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A Revision of the Genus Aglaonema (Araceae)

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ABSTRACT

Nicolson, Dan Henry. A Revision of the Genus *Aglaonema* (Araceae). *Smithsonian Contributions to Botany,* 1:1–66. 1969.—This revision of *Aglaonema* (ranging from northeastern India through New Guinea) is based on study of over 1500 herbarium specimens in 33 herbaria, supplemented by field studies and over 100 personal collections made in southeastern Asia over a period of 18 months. Much of the literature of the genus is reviewed, particularly on cytology, embryology, and morphology. The taxonomic portion of the text includes keys, synonymies, descriptions, notes on range, habitat, typification as well as discussion of taxonomic and nomenclatural problems.

The sections *Aglaonema* and *Chamaecaulon* are recognized for the first time. Although 76 binomials have been published for the genus, only 21 are recognized and accepted herein as species. No new species have been recognized.

Introduction

Aglaonema is a genus of tropical aroids of 21 species native to southeastern Asia from northeastern India across southern China and Indonesia through New Guinea. All species are herbaceous. The generic name means "shining stamen" in Greek.

This paper is a condensation of a doctoral dissertation accepted by Cornell University in 1964. The thesis is available through University Microfilms, Inc., of Ann Arbor, Michigan, as negative microfilm number 65–3347. Thanks are due to my special committee: Drs. W. J. Dress (Chairman), R. E. Lee, H. P. Banks, and J. F. Cornman. I owe a particular debt to Dr. G. H. M. Lawrence, who was chairman of my special committee in the initial stages. Mr. C. V. Morton of the Smithsonian Department of Botany also critically read the manuscript and many of his suggestions were gratefully adopted.

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MATERIALS AND METHODS.—The first stage of this study emphasized visiting the type-localities of as many described taxa as possible and the herbaria known to have major collections of tropical Asiatic plants. Type-localities were emphasized for two reasons: to collect topotype material to help offset loss of type material destroyed during World War II and to obtain some idea of variability in type-localities. Other considerations (political situations, contacts, time, money) largely determined where and how long I could stay and study within the natural distribution of the genus *Aglaonema*. The following résumé indicates how many months were spent in each country and in what provinces (districts or divisions) collections were made:

Dates	*Country*	*Provinces*
Sept. 60–Jan. 61	Philippines	Agusan, Albay, Bukidnon, Catanduanes, Davao, Laguna, Leyte, Misamis Oriental, Negros Oriental, Quezon
Jan. 61–June 61	Indonesia	West Java
June 61–Aug. 61	Malaysia	Johore, Penang, Perak, Sarawak, Selangor, Singapore
Sept. 61–Nov. 61	Territory of New Guinea, Papua	Morobe District, Bougainville, New Britain, Manokwari
Dec. 61–Feb. 62	Thailand	Bangkok, Chanthaburi, Chieng Mai, Nakhon Nayok, Trat, Trang

The number of my collections (total=103) of *Aglaonema* by country are as follows: Indonesia, 17; Malaysia, 29; New Guinea, 3; Philippines, 34; Thailand, 16; U.S.A., 4.

Duplicates (an average of 4 per collection) were distributed in the following order: 1, Washington (US); 2, national herbarium of county of origin; 3, Ithaca (BH); 4, Leiden (L); 5, Kew (K); 6, Berlin (B); 7, Vienna (W); 8, Paris (P); 9, Manila (PNH); 10, Bogor (BO); 11, Singapore (SING); 12, Calcutta (CAL); 13, London (BM); 14, Geneva (G); 15, Cambridge (A); 16, New York (NY); 17, Brisbane (BRI); 18, Bangkok (BK). The abbreviations are the standard ones of Lanjouw and Stafleu (1964).

I have studied the available material of *Aglaonema* in the following herbaria:

Bogor (BO)	276	Kepong (KEP)	14
Kew (K)	242	Kuching (SAR)	12
Singapore (SING)	233	Stockholm (S)	11
Leiden (L)	133	Utrecht (U)	10
Paris (P)	108	Munich (M)	10
Calcutta (CAL)	73	Edinburgh (E)	7
London (BM)	70	Zurich (Z)	7
Washington (US)	52	Bangkok (BKF)	5
Manila (PNH)	46	Vienna (W)	3
New York (NY)	42	Lae (LAE)	3
Ithaca (BH)	38	Dehra Dun (DD)	3
Bangkok (BK)	33	Brisbane (BRI)	2
Cambridge (A)	25	Brussels (BR)	2
Geneva (G)	22	Manokwari (MAN)	0
Berlin (B)	21	Rangoon (RANG)	0
Cambridge (GH)	20		
Copenhagen (C)	20	Total	1562
Florence (FI)	19		

These sheets were recorded on three-by-five inch filing cards with the collector's name, numbers, herbarium, determination, date of collection, locality, field notes, and measurements. By this method duplicate sheets could be recognized in different herbaria. Since the 1,562 sheets include 461 duplicates, the sheets actually represent 1,101 collections. Thus, this study is based on 103 personal collections and 1,101 earlier collections, a total of 1,204 collections, more extensive than the most recent monograph of *Aglaonema* (Engler, 1915), which cited only 160 collections.

According to the card file, Ridley collected *Aglaonema* the largest number of times (86). Other collectors who collected considerable numbers of *Aglaonema* were Kerr (42), Bünnemeijer (38), and Koorders (32). Engler probably saw most of Ridley's and Koorders' collections but none of Bünnemeijer's and Kerr's since they are more recent.

Data were accumulated from each specimen. The habit of the stem was noted (erect, repent, or decumbent), its length measured or taken from field notes, and its largest diameter measured. Although experiments were not performed, it is my impression that the width of a pressed and dried stem is approximately that of a fresh stem since the shrinkage in drying appears to be matched by the increase due to flattening during pressing. Internode length was noted and was commonly found to be about equal to the stem thickness; i.e., internodes were longest on the thickest basal portion of the stem and shortest on the uppermost portion of the stem. Petiolar length, petiolar sheath length, blade length, and blade width were measured on the most accessible and complete leaf on a specimen in order to ensure that ratios comparing these measurements would be real. If other complete leaves were available, one or two were measured to obtain an indication of variability in the actual measurements and ratios between leaves on a given specimen. The petiolar sheath was noted as being scarious or membranous. Leaf shape and the shape of the leaf bases and apices were recorded. The terminology for leaf shape follows that of the Committee on Terminology (1962) except that I regard their numbers 36 and 37 (q.v.) as lanceolate (not narrowly ovate), and I use "broadly" when the margin of the leaf base or apex forms an angle between 70° and 89° and "narrowly" when the margin of the angle formed is less than 45°. For terminology of leaf apices and bases I followed Stearn (1956) with a few minor exceptions; i.e., my "obtuse" is pointed (not rounded) with margins diverging at more than 90°. The presence of variegation was noted and described. The relative distinctiveness of primary venation from secondary venation was noted and, if the primary venation was strongly or weakly differentiated, then the number and angle of divergence of the veins from the midrib was noted. The presence, location, and appearance of cataphylls were noted. The number and length of peduncles were noted. Width of the spathe was established by measuring the circumference with a string. The lengths of the spathe, spathe decurrency, stipe, spadix, pistillate and staminate portions of the spadix were measured from the most accessible side of the spadix, the front, with the exception of the stipe length, which was measured along the back of the spadix. The color, length, and width of the fruits were noted.

Aglaonema within the Family Araceae

I have previously discussed (1960) the various classifications proposed for the Araceae. There are two contending classifications of the family, Hutchinson's (1959) and Engler's (1920). I have concluded that the latter system seems to achieve more realistic groupings of genera than the former.

There have been two other classifications of Araceae, both of which are progenitors of Hutchinson's system. Hooker's (1883) system was the basis for Hutchinson's, and Schott's (1860) was the basis of Hooker's treatment.

Engler (1920) and Hutchinson (1959) divided the family into rather different groupings. Hutchinson used 2 series and 18 tribes while Engler used 8 subfamilies and 31 tribes. Hutchinson placed *Aglaonema* in the tribe Richardieae (comprising 20 genera) and Engler placed *Aglaonema* in the subfamily Philodendroideae (comprising 17 genera). If we eliminate the eleven genera common to Engler's Philodendroideae and Hutchinson's Richardieae, the three genera that were reduced by Engler but were accepted by Hutchinson, and the one genus that was published subsequent to Engler's work, there remain eleven problematic genera on which the two authors disagreed. Six of these genera (*Amauriella, Anubias, Dieffenbachia, Peltandra, Philodendron, Typhonodorum*) were included in Engler's Philodendroideae but were placed in other tribes (Colocasieae, Dieffenbachieae, Philodendreae) by Hutchinson. Five of the genera (*Anchomanes, Montrichardia, Nephthytis, Plesmonium, Pseudohydrosme*) were included in Hutchinson's Richardieae but were placed in the subfamily Lasioideae by Engler.

With regard to these eleven controversial genera, I find Engler's Philodendroideae more natural than Hutchinson's Richardieae. Within the monocotyledons, the Araceae are rather distinctive in having reticulate as well as striate ("parallel") venation. All the genera in Engler's Philodendroideae have striate venation. Hutchinson's Richardieae are mostly genera with striate venation, but the five controversial genera included by Hutchinson all have reticulate venation. Engler's classification is followed in this present discussion.

Although Engler (1920, p. 63) regarded one subfamily, Pothoideae, as the root of the family and giving rise to the other subfamilies, in practice he treated the family as polyphyletic, with separate and overlapping sequences in each subfamily. The resulting system is complex, and discussion of it is beyond the scope of this paper. The members of the Philodendroideae, however, are relatively easy to recognize, for only the Philodendroideae combine the characteristics of being terrestrial (not free-floating aquatics like *Pistia*), having unisexual flowers, and having striate (or parallel) venation.

Engler (1912) divided the subfamily Philodendroideae into seven tribes. His "systema subfamiliae" has so many errors (when compared to his generic descriptions) and is so confusing (because of contrasted leads which are not strictly mutually exclusive) that I prefer to present an original dichotomous key, retaining the order of tribes as given by Engler and using the characteristics emphasized in his key but corrected in accordance with his descriptions:

1. Caudex epigeal.
  2. Ovules many in each locule.
    3. Stamens free . . . . . 1. PHILODENDREAE
    3. Stamens fused into synandria [or free] . . . . . 2. ANUBIADEAE
  2. Ovule solitary in each locule.
    4. Locule solitary. Stamens free . . . . . 3. AGLAONEMATEAE
    4. Locules several. Stamens fused into synandria . . . . . 4. DIEFFENBACHIEAE
1. Caudex hypogeal.
  5. Stamens free . . . . . 5. ZANTEDESCHIEAE
  5. Stamens fused into synandria.
    6. Staminodia free . . . . . 6. TYPHONODOREAE
    6. Staminodia fused . . . . . 7. PELTANDREAE

As can be seen from this key, the tribe Aglaonemateae can be defined as having (1) unilocular ovaries, (2) a solitary ovule, (3) free stamens, and (4) an epigeal caudex.

Engler's tribe Aglaonemateae has only two genera, *Aglaonema* and its only closely related generic relative *Aglaodorum*. *Aglaodorum* Schott is monotypic and is endemic to Malaya, Sumatra, and Borneo. It is limited to tidal mudflats, where it is not easily accessible for collecting and has apparently been collected only about 25 times.

There has been some disagreement as to whether

Aglaodorum is a distinct genus or not. A number of authors treated *Aglaodorum* under *Aglaonema* (Hooker, 1883; Ridley, 1925); however, specialists in the family have maintained *Aglaodorum* (Schott, 1860; Engler, 1915; van Alderwerelt van Rosenburgh, 1922).

Both Schott (1858) and Engler (1915) separated *Aglaodorum* from *Aglaonema* on the basis of the supposed presence in the former of staminodia among the pistils. This appears to be nothing but a misinterpretation of the pressed, fruiting, type-specimen. There are staminodia on the lower part of the staminate portion of the inflorescence, which abuts on the single whorl of pistillate flowers, but none beneath or between the pistillate flowers. As the fruits develop, the pistils enlarge greatly and may squeeze themselves out of the original single whorl. The lower staminodia may be caught in this developmental distortion, as illustrated by Schott (1858, pl. 58) in a drawing of the type specimen. Engler (1915, p. 35) followed Schott's misinterpretation, but published an illustration (ibid. fig. 16*C*) of a young inflorescence, showing the pistils in a single whorl without staminodia among the pistils. Alderwerelt van Rosenburgh (1922, p. 163) correctly observed:

> Since . . . I had not yet set eyes on a specimen of the species [*Aglaodorum griffithii*], I took the presence of staminodes as a generic character from the said authors [Schott and Engler]. Now I have had the opportunity to examine a living specimen. . . . this specimen agrees exactly with Engler's fig. 16 and has *no* staminodes encircling the ovaries but it has the lower stamens sterile, which, however, are in aspect not different from the fertile ones when seen from above.

My two collections of the genus confirm van Alderwerelt van Rosenburgh's conclusions.

Some differences found useful in differentiating these genera are tabulated below:

	Aglaonema	*Aglaodorum*
arrangement of pistillate flowers	several spirals (usually)	one whorl
length of peduncle	to 25 cm	40–50 cm
habitat	forest	tidal mudflats
color of ripe fruits	red	green

Aglaodorum probably is closely related to *Aglaonema* section *Chamaecaulon,* since the members of *Chamaecaulon* and *Aglaodorum* are repent and have exceedingly short petiolar sheaths. Since *Aglaodorum* is so distinct from *Aglaonema* in appearance and habitat, it is maintained herein as a distinct genus.

No other genera of Araceae have so much in common with *Aglaonema* as does *Aglaodorum.* When only vegetative material is available, however, some *Dieffenbachia* species cannot be distinguished from *Aglaonema* with certainty. Although some affinity may be suggested by this fact, *Dieffenbachia* is native to the New World and has the stamens fused into synandria, four staminodia subtending each pistillate flower, and a 2–3-locular ovary.

Schismatoglottis occasionally is confused with *Aglaonema* but is recognized easily by its deciduous upper spathe and spadix, sterile apex of the staminate portion of the inflorescence, and multi-ovulate ovary.

There seem to be three separate trends of evolution within the subfamily Philodendroideae: (1) from many locules to incomplete (partial) locules to the unilocular condition (respectively represented by *Philodendron, Homalomena, Schismatoglottis*); (2) from many ovules per locule to few ovules per locule to one ovule per locule (represented by *Philodendron, Zantedeschia, Dieffenbachia*); (3) from free stamens to partially fused stamens to synandria (represented by *Philodendron, Amauriella, Peltandra*).

These three trends interrelate in such a complex fashion that it is not possible to make a meaningful two-dimensional "family tree"; nevertheless, the evidence suggests that *Philodendron* with its many carpels, many ovules, and free stamens, has the most primitive flowers in the subfamily. The pistillate flower in *Aglaonema* (with one ovule in a unilocular ovary) could have arisen from the *Schismatoglottis* type (unilocular, multiovulate) by reduction of ovules; however, it could also have arisen from the *Homalomena* type (which has several incomplete locules, many ovules) by reduction in ovule and locule number. In a search for a possible derivation of *Aglaonema,* the above facts must be considered as well as the fact that, today, all three genera have the same distribution. Of the three, on the basis of the locular and ovular situation, *Homalomena* appears to be closest to the ancestral type while *Aglaonema* and *Schismatoglottis* appear to be more specialized and derivative branches.

Taxonomic History of *Aglaonema*

Because the members of the genus *Aglaonema* are relatively inconspicuous plants of dark places in the southeast Asiatic rainforest, they do not appear in much pre-Linnaean literature.

The first author to publish on a species of *Aglaonema* was Camellus (1704), also known as "Kamel" or "Camel," a Jesuit priest in the Philippines from 1688 until his death in 1706. Camellus (1704, p. 36) described a species that he called *"Dracunculus Luzonis primus."* According to Camellus's unpublished drawing (Figure 23) this is a fruiting *Aglaonema*. No one has yet been able to show with certainty what species is represented by Camellus's description. The problem is discussed herein under "Dubious Binomials."

The only other pre-Linnaean author to discuss (and illustrate) *Aglaonema* was Rumphius (1747) in his *Herbarium Amboinense*. In that work two plants were reported, *Arum aquaticum* Rumphius (1747, vol. 5, pp. 312–313, pl. 108) and *Adpendix erecta* Rumphius (1747, vol 5, p. 487, pl. 182: fig. 2). Merrill (1917) in his *Interpretation of Rumphius's Herbarium Amboinense* concluded that both represent the same species, *Aglaonema marantifolium* Blume, as interpreted herein.

Linnaeus (1754, p. 22; 1736, p. 1371) misidentified *Arum aquaticum* Rumphius with *Arum ovatum* L., the basionym of *Lagenandra ovata* (L.) Thwaites. This misidentification was initiated by Rumphius (1747, vol. 5, p. 313), who indicated that his plant matched a plate of Rheede's *Hortus Malabaricus,* which later became the type of *Arum ovatum* L. Linnaeus apparently accepted Rumphius's opinion without question. There is a specimen of *Aglaonema simplex* in the Linnaean herbarium labelled *Arum ovatum* L. Nothing further is known of this specimen (see discussion of *A. simplex*).

Roxburgh (1814, p. 65) published *Calla oblongifolia* in a list of the plants cultivated at the Calcutta Botanic Gardens. In a footnote Roxburgh referred to *Arum aquaticum* Rumphius. Roxburgh's *Calla oblongifolia* thus was the first legitimate binomial applicable to the genus *Aglaonema*.

Jack (1820, vol. 1, no. 1, p. 24) described a new species from Penang that he called *Calla nitida*. This was the second legitimate binomial applicable to the genus *Aglaonema*.

In 1822 Link (p. 394) described *Arum integrifolium,* which he believed to be a new species, in a list of plants cultivated at the Berlin Botanic Gardens. This plant was the same Malayan species that Jack described two years earlier.

The recognition and publication of *Aglaonema* as a distinct genus by Schott (1829), who was the first specialist in the taxonomy of the Araceae, was marred by an unfortunate nomenclatural error. The significance of this error has been overlooked by subsequent botanists. Schott named the type species *Aglaonema oblongifolium*. There was no reference to *Calla oblongifolia* Roxburgh, nor is the species that was described the same as the Roxburghian species; however, "*Arum integrifolium* Hort. Berol." was cited in synonymy, a clear reference to *Arum integrifolium* Link, which had been published seven years earlier. Thus, *Aglaonema oblongifolium* Schott (1829, under Article 63, ICBN, 1966) is nomenclaturally superfluous and illegitimate. Schott later (1832, p. 20), perhaps realizing his error, renamed his type species *Aglaonema integrifolium*.

In 1832 the first complete edition of Roxburgh's *Flora Indica* was published. In that work *Calla picta* Roxburgh, a Sumatran species of *Aglaonema,* was first published with a description.

Blume (1837, p. 153), in an important study of Asiatic aroids, named three new species of *Aglaonema*. The first, *A. simplex,* is one of the commonest species of the western Malesian area. The second, *A. marantifolium,* is the commonest species of the eastern Malesian area and included *Adpendix erecta* Rumphius (1747, 5, p. 487, pl. 182: fig. 2). Within the genus *Aglaonema,* this is the epithet available for the Moluccan species. The earlier epithet, *oblongifolium,* from *Calla oblongifolia* Roxburgh (1814), cannot be transferred to *Aglaonema* since the resulting combination becomes a later homonym of *Aglaonema oblongifolium* Schott (1829). The third species, *A. maculatum,* was regarded as dubious by Blume. It is based entirely on *Dracunculus Luzonis primus* Camellus (1704), which, as mentioned earlier, is still a problem. Blume was the first to point out the difference between conspicuous and inconspicuous primary venation in *Aglaonema,* a differentiation that has been overemphasized by most subsequent authors.

Kunth (1841) deserves to be recognized as the first monographer of the genus *Aglaonema* since he was the first to bring together all of the previous information on the genus. He accepted seven species, publishing the new combinations *A. oblongifolium* (Roxburgh) Kunth (not Schott, 1829), *A. pictum* (Roxburgh) Kunth, and *A. nitidum* (Jack) Kunth.

By this time, *Aglaonema* was relatively well accepted as a genus and several species were in cultivation as ornamental foliage plants. In the following years many new species were proposed, frequently from cultivated material. A number of authors made major contributions to the knowledge of the genus.

Schott, in the late 1850s and early 1860s, described a number of new species. His most important treatment of the genus is in *Prodromus Systematis Aroidearum* (1860), which recognizes eleven species plus two dubious species, an enlargement of Kunth's monograph of 1841.

Engler (1879), in his first monograph of the family Araceae, recapitulated Schott's (1860) work on *Aglaonema,* recognizing eleven species.

N. E. Brown, in the late 1880s and early 1890s, described six new species of *Aglaonema* from cultivated plants. It is apparent from N. E. Brown's autograph manuscripts at Kew that he collaborated closely with Hooker on *Aglaonema* in the following work.

Hooker (1893), in his *Flora of British India,* recognized 13 species, of which 8 were thought to be new. This work is important as it covers the western area of the distribution of *Aglaonema.*

Engler's (1915) monograph of *Aglaonema,* which is part of his second monograph of the family Araceae, is unquestionably the most important taxonomic work on the genus. Forty-one species plus two dubious species were recognized, of which twelve were considered to be new. The criticism one might make of this monograph is that no consistent effort was made to clarify relationships. Apparently strong differentiating criteria were not found. The need for valid differentiating characters and the lack of information sufficient for postulating relationships within the genus led to the present study.

Alderwerelt van Rosenburgh (1922) described ten Indonesian species that he considered to be new. None of them is accepted in this work since they fall within the range of variation of previously established species.

Ridley (1925, p. 99) discussed the Malayan species of *Aglaonema.* Gagnepain (1942) discussed the Indochinese species of *Aglaonema* and accepted 17 species.

The *Index Kewensis* lists 76 specific epithets that have been published in the genus *Aglaonema.* The most recent monograph (Engler, 1915) accepted 43 species and 15 have since been proposed, making a total of 58 more or less generally accepted species. In this work only 21 species are accepted.

Cytology

A number of major surveys have been made on chromosome numbers in Araceae (Ito, 1942; Malvesin-Fabre, 1945 [ex Delay, 1951]; Mookerjea, 1955; Jones, 1957; Pfitzer, 1957). The last mentioned paper was the first to be largely founded on meiotic counts.

There is a great deal of evidence that, as Mookerjea (1955) has said, "Specification is affected [sic] through karyotypic changes in the soma and through their entrance into the growing point." Tremendous variation in chromosome number in somatic tissue has been reported several times; for instance, Sharma and Datta (1961) found eleven different chromosome complements in *Aglaonema costatum* 'Foxi' (=*A. costatum* f. *immaculatum*) and were obliged to do a statistical analysis to decide what was the "normal complement."

The question of a primitive number for the family is far from settled. Gaiser (1927) apparently felt that eight was basic. Mookerjea (1955) favored seven. Jones (1957) found indications that six and seven were basic. Pfitzer (1957) was impressed by consecutive sequences of numbers within genera and the frequent occurrence of prime numbers (11, 13, 17, 19).

