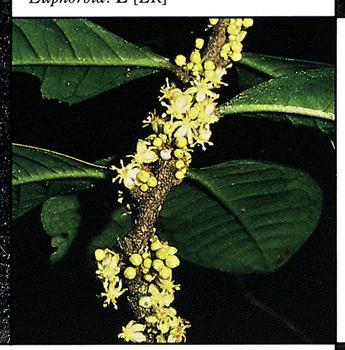
The Euphorbiaceae Family

Research at the Missouri Botanical Garden

◀ **The Euphorbiaceae, or Spurge Family, with some 8000 species, is one of the world's largest and most diverse families of flowering plants.** Primarily tropical and subtropical, it also occurs in temperate regions, and is represented by herbs, shrubs, trees, vines, and even one floating aquatic species. **Important crops include rubber, cassava, castor oil, and the ornamental poinsettia.** Pictured: African dry forest with giant succulent *Euphorbia*. **E** [ER]

◀ **Research: The Missouri Botanical Garden hosts an international conference** in August 1989, gathering specialists in the Euphorbiaceae from institutions all over the world to increase our understanding of this important family, which is still relatively poorly known. MBG researchers Michael J. Huft and Gordon McPherson specialize in the study of the Euphorbiaceae. Pictured: succulent *Euphorbia* in Namibian Desert, southwestern Africa. **E** [ER]

◀ **Diversity: *Euphorbia*, with approximately 1600 to 2000 species, is a magnificent example of variation within a genus,** yet each species displays the characteristic inflorescence: a highly reduced cup-like structure, called a cyathium, which resembles a single flower. At the rim of the cyathium there are usually four or five nectar-producing glands, which sometimes have petal-like appendages. Pictured: Snow-on-the-Mountain, *Euphorbia marginata*, Nebraska, U.S.A. **E** [MH]



◀ **Species new to science: MBG scientists described 197 new species in 1988.** The unusual genus *Croizatia* was discovered in Venezuela by MBG scientist Julian Steyermark (1909-1988), who discovered more than 2200 new species and collected more than 130,000 specimens in his career. In 1984, MBG scientist Paul Berry collected specimens with flowers, allowing the broader relationships of *Croizatia* to be understood for the first time. Pictured: *Croizatia naiguatensis*, Venezuela. **P** [PB]

Classification: The diversity within the Euphorbiaceae has fostered many attempts at defining groups of related genera. **The most recent system is by Grady Webster of the University of California, Davis, who recognizes five subfamilies.** This widely accepted system is based on number of seeds, latex constituents, and pollen characteristics. Except for seed number, there is no obvious way to place a genus in the proper subfamily by sight.

◀ **Classification: Subfamily Oldfieldioideae, 70 species.** This smallest and least familiar of the five subfamilies was only recently recognized. It brings together several genera that had previously been scattered throughout the family. Pictured: *Picrodendron baccatum*, West Indies. [JH]

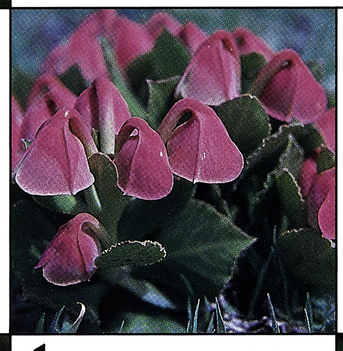
▲ **Habit: Trees, shrubs, herbs, and vines.** The Old World tropics has the richest concentration of euphorbiaceous species, closely followed by the New World tropics. **A widely recognized characteristic of the Euphorbiaceae is the three-lobed fruit,** which contains three or six seeds, depending on the subfamily. Pictured is flowering spurge, *Euphorbia corollata*, a common species of the eastern United States, including Missouri. **E** [WB]

The Tropics: At least two-thirds of all plants and animals on earth live only in the tropics. Most are unknown scientifically and in danger of extinction. Of the approximately 250,000 species of flowering plants in the world, two-thirds occur only in the tropics.

Deforestation: Tropical evergreen forests cover 7% of the earth's surface and are essential to the stability of global climate and hence to human welfare; yet **60 million acres of lowland rainforest are destroyed every year.** Explosive population growth, widespread poverty, and poor land use are underlying causes. **Tropical forests are being consumed rather than managed for human benefit.**

MBG Research: In cooperation with scientists from the countries involved, MBG researchers are seeking the basic information that will help reverse the process of deforestation. **All tropical forests are likely to be destroyed or permanently damaged within 50 years.**

▶ **Classification: Subfamily Euphorbioideae, 2500 species.** Dominated by the cyathium-bearing genus *Euphorbia*, this group, which also includes *Sapium*, *Sebastiana*, and *Mabea*, has milky latex, or sap, which is usually caustic and poisonous. Flowers in most genera are extremely inconspicuous and are highly congested in compact inflorescences, or groups of flowers. Pictured is *Monadenium*, a small African genus of succulents closely related to *Euphorbia*. [WB]



