# A SYNOPSIS OF BIGNONIACEAE ETHNOBOTANY AND ECONOMIC BOTANY[1]

*A. H. Gentry*[2]

ABSTRACT

Bignoniaceae include attractive ornamental flowering trees and lianas and produce hard and durable timbers, many pharmacologically active chemicals, various products used in local handicrafts, and even a few edible seeds and fruits. These uses are summarized here.

When I came to Washington University as a graduate student to work with Walter Lewis, I was aware that my specific interests in large woody tropical plants were rather different from his focus at that time on largely herbaceous and temperate taxa (e.g., Lewis 1962, 1976; Lewis & Oliver, 1961; Lewis & Semple, 1977). Worse, a major theme of Lewis's research has been change in chromosome number (e.g., Lewis, 1976, 1980; Lewis & Terrell, 1962), but nearly all Bignoniaceae have 40 chromosomes (Goldblatt & Gentry, 1979), making studies of chromosome number of minimal interest. As a graduate student, I was grateful that Walter Lewis gave me the freedom and support to go to the tropics and study Bignoniaceae, even though my proposed research impinged little on his own interests. Today I am delighted to report that we have come full circle: ethnobotany of the Bignoniaceae, one of the families that the Lewises (Lewis et al., 1987, 1988) have found to be the most significant in their studies of Jivaro ethnomedicine, is a most fitting contribution to a symposium dedicated to Walter.

Contrary to van Steenis (1978), who stated, "There are no outstanding qualities marking Bignoniaceae as useful plants," the Bignoniaceae do indeed have ethnobotanical significance. The utility of Bignoniaceae spans a broad gamut of human endeavor. Here I will summarize some of the uses of Bignoniaceae for horticulture, food, handicrafts, timber, dyes, rituals, and medicine.

## HORTICULTURE AND ORNAMENTALS

This family is of paramount horticultural importance because of its often spectacular flowers. For example, Menninger (1960), widely known as "The Flowering Tree Man," has stated that *Tabebuia* contains "the most satisfactory flowering trees for parkway and yard planting in southern Florida." At least seven neotropical countries have chosen a species of Bignoniaceae as their national flower or tree (Table 1). *Jacaranda mimosifolia* D. Don is perhaps the world's most widely planted ornamental tropical tree (Gentry, 1984; Fig. 1). Perhaps its closest competition for such a designation is *Spathodea campanulata* Beauv., also a Bignoniaceae (e.g., Gentry, 1982; Fig. 1). In some eastern African and tropical Asian cities, *Millingtonia hortensis* L.f., with its fragrant hawkmoth-pollinated flowers, fills a similar role, at least locally. Menninger (1970) listed 34 different Bignoniaceae vine species of horticultural importance (second only to Leguminosae): *Podranea ricasoliana* (Tanfani) Sprague and *Pyrostegia venusta* (Ker Gawler) Miers are among the most attractive and widely cultivated of all tropical ornamental vines, while *Campsis radicans* enjoys a similar distinction in the temperate zone. Even the currently burgeoning artificial flower industry appreciates Bignoniaceae, with recognizable plastic versions of *Tecoma capensis* (Thunb.) Lindley and *Millingtonia hortensis*, currently available in the Bangkok market (Santisuk, pers. comm.).

[1] Dedicated to Walter Lewis on the occasion of his 60th birthday with thanks for his role in helping me develop my career as a student of Bignoniaceae and of tropical forests in general. I thank the National Science Foundation for the series of grants (most recently BSR-8607113) that has supported my study of Bignoniaceae over the years during which the ethnobotanical data reported here were assembled. As a result, Bignoniaceae are now one of the few tropical forest families well enough known to make possible accurate identification of the often miserable, nearly always sterile, vouchers on which ethnobotanical studies are mostly based.

[2] Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.


FIGURE 1. Bignoniaceae used in horticulture.—A. Street in Campinas, São Paulo, Brazil, lined entirely with *Spathodea campanulata*.—B. *Jacaranda mimosifolia*, perhaps the most widely cultivated flowering subtropical tree in the world.—C. *Tabebuia rosea*, national tree of El Salvador, widely cultivated throughout the world's tropics.

## FOOD

Bignoniaceae also have more utilitarian attributes, although only a few species are used for food, and none are a major food crop. Nevertheless, *Parmentiera aculeata* (HBK) Seemann (Fig. 2) is a significant cultivated fruit tree in the Mayan region (Gentry, 1980). *Parmentiera stenocarpa* Dugand & L. B. Smith, endemic to the Colombian Chocó, produces an edible fruit that has been promoted as having commercial potential because of a flavor apt for desserts or fruit juices (Romero-Castañeda, 1985). In pre-Colombian Panama, the pulp of the tree calabash (*Crescentia cujete* L.) was eaten (Wafer, 1699). Today its seeds are used to make a refresco called "semilla de jícaro," which is locally popular in Nicaragua (Fig. 2), almost constituting a kind of national drink, although this use seems not to have spread to other countries. The waxy fruit of *Parmentiera cereifera* Seemann has occasionally been eaten in Panama (Gentry, 1980) and was formerly an important cattle food (Seemann, 1851). In Africa the ripe fruit of *Kigelia africana* (Lam.) Benth. is baked and added to beer, where it aids fermentation but may cause headaches (Lovett, 1990); its seeds are also roasted in time of famine. The garlic-smelling species of *Mansoa* and clove-smelling *Tynanthus* are frequently used as condiments.