The lowest number reported for the family is $2n=14$ (Huttleston, 1953, p. 174) in *Pistia stratiotes.* Gow (1907, 1908, 1913) reported $n=8$ or $2n=16$ in *Aglaonema, Dieffenbachia, Symplocarpus* and *Xanthosoma* while Sharma and Mukhopadhyay (1965) reported $2n=16$, 18 and 26 ($n=8$, 9 and 13) in *Typhonium.* Jüssen (1928), Dudley (1937), and Banerji (1947) reported that $n=9$ in *Spathiphyllum, Acorus,* and *Typhonium,* but these counts have not all been confirmed by subsequent studies. Vignoli (1939) reported $n=11$ in *Ambrosinia.* This review indicates that low numbers (less than 12) are not common in the family; therefore, establishing a low basic number for the entire family may be difficult.

The following list shows the chromosome numbers of all genera of the Philodendroideae that have been reported in the literature. The known or presumed (from somatic material) meiotic numbers are given. Only the most frequently reported number is used and no attempt is made to include all the various complements reported for each genus. The variation in number indicates the difficulty of determining a basic number for the subfamily. As may be seen, com-

pared with other genera, *Aglaonema* does not have a particularly high number of chromosomes:

Genera	*n*	*References*
Zantedeschia	16	Jones, 1957
Dieffenbachia	17	Pfitzer, 1957
Homalomena	17*	Mookerjea, 1955
Philodendron	17 and 18	Pfitzer, 1957
Aglaodorum	18*	Earl, 1956
Aglaonema	20	Pfitzer, 1957
Anubias	24	Pfitzer, 1957
Schismatoglottis	28*	Mookerjea, 1955
Peltandra	56	Goldberg, 1941

*Meiotic number was deduced from a mitotic determination.

By morphological criteria, *Aglaodorum* is most closely related to *Aglaonema*. There is some confusion, however, over the chromosome number of *Aglaodorum*. Earl (1956) published a report that *Aglaodorum* (*Aglaonema*) *griffithii* had 36 chromosomes. Later, she (Jones [née Earl], 1957) gave more details, stating that the chromosome number was 34 but that several cells were seen with 36. It would be useful to have confirmatory studies to determine the "normal" complement.

Table 1 summarizes the information available concerning chromosome numbers within the genus *Aglaonema*. The reports are arranged in order of the chromosome numbers.

Ignoring a few deviations, it is reasonably clear that, as Pfitzer (1957) indicated, "triploid, tetraploid, and hexaploid forms are derived from the basic number of 20." Pfitzer's conclusion was supported by his demonstration of meiosis of a triploid (2n=60) showing 20 bivalents at the metaphase equatorial plate and 20 univalents being distributed at random (with 16 to one pole) (Pfitzer, 1957, p. 441, fig. 1). Pfitzer also demonstrated that the hexaploid was apomictic and that the triploids were sterile, the pollen in both cases aborting during meiosis or soon afterward.

Gow's (1908) report of n=8 for *Aglaonema versicolor* (=*A. pictum*) seems improbable in light of subsequent counts in the same species.

Sharma and Datta (1961) found chromosome complements of 10, 13, 27, 38, and 40 in *Aglaonema hospitum* (=*A. brevispathum* f. *hospitum*). Accessory chromosome fragments were found in all complements except 40. Cells with the "normal" complement (i.e., most frequent) of 38 had from two to six accessory chromosomal fragments. This suggests that 38 was probably derived from 40 by fragmentation.

In *Aglaonema costatum,* Sharma and Datta (1961) found chromosome complements of 14, 22, and 40. The number most frequently observed was 40, and that was termed the "normal" complement. No accessory fragments of chromosomes were observed in cells with the "normal" complement.

In *Aglaonema costatum* 'Foxi' Sharma and Datta (1961) found eleven different chromosome complements: 16, 21, 25, 29, 32, 34, 36, 40, 44, 48, and 56.

TABLE 1.—*Chromosome numbers within the genus* Aglaonema

	n	*2n*	*References*
versicolor (=*pictum*)	8		Gow, 1908
hospitum (=*brevispathum*)		38*(10–40)	Sharma and Datta, 1961
hospitum (=*brevispathum*)	20		Pfitzer, 1957
angustifolium (=*simplex*)	20		Pfitzer, 1957
pictum	20		Pfitzer, 1957
pictum		40	Asana and Sutaria, 1939
costatum	20		Pfitzer, 1957
costatum		40*(14–22)	Sharma and Datta, 1961
costatum 'Foxi'		48*(16–56)	Sharma and Datta, 1961
modestum		56	Wang, 1939
simplex (=*modestum?*)	30		Pfitzer, 1957
simplex (=*modestum?*)		60	Earl, 1956
haenkei (=*densinervium?*)		60	Earl, 1956
roebelinii (=*crispum*)		60	Pfitzer, 1957
roebelinii hyb. (=*crispum*)	ca. 30		Pfitzer, 1957
treubii (=*commutatum*)	40		Pfitzer, 1957
commutatum		119*(118–120)	Pfitzer, 1957
commutatum		120	Earl, 1956

* "Normal" complement, i.e., number most frequently observed; numbers in parentheses are extremes of variant complements also observed.

The number most frequently encountered was 48, and this was termed the "normal" complement. Even in cells with the "normal" complement there were up to eight chromosomal fragments. The detailed karyotypic analysis given by Sharma and Datta (1961) does not clarify the origin of this number but the number clearly is unstable.

Wang's (1939) report of 2n=56 in *Aglaonema modestum* is probably derived from a full triploid complement (2n=60). Such a variation is possible according to the variation reported in other species by Sharma and Datta (1961).

Pfitzer (1957) made root tip counts on seven plants of the hexaploid *A. commutatum* and found that one plant had 118 chromosomes, four had 119, one had 120, and one had both 118 and 120. Such variability in high polyploids is not unusual. The only peculiarity was that the distinctive satellite (SAT) chromosomes were only four and sometimes five but never six, as would be expected in a hexaploid. Jones (1957, p. 56) also mentioned finding four of these chromosomes in *A. commutatum.*

SUMMARY.—There is not yet enough information to be definitive but 20 seems to be established as the basic number for *Aglaonema;* however, only cultivated material has been studied, of which the majority are variegated and probably anomalous or derived elements. It would be valuable to have counts from wild material of *Aglaonema simplex, A. nebulosum, A. nitidum, A. hookerianum,* and *A. marantifolium* since these species cover the basic range of the genus. It would also be useful to have counts from wild, nonvariegated *Aglaonema costatum, A. brevispathum,* and *A. pictum* to indicate whether or not the variegated material—some of which has long been in cultivation and propagated vegetatively—has diverged. It may be that polyploidy exists only in cultivation. It may be that numbers lower than 20 exist in the wild. At any rate, the demonstration that several of our cultivated plants are sterile polyploids casts doubt on their status as "good species."

Embryology

MICROSPOROGENESIS.—I have found nothing in the literature on microsporogenesis in *Aglaonema.* Three-nucleate pollen grains have been reported in *Aglaonema pictum* by Campbell (1903, p. 677). This was confirmed in *Aglaonema pictum* and *A. costatum* by Jüssen (1928, p. 239). According to Schnarf (1931, p. 281), 3-nucleate pollen is common in aroids with unisexual flowers while 2-nucleate pollen is common in aroids with bisexual flowers.

Although microsporogenesis has not been demonstrated in *Aglaonema,* most aroid genera that have been studied share the following characteristics: (1) the tapetal cells have amoeboid protoplasts that coalesce into the periplasmodium; (2) reduction division of the microsporocytes is of the successive type (Schnarf, 1931, p. 281).

MEGASPOROGENESIS.—Apparently no one has yet observed reduction division of the megasporocyte in *Aglaonema.* In *A. commutatum* Schott, Campbell (1912, p. 102) noted a "group of cells occupying the greater part of the nucellus . . . . These cells probably are to be considered as megaspores." In *Aglaonema simplex* and *A. modestum,* Campbell reported that the "primary sporogenous cell" (megasporocyte?) usually develops directly into the embryo sac (generative apospory?).

EMBRYO SAC DEVELOPMENT.—In most aroids, embryo sac development is accompanied by destruction of the nucellus although a micropylar nucellar cap almost always remains (Schnarf, 1931, p. 282).

Embryo sac development in most aroids studied is of the *Polygonum* type (i.e., the normal type) leading to an 8-nucleate polarized embryo sac. In *Aglaonema commutatum,* Campbell (1903, p. 683) commented on a number of irregularities of embryo sac development: (1) "a varying number of embryo sacs" [a tendency toward polyembryony]; (2) "in some cases it looks as if these [embryo sacs] originated independently from hypodermal cells [somatic apospory]"; (3) "extraordinary variation in the number of nuclei in the embryo sac . . . from four to twelve"; (4) "multiple nuclear fusions."

Pfitzer (1957, p. 442) presented strong evidence that *Aglaonema commutatum* is apomictic. He found that *A. commutatum* was hexaploid (2n=118 to 120), had all the pollen degenerating in meiosis and yet that fruiting was abundant.

Embryo sac development in certain other species has been reported. The first two nuclear divisions are normal in *Aglaonema simplex* and *A. modestum,* but Campbell (1912, p. 105) could not definitely establish the further sequence of events. He said:

> Stages between the four-nucleate condition and that in which the egg apparatus was completely developed were not found, but is practically certain that only one of the upper [micropylar] pair of nuclei divides, giving rise to the syner-

gidae, while the other remains undivided and becomes the nucleus of the egg, there being no polar nucleus present. Thus at the time when the egg apparatus seems to be fully developed there are only five nuclei in the embryo-sac, instead of the eight usually found in angiosperms.

Other workers (Michell, 1916; Jüssen, 1928) found a preponderance of 5-nucleate embryo sacs in their sections but were able to demonstrate that the 8-nucleate stage was of very short duration and that the three antipodal nuclei immediately degenerated and easily became confused with the chalazal nucellar remnants. Both of these workers concluded that *Aglaonema* did have an 8-nucleate embryo sac. Campbell had once (1903, p. 677) described *Aglaonema pictum* as having a typical 8-nucleate embryo sac, but later (1912, p. 105) he changed his mind and, speaking of what he had formerly called "a typical group of three antipodal cells," he said that, "as the adjacent cells of the nucellus are quite like the antipodal cells in appearance, it may be that these 'antipodal' cells did not really belong in the embryo-sac."

The facts that (1) Campbell did not observe the peculiar origin of the 5-nucleate embryo sac which he described, (2) all authors agree that the antipodal cells resemble the nucellar remnants, (3) the 8-nucleate stage is very short in all aroids in which it has been definitely established, and (4) the 5-nucleate stage is of long duration (the three antipodals having degenerated) suggests that the observations of Michell and of Jüssen were more accurate than those of Campbell and that members of *Aglaonema* normally have the usual 8-nucleate embryo sac.

Gow (1908, p. 40) reported in *Aglaonema pictum* (*A. versicolor*) that the final stages of the embryo sac had from two to eleven antipodals and that they might possibly be even more numerous sometimes. The same author (1913, p. 127) reported that, in *Aglaonema nitidum,* "in the mature embryo sac there are ten cells, five of which occupy the position of antipodals, the other five performing the usual functions." Perhaps this author has confused the haustorial basal apparatus, which is developed by the endosperm nucleus in Araceae, with one developed by the antipodals, as in other families.

In most Araceae, after fertilization, the endosperm nucleus sets up a basal apparatus, (this will be discussed below); however, Gow (1908, 1913) does not appear to be speaking of a mature embryo sac but of a fertilized one. Two points should be made: (1) Gow (1908, pl. 6: fig. 38) shows a rather disorganized embryo sac at the time of fertilization, wherein the antipodals are two and enucleate; (2) in other aroids the antipodals are ephemeral. It is possible that what Gow considered to be a "mature embryo sac" was actually a fertilized embryo sac with development of the endospermous basal apparatus already under way.

Another explanation for Gow's basal cells is possible. Buell (1938) reported that, in *Acorus calamus,* after degeneration of the antipodals and fusion of the two polar nuclei, the fusion nucleus moved to the base and divided, before fertilization.

Summary: The exact nature and the sequence of events leading to the mature embryo sac are poorly understood and what evidence has been reported is often conflicting. It appears likely, however, that *Aglaonema,* excepting its apomictic members, has a normal type of embryo sac development but that the antipodals quickly degenerate, leaving a 5-nucleate stage which is quite stable.

FERTILIZATION.—In his studies on *Aglaonema commutatum, A. modestum, A. simplex,* and *A. pictum,* Campbell (1912, p. 107) did not obtain

a satisfactory demonstration of the penetration of the pollen tube or the fertilization of the egg. Indeed, one is almost forced to the conclusion that the development of the embryo and endosperm goes on without fertilization. For some time after endosperm formation begins the egg apparatus remains apparently unchanged, and there is no sign of a degeneration of the synergidae such as usually occurs in cases of normal fertilization.

Gow (1908, p. 40, fig. 38) described and illustrated in *Aglaonema versicolor* (=*A. pictum*) an "8-nucleate sac and two male cells." It is difficult to tell from Gow's writing and discussion what he considered to be cells and nuclei. For instance, it is not likely that a "male cell" would be found inside the embryo sac. Also, cell wall formation generally cuts off the nuclei of the embryo sac at a fairly early stage. At any rate, Gow does seem to be describing fertilization.

ENDOSPERM.—There is a great deal of conflicting and irreconcilable information on this subject, not only for *Aglaonema* but also for the rest of the family. Confirmatory studies are badly needed. Maheswari and Khanna (1956) conclude that, although there are several reports of the free-nuclear endosperm formation type, none of them is authenticated. Most aroids, up until the last twenty-five years, have been considered as having the helobial type of endosperm formation (Jüssen, 1928; Schnarf, 1931); however, Maheshwari and Khanna (1956), after reviewing the literature on

this subject and their own findings, said, "We feel that on reinvestigation many reports of Helobial type may turn out to be of the Cellular type."

Campbell (1912, p. 107) reported that in *Aglaonema pictum* the polar nuclei fused, but he did not study further development; however, in *Aglaonema simplex* and probably also in *A. modestum,* and *A. commutatum* there was no fusion of the polar nuclei, according to Campbell (1912, p. 107). These two nuclei remained separate and each divided, making four free nuclei, after which cell wall formation began. In other cases, in *A. simplex,* discoid groups of flat cells were observed. "These are bounded by delicate but evident cell walls and in the undivided cavity of the sac may be seen several free nuclei between which walls are beginning to form (Campbell, 1912, p. 107)."

Gow (1908, p. 40) reported that in *Aglaonema versicolor* (*A. pictum*) endosperm formation is of the cellular type. In *A. nitidum,* Gow (1913, p. 128) reported that the endosperm nucleus gives rise to a heavy-walled endosperm developing simultaneously with the embryo.

Campbell (1912, p. 108) reported that, in *Aglaonema simplex,* the first formation of endosperm is at the chalazal end and proceeds upward, filling the sac with a few large cells. The smaller endosperm cells at the chalazal end look like antipodals.

In view of the work of Maheshwari and Khanna (1956), it is probable that Campbell was correct in believing that the first, chalazal, endosperm cells are small and look like antipodals. Gow apparently regarded these as antipodals; however, the nuclear type of endosperm formation described by Campbell seems very peculiar and it may be that Gow's statement that the endosperm formation is cellular is correct. Obviously, confirmatory studies are needed.

Embryo.—Campbell (1912, pp. 109–112) is the only worker who has reported on the development of the embryo. The following summary is from his findings on *Aglaonema modestum.* Since differentiation of the organs takes place only after the embryo has reached a rather large size, the study of the young embryo does not throw light on the origin of the organs of the young plant.

A large basal cell is sometimes observed and this may be considered as a suspensor. The upper part of the embryo is composed of an oval mass of similar cells. In other cases the embryo is isolated by the endosperm and no suspensor is differentiated. Growth of the embryo is very rapid and it encroaches on the endosperm until the latter finally is almost entirely destroyed by the embryo, which almost fills the embryo sac cavity.

The embryo becomes much elongated and the micropylar end becomes the apex of the first root while the other end develops into a large cotyledon with a single vascular bundle. The root remains very short, the cotyledon forming much the greater part of the embryo. The sheathing base of the cotyledon conceals the stem apex. A second leaf is developed before the seed ripens.

As in most Araceae, the basal part of the ovule becomes very massive, so that a section of the seed shows that the embryo sac, occupied by the embryo, is only about one-half the bulk of the seed; the remainder is made up of what Campbell termed "perisperm, comparable to that in Piperaceae or Cannaceae, but not developed from the nucellus but from the chalazal region of the ovule."

Gatin (1921, pp. 154–155) illustrated the condition of the embryo in the seed at the time of germination in *Aglaonema nitidum.* Within the embryo is a simple vascularization of two irregular circles of strands. In the hypocotyl the vascular bundles form an almost continuous ring. At the micropylar end the embryo develops a number of small scales that are suberized. The entire embryo is covered by a secondary layer of periderm and under that layer are cells with chlorophyll. Outside the embryo are two teguments. The teguments ("perisperm" of Campbell) and the embryo make up the seed. Outside the seed is a fleshy pericarp that finally becomes red.

Germination.—In *Aglaonema,* according to Gatin's (1921) description and illustration, the germination is hypogeal, i.e., the seed coat containing the cotyledon remains below ground. Engler (1912, figs. 1B–D) illustrates epigeal germination in *Philodendron* with the cotyledon aerial and leaflike with the seed coat borne at the tip of the aerial cotyledon. According to Eames (1961, p. 320), epigeal germination (as in *Philodendron*) is more primitive than hypogeal germination (as in *Aglaonema*).

Engler (1920, p. 37) does not emphasize these two types of germination but places great importance on a characteristic that may be correlated, i.e., whether the mature seed contains endosperm or not. According to Engler, in the germination of endospermous seeds a foliage leaf immediately follows the cotyledon and the cotyledon itself may even be foliate. In the germination

of endospermless (exalbuminose) seeds, the reduced cotyledon is followed by a number of cataphylls before a foliage leaf is produced. *Aglaonema* fits Engler's second category since, as Campbell (1912, p. 110) demonstrated, endosperm is consumed by the developing embryo and, as Gatin (1921, pl. 6: figs. 8–10) showed, the cotyledon is followed by a number of scale-like cataphylls before a foliage leaf is produced.

Morphology

Most species of *Aglaonema* are erect, with relatively unbranched stems and generally with distinct internodes. Growth is continuous but the lower leaves fall off, leaving the plant with the leaves tufted on the upper part of a stem covered below by circular leaf scars. The erect habit is rather unusual in the family and is also characteristic for most species of the genera *Dieffenbachia* (Philodendroideae) and *Montrichardia* (Lasioideae). The erect habit, however, is found in occasional members of the genera *Homalomena, Schismatoglottis, Philodendron* (Philodendroideae), and *Alocasia* (Colocasioideae).

Two species, *Aglaonema brevispathum* and *A. costatum,* are repent, with branched stems and relatively short internodes. The stems of wild plants of these species are typically found beneath the humus on the forest floor. In cultivation the stems creep on the soil surface. The stems are actually epigeal and only appear to be hypogeal in the wild because they are buried by leaf fall. The creeping or climbing habit is typical in most other genera of the Philodendroideae, except in *Zantedeschia, Peltandra,* and *Typhonodorum,* where the stem is truly hypogeal and functions as a storage organ. Thus, these two species of *Aglaonema* that form the section *Chamaecaulon,* are intermediate in habit between the typically erect species of *Aglaonema* and the rest of the typically repent or or climbing Philodendroideae.

Several plants of *Aglaonema* have been observed by the author and described in the literature (Engler, 1915, p. 10) as decumbent. *Aglaonema rotundum* has been observed to produce many roots along the lower part of the erect stem. These roots appear to be contractile (like those described in other aroids [Holm, 1891; Rimbach, 1900; Rosendahl, 1916]), pulling the lower stem close to the ground into a decumbent position. Larger species like *A. marantifolium* rarely stand erect over five feet although the stem may be up to ten feet long. The stem is not strong enough to support the weight of the plant body and the lower stem is forced to lie against the ground in a decumbent position.

Van Tieghem (1867, pp. 122–124, pl. 3: fig. 10) discussed the anatomy of the stem from the epidermis to the center. He reported that inside the epidermis and one or two tabular, colorless layers ("couches incolores tabulaires"), there is a continuous parenchyma from the periphery to the center of the stem in *Aglaonema marantifolium;* inside a fairly large thickness of stem without any vascular bundles is a ring of small bundles with some phloem and one or two vessels ("vaisseaux"); inside this ring of vascular bundles is a ring of about 20 schizogenous canals, each of which is about 0.24 mm in diameter and is full of gummy sap (the cells bordering the canals are much smaller and have more irregular shapes than those of the surrounding parenchyma). Just inside the ring of canals and alternating with the canals is another rim of vascular bundles. These bundles are simple (like the outer ones) but the remaining bundles toward the center of the stem are found to be compound ("faisceaux composés"), i.e., with several groups (separated by phloem) of two or three vessels each. (According to Van Tieghem, it is the separation and turning out of these small groups of vessels, accompanied by phloem and two laticifers, that give rise to the outer, simple vascular bundles which immediately or eventually run out into the lateral organs.)

The stem of *Aglaonema simplex* was found to be almost the same except that it lacked the schizogenous canals (Van Tieghem, 1867).

Branching.—In *Aglaonema,* as in most Araceae, bud primordia are formed in the axils of foliar organs. These buds appear to be "reserve" buds that, if separated from the mother-plant with a piece of stem, can grow into new plants or, if they remain attached, typically develop only after suppression of the terminal shoot (Engler, 1920, p. 12).

I have observed in a number of plants of *Aglaonema* and other genera of the family that axillary buds do develop while attached to the mother-plant if the subtending node is strongly rooted in the ground. The creeping stems of the section *Chamaecaulon* are tightly rooted to the ground and typically are well branched.

In general, erect plants of *Aglaonema* appear to be unbranched; however, all *Aglaonema,* like all other Araceae (except for three rather primitive genera, *Pothos, Pothoidium,* and *Heteropsis*) are supposed to

have sympodial growth after production of the first inflorescence (Engler, 1920, p. 11).

Engler (1912, pp. 3–5) recognizes two kinds of shoots in a sympodium, the lateral continuation shoot ("Fortsetzungsprosse") and the terminal reproductive shoot ("Vermehrungsprosse"). Study of living material of *Aglaonema commutatum* (Figure 1), *A. pictum,* and *A. modestum* indicates that in *Aglaonema* the situation may not be exactly as described by Engler. On the mature stem below the inflorescence, the base of each leaf clasps and encircles the stem; however, when an inflorescence is produced, it is subtended by a leaf which seems to clasp only the inflorescence, but not the entire stem (Figure 1). This fact suggests that simple monopodial growth is not occurring and that the inflorescence is actually terminal. The continuation of the vegetative shoot might then be considered the "lateral continuation shoot"; i.e., the development of the axillary bud from the axil of the leaf one node lower than, and on the side of the stem opposite to, the leaf subtending the inflorescence. This lower leaf, however, was found to have not only the "lateral continuation shoot" but also an axillary bud (Figure 1). Ontogenetic studies are necessary to any attempt to establish not only the exact sequence of events but also which buds are terminal, which are lateral or adventitious, and what happens to each bud. Without such study it is not possible to give an adequate interpretation.

