COLLECTING AND PREPARING SPECIMENS OF ARACEAE

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The family Araceae is a conspicuous component of moist to very wet life zones in the tropics. Because of the frequently succulent and often large parts, the preparation of specimens is often difficult. A detailed discussion of all aspects to be considered in preparing descriptions of *Anthurium* (applicable as well to most other genera) was published for use by aroid workers (Croat & Bunting, 1979). This paper will deal only with those aspects which should be recorded when specimens are being prepared in the field. Since the family is well suited to cultivation, and since an increasingly higher percentage of the collections are also being collected and sent back alive, this paper will be divided into two parts: 1. herbarium specimens; 2. live collections.

HERBARIUM SPECIMENS AND FIELD NOTES

ECOLOGICAL ASPECTS OF ARACEAE

The diversity of habit types in Araceae is much greater than in most families (Simmonds, 1950; Madison, 1978) and special attention should be given to aspects of habit. Some members of the family, such as *Caladium, Chlorospatha, Dieffenbachia, Spathiphyllum,* and *Xanthosoma* are strictly terrestrial. Most temperate species such as *Arisaema,* and of course all tuberous members of subfamilies Lasioideae (e.g., *Dracontium, Amorphophallus,* etc.) and Aroideae, are also terrestrial. Quite a number of aroids are rooted aquatics in standing water, including *Orontium, Montrichardia, Urospatha,* and other genera. *Symplocarpus, Spathiphyllum,* and others occur in marshy habits or sometimes in standing water. Some *Spathiphyllum* and *Anthurium* species occur only on rocks along streams. Riparian species are particularly common in southwest Asia with genera such as *Holochlamys, Piptospatha,* and *Aridarum* frequenting such habitats. *Pistia* is a free-floating aquatic and *Jasarum* a rooted but wholly immersed aquatic. The largest percentages of aroid species are, however, either epipetric or epiphytic in one form or another. The types of epiphytism are diverse with some genera such as *Anthurium* and *Stenospermation* usually being true epiphytes while other genera like *Monstera, Syngonium,* and most *Philodendron* begin their life in the soil then eventually climb trees while becoming hemiepiphytes and at least in part often losing their connection with the ground to become true epiphytes. Some *Philodendron,* such as *P. wendlandii* Schott, have seeds which germinate only on tree branches and are thus true epiphytes. Still others such as *P. radiatum* Schott grow as true epiphytes until they eventually send roots to the ground at which time they must be classified as hemiepiphytes.

Many genera pass most of their adult lives slowly creeping up tree trunks. These are referred to as "appressed climbers" or "epiphytic creepers." However, depending on their situation, such plants in certain genera, notably *Monstera* and *Syngonium,* can revert again and again to juvenile forms owing to being dislodged from their host plant or merely because they have run out of space to climb. These reversions have been studied for *Monstera* (Madison, 1977) and especially for *Syngonium* (Ray, 1981; Croat, 1982). Leaf forms for juvenile plants, pre-adult plants (usually found down low on tree trunks), and adult plants are generally totally distinct and may even seem to be distinct species. If possible, one should collect juvenile and pre-adult forms.

The habit of *Philodendron* is particularly diverse with, for example, some species occurring only over the crowns of understory shrubs while others occur only on the lower portions of larger tree trunks and still others grow only high in the canopy where more light is available. To merely refer to all of these as epiphytes (the usual case) or epiphytic vines (in fact most are hemiepiphytic vines) does little justice to a complex array of life forms and habits. It is thus important when making aroid collections to make note of the habitat and habit of the collection. The habit of the collection is particularly important.

IMPORTANT MORPHOLOGICAL FEATURES

Since it is often not possible to collect the whole plant, certain morphological features are impor-

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TABLE 1. Synopsis of features to note for certain genera of Araceae.