## HANDICRAFTS

More significant may be the use of Bignoniaceae fruits for various utensils and in local handicrafts. By far the most important such use is of the exocarp of *Crescentia cujete* (Fig. 2). As early as 13 October 1492, on the very day he discovered the New World, Columbus reported in his journal on the use of *Crescentia* exocarp to bail native canoes (Sauer, 1969). Even today, nearly every dugout canoe in out-of-the-way parts of the Neotropics carries its piece of *Crescentia* exocarp for use as

TABLE 1. Bignoniaceae national symbols (national tree or national flower).

| Country | Species | Source |
|---|---|---|
| Argentina | *Jacaranda mimosifolia* D. Don | Fabris, 1965 (runner-up as national tree) |
| Bahamas | *Tecoma stans* (L.) Juss. ex HBK | |
| Brazil | *Tabebuia serratifolia* (Vahl) Nicholson | Gentry et al., 1984 |
| Ecuador | *Tabebuia chrysantha* (Jacq.) Nicholson | |
| El Salvador | *Tabebuia rosea* (Bertol.) DC. | Menninger, 1949 |
| Japan | *Paulownia tomentosa* (Scrophulariaceae?) | Asch, 1968 |
| Paraguay | *Tabebuia heptaphylla* (Vell. Conc.) Toledo | Brunner, pers. comm. |
| Venezuela | *Tabebuia billbergii* (Bureau & Schumann) Standley | Steyermark, 1973 |
| Virgin Islands | *Tecoma stans* (L.) Juss. ex Kunth | |

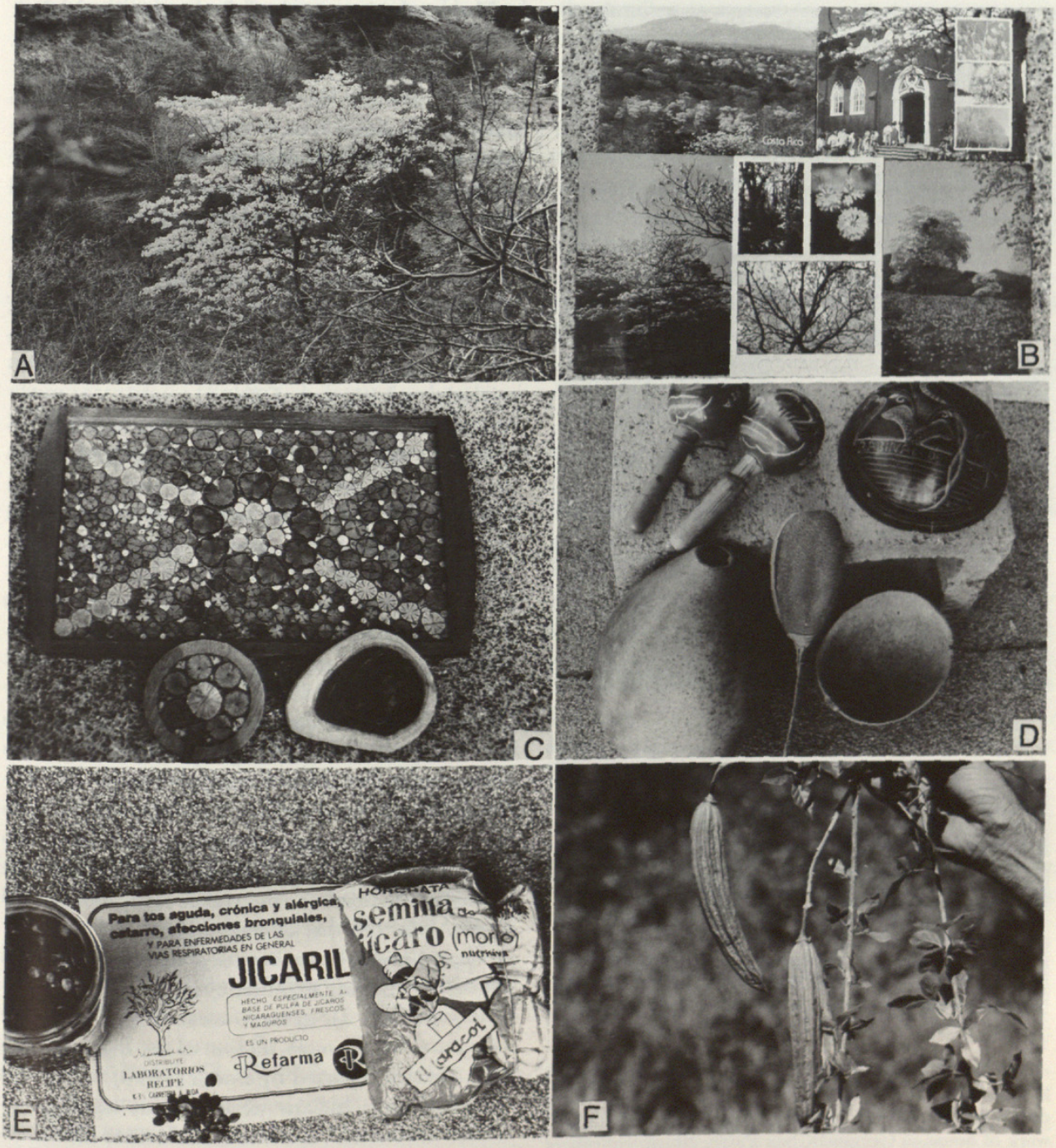


FIGURE 2. Miscellaneous uses of Bignoniaceae.—A. Mass-flowering tree of *Tabebuia ochracea*.—B. Mass-flowering trees of *Tabebuia ochracea* subsp. *neochrysantha* as illustrated on Costa Rican postcards.—C. Cross sections of Bignoniaceae lianas used in local handicrafts, São Paulo, Brazil.—D. Bignoniaceae fruits used as utensils and in local handicrafts. Upper left = *Crescentia alata* used for maraca rattles; upper right = *Crescentia cujete* decorated for wall-hanging; middle = *Pithecoctenium crucigerum* used as a kind of artificial flower in "floral" arrangements; bottom left and right = *Crescentia cujete* used as household containers.—E. "Semilla de jícaro" (*C. cujete*), a favorite Nicaraguan refresco. Left, a container of seeds; right, a packet of powdered seeds; middle, a newspaper clipping advertising *Crescentia* seeds.—F. *Parmentiera aculeata* fruits, cultivated in Guatemala.

a bailer. Engraving of the fruit of *Crescentia* is a significant local artesan industry among various rural groups (Fig. 2; Price, 1982). The smaller fruits of *C. alata* are used as "maraca" rattles (Fig. 2) in much of Mexico and Central America. Maraca manufacture is so important in Mexico's Morelos state that Bye (1992) reports that the entire fruit production of 12,000 trees per year is needed to support the local industry, a figure that gains significance in view of the fact that only 12,381 calabash trees are known to grow in the entire state.

