16–20 cm long, outer face usually arachnoid pubescent, inner face villous (Figure 2). The fruit is cylindrical, ovoid to oblong-ovoid, somewhat flattened, 3.3–3.7 mm long, with soft, sweet flesh around many small seeds (Wagner et al. 1999).

Figure 2. Unopened flowers of unidentified *Cecropia* sp. (photo: DPI&F).

C. peltata is often confused with *C. palmata*, which has leaves divided almost to the base (as opposed to a third of the way in) and longer fruits. *C. peltata* has leaves divided only halfway to the base, staminate spikes in clusters of 12–50, and pistillate spike less than 12 cm long when fully expanded (Wagner et al. 1999).

In most of their native range *Cecropia* are inhabited by stinging ants, which are thought to protect the trees from herbivory; however, in Puerto Rico and Hawaii, where ants are not associated with the species, trees still thrive. *Cecropia* are known to coppice freely following cutting (Binggeli 1999).

Phenology and seed production

Cecropia are dioecious and become sexually mature in 3–5 years (Binggeli 1999). *C. schreberiana* has been recorded to flower as early as 3.3 years of age in permanently open, sunny areas such as roadsides, but flowers later (as early as 5.6 years) in forest gaps where light is reduced (Silander 1979; Silander & Lugo 1990). The flowers are wind-pollinated (McCormick 1995) and produce about 18% viable seeds. On female plants, the minute one-seeded fruits form large clusters which take about 1 month to mature. Each spike contains approximately 800 viable seeds. Each seed is about 2 mm long and weighs 1.6 mg (Binggeli 1999).

In Costa Rica, flowering and fruiting are seasonal, lasting about nine months, with a peak of four months during the early part of the wet season (Binggeli 1999). *C. peltata* has a lifespan of 20–30 years (Bingelli 1999). Over a reproductive lifetime a female tree could produce nearly 38 000 000 flowers (using 30 years for longevity) and 6–7 million viable seeds (Silander 1979, Silander and Lugo 1990). At one point in time, Silander (1979) estimated that a population of *Cecropia* growing in the rainforests of Puerto Rico produced 731 seeds/m^2 of forest floor. This enormous seed production results in a massive soil-stored seed bank, which germinates only after cyclone-damage to the rainforest canopy (on average every 30–50 years).

Dispersal and seed longevity

In Trinidad, fruit bats eat large quantities of *Cecropia* fruits and are the main seed disperser, although birds also distribute the seeds. In Costa Rica, a similar amount of fruits are consumed during the day, mainly by monkeys, and at night by bats and arboreal mammals. Leck (1972) counted 20 bird species, including six migrant species, visiting *Cecropia* in the rainforests of Puerto Rico. Low (2004) commented that in Central America the plant's fruits are 'magnets for toucans, tanagers, woodpeckers and other birds'. Fruit bats have been observed feeding on fruits of *Cecropia* each night in North Queensland (M Puckey, pers. comm. 2004). Studies on seeds of *C. peltata* have shown that passage through the digestive tracts of birds may enhance germination (Olson & Blum 1968) and that passage through bats definitely does (Fleming & Heithaus 1981). *Cecropia* seeds can be dispersed by bats up to several kilometres from a source tree (Fleming & Heithaus 1981). *Cecropia* seeds are also dispersed by flowing water. In Central America, seedlings have been observed to emerge along riverbanks after annual flooding. Seeds are also likely to be transported as a contaminant of soil taken from beneath canopies of *Cecropia*.

Studies in Puerto Rico have found soil-seed banks of up to 409 *Cecropia* seeds/m^2, 3–5 cm deep in the soil (Silander 1979). In another study, both landslide and forest soil samples were dominated by seeds of *Cecropia* (Guariguata 1990). Seeds in moist peat in the laboratory remained viable for at leastsix months, and those on the forest floor remained viable for 2–3 months (Silander 1979). Germination is associated with removal of the forest canopy (i.e. increased light and temperature on the forest floor) and is negatively associated with litter and saturated soil (Bell 1970; Devoe 1989; Guzman-Grajales & Walker 1991; Everham et al. 1996). While seeds are relatively short-lived, the soil seed-bank is constantly replenished from above, so that at any point in time there are substantial quantities of viable seed in the soil.

In North Queensland, sections of the plant's stem that were cut and dropped onto the ground produced roots at the nodes. These presumably would be capable of transportation and continued development.

