Hura crepitans L. Sandbox, molinillo, jabillo

SO-ITF-SM-38
November 1990

Euphorbiaceae Spurge family

John K. Francis

Hura crepitans L., known as sandbox, molinillo, and jabillo, is a large tree of the West Indies and South America. Although sandbox has a spiny trunk (fig. 1) and poisonous latex, it is planted as an ornamental and shade tree for its pleasing form (fig. 2) and dark-green foliage. The strong, light-weight wood has a number of uses in general carpentry.

HABITAT

Native Range

The native range of sandbox extends from Costa Rica to southern Brazil and Amazonian Bolivia. The species also grows throughout the Greater and Lesser Antilles (fig. 3), (*13, 19*). Thus, the range extends from 24° N. to about 19° S. latitude. Sandbox is listed as a member of a native plant community in Barbados (*8*) and is probably native there. The species has been regarded both as exotic (*13, 23, 33*) and as native to Puerto Rico (*18, 19*). Herbarium specimens from Puerto Rico were examined by Linnaeus in 1753 (*33*), but sandbox is not a member of any native plant community existing in Puerto Rico today. It is possible that it was taken to Puerto Rico by Spanish settlers or native people in pre-Columbian times. Sandbox is cultivated in Hawaii (*24*), Florida, California, the Bahamas, and the Dutch West Indies (*19*) and is planted widely in the Old World tropics. It has naturalized in West Africa (*30*).

Climate

Sandbox is generally confined to regions with constantly warm climates. Mean annual temperatures in its natural range vary from 25 °C in the Caribbean Islands to 28 °C in South America. Monthly means range from 22 to 28 °C in the Caribbean Islands and vary little in the Amazon Basin. Frosts do not occur within the natural range of the species.

Sandbox requires ample rainfall or ground water in the root zone. In Puerto Rico, at least 1500 mm of well-distributed annual precipitation is required in areas where no ground water is available to sustain the trees.

Soils and Topography

Sandbox is usually found on soils that are rich in mineral nutrients. It can tolerate soil acidity to a pH of at least 5.0; the upper limit of pH tolerance probably reaches 8.0 (author, personal observation). Sandbox must have moist soil (*17*). In Puerto Rico, development is best on sandy loam soils (*16*) and alluvial floodplains (*12*), but sandbox also grows on poorly drained clay flats (author, personal observation). Where sufficient moisture is available, the species may be found on rolling hills adjacent to the coastal plain in Puerto Rico. In Surinam, sandbox is locally dominant on low ridges

Figure 1.—*Spiny trunk of a sandbox tree* (Hura crepitans).

John K. Francis is research forester at the Institute of Tropical Forestry, U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Río Piedras, Puerto Rico 00928, in cooperation with the University of Puerto Rico, Río Piedras, Puerto Rico.

Figure 2.—*Large sandbox tree* (Hura crepitans) *growing in Puerto Rico.*

Figure 3.—*Native or naturalized range of sandbox trees* (Hura crepitans) *in the Neotropics.*

in marshy, usually brackish areas (*14*). In Costa Rica, sandbox grows on slopes and alluvial soils in the tropical dry and tropical moist life zones (*11*). In Venezuela, however, it does not occur in dry forests (*5*). The species grows at elevations ranging from sea level to 1,000 m (*16*).