The Siona Indians of Amazonian Ecuador use capsule valves of *Jacaranda copaia* (Aublet) D.

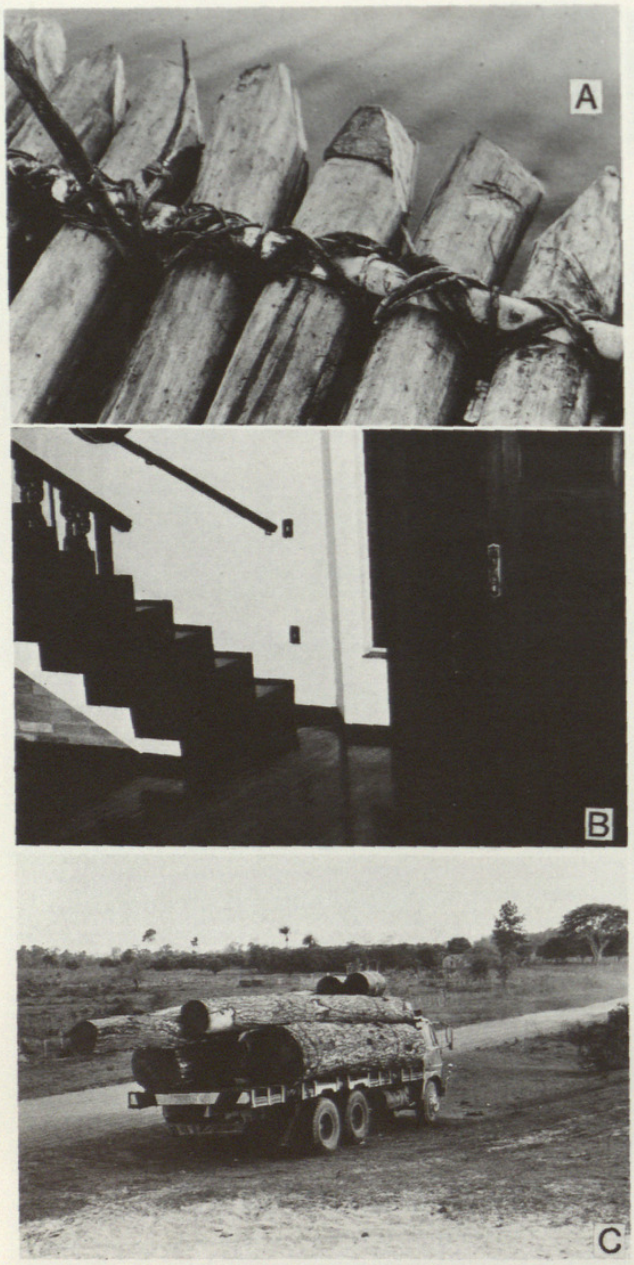


FIGURE 3. Bignoniaceae wood used in construction and cabinetry.—A. Bignoniaceae liana used to tie floating dock together, Mazan, Peru.—B. Interior trim and woodwork of house in Campinas, São Paulo, Brazil, entirely of *Tabebuia heptaphylla*.—C. Truckload of "lapacho" logs (*Tabebuia heptaphylla*) headed for market in eastern Paraguay.

Don as tools to shape pottery (Vickers & Plowman, 1984). In Africa the fruit of *Kigelia* is hollowed out to make a kind of mousetrap using a bait and noose; it is also made into ladles, cups, and dolls (Lovett, 1990). The dried fruit valves of *Pithecoctenium* are frequently placed on a stick (Fig. 2) and used in exotic "floral" arrangements; I once encountered the fruits of the rather rare *Amphilophium pannosum* (DC.) Bureau & K. Schumann similarly displayed in Germany, though how they had arrived there is anybody's guess.

The aesthetic appeal of the contrastingly dark heartwood and light sapwood of many *Tabebuia* species has led to use of the wood in local handicrafts. In western Ecuador, *Tabebuia chrysantha* (Jacq.) Nicholson ("guayacan") is one of the most important timber woods, with much of its lumber being converted into knickknacks, such as salad and sugar bowls and carved statues, and furniture. One indication of the esteem in which "guayacan" (now becoming rare due to overexploitation) is held is the prevalence on the tourist market of items of imitation guayacan made by painting dark brown bands or patches on an article made from a light-colored wood (Gentry, 1980).

The strikingly anomalous cross sections of Bignoniaceae lianas are used in making parquetlike trays and placemats in southern Brazil (Fig. 2). Bignoniaceae lianas are the basis of an important basket-weaving cottage industry of the Guaymi indigenous community at Coto Brus, Costa Rica (Benzecry, pers. comm.). There are also reports from the Yucatán of bignon lianas being used in basket-making (e.g., *Arrabidaea pubescens* (L.) A. Gentry, fide *Chan et al. 301*, XAL, M). Reputedly (R. Ocampo, pers. comm.), stems of *Cydista* are now being removed in large quantities from the Guatemalan Petén for similar purposes. An *Arrabidaea* species is used in Caqueta, Colombia, to make "balais" or manioc strainers (coladoras) (*Toro et al. 12*, Herbarium of TROPENBOS-Colombia housed at the Corporación Araracuara, abbreviated to ARAR in the rest of this paper).

Bignoniaceae lianas are used frequently in local construction, tying together everything from houses to piers (Fig. 3). In some areas this may be their major use; for example, all four of the Bignoniaceae liana species reported by Boom (1990) to be used by the Panare Indians were used as lashing materials. Elsewhere there are herbarium-label records of at least nine different genera used for this purpose. An interesting special use of bignons for tying is as tourniquets for snakebite (*Duke 10875*, MO), which the Chocó Indians of Darién make out of the thin and flexuous juvenile stems of *Mansoa parvifolia* (A. Gentry) A. Gentry.

