A GUIDE TO COLLECTING LECYTHIDACEAE[1]

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Abstract

Because of their arborescent habit and unique flowers and fruits, Lecythidaceae present specialized collection problems. Instructions for the preparation of more informative collections of Lecythidaceae for use in taxonomy are provided.

The Lecythidaceae sensu lato are a pantropical family of small to very large trees. The family includes four subfamilies: Planchonioideae with 55 species in six genera distributed through tropical Asia, Malaysia, northern Australia, and the Pacific Islands; Foetidioideae, with five species in a single genus distributed in Madagascar, India, and Malaysia; Napoleonaeoideae, with 11 species in two genera distributed in West Africa and one species in the upper Rio Negro of Amazonia; and the Lecythidoideae, with about 206 species in ten genera distributed through tropical America from Veracruz, Mexico to southern Brazil (Kowal et al., 1977; Prance & Mori, 1979). Because our collecting experience has been mostly in the Neotropics, this essay emphasizes the Lecythidoideae. However, the methods described are applicable not only to other subfamilies of Lecythidaceae but to tropical trees in general.

General collections of plants provide the data upon which the monographic and floristic treatments of plant taxonomists are based. A single collection of a species usually does not provide sufficient data for its taxonomic description. Consequently, collections are needed that represent: (1) all parts of the plant used in classification (bark, wood, chromosomes, etc. as well as leaves and reproductive structures), (2) all stages of the life cycle of the plant (flowers, fruits, seeds, and seedlings), (3) individuals from distinct habitats in which the plant grows, (4) individuals from throughout the geographic range of the species, and (5) intra- and interindividual variation.

Many recent collections of neotropical Lecythidaceae have added little to what was already known about the species collected. These collections usually provide inadequate information about those features of the plant, such as habit and bark, that are not preserved on the herbarium sheet. Careful notes on habitat are usually lacking and even flower color is often not recorded in a manner that can be interpreted by taxonomists. Worst of all, flowers are often dried under such extreme heat and pressure that they become so carbonized that their structure is impossible to determine. Even fruits are collected in such a way that their taxonomic features and morphological variation are difficult to interpret. Finally, few collections of flowers and fruits are unequivocally documented as having come from the same tree.

Another problem is the continued collection of herbarium material of the same taxa from the same area by the same collectors. However, some duplication is necessary to voucher ecological studies of tropical forest structure and composition. Collections of some Lecythidaceae, such as *Gustavia augusta* L. and *G. hexapetala* (Aublet) J. E. Smith, continue to accumulate without augmenting the information needed for understanding the species. These collections do not merit the cost of their processing or the valuable space they occupy in herbaria. This same lack of selectivity in collecting occurs in almost all woody tropical families, for example, the Chrysobalanaceae (Prance & Campbell, in press).

If further progress is to be made in the taxonomy of tropical woody groups, more careful and selective collections by more sophisticated collectors are needed. The purpose of this article is to provide the information needed for making these collections. While we emphasize Lecythidaceae, similar needs pertain to almost all rainforest woody plant families.

Tree Climbing

Because of their large size, many species of Lecythidaceae can be collected only by felling or

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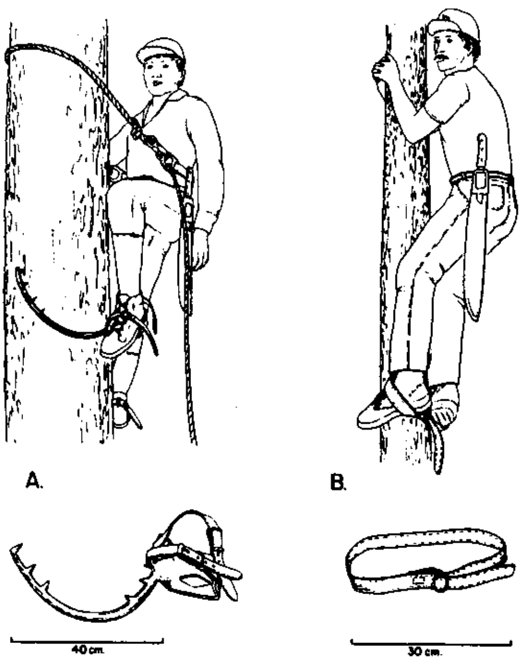

FIGURE 1. Climbing methods used to collect Lecythidaceae.—A. French tree climbing spikes ("griffes").—B. Brazilian belt used by native climbers ("peconha"). Reprinted with permission from the *Memoirs of the New York Botanical Garden.*

climbing. As a general rule, trees should be felled only if they face imminent destruction by road construction, agricultural clearing, dam construction, etc. Forest clearing provides an excellent opportunity for making collections from felled trees. The taxonomic information gathered from a herbarium specimen often does not warrant the sacrifice of a tree. This is especially true when collecting near Indian villages or settlements where trees may have economic value or cultural significance to natives. Boom (1985) has shown that 82% of the species of trees surrounding a Chácobo Indian village in Bolivia are used in one way or another by the Indians.