Associated Forest Cover

Sandbox sometimes forms pure stands in Surinam and Trinidad (*17*). In an area classified for intensive forest management in the Palcazu Valley of Peru, sandbox was associated with *Pouteria* spp., *Inga* spp., *Schizolobium parahybum* (Vell.) Blake, *Pithecellobium* spp., *Enterolobium* spp., *Parkia pendula* Benth., *Matisia codata* H. & B., *Cedrelinga catenaeformis* Duke, and *Eschweilera* spp. (*32*). On alluvial flatlands near Playa Naranjo, Costa Rica, sandbox grows in association with *Brosimum alicastrum* Sw., *B. guianense* (Aubl.) Huber, *Licania arbora* Seemann, *Manilkara zapota* (L.) v. Royen, and *Terminalia oblonga* (R. & P.) Stend. (*12*). Gully floors in Barbados support sandbox along with *Ceiba pentandra* (L.) Gaertn., *Chlorophora tinctoria* Gaud., *Citharexylum spinosum* L., *Sapium hippomane* Mey., *Cecropia peltata* L., *Inga laurina* (Sw.) Willd., *Spondias mombin* L., and *Bursera simaruba* (L.) Sarg. (*8*). In a similar habitat in St. Kitts, sandbox grows in association with *Samanea saman* (Jacq.) (*2*). The naturalized habitat of sandbox in Puerto Rico supports native and exotic trees including *Peltophorum inerme* (Roxb.) Naves, *Cassia siamea* Lam., *Andira inermis* (W. Wright) H. B. K., *Calophyllum brasiliense* Camb., *Albizia procera* (Roxb.) Benth., and *Erythrina glauca* Willd. (author, personal observation).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—This monoecious tree bears clusters of red male flowers at the ends of branches and small, single, red female flowers on twigs (*17, 19, 34*). Precocious flowering of seedlings has been reported (*10*). Flowering takes place during several months each year; the time of year is somewhat variable depending on the environment. The 6- to 9-cm diameter fruits look like little pumpkins (fig. 4) and mature about 3 months after flowering (*6, 19*). In Haiti fruits mature during the late rainy season or the following dry season (*16*). Individual trees bear from a few to more than 100 fruits.

Seed Production and Dissemination.—Each fruit contains about 15 cells with one large seed per cell (*34*). The cells of the capsules are separated by septa that act as compressed springs. When the fruits are sufficiently dry, they crack and fly apart violently, and the seeds are scattered (*19*). The individual seeds may be thrown 8 m or more (author, personal observation). The seeds are flat, 2.0 to 2.5 cm across, and have a hard, leathery testa (*17*). They float and can be spread by flood waters. Thirty-eight air-dry seeds collected in Puerto Rico weighed an average of 1.35 ± 0.03 g per seed (author, personal observation).

Seedling Development.—Germination is epigeous. A sample of seeds in Venezuela germinated in 17 to 37 days from sowing with an 86-percent success rate (*27*), and a sample of seeds from Puerto Rico germinated in 6 to 17 days with 72-percent success (author, personal observation). The shoots from germinating seeds elongate to about 12 cm in height before the cotyledons open. True leaves are soon produced, and growth proceeds rapidly.

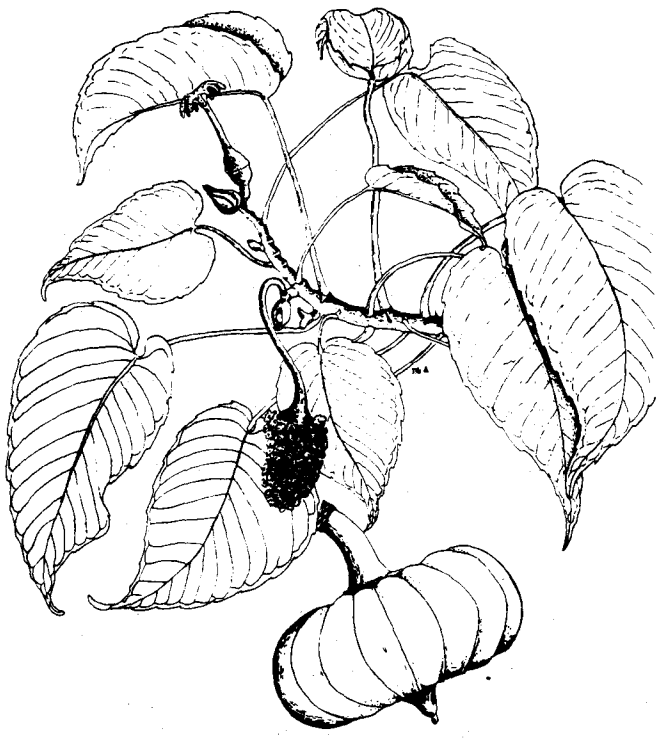

Figure 4.—*Detail of leaves, flowers, and fruit of sandbox tree* (Hura crepitans) *(Reprinted from* 19).

Germinants are most easily transferred to nursery beds or containers as the radicle first emerges from the seed. More advanced seedlings can be transplanted, but they are succulent and easily injured. Alternately, seeds can be sown directly into the nursery containers. Seedlings grown under light shade reached a 0.5-m height and were ready to outplant 3.5 months after sowing (author, personal observation).