Anthurium	Habit; internode length; petiole cross-sectional shape; disposition of inflorescence; color and disposition of spathe; color of spadix; color and shape of fruits.
Dieffenbachia	Height of plant; diameter, color and glossiness (matte or glossy) of stem; cross-sectional shape, color and markings of petioles; color and markings of leaves; shape of upper midrib.
Homalomena	Scent of cut parts; coloration and variegation of leaves.
Monstera	Habit; length, coloration, and markings of internodes; collect juvenile and pre-adult leaves if possible; color of spathe and spadix.
Philodendron	Habit; internode length and color; cataphylls deciduous or persistent, kind and degree of ribbing; cross-sectional shape of petiole; shape of midrib on upper surface; prominence of minor veins on lower surface; color of sap; number of inflorescences per axil; color of spathe (inside and outside).
Rhodospatha	Habit; internode length; color of spathe and spadix.
Spathiphyllum	Habitat; degree of clustering; spathe and spadix color; color of tepals; color and degree of protrudence of pistils.
Syngonium	Habit; internode length; collect juvenile and pre-adult leaves if possible; number of inflorescences per axil.
Xanthosoma	Spathe tube color (inside and outside); color of female spadix.

tant to note. These are summarized for certain important genera in Table 1.

Stem. Numerous taxonomic characteristics are exhibited by the stem. Obviously in climbing genera, such as *Monstera, Philodendron,* and *Syngonium,* the internode length can be important. If it is not possible to collect the stem either because of its size or because the stem is being used as a live specimen, one should make note of the length and width of the internodes. In most climbing genera even one or two internodes included with the specimen yields considerable information because many species have unique colors on drying or are fissured in characteristic manners. The stems of *Philodendron* and other scandent genera may be variously flattened on one side or variously sulcate providing useful taxonomic characteristics. Though most of the figures in this paper lack stems because the stems were taken for cultivation, it is always best to include the stem if it is not to be used.

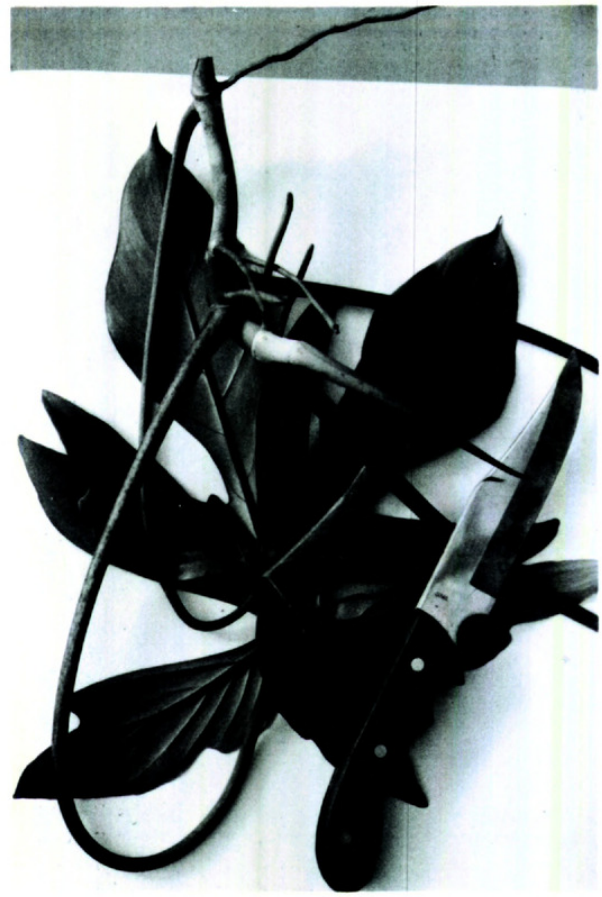


FIGURE 1. Stem with several nodes, cataphyll and both surfaces of blade.