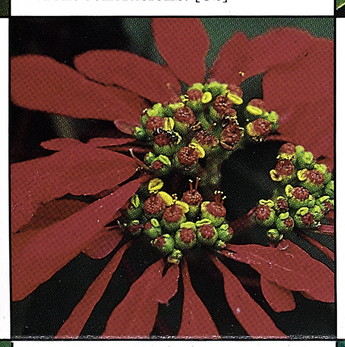
▶ **Classification: Subfamily Crotonoideae, 1500 species.** Characterized by harmless and sometimes colored latex, this assemblage includes such well-known genera as *Croton*, or croton; *Manihot*, or cassava; *Jatropha*; and *Cnidoscolus*, or Bull-nettle. Pictured is a species of *Ricinocarpus*, a genus of about 15 species in Australia and one on New Caledonia. [GW]

▶ **Classification: Subfamily Phyllanthoideae, 2000 species.** Characterized by six seeds in each fruit, this subfamily is considered the most primitive of the Euphorbiaceae. Pictured: *Uapaca*, with several species in Africa and Madagascar, whose inclusion in the Euphorbiaceae is controversial. It has also been placed in its own family, the Uapacaceae. **Taxonomists studying the relationships between closely related species may sometimes reach different conclusions.** [GS]

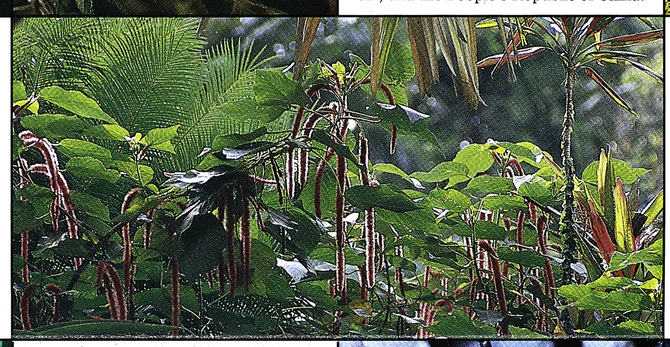
◀ **Classification: Subfamily Acalyphoideae, 2000 species.** Characterized by colorless latex, this group includes *Acalypha*, *Tragia*, and *Dalechampia*. Pictured: *Dalechampia boiviniana*, Mauritius, Indian Ocean. [DL] **International Collaboration:** MBG works closely with institutions and scientists worldwide to produce regional floras and monographic studies of poorly known plant groups, concentrating on the plants of North America, Central and South America, Africa, Madagascar, and the People's Republic of China.

◀ **Horticulture: Many Euphorbiaceae are sought after for their striking foliage** and are cultivated for their showy leaves, bracts, or stems. Best known is the poinsettia, with its attractive red bracts. Another, which has produced remarkably varied forms in cultivation, is the leaf ornamental croton, *Codiaeum variegatum* (pictured), of east Asian origin and related to the genus *Croton*. Other leaf ornamentals are in the genera *Breynia* and *Acalypha*. **C** [KS]

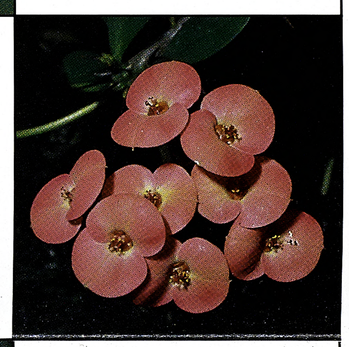
▲ ▶ **Horticulture: The Christmas poinsettia, *Euphorbia pulcherrima*, is the best known ornamental member of the Euphorbiaceae.** Grown in temperate zones as a robust herb, it is a large shrub throughout the tropics, where it is even found growing in fence rows. It is native to western Mexico. Poinsettias are characterized by colorful bracts, or modified leaves, which appear to be petals. The bracts surround a compact collection of cyathia. **E** [WB] [MH]

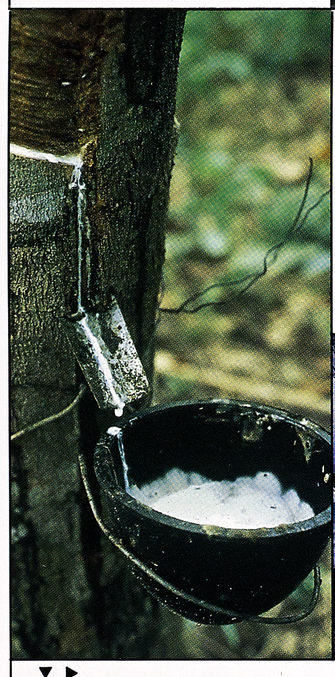


▶ **Horticulture: The southeast Asian shrub, *Acalypha hispida*,** is widely cultivated throughout the tropics, where the strikingly red, tassel-like inflorescences are a common sight. These tassels consist of bright red bracts and inconspicuous flowers. **A** [KS] **Deforestation: Commercial lumbering is the leading cause of forest loss in tropical and subtropical Asia. Clearing the forest for agriculture and cattle raising are the main threats to forests in the Neotropics.**