## TIMBER

In terms of financial return, wood products may be the most important contribution of Bignoniaceae to humanity. Many of the tree taxa are important sources of timber. The large neotropical genus *Tabebuia*, which has many species with unusually strong wood, is especially important in this respect (see Gentry, 1991). *Tabebuia*, along with *Guaiacum*,

may have the hardest, heaviest, most durable wood of any neotropical tree (Record & Hess, 1940; Gentry, 1980). For example, *Tabebuia guayacan* (Seemann) Hemsley was among the most resistant to wood-boring organisms of all the Panamanian woods tested by Bultman & Southwell (1976; Southwell & Bultman, 1971), and nearly all the sound trees that remain standing in Gatun Lake, more than 50 years after flooding by construction of the Panama Canal, are that species. Not surprisingly, the timbers of this species in the ruined colonial cathedral at Panamá Viejo are still sturdy after exposure to the elements for 400 years. *Tabebuia serratifolia* (Vahl) Nicholson, closely related to *T. guayacan*, is currently the most highly desirable hardwood in Pará, Brazil, being worth $40 per $m^3$ before sawing (Uhl & Vieira, 1989). Currently efforts are being made to import wood of this species to the United States (source at Amazonex Lumber Co., pers. comm.). In western Ecuador two other related hard-wooded species (*T. chrysantha* and *T. billbergii* subsp. *ampla* A. Gentry) are among the most important timber woods. The furniture and interior trim of many of the finest homes in Guayaquil are made of *Tabebuia* wood. The similar wood of *Tabebuia heptaphylla* is much prized in Paraguay and southern Brazil. In São Paulo State this species is commonly used for floors and interior trim (Fig. 3).

These same wood properties are appreciated by campesinos and indigenous peoples as well. For example, the metates (corn grinders) of the Guajira Indians in northern Colombia are always made of the wood of *T. billbergii* (Bureau & Schumann) Standley (Cuadros, pers. comm.), and *T. serratifolia* is used preferentially for ax handles by the Ka'apor of Brazil (fide W. Balee).

Because most of the good timber trees in southern Brazil have already been cut, the Paraná forests of Paraguay are now the main regional source of *Tabebuia* wood; *T. heptaphylla* is currently the most important timber species in eastern Paraguay, being high-graded from otherwise intact forests, as at Río Jejui-Mí (Fig. 3).

Curiously, other species of *Tabebuia*, especially those growing in swamps, have unusually lightweight woods. The light spongy wood of the roots of *T. cassinoides* (Lam.) DC., for example, has been reportedly used for lifebuoys, razor straps, and inner shoe soles in Brazil (Correa, 1926), and its wood for spoons and ladles, troughs, paper pulp, and even wooden shoes.

There is also a large group of *Tabebuia* species with intermediate-weight woods. One of these, *Tabebuia heterophylla* (DC.) Britton, widespread in the Antilles, is among the most important timber trees on many West Indian islands. This species and closely related *T. angustata* Britton are especially used for wharves and canoes because of their durability in contact with salt water (e.g., Gentry, 1991; Hodge & Taylor, 1957). *Tabebuia rosea*, called "roble" (Spanish for oak) in some countries, is much sought after in Mexico and Central America for general construction and carpentry. In Panama this is the fourth species to be selectively cut by timber cruisers before general lumbering of an area begins (Gentry, 1980). In northwestern South America, *T. rosea* (Bertol.) DC., is also an important timber tree. A relative, *T. roseo-alba* (Ridley) Sandw., is used for "tabua, taco, frigo, e ripas" in Brazil (*Lino 138*, MO). Another relative, *Tabebuia insignis* (Miq.) Sandw., is the main native "additive" to the Jari plantation paper pulp (Fearnside, 1988). *Paratecoma*, a related genus endemic to coastal Brazil but now almost extinct, was once the most important timber tree of the Rio de Janeiro area, being used to finish all the better-class houses and commercial buildings of Rio de Janeiro and for much of the best-quality furniture there (Record & Mell, 1924). In the Peruvian Andes *Tecoma sambucifolia* HBK is an important wood for carpentry (*Lopez & Sagastegui 2779*, LP, MO).

Another Bignoniaceae genus with timber potential is *Jacaranda*. *Jacaranda copaia* subsp. *spectabilis*, for example, is an important second growth species in many moist areas of the lowland Neotropics. It is fast-growing and is currently being promoted in Amazonian Ecuador as one of the most promising lightweight neotropical timbers (Peck, pers. comm.). *Crescentia* wood is used specifically to make wooden saddles in western Mexico (Bye, pers. comm.). In eastern Africa, the International Council for Research in Agroforestry (ICRAF) has selected *Markhamia lutea* (Benth.) Schumann as one of five focal species for agroforestry tree breeding (D. Boland, pers. comm.).

## Dyes

Several Bignoniaceae are used for dyes. The best known of these is *Arrabidaea chica* (Humb. & Bonpl.) Verlat, the use of which as a body paint was so important to the indigenous cultures along the Orinoco that the local equivalent of "He is so poor that he can't clothe half his body" became "He is so poor he can't paint half his body" (Humboldt & Bonpland, 1808). That species is still used by the Indians of Amazonian Colombia and Ecuador today to paint women's lips as well as faces and

bodies (Garcia-Barriga, 1975; Vickers & Plowman, 1984). It is also used by the Chocó Indians to dye basketry fibers black as well as red, depending on the treatment (pers. obs.) and by the Sionas of Amazonian Ecuador to make a dark brown or blackish dye for painting designs on clothing (Vickers & Plowman, 1984).

Another famous bignon dye is "yangua" or *Cybistax antisyphilitica* (C. Martius) C. Martius ex DC., whose use as a blue dye in the Tarapoto region of Peru was reported by Spruce (1859). Less well known is the use of bark of *Sparattosperma leucanthum* (Vell. Conc.) Schumann by the Chacobos of Bolivia to produce a brown dye used to stain cotton thread (Boom, 1987) or the fruit of *Crescentia* to produce a black dye (Hodge & Taylor, 1957).