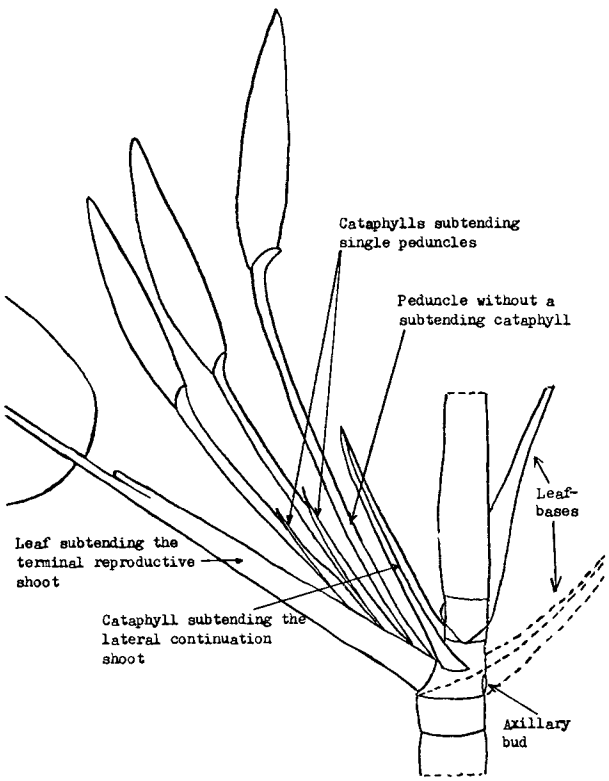

FIGURE 1.—Stylized lateral view of a flowering stem of *Aglaonema commutatum* Schott.

CATAPHYLLS AND LEAVES.—According to Engler (1920, p. 17) and my own observations, the cataphyll of Araceae corresponds to the petiolar sheath (vagina) of a foliage leaf. The cataphyll serves the same function as the petiolar sheath, protecting the subtended shoot during ontogeny. It occasionally ends in a little tip that looks like the rudiment of a leaf-blade. Ertl (1932, p. 120) supported the concept of the aroid cataphyll as homologous with the petiolar sheath when he described the development of the leaf in *Aglaonema commutatum:* The leaf-bud clasps the subtended shoots and first develops into a thin, cataphyll-like structure; later, the petiole is formed by thickening growth along the longitudinal axis and the leaf-blade by growth in breadth at the upper end; the margins of the thin, cataphyll-like structure are left as the petiolar sheath on the petiole. It appears that cataphylls originate from the same kind of primordia as do the leaves but that differential growth does not occur in the primordia of cataphylls. Glück (1919, p. 236) stated that we must interpret the cataphylls ("Vorblätter") of Araceae, as well as the cataphylls ("Niederblätter") of many monocotyledons as bladeless, petiolar sheaths ("Blattscheiden").

In *Aglaonema* the location of the cataphyll is sometimes of diagnostic importance. In all species of the genus cataphylls are found between the inflorescences and sometimes at the base of the reproductive shoot; however, as was mentioned in the section on stems, species of the section *Chamaecaulon* have one or more cataphylls subtending the petioles, as well as those subtending the inflorescences. Thus, in the section *Chamaecaulon* cataphylls are found between the leaves. This does not happen in other *Aglaonema* species.

The cataphylls in the genus *Aglaonema* are generally cream colored or very light green. They soon dry to a brown color and disappear, leaving only a scar.

The petioles of most aroids clasp the stem and are grooved longitudinally on the adaxial side at the base. The margins of this groove are generally broad and run up on the petiole in what is called a vagina or petiolar sheath. The petiolar sheath provides many

variations in length, attachment, and appearance that sometimes are useful to the taxonomist. In *Aglaonema,* however, the characteristics of the petiolar sheath may vary greatly within a given plant; lower leaves, for instance, tend to have longer petiolar sheaths than the upper leaves.

Aglaonema rotundum has been observed by me to have the upper end of the petiolar sheath free and ligulate, but only for a matter of millimeters. *Aglaonema crispum* and *A. nitidum* commonly have chartaceous or scarious margins of the sheath that appear to be rather saw-toothed. *Aglaonema pictum* has a sheath that is more than one-half the length of the petiole while the closely related *A. nebulosum* and *A. vittatum* have sheaths that are much less than one-half the length of the petiole. In the section *Chamaecaulon* the sheath is exceedingly short, normally only long enough to clasp the stem.

Ertl (1932, pp. 124–5) described the vascularization in the petiole of *Aglaonema commutatum.* In a cross-section of the petiole, the vascular bundles are arranged approximately in three semicircles. The outer semicircle is made up of small bundles alternating with strands of collenchyma. The second semicircle is made up of larger vascular bundles that will be the primary longitudinal bundles of the leaf-blade, described below. The third, innermost semicircle consists of four to five larger bundles that branch above and form veins of higher order in the leaf-blade. All these bundles run parallel to one another through the petiole and into the midrib, with only a few branches and cross connections. In the leaf-blade these veins successively arch out, causing the midrib to diminish toward the leaf tip until only the medial vascular bundle remains, which goes all the way to the leaf tip.

The leaf-blades of *Aglaonema* are generally narrowly oblong to narrowly elliptic and commonly have an acute to acuminate apex and a rounded to obtuse leaf base. Occasional specimens have more or less cordate leaf bases.

The venation of *Aglaonema* is essentially parallel or striate. This type of venation, although common in monocotyledons, is only found in a few Araceae (all Philodendroideae and many Monsteroideae).

The overall venation patterns in species of *Aglaonema* are similar, but taxonomists like Engler (1915) have placed much importance on the relative distinctiveness of the primary lateral veins and on the angle of divergence from the midrib.

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The relative distinctiveness of the primary veins has been considered to be of taxonomic value from the time that Blume (1837) described *Aglaonema simplex* as "protuberati-venosis" and *A. marantifolium* as "obselete parallelo-venosis." Engler (1915, p. 10) used distinctiveness of venation in the opening lead of his key to the genus, comparing "Foliorum nervi laterales I. et II. subaequales, tenues, densi, subparalleli" with "Foliorum nervi laterales I. quam nervi II. ± validiores." In the latter lead, however, one finds half of the species recognized by Engler under a further subdivision, "Nervi laterales I. quam nervi II. paullum validiores," suggesting that this is not an absolute differentiating character. The possibility has been borne out in this study: even in the same species (e.g., *A. marantifolium* or *A. nitidum*) some plants have been found to have venation scarcely differentiated and others to have strongly differentiated primary venation.

The angle of divergence of the primary lateral veins has been found to be more or less correlated with the width of the leaves. Narrow leaves tend to have smaller angles of divergence and broad leaves tend to have large angles (cf. *A. simplex*); however, some plants (e.g., *A. commutatum*) show unusually wide angles of divergence (almost 90°) of the primary veins for the width of the leaves, which are not particularly broad.

Ertl (1932, p. 120–5) described the ontogeny of the venation in *Aglaonema commutatum* in detail. Early in ontogeny three vascular bundles are laid down. The center bundle runs to the leaf tip in a straight line; the two outer bundles also run all the way to the apex, but about half way up the leaf they arch out and later turn back to the leaf apex in a gentle curve. Soon afterward, the third, fourth, and fifth pairs of bundles are successively laid down outside the first pair, arching out progressively lower on the leaf blade. All these veins run to the apex and are called "primary lateral veins."

Secondary lateral veins develop between the primaries and are distinctive since they turn out and anastomose with the next outermost primary vein and do not go all the way to the apex.

Tertiary veins develop between the primary and secondary veins and are similar to the secondary veins except that they turn out and anastomose with the next outermost vein much further from the leaf apex and margin than do the secondaries.

This process is repeated until lateral veins of a fifth or sixth order are formed.

Finer cross-venation, which is unbranched and rather short, develops between the lateral veins.

The leaf blades of many *Aglaonema* are variegated in patterns that are more or less distinctive for certain species or cultivars. *Aglaonema crispum* has an ashy variegation that completely covers about two-thirds of the center of the leaf, the outer, marginal areas being of a normal dark green color. *Aglaonema nitidum* seedlings frequently show streaks of ashy variegation along the primary veins and sometimes this pattern is carried on into the adult plants, which are known as *A. nitidum* f. *curtisii*. *Aglaonema commutatum* shows similar ashy patterns. *Aglaonema costatum* and *A. brevispathum* commonly exhibit scattered white or yellowish spots and/or a white midrib. *Aglaonema vittatum* typically has a white midrib. *Aglaonema rotundum* has red variegations following the primary veins. *Aglaonema pictum* has rather ashy to silvery irregular blotches spattered over the leaves.

Bergdolt (1955) studied the ontogeny of variegation in *Aglaonema roebelinii* (=*A. crispum*), *A. roebelinii* var. *pseudobracteosum* (=*A. commutatum* cv. 'Pseudobracteatum'), *A. costatum, A. marantifolium* (=*A. commutatum* var. *maculatum*) as well as in species of other genera of Araceae. In all cases she found that in the initial stages all cells of the epidermis, mesophyll, and palisade layers contained colorless plastids of the same size. During ontogeny the chloroplasts of certain groups of cells of one or more layers failed partially or entirely to enlarge and become green, creating the variegated patterns. Some of these chloroplasts degenerated, making the process irreversible. In other cases the inhibition was found to be reversible. The damage to the plastids was found to be correlated with cell size; the cells losing their chloroplasts were distinctly smaller than cells with normal plastids. Experiments with *Dieffenbachia* showed that development of variegation was retarded by lowering light exposure. Less than normal daylight resulted in less variegation. A chemical, disruptive factor ("Störfaktor") that was distributed through the vascular tissues was made responsible for the damage to the plastids. Unfortunately, this factor was not isolated.

Webber (1960) found that the lateral walls of the cells of the upper leaf epidermis were undulate in *Aglaonema costatum, A. pictum,* and *A. commutatum* var. *maculatum*. This undulation has also been observed in single species of *Nephthytis* (Webber, 1960), *Amorphophallus, Homalomena,* and *Alocasia* (Dalitzsch, 1886).

The epidermal cuticle showed a "ribbing" of more or less parallel striations in the three species of *Aglaonema* studied. This was also observed in *Porphyrospatha, Pothos, Homalomena,* and *Spathiphyllum*.

Stomata in *Aglaonema pictum* were found only on the lower leaf surface. They had only one pair of accessory cells. Stomata were found on both leaf surfaces in *Aglaonema costatum* with varying numbers of accessory cells.

Webber (1960) concluded from his study of the epidermal structure of Araceae that "it is doubtful if any taxonomic significance can be drawn from these findings."

INFLORESCENCE.—The morphology of the peduncle, spathe, and spadix could be discussed separately but so little is known anatomically and morphologically in *Aglaonema* that it is convenient to consider them together. According to Van Tieghem (1867, p. 180), the structure of the inflorescence axis is similar in all aroids except *Acorus*. Van Tieghem (1867, p. 176; 181) found evidence that the peduncle of *Acorus calamus* L. includes two separate vascular systems: one, an outer, subepidermal circle of small vascular bundles that run into the spathe and the other, a V-shaped series of nine large bundles that run into the spadix. Such evidence suggests the possibility that in *Aglaonema* and other Araceae the entire inflorescence may be composed of two parts: a shoot with an elongate naked base (peduncle) terminating in a spike (spadix) that is fused with a foliar organ (spathe) that actually subtends the shoot. Glück (1919, p. 238) supported this interpretation when he concluded that the spathe of Araceae must be a leaf lamina without a petiole; however, Van Tieghem (1867, p. 124) reported that the vascularization of the peduncle of *Aglaonema simplex* is identical with that the petiole.

In the same work Van Tieghem described the general structure of the aroid spadix, excluding *Acorus*. Under the epidermis there is cortical parenchyma, then a circle of vascular bundles. Inside are scattered a great number of similar bundles. Each of these bundles is made up of an arc of sclerenchyma with thin walls bordered by laticifers—if the plant has them, and *Aglaonema* does—a bundle of phloem, and a large group of vessels. These bundles send branches out to the flowers.

Staminate Flower: In *Aglaonema* it is almost impossible to determine how many stamens there are in a staminate flower. To phrase it another way, it is almost impossible to define a staminate flower in *Aglaonema.* There are no subtending perianth parts, there is no consistent pattern of groups of stamens, and there is no evidence of fusion of stamens. The upper spadix is simply a mass of thick stamens, each with a single vascular strand and four microsporangia that are grouped in two pairs on opposite sides of the stamen. With nothing more than external appearances to judge by, one could just as well conclude that each stamen is a staminate flower.

Indeed, one worker has said as much. Van Tieghem (1907, p. 315) observed that the endothecium around each microsporangium in *Aglaonema* was complete and independent of those of other microsporangia, that the xylem of the solitary vascular trace divided at a certain level, and that near the apex of the stamen the trace itself divided into the two branches which diverged toward the sporangia pairs. From this evidence, Van Tieghem concluded that the quadrisporangiate body everyone had been calling a stamen in *Aglaonema* was the product of fusion of two bisporangiate anthers along their ventral faces. In other words, each quadrisporangiate structure was considered as a staminate flower, a synandrium of two bisporangiate stamens.

This interpretation (Van Tieghem, 1907) has not been accepted herein for several reasons. Van Tieghem's observation that each endothecium was complete and independent has not been supported by my observations, nor, for that matter, by Van Tieghem's own illustrations (1867, pl. 8: figs. 11–13); even if his observations were correct, it would not necessarily indicate the conclusion reached by Van Tieghem. Van Tieghem's observation that the xylem branched toward the sporangia pairs at the upper end of the vascular strand may have a more conventional explanation. For instance, the bifurcation could indicate the dichotomous nature of the origin of the stamen. Wilson (1942) reached this conclusion from the same type of evidence in *Tilia* and *Enallagma.* To my knowledge, bisporangiate stamens have not otherwise been reported in Araceae. In fact, genera related to *Aglaonema* and in which there is no question of the definition of the stamen or the staminate flower, have exactly comparable quadrisporangiate stamens: e.g., *Dieffenbachia,* where there is fusion of four to five quadrisporangiate stamens into synandria, and the genera *Homalomena* and *Philodendron,* where the grouping and orientation of from two to six free quadrisporangiate stamens define the staminate flower. In addition, the origin of the vascular traces, discussed in the following paragraphs, indicates that these quadrisporangiate bodies also can occur in groups comparable to those in the related genera mentioned above. Thus, we may describe the stamen in *Aglaonema* as a quadrisporangiate structure with a single trace that bifurcates near the apex.

The question still remains: How many stamens to a staminate flower? Perhaps because external morphology gave no clue, the author of the genus, Schott (1829, 1832, 1856, 1859, 1860), refrained from stating the number of stamens in a staminate flower of *Aglaonema.* The first person to mention the number of stamens was Engler (1879, p. 315), who stated, "Flores masculi 2-andri." This statement also appeared in his most recent monograph (Engler, 1915). Since I could find no external evidence to support this report of two stamens, I attempted to trace the origin of vascular traces of stamens by serial cross-sections at ten microns.

A portion of an inflorescence of *Aglaonema nitidum* (*Nicolson 1022*) and a portion of an inflorescence of *A. nebulosum* f. *nanum* (*Nicolson 1123*) with seven stamens were sectioned.

In *Aglaonema nitidum* I found that the solitary vascular traces of three stamens arose from a single trace that gave off two lateral traces at 170 microns below the surface of the spadix. The traces of the other nine stamens moved out of the sections before any branching or fusion of traces was observed. The common origin of the three traces suggests that the three stamens compose a highly reduced staminate flower.

The sections in the material of *Aglaonema nebulosum* f. *nanum,* however, went much deeper (660 microns below the surface of the spadix), and all seven staminal traces were found to be more or less related by various branchings and fusions. Such evidence suggested that the deeper one went, the more difficult it became to interpret the number of stamens from the origin of the staminal traces.

The results indicated that the number of stamens to a pistillate flower might range from one to seven. For practical and gross morphological purposes, one can say that each stamen appears to represent a staminate flower.

Pistillate Flower: The pistillate flower in *Aglaonema* is unilocular and uniovulate. Only two workers (Van

Tieghem, 1867; Engler 1915, 1920) have reported its structure.

Relatively little is known of the floral anatomy and vascularization or aroid flowers although the flowers are of basic importance in the taxonomy of the family. Van Tieghem (1867) reported on the vascularization of the pistillate flowers in *Zantedeschia, Alocasia,* and *Aglaonema.* Birdsey (1955) discussed the vascularization of pistillate flowers in *Syngonium.* Eyde et al. (1967) surveyed floral anatomy in the family with studies on 23 species in 18 genera in six subfamilies. Floral structure was found to be extremely diverse.

Van Tieghem (1867, p. 188) found that the pistil in *Aglaonema marantifolium* was unilocular and uniovulate. The ovule was found to be obliquely attached at the base and therefore derived from a parietal placenta. The wall of the pistil was found to have six bundles that were interpreted as three dorsal traces and three fused ventral pairs from three carpels. Van Tieghem regarded *Zantedeschia* as having a basic type of trimerous pistil (precisely like the Liliaceae) with parietal placentae and 3-trace carpels. *Aglaonema*'s organization was derived from this basic type by reduction.

Engler (1915, p. 10) stated: "Flores feminei 1-, rarissime 2-gyni." In the same description he stated: "Ovarium 1-, raro 2-loculare." The ovule was described and illustrated as being anatropous and obliquely attached to an indistinct basal placenta or "in ovariis 2-locularibus ad basin dissepimenti." Engler did not say in what species he observed the rare 2-locular condition, nor have I observed it.

Engler later (1920, p. 35) cited *Aglaonema* as a case wherein a uniovulate ovary was certainly developed from more than one carpel. He did not say how many carpels were involved, nor did he state what evidence led him to this conclusion, but he did indicate that he considered that the pistillate flower of *Aglaonema* was derived by reduction from more than one carpel.

Serial sections of six pistillate flowers (four in cross-section and two in longitudinal section) of *Aglaonema nitidum* (*Nicolson 1022*) and five pistillate flowers (two in cross-section and three in longitudinal section) of *Aglaonema nebulosum* f. *nanum* (*Nicolson 1123*) were made at ten microns. The vascularization was found to vary from flower to flower in an exceedingly confusing fashion. The base of each flower had a ring of from four to nine traces, and the stylar regions had a ring of from four to seven traces. Since each flower differed from all others, it was not possible to say if any were representative of the spadix, the species, or the genus.

It was not possible to differentiate the carpellary traces from the lateral traces in a consistent fashion applicable to each flower. It was not even possible to determine, with any degree of certainty, the number of carpels composing a pistillate flower. Perhaps this was due to reduction, to the peculiar nature of monocotyledonous venation, or to both. Depending upon how much weight one might give a particular piece of evidence, it was possible to interpret a given pistillate flower as being composed of one, two, three, or more carpels.

The inconclusiveness of vascular evidence demands that one consider the carpellary facts in related genera. Of 17 genera placed in the Philodendroideae by Engler (1920), only 6 have unilocular pistils. Except for *Aglaonema,* all of these genera are minor, having only three or fewer species. The other 11 genera, including *Philodendron,* the largest and possibly the most primitive genus in the subfamily, have two or more locules (carpels). This suggests that *Aglaonema* may have arisen from syncarpous stock.

Comparison of sections shows a certain bilateral symmetry in the arrangement of vascular traces in the lower stylar region. Typically, more than half of the traces are in an arc of about 120° and the remaining traces are widely scattered in the other 240°. This positioning of bundles to one side suggests abortion of one or more carpels or the presence of sterile carpels. If one assumed that abortion occasionally does not occur, this would explain Engler's (1915) report of bilocular pistils in *Aglaonema.*

Plant Diseases

According to the *Review of Applied Mycology,* members of *Aglaonema* have been reported with a leaf spot caused by anthracnose fungi and *Pythium* root rot.

Baker (1914, p. 2157) reported *Gleosporium graffii* Sydow on a Philippine plant from the wild that was determined as *Aglaonema densinervium.* Graham and Strobe (1958) reported a related fungus, *Colletotrichium,* on leaves of several genera of oranamental foliage plants cultivated in Washington State, including *Aglaonema commutatum.*

Pythium splendens root rot, first noticed in Orange County, Florida, nurseries in 1943 on *Aglaonema modestum,* has been the subject of several studies. Tisdale and Ruehle (1949) discussed the symptoms, which develop over a 3-week period. Plants were first observed to show stunting in their aerial parts and drooping of the leaves. Finally the stems rot off at ground

level and the plants fall over. The roots were found to have water-soaked lesions that rot and remain in the ground, even if the plants are pulled up. Other aroids (*Dieffenbachia, Nephthytis, Philodendron, Rhaphidophora*) were affected by the root rot, but not as seriously as *Aglaonema*.

A paper discussing control of *Pythium* root rot in Chinese evergreen (*A. modestum*, although the author calls it *A. simplex*) was published by Miller (1959). He took sterile peat, mixed it with infested debris and let it sit for four weeks. Various fumigation methods were applied (Vapam soil drench, mylone powder broadcast, methyl bromide injection) and three weeks elapsed before the beds were planted. The highest percentage of loss was 1.27 percent (Vapam) except for the untreated control (87.4 percent).

Aglaonema Schott

Aglaonema Schott, 1829 (8 Sept.), p. 892.

Stem smooth, usually green, often rooting at nodes, erect and unbranched or creeping and often branched. Internodes, usually longest near the stem-base. Petioles usually equaling or slightly shorter than the leaf-blade. Petiolar sheaths membranous to scarious, rarely slightly prolonged, equaling the stem circumference in a few species to extending the length of the petiole. Leaf-blades ovate-elliptic to lanceolate-narrowly elliptic, rarely broadly ovate or sublinear; base often unequal, obtuse to cordate or attenuate; apex often apiculate, usually acuminate to acute, sometimes gradually or abruptly acuminate; variegation none or of various patterns; venation undifferentiated to strongly or weakly differentiated into 5–8 primary lateral veins diverging from the midrib at 40°–60°; texture coriaceous to membranaceous. Cataphylls usually subtending inflorescences, occasionally subtending petioles. Peduncles erect, solitary to less than 10 together, from half as long as to longer than the subtending petiole, deflexing in fruit. Spathe ovate, erect, not differentiated into a tube and blade, often apiculate, green to yellowish white, slightly to strongly decurrent, usually finally marcescent. Stipe almost none to half the spadix length. Spadix thin-cylindric to clavate, erect, from half as long as to longer than the spathe; pistillate portion below, pistils 1-locular, 1-ovulate, style short and thick, stigma broad and disk-like; staminate portion white to cream colored, stamens solitary but tightly compacted, opening in pairs at tops of the four sporangia. Fruits ellipsoidal, the outer layer fleshy green but turning yellow (rarely white) and finally red. Seed solitary, erect, ellipsoidal, almost as large as the fruit. Embryo macropodal. Endosperm none.