▶ **Horticulture: Crown-of-thorns,** *Euphorbia millii* from Madagascar, has red petal-like bracts that are actually modified leaves. **E** [ER] **Extinction-Endemism: Of the 10,000 plant species in Madagascar, 75% are endemic, occurring only on the island.** Deforestation has already destroyed 90% of the country's forests, and **many of the island's unique species are extinct, lost to mankind forever.** MBG collaborates on an innovative conservation and collection program on Madagascar.





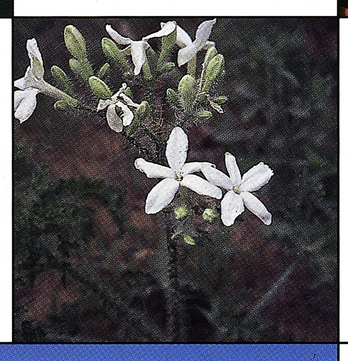
◀ ▶ **Economics: Natural rubber** is a product of a large South American euphorbiaceous tree, *Hevea brasiliensis*. The latex or sap, from which the rubber is made, is collected by allowing the latex to run from V-shaped slashes in the bark into a bucket. Although synthetic rubber was introduced in 1931, **natural rubber remains important, and more than 580,000 metric tons were consumed annually during the early 1980s** in the United States alone. **C** [MB] [GD]

▶ **Ecology:** Although the milky latex of succulent euphorbias is poisonous and often very caustic, some herbivores, such as this insect chewing on a succulent *Euphorbia*, have found mechanisms to deal with the toxins and eat the watery leaves, which are poisonous to most herbivores. **E** [ER]

◀ **Economics: Castor oil** which comes from the seeds of the castor-bean plant, *Ricinus communis*, is a strong cathartic and also finds industrial use in lacquers, paints, cosmetics, and insulation products. **Ricin, one of the most toxic compounds known,** is isolated from *Ricinus* seeds, but does not occur in castor oil. It may eventually be used to help formulate an anti-cancer agent, and **is a good example of a poisonous plant compound that can benefit humans. A** [WB]

Economic Plants—Conservation: Urgent attention must be given to conserving and studying plants of potential economic importance. MBG scientists frequently describe new species that may become important as foods, chemicals or energy sources—**if they can be studied before they disappear forever. Only a few kinds of plants are used by human beings; extinction is occurring more rapidly than discovery and scientific understanding.**

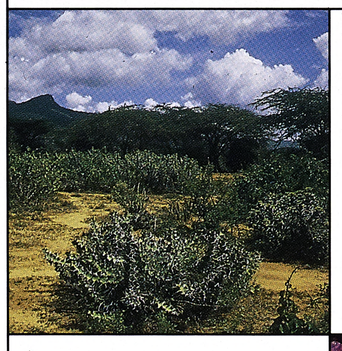
◀ **Ethnobotany:** Fresh bark from the Dragon's Blood *Croton lechleri*, a common tree of western Amazonia, is used locally for healing superficial wounds, and a desiccated extract is taken internally for ulcers. **These are good examples of what we can learn from native uses of plants.** Pictured: a strip of bark is being sold in a Peruvian market. **C** [MD]



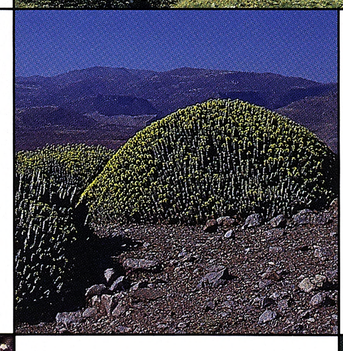
◀ **Economics:** Many members of the Euphorbiaceae contain compounds known as phorbol esters. These are well known tumor-promoting agents and are useful in cancer research. **MBG, The New York Botanical Garden, and a consortium from the University of Illinois at Chicago and Harvard University are involved in collecting plants for screening by the National Cancer Institute.** Among genera shown to be high in phorbol ester content is *Cnidoscolus*. Pictured: *Cnidoscolus texanus*, Oklahoma. **C** [MH]