We have found climbing to be the most satisfactory method of obtaining specimens of Lecythidaceae. Although numerous methods are used for gaining access to tropical trees, we have employed (1) native climbers, (2) "Swiss Tree Grippers" (Mori, 1984; available from Forestry Suppliers, Inc., 205 West Rankin St., P.O. Box 8397, Jackson, Mississippi 39204-0397), and (3) French tree climbing spikes (Fig. 1).

Native climbers are becoming increasingly difficult to find. We have employed them most effectively to collect Lecythidaceae in Brazil, especially in eastern Amazonia where climbers are still common because of the custom of gathering edible fruits from *Euterpe* and *Oenocarpus* palms. The Brazilian climbers can efficiently scale trees under 35 cm DBH by using an adjustable canvas loop called a "peconha" (Fig. 1). A climber can be hired for about $10 per day.

For trees from 50 to 72 cm DBH we have used "Swiss Tree Grippers." To use them, lianas and epiphytes have to be cleared from the trunks before the trees can be ascended, but the trees themselves, in contrast to those scaled with spikes, are not damaged. The weight, bulk, and high price of the grippers often counterbalances the advantage of being able to climb the few additional trees not climbable with spikes.

We have found French climbing spikes (Fig. 1) to be the most efficient method for collecting Lecythidaceae. Smaller spikes (24 cm diam.) are used for trees from 10 to 25 cm DBH, whereas larger ones (35 cm diam.) are employed for trees from 26 to 50 cm DBH. The advantage of these spikes over the single spur spike preferred by some climbers is the ease with which trees can be climbed. The climber's weight and safety belt secures him to the tree in such a fashion that his hands are free for using clipper poles, capturing insects for pollination studies, etc. The advantage of the single spike apparatus is that trees of all sizes can be ascended with one pair of spikes. The French spikes are available from Ets Lacoste, 24160 Excideuil, France for about $50 a pair, not including shipping.

All climbs should be made with the climber secured to the tree with a safety belt. We prefer the Klein nylon protective belt with two D rings in combination with the Klein nylon adjustable lanyard (both available from Forestry Suppliers, Inc.). The use of two lanyards insures that the climber is attached to the tree at all times. When the climber reaches a branch, one lanyard remains around the trunk below the branch while the other is secured around the trunk above the branch to be passed. The belt around the main trunk beneath the branch can then be released and the climber is free to move above the branch.

We have climbed several thousand trees using the French spikes without any falls. Nevertheless, the climber should be extremely careful before and during any climb. Before climbing, the tree should be carefully inspected to insure that it is in good enough condition to support the weight of the climber, and for the presence of stinging and biting animals. Special attention should be paid to swarms of bees, as they may be made up of the particularly aggressive African honey bee, which has been responsible for the death of at least one biologist. The bases of tropical trees often serve to house creatures that vary from sand flies that carry the protozoan disease of leishmaniasis to snakes that can inflict painful and deadly bites. The tree itself may be occupied by bees, wasps, biting ants, and the deadly snake *Bothrops bilineata* (an arboreal fer-de-lance). The last is more frequent in fruiting trees, where it lies in wait to prey upon visiting frugivores. Extreme care should be used when reaching over branches or when climbing past epiphytes. Nearby trees should also be examined so that wasp and bee nests are not disturbed during manipulation of the clipper pole. Finally, the condition of the climbing gear should be constantly monitored and any frayed or defective parts should be immediately replaced. The recent fatal fall of a young botanist in Venezuela is a shocking reminder of the danger involved in making tropical tree collections.

Collection of specimens from the tree's canopy by a collector on the ground or in the tree itself is greatly facilitated by the use of a tree pruner attached to a series of aluminum poles. We have found the poles developed by botanists of the Missouri Botanical Garden staff to be the most efficient. This system includes three sets of two telescoping aluminum poles attached to one another by a spring activated button that passes from a hole in one pole into that of the next. Each pole is 1.8 m long so that when all six poles are joined nearly 11 meters plus the height of the collector can be attained. However, when more than four poles are joined it is very easy to bend the poles. In order to avoid this, it is best to cut with the poles in the most vertical position possible and to wrap the cutting rope around the poles several times in order to insure that the cutting force is directed along the poles. We find the best tree pruner to be the Snap-cut model 33 (available from Forestry Suppliers, Inc.) which fits exactly onto the end of one of the smaller aluminum poles. This head is light enough to allow maneuverability yet strong enough to cut most branches to about 4 cm in diameter.