On large stems it is best to cut off a small portion of the apex of the stem, then split the stem longitudinally (or even remove all but a thin portion of the outer part of the stem so that the uppermost cataphyll is still intact). If possible and the size of the petiole does not prohibit it, the uppermost petiole should be left with the stem tip (Fig. 1).

Cataphylls. Philodendron, a large and taxonomically complex genus, has cataphylls that provide several important taxonomic characteristics. Cataphylls are bract-like structures at least partially encircling the stem, at or near the apex, and subtending each new leaf for its protection as it emerges. They may be present or absent (in

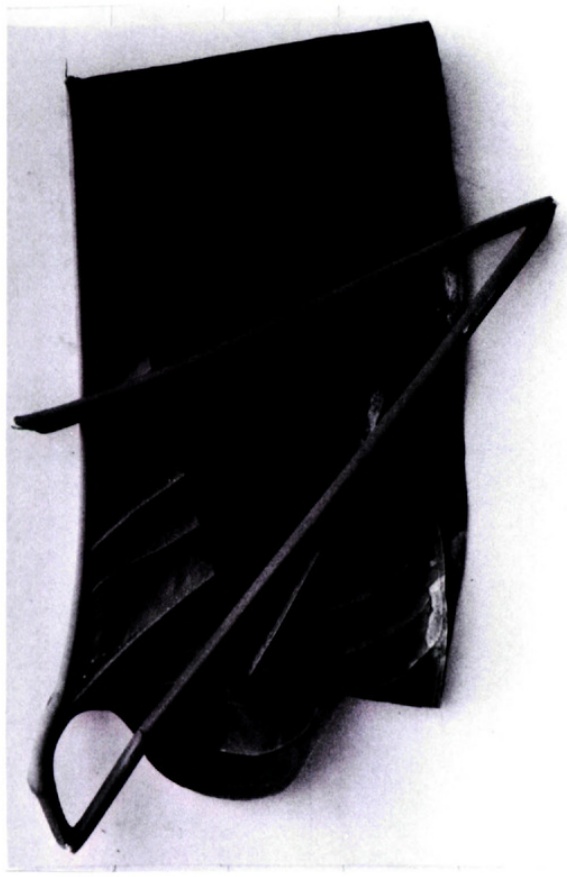


FIGURE 2. One-half of large blade with midrib and petiole, folded to show base and apex.