Vegetative Reproduction.—Young trees, but not old ones, will coppice. Young branch cuttings, which root readily, are stuck into the soil and become living fenceposts (*13*). Also, cuttings can be rooted in heated sand beds in greenhouses (*1*).

Sapling and Pole Stage to Maturity

Growth and Yield.—Sandbox is not a fast-growing tree, but it is long-lived (*5*). Five-year-old seedlings in a planting test in Venezuela had 91-percent survival but averaged only 0.7 m in total height (*7*). On the other hand, greenhouse specimens have been known to reach a 1-m height in 10 months and a 3-m height in 3.5 years (*10*). In the Palcazu Valley of Peru, where a stand of tropical forest has been classified for intensive management, volume was reported as 102 m^3/ha for all trees over 30 cm in diameter at breast height (d.b.h.), and sandbox comprised 1.7 m^3 of this total volume (*32*). It was estimated that nearly pure natural stands of sandbox on the coastal plain of Surinam contained up to 1,790 m^3/ha in trees reaching a maximum height of 60 m and having clear boles 15 to 30 m in length (*26*). Individual trees as large as 3 m in d.b.h. have been reported in Costa Rica (*11*). Although sandbox develops by Koriba's model in which each node produces two initially equal shoots, one of which turns up to become the leader and the other out to be a branch, it usually produces straight boles (*10*).

Rooting Habit.—Sandbox seedlings produce a fleshy taproot. Older trees develop superficial root systems, probably because there are high water tables or poorly aerated clay subsoils in much of their habitat (*5*). Lower trunks of sandbox trees display some butt swell but little buttressing.

Reaction to Competition.—Sandbox is light demanding when mature (*5*). Seedlings can survive for 2 or more years under the fairly heavy shade of adult trees, and saplings can grow up through a light overstory of early secondary species (author, personal observation), but normally the species requires openings for successful regeneration (*11*). Sandbox seems to compete well with grasses and other plants on wet alluvial soils. On better drained upland sites where sandbox does not reproduce naturally, successful establishment of plantations would probably require a lot of weeding. No information about sustainable basal area and best management is available. It is probably safe to plant sandbox on a 3- by 3-m spacing and to thin plantations soon after crown closure occurs.

Damaging Agents.—No serious enemies of sandbox are known. Two wet-wood termites, *Nasutitermes costalis* (Holmgren) and *N. nigriceps* (Haldeman), commonly feed on dead limbs, and two homopteran insects were reported feeding on the leaves of sandbox in Puerto Rico (*21*). Heartrot frequently enters through basal scars and eventually reaches the interior of large trees. Seedlings are frequently trampled by cattle but are not normally grazed. The species has good resistance to light fires but not to intense ones (*5*). Sandbox is reported to be quite susceptible to breakage in high winds (*5, 19*). When Hurricane Hugo struck Puerto Rico in 1989, gusts in excess of 160 km/h stripped all the leaves and most of the twigs from sandbox trees. Many small and medium branches were broken, but breakage of thick branches was infrequent, windthrow was rare, and the trees quickly refoliated (author, personal observation).

SPECIAL USES

The heartwood of sandbox is pale yellowish brown to pale olive gray; the sapwood is slightly lighter in color, although it is often indistinct from the heartwood (*3*). Specific gravity of the wood varies from 0.33 to 0.41 g/cm^3 (ovendry) (*3, 28*). Shrinkage from green to air-dry is low to moderate; 4.5 percent tangetial, 2.7 percent radial, and 7.3 percent volumetric (*20*). The physical properties of sandbox wood compare well with those of other woods of similar density. It has a modulus of elasticity of 82,000 kg/cm^2, a modulus of rupture of 612 kg/cm^2, and a side hardness of 249 kg/cm^2 (*28*). The wood is moderately difficult to air-season; it dries rapidly, checks slightly, and sometimes warps severely. Sandbox wood cuts and machines well when dry, but fuzzy surfaces often result when the wood is worked green. It finishes and glues well (*3, 20, 31*).

This wood is very susceptible to damage by dry-wood termites (*35*). It is durable in the ground (*22*) and very resistant to decay when submerged (*9*), but it is variable in resistance to wood-decaying fungi and highly susceptible to blue stain (*3*).