Leaf Variation

Normal collection for herbaria does not adequately sample intra- and interindividual variation in leaf morphology. Collections which include shade and sun leaves, young and old leaves, and extremes in leaf size are invaluable in helping to solve taxonomic problems. In *Couroupita,* for example, there was much taxonomic confusion due to differences in leaves from the crown versus those that appear on the cauliflorous inflorescence. These leaves differ in shape, texture, and pilosity and were sometimes described as different species, though they in fact represent variation within the same species. Consequently, it is important to document leaf variation, even if more than one herbarium sheet is needed to do so.

Flowers and Fruits

The remarkable variation in the floral and fruit morphology of Lecythidaceae can often be related to pollinators and seed dispersers. The two principal floral types in neotropical Lecythidaceae differ in the structure of the androecium. One type is radially symmetrical (actinomorphic) and the other is bilaterally symmetrical (zygomorphic, Fig. 2). The actinomorphic androecium consists of a fused basal portion, the staminal ring, which is surmounted by free stamens (Fig. 2). In the zygomorphic androecium, the staminal ring is prolonged on one side into a stamen-free area called the ligule, which terminates in an appendage-bearing hood (Fig. 2). The hood may be open (with a space between it and the summit of the ovary) or closed and tightly appressed to the summit of the ovary. New World genera with the former type of androecium are *Asteranthos, Gustavia, Grias,* and *Allantoma,* whereas the latter type is found in *Couroupita, Corythophora, Bertholletia, Lecythis, Eschweilera,* and *Couratari* (Fig. 3). The flowers of *Cariniana* are intermediate between these two types (Fig. 3).

Pollinator rewards are produced exclusively by the androecium. In actinomorphic species the reward is always pollen. Moreover, the pollen collected by pollinators from actinomorphic flowers is the same kind of pollen that affects fertilization, i.e., no nectar or specialized pollen are produced. In the zygomorphic species either pollen or nectar may serve as the pollinator reward. However, the pollen collected by pollinators differs physiologically, and sometimes even morphologically (e.g., *Couroupita guianensis* Aublet: Mori & Boeke, 1987; Mori et al., 1980), from that which affects pollination. This specialized or fodder pollen is found in the anthers of the hood or in a group of stamens of the stam-

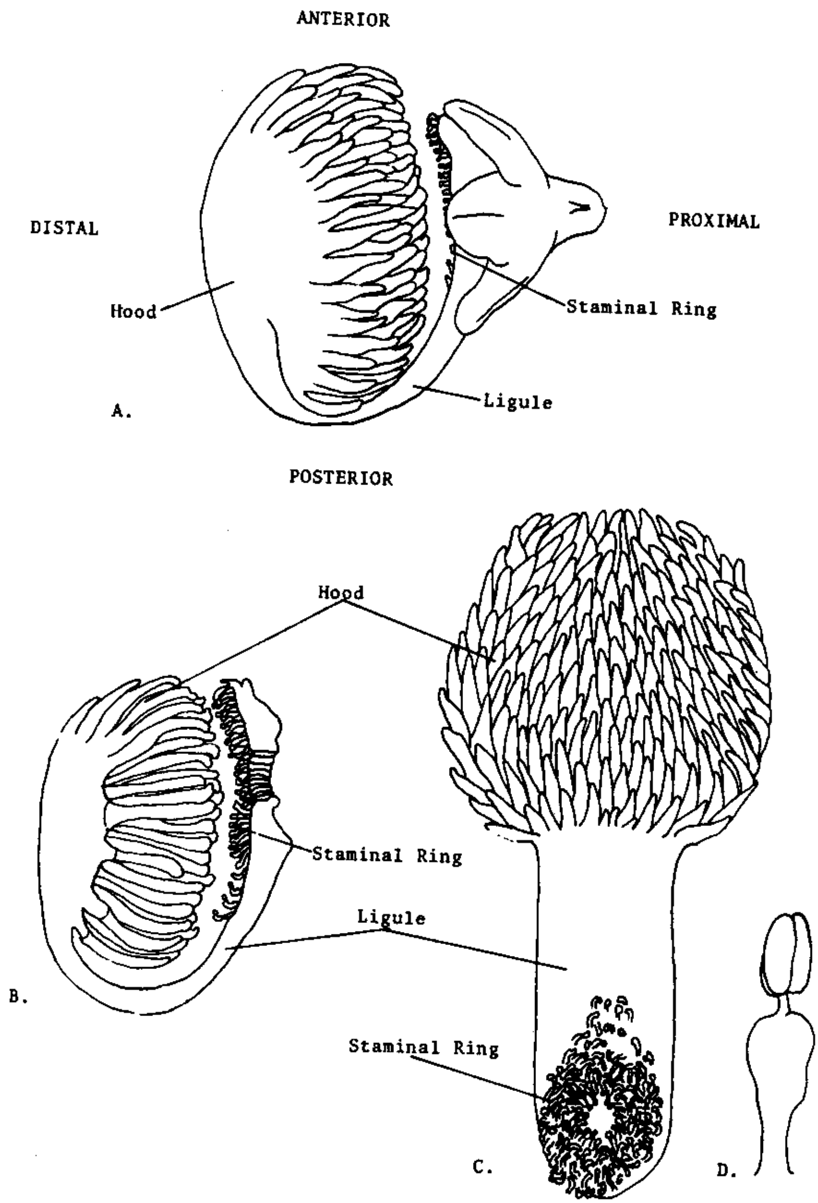

FIGURE 2. Androecial structure of a zygomorphic-flowered New World Lecythidaceae.—A. Side view of flower with petals removed, showing terminology used in describing floral orientation and in describing the androecium.—B. Medial section of the androecium.—C. Artificially opened androecium.—D. Stamen from staminal ring. Reprinted with permission from *Flora Neotropica.*