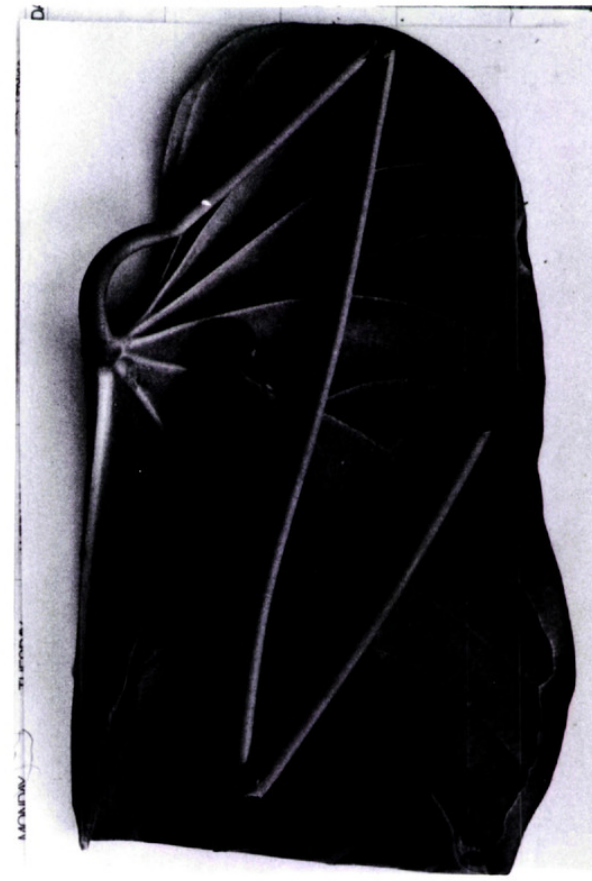
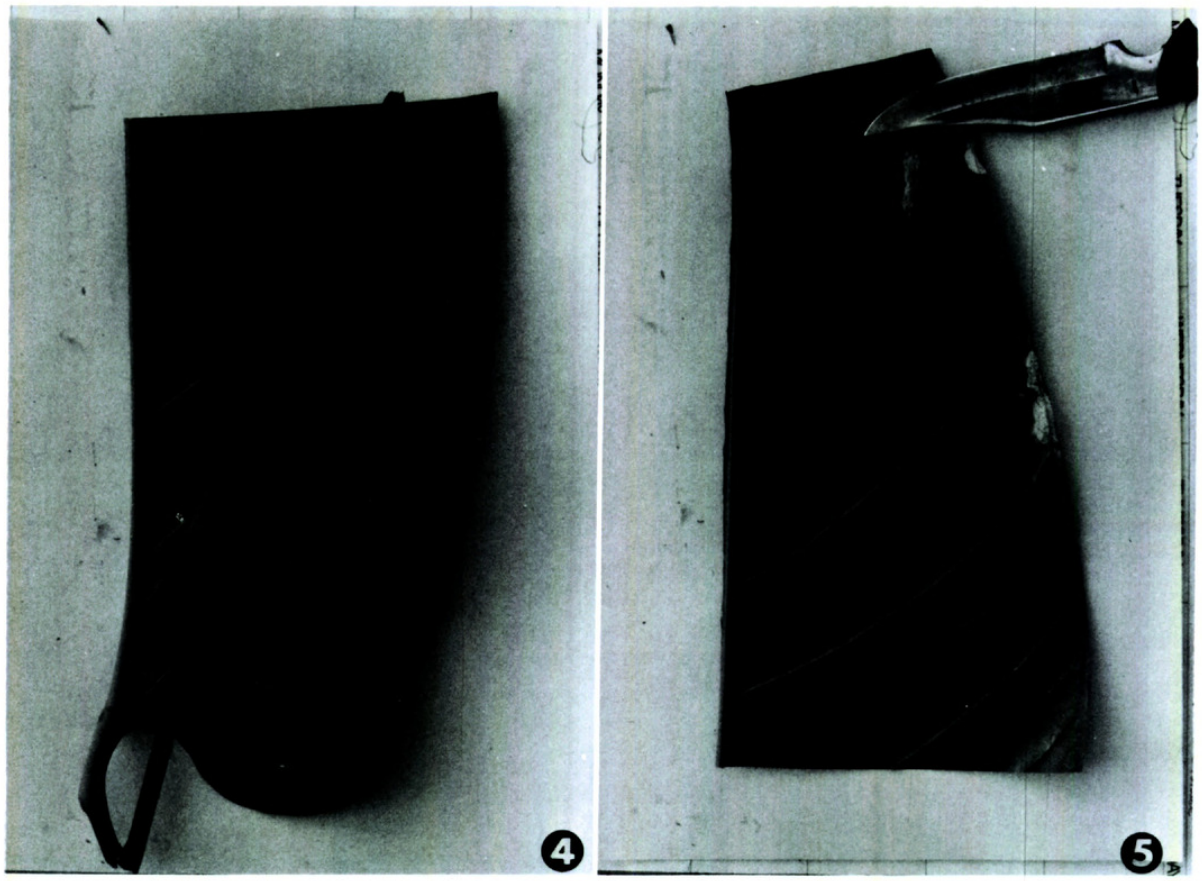


FIGURE 3. Large blade with apex folded back (slightly to one side to expose primary lateral veins and the sinus).

the case of some entire sections of the genus, e.g., sect. *Pteromischum,* where protection of the new leaf is accomplished by a sheathing petiole of an earlier leaf) and may be variously colored. Cataphylls may also be unribbed, 1-ribbed, or 2-ribbed and at the same time they may be deciduous or variously persistent (either remaining intact or more usually weathering to a mass of persistent fibers which envelop the stem). At least the apical portion of the stem is thus essential for an adequate specimen.