### Ritual Uses

Even Christianity has sometimes climbed on to the Bignoniaceae bandwagon. The cross-shaped, 3-foliolate leaves and winged petiole of *Crescentia alata* HBK led to its cultivation in the Philippines because of the suggested religious symbolism, while the distinct cross seen in stem cross sections of *Bignonia capreolata* (hence the vernacular name "cross vine") has led to similar connotations (Gentry, 1982).

Bignoniaceae also have their place in indigenous religion. For example, a leaf concoction of *Anemopaegma paraense* Bureau & Schumann is used by the Wayapi of French Guiana to exorcise a child whose father has violated a sloth-hunting interdiction (Grenand, 1980). It is not clear whether reports of use of an infusion of *Cydista aequinoctialis* (L.) Miers, *Arrabidaea corallina* (Jacq.) Sandw. or *A. inaequalis* (DC. ex Splitg.) Schumann as eye drops by the Witotos in Amazonian Colombia "to see more" refers to hallucination or religion. Whether to categorize the waving by a Tirio medicine man of *Stizophyllum* branches over sick people to cure fever (Plotkin, pers. comm.) as medicine or religion is equally moot. Another faith-related use of a bignoniaceous "charm" is reported from the Brazilian Xingu (*Balee 2225*, NY), where the Ka'apor tape *Stizophyllum riparium* on children's legs to make them grow taller.

### Poisons and Medicines

According to Frank Lloyd Wright, "A doctor can bury his mistakes, but an architect can only advise his clients to plant vines." This dictum takes on new significance when viewed in the context of Bignoniaceae. It is in medical ethnobotany that Bignoniaceae achieve their greatest prominence, and, although a number of Bignoniaceae trees have medicinal uses, it is the lianas that have the greatest array of bioactive constituents (Gentry & Cook, 1984; Phillips, 1991). The doctor, as well as the architect, might be well advised to turn to vines, especially bignon lianas. For example, 10 of the 12 Bignoniaceae genera used medicinally by the Jivaro in Peru were lianas (Lewis et al., 1987), and no fewer than 13 genera of bignon lianas were listed by Phillips (1991) as having specific medicinal uses. Altogether, I now have records for 27 genera of Bignoniaceae lianas and nine genera of trees that are used medicinally.

At the opposite extreme, but no less biologically active, are various Bignoniaceae species reported as toxic, in several cases the same taxa that are medicinal in other contexts. Paramount among poisonous Bignoniaceae is the genus *Tanaecium*. *Tanaecium excitiosum* Dugand of the Magdalena Valley of Colombia is locally famous for its toxicity to cattle (Dugand, 1942) and has been largely eradicated in an attempt to reduce livestock death (pers. obs.). Crushed leaves and stems of almond-smelling *Tanaecium nocturnum* (Barb. Rodr.) Bureau & Schumann are used by the Wayapi of French Guiana to enervate bees while gathering honey (Grenand, 1980), and similarly toxic effects have been reported on humans (Prance et al., 1977). Another well-documented instance of poisonous Bignoniaceae involves two closely related species of *Arrabidaea*, *A. elegans* (Vell.) A. Gentry and *A. bilabiata* (Sprague) Sandw., which have been responsible for numerous livestock poisonings (Tokarnia et al., 1969; Gentry, 1983).

Poisonous properties may also be advantageous in hunting or fishing. For example, *Memora* may have efficacy as a fish poison. *Memora allamandiflora* (Spruce) Bureau reportedly has been used as a fish poison on the Xingu (*Balee 1962*, NY), and *M. cladotricha* Sandw. is sometimes called "barbasco huasca" (= fish-poison vine) in Peru, indicating similar use. There are several reports of Bignoniaceae as curare ingredients in Amazonia, including the roots of *Distictella magnoliifolia* (HBK) Sandw. and *Martinella obovata* (HBK) Bureau & Schumann by the Barasana (Schultes, 1969, 1970), *Schlegelia cauliflora* A. Gentry and *Callichlamys latifolia* (Rich.) Schumann by the Miranas (*La Rotta 379*, ARAR; Garcia-Barriga, 1975), *Arrabidaea* aff. *oligantha* by the Yukuna (*Pabon 800*, ARAR), and *Schlegelia scandens* (Briq. &