Sandbox wood is used in general carpentry and joinery and to make boxes, crates, interior trim, interior furniture parts, plywood, and particle board (*3, 20, 30, 31*). Dugout canoes and troughs were formerly cut from sandbox trees (*17, 19, 23*). The wood is also used as fenceposts, as firewood, and as a source of charcoal (*15, 19*). The sap of sandbox is caustic and poisonous. It is a skin irritant and has caused temporary blindness in humans, which has been a deterrent when felling and bucking the trees (*1*). The dry-wood dust is also an irritant, but workers can overcome this by wearing dust masks and goggles (*4, 9*).

Sandbox is an important shade tree in a number of countries (*5, 16, 17, 19*). It is evergreen in all but the driest habitats and has attractive dark-green foliage and a spreading form. Its large size and tendency to produce large roots near the surface of the ground discourage its use in congested urban areas. However, it has few rivals when used to shade farmyards, pastures, or country roads or as living fenceposts. In these rural settings, the tree's spines are not a serious drawback, and the caustic sap is a threat only to those who cut the bark.

In colonial times, the immature pods were used to hold blotter sand, and the tree derived its English name from this use (*29*). Today, the dried septa of the mature pods are strung for leis and jewelry (*5, 24*). In the past, the seeds and sap were commonly used as purgatives and to treat elephantiasis, leprosy, rheumatic fever, swelling, boils, and intestinal worms (*4, 15, 17*). Although the raw seeds are poisonous to humans and most mammals, they are reported to be relished by poultry (*29*). The seeds can be rendered edible and tasty by toasting (*17*). The sappy latex has been used to stupefy fish (*11, 19*). The seed oil has been proposed for use in the manufacture of linoleum, soap, and varnish (*17, 20*).

GENETICS

The genus *Hura* contains one other species, *H. polyandra* Baill., which grows in tropical Mexico and Guatemala (*25*). It is very similar to *H. crepitans* but is smaller in stature.

LITERATURE CITED

1. Bailey, L.H. 1941. The standard cyclopedia of horticulture. Vol. 2. New York: Macmillan. 2421 p.
2. Carter, J.C. 1944. Forestry in the Leeward Islands. Welfare Bull. 7. Port of Spain, Trinidad and Tobago: Conservator of Forests. 104 p.
3. Chudnoff, Martin. 1984. Tropical timbers of the world. Agric. Handb. 607. Washington, DC: U.S. Department of Agriculture. 464 p.
4. Cook, O.F.; Collins, G.N. 1903. Economic plants of Puerto Rico. Contr. U.S. Nat. Herbarium Vol. 8, Part 2. Washington, DC: Smithsonian Institution. 269 p.
5. Esteva, Francisco Oliva. 1969. Árboles ornamentales y otras plantas del trópico (Venezuela). Caracas, Venezuela: Ediciones Armitano. 368 p.
6. Frankie, Gordon W.; Baker, Herbert G.; Opler, Paul A. 1974. Comparative phenological studies of trees in tropical wet and dry forests in the lowlands of Costa Rica. Journal of Ecology. 62: 881–919.
7. García Colmanarez, José R. 1978. Evaluación preliminar de la plantación experimental con especies forestales en las sabanas de la estación El Irel. Barrancas, Estado Barinas, Venezuela. Revista Forestal Venezolana. 28: 97–129.
8. Gooding, E.G.B. 1974. The plant communities of Barbados. Bridgetown, Barbados: Ministry of Education. 243 p.
9. Grosourdy, D. Renato de. 1864. El médico botanico criollo. Paris: Librería de Francisco Brachet. Vol. 2. 416 p.
10. Hallé, F.; Oldeman, R.A.A.; Tomlinson, P.B. 1978. Tropical trees and forests, an architectural analysis. New York: Springer-Verlag. 241 p.
11. Hartshorn, G.S. 1983. *Hura crepitans* (jabillo, sandbox tree). In: Costa Rican natural history. Chicago, IL: University of Chicago Press: 251–252.
12. Hartshorn, G.S. 1983. Plants. In: Costa Rican natural history. Chicago IL: University of Chicago Press: 118–157.
13. Howard, Richard. 1989. Flora of the Lesser Antilles. Jamaica Plain, MA: Arnold Arboretum, Harvard University. Vol. 5. 604 p.
14. Hulster, I.A. de; Lanjouw, J.; Ostendorf, F.W. 1953. The vegetation of Surinam. Amsterdam: Van Eedenfornds. Vol. 1, Part 1. 135 p.
15. James, Arlington A. 1986. Cabrits plants and their uses. Roseau, Dominica: Ministry of Agriculture, Forestry and Wildlife Division. 48 p.
16. Jenkins, Michael B. 1988. The useful trees of Haiti; a selected review. New Haven, CT: Draft manuscript published by Michael B. Jenkins. 238 p.
17. Liogier, Alain Henri. 1978. Árboles Dominicanos. Santo Domingo, Dominican Republic: Academia de Ciencias de la Republica Dominicana. 220 p.
18. Liogier, Henri Alain [Alain Henri]. 1982. Flora of Puerto Rico and adjacent islands: a systematic synopsis. Río Piedras, PR: Editorial de la Universidad de Puerto Rico. 342 p.
19. Little, Elbert L., Jr.; Wadsworth, Frank H. 1964. Common trees of Puerto Rico and the Virgin Islands. Agric. Handb. 249. Washington, DC: U.S. Department of Agriculture. 548 p.
20. Longwood, Franklin R. 1962. Present and potential commercial timbers of the Caribbean. Agric. Handb. 207. Washington, DC: U.S. Department of Agriculture. 167 p.
21. Martorell, Luis F. 1975. Annotated food plant catalog of the insects of Puerto Rico. Río Piedras, PR: University of Puerto Rico, Agricultural Experiment Station. 303 p.
22. Mayorca, Lerida de. 1976. Estudio de durabilidad de 17 maderas de la región centro occidental de Venezuela. Revista Forestal Venezolana. 26: 61–72.
23. Murphy, Louis S. 1916. Forests of Puerto Rico, past, present, and future. Bull. 354. Washington, DC: U.S. Department of Agriculture. 99 p.