inal ring adjacent to the ligule. Color differences help to separate the two types of pollen. For example, in *Lecythis pisonis* Cambess. the fodder pollen, located in the hood, turns black after 24 hours, whereas the pollen in the staminal ring remains yellow. In *L. corrugata* Poit. subsp. *corrugata* the fodder pollen, located in a row of stamens on the ligular side of the staminal ring, is yellow in contrast to the white pollen of the remainder of the stamens. Nectar is the principal pollinator reward in those zygomorphic species with coiled androecial hoods.

The aforementioned androecial structures as well as other floral characteristics provide features useful in the classification of Lecythidaceae. Unfortunately, most collections do not ade-

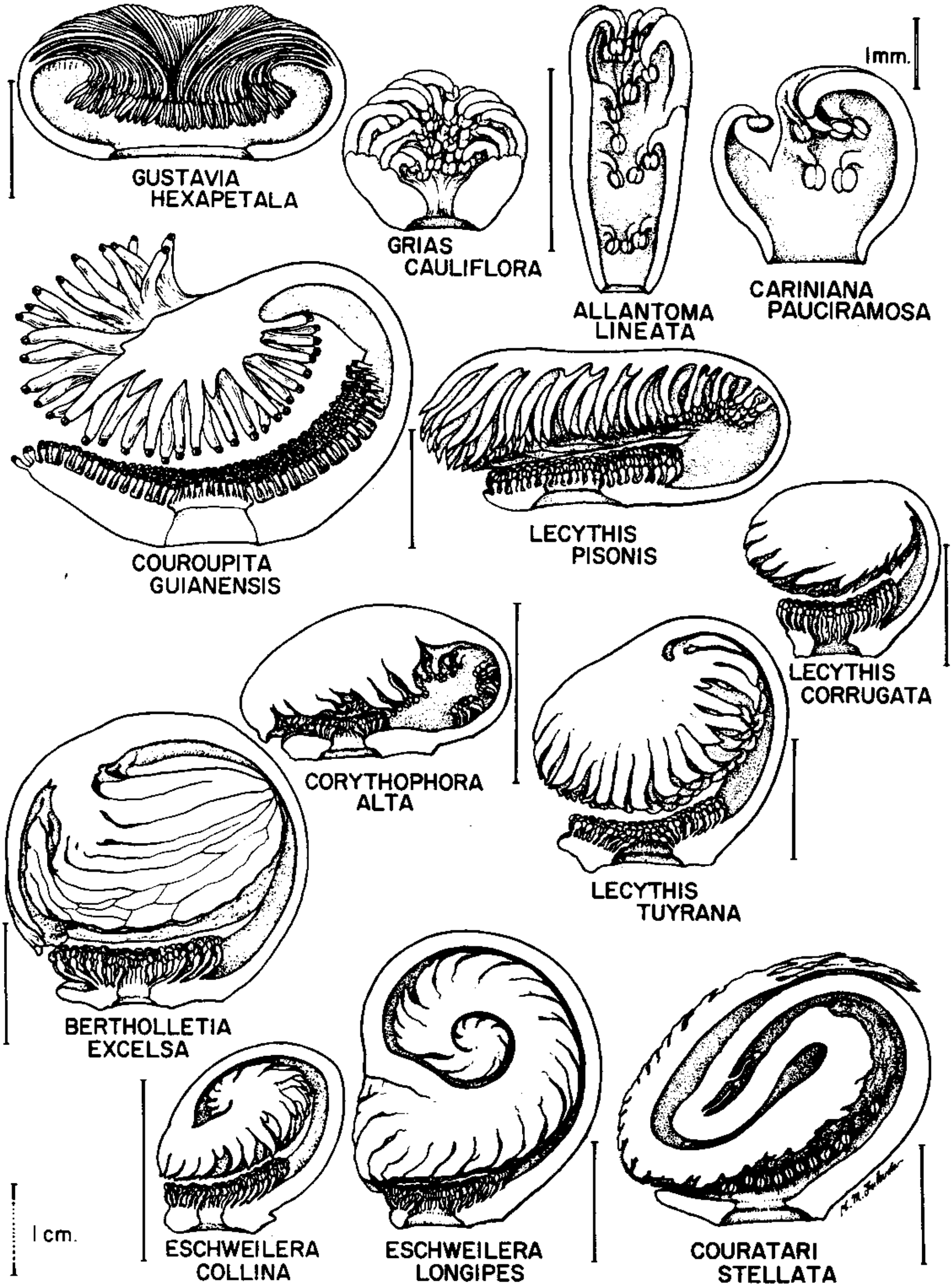

FIGURE 3. Variation in androecial structure of New World Lecythidaceae. In all cases the androecium has been removed from the flower and cut in medial section. *Gustavia, Grias,* and *Allantoma* are actinomorphic, whereas the remaining genera display varying degrees of zygomorphy. Reprinted with permission from *Flora Neotropica.*