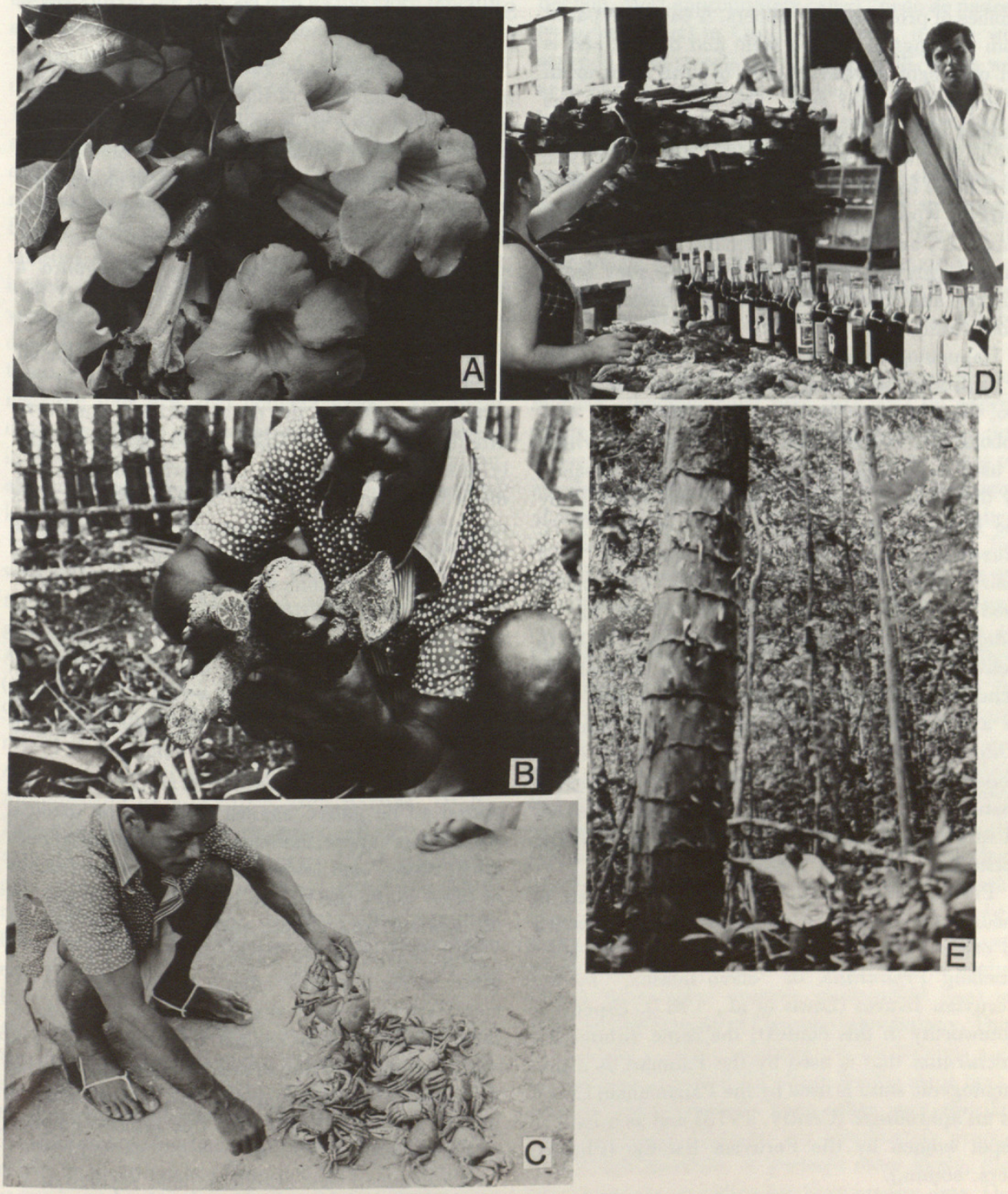


FIGURE 4. Bignoniaceae as sources of biologically active chemicals.—A. *Melloa quadrivalvis*, "mata cangrejo," used to trap crabs in northern Colombia.—B. *Melloa* stem sections as stored underground at house of local "cangrejero" prior to use.—C. Crabs caught with bait made of *Melloa* by picking them up outside their holes the next morning.—D. Bark of *Tabebuia* for sale in market at Iquitos, Peru (on shelf).—E. *Cariniana* (Lecythidaceae) tree stripped of bark (in forest reserve at Puerto Almendras, near Iquitos, Peru), which resembles *Tabebuia* bark; *Tabebuia* bark has been over-harvested locally so that the morphologically similar, although biologically inactive, bark of *Cariniana* is now being sold instead, as a kind of fake *Tabebuia* bark.

Spruce) Sandw. by the Tikuna (Schultes & Raffauf, 1990).

Another interesting use of a species of Bignoniaceae for its poisonous properties is of *Melloa quadrivalvis* (Jacq.) A. Gentry to immobilize crabs in northern Colombia (Gentry & Cuadros, in prep.; Fig. 4). The plant is locally called "mata cangrejo," and its use is a closely guarded secret among certain

families of professional crabbers. A bait is prepared from shavings of *Melloa* stem and banana and is left overnight outside a series of crab holes in an appropriate coastal area. The next morning the crabber merely returns to the crab holes, picks up the crabs, which have been immobilized outside their holes by the *Melloa*, and carries them off to market. Apparently the effect of the *Melloa* is temporary and nontoxic to humans, since the crabs have largely recuperated by the time they reach market, and no adverse effects have been reported from eating them.

Hallucinogens might be classed as either poisons or medicines, depending on one's perspective. Here, too, Bignoniaceae lianas make a significant ethnobotanical contribution. *Tanaecium nocturnum* is used as an hallucinogenic snuff called "kosibo" by the Paumari Indians of Brazil and similarly by the Puinaves of Colombia (Prance et al., 1977). *Mussatia hyacinthina* (Standley) Sandw., or "chamairo" (Quechua for "wick of delight"), is a widely used coca additive in Peru and Bolivia and has an independent euphoric effect (Plowman, 1980). In Bolivia, *Clytostoma sciuripabulum* Bureau & Schumann roots are sometimes mixed with coca as a substitute for "chamairo" by the Chimane (*Davis & Marshall 1187*, MO). Another occasional coca additive is *Distictis pulverulentus* (Sandw.) A. Gentry, the ashes of the burned leaves of which are mixed with their coca by the Makuna (Schultes & Raffauf, 1990).

Perhaps more akin to hallucinations than to medicine are the aphrodisiacal properties attributed to other Bignoniaceae lianas, for example clove-smelling *Tynanthus*, or "clavo huasca," by the Peruvian Jivaros (Lewis et al., 1987). Especially noteworthy in this context, the same *Tanaecium nocturnum* that is used by the Paumari as a hallucinogenic snuff is used by the Panamanian Chocó as an aphrodisiac (Gentry, 1973) and as a bath to repel women by the Peruvian Ese-Eje (Phillips, pers. comm.).

Another Bignoniaceae famous for its reputed aphrodisiacal properties is *Anemopaegma arvense* (Vell. Conc.) Stellf. ex de Sousa, or "catuaba," of the Brazilian cerrado. The vernacular name, Tupi, for "tree of togetherness," reflects its reputation; an herbal tea prepared from "catuaba" is supposed to be especially efficacious for combating male impotence (Sylvester, 1989). Other Bignoniaceae with reported aphrodisiacal uses include a confection of the flowers of *Stereosperma chelonoides* (L.f.) DC. (as *S. suaveolens*) in India (Chopra et al., 1956), and *Macfadyena uncata* (Andrews) Sprague & Sandw. as a love charm in Amazonian Peru (Phillips, pers. comm.).