Petioles. Petiole cross-sectional shape on many genera including both *Philodendron* and *Anthurium* is one of the most valuable taxonomic characteristics and should be noted. Because this feature is so variable and because a typical shape has been described so differently by different collectors, an illustration of the various petiole shapes along with descriptive terminology is included (Fig. 9).

Blades. When blades are small, it is best not to fold the blade but to prepare the specimen with the lower surface up (Fig. 1). The lower surface, because of the generally more pronounced venation, provides more characters. On a larger blade it is best to slice off one-half of the blade leaving the midrib and petiole with the half which is to be saved (blades of Araceae are generally bilaterally symmetrical but where not, this technique should be replaced by making one or more sections of the blade perpendicular to the midrib). The half leaf can then be folded accordian style to fit a standard sized newspaper for specimen preparation (Fig. 2). It is important to start at the base of the blade with the lower surface facing upward, then fold the apical lobe over so that it is directed slightly to one side so the midrib and the sinus (space between the posterior lobes) is still visible (Fig. 3). When the blade is particularly long, two or more folds can be made, but particularly large blades should be cut in half perpendicular to the midrib and mounted on two sheets (Figs. 4, 5). When blades are wide and the basal portion will not fit on a standard sized herbarium sheet, the lower portion can be placed on the sheet sideways (Fig. 6) with the remainder folded on a second sheet. If a speci-



FIGURES 4, 5. Blade cut perpendicular to midrib and placed on two sheets.

men is of moderate size, the petiole, stem, and inflorescence can be accommodated on the same sheet. After folding the blade (usually only one can be accommodated) in the manner described above, the petiole, section of stem apex, and the inflorescence (usually in one of uppermost axils) can be folded over the leaf. This method can at least be used for initial field drying, then if the value of the collection warrants it, the collection can later be cut along the fold lines and mounted on separate sheets.

Inflorescence. Because of the unusual nature of flower morphology, some discussion is warranted (see Croat & Bunting, 1979, for a more detailed treatment).

Araceae flowers are invariably quite small and are borne in congested spikes (or spadices) which are, at least initially, always enveloped by a conspicuous spathe. Flowers may be unisexual (in which case plants are usually monoecious) or bisexual. When they are unisexual, the female (pistillate) flowers are always borne on the lower part of the spadix and mature first (aroids are all believed to be protogynous). The male (staminate) flowers are borne on the usually much longer upper part of the spadix. The lower part of the staminate spadix often bears a small section of sterile male flowers. A few genera in the old world, e.g., *Alocasia* and *Amorphophallus,* bear an elongated, often conspicuous, appendage at the apex above the male spadix. In the case of unisexual flowers, the respective sections of the spadix may be of different colors and these should be noted. Bisexual flowers are borne in uniform spadices and are usually of uniform color though the tepals may be a different color than the pistils. Color changes may also occur after anthesis and sometimes it is possible to note these by observing several inflorescences on a plant or several plants in a population.

The spathe color is taxonomically important and should be noted. Like the spadix, color changes often occur after anthesis and if so, these should be noted. Species with convolute spathes (such as *Philodendron*) may have the spathe colored differently on the inner surface than on the outer surface. These important differences should be noted. Since many genera may have massive inflorescences or infructescences, it is often wise to dissect the spadix longitudinally for better