TYPE OF GENUS.—*Aglaonema oblongifolium* Schott, superfluous name (*Arum integrifolium* Link, *Aglaonema integrifolium* (Link) Schott) [=*Aglaonema nitidum* (Jack) Kunth].

DISTRIBUTION.—Tropical Southeast Asia from northeastern India through New Guinea.

Key to the Species of *Aglaonema*

1. Stem repent, frequently branching; petiole sheath less than 20% the petiole length, less than 1 cm long; cataphylls subtending the petioles . . . . . Section *Chamaecaulon*
   2. Cataphyll subtending petiole usually drying-persistent; petiole usually equaling or exceeding blade; leaf-base usually obtuse to subrounded . . . . . 1. *A. brevispathum*
   2. Cataphyll subtending petiole usually immediately deliquescent; petiole usually less than blade length; leaf-base subcordate to rounded . . . . . 2. *A. costatum*
1. Stem erect, rarely decumbent, rarely branching; petiole sheath rarely 20% the petiole length usually more than 1 cm long; cataphylls usually only subtending peduncles, rarely among the petioles . . . . . Section *Aglaonema*
   3. Spadix sessile, the stipe and major part of pistillate portion of spadix adnate to spathe.
      4. Pistillate flowers separated from functional staminate flowers by several series of staminodia, these slightly larger than and of a different color from the functional staminate flowers (even in dried material); peduncle 3.5–7.0 (10) cm long . . . . . 3. *A. ovatum*
      4. Pistillate flowers contiguous with functional staminate flowers, or staminodia, if present, few (i.e., only a single series) and indistinguishable from functional staminate flowers except for their lack of pores; peduncle 5–21 cm long.
         5. Apex of spadix short 1 cm or more of spathe apex; leaf-acumen elongate, over 2.5 cm from point of 1 cm blade width; peduncle 5–10 cm long . . . . . 4. *A. modestum*
         5. Apex of spadix equaling (within 0.5 cm) spathe apex; leaf-acumen shorter, less than 2.5 cm from point of 1 cm blade width; peduncle (6) 10–21 cm long . . 5. *A hookerianum*

3. Spadix stipitate, the stipe free from spathe for 0.2 cm or more (at anthesis or after).
  6. Spadix clavate; spathe globose.
    7. Spadix exserted from spathe at anthesis; upper leaf-surface dull; leaves not variegated or else covered with irregular silver or gray blotches.
      8. Petiole sheath more than ½ petiole length. Plants of mountain slopes, commonly over 1000 m. Sumatra. . . . . 6. *A. pictum*
      8. Petiole sheath less than ½ petiole length. Plants of lowland swamp forest. Malaya and Borneo . . . . . 7. *A. nebulosum*
    7. Spadix included in spathe, even at anthesis; upper leaf surface shiny, leaves not variegated or else only with reddish or whitish midrib and/or primary lateral veins.
      9. Leaf-blade lanceolate, 1.7–3.0 cm wide . . . . . 8. *A. vittatum*
      9. Leaf-blade ovate, 5–10 cm wide . . . . . 9. *A. rotundum*
  6. Spadix cylindric; spathe elongate.
    10. Apex of spadix equaling, exceeding, or short no more than 1 cm of spathe apex; pistillate flowers usually more than 20 (except in *A. cochinchinense* and *A. nitidum* var. *helferi*).
      11. Margin of petiole sheath scarious; leaf-base acute to attenuate . . 10. *A. nitidum*
      11. Margin of petiole sheath usually membranous; leaf-base obtuse to rounded.
        12. Venation undifferentiated . . . . . 11. *A. cochinchinense*
        12. Venation differentiated into primary and secondary veins.
          13. Spathe 1.8–2.5 (4) cm long . . . . . 12. *A. tenuipes*
          13. Spathe (2.3) 3–5 (6.5) cm long . . . . . 13. *A. simplex*
    10. Apex of spadix short 1 cm or more of spathe apex; pistillate flowers usually less than 20.
      14. Leaf-blade broadly ovate with cordate base; petiole sheath less than ⅓ the petiole length. . . . . 14. *A. cordifolium*
      14. Leaf-blade narrowly elliptic-oblong with acute to rounded base; petiole sheath usually more than ½ the petiole length.
        15. Stipe (usually over 1 cm long) 0.3 cm longer than spathe decurrency (this less than 1 cm; see also *A. commutatum*). . . . . 15. *A. marantifolium*
        15. Stipe (usually less than 1 cm long) shorter or to 0.2 cm longer than spathe decurrency (this usually more than 1 cm long).
          16. Leaves variegated.
            17. Variegation (usually in form of bars, rarely in spots) oriented along primary lateral veins; margins of petiole sheaths usually membranous . . . . . 16. *A. commutatum*
            17. Variegation forming solid band down center of each side of leaf parallel to leaf margin; margins of petiole sheaths scarious . . . . . 17. *A. crispum*
          16. Leaves not variegated.
            18. Leaf-blade over 4 times longer than wide; petiole length ½ the leaf-blade or less . . . . . 18. *A. stenophyllum*
            18. Leaf-blade less than 3.5 times longer than wide; petiole length ⅔ the leaf-blade or more.
              19. Petiole sheath 17–30 cm long, ⅔ to equaling the petiole; leaf-blade 12–19 cm wide; peduncle 20–32 cm long . . . . . 19. *A. densinervium*
              19. Petiole sheath 1–17 cm long, ¼–¾ the petiole; leaf-blade 2.5–13 cm wide; peduncle 2–17 cm long.
                20. Petiole (8.5) 14–25 cm long . . . . . 20. *A. philippinense*
                20. Petiole 3.5–7.0 cm long . . . . . 21. *A. pumilum*

Aglaonema section *Chamaecaulon* Nicolson, new section

Caudex repens, internodiis vix 0.5 cm longis; cataphylla petiolum plerumque amplexa, nonnumquam, deliquescens; petioli vagina usque ad 1 cm longa, vix ⅕ petioli longitudinis.

Roots frequently approaching the stem thickness. Stem repent and often branching, usually less than 1 cm thick. Internodes usually less than 0.5 cm long. Petiolar sheaths inconspicuous, to 1 cm long, 0.03–0.15 times as long as the petiole. Leaf-blades lanceolate to ovate, rarely narrowly elliptic; variegation none or with white spots affecting both sides of leaf and/or a central white stripe on or over the midrib; venation usually differentiated. A cataphyll subtending and clasping each petiole, this soon deliquescent in *A. costatum*. Peduncle solitary. Spathe (1.5) 2.5–4.0 (5) cm long. Spadix ellipsoidal-cylindric, (1.2) 1.8–3.5 cm long, commonly exceeding spathe by 0.3–1.0 (1.5) cm;

pistillate portion 0.2–0.5 cm long, pistils 6–13. Fruits red, 1.2–1.7 cm long, 0.5–1.0 cm thick.

TYPE OF SECTION.—*Aglaonema costatum* N. E. Brown.

DISTRIBUTION.—Two species of continental Southeast Asia.

HABITAT.—Humid shady places below 500 m.

The section *Chamaecaulon* is characterized by a creeping and branching habit, exceedingly short petiolar sheaths, and the occurrence of cataphylls among the leaves. In these characters it is similar to two genera that are considered to be closely related, *Aglaodorum* (west Malesia) and *Anubias* (Africa); however, unlike *Aglaonema,* both these genera are tidal mudflat or swamp dwellers.

Within the genus *Aglaonema,* several of the smaller species, such as *A. pumilum* and *A. rotundum,* seem to be intermediate between the two sections. These rare and poorly known species are decumbent, occasionally have short petiolar sheaths, and may have cataphylls among the leaves.

1. *Aglaonema brevispathum*

Aglaonema brevispathum (Engler) Engler, 1915, p. 32, fig. 15.

Stem repent and often branching, rarely with more than three leaves, 0.5–1.0 cm thick. Internodes ca. 0.3 cm long, very rarely 1.5 cm. Petioles (7) 13–25 (33) cm long, (0.5) 0.8–1.2 (1.6) times as long as the blade length. Sheaths 0.5–1.0 cm long, 0.03–0.15 times as long as the petiole. Leaf-blades lanceolate, rarely narrowly elliptic, (10) 14–20 (24) cm long, (3.9) 4.4–8.0 cm wide, length/width ratio 1:2.5–4.2; base obtuse, occasionally rounded or broadly acute, often unequal; apex usually acuminate, sometimes acute to subacuminate or gradually acuminate; variegation none, in the form of a central white stripe, or in the form of scattered spots on both sides of the leaf; venation weakly or strongly differentiated into 4–7 primary lateral veins diverging from the midrib at (30) 40°–50°; texture coriaceous. Cataphylls like brown paper, commonly clasping the petiole for most of their length. Peduncle solitary, (5.5) 7–12 (15.5) cm long, usually ⅓–¾ the petiole length. Spathe usually apiculate, 1.5–3.5 cm long, decurrent for 0.5–1.3 cm. Stipe 0.2–1.0 cm long. Spadix ellipsoidal, 1.2–2.5 cm long, equaling to exceeding spathe by 0.3–0.6 cm; pistillate portion 0.2–0.5 cm long, pistils less than 10; staminate portion 1–2 cm long, 0.3–0.6 cm thick. Fruits red, 1.2–1.7 cm long, 0.5–1.0 cm thick.

DISTRIBUTION.—Eastern continental Southeast Asia (Figure 3).

HABITAT.—Near streams or on heavily wooded slopes below 500 m.

FLOWERING TIME.—March–July.

Aglaonema brevispathum is obviously most closely related to *A. costatum.* The differences used in the key seem to be more subjective than objective (*Poilane 10746* from South Vietnam would key to *A. costatum* but its narrow leaves (1:4), few primary veins, and obtuse leaf base are more similar to *A. brevispathum*). Further studies and evidence would be necessary before these species could be united.

Key to the Forms of *Aglaonema brevispathum*

Leaf-blade without scattered spots . . . . . 1a. forma *brevispathum*
Leaf-blade with scattered spots. . . . . 1b. forma *hospitum*

1a. *Aglaonema brevispathum* f. *brevispathum*

Aglaonema brevispathum (Engler) Engler, 1915, p. 29.
Homalomena brevispatha Engler, 1902, p. 172.
Aglaonema ridleyanum Engler, 1915, p. 28, fig. 12.
A. hospitum var. *obtusatum* Engler, 1915, p. 29.
A. costatum var. *viride* sensu Gagnepain, 1942, p. 1124 [not Engler, 1915].

Leaf not blotched; venation usually strongly differentiated into 3–6 primary lateral veins diverging from the midrib at (35°) 45°–50°. Spathe apiculate, 3–3.5 (1.8, fide Engler, 1915) cm long. Stipe 0.2–0.8 cm long. Fruit red, 1.2–1–7 cm long, 0.5–1.0 cm thick.

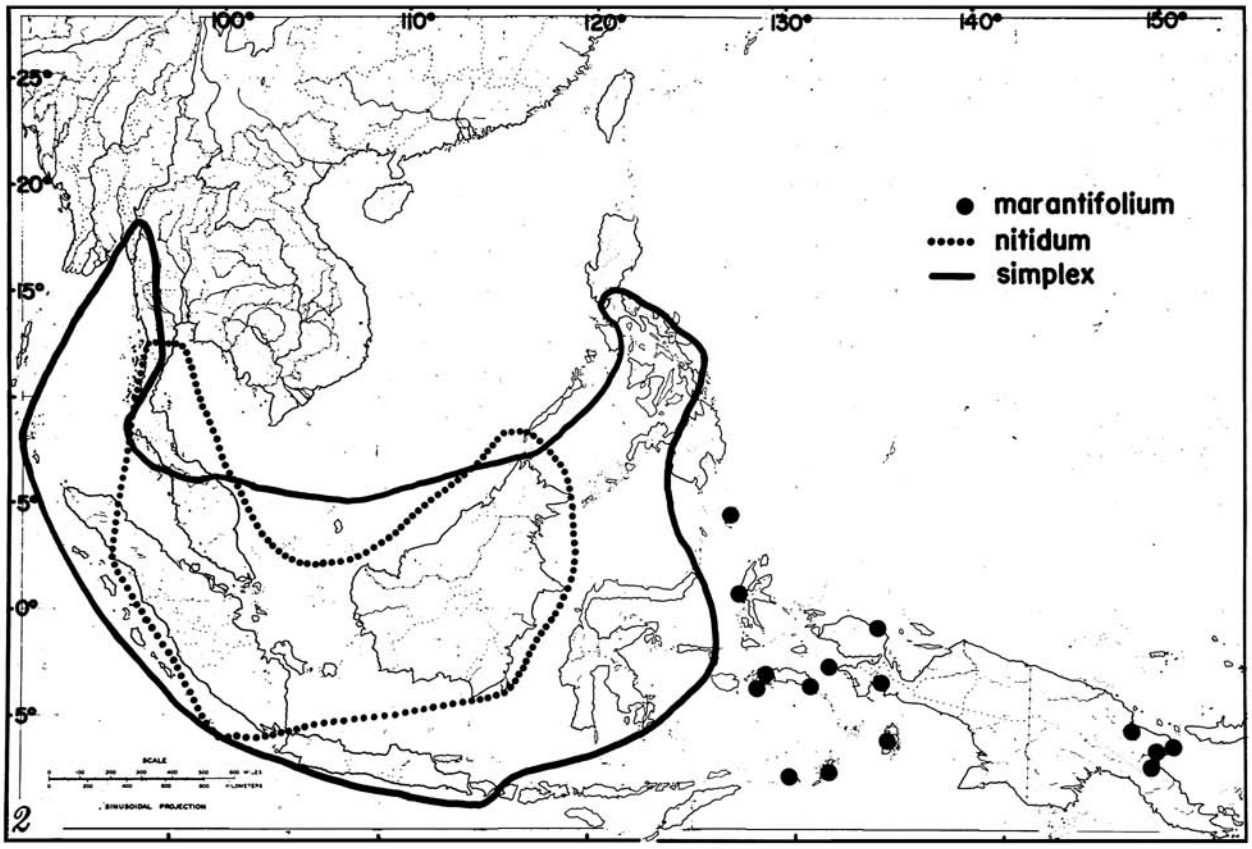
TYPE COLLECTION.—Thailand, Koh Chang, Skoven nar Klong Son, 1 March 1900, *Schmidt 675a* (holotype: B; isotype: C).

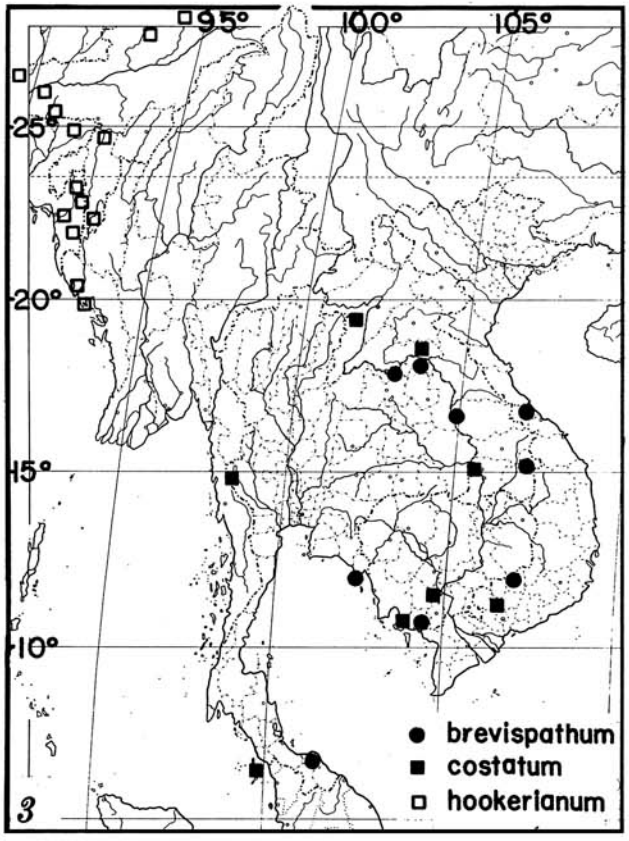
DISTRIBUTION.—Eastern Southeast Asia.

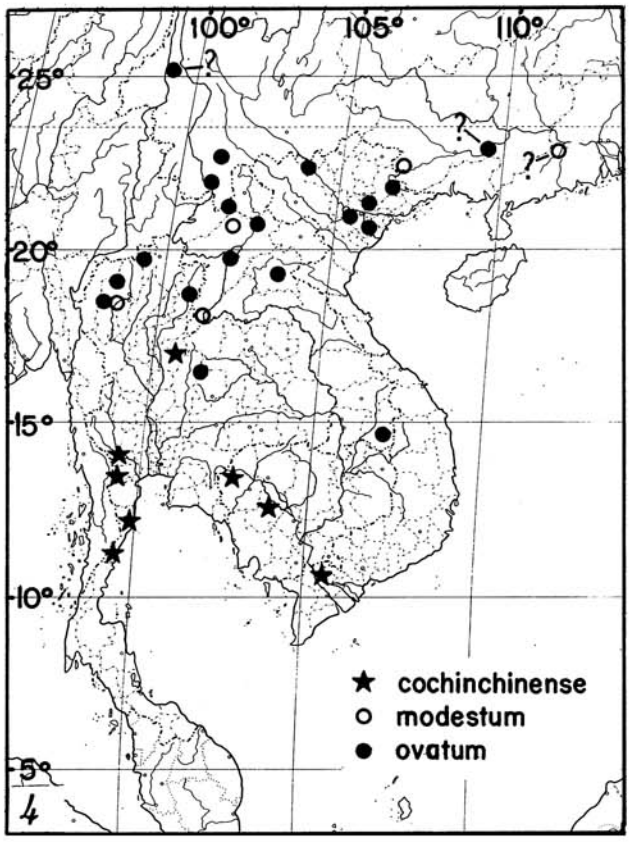
HABITAT.—Near streams or on heavily shaded slopes below 500 m.

FLOWERING TIME.—March–July.

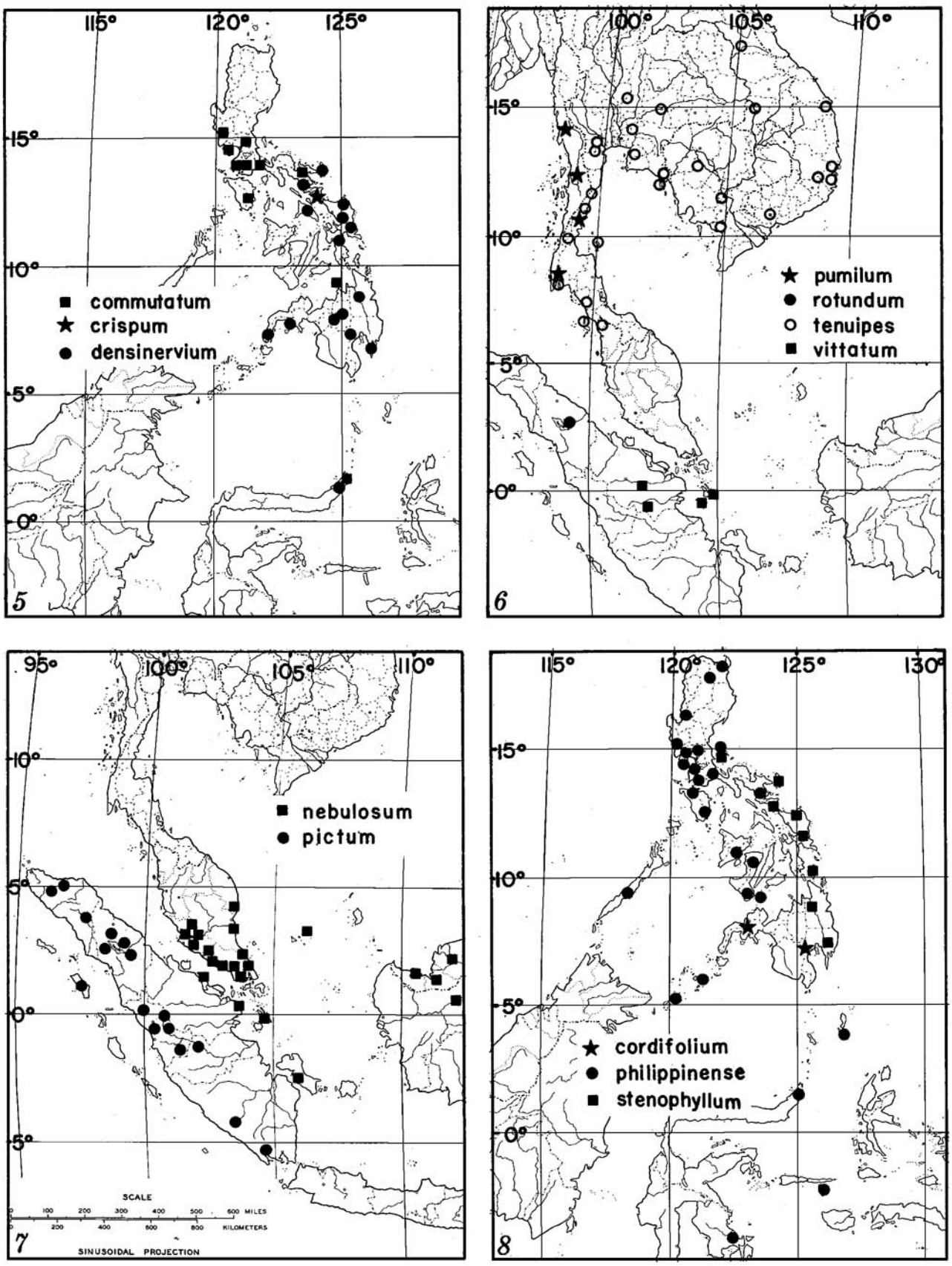
Aglaonema ridleyanum must be typified on the drawing published by Engler (1915, fig. 12) since no specimen or collector was cited and no authentic specimens have been found. Engler cited "Siam (Bangkok.-Bot. Gart. Singapore)." The illustration fits *A. brevispathum* but the description has several misleading statements: (1) "Lamina . . . . 2–3 cm. longa"—the "cm." is presumably an error for "dm." although 20–30 cm would be an excessively long leaf; (2) "nervis . . . angulo circ. 80°"—which is exces-







Figures 2–4.—Distribution of nine species of *Aglaonema*.



Figures 5–8.—Distribution of twelve species of *Aglaonema*.