Although there have been few detailed or systematic investigations of Bignoniaceae phytochemistry, it is obvious from their characteristic vegetative odors that the species of many genera are related by distinctive suites of chemical characters. For example, *Tynanthus* smells like cloves, most *Mansoa* species smell like garlic, *Tanaecium* has either an almond or bitter odor, *Paragonia* a sweetish odor, *Godmania* a rank odor that has been likened to that of horse urine. This kind of chemical signature is also reflected in the similar ethnomedicinal uses for different species of the same genus. One of the most striking examples is *Martinella* (Gentry & Cook, 1984), which is widely used throughout most of South America as a medicine for conjunctivitis. Such medicinal uses are reflected in an abundance of specific epithets like "ophthalmica" (*Bignonia ophthalmica*, a synonym of *Martinella obovata*), "antisyphilitica" (*Cybistax antisyphilitica*), "impetiginosa" (*Tabebuia impetiginosa* (C. Martius ex DC.) Standley), "curialis" (*Tecoma curialis*, a synonym of *Tabebuia heptaphylla* (Vell. Conc.) Toledo), and in the vernacular name "para todo" for *Tabebuia aurea* (Manso) Benth. & Hook. ex S. Moore.

A number of Bignoniaceae taxa have been reported to be active against such major medical scourges as cancer, diabetes, syphilis, malaria, hepatitis, rabies, and leshmaniasis. The most famous of these is the use of the bark of various species of *Tabebuia* as a cancer cure (Fig. 4; see Awang, 1988; Gyllenhaal & Farnsworth, ms. in prep.). Many of the cytotoxic effects of Bignoniaceae extracts on neoplasic cells, as well as their documented effectiveness against trypanosomiasis and various viruses are due to properties of the lapachol and related naphthoquinones that are widespread in, and mostly restricted to, this family (Ferreira et al., 1990).

Additional recent ethnobotanical reports of indigenous uses of *Tabebuia* bark against cancer include that of *T. incana* A. Gentry and *T. impetiginosa* by the Campas in Peru (Reynel et al., 1990), of *T. serratifolia* in Colombia (Garcia-Barriga, 1975), and of *T. rosea* by the Mayas in Mexico (Dominguez & Alcorn, 1985). That almost all such reports are for the genus *Tabebuia*, and that they come from such widely scattered localities and ethnic groups, lends ethnobotanical credence to the postulated medical effectiveness.

Unfortunately, the uncritical tend to interpret such data overzealously, in a manner that often

casts doubt on the real, as well as the more fanciful, effectiveness of a plant like *Tabebuia*. For example, "ozone-friendly" *Tabebuia* ("lapacho" or "pau d'arco") was reported in a recent article (Sylvester, 1989) to build immunity, improve vitality, and strengthen cells, as well as being effective against diabetes, leukemia, multiple sclerosis, arthritis, rheumatism, allergies, chronic infections, colds, influenza, boils, snake bites, and AIDS; no doubt the unusual flowers, which "are carnivorous and eat insects, keeping the tree free from parasites and viral growths," contribute to its healing power as does the fact that "it apparently only grows where there is a high ozone content in the air where vital negative ions are also concentrated." Yet these distinctly off-the-wall observations are confusingly interspersed with better documented ones about effectiveness against *Candida albicans* and several kinds of cancer.

There are also several reports of Bignoniaceae with antimalarial properties. These include *Pleonotoma melioides* (S. Moore) A. Gentry (J. Rios Trigosa, pers. comm.), *Macfadyena unguis-cati* (L.) A. Gentry (Garcia-Barriga, 1975), *Tabebuia rosea* (*Steyermark 51372*, F), and *T. ochracea* (Cham.) Standley (Schultes & Raffauf, 1990). Bignoniaceae reported as effective against syphilis include *Arrabidaea chica* (Triana fide Garcia-Barriga, 1975), *Macfadyena unguis-cati* (Garcia-Barriga, 1975), *Tabebuia heptaphylla* (Martius, 1843), *Tecoma stans* (L.) Juss. ex Kunth (Liogier, 1974, fide Duke, pers. comm.), and *Cybistax antisyphilitica* (Martius, 1843); *Jacaranda caucana* Pitt. has also been reported to be effective against venereal disease (*Grant 10711*, WIS; Garcia-Barriga, 1975). Both *Callichlamys latifolia* and *Jacaranda copaia* have been reported to be specifically used by the Peruvian Jivaro against leshmaniasis (Lewis et al., 1987), and *Cybistax antisyphilitica* roots against epilepsy (*Mathias & Taylor 5617*, MO). *Tabebuia rosea* has been reported to be used against rabies in Guatemala (*Ruano 425*, US). *Tecoma stans* is reputed to be effective against diabetes in several countries, apparently because a piperidine derivative lowers blood sugar levels by stimulating insulin production (Lozoya-Meckes & Mellado-Campos, 1985; Perl, 1988; Duke, pers. comm.).

On the other hand, equally specific reports of the use of strongly aromatic genera like *Mansoa* against tuberculosis, *Tynanthus* against hepatitis, and both against rheumatism (e.g., Lewis et al., 1987) may well be more closely related to psychological than physiological effects. Garlic-smelling *Mansoa* is especially instructive in this connection. Most appropriately called "pedo de padre" (= priest's fart) in Central America, it may well serve to repel insects (Lewis et al., 1987)—as well as most other organisms. No doubt burning it where sick chickens roost to prevent an epidemic (Alarcón, 1988) would have as strong a repulsive effect on the potential disease vectors of the chickens as drying it in a closed building does on an unwary plant collector (pers. obs.). However, much of its exceedingly wide medical application against a great variety of ailments, including such difficult-to-treat ones as snakebite, is likely to be due to placebo effect.