quately preserve or describe these features. The most common error in the collection of flowers of Lecythidaceae is the use of excessive heat and pressure in the drying process. It is useful to dry at least some of the flowers outside the press in a paper bag over low heat and to preserve flowers in F.A.A. or 70% ethanol. Structure of the androecial hood can also be recorded by photographing a medial section of it. The photographs should subsequently be attached to the herbarium sheet.

Flower color and size are also useful features that have not been adequately considered in the classification of Lecythidaceae because they are seldom properly recorded. After drying, it is very difficult to determine flower size, and therefore the maximum diameters of several flowers from the same tree should be measured and stated on the label. It is also important to record the color of all the separate floral parts. It is not sufficient to state that the flowers are white, yellow, or some other color. If indeed they are entirely of a single color, this is unusual and should be clearly indicated. In many species of Lecythidaceae, the petals and androecial hood are different colors and this should be noted. In addition, the color and position of differently colored anthers should be recorded, as this indicates whether one or two types of pollen are produced within the same flower.

The fruits and seeds of neotropical Lecythidaceae have evolved a variety of forms in response to pressures exerted by different seed dispersal agents, fruit and seed predators, and environmental constraints. Major trends caused by these selective pressures are (1) indehiscence versus dehiscence; (2) retention of the fruit on the tree until the seeds have been released versus drop of fruits with the seeds inside; (3) fleshy versus woody pericarps; (4) development of mucilage within the pericarp; (5) lateral versus basal fleshy arils; (6) development of arils that completely surround the seeds; (7) loss of arils; (8) development of membranous, winglike arils; (9) development of plano-convex cotyledons as in *Gustavia*; (10) development of leaflike cotyledons as in *Cariniana*, *Couratari*, and *Couroupita*; (11) lack of well-developed cotyledons as in *Allantoma*, *Bertholletia*, *Corythophora*, *Eschweilera*, *Grias*, and *Lecythis*; and (12) terminal versus lateral seed germination. These characters have coevolved with animal and wind seed dispersers and environmental factors throughout a long history under rainforest conditions (Prance & Mori, 1978, 1979, 1983; Mori & Prance, 1981). The terminology used to describe the fruits and seeds of Lecythidaceae is illustrated in Figure 4.

A particularly difficult problem in the taxonomy of Lecythidaceae has been the determination of the extent of intraspecific fruit variation. Unfortunately, earlier monographers of the family (Miers, 1874; Knuth, 1939) did not have a concept of intraspecific fruit variation. They simply named all fruit variations as separate species. However, beginning with Dugand (1947), botanists have become aware that the fruits of Lecythidaceae can display considerable variation within the same species (Mori & Prance, 1981). In *Allantoma*, fruit morphs representing as many as six of Miers's species have been found on a single tree (Prance & Mori, 1979).

Collectors can help in the description of fruit and seed features of Lecythidaceae. They can also gather material that adequately shows fruit variation within and between individuals. It is especially important that the developmental state of the fruits is recorded. Under heat, young fruits may dehisce and thereby appear to be mature. Because it is often very difficult to open up dried fruits, some should be cut lengthwise through the middle and seeds removed from the fruit with the arils and funicles intact. The features mentioned earlier should be recorded at the time of collection.

It is extremely useful to have flowers and fruits from the same tree. Therefore, resident collectors can provide a useful service by periodically returning to the same trees to gather representative material from all stages of the plant's life cycle. This is especially critical in *Eschweilera*, where the similarity of the leaves of many species can lead to falsely relating fruits of one species with flowers of another. Collectors can also contribute to the proper correlation of flowers and fruits by always searching in the canopy and under flowering trees for old fruits. If the fruits are too rotten to collect, a photograph should be made and subsequently affixed to the herbarium collection. However, care must be taken to avoid attributing fruits from the ground to an incorrect tree. If any doubt exists, the fruits should be given a separate collection number.