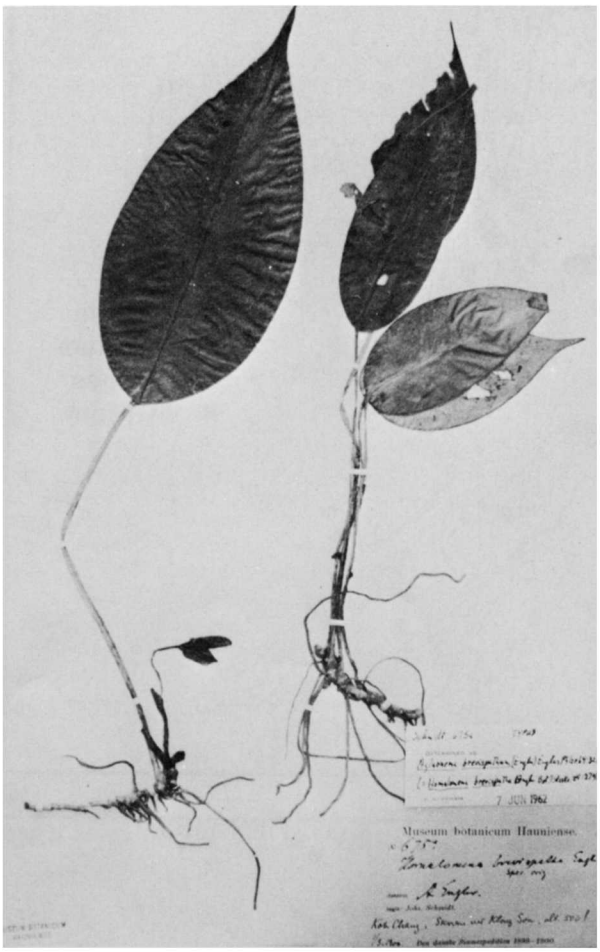


FIGURE 9.—Isotype of *Aglaonema brevispathum* (Engler) Engler: *Schmidt 675a* (C).

sively broad, not only for this species but for the type drawing; (3) "Pedunculi plures . . ."—which is very disturbing because members of the section *Chamaecaulon* have solitary inflorescences.

Gagnepain (1942, p. 1129), who had no more information than that published by Engler, regarded *A. ridleyanum* as having an erect stem; however, Engler placed *A. ridleyanum* next to *A. hospitum,* which is treated herein as part of *A. brevispathum.* With the exceptions noted above, the descriptions and illustration of *A. ridleyanum* fit well into *A. brevispathum.* Since the description of *A. ridleyanum* did not mention variegation, I am placing it with this forma.

The typification and interpretation of *A. hospitum* var. *obtusatum* are also problematic. Engler cited his material as "Cochinchina (L. Pierre.–Herb. Mus. Paris, Berlin)." A diligent search by me in the Berlin herbarium failed to reveal any specimens, now presumed lost. In the Paris herbarium there are only three Pierre sheets annotated by Engler as *A. hospitum* although none of them are annotated as *A. hospitum* var. *obtusatum.* Since two of the three sheets clearly have erect stems and are not referable to section *Chamaecaulon,* they were excluded from further consideration; they have been identified, in fact, as *Aglaonema tenuipes* Engler. According to my notes, the third sheet consists of separate specimens, one of which has a central white stripe on the leaf-blade and no spots, while the other specimens appear to have the leaves totally unmarked. In the absence of other evidence, we must rely on Engler's description: "Foliorum lamina basi obtusata atque immaculata." Since all leaves of these Paris specimens are obtuse, "immaculata" becomes definitive. I therefore recognize the unmarked material as typifying *Aglaonema hospitum* var. *obtusatum.*

Another sheet (*Pierre s.n.*), not annotated by Engler, is a mixture of three forms of *A. brevispathum,* no markings on one specimen, blotches on a second specimen, and a central white stripe on a third specimen. The mixture of forms on these sheets indicates that the taxa are of minor significance. If the white striped form becomes better known, it probably will be named as a forma.

All specimens annotated and cited by Gagnepain (1942) as *A. costatum* var. *viride* have been placed here.

1b. *Aglaonema brevispathum* f. *hospitum*

Aglaonema brevispathum f. *hospitum* (Williams) Nicolson, 1968, p. 124.

Schismatoglottis siamensis Bull, 1885, p. 15 [not *Aglaonema siamense* Engler, 1902].

Aglaonema hospitum Williams, 1904, p. 226.

Leaf variegation in form of small spots that affect both sides of the leaf; venation weakly to strongly differentiated into 4–7 primary lateral veins diverging from the midrib at 40°–50°. Spathe 2.5–3.5 cm long. Stipe 0.5–1 cm long. Fruits unknown.

TYPE COLLECTION.—Hong Kong Botanic Garden No. 59/88, received from Bangkok several years ago, 30 May 1888 [without collector] (holotype: K).

DISTRIBUTION.—Thailand (Koh Chang) and "Cochinchine."

HABITAT.—Lowland rainforest.

USES.—Widely cultivated as an ornamental for its variegated leaves.

The type of *Schismatoglottis siamensis* Bull is: England, Hort. Bull, Siam, 10 Nov. 1885 [*N. E. Brown?*] (holotype: K). This epithet is the oldest applicable not only to this forma but to the entire species. It is unavailable at the specific level as its transfer to *Aglaonema* would create a later homonym of *A. siamense* Engler (1902) (=*A. tenuipes*).

In collecting this forma in the wild on Koh Chang, I noted that plants with unvariegated leaves occurred in the same population (*Nicolson 1623*). This indicates that the presence of variegation is only a minor character.

2. *Aglaonema costatum*

Aglaonema costatum N. E. Brown, 1892, p. 426.

Roots up to 0.5 cm thick. Stem repent and branching, 0.6–1.3 cm thick. Internodes 0.1–0.5 cm long. Petioles 5–12 (19) cm long, (0.3) 0.5–1 times as long as the leaf blade. Sheaths 1 cm long, 0.05–0.15 (0.3) times as long as the petiole length. Leaf-blade usually ovate, rarely lanceolate, 9.5–20 (26) cm long, (4.7) 6–10 cm wide, length/width ratio 1:1.5–2.5 (3.6); base often unequal, subcordate to rounded; apex often apiculate, acute to subacuminate, occasionally abruptly acuminate; usually variegated with scattered spots on both sides of the leaf and/or with a white midrib, rarely not variegated; venation differentiated into 7–15 primary lateral veins diverging from midrib at 50°–70°. Cataphylls 5–8 cm long. Peduncle solitary, (2.5) 5–15 (23) cm long, ¾ to longer than subtending petiole. Spathe often apiculate, (2.2) 2.5–4.0 (5) cm long, decurrent for 0.5–1.5 (3) cm. Stipe 0.2–0.6 cm long. Spadix ellipsoidal-cylindrical, exceeding spathe by 0.3–1.0 (1.5) cm, (1.8) 2–3.5 cm; pistilate portion 0.2–0.5 cm long, pistils 6–13; staminate portion 1.5–3.3 cm long, 0.5–0.8 cm thick. Fruits unknown.

DISTRIBUTION.—Continental Southeast Asia from Langkawi Island to Vietnam (Figure 3).

HABITAT.—Humid, shady places on limestone or near streams.

FLOWERING TIME.—March–June.

This species is closely related to *Aglaonema brevispathum* and occasional specimens prove difficult to determine. These specimens involve *A. brevispathum* f. *brevispathum,* which may be difficult to separate from *A. costatum* f. *immaculatum* and f. *concolor.* Field studies are needed to determine how similar or different *A. costatum* and *A. brevispathum* really are.

Aglaonema costatum has been popular in cultivation for its variegated forms that have been introduced from the wild. Birdsey (1951, p. 14) dismissed the forms because he had observed that the amount and kind of variegation varied greatly on leaves of the same plant. It is true that the patterns are strongest on youngest leaves and that they fade with age, but I have not observed the great variability on the same plant emphasized by Dr. Birdsey. Perhaps such forms do not warrant taxonomic recognition but, in this case, all the variants have been named and I believe it would be well to clarify them and their nomenclature.

Key to the Forms of *Aglaonema costatum*

1. Leaf-blade with a white midrib.
   2. Leaf-blade with irregularly scattered spots . . . . . 2a. forma *costatum*
   2. Leaf-blade without spots . . . . . 2b. forma *immaculatum*
1. Leaf-blade with a green midrib.
   3. Leaf-blade heavily and irregularly blotched . . . . . 2c. forma *virescens*
   3. Leaf-blade not variegated . . . . . 2d. forma *concolor*

2a. *Aglaonema costatum* f. *costatum*

Aglaonema costatum N. E. Brown, 1892, p. 426.
A. costatum var. *maculatum* Engler, 1915, p. 17.
A. costatum var. *foxii* Engler, 1915, p. 17.

Petioles 5.0–7.6 (18) cm long. Leaf-blades 9.5–18 cm long, 5.3–10 cm wide, lengtn/width ratio 1:1.5–1.9; variegation in the form of a central white stripe and scattered spots on both sides of the leaves; venation differentiated into 7–15 primary lateral veins diverging from the midrib at 60°–70°. Peduncle (2.5) 4.5–9.0 cm long.

TYPE COLLECTION.—England, Hort. Veitch, introduced from Langkawi Island by Curtis, 26 March 1892 [*N. E. Brown?*] (holotype: K). In the original publication Brown stated: "A native of Perak." Curtis, the original collector, noted on another specimen collected by him on Langkawi Island: "The habitat Perak in G[ardeners'] C[hronicle] is an error." Brown, author of the error, corrected his note on the holotype so that it now reads: "Introduced from Langkawi Island by Mr. Curtis."

DISTRIBUTION.—Endemic on Langkawi Island.

HABITAT.—"Damp shady places at foot of limestone hills" (*Curtis 2813*).

FLOWERING TIME.—March, coinciding with the onset of the rainy season.

Aglaonema costatum var. *maculatum* is typified by: Malaya, Langkawi Island, Coah, March 1892, *Curtis 2813* (K, SING). In his description Engler did not mention that the midrib is white as it is on the type-specimens. It does not differ from the typical element of the species.

Aglaonema costatum var. *foxii* is a rather dubious element. The type is apparently no longer extant, the citation of the type-locality includes errors, and the short description does not exactly fit any plants known to me. Engler's description—"Leaf dark green, marked with a pale green blotch which irregularly flows out from the midrib on each side"—best fits *Furtado s.n.*, 22 September 1928 (SING). Photographs published by Graf (1957, 1959, 1963) as *Aglaonema costatum foxii* also show this, which is rather different from the simple white midrib found in *A. costatum* f. *immaculatum;* however, all of these also have a few scattered spots, which Engler did not mention. Perhaps these spots had faded on a dried specimen. Interpreted in this fashion, since *A. costatum* var. *foxii* is no more than typical *A. costatum* with broader variegation on the midrib and fewer spots than usual, it should be regarded as a cultivar.

2b. *Aglaonema costatum* f. *immaculatum* (Ridley) Nicolson, new status

Aglaonema costatum var. *immaculatum* Ridley, 1907, p. 20.
A. costatum var. *lineatum* Engler, 1915, p. 17.

Petioles 5–18.5 cm long, grooved in upper quarter. Leaf-blades 12–23 cm long, 4.7–8.0 cm wide, length/width ratio 1:(1.6)2.1–3.1(3.6); variegation in form of a white midrib; venation differentiated into 7–12 primary lateral veins diverging from the midrib at 60°–70°. Peduncle (6.5) 8–13 cm long.

TYPE COLLECTION.—Singapore Botanic Gardens, 1898, *Ridley s.n.* (holotype: K).

DISTRIBUTION.—Continental Southeast Asia.

HABITAT.—Forest, near streams.

FLOWERING TIME.—April–June.

The type of *Aglaonema costatum* var. *lineatum* presumably was deposited at Berlin but, if so, it is no longer extant. No material was found elsewhere, including Bogor, that could qualify as a type. The description "Folia supra atroviridia, costa albida" is sufficient to warrant placing the taxon here.

The wild material shows considerable variability. *Kerr 21263* has leaves ranging from 1.6–3.1 times longer than broad. Kerr also noted "leaves sometimes with white stripe along midrib." This suggests that the taxon hardly can be regarded as more than a form occurring in the same population with other forms.

Alston 792 (cultivated in Ceylon) has long petioles, a cataphyll subtending the petiole, and narrow leaves like those of *A. brevispathum,* but the base is subcordate and the veins are many and wide-spreading as in *A. costatum.*

2c. *Aglaonema costatum* f. *virescens* (Engler) Nicolson, new status

Aglaonema costatum var. *virescens* Ridley ex Engler, 1915, p. 17.

Petioles 9–19 cm long, grooved for entire length in fresh material. Leaf-blades 15–26 cm long, 8.0–10 cm wise, length/width ratio 1:1.8–2.4; variegation in the form of irregularly scattered blotches of white sometimes on both sides of the leaf; venation differentiated into 10–14 primary lateral veins diverging from the midrib at 50°–70°. Peduncle 11–15 cm long.

TYPE COLLECTION.—"Kultiviert im Bot. Garten Singapore (*A. Engler, Reise nach Java und Brit. Indien n. 3811*)" (holotype: B, presumed destroyed). England, Hort. Kew, 324–05, Singapore, 1914 [without collector] (neotype: K). In designating a neotype I have selected a specimen fitting Engler's description; the original plant came to Kew from Singapore in 1905, the year of Engler's visit to Singapore.

DISTRIBUTION.—Western Laos.

Aglaonema costatum var. *virens* Ridley (in Anderson, 1912, p. 111) is a nomen nudum, presumably being referred to by Engler when he adopted the epithet "virescens."

2b. *Aglaonema costatum* f. *concolor* Nicolson, new form

A forma typica folius concoloribus sine notis differt. Pedunculus 18–23 cm longus. Pistilis paucis, 7–8.

TYPE COLLECTION.—Malaya, Kedah, P. Langkawi, Selat Panchor, 21 November 1934, *Henderson s.n.* (holotype: SING).

DISTRIBUTION.—Western Thailand and southern Laos.

HABITAT.—On limestone, 280 m.

FLOWERING TIME.—May.

Aglaonema costatum var. *inornatum* Ridley (in Anderson, 1912, p. 111), a nomen nudum, is placed here with some doubt. Authentic material could not be

found and I place the epithet here solely on the basis of its descriptive name.

Forma *concolor* approaches *A. brevispathum* in its general size although its proportions are those of typical *A. costatum*. The presence of few (7–8) pistils is more usual for *A. brevispathum*.

Kostermans, Kwae Noi Exped. 998 from Thailand has long petioles and there is a cataphyll subtending the petiole, as in *A. brevispathum;* however, the leaf base is subcordate and the veins are many, as in *A. costatum*. *Vidal 1852* from Laos has rather narrow leaves (2.5 times longer than broad) but otherwise seems to fall here.

Aglaonema section *Aglaonema*

Roots rarely approaching the stem in thickness. Stem erect to partially decumbent, 10–200 cm tall, 0.2–6.0 cm thick. Internodes 0.4–3.0 (5) cm long. Petiolar sheaths conspicuous, (0.8) 4–17 (25) cm long, (0.1) 0.3–0.8 (1) times as long as the petiole. Leaf-blades ovate-elliptic to lanceolate–narrowly elliptic, occasionally broadly ovate to sublinear; variegation rarely affecting the lower leaf surface, never with a central white stripe; venation undifferentiated to weakly or strongly differentiated. Cataphylls usually found only among the inflorescences (except possibly in *A. rotundum* and *A. pumilum*). Peduncles solitary to 7 together. Spathe (1) 3–7 (12) cm long. Spadix thin-cylindric to clavate, (1.2) 2.5–5.0 (7) cm long, from ½ the spathe length to exceeding the spathe by 1 cm; pistillate portion 0.2–1.0 (2) cm long, pistils (3) 10–25 (38); staminate portion rarely (*A. tenuipes*) with a gap between staminate and pistillate portions. Fruits ellipsoidal, green but turning yellow and finally red, up to 3 cm long and up to 1.5 cm thick.

3. *Aglaonema ovatum*

Aglaonema ovatum Engler, 1898, p. 21.

Stem erect, 0.5–1.5 cm thick. Internodes 0.7–3.0 cm long. Petioles (5) 8–14 (18) cm long, (0.3) 0.5–0.8 (1.1) times as long as the leaf-blades. Sheath membranous, (1.5) 3–8 cm long, (0.3) 0.4–0.6 (0.7) times as long as the petiole. Leaf-blades ovate to lanceolate, rarely elliptic, (10) 13–21 (26) cm long, (3) 5–10.5 cm wide, length/width ratio 1: (1.7) 2–3(5.5); base rounded to obtuse, rarely subcordate; apex often apiculate, acuminate (acumen 1.0–2.8 cm from point of 1 cm blade width to apex); rarely variegated with scattered blotches; venation weakly to strongly differentiated into 5–10 primary lateral veins diverging from the midrib at 35°–60°. Peduncles 1–2 together, 3.5–7.0 (10) cm long, usually about ½ as long as the petiole. Spathe 3.5–4.7 cm long, decurrent for 0.4–1.5 cm. Stipe none. Spadix cylindric, 3.0–4.3 cm long, usually exceeding spathe but sometimes 0.5 cm short of spathe apex; pistillate portion 0.4–1.6 cm long, pistils ca. 10–20; staminate portion 2.8–3.5 cm long, 0.6–1.0 cm thick, with lower 0.5 cm sterile and distinctly differentiated in color and size from the fertile area. Fruits red, 1.1–2.0 cm long, 0.7–1.0 cm thick.

DISTRIBUTION.—Northern continental Southeast Asia (Figure 4).

HABITAT.—In evergreen forest along streams or in shaded and humid places.

FLOWERING TIME.—April–May (July), probably influenced by the onset of the summer monsoonal rains (March–April).

This species is most closely related to *Aglaonema hookerianum* and *A. modestum*. It is distinguished by having the spadix equaling or exceeding the spathe and by rather strongly differentiated staminodia between the pistillate and staminate flowers. Fruiting specimens can be distinguished from *A. hookerianum* by their shorter peduncles. Fruiting and sterile specimens cannot be satisfactorily distinguished from *A. modestum*. The leaves of *A. modestum* are very long-acuminate (acumen over 2.5 cm long from point of 1 cm blade width to apex), a condition not attained in *A. ovatum;* however, flowering material of *A. modestum* from Laos lacks the extremely long acumen. It is hoped more and better flowering material may provide the means of recognizing better vegetative characters.

It should be noted that *Aglaonema tenuipes* occasionally has subsessile spadices and differentiated staminodia, suggesting possible confusion with *A. ovatum*. I am not certain that all fruiting or sterile specimens can be satisfactorily separated from *A. tenuipes*.

Key to the Forms of *Aglaonema ovatum*

Upper leaf surface not variegated . . . . . 3a. forma *ovatum*
Upper leaf surface variegated with ashy blotches . . . . . 3b. forma *maculatum*

3a. *Aglaonema ovatum* f. *ovatum*

Aglaonema ovatum Engler, 1898, p. 21.
Scindapsus tonkinensis Krause, 1932, p. 311.
Aglaonema decurrens Buchet ex Gagnepain, 1942, p. 1130 [without Latin diagnosis].

Leaf-variegation none; venation usually strongly differentiated into 5–10 primary lateral veins diverging from the midrib at 35°–60°. Peduncles 1 or 2, 3.5–7.0 (9.0) cm long, usually less than half as long as the petiole. Spathe 3.5–4.7 cm long, decurrent for 0.4–1.5 cm. Spadix 3.0–4.3 cm long, usually equaling to exceeding spathe.

TYPE COLLECTION.—Cochinchina, in ditione fluvii Attopeu (Laos) *Harmand 1435* (holotype: P; isotypes: P). *Harmand 1495 nad Herb. Pierre 3347 are* the same collection and both collectors' names and numbers are found on the holotype.

DISTRIBUTION.—Northern continental Southeast Asia.

FLOWERING TIME.—March–July.

The type of *Scindapsus tonkinensis* is Viet-Nam, Hanoi, April 1924, *Pételot 1371* (holotype: B; isotypes: BO, P, UC). Krause erroneously placed this specimen in *Scindapsus,* which has bisexual flowers. Study of the flowers shows that they are the usual unisexual flowers of *Aglaonema.* Krause's description of the stem as "scandens" is not supported by the specimen. E. D. Merrill, apparently unaware that he had isotypes, correctly determined the unidentified isotypes at BO and UC as *Aglaonema ovatum.* Gagnepain (1942) overlooked *Scindapsus tonkinensis* in his treatment of the aroids of Indochina.

The basis of *Aglaonema decurrens* Buchet ex Gagnepain (1942, p. 1130) is the drawing (fig. 107: 5–8, on p. 1128). The original drawing, in the Paris herbarium, was made from material cultivated in the Paris Botanic Garden. This material was received as *Cadière 27* from Cua-tung, near Hue. This binomial was invalidly published since there was no Latin diagnosis. Although Gagnepain regarded *A. decurrens* as new, he placed it among the "espèces insuffisamment connues," along with *A. ovatum.* The decurrent and prolonged spadix is common in *A. ovatum.* I see no reason to consider *A. decurrens* distinct from *A. ovatum* f. *ovatum.*

Dr. Shiu Ying Hu has annotated *Liang 69877* from Kwangsi as *Aglaonema liangii,* new species. I do not regard the specimen as sufficiently distinct from *A. ovatum* f. *ovatum* to warrant recognition.

In leaf shape, *Kerr 20899, 21776,* and *Nicolson 1681* represent the narrowest extreme. Other specimens show all stages of intergradation to the typical ovate leaf shape and, thus, do not warrant recognition.

3b. *Aglaonema ovatum* f. *maculatum* Nicolson, new form

Aglaonema ovatum var. maculatum Gagnepain 1942, p. 1130 [without Latin diagnosis].

A forma ovato foliorum laminis irregulariter cinereo-maculatis differt.

Leaf-variegation of scattered ashy blotches about 1 cm square, these frequently irregularly confluent; venation weakly differentiated into 6–8 primary lateral veins diverging from the midrib at 50°. Peduncles 1 or 2, 8–10 cm long, over half the petiole. Spathe decurrent for 1 cm.

TYPE COLLECTION.—Thailand, Petchabun, Ta Luang, 200 m, evergreen forest, 5 March 1931, *Kerr 20370* (holotype: K; isotypes: K).

This form is known only from a single fruiting collection that shows no evidence of a stipitate inflorescence. Its locality and vegetative characters indicate that it belongs with *A. ovatum* rather than with *A. modestum* or *A. hookerianum.* It was called *A. ovatum* var. *maculatum* Gagnepain (1942, p. 1130), but this name was invalidly published without a Latin description.

4. *Aglaonema modestum*

Aglaonema modestum Schott ex Engler, 1879, p. 442.
A. acutispathum N. E. Brown, 1885, p. 39.
A. costatum var. *viride* Engler, 1915, p. 17.
A. laoticum Gagnepain, 1941, p. 117.
A. marantifolium sensu Troll, 1928, p. 123, figs. 10–13 [not Blume, 1837].
A. simplex sensu Bailey, 1930, p. 31 [not Blume, 1837].
A. modestum cv. 'Variegatum' Graf, 1963, pp. 118, 1527.

Stem dark green, erect, 20–50 cm tall, 0.4–2.0 cm thick, internodes 0.4–3.0 cm long. Petioles (6) 10–20 (22) cm long, (0.4) 0.5–0.9 (1.1) times as long as the leaf-blade, upper portion flattened. Sheaths broad and membranous, (2.5) 4–8 (11) cm long, (0.2) 0.4–0.8 times as long as the petiole. Blades ovate to sublanceolate, rarely elliptic, (12) 14–25 cm long, (5) 8–11 cm wide, length/width ratio 1:1.9–2.5(2.8); base often unequal, obtuse to rounded; apex gradually long-acuminate (typically 2–3.5 cm from point of 1 cm blade width to apex); variegation none; venation weakly to strongly differentiated into 4–6 primary lateral veins diverging from the midrib at 30°–50°. Peduncles 1–3 together, 5–12.5 cm long, usually more than half as long as the petiole. Spathe apiculate, (3) 6–9 cm long,

FIGURE 10.—Reproduction of the type (no longer extant) of *Aglaonema modestum* Engler.