Another kind of precautionary note on Bignoniaceae ethnomedicinal uses may also be appropriate. In at least some cases, unreliable or uncooperative informants may have invented uses or misidentified the plant involved. Thus, the dozens of independent reports, including an unpublished one dating from 1791, of use of *Martinella* for eye ailments surely indicates that the plant is an effective medicine (Gentry & Cook, 1984). However, there are also isolated reports of uses of *Spathicalyx xanthophylla* (DC). A. Gentry (Schultes, 1970), *Haplolophium rodriguesii* A. Gentry (*Boom 4688*, NY), *Macfadyena uncata* (Lewis et al., 1987), *Tabebuia insignis* var. *monophylla* Sandw. (*Schultes & Cabrera 19734*), and *Arrabidaea chica* (Schultes & Raffauf, 1990) to treat conjunctivitis. All of these are vegetatively rather similar to *Martinella*, and one wonders whether some kind of mix-up, intentional or otherwise, might be involved. Similar confusion between plants may also apply to the reported use to cure diarrhea of four of the five identified useful bignon lianas (plus another unidentified one) in Boom's (1987) study of Chacobo ethnobotany. This is otherwise a rarely reported use for bignons and has not been reported elsewhere for the same taxa, some of which normally have other very specific uses. Either the Chacobo are inordinately preoccupied with diarrhea, or perhaps more likely, the informants are providing less than precise data. On the other hand, the use of an obscure species like *Memora flavida* (DC.) Bureau & Schumann by three different Surinamese ethnic groups (Tirios, Wayanas, and Akuriyos) for essentially the same purpose (for aching joints, body aches, and to treat aching facial muscles, respectively) (Plotkin, pers. comm.) strongly suggests that a genuine biologically active property of this species is involved.

In summary, while it is difficult to know to what extent the extensive ethnomedicinal literature on Bignoniaceae, and especially bignon lianas, reflects

real pharmacological activity, the fact that there are so many such reports strongly suggests that there is a real basis for many of them. Indeed, taken at face value they suggest that Bignoniaceae constitute a kind of one-family rainforest pharmacy, with different taxa curing ailments of the eyes (*Pleonotoma variabilis* (Jacq.) Miers (fide *La Rotta 379* ARAR), *Martinella*), ears (*Arrabidaea florida* DC.: Schultes & Raffauf, 1990), teeth (*Arrabidaea chica* (caries prevention), *Crescentia* leaves (toothaches), *Lundia erionema* DC. (bleeding gums)), nose and throat (e.g., *Mansoa, Crescentia, Stizophyllum, Pyrostegia, Parmentiera, Tanaecium nocturnum*), skin (e.g., *Amphilophium, Callichlamys, Cydista, Jacaranda, Memora, Mussatia, Kigelia, Parmentiera, Tabebuia, Tanaecium*), stomach and intestines (eg., *Arrabidaea, Callichlamys, Crescentia, Jacaranda, Macfadyena, Mussatia, Paragonia, Parmentiera, Pithecoctenium, Pleonotoma, Tabebuia*), kidneys (*Parmentiera*), liver (*Macfadyena: Schinini 4892*, CTES), joints (*Mansoa, Tynanthus, Jacaranda, Macfadyena, Memora, Pitecoctenium, Tabebuia*). In addition to being used against the above-mentioned maladies and against asthma, influenza, and the common cold, they are used to treat fevers (*Arrabidaea candicans* (Rich.) DC., *Callichlamys, Macfadyena, Mansoa, Martinella, Memora, Tanaecium nocturnum, Tynanthus, Xylophragma*), headaches (*Arrabidaea spicata* Bureau & Schumann, *Pithecoctenium*), diarrhea (*Arrabidaea candicans, A. platyphylla* DC., *Callichlamys, Lundia, Mussatia, Tanaecium nocturnum, Tynanthus*), flatulence (*Mussatia, Tabebuia barbata* (E. Meyer) Sandw.: by the Kuripakos specifically to combat excess flatulence from eating tapir meat), hemorrhaging (*Crescentia, Macfadyena*, flowers of *Tabebuia obscura* (Bureau & Schumann) Sandw.), hiccoughs (*Schlegelia macrophylla* Ducke), snakebite (e.g., *Mansoa, Clytostoma sciuripabulum, Tabebuia aurea* (fide *Balick et al. 1395*, MO), *Tecoma stans*), and behavioral disorders (*Macfadyena uncata* against aggressive tendencies in Peru, *Crescentia cujete* as a tranquilizer in Ecuador (*Miller et al. 2397*, MO), *Stereospermum colais* (Buch.-Ham. ex Dillwyn) Mabberley (as *S. tetragonum*) for maniacal cases in India). They are used against baldness (*Tynanthus panurensis* (Bureau) Sandw. in Ecuador (*Marles 113*, F)), to treat broken bones (*Pithecoctenium crucigerum* (L.) A. Gentry by the Peruvian Amuesha (fide *Salick 7198*, MO), as a permanent contraceptive (*Macfadyena uncata* in Peru) and to cause spontaneous abortion (*Crescentia cujete* in Ecuador (*Marles 123*, F; *Miller et al. 2397*, MO), as a cosmetic to keep the skin soft and moist (*Arrabidaea chica, Memora cladotricha*), or to remove pimples (*Amphilophium paniculatum* (L.) HBK (fide *Standley 19719A*, US)), and to eliminate tapeworms (*Macfadyena unguiscati*) or treat ringworm (*Cydista lilacina* A. Gentry: *Balee 2596*, NY). They are even used in veterinary medicine (e.g., *Tynanthus panurensis* in Colombia to "enfriar el calor de los animales": *La Rotta 379*, ARAR; *Ceratophytum tetragonolobum* (Jacq.) Sprague & Sandw. in Mexico for coughing dogs: *Ucán 752*, XAL, M) (Alarcon, 1988; Boom, 1987, 1990; Chopra et al., 1956; Garcia-Barriga, 1975; Grenand, 1980; Lewis et al., 1987; Phillips, 1991; Plowman, 1980; Reynel et al., 1990; Schultes & Raffauf, 1990; Tournon et al., 1986; Vickers & Plowman, 1984).

Bignoniaceae clearly enrich the lives of the people who share the world's tropical forests with them. Although they are already important to the developed world as well, it seems likely that they can become even more useful. Bignoniaceae would seem clearly to merit additional ethnobotanical, especially pharmacological, investigation, before they, along with the knowledge of their plethora of potential uses and the very rainforests in which they live, disappear from the face of the earth.

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