Distribution

An unknown number of *Cecropia* specimens were given away or sold by a private plant collector, possibly the original importer, in North Queensland, c. 20 years ago. Some of these were planted by another collector at El Arish near Mission Beach. To date, the only naturalised specimens of *Cecropia* in Queensland were from the latter site and all plants have been destroyed (Figure 3). Other garden specimens almost certainly exist elsewhere since the genus is well known by professional plant importers. For example, garden specimens have been found in Mackay, Cairns and Brisbane.

Figure 3. Unidentified *Cecropia* sp. growing on the margin of rainforest near Mission Beach.

Origin

Cecropia are native to Central and South America and the West Indies, but have naturalised in parts of Africa, Malaysia and the Pacific (Figures 4, 5 and 6).

The three subspecies of the *C. peltata* complex are distributed as follows: *C. peltata* in Central America, northern South America and some Caribbean islands, *C. pachystachya* from central and eastern Brazil to northern Argentina and *C. concolor* in the Amazon basin. In the rainforests of Puerto Rico, *C. schreberiana* (= *C. peltata*) is one of the most abundant trees. In many parts of its range, its abundance has increased following human-related disturbance.

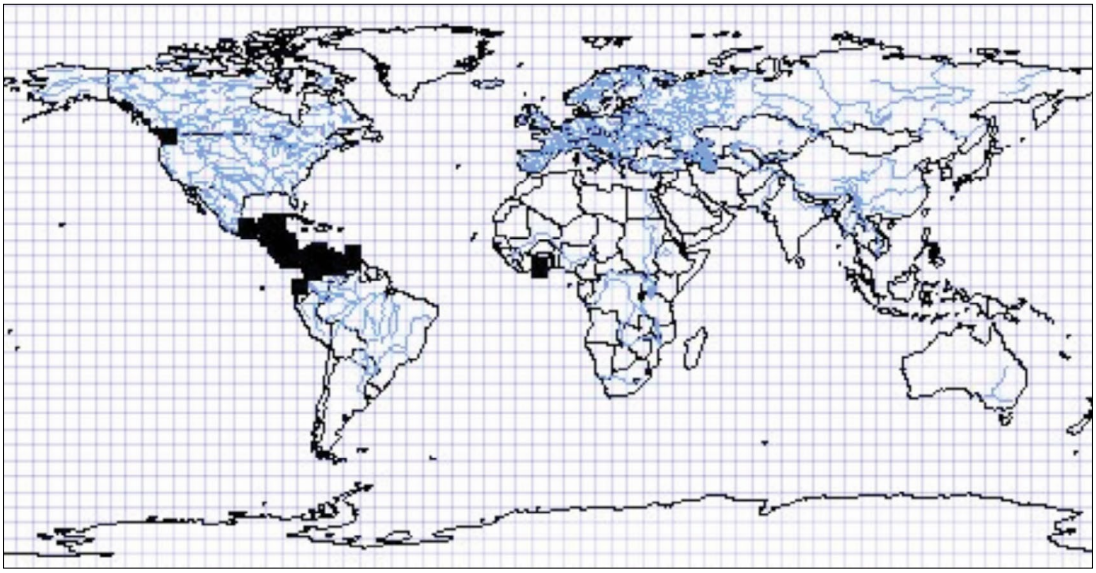

Figure 4. Global distribution of *C. peltata* (Missouri Botanical Gardens w³ database 2004).

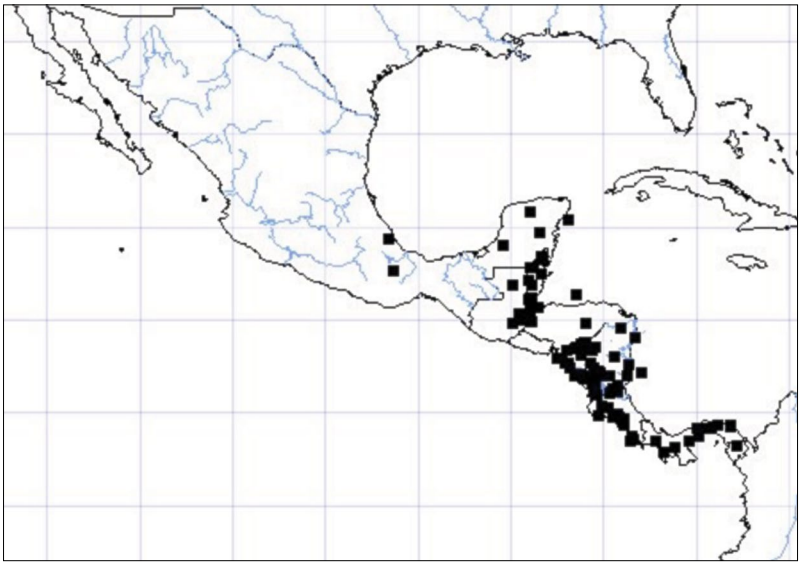

Figure 5. Central American distribution of *C. peltata* (Missouri Botanical Gardens w³ database 2004).