(1.5) 2.4–2.6 cm wide, turning yellow with age, decurrent for 0.5–2.0 cm. Stipe none. Spadix thin-cylindric, (1.5) 3–4.3 cm long, (0.6) 1.2–3.1 cm short of spathe apex; pistillate portion 0.5–1.0 cm long, adnate to spathe, pistils 9–13; staminate portion 2.3–3.5 cm long, 0.3–0.6 cm thick, not shedding pollen. Fruits orange, 2–3 cm long, 1.0–1.3 cm thick.

TYPE COLLECTION.—Philippines, Manila, *Gaudichaud s.n.* (holotype: P, fide Engler, 1915, but not found). *Schott, Aroideae Nr. 56* (W), a drawing of the holotype, is suggested here as a neotype, if the holotype has been lost. The neotype is the basis for the drawing distributed as *Engler, Araceae 74* (seen in B, G, K, SING, Z).

DISTRIBUTION.—Southern China, northern Laos, and northern Thailand (Figure 4).

HABITAT.—Humid ravines in tropical and semi-deciduous forest.

FLOWERING TIME.—March–April.

This species is commonly called "Chinese evergreen" in the United States and is popular as a house plant. It is called "Wan-lien-tching" in Chinese (*Morse 374*), literally "10,000 years green," i.e., evergreen, and is considered to bring good fortune to the owner.

Hitherto, this species was thought to be native to the Philippines since the type supposedly was collected there. Merrill (1923, p. 184) suggested that the type actually was collected in Macao. Merrill (1932, p. 94) later reconsidered and thought it highly probable that Gaudichaud

> actually did secure his material from Manila but that the specimens were taken from plants imported from southeastern China by the Chinese and grown for ornamental purposes in Manila; it seems probable that the species has been cultivated for a long time by the Chinese, and that it was more or less disseminated by them in the Orient, quite as in more recent times it has been disseminated by them in the United States.

This hypothesis is supported by my findings.

Aglaonema modestum is most closely related to *A. hookerianum* and *A. ovatum*. It differs from both in having the spadix distinctly shorter than the spathe (by more than 1 cm). Vegetative or fruiting material is difficult to determine with any degree of certainty. *Aglaonema modestum* typically has a long acumen on the leaf apex; however, this is not found in the material called *A. laoticum* although the spadix is 1.3 cm short of the spathe apex and the species clearly is referable to *A. modestum*.

The type of *Aglaonema acutispathum* N. E. Brown is: England, Hort. Kew., from Hong Kong by H. V. Knaggs, 1 June 1885 [*Brown*] (holotype: K). Brown (1903, p. 185) himself reduced his taxon to synonymy saying, "In my description I stated that it was distinct from *A. modestum,* but Engler's reproduction of Schott's figure of the species (*Engler, Araceae No. 74*), which I had not then seen, demonstrates that the two are identical."

The type of *Aglaonema costatum* var. *viride* Engler is: Hort. Bot. Calcuttensis, Perak [origin], April 1896, *Kunstler s.n.* (holotype: CAL). The origin "Perak"

noted on the specimen seems unlikely unless it was from cultivation. The specimen is annotated by Engler only as "*Aglaonema costatum* N. E. Br." without mention of a varietal name; however, this is the only specimen I have seen that fits Engler's citation "Malakka, Perak (Kunstler. – Kult. im Bot. Gart. Calcutta)." Only one leaf and one inflorescence (one destroyed) are present, but the material seems to be *A. modestum* or, possibly *A. hookerianum*. Furtado annotated the specimen as "certainly not *A. costatum*."

The types of *Aglaonema laoticum* Gagnepain are: Laos, Luang Prabang, Ken Luong [no date], *Spire 726* (lectotype: P); [Laos] Paklai, 1866–1868, *Thorel s.n.* (syntype: P); Thailand, Chieng Mai, Doi Soo-tep, 3000 ft, 2 May 1910, *Kerr 1160* (syntype: K). This lectotype was selected because it is the most complete (with flowers and fruits) and because Gagnepain made sketches of the inflorescence on it. The spadix is sessile, reaching 1.3 cm short of the spathe apex, and without conspicuous staminodia, indicating that this is *A. modestum* although the acumen of the leaves is short for *A. modestum*. The large seed (3 x 1 cm) is usual for *A. hookerianum*, but the plants are much smaller than those of that species.

The binomial *Aglaonema simplex* is often misapplied to *A. modestum*. This misidentification has been pointed out by Merrill (1932, p. 93). True *A. simplex* has a stipitate spadix and only rarely has the long acumen commonly found in *A. modestum*.

Aglaonema modestum cv. 'Variegatum' was reported to come from Pennock's Puerto Rico Nursery. The photograph published by Graf (1963) is not clear but the plant looks as though the variegation might be caused by a disease.

5. *Aglaonema hookerianum*

Aglaonema hookerianum Schott, 1859, p. 30.
A. clarkei Hooker f., 1893, p. 529.

Stem erect, 40–50 cm or more, 1.5–2.0 cm thick. Internodes 1.5–3.0 cm long. Petioles 14–24 cm long, 0.7–0.9 (1.2) times as long as the leaf-blade. Sheaths membranous, (4) 8–15 cm long, (0.2) 0.5–0.6 (0.8) times as long as the petiole. Leaf-blade ovate to elliptic or lanceolate to narrowly elliptic, 20–27 cm long (5.3) 7–12 cm wide, length/width ratio 1:2.0–2.9(3.8); base often unequal, rounded, obtuse or broadly acute, rarely acute; apex often apiculate, acuminate to gradually or suddenly long acuminate (acumen to 2.1 cm long from point of 1 cm blade width to apex); variegation none; venation weakly to strongly differentiated into 7–13 primary lateral veins which diverge from the midrib at (30°) 40°–50°. Peduncles 1–3 together, (6) 10–21 cm long. Spathe 3.7–6.0 cm long, decurrent for (0.6) 1–1.5 (2) cm. Stipe none. Spadix thin-cylindric, 2.5–4.0 cm long, equaling to 0.8 cm short of spathe apex; pistillate portion 0.3–0.6 cm long, attached to spathe, pistils ca. 10–15; staminate portion 2.0–3.7 cm long, 0.3–0.6 cm thick. Fruits red, large when ripe, (1.7) 2–3 cm long, (0.7) 0.9–1.4 cm thick.

TYPE COLLECTION.—India, Churra [Cherrapunji], 2000 ft, 15 June [18]50, *Hooker and Thomson s.n.* (holotype: K).

DISTRIBUTION.—Northeastern India, East Pakistan, and coastal western Burma (Figure 3).

HABITAT.—Below 1000 m, in deep shade of forest receiving more than 80 inches of annual rainfall.

FLOWERING TIME.—June–July, probably influenced by the onset of the summer monsoon.

Aglaonema hookerianum Schott, as indicated by the key to species, is very similar to *A. modestum* and *A. ovatum*. The primary differences between these species seem to be in the spadices. Most of the specimens available are in fruit; because of the paucity of flowering material, I am not certain just how distinctive these taxa are. Secondary considerations like plant size, leaf shape, and distribution were used for identification. Also, lack of collections from northern Burma and southwestern China made it impossible to know whether or not intergradations occur in the areas where they would be most expected. The distinctive characteristics of *A. hookerianum* are: (1) sessile spadix, (2) spadix equaling the spathe (3) large fruits, (4) a long peduncle (compared with *A. ovatum* and *A. modestum*), and (5) restriction to western Burma, southern East Pakistan, and northeastern India.

At one time it seemed to me justifiable to segregate *Aglaonema ovatum*, *A. modestum*, and *A. hookerianum* as a separate section of the genus because of their sessile spadices and northern distribution. The absence of any other distinguishing characters and the occasional occurrence of subsessible spadices in *A. simplex*, *A. tenuipes*, and *A. cochinchinense* made this segregation untenable.

The type of *Aglaonema clarkei* Hooker f. is: East Pakistan, Kaselong [Kaselang River], 10 Jan. 1869, *Clarke 8266* (holotype: K). *Aglaonema clarkei* is similar to *A. hookerianum* with its large seeds, sessile spadix, and long peduncle. It differs primarily by its exceedingly short petiolar sheath and scandent habit.

The report of scandent habit is surely an error for the reason that, although large plants of *Aglaonema* tend to recline against their neighbors, they are not climbers in the usual sense of the word. The short petiolar sheath is represented only by the one leaf on the type. Superficially the taxon resembles *A. nitidum* in its acute leaf-base and lack of differentiated venation, characters occasionally found in *A. hookerianum* (*Prazer s.n.* and *Leslie 306*). It seems best to regard *A. clarkei* as a probable synonym of *A. hookerianum*. The type-locality, on the Kaselang River, may now be drowned by the Karnaphuli Reservoir.

6. *Aglaonema pictum*

Aglaonema pictum (Roxburgh) Kunth, 1841, p. 55.
Calla picta Roxburgh, 1832, p. 516 [1814, p. 65, nomen nudum].
Aglaonema gracile Schott, 1864, p. 279.
A. versicolor Hort. Bull [sic], 1893 (Apr. 8), p. 414.
A. pictum var. *tricolor* N. E. Brown ex Engler, 1915, p. 33.

Stems erect, 30–50 cm tall, 0.3–2.0 cm thick. Internodes 0.5–5.0 cm long, longest near the base of the plant. Petiole (2.1) 3–7 (14) cm long, 0.3–0.4 (0.6) times as long as the leaf-blade. Sheaths broad, hyaline to scarious, often slightly prolonged, 1.5–5.0 (13) cm long, (0.25) 0.5–0.8 (1.0) times as long as the petiole. Leaf-blades dull above, frequently with a crispulate margin, narrowly elliptic to elliptic or ovate, rarely lanceolate, (5.7) 10–16 (20) cm long, (2.7) 3.5–6.0 (9.5) cm wide, length/width ratio of 1:(1.6) 2.3–3.0(4.0); base often unequal, obtuse to rounded, rarely truncate; apex often apiculate, acuminate; variegated or not with irregular light green to silvery irregular maculations on a dark green background; venation strongly differentiated into 4–8 (10) primary lateral veins diverging from the midrib at (30°) 40°–55°. Peduncles 1–4 together, 3–6 (15) cm long. Spathe light green to yellowish, globose, abruptly apiculate, 1.5–3.0(5) cm long, 7 cm wide, decurrent for 0.2 cm (rarely 0.5–1.0 cm). Stipe 0.3–1.2 cm long, elongating in anthesis and fruit. Spadix clavate, exserted from spathe for 0.5 cm in anthesis, 1.4–3.0 cm long; pistillate portion 0.2–0.5 cm long, pistils 12–26 (15 and 26 on *Nicolson 676*), stigmas broad as ovary; staminate portion 1–2 (2.5) cm long, lower half often sterile, 0.3–0.5 cm thick at base, 0.7–0.8 cm thick at middle or slightly above middle. Fruits becoming red, 1–1.5 cm long, 0.5–1.0 cm thick.

TYPIFICATION.—The type is Roxburgh's drawing No. 1662 (K). This drawing was published by Wight (1844, vol. 3, pl. 804). The typification of this epithet was discussed by Sealy (1957).

DISTRIBUTION.—Sumatra and Nias Island (Figure 7).

HABITAT.—Usually reported between 1000 and 2000 m on the slopes of major volcanos. Occasionally collected as low as 35 m (*Jacobson 127* from Padang).

FLOWERING TIME.—April or August. Most fruiting material was collected in March. Seasonality is weak and probably variable according to the exposure of the mountain side.

The type of *Aglaonema gracile* is: Sumatra? [*Korthals*] (holotype: L). The origin of this specimen has long been in doubt because the original label was lost. In the original publication Schott stated: "Borneo, Sumatra vel Iava (Sched. deperd.)." The type is presently annotated as being from "Java." Schott had a drawing (Aroideae Nr. 45) labelled "Borneo?" that was prepared from the type. I have annotated the type as probably being from Sumatra, the only island of the three cited in the original publication in which *A. pictum* is native. Engler (1879, p. 437) reduced *A. gracile* to synonymy under *A. pictum*. Engler later (1915, p. 33) placed *A. gracile* as an unpublished name under *A. simplex*. This disposition seems mistaken since the leaves are variegated and the spathe decurrency is very short. I am returning *A. gracile* to synonymy under *A. pictum*.

I designate the plate on page 6 in Bull (1894) as the neotype of *Aglaonema versicolor*. This plate was published subsequently to the original publication but clearly represents the plant Bull earlier had in mind. Bull's plant differs from *A. pictum* only in its variegation: ". . . irregularly blotched with patches of dark velvety green interspersed among patches of lighter green, and some of milky white." Thus, the leaves have three colors and it may be difficult to tell which is the basic leaf color. Plants of *A. pictum* with 3-colored leaves with white patches probably are best handled as a cultivar.

The type of *Aglaonema pictum* var. *tricolor* is: England, Hort. Veitch, September 1886, without collector [*N. E. Brown?*] (lectotype: K). No specimen was cited in the original description, but the name was attributed by Engler to N. E. Brown in manuscript. This is the only specimen anotated by N. E. Brown as *A. pictum* var. *tricolor*. Engler (1915) described *A. pictum* var. *tricolor* as having the blade marked with yellowish and yellowish-green spots. This may be truer of dried specimens than fresh specimens. A slightly

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different definition was given by van Alderwerelt van Rosenburgh (1922, p. 327) who reported the leaf-blade as "rather marbled with dark green, bright green and pale-grey-green so that the bright green portions are dominant."

Aglaonema pictum differs from *A. nebulosum*, the most closely related species, by its longer petiolar sheath. In *A. nebulosum* the sheath rarely is over two-fifths as long as the petiole and in *A. pictum* the sheath is rarely less than half as long as the petiole. The species also occupy different ranges and habitats. *Aglaonema nebulosum* is found in lowland swamp forests of Malaya and Borneo, and *A. pictum* normally is found at over 1000 meters on slopes of Sumatran volcanos.

A number of the specimens appear not to have any leaf variegation: *Meijer 6431, Rahmat Si Boeea 10262, Steenis 6407.* I cannot justify taxonomic recognition of this nonvariegated material since variegation may fade in dried material and I have found no other characters correlating with the lack of variegation.

Two specimens had definitely lanceolate leaves with the length almost four times the width; *Steenis 8887* from Atjeh and *Dames 39* from Sibolga. These extreme specimens are joined with the more usual specimens by intermediates such as *Bartlett 8169* and *Rahmat Si Boeea 6030,* in which the length/width ratios vary from 3.0–4.0 on different leaves of the same specimen. This indicates that the extremes do not represent distinct taxa.

The spathe of *A. pictum* normally seems to be quite globose at anthesis in fresh material, but this is practically impossible to determine in dried and pressed material. The globosity seems to be correlated with a short spathe decurrency (0.2 cm). In nonvariegated fruiting material a short spathe scar is very useful in distinguishing *A. pictum* from *A. simplex* since *A. simplex* typically has the spathe scar 0.5 cm long or more in Sumatran material. Unfortunately, some exceptions are known. There are several specimens with flowering and fruiting material in which the spadix is clearly clavate but the spathe scar is 1 cm long, e.g., *Rahmat Si Boeea 10262* and *Bünnemeijer 4636.*

Rahmat Si Boeea 10262 is extremely anomalous, having peduncles 10–15 cm long, a spathe 5 cm long, a spathe decurrency of 1.0 cm, leaves 9.5 cm wide, petiole 14 cm long, and the sheath 13 cm long. All these measurements are extremes for the species. Since the material, however, has a clavate spadix and its ratios fall with *A. pictum,* I have decided to place it here.

7. *Aglaonema nebulosum*

Aglaonema nebulosum N. E. Brown, 1887, p. 67, pl. 24.

Stem erect, 10–60 cm tall, 0.5–1.0 cm thick. Internodes 0.5–2.0 cm long. Petioles 2–5 cm long, (0.1) 0.2–0.4 times as long as the leaf-blade. Sheaths membranous, short, 0.5-1.5 (2) cm long; 0.15-0.3 (0.6) times as long as the petiole. Leaf-blades dull above, oblanceolate to narrowly elliptic-oblong, rarely obovate to elliptic, (6.5) 9–18 (20) cm long, (2.5) 3–5.5 (7) cm wide, length/width ratio 1: 2.5–3.5; base obtuse to acute; apex often apiculate, acuminate to abruptly acuminate; variegation rare, then in the form of ashy or silvery irregular blotches on the upper leaf surface; venation usually strongly differentiated into 5–10 or more pairs of primary lateral veins diverging from the midrib at 40°–60°. Peduncles solitary, rarely 2 together, 2–4.5 cm long, equaling the petioles. Spathe apiculate, light green to whitish, globose, 1.7–2.7 cm long, to 4 cm wide, decurrent for 0.2–0.5 cm. Stipe 0.3–1.0 cm long. Spadix clavate, exserted from spathe for 0.5 cm at anthesis, 1.2–2.0 cm long; pistillate portion 0.3–0.6 cm long, ca. 0.6 cm thick, pistils 10–20; staminate portion 0.9–1.5 cm long, 0.3–0.4 cm thick at base, 0.6–0.8 cm wide at or above middle, white. Fruits dark red, 0.7–2.0 cm long, 0.4–0.9 cm thick.

DISTRIBUTION.—Malaya, Borneo, and islands off the east coast of Sumatra (Figure 7).

HABITAT.—Peat and freshwater forests.

FLOWERING TIME.—Nonseasonal.

Aglaonema nebulosum N. E. Brown has been taxonomically confused since its inception. It originally was described from vegetative material cultivated by Linden and was reported to have originated in Java. All available evidence is against this source, for three other cultivated specimens sent earlier to Brown by Linden and Bull were noted as having originated from Borneo, and the species is not known to reach Java. It is not clear to me why Brown chose to describe only vegetative material and chose to overlook the flowering material of *A. nebulosum,* which he had already prepared. It is this flowering material that makes it possible to identify *A. nebulosum* with later collections from the wild and with epithets subsequently applied to the species.

Hooker (1893) did not include *A. nebulosum,* but had three nonvariegated collections of material assignable to this species, each of which he recognized as the type of a species: *A. minus, A. nanum,* and *A.*

scortechinii. Ridley (1907) reduced *A. nanum* and *A. scortechinii* to varieties of *A. minus.* Engler (1915), who did not cite Ridley's work, recognized all the four species *A. nebulosum, A. minus, A. nanum,* and *A. scortechinii,* noting that *A. nebulosum* and *A. scortechinii* were "Species imperfecte cognita." Ridley (1925) added a new element of confusion when he reduced *A. minus* to synonymy with *A. pictum* and recognized *A. nanum* and *A. scortechinii* as varieties of *A. pictum. Aglaonema pictum* is, to be sure, closely related to *A. nebulosum* but seems to be distinct. In *A. pictum* the petiolar sheath is consistently well over half the petiole length while in *A. nebulosum* the sheath is rarely over one-third as long as the petiole. Apparently Ridley confused the species because variegation patterns in the two species are almost identical.

Aglaonema vittatum may be confused with *A. nebulosum* since both have short sheaths and overlapping distributions, but the spadix is not exserted in *A. vittatum* as it is in *A. nebulosum.*

Key to the Forms of *Aglaonema nebulosum*

Leaves variegated . . . . . 7a. forma *nebulosum*
Leaves not variegated . . . . . 7b. forma *nanum*

7a. *Aglaonema nebulosum* f. *nebulosum*

Aglaonema nebulosum N. E. Brown, 1887, p. 67, pl. 24.
A. rotundum sensu N. E. Brown, 1893b, p. 379, fig. 56 [not N. E. Brown, 1893a].
A. pictum sensu Ridley, 1925, p. 102 [not Kunth].

Leaf variegation in irregularly ashy to silvery blotches over the upper leaf surface.

TYPE COLLECTION.—[Belgium, Ghent, Hort. Linden] Java, from Mr. Linden, July 1887 [*N. E. Brown?*] (holotype: K).

DISTRIBUTION.—Singapore and southern Malaysia (Johore).

It is curious that Brown made no reference to the flowering material sent to him before 1887, not only by Linden but by Bull. This flowering material, with its variegated leaves, short petioles, short sheaths, exerted and clavate spadix, and globose spathe, clearly relates *A. nebulosum* to *A. nanum,* which appears to be only a form with nonvariegated leaves. The type seems to have somewhat longer leaves than the wild material. The type and some of the wild collections do not show their variegation after drying.

FIGURE 11.—Holotype of *Aglaonema nebulosum* N. E. Brown: *N. E. Brown?* (K).

7b. *Aglaonema nebulosum* f. *nanum* (Hooker f.) Nicolson, new status

Aglaonema nanum Hooker f., 1893, p. 530.
A. minus Hooker f., 1893, p. 530.
A. scortechinii Hooker f., 1893, p. 530.
A. minus var. *scortechinii* (Hooker f.) Ridley 1907, p. 22.
A. minus var. *nanum* (Hooker f.) Ridley, 1907, p. 22.
A. obovatum van Alderwerelt van Rosenburgh, 1922, p. 322.
A. pictum var. *scortechinii* (Hooker f.)Ridley, 1925, p. 102.
A. pictum var. *nanum* (Hooker f.) Ridley, 1925, p. 102.

Leaf variegation none.

TYPE COLLECTION.—Malaya [Selangor], Ulu Bubong, July 1886, *King's Collector 10421* (holotype: K; isotypes: BM, CAL, SING). In this case, Dr. King's collector was Kunstler.

DISTRIBUTION.—Malaysia, Borneo, and islands off the eastern coast of Sumatra. Highest elevation reported is 2000 ft (*Derry 613*) on Mt. Ophir, Malacca.

FLOWERING TIME.—Appears to be nonseasonal.

The type of *Aglaonema minus* is: Singapore, October 1822, *Wallich, E. India Co. 8960A* (holotype: K). The type is in abortive fruit and the smallish leaves have three to four pairs of weakly differentiated veins. I regard this specimen as a poorly developed individual of *A. nebulosum,* which generally has six or more rather strongly differentiated pairs of veins.

The type of *Aglaonema scortechinii* is: Perak [no date], *Scortechini 255* (holotype: K, isotype: CAL).

The Kew specimen is regarded as the holotype since it was annotated by N. E. Brown, who assisted Hooker with Araceae for the *Flora of British India.* The leaves of this specimen are ovate (2.0–2.4 times longer than broad) rather than oblanceolate; however, some of these lower leaves are broader than the upper, more vigorous leaves, making it difficult to justify maintenance of *A. scortechinii* solely on the basis of leaf shape.