Local collectors can contribute much to our knowledge of Lecythidaceae by becoming experts on the family in their areas. On-site studies of taxonomy, ecology, pollination biology, population dynamics, and ontogenetic development in species-rich areas will add much to our knowl-

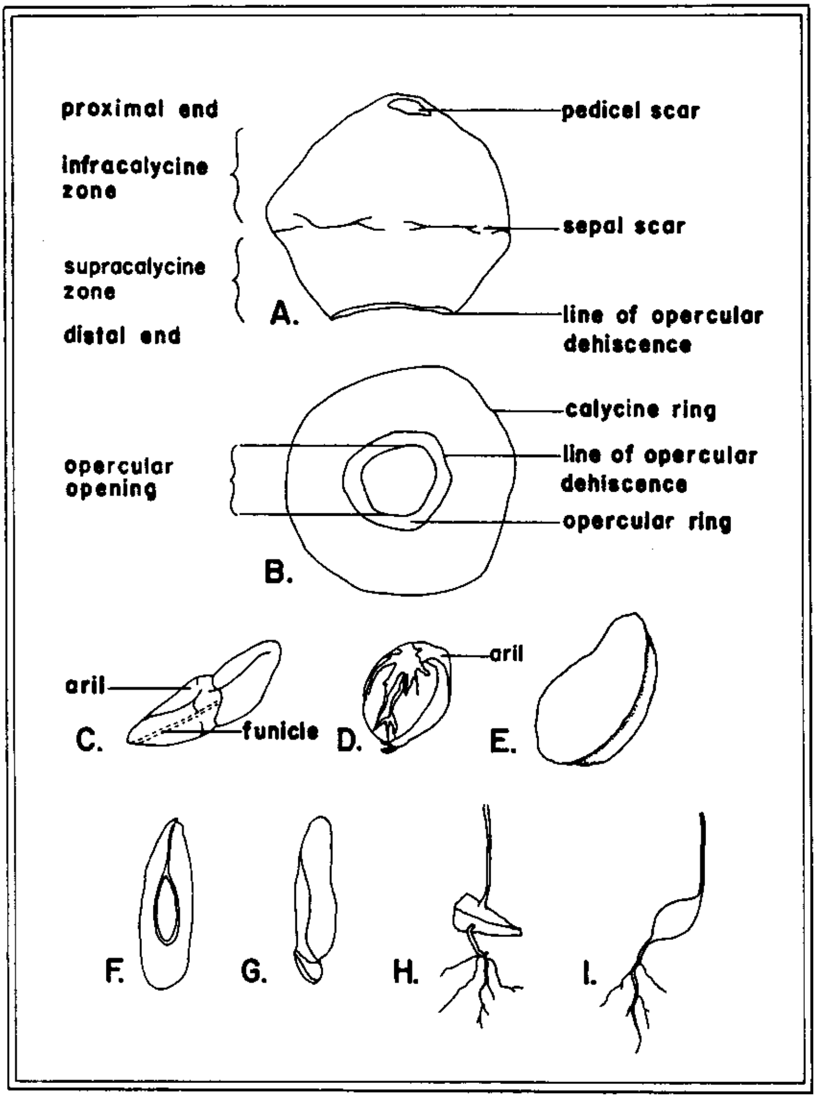

FIGURE 4. Fruit, seed, and seedling features of New World Lecythidaceae.—A–C. *Lecythis ampla* Miers. Note the basal aril in C.—D. *Eschweilera* sp. Seed with lateral aril.—E. Seed of *Bertholletia excelsa* Humb. & Bonpl. Note that this species lacks an aril.—F. Winged seed of *Couratari stellata* A. C. Smith. Note that the wing entirely surrounds the seed.—G. Unilaterally winged seed of *Cariniana micrantha* Ducke.—H. Lateral germination of *Eschweilera tenuifolia* (Berg) Miers.—I. Apical germination of *E. pittieri* R. Knuth. Modified with permission from *Flora Neotropica.*

edge of the family. These studies are needed because many features that allow recognition of species in the field are not apparent in herbarium specimens. For example, in French Guiana, where the senior author has recently completed a detailed study of the 27 species of Lecythidaceae in the proposed national park surrounding Saül (Mori & collaborators, 1987), we were able to resolve a number of taxonomic problems that could not be understood with herbarium material alone. Similar studies would be especially useful in central and western Amazonia and in the Chocó of Colombia.

ADDITIONAL NOTES

Collectors generally do not provide enough information on habitat, habit, and bark to aid in the identification and classification of Lecythidaceae. These features are valuable in separating species of Lecythidaceae and should be recorded by the collector.