Figure 6. South American distribution of *C. peltata* (Missouri Botanical Gardens w³ database 2004).

Preferred habitat and climate

Cecropia are short-lived, quick-growing, shade-intolerant, pioneer species that dominate early successional habitats in tropical and subtropical rainforests (Brokaw 1998; Binggeli 1999). They have a clear preference for disturbed sites within rainforests, wherever the forest canopy has been damaged to allow full sunlight onto the forest floor. All 108 trees in transect studies in the rainforests of Puerto Rico were growing in full sun, either in forest gaps or along roadsides (Silander 1979). Seedlings are especially light-demanding (Silander & Lugo 1990). *C. schreberiana* (syn. *C. peltata*) is among the 10 most abundant tree species in the tropical rainforests of the Luquillo Mountains in Puerto Rico, where its dominance is maintained by regular disturbance caused by hurricanes (Brokaw 1998). The population of *Cecropia* trees in Puerto Rico is literally rejuvenated every 30–50 years by hurricane disturbance, then matures and senesces until disturbance restarts the cycle. The Luquillo Mountains rise to 1000 m with prevailing winds coming off the ocean, 5 km to the east. Annual rainfall is 3537–4849 mm and average monthly temperatures at lower elevations range from 23.5–27 °C from January to September. The soils are acidic, leached clays and silty loams derived from igneous rocks. The climate, soils and topography of this region are comparable to the eastern slopes of the Wet Tropics region of North Queensland. In addition to habitats within large tracts of rainforest, *Cecropia* are abundant pioneer species along roadsides, creek banks and other disturbed, open sites in tropical America (Brokaw 1998).

Status as a weed in other states

Cecropia have not been recorded as weeds in other Australian states or territories.

History as a weed overseas

In tropical America, where *Cecropia* are native, several species have become abundant in response to increasing disturbance caused by agricultural development. Some species are common weeds along roadsides, abandoned crop lands (e.g. corn fields) and other heavily disturbed sites in Yucatan Mexico and Guatemala (Low 2004). Low (2004) commented: 'I saw *Cecropia* everywhere I went (in Guatemala and Yucatan Mexico) … along with leucaena it was the most common roadside weed I saw'. Similarly, G Viviansmith (NRM&E) has also seen *Cecropia* first-hand in Central America and commented: 'They include some of the most abundant and rapidly growing pioneer species in disturbed areas. Although *Cecropia* often grows in mixed stands, it is also found growing in pure stands.' (G Viviansmith 2004, pers. comm.). *C. peltata* is abundant in open areas and in logged and natural forests throughout Puerto Rico and is generally considered a weed tree (Binggeli 1999).

Randall (2002) listed the following nine species of *Cecropia* as weeds overseas:

Species	Weed history
C. adenopus Mart. Ex Miq.	Brazil (Holm et al. 1979)
C. ferreyrae Cuatr.	Peru (Holm et al. 1979)
C. juranyiana Alad. Richt.	Peru (Holm et al. 1979)
C. lyratiloba Miq.	Peru (Holm et al. 1979)
C. obtusifolia Bertol.	Florida, Hawaii and Raratonga (PEAR 2003).
C. pachystachya Trecul.	Brazil (Lorenzi 2000).
C. palmata Willd.	Florida (Randall 2002)
C. peltata L.	Hawaii, Dominican Republic, Honduras, Jamaica, Trinidad (Holm et al. 1979), Malaysia, Singapore, French Polynesia, Cameroon, Puerto Rico and the Ivory Coast (Binggeli 1999, PIER 2003).
C. tessmannii Mildbr.	Peru (Holm et al. 1979)

C. peltata was planted in a forestry plot in Malaysia in the 1950s and is now one of the most common colonising trees along roadsides and under nearby pine plantations (Low 2004). Two botanists studying it, Putz and Holbrook, concluded: 'There is every reason to believe *Cecropia* will become an important species in the logged and otherwise perturbed forests that now characterise much of Peninsula Malaysia.' In Malaysia, native pioneer species regenerate in smaller forest gaps, produce larger seeds, grow slower in full sunlight and suffer from higher leaf loss rates compared to *C. peltata* (Binggeli 1999).