24. Neal, Marie C. 1948. In gardens of Hawaii. Spec. Pub. 40. Honolulu, HI: Bernice P. Bishop Museum. 805 p.
25. Pennington, T.D.; Sarukhan, José. 1968. Árboles tropicales de México. Mexico City, Mexico: Instituto de Investigaciones Forestales and The United Nations Food and Agriculture Organization. 413 p.
26. Record, Samuel J.; Hess, Robert W. 1943. Timbers of the New World. New Haven, CT: Yale University Press. 588 p.
27. Ricardi, M.; Torres, F.; Hernandez, C.; Quintero, R. 1977. Morfologia de plantulas de árboles Venezolanos. I. Revista Forestal Venezolana. 27: 15–56.
28. van der Slooten, A.J.; Martinez E., Pausolino. 1949. Descripción y propiedades de algunas maderas Venezolanas. Mérida, Venezuela: Instituto Forestal Latinonamericano de Investigación y Capacitación. [not paged].
29. Storer, Dorothy P. 1958. Familiar trees and cultivated plants of Jamaica. Kingston, Jamaica: Institute of Jamaica. 81 p.
30. Streets, R.J. 1962. Exotic forest trees in the British Commonwealth. Oxford, England: Clarendon Press. 765 p.
31. Surinam Forest Service. 1955. Surinam timber. Paramaribo, Surinam: Surinam Forest Service. 93 p.
32. Tosi, Joseph A., Jr. 1982. Sustained yield management of natural forests: forestry sub-project, Central Selva resource management project, Palcazu Valley, Peru. San José, Costa Rica: Tropical Science Center. 53 p.
33. Urban, Ignatius. 1911. Symbolae Antillanae seu fundamenta flora Indiae Occidentalis. Paris: Paul Klincksieck. Vol. 4. 771 p.
34. Whitmore, Jacob L.; Hartshorn, Gary S. 1969. Literature review of common tropical trees. Contrib. 8. Seattle, WA: Institute of Forest Products, University of Washington. 102 p.
35. Wolcott, George N. 1946. A list of woods arranged according to their resistance to the attack of West Indian dry-wood termites, *Cryptotermes brevis* (Walker). The Caribbean Forester. 7(4): 329–334.