Species of Lecythidaceae are primarily found in lowland moist forests. Nevertheless, a few species have invaded savanna habitats [e.g., *Cariniana rubra* Gardner ex Miers and *Eschweilera nana* (Berg) Miers of central Brazil and *L. schomburgkii* Berg of Roraima, Brazil], and 14 species of *Eschweilera* are known to occur at elevations above 1,000 m (Prance & Mori, 1979). Within lowland habitats, some species of Lecythidaceae are restricted to the periodically inundated *várzea* habitat where they may be among the most conspicuous elements of the vegetation [e.g., *Allantoma lineata* (Mart. ex Berg) Miers, *Couratari oligantha* A. C. Smith, *C. tenuicarpa* A. C. Smith, *Eschweilera ovalifolia* (DC.) Niedenzu, *E. parvifolia* Mart. ex DC., and *E. tenuifolia* (Berg) Miers]. However, Lecythidaceae are most diverse in the nonflooded, or *terra firme*, habitat. Even within *terra firme* some species appear to prefer ridge tops, others hillsides or valley bottoms (Mitchell & Mori, 1987). Consequently, it is important that collectors make very careful habitat notes, indicating the vegetation type, altitude, and slope from which collections are made. It is especially useful to note whether the plant grows near a stream or other body of water, and if the water is white, black, or clear.

Although all species of Lecythidaceae are trees (some may occasionally grow as shrubs), the collector should be aware of and note differences in habit. Some species (e.g., *Gustavia monocaulis* Mori) are unbranched pachycauls, others [e.g., *G. grandibracteata* Croat & Mori and *G. superba* (Kunth) Berg] are branched pachycauls, and others [e.g., *G. hexapetala* (Aublet) J. E. Smith and most other species] are leptocauls.

Species of Lecythidaceae are found as understory, canopy, and emergent trees. In order to communicate this information, the collector should record the height and DBH of collections as well as note the stratum to which this and other individuals of the species belong. Only reproductive individuals should be considered when determining the tree stratum in which the species belongs. For detailed studies of Lecythidaceae, diameter versus height diagrams should be prepared. The graphs will level out at the stratum in which the species reaches reproductive maturity. In his study of Surinam forests, Schulz (1960) has prepared such graphs for a number of species of Lecythidaceae as well as for species of other families.

The base of the trunk should also be described. Some species (e.g., *Lecythis idatimon* Aublet) have cylindric trunks to the very base, others (e.g., *L. chartacea* Berg) have basally swollen trunks, and others (e.g., *L. zabucaja* Aublet) have well-developed buttresses. The height, width, and thickness of the largest buttress should be measured. An undescribed species from French Guiana has pneumatophores.

An important but infrequently described feature of Lecythidaceae is the bark. There are four types of external bark morphology in the family. In the first, the bark is very deeply fissured (e.g., *Bertholletia excelsa* Humb. & Bonpl., *Corythophora rimosa* W. Rodr., and *Lecythis zabucaja* Aublet); in the second it is nearly smooth (e.g., *Eschweilera collina* Eyma); in the third it is more or less smooth, but shallow vertical cracks and lenticels may be present [e.g., *Eschweilera pedicellata* (Richard) Mori and *L. corrugata* Poit.]; and in the last it may be markedly scalloped or dippled [e.g., *E. micrantha* (Berg) Miers and *E. apiculata* (Miers) A. C. Smith]. The thickness of the outer and inner barks as well as the color of the inner bark should also be recorded. The bright yellow inner bark of *Lecythis poiteaui* Berg or the flesh pink inner bark of *Eschweilera apiculata* are excellent aids in field identification. Heartwood color should also be recorded when possible.

One of the best ways to communicate habit and external bark features is with photographs. The photograph should include a scale and the number of the collection and should eventually be affixed to the herbarium sheet.

SPECIALIZED COLLECTIONS

Known chromosome counts of Lecythidaceae are summarized in Kowal et al. (1977). Additional counts are needed for *Allantoma, Cariniana, Corythophora,* and *Couratari* of the New World Lecythidoideae, for most of the Old World genera, for *Asteranthos brasiliensis* Desf. (the only member of Napoleonaeoideae in the New World), and for species of *Gustavia* to determine the extent of polyploidy. Collections of buds of all sizes should be fixed in either Farmer's (3 ethanol : 1 glacial acetic acid, v/v) or Jackson's (4 ethanol : 2 methanol : 2 chloroform : 1 proprionic acid : 1 acetone, v/v). The best results have been obtained with fixation in Jackson's solution (Kowal, pers. comm.). If possible, the buds should be left on the inflorescence, as this facilitates location of buds in the proper stage for counting. In addition, because of their thickness, buds should be slit open to allow penetration of the fixative. After 12 hours of fixation the buds should be transferred to 70% ethanol and stored in a freezer when possible.

For anatomical studies, collections of leaves, twigs of several sizes (newly flushing ones are especially useful), and bark should be fixed in F.A.A. (10 ethanol : 7 distilled water : 2 formalin : 1 glacial acetic acid, v/v). They may be stored in F.A.A. or in 70% alcohol. The bark sample should consist of a block ca. 2 cm square and should include a portion of the outermost sapwood to insure that all layers of the bark are included in the sample.