In Hawai'i, *C. obtusifolia* (Syn. *C. palmata*) has naturalised in pastures and disturbed low elevation wet forest where it has formed dense stands that seriously impede growth of other plants (Smith 1985; Wagner et al. 1999). On the eastern side of the Big Island of Hawaii, *Cecropia* is common from sea level up to 300 m elevation (Wetterer 1997). It is also invasive in French Polynesia (Tahiti), where it is widely established in forests to several hundred metres elevation (PIER 2003) and on Rarotonga, Cook Islands (McCormack 2000; Space & Flynn 2000).

C. peltata was introduced to a number of botanical gardens in Cameroon, Zaire (Eala, 1911) and Java (Bogor). In 1953 a trial plot was set up in Malaysia and the species was introduced to the Ivory Coast in 1910 as a shade tree in coffee plantations. Since the Eala and Bogor material originated from Brazil they would, therefore, appear to be *C. pachystachya*, whereas the identity of the Cameroon and Ivory Coast plants is unclear as their origin is unknown (Binggeli 1999). In the three African regions where *C. peltata* was introduced, the species has been spreading in disturbed areas and appears to be displacing or at least competing with an ecologically equivalent tree *Musanga cecropioides* R. Br. ex Tedlie. Both trees are taxonomically related and morphologically similar (Binggeli 1999). *C. peltata* appears to grow faster and is more commonly found on exhausted agricultural soils. It also colonises old lava flows on Mount Cameroon. Along roadsides, pure stands may be encountered. In most regions, the tree started to spread soon after introduction. However, in the Ivory Coast, the rate of spread was very slow for the first six decades and accelerated substantially following destruction of most the forest cover by human activity (Binggeli 1999).

Useful characteristics

Some species, such as *C. palmata* and *C. peltata*, are cultivated as garden ornamentals (Bodkin 1990). Indian tribes in the Amazon use *Cecropia* for its anti-inflammatory properties. The leaf is made into a tea and used widely for asthma and other upper respiratory complaints, as well as for diabetes. In herbal medicine systems, *Cecropia* is used widely throughout Central and South America. The light wood is used to make matchsticks, boxes and crates, interior boarding and paper pulp. Hollow branches and trunks are used to make floats, gutters and trumpets. The leaves, latex and bark are used for a range of medicinal remedies, many of which have not been proven clinically (Binggeli 1999). The range of benefits offered by *Cecropia* provides an incentive for people to import these species into Queensland. The continued development of the internet means that more people are gaining quick and easy access to sites that promote species such as *Cecropia* and also offer seeds for sale.

Pests and diseases

C. peltata is attacked by *Historis* spp. and various moth species (Binggeli 1999). Sometimes the tree is extensively defoliated in Cameroon (Binggeli 1999). No other information on pests and diseases could be found.

Pest potential in Queensland

Based on the available literature, most, if not all, species of *Cecropia* appear to have the potential to become significant weeds within Queensland's Wet Tropics rainforests and probably subtropical rainforests in coastal, south-east Queensland. Habitats at risk within these regions include:

- any area of rainforest where the canopy is occasionally 'opened up' by cyclones
- poorly managed pastures
- neglected farmland and fruit orchards
- roadsides
- margins of rainforests
- stream-banks.

Queensland's Wet Tropics region has fertile soils and a tropical climate that is very similar to parts of Central and South America, where a number of *Cecropia* species are dominant early successional species. These species are shade-intolerant, opportunistic, early successional plants that prefer full sun. As such, they are not expected to become significant pests within tall rainforest, unless the canopy is damaged or destroyed. For example, *C. schreberiana* (syn. *C. peltata*) is documented to regenerate freely as soon as open areas are formed within standing tropical rainforest (Brokaw 1998; Binggeli 1999). In natural forests it only becomes established in large gaps and often fails to reach sexual maturity in gaps ‹150 m^2 (Binggeli 1999).

There seems little doubt that any *Cecropia* plants cultivated within either the Wet Tropics region or subtropical rainforests of southern Queensland will spread rapidly and invade suitable habitats nearby. All species of *Cecropia* produce large numbers of seeds that are readily dispersed by a range of birds and fruit bats.

References

Bell, CR (1970), 'Seed distribution and germination experiment', pp. D177-D182 in HT Odum & RF Pigeon (eds), *A tropical rain forest: a study of irradiation and ecology at El Verde,* Puerto Rico, National Technical Information Service, Springfield, VA.