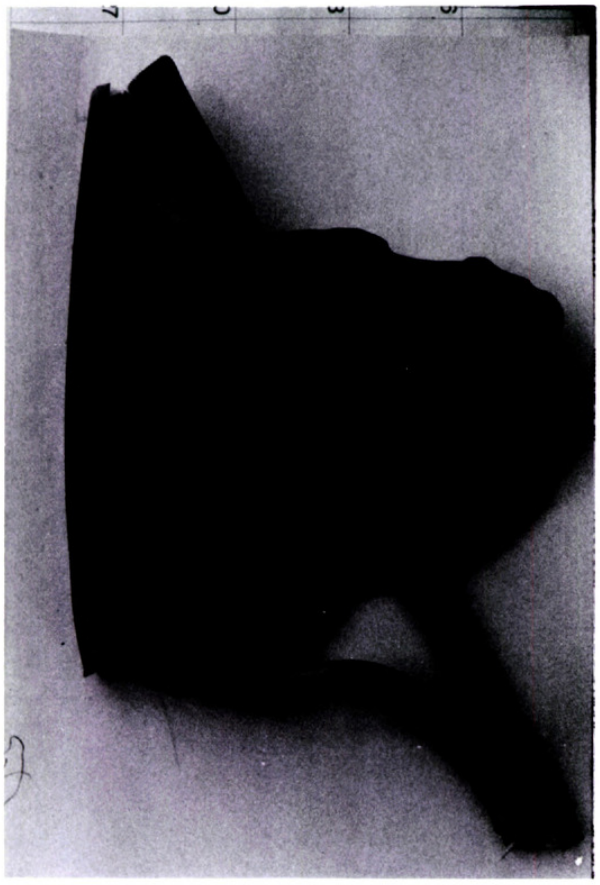


FIGURE 6. Lower portion of blade placed sideways on sheet to accommodate broad blade (upper half of blade dried in a separate sheet).

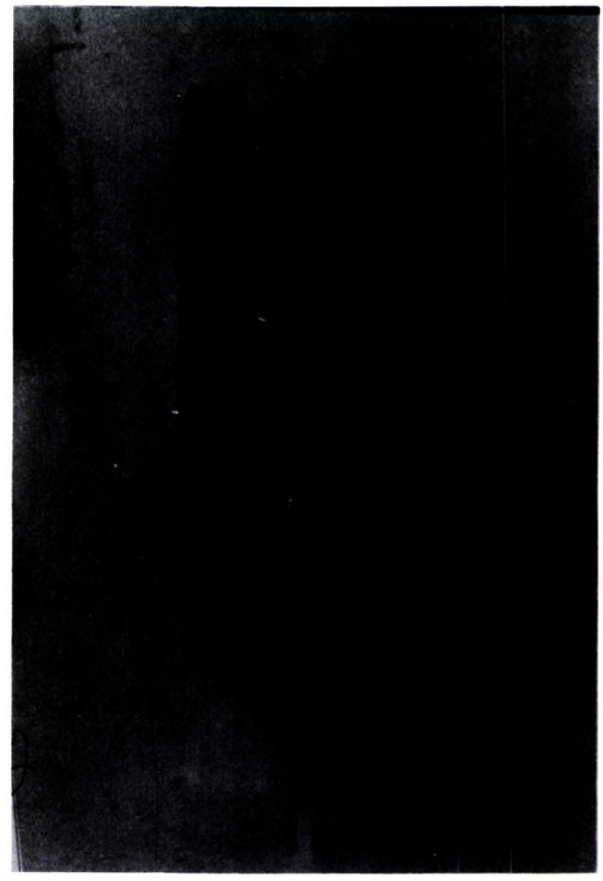


FIGURE 7. Spathe removed by cutting the base near peduncle attachment and by pulling the two sections apart.

drying. Genera with convolute, closed spathes pose special problems since the spadix enclosed in them exhibits important characters which must be exposed. Ideally it is best to leave one inflorescence intact (if it can be dried) and dissect another to expose the spadix. One method is to remove the spathe completely by cutting around the spathe just above its attachment with the peduncle (Fig. 7). Another method is to cut a large window in the spathe at the base to expose the pistillate portion and at least the base of the staminate pattern (Fig. 8). It is important to make note of any differences in coloration of the male and female portions, because in many cases they are not the same.