Wood samples may be chisled from standing trees or cut from felled trees. In the former case, the block should be about 10 cm square by 10 cm deep and the bark should be left attached to the wood sample. Smaller blocks can be removed but, because of splitting of the sample upon drying, they are not as desirable. The wound left by the removed block should be painted over with a sealer to minimize infection. In the case of felled trees, larger blocks of wood or segments of trunk that can later be cut into specimens about 10 cm long (parallel to the long axis of the trunk) by 5 cm wide (tangentially) by 2 cm thick (radially) should be collected. Specimens should be taken from breast height and from the bole itself rather than from large branches or from the buttresses. The specimens should be dried over low heat to insure that a minimal amount of cracking occurs.

There have been no detailed studies of any aspect of the chemistry of neotropical Lecythidaceae (Prance & Mori, 1987). If collecting material for study of flavonoids, the collector should remember that the preservatives used in tropical fieldwork (i.e., aqueous mixtures of formaldehyde or paraformaldehyde, pentachlorophenol in alcohol, or alcohol) may remove these and other compounds and thus render the specimens useless for chemical study. Therefore, if material is collected for chemical study, it should be kept free of field preservatives and air dried. Moreover, all field preserved specimens should have the treatment indicated on the label so that the specimens are not subsequently screened for compounds soluble in the preservatives (Coradin & Giannasi, 1980).

It is now known that bees play a major role in the pollination of most neotropical Lecythidaceae. A recent review of pollination in neotropical members of the family is provided by Mori & Boeke (1987). Nevertheless, in order to understand the complex interactions of bees and Lecythidaceae, many carefully documented collections of bees visiting Lecythidaceae are still needed. Especially useful are detailed studies of the pollination of individual species of Lecythidaceae. Collections should be made at all times of the day when flowers are open. Fortunately, most species of Lecythidaceae open their flowers at daybreak and drop them late in the same afternoon. However, some species either flower entirely at night or open their flowers during the night. For example, the bat-pollinated *Lecythis poiteaui* Berg opens its flowers at dusk and drops its petals and androecia at about 0300, and the bee-pollinated *Gustavia augusta* L. opens its flowers during the night and drops its petals and androecia by late afternoon the next day. During the day, a French Guianan individual of *G. augusta* was visited mostly by trigonid bees, whereas the night-flying bee *Megalopta genalis* visited its flowers before daybreak. Consequently, it is necessary to determine floral longevity before a pollination study is begun, and once this is established, the plant must be observed and pollinators collected at all times when flowers are open. In addition, the species should be studied and pollinators collected throughout its entire flowering cycle. The pollinators at peak flowering may not be the same as those visiting the plant at the onset or the end of the flowering period. For example, Mori & Boeke (1987) have collected completely different species of *Trigona* dominating the flowers of *G. augusta* during the day at different times during its flowering cycle.

We have collected bees visiting Lecythidaceae by simply climbing into the crown and waiting by flowers until insects enter them. Random capture of all insects that approach flowers of Lecythidaceae will often give erroneous ideas of the pollinating species because many species of insects, such as wasps, visit flowers of Lecythidaceae to prey upon other insects, not to collect pollen or nectar. In species with zygomorphic flowers, it is especially important to observe the position and behavior of the bee in the flower, since this will indicate what type of pollinator reward the bee is after. Euglossine bees are best captured after they have completely entered the flower; otherwise, they often are quick to spot the movement of the net and escape.

We use the chlorocresol method described by

Tindale (1962) to preserve our insect collections in the field. This method keeps the insects moist and free of mold and allows them to be pinned directly upon their removal from the storage container. In this method, a teaspoonful of chlorocresol is placed on the bottom of a plastic container. It is held in place by a layer of cotton or tissue followed by a tightly fitting layer of cardboard or blotter paper. The bees are then placed in layers separated by tissue paper. Labels with the collection data are inserted in each layer. The plastic container is tightly sealed so that the moisture of the insects' bodies keeps them supple. If the collections are too dry, a little water may be sprinkled into the container before it is sealed. The insects should be pinned soon after removing from the container as they dry out relatively quickly upon removal. If the container is properly sealed, the insects will remain in good condition for months. Chlorocresol can be purchased from BioQuip Products, P.O. Box 61, Santa Monica, California 90406.

CONCLUSIONS

A complete understanding of the taxonomy and biology of neotropical Lecythidaceae must be based, to a large extent, on adequately prepared and documented herbarium specimens. It is not good practice to simply collect Lecythidaceae without giving consideration to the proper preservation of the structures used in the classification of the family. Moreover, it is essential that more detailed descriptions of structures not preserved on herbarium sheets, such as flower color and bark characteristics, be noted by the collector. Better descriptions of the phenological state of the plant and its habitat are needed as well. Specialized collections for the study of chromosomes, anatomy, chemistry, and pollination biology will add greatly to our knowledge of Lecythidaceae. It is also important that local collectors become more selective in the species they collect. Some species have already been adequately collected from a given locality, and, therefore, their continued collection adds no new information to our herbaria and only causes undue expense and takes up valuable space in herbaria.

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