Binggeli, P (1999), *Cecropia peltata* L. (Cecropiaceae). http://members.lycos.co.uk/WoodyPlantEcology/docs/web-sp3.htm?

Bodkin, F (1990), *Encyclopaedia botanica*, p. 230, Cornstalk Publishing.

Brokaw, NVL (1998), '*Cecropia schreberiana* in the Luquillo Mountains of Puerto Rico', *The Botanical Review* 64(2): 91–120.

Devoe, NN (1989), *Differential seeding and regeneration in openings and beneath closed canopy in subtropical wet forest*, PhD thesis, Yale University, New Haven.

Everham, EM, Myster, RW & VanDeGenachte, E (1996), 'Effects of light, moisture, temperature and litter on the regeneration of five tree species in the tropical montane wet forests of Puerto Rico', *American Journal of Botany* 83: 1063–8.

Fleming, TH & Heithaus, ER (1981), 'Frugivorous bats, seed shadows, and the structure of tropical forests', *Biotropica* 13: 45–53.

Guariguata, MR (1990), 'Landslide disturbance and forest regeneration in the upper Luquillo Mountains of Puerto Rico', *Journal of Ecology* 78: 814–32.

Guzman-Grajales, SM & Walker, LR (1991), 'Differential seedling responses to litter after hurricane Hugo in the Luquillo Experimental Forest, Puerto Rico', *Biotropica* 23: 407–13.

Holm, LG, Pancho, JV, Herberger, JP & Plucknett, DL (1979), *A geographical Atlas of world weeds*, Krieger Publishing Company, Florida.

Leck, CF (1972), 'Observations of birds at *Cecropia* trees in Puerto Rico', *Wilson Bull,* 84: 498–500.

Little, EL & Wadsworth, FH (1964), 'Common trees of Puerto Rico and the Virgin Islands', *Agriculture Handbook* No. 249, USDA Forest Service, Washington, DC.

Low, T (2004), 'Spotlight on Cecropia', *Ferald Herald: Newsletter of the Invasive Species Council*, vol. 1(6): 1–2.

Mabberly, DJ (1987), *The plant book: a portable dictionary of the higher plants*, Cambridge University Press, Cambridge.

McCormack, G (2002), Cook Islands Natural Heritage Project database, Cook Islands Natural Heritage Project.

McCormick, JF (1995), 'A review of the population dynamics of selected tree species in the Loquillo Experimental Forest, Puerto Rico', pp. 224–257, in AE Lugo & C Lowe (eds), *Tropical forests: management and ecology*, Springer-Verlag, Berlin.

Olson, SL & Blum, KE (1968), 'Avian dispersal of plants in Panama', *Ecology* 49: 565–66.

PIER (2003), *Cecropia peltata*, Global Invasive Species Database, Pacific Island Ecosystems at Risk (PIER), www.invasives.org/database/

Randall, RP (2002), *A global compendium of weeds*, p. 66, RG & FJ Richardson, Melbourne.

Scatena, FN, Moya, S, Estrada, C & Chinea, JD (1996), 'The first five years in the reorganisation of above-ground biomass and nutrient use following hurricane Hugo in the Bisley Experimental Water-sheds, Luquillo Experimental Forest, Puerto Rico', *Biotropica* 28: 424–40.

Silander, SR (1979), *A study of the ecological life history of Cecropia peltata L., an early secondary successional species in the rain forest of Puerto Rico*, MS thesis, University of Tennessee, Knoxville.

Silander, SR & Lugo, AE (1990), '*Cecropia peltata* L. Yagrumo hembra, trumpet tree', pp. 244–49, *Silvics of North America*, *vol. 2: Hardwoods*, Agricultural Handbook 654, US Department of Agriculture, Washington DC.

Smith, Clifford W (1985), 'Impact of alien plants on Hawai'i's native biota', p. 187, in Charles P Stone & J Michael Scott (eds), *Hawai'i's terrestrial ecosystems: preservation and management*, Cooperative National Park Resources Studies Unit, University of Hawaii, Manoa.

Space, JC & Flynn, T (2002), Report to the Government of the Cook Islands on invasive plant species of environmental concern, USDA Forest Service, Honolulu.

Wagner, WL, Herbst, DR & Sohmer, SH (1999), *Manual of the flowering plants of Hawai'i*, p. 530, revised edition, University of Hawai'i Press, Honolulu.

Wetterer, JK (1997), 'Ants on *Cecropia* in Hawaii', *Biotropica* 29: 128–32.