Fruit. Color and shape of fruits are taxonomically important and should be reported accurately since even where live material exists, it is often not possible to successfully pollinate the plant and thus study the fruits. Fruits usually are solid colored but are often bicolorous with the lower portions usually paler. Recording the shape of the berries is important because drying greatly distorts them.

PREPARATION AND SHIPMENT OF LIVING MATERIAL

Most Araceae are either epiphytic or have short internodes and are easily shipped live. Generally the most difficult to ship live are slender stemmed vines especially those with long internodes such as *Heteropsis* or *Philodendron* (sect. *Pteromischum*). Generally a live specimen should consist of at least three nodes (preferably more). The most successfully transplanted cuttings are usually about 15–20 cm long (6–8 in.). Old cataphylls, as well as all leaves and roots, should be removed as they usually perish during shipment. Generally dirt and debris can be removed by wiping the stems with your hands or a rag and a knife can be used to scrape off more difficult to remove dirt. Washing with a brush in clean moving water is good but all excess water must be blotted off or stems must be allowed to air dry before packaging to prevent mold. Individual cuttings should be tagged first then wrapped in small pieces of newspaper. The cuttings should be gathered into plastic bags, tightly sealed, and

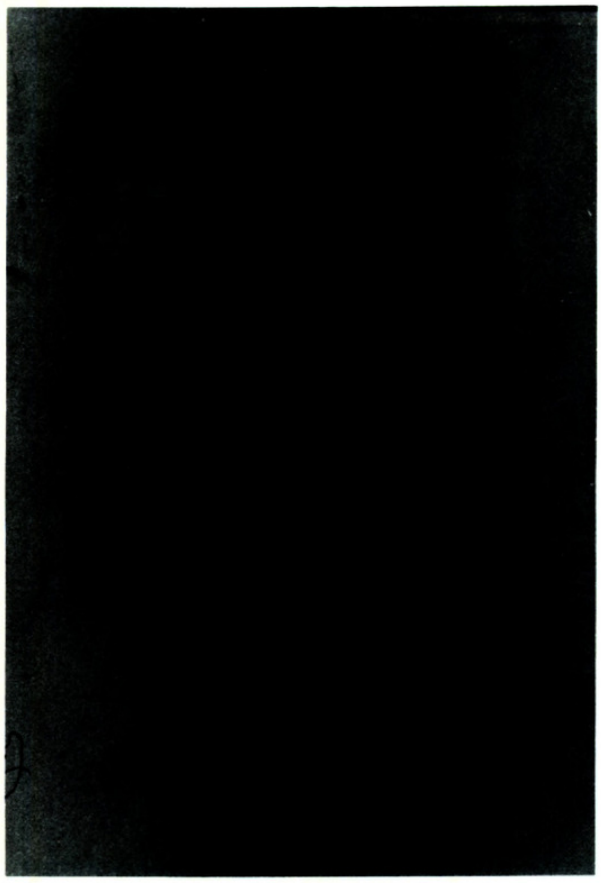


FIGURE 8. Spathe cut to expose portion of spadix (including lower pistillate portion, sterile staminate flowers and the lower half of the staminate spadix).