The type of *Aglaonema obovatum* is: Indonesia, Lingga Archipel, Pulo Lingga, Kampong Panggak, 30 m, Sago bosch, 27 July 1916, *Bünnemeijer 7039* (holotype: BO). Alderwerelt van Rosenburgh did not comment about the relationships of his species nor indicate what was distinctive about it. I cannot maintain it since the type is adequate and falls completely within my concept of *A. nebulosum* f. *nanum.*

8. *Aglaonema vittatum*

Aglaonema vittatum Ridley ex Engler, 1915, p. 33.

Stem 10–15 cm tall, 0.2–0.7 cm thick in dried material. Internodes 0.4–1.4 cm long. Petioles 2–4.2 cm long, 0.3–0.6 times as long as the leaf-blade. Sheaths 0.8–1.2 cm long, 0.2–0.4 times as long as the petiole. Leaf-blade lanceolate, 6.5–10.5 cm long, 1.7–3.0 cm wide, length/width ratio 1: (2.6)3–4.4; base often unequal, obtuse; apex gradually attenuate; variegation none or in form of a narrow central white stripe along the midrib; venation differentiated into 2–3 primary lateral veins diverging from the midrib at 30°. Peduncle solitary, 2.5–3.0 cm long (4–5 cm, fide Engler, 1915). Spathe 2–3 cm long, decurrent for 0.3–0.5 cm. Stipe 0.1–0.4 cm long. Spadix clavate, about half the spathe length (fide drawing at Kew); pistillate portion with ca. 10 pistils. Fruits red.

TYPE COLLECTIONS.—Indonesia, Lingga, Batu Gajah, 1–2000 ft, 19 July 1893, *Hullett s.n.* (lectotype: SING); Indonesia, Sungei Kelantan, Siak, November 1897, *Ridley s.n.* (syntype: SING).

DISTRIBUTION.—Restricted to eastern Sumatra and the Lingga Archipelago (Figure 6).

HABITAT.—In primary rain forest from a few meters above sea level (*Buwalda 6629*) to 300–600 m (*Hullett s.n.*).

FLOWERING TIME.—July–August on the few specimens available. Seasonality is not expected since all collections are from lowlands and within one degree of the equator.

Some of the collections show no evidence of the white midrib. *Teysmann s.n.* (BO 100514) is made up of four plants; two are variegated, one is not, and I am uncertain about the fourth. *Bünnemeijer 7161* is variegated and *Bünnemeijer 7173* is not although both were collected the same day, at the same elevation, and in the same locality.

Aglaonema vittatum is most similar to *A. rotundum,* judging by the unpublished drawings of the inflorescence at Kew. It resembles *A. nebulosum* in its short petiole and sheath but differs by its much narrower leaf.

9. *Aglaonema rotundum*

Aglaonema rotundum N. E. Brown, 1893a, p. 86.

Stem decumbent, erect for the terminal 5–6 cm, 0.3–0.9 cm thick. Internodes 1 cm long. Petioles 2.5–4.5 cm long, 0.3–0.4 times as long as the leaf-blade. Sheaths membranous, broad, frequently prolonged for 0.5 cm, 1–3.5 cm long, 0.4–0.8 times as long as the petiole. Leaf-blade broadly ovate, 6–13.5 cm long, 5.8–10.6 cm wide, length/width ratio 1:1.0–1.3; base obtuse to truncate; apex slightly apiculate, obtuse; variegation in form of whitish or pink midrib and veins on a dark, glossy green upper surface, lower surface dark red; venation differentiated into 4–6 primary lateral veins diverging from midrib at 50°–60°; texture rather coriaceous. Cataphylls to 3.5 cm long, like brown-paper, mixed with petioles. Peduncle solitary, 6.5–7.0 cm long, exceeding the petioles. Spathe large 6–7 cm long, bent forward, decurrent for 0.6–1.5 cm. Stipe present? Spadix clavate, 3 cm long, bent forward; pistillate portion 0.6 cm long, pistils in 2–3 series (ca. 15?); staminate portion 2.5–3.5 cm long, 1.3 cm thick (fide Brown). Fruits 0.8 cm long, 0.6 cm thick.

TYPE COLLECTION.—England, Hort. Veitch, 4 July 1893 [*N. E. Brown?*] (holotype: K).

DISTRIBUTION. (Figure 6).—The only collection (*Bartlett 6739*) definitely taken from wild-growing material is from near Medan in North Sumatra. *Huttleston 1907* reports his plant was collected by W. H. Hodge in Thailand, but it may have been cultivated there. Graf (1963, p. 1527) states that he found the plant in northern Thailand, but again it may have been from cultivation. The earliest collection was made from Hort. Veitch on 27 July 1889 and was reported to have been "imported from Calcutta without information." On the holotype N.E. Brown wrote, "Native country unknown, the plants were received by Mr. Veitch from Calcutta and Penang."

HABITAT.—Near a waterfall, 360 m (*Bartlett 6739*).

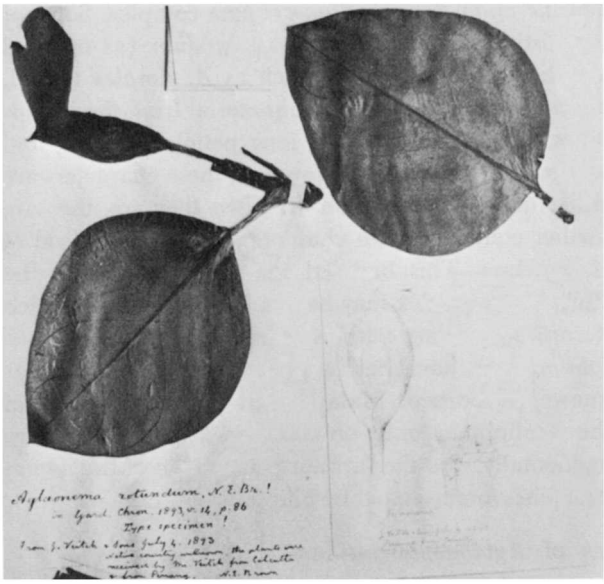

FIGURE 12.—Holotype of *Aglaonema rotundum* N. E. Brown: *N. E. Brown?* (K).

USES.—A very desirable foliage plant. In Thailand I was shown a wellgrown specimen in a home and was told that the plant brings good luck to the owner. In the market of Bangkok I saw a depauperate specimen for sale for what seemed to be an extremely high price. A living specimen was given to me by Prof. Kasin Suvatabandhu of Chulalongkorn University, but I regret to note that it has disappeared from my collections.

The inflorescence disintegrates by the second day (*Huttleston 1907*) after opening and it is not possible to determine from material available to me whether or not there is a stipe. On *Huttleston 1907* there appears to be a stipe, but this may be the result of distortion in pressing. In his original description Brown noted the presence of a stipe, but he may have been referring to the naked portion of the spadix rather than to the stipe as the term is used here (measured next to the spathe). I assume, with doubts, that it is stipitate.

The wild specimen is much smaller than the cultivated material and has shorter petiolar sheaths. This is not considered to be of significance since both characters may be influenced by the care given to cultivated material.

The spadix is much shorter than the spathe. In this respect *A. rotundum* is similar to *A. vittatum*.

The presence of cataphylls among the petioles and the decumbent habit is very suggestive of section *Chamaecaulon*.

10. *Aglaonema nitidum*

Aglaonema nitidum (Jack) Kunth, 1841, p. 56.
Calla nitida Jack, 1820, p. 24.

Stem erect or with lower part reclining on ground in larger plants, to 1 m or taller, 0.5–5 cm thick. Internodes 0.5–2.0 cm long. Petioles (8) 11–26 (29) cm long, 0.4–0.9 times as long as the leaf-blade, often in two spirals. Sheaths with scarious margins, (5) 9–22 (28) cm long, (0.4) 0.7–1.0 times as long as the petioles. Leaf-blades narrowly elliptic to narrowly oblong or oblanceolate, (11) 20–45 (50) cm long, (4) 7–16 (20) cm wide, length/width ratio 1:(2.1)2.7–3.6(4.3); base acute to attenuate, rarely broadly acute; apex often apiculate, acuminate to broadly acute or shortly acuminate; variegation usually not present; when present, either in bars following the venation or in rather irregularly scattered blotches; venation usually undifferentiated in dry material but sometimes weakly differentiated into 5–9 or more primary veins diverging from the midrib at 35°–55°; texture coriaceous. Peduncles rarely solitary, 2–5 together, (5) 10–17 (21) cm long, commonly equaling or surpassing the subtending petiole. Spathe light green but frequently turning white with age, eventually withering, 3–7 (8.5) cm long, decurrent for (0.4) 1–1.6 (2.0) cm. Stipe 0.2–0.9 cm long. Spadix cylindric, equaling or slightly exceeding spathe, (1.3) 4–7 cm long; pistillate portion (0.2) 0.5–1.0 cm long (to 2 cm in fruit), pistils 16–37, scattered at anthesis, stigmas yellowish, to 0.3 cm broad, the style weakly constricted; staminate portion (1.1) 2.5–5.0) (6.0) cm long to 1.5 cm thick, commonly rotting or shriveling soon after anthesis. Fruits white.

DISTRIBUTION.—Southern Burma, Malaysia, Sumatra, and Borneo (Figure 2).

HABITAT.—Lowland primary dipterocarp forest in damp and well-shaded place. Found in freshwater peat-swamp forests and on limestone but in pockets and damp ravines.

FLOWERING TIME.—Nonseasonal. The species is largely restricted to the equatorial region, where rainfall is daily (convectional) rather than seasonal and the plants live in dark places where the humidity is always high.

There are two important taxonomic problems in *Aglaonema nitidum*. The first problem involves the northwestern extremity of the distribution of the species. In that area the species appears to undergo

several tendencies: smaller size, shorter petiolar sheath, loss of the scarious petiolar margin, membranous rather than a coriaceous texture, more ovate leaves with rounded leaf-bases, and fewer pistillate flowers. The plants of central Thailand, Cambodia, and South Vietnam are so strongly differentiated in these characters that they could be maintained as a distinct species, *A. cochinchinense*. The plants of southern Burma, however, show only enough differentiation to justify recognition as a variety, *A. nitidum* var. *helferi*. Further collections from southern Burma and western Thailand would be very desirable to clarify the complex.

The second problem involves the northeastern extremity of the species. In the Philippines there seems to be some overlapping with the *A. philippinense-densinervium-stenophyllum-crispum* complex. Some of the distinctive characters of *A. nitidum* (as opposed to other common species, such as *A. simplex* and *A. marantifolium*) are found in material from the Philippines, i.e., acute leaf base, long petiolar sheaths, and scarious sheath margins; however, these characters are either not in combination or, when they are, they are further combined with characters not at all typical of *A. nitidum*. This had led me to consider that the Philippine complex may have a hybrid origin in which *A. nitidum*, along with *A. simplex* and *A. marantifolium*, may have had a part. True *A. nitidum*, as known in Borneo, Malaya, and Sumatra, occurs in the Philippines only on Balabac Island (which is, incidentally, also the farthest penetration of the mouse deer [chevrotain] into the Philippines).

Key to the Varieties and Forms of *Aglaonema nitidum*

1. Spathe (3.5) 4.5–8.5 cm long . . . . . var. *nitidum*
   2. Leaf-blade not variegated . . . . . 10a. forma *nitidum*
   2. Leaf-blade variegated . . . . . 10b. forma *curtisii*
1. Spathe 3.0 cm long . . . . . 10c. var. *helferi*

10a. *Aglaonema nitidum* var. *nitidum* f. *nitidum*

Calla nitida Jack, 1820, vol. 1, no. 1, p. 24.
Arum integrifolium Link, 1822, p. 394.
Aglaonema oblongifolium Schott, 1829, p. 829.
A. integrifolium (Link) Schott, 1832, p. 20.
A. nitidum (Jack) Kunth, 1841, p. 56.
A. princeps Kunth, 1841, p. 55.
A. oblanceolatum van Alderwerelt van Rosenburgh, 1922, p. 322.
A. oblanceolatum f. *maximum* van Alderwerelt van Rosenburgh, 1922, p. 323.

Petioles (8.5) 11–26 (29) cm long, 0.4–0.9 times as long as the leaf-blade. Sheaths (7) 10–20 (28) cm long, 0.6–1.0 times as long as the petioles. Leaf-blades (19) 25–45 (50) cm long, (5) 7–16 (20) cm wide, length/width ratio 1:(2.1)2.7–3.6(4.3); variegation sometimes seen on juvenile leaves. Peduncles (8.5) 10–17 (21) cm long. Spathe 3.5–8.5 cm long, decurrent for (0.8) 1–1.6 (2) cm. Spadix (2.5) 4.5–6.0 (6.9) cm long; pistillate portion 0.3–1.0 cm long, pistils (10) 16–37; staminate portion 2–6 cm long.

TYPE COLLECTION.—Malaya, Penang, August 1822, *Wallich, E. India Co. 8965A* (neotype: K).

DISTRIBUTION.—Peninsular Thailand, Malaya, Sumatra, and Borneo.

HABITAT.—Lowlands, in damp and shady places.

FLOWERING TIME.—Nonseasonal.

A neotype must be selected for *Calla nitida* Jack. All of Jack's types have been elusive since the bulk of his collections burned with the ship *Fame* in 1824. Cowan (1954) reported on newly recognized Jack specimens at Edinburgh, but none of these were Araceae. The classical commentary on Jack is Burkill's (1916) publication of the letters written by Jack to Wallich from 1819 to 1821. Jack's letter of 7 May 1819 from Penang includes the following: "Capt. Fergusson of the Boyne, has agreed to take charge of a box of growing plants, and a parcel of specimens, which hope will arrive safe." Although nothing is said about aroids in the parcel of dried specimens, Jack continues, "I hope the box of plants will please you, it contains a good many which I have never seen in flower . . . . There are besides, two species of *Arum*, one of *Calla* . . . ." Jack (1820) described three species of Araceae from Penang: *Calla* [*Homalomena*] *humilis*, *Calla* [*Homalomena*] *angustifolia*, and *Calla* [*Aglaonema*] *nitida*. I believe that all three of these species (two called *Arum* at that time) were included in that shipment of living plants. Burkill (1916) tends to support this view, saying that the "one of *Calla* [is] *Aglaionema* [sic] *oblongifolium* Schott" on page 174 although on page 268 he says it is *Aglaonema marantifolium* Blume. This second determination seems to be part of the nomenclatural confusion involving the type-species. It is not likely that Burkill intended to refer to a Moluccan species.

It seems probable that living material of *Calla nitida*

FIGURE 13.—Painting of *Aglaonema nitidum* (Jack) Kunth, neotype of *Aglaonema oblongifolium* Schott and of *Aglaonema integrifolium* (Link) Schott: *Schott, Aroideae Nr. 59.*

Jack was sent by Jack from Penang to Wallich in Calcutta, but there is no record there of a dried specimen from Jack. Study of the material of the East India Company, which was distributed by Wallich, shows that there are two collections from Penang that, apart from mixed material, belong to what is now known as *Aglaonema nitidum* (Jack) Kunth. Neither was collected by Jack. *Porter, E. India Co. 4443* was labelled as *Pothos marginatus* Wallich (nomen nudum). According to the numerical list of the East India Company Museum, issued by Wallich (1828–1849), *No. 4443* was collected by "G. P." [George Porter], who travelled with Wallich to Penang in 1822 and stayed to start the Penang Botanic Garden; however, material at Brussels of *Porter, E. India Co. 4443* is a mixture of three species, *Aglaonema nitidum* (Jack) Kunth, *Anadendrum marginatum* Schott, and an aquatic plant that is not an aroid. According to Engler (1905, p. 47), "Wallich, 4443 – Herb. Kew u. a. [und andern]" is *Anadendrum marginatum* Schott. Porter's collection, distributed by Wallich as *E. India Co. 4443,* need not be further considered for neotypification of *Calla nitida* Jack since it is a mixed collection.

The only other specimen of *Aglaonema nitidum* (Jack) Kunth in the East India Company's herbarium from Penang is *No. 8965A.* According to Wallich (1828–1849), *No. 8965A* was collected in Penang in August 1822. The collector's name is not given and therefore it is presumed that it is Wallich's own collection. It is known that Wallich was in Penang in August 1822 (Steenis-Kruseman, 1950, p. 557).

This neotypification is the same as that inferentially used by previous workers. Schott (1860, p. 302) cited only one specimen under *Aglaonema nitidum:* "Pulo Penang. Wallich – v.v. et s. sp." Engler (1879, p. 438) cited "India orientalis; Pulo Penang (Jack, Wallich n. 8965) . . . ."

A neotype must be designated for *Arum integrifolium* Link. In describing this species from cultivation in the Berlin Botanic Garden, Link (1822) did not cite any type. There is no herbarium specimen that can be connected with the original description; however, there is every indication that Link's *Arum integrifolium* was *Aglaonema nitidum:* the description spoke of the leaves being attenuate at the base. I have seen two specimens and one watercolor painting made from plants cultivated in the Berlin Botanic Gardens, all of which have the epithet "*integrifolium*" appearing on them, and all of which are identifiable with *Aglaonema nitidum.* Previous monographers of the family, i.e., Schott (1860, p. 303) and Engler (1879, p. 438), have treated *Arum integrifolium* as a synonym of *Aglaonema nitidum.* It seems best to select the watercolor *Schott, Aroideae Nr. 59* (W) as neotype since the description fits it well and the specimen is annotated "*Ar. integrifolium* Hort. Berol." Selection of this neotype also settles a nomenclatural problem involving the type-species of the genus *Aglaonema,* as explained below.

Aglaonema oblongifolium Schott is the type-species of the genus *Aglaonema.* Beginning with Hooker's (1893, p. 529) unwarranted inclusion of *Calla oblongifolia* Roxburgh as a synonym of *Aglaonema oblongi-*

folium Schott, most botanists have, in effect, typified the Schottian binomial on the type of the Roxburghian binomial. This was easy to assume since the epithets were identical. Study of the original descriptions and reliquiae, however, clearly shows that each epithet has its own type, that each pertains to a different species, and that it was only by coincidence both authors chose the same descriptive epithet. The typification of *Calla oblongifolia* Roxburgh is discussed under *Aglaonema marantifolium* Blume and the typification of *Aglaonema oblongifolium* Schott follows.

In describing *Aglaonema oblongifolium* from material cultivated at Schoenbrunn Garden in Vienna, Schott did not cite any specimens; however, he did cite "*Arum integrifolium* Hort. Berol.," which may be an indirect reference to the earlier binomial *Arum integrifolium* Link (1822) or it may only be a reference to the label name and the source of the plant at Schoenbrunn.

Supposing *Aglaonema oblongifolium* Schott is not a superfluous name for *Arum integrifolium* Link, we must select a neotype. The entire Schottian herbarium, with the exception of one bundle, was destroyed after the World War II, but a collection of 3282 drawings and paintings of Araceae was saved. There are only four drawings pertinent to *Aglaonema nitidum,* and of these none is labelled *Aglaonema oblongifolium* Schott although one is labelled "*Ar. integrifolium* Hort. Berol." That one is *"Schott, Aroideae Nr. 59,"* which I designated above as the neotype for *Arum integrifolium* and now designate as the neotype of *Aglaonema oblongifolium* Schott also. The designation of the same neotype for these two binomials so links them that *Aglaonema oblongifolium* Schott must be regarded as a superfluous name. Actually, Schott seemed to regard his own epithet as superfluous since he almost immediately (1832, p. 20) published the correct combination, *Aglaonema integrifolium* (Link) Schott, and never again referred to his original publication.

Aglaonema princeps Kunth was described from material cultivated in Berlin labelled "*Caladium princeps* Hort. Berol." Schott (1860, p. 303) treated it as a synonym of *Aglaonema nitidum;* however, Engler (1879, p. 439) transferred it later to synonymy under *Aglaonema simplex.* The only material extant today is a drawing of the inflorescence with dissections, *Schott, Aroideae Nr. 70* (W). The pistillate flowers are scattered like those of *A. nitidum* rather than *A. simplex.* The description of a plant with an acute leaf base and a petiole that is sheathed almost to the apex clearly pertains to *A. nitidum* rather than *A. simplex.* I see no reason to accept Engler's treatment and am following Schott in placing *A. princeps* under *A. nitidum.*

Aglaonema oblanceolatum was based on *Lörzing 5352* (BO, L) and *Lörzing 5887* (BO), both from Sibolangit, Sumatra. I designate *Lörzing 5352* [Herbarium Bogoriense 100355] (BO) as lectotype, with *Lörzing 5352* [Herbarium Bogoriense 100356] (BO, L) as isolectotypes, leaving *Lörzing 5887* (BO) as a syntype. I can see no reason for this material to be regarded as distinct from *Aglaonema nitidum.* The author evidently had no idea of the identity of *Aglaonema nitidum* although he stated: "Probably very near *A. oblongifolium* Kunth [which was true, sensu Engler, not Kunth]."

Aglaonema oblanceolatum f. *maximum* was described from cultivated material at Bogor. Search of the Gardens Herbarium revealed the holotype, *van Alderwerelt van Rosenburgh 372* (BO), which had been collected from "XI. B. IX. 113." Study of the Garden Register showed that material designated as "XI. B. IX. 113" had originally been collected by Docters van Leeuwen from Sibolangit, Sumatra, in 1919, and that in October 1923, it had been transferred to "XI. B. IX. 166." Any subsequent collections from "XI. B. IX. 166" such as *Nicolson 994* may be regarded as clonotypes.

The inflorescence of *A. nitidum* var. *nitidum* can be identified by its many scattered pistils on a spadix equaling the spathe, which is long-decurrent. The leaves are also distinctive by their long, scarious petiolar sheaths, and blades more or less acute at the base with undifferentiated lateral venation. This is the only species that often has a white spathe in fruit and white berries.

10b. *Aglaonema nitidum* var. *nitidum* f. *curtisii*

Aglaonema nitidum var. *nitidum* f. *curtisii* (N. E. Brown) Nicolson, 1968, p. 126.

A. oblongifolium var. *curtisii* N. E. Brown, 1897, p. 70.

Leaf-variegation of ashy or silvery stripes along the courses of ten or more lateral veins or irregularly scattered.

TYPE COLLECTION.—England, Hort. Veitch, from Penang by Mr. Curtis, 22 November 1896 [*N. E. Brown?*] (holotype: K).

DISTRIBUTION.—Malaya and Lingga Archipelago.

USES.—Popular in conservatories for its variegated leaves.

This form differs from the typical form only in having variegated leaves. Occasional collections do not show the usual striped variegation known in cultivation but have rather irregularly blotched leaves.

In the original publication, N. E. Brown spoke of a plant at Kew that "had one leaf near the basal part of the stem variegated in exactly the same way as Messrs. Veitch & Son's plant, and all the other leaves on the plant were of the usual deep glossy green of the typical form." In the wild I have also observed variegation restricted to juvenile and seedling plants (*Nicolson 1146*). Perhaps the variegated form only represents perpetuation of this occasional characteristic of juvenile plants.

10c. *Aglaonema nitidum* var. *helferi* (Hooker f.) Nicolson, new status

Aglaonema helferi Hooker f., 1893, p. 529.