▼ ▶ **Convergence:** Several hundred species of succulent **Euphorbia** are known from sub-Saharan Africa, and a few are native also to north Africa, Asia, and South America. **The resemblance between succulent euphorbias and cacti is one of the best examples of convergence, a phenomenon in which unrelated species strongly resemble each other in appearance.** Succulent euphorbias occur in the Old World in the same habitats occupied by the unrelated cacti restricted to the New World. (Right) *Euphorbia* species in the Namibian Desert, southwestern Africa. **E** [ER]. (Below) *Euphorbia breviarticulata* in Kenya. **E** [PR]
Tropical Ecology: Tropical ecosystems store nutrients in their living organisms, unlike temperate ecosystems, where nutrients are largely stored in the soil. Clearing tropical forests makes regeneration almost impossible, creating "green deserts" of very low productivity. **Once the tropical forest is destroyed, the ecosystem is not renewable.**

▶ **Economics: Cassava or manioc, *Manihot esculenta*, is one of the main food crops throughout the tropics.** The flour made from cassava roots is used in breads and is the source of tapioca. Elaborate preparation is necessary to remove the poisons, or toxins, found in the roots. **C** [JZ]
Only 20 of the 250,000 species of flowering plants account for more than 80% of the world's food consumption.

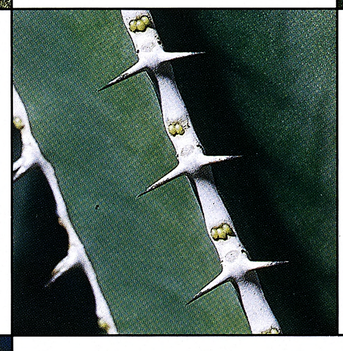


▶ **Habit: Diversity.** The succulent habit found in some euphorbias, such as this giant cushion-like mound in the Moroccan desert, gives protection against water loss in the dry desert environment. *Euphorbia* sp. **E** [ER]



▶ **Habit: Diversity.** Euphorbia fanciers collect and grow a dazzling array of bizarre and fascinating forms of succulent *Euphorbia* and related genera. Tree-size specimens are cultivated in gardens and parks throughout the tropics. **E** [WB]

Scientists have discovered and named no more than one out of six of the more than three million tropical organisms.



▶ **Flowers: Unisexual.** Although dioecious arrangements exist—male and female flowers on separate plants—the most common situation in the Euphorbiaceae is an inflorescence with female flowers below and male flowers above, as in the castor bean plant, *Ricinus communis* (pictured). **The flowers in the Euphorbiaceae are exclusively unisexual. A** [WB]

▶ **Flowers: Compact.** Although small inconspicuous flowers are a constant throughout the Euphorbiaceae, this reduction is carried to an extreme in the sandbox tree, *Hura crepitans*. Here, numerous minute male flowers are arranged in rows on a fleshy axis, which breaks through a thin bract. A number of fleshy axes make up the extremely compact inflorescence. **E** [KST]

▶ **Flowers: Complex.** *Dalechampia*, a genus of about 100 species of mostly herbaceous vines or occasionally erect herbs, has evolved a very complex inflorescence that looks like a single flower. The *Dalechampia* inflorescence has not reached the elegant simplicity of the *Euphorbia* inflorescence, however. In most species of *Dalechampia*, a pair of conspicuous white, purplish, cream, or greenish bracts advertise the inflorescence. *Dalechampia ipomoeifolia* (Kenya). **A** [PM]

International Cooperation: The future of tropical vegetation and the survival of thousands of species depend on combining economic development with conservation, addressing the needs of local residents, who often see conservation projects as threatening their very survival. **The number of people in the tropics is expected to double in less than 30 years; more than a third of them live in extreme poverty.**

The MBG research program provides technical assistance and training to scientists from developing tropical countries. The primary focus of MBG research is to provide in-depth studies of tropical plant groups and baseline inventories of selected regions. The results of these studies are often used to suggest conservation priorities and action through recognized international channels. **Global cooperation for conservation must be a continuing process and a new international ethic.**

This poster is dedicated to the memory of Julian Alfred Steyermark (1909-1988): native St. Louisan, graduate of the Henry Shaw School of Botany at Washington University, Garden curator since 1984, and Guinness' "World Champion Plant Collector." His energy and scholarship enriched all our lives, as well as the literature of botany.

Research at the Missouri Botanical Garden
Forty-two Ph.D.-level scientists, eight of whom live in tropical countries, technical staff and graduate students devote their energies to collecting and studying tropical plants and to exploration of selected regions. These efforts are concentrated in northwestern South America, Central America, Africa and Madagascar.

The individual scientists are specialists in the plants of particular regions or in the classification of certain plant families, such as the economically important grass, legume, and nightshade families. Their research is carried out in collaboration with scientists of the countries in which they are actively working. Together they are attempting to contribute to a common knowledge of the plants that sustain us all, with a view toward conserving and properly utilizing them.

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MBG=Missouri Botanical Garden
A Acalyphoideae
C Crotonoideae
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O Oldfieldioideae
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