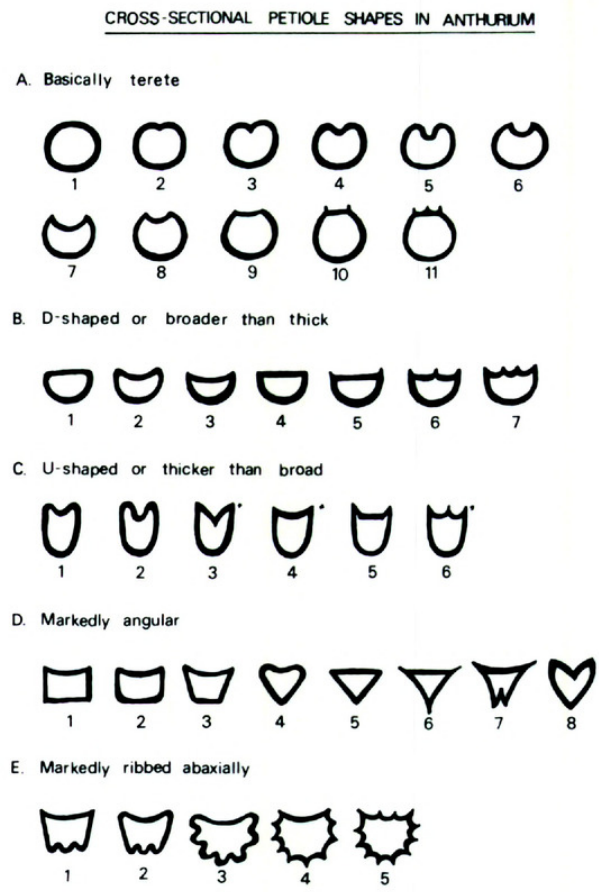


FIGURE 9. Cross-sectional petiole shapes in *Anthurium*.—A. Basically terete: ranging from esulcate (1), to shallowly and acutely sulcate (2, 3), to obtusely and broadly sulcate (4), to narrowly and obtusely sulcate (5), to narrowly and acutely sulcate (6), broadly and acutely sulcate (7), shallowly sulcate (8), flat adaxially (9), flat adaxially with marginal ribs (10), to flat adaxially with marginal and medial ribs (11).—B. D-shaped or broader than thick: ranging from flat adaxially with obtuse margins (1), to broadly sulcate with obtuse margins (2), broadly sulcate with acute margins (3), sharply D-shaped (4), flat adaxially with erect margins (5), and flat adaxially with erect margins with one or more medial ribs (6, 7).—C. U-shaped or thicker than broad: ranging from broadly and obtusely sulcate (1), to narrowly and obtusely sulcate (2), narrowly and acutely sulcate with acute margins* (3), shallowly and acutely sulcate* (4), sulcate with acute margins (5), sulcate with sharp margins and a medial rib* (6).—D. Markedly angular: ranging from quadrangular with acute angles (1), to quadrangular with obtuse angles (2), trapezoidal (3), obtusely triangular (4), acutely triangular (5), acutely triangular with two marginal ribs (6), basically triangular with two abaxial ribs (7), obtusely triangular, narrowly and sharply sulcate with convex sides (8).—E. Markedly ribbed abaxially: ranging from trapezoidal or quadrangular, sharply and broadly sulcate adaxially, 3-ribbed abaxially (1), to obtusely and broadly sulcate adaxially, 3-ribbed abaxially (2), broadly and obtusely sulcate adaxially, 5-ribbed abaxially (3), broadly and sharply sulcate adaxially, narrowly and sharply ribbed around the remaining circumference (4), or with one or more ribs on the sulcus (5). *Not yet observed but to be expected.

kept in a shady, preferably cool, place until shipped.

Aluminum tags that can be written on with a ballpoint pen are excellent and are designed to wrap around the stem. Masking tape wrapped around the stem also persists well but should be marked with an indelible marker. Paper tags often fall off before they arrive. Never attempt to ship stems with the tag attached to a petiole or around the tip of the stem as petioles are soon deciduous and tags often fall off of the generally pointed tip of the plant. For additional information concerning the availability of different types of tags, see Croat (1984).

Generally, the simplest and cheapest way to send back live material is to collect fruits and prepare the seeds for shipment. Aroid fruits are invariably fleshy and the seeds must be removed from the berry to meet importation requirements. This is easily done by careful maceration in a bowl. If the resulting material is flushed with water, the pulpy mesocarp usually floats to the surface and can be removed by decantation. The seeds are then wrapped in a small piece of dry