Petioles 11.5–12.5 [15, fide Hooker] cm long. Sheaths 5–9 cm long, 0.4–0.7 times as long as the petioles. Leaf-blades [15, fide Hooker] 21–25 cm long, 5.6–7.5 cm wide, length/width ratio of 1: 3.3–4.0. Peduncles 5–8 cm long. Spathe 3 cm long, decurent for 0.4–0.5 cm. Spadix 1.3–1.7 cm long; pistillate portion 0.2 cm long, pistils ca. 4–16; staminate portion 1.1–1.5 cm long.

TYPE COLLECTION.—Burma, Tenasserim [no date], *Helfer, E. India Co. 5994* (holotype: K).

DISTRIBUTION.—Southern Burma.

This variety approaches *A. cochinchinense* by its exceedingly short spathe; however, it is more similar to *A. nitidum* by its scarious petiolar sheath margins and acute to attenuate leaf-bases. Short spathes are known in *A. nithidum* (3.5 cm long in *Korthals s.n.* from Borneo). The number of specimens available is insufficient to make firm decisions, but what is available does not justify maintenance of *A. helferi* as a species. Further collections and study in southern Burma may shed light on its status.

11. *Aglaonema cochinchinense*

Aglaonema cochinchinense Engler, 1915, p. 16.
A. cambodianum Gagnepain, 1941, p. 116.

Stem erect, 1–1.5 cm thick. Internodes 0.4–1.0 cm long. Petioles (8) 10–18 (22) cm long, (0.4) 0.6–0.8 (0.9) times as long as the leaf-blade. Sheaths with membranous margins, (3) 5–10 (13) cm long, 0.3–0.7 times as long as the petiole. Leaf-blades ovate or lanceolate to elliptic to narrowly elliptic, (11) 15–25 (28) cm long, (4) 5.5–10 (12.5) cm wide, length/width ratio 1: 2.1–3.2; base obtuse to rounded, frequently unequal; apex obtuse to acute, sometimes apiculate; variegation none; venation undifferentiated; texture membranous. Peduncles 1–2 together, (6) 9–15 cm long, frequently exceeding the subtending petiole. Spathe green, 3–5 cm long, often apiculate, decurrent for (0.5) 1–1.5 (2) cm. Stipe 0.3–1.0 cm long (0.1 in *Kerr 20525*). Spadix cylindrical, 1.9–3.2 cm long, often exceeding the spathe at anthesis; pistillate portion 0.4–0.7 cm long, the pistils ca. 10, scattered; staminodia occasional; staminate portion white, tapering. 1.5–3.0 cm long, 0.4 cm thick. Fruits red, to 2 cm long and 1 cm thick.

TYPE COLLECTION.—Cochinchina, *Pierre s.n.* (holotype: B).

DISTRIBUTION.—Southern Thailand, Cambodia, and South Vietnam (Figure 4).

HABITAT.—Lowland rainforest, on limestone or calcareous soil.

FLOWERING TIME.—March–July.

Aglaonema cochinchinense appears to be most closely related to *A. nitidum,* both of which have undifferentiated venation and spadices that equal or exceed the spathe at anthesis. The principal differences from *A. nitidum* are: smaller size, shorter petiolar sheath, membranous petiolar sheath margins, lack of the thin, translucent margin of the leaf-blade, membranous leaf texture, and few (ca. 10) pistils. *Aglaonema nitidum* var. *helferi,* however, seems to be intermediate between *A. nitidum* and *A. cochinchinense.* It is possible that *A. cochinchinense* should be given subspecific rank under *A. nitidum,* but it seems well enough differentiated, even in upper peninsular Thailand, where the two species overlap, to justify its maintenance as a distinct species.

The type of *Aglaonema cambodianum* is: Cambodge, Pursat, 14 March 1914, *Chevalier 32011* (holotype: P). As illustrated by Gagnepain (1942, fig. 107), the spadix exceeds the spathe by almost half its length. Other specimens do not show this. In differentiating *A. cambodianum* from *A. cochinchinense* in his key to species, Gagnepain (1942, p. 1120) indicated that *A. cambodianum* has a rounded to obtuse leaf-base while *A. cochinchinense* has an attenuated leaf-base. This separation is not supported by material of the type-collection of *A. cochinchinense,* which I found to have rounded to obtuse leaf-bases with occasional, smaller leaves having an acute leaf-base. At any rate, three of the four specimens cited by Gagnepain as *A. cochinchinense* have rounded leaf-bases.

12. *Aglaonema tenuipes*

Aglaonema tenuipes Engler, 1902, p. 275.
A. siamense Engler, 1902, p. 275.
A. pierreanum Engler, 1915, p. 24, fig. 8.
A. subfalcatum Engler, 1915, p. 23.

Stem erect, 40–150 cm tall, 0.6–2.5 cm thick. Internodes 0.5–2.0 cm long. Petioles (5) 7–17 (22) cm long, 0.5–0.8 times as long as the leaf-blade. Sheaths membraneous, (2.5) 5–8 (15) cm long, (0.4) 0.5–0.7 (0.8) times as long as the petiole. Leaf-blades ovate or elliptic to lanceolate, frequently unequal or falcate, (6) 15–25 (35) cm long, (2.4) 5–13 (21) cm wide, length/width ratio 1:(1.7)2.3–3.2(6.7); base truncate to subacute, commonly rounded, sometimes unequal; apex usually gradually acuminate, sometimes acute or acuminate; variegation none; venation strongly (sometimes weakly) differentiated into 4–8 primary lateral veins diverging from the midrib at (30°) 40°–50° (60°); texture membranaceous to subcoriaceous. Peduncles 1–5 together, 2.5–8.0 (13) cm long, deflexing in fruit. Spathe green, 1.8–2.5 (4 in *Kerr 7010*) cm long, to 3 cm wide, often apiculate, decurrent for 0.3–1.0 cm. Stipe 0.2–1.0 cm long. Spadix short-cylindric to subclavate, often slightly exceeding the spathe, 1.4–2.5 cm long; pistillate portion 0.2–0.7 cm long, pistils 16–19 or more (only 3 in *Kerr 19940*); staminate portion white, sometimes separated from pistillate portion by small gap (as in *Kerr 3005*), 0.7–2.9 cm long, 0.3–0.8 cm thick. Fruits turning red, 1.5 cm long and 0.8 cm thick.

TYPE COLLECTION.—Thailand, Koh Chang, Klong Munsé, 8 February 1900, *Schmidt 451a* (holotype: C).

DISTRIBUTION.—Southern continental Southeast Asia from South Vietnam, Laos, and Cambodia to peninsular Thailand (Figure 6).

HABITAT.—In evergreen forest up to 1000 m in damp areas.

FLOWERING TIME.—February–April.

The type of *Aglaonema siamense* is: Thailand, Koh Chang, Skoven n. f. Lem Dan, 6 January 1900, *Schmidt 90* (holotype: C; isotype: B). Engler (1902, p. 275) erred in describing the leaves as 2.5 cm wide, implying a length/width ratio of 1:8–10. In the type collection the leaves are 8.5 cm wide with a length/width ratio of 1:2.7.

The types of *Aglaonema siamense* and *A. tenuipes* were taken from the same general locality (within three miles of each other). In the original publication both were cited as being from "jungle near Lem Dan." The differences in their reproductive structures are largely explicable in terms of their difference in developmental stages, *A. siamense* being in ripe fruit and *A. tenuipes* being in bud. Vegetatively they differ principally in: (1) leaf shape (*A. siamense* having leaves with a length/width ratio of 1:2.5–2.9, and a truncate base; *A. tenuipes* having leaves with a length/width ratio 1:3.0–3.4, and an obtuse leaf base); and (2) petiolar sheath length (*A. siamense* having the sheath 8 to 10 cm long [about 0.7 the petiole length] and *A. tenuipes* having the sheath 3 to 4 cm long [about 0.4 the petiole length]). Neither difference is significant. Leaf shape appears to be variable in the pertinent plants of *Aglaonema* from Koh Chang. Flowering material (*Kerr 6799*) from Klong Mayon on Koh Chang (about one mile from Klong Munsé) includes duplicates that vary in their length/width ratio from 1:2.4–4.0. Length of petiolar sheath also seems to be rather variable. *Nicolson 1616* has (from type-locality) petiolar sheaths 6–7 cm long, almost halfway between those described for *A. siamense* and *A. tenuipes*.

Gagnepain (1942) described the spathe of *A. siamense* as 3.5–4.5 cm long. Study of specimens cited shows that this excessively long spathe is based on *Kerr 20899* from Laos, which I identify as *A. ovatum*.

I see no reason to maintain *A. siamense* and *A. tenuipes* as sympatric species. Both epithets have equal priority. No one previously has united them. I am adopting the name *A. tenuipes* since it is based on flowering material more easily identifiable with other specimens than the fruiting specimens typifying *A. siamense*.

The types of *A. pierreanum* are: Cochinchina, 500 m, June 1877, *Pierre s.n.* (lectotype: P); Bienhoa, March 1877, *Harmand, Herb. Pierre 1936* (syntype: B). The many Pierre specimens of *A. tenuipes* are mostly incompletely labelled and many have been determined by Engler as *A. pierreanum*. In choosing a lectotype, one can consider only material actually cited in the description, restricting the choice to the two cited above. I have chosen the first specimen as lectotype since it has flowering material that is necessary to recognize *A. tenuipes* definitely. One reason for not selecting the second specimen is that the description depicted the leaves as being 6–8 cm wide whereas the leaves on the second specimen are only 4.5 cm wide. Engler (1915) regarded *A. pierreanum* as distinct from *A. tenuipes*. He placed *A. pierreanum* in his key as having the primary veins more or less incised above and highly prominent below, while he placed *A.*

tenuipes among the species with primary veins slightly stronger than the secondary veins. Reliance on venation alone and without further supporting characters is not justified since individual specimens show much variation. *Aglaonema tenuipes* generally has rather strongly differentiated venation but occasionally this is not the case. I believe this to be more environmentally than genetically determined.

The type of *A. subfalcatum* is: France, Paris, Jardin des Plantes, without collector *s.n.* (holotype: B). This species, represented only by the type collection taken from cultivated material probably originating from South Vietnam (fide Engler, 1915), was placed next to *A. pierreanum* Engler. The difference between these two species, published simultaneously, was that *A. pierreanum* was supposed to have a cordate leaf base and *A. subfalcatum* an acute or rounded one. This distinction does not exist on the types. In the description of *A. pierreanum,* Engler was much more accurate when he described the leaf base as "emarginata vel subcordata." In the published illustration of *A. pierreanum* the leaf bases are only rounded, definitely not cordate.

Gagnepain (1942) separated *A. pierreanum* from *A. subfalcatum, A. siamense,* and *A. tenuipes* on the erroneous assumption that the spadix did not surpass the spathe in *A. siamense, A. subfalcatum,* and *A. tenuipes.* This distinction is not borne out by the types of *A. subfalcatum* and *A. siamense,* in which the spadix clearly surpasses the spathe although it appears to be true in the type of *A. tenuipes.* The fact, however, that the spathe is closed and that the peduncle is so short indicates that the type of *A. tenuipes* is in bud and that the stipe and spadix may not have fully elongated.

Gagnepain (1942) regarded *A. tenuipes* as most closely related to *A. subfalcatum* since both had more or less acute leaf bases, the main difference being that *A. subfalcatum* had an oblique leaf base and *A. tenuipes* did not. It seems to me that the vegetative dissimilarities emphasized by Engler and Gagnepain are outweighed by the reproductive similarities. Therefore, I reduce all three binomials to *A. tenuipes.*

The following variations are of note since they represent extremes of morphological variation within *A. tenuipes.* I have not accorded them formal taxonomic recognition since intermediates were frequent and widely scattered. *Nicolson 1625* and *1638* have some of the broadest leaves observed in the species, 15–20 cm wide with length/width ratios less than 1:2. *Evrard 478* has the narrowest leaves observed in the species, to 2.6 cm wide with length/width ratio up to 1:6.7. A number of plants seem to be rather smaller than usual for the species: *Kerr 10765, Put 1444, Kiah, SFN 35244, Put 1615, Rock 499, Pierre s.n.* (24 February 1877), and *Put s.n.* (20 June 1926.) One specimen (*Kerr 19440*) seems quite anomalous in that it has only three pistils in the one inflorescence I studied.

Aglaonema tenuipes obviously is closely related to *A. simplex* but may intergrade with *A. ovatum.* At times the stipe seems very short (approaching that of *A. ovatum*). There is a possibility that *A. tenuipes* is only a geographical subspecies of *A. simplex.* These species are separable only when the spathe is present. Fruiting material has been identified from geographical evidence; for instance, all flowering material from Koh Chang has the short spathe and blunt spadix of *A. tenuipes;* the type of *A. siamense* is from Koh Chang but is in fruit, and so I have made the assumption that *A. siamense* has the *A. tenuipes* type of inflorescence. Because of the doubt surrounding each fruiting specimen, I cannot be certain what actually are the ranges of *A. simplex* and *A. tenuipes.* I therefore hesitate to make further taxonomic reductions.

13. *Aglaonema simplex*

Aglaonema simplex Blume, 1837, p. 152, pls. 36D, 65.
Caladium simplex Reinwardt ex Blume, 1823, p. 103 [nomen nudum].
Aglaonema schottianum Miquel, 1856 (Aug. 15), p. 565; 1856 (Dec. 25), p. 216.
A. malaccense Schott, 1859, p. 30.
A. longicuspidatum Schott, 1860, p. 304.
A. propinquum Schott, 1864, p. 280.
A. birmanicum Hooker f., 1893, p. 529.
A. nicobaricum Hooker f., 1893, p. 530.
A. angustifolium N. E. Brown, 1895, p. 18.
A. angustifolium var. *undulatum* Ridley, 1907, p. 21.—Furtado, 1937, p. 243.
A. borneense Engler, 1915, p. 22.
A. schottianum var. *genuinum* Engler, 1915, p. 20.
A. schottianum var. *genuinum* f. *angustifolium* (N. E. Brown) Engler, 1915, p. 20.
A. schottianum var. *brownii* Engler, 1915, p. 21.
A. schottianum var. *malaccense* (Schott) Engler, 1915, p. 21.
A. schottianum var. *winkleri* Engler, 1915, p. 21, fig. 7.
A. brevivaginatum van Alderwerelt van Rosenburgh, 1922, p. 324.
A. elongatum van Alderwerelt van Rosenburgh, 1922, p. 326.
A. emarginatum van Alderwerelt van Rosenburgh, 1922, p. 324.
A. grande van Alderwerelt van Rosenburgh, 1922, p. 325.
A. latius van Alderwerelt van Rosenburgh, 1922, p. 325.
A. nieuwenhuisii Engler ex van Alderwerelt van Rosenburgh, 1922, p. 320.

A. simplex f. *inaequale* van Alderwerelt van Rosenburgh, 1922, p. 323.

A. simplex f. *typicum* van Alderwerelt van Rosenburgh, 1922, p. 323.

A. subarborescens van Alderwerelt van Rosenburgh, 1922, p. 326.

In the following description some exceptional measurements have been included in brackets which were given by van Alderwerelt van Rosenburgh in his description of *A. subarborescens*.

Stem erect, 15–120 [300] cm tall, 0.4–1.7 (2.5) cm thick, thickest near the base. Internodes usually less than stem diameter, 0.3–2.5 cm long, longest near base of stem. Petioles (4.3) 5–12 (21.5) [27.5] cm long, (0.2) 0.3–0.5 (0.9) times as long as the leaf-blade. Sheaths usually with a membranous but sometimes slightly scarious margin, (1) 3–10 (22) cm long, (0.25) 0.5–0.8 (1) times as long as the petiole. Leaf-blades narrowly oblong, narrowly elliptic to lanceolate, occasionally linear, elliptic or ovate, (10) 13–25 (35) cm long, (1.9) 4–10 (25) cm wide, length/width ratio 1:(1.5)2.8–5.0(10); base often unequal or oblique, obtuse, rounded or subtruncate, rarely acute or subcordate; apex often apiculate, acuminate, sometimes abruptly or gradually acuminate; variegation none; venation strongly differentiated into (3) 5–10 (14) primary lateral veins diverging from the midrib at (15°) 30°–50° (60°), rarely weakly differentiated; texture coriaceous. Peduncles (1) 2–4 (6), (1.5) 4–9 (12) [17.5] cm long. Spathe often apiculate, (2.3) 3–5 (6.5) cm long. decurrent (0.3) 0.4–1.0 (1.5) cm long. Stipe (0.2) 0.4–0.8 (1.2) cm long. Spadix equaling or slightly exceeding spathe, (1.7) 2–4 (4.3) cm long; pistillate portion 0.3–1.0 cm long, pistils (12) 18–30 (38); staminate portion (1.5) 2.0–3.1 (3.8) cm long, 0.5 cm thick. Fruits turning red, 1–1.7 cm long, 0.5–0.8 cm wide.

TYPE COLLECTIONS.—Java, voet Pulusarie, [*Kuhl and van Hasselt*] *12* (lectotype: L); Java, Gedogang, nähe van Kapang dungar, *Kuhl and van Hasselt s.n.* (syntype: L). Out of all the specimens in various herbaria, principally Leiden, that might be considered as type material, these are the only specimens with original labels that definitely associate them with Blume's citations and discussions. I have selected the specimen from Mt. Pulusarie as lectotype since it shows a long-stipitate spadix. Shortness of the stipe was used by Miquel to segregate *A. schottianum* from *A. simplex*.

DISTRIBUTION.—Southern Burma to the western Moluccas (Figure 2).

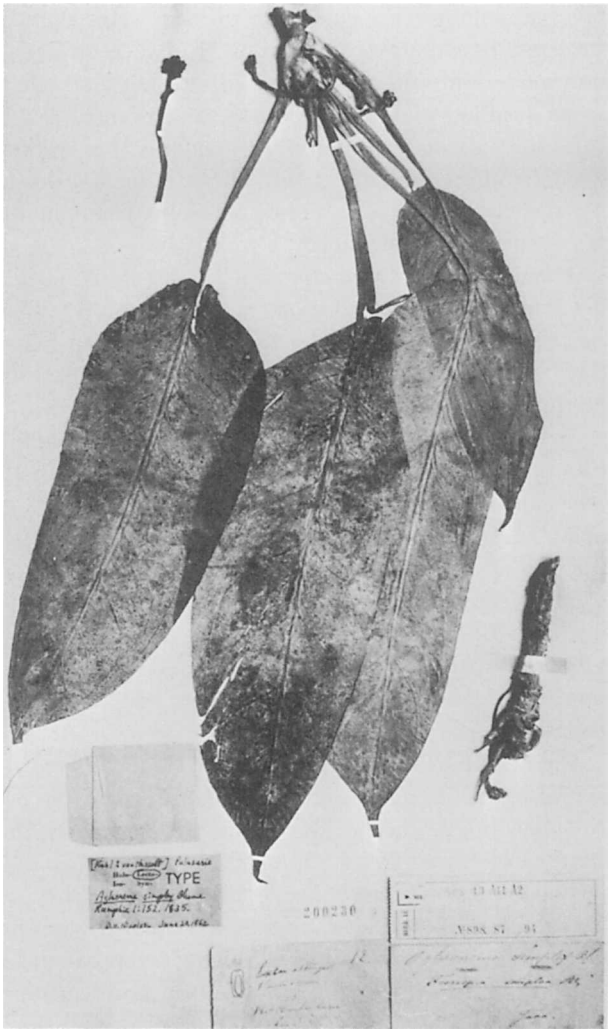

FIGURE 14.—Lectotype of *Aglaonema simplex* Blume: *Kuhl and van Hasselt 12* (L).

HABITAT.—In primary or secondary forests in ravines or damp places. It rarely occurs over 1500 m but has been reported at "7000 feet" (over 2000 m) on Mt. Kinabalu (*Clemens 40985*).

FLOWERING TIME.—Essentially nonseasonal.

LOCAL NAMES.—Only one name has been recorded more than twice, "Lempoei" on three different plants cultivated at Bogor and its probable variant, "Lempoeng." Although the language involved is Sundanese, "lempung" or "lempong" means "light or soft wood" in Indonesian and Malayan and may be more of an adjective than a name.

The existence of a specimen of *Aglaonema simplex* in the Linnaean herbarium, identified by Linnaeus

(presumably) as *Arum ovatum,* opened the question of whether it typified the Linnaean binomial. Linnaeus (1753, p. 967) defined *Arum ovatum,* "*Arum acaule,* foliis ovato-oblongis," and cited "Karinpola. *Rheed. mal.* 11. p. 45. *t.* 23. Habitat *in* India." Rheede's (1692) plate of "Karinpola" is clearly *Lagenandra ovata* (L.) Thwaites. The specimen of *Aglaonema* in the Linnaean herbarium is devoid of any information except for being noted as "ovatum." In view of this it seems clear that Linnaeus placed primary, if not total, emphasis on the information in Rheede. This contention is supported by the fact that the specimen of *Aglaonema,* although broken off near the leaves, is clearly caulescent and thus does not fit the critical phrase name of Linnaeus. Therefore, the Linnaean specimen of *Aglaonema,* referred to *Arum ovatum* by Linnaeus, should not be considered to typify the Linnaean binomial.

Aglaonema simplex Blume is the most variable species in the genus. On the fringes of its distribution it tends to intergrade, to some extent, with other species. These complexities have led taxonomists to segregate many taxa within the complex and thereby obscure the relatively distinctive characteristics of *Aglaonema simplex,* sensu lato: strong venation, short petiole (rarely over 12 cm, i.e., one-half as long as the blade), short peduncles (rarely over 9 cm), usually more than 20 pistils, stipitate spadix, and spadix equaling the spathe.

Within the species it is tempting to segregate the specimens into three groups: (1) narrow-leaved, (2) broad-leaved, and (3) intermediate. The narrow-leaved plants might be defined as having the leaf-blade 7–11 times longer than broad and 1.3–4 cm wide. Roughly speaking, the following taxa would fit this category: *A. angustifolium, A. angustifolium* var. *undulatum, A. schottianum* var. *brownii,* and their isonyms. The broad-leaved plants might be described as having the blade 1.4–2.5 times longer than broad and 8–25 cm wide and would certainly include *A. nicobaricum, A. borneense, A. emarginatum, A. grande, A. latius,* and probably also *A. nieuwenhuisii* and *A. subarborescens.* The intermediate plants have the leaf-blade 2.6–6.9 times longer than broad and (4) 5–9 (11) cm wide and include *A. simplex, A. schottianum, A. propinquum, A. malaccense,* and probably *A. schottianum* var. *winkleri, A. elongatum,* and *A. brevivaginatum* (the latter three might be placed among the narrow-leaved plants if the definitions were changed slightly). Simultaneous comparison of the types of these taxa with the specimens cited herein indicates that these taxa are parts of a spectrum, not district entities. I have tried grouping the specimens along the lines suggested above and also by geographical areas, and have found no evidence of a correlation of geographical areas with the morphological groups. Therefore, I have not recognized any of these taxa, even at the form level.

Among the previously proposed taxa, two, though intergrading into the more usual forms through specimens from the same or other areas, do represent extremes. One is *A. nieuwenhuisii* from central Kalimantan, which represents *A. simplex* in its smallest aspect (leaf-blades only 12 cm long). The other is *A. subarborescens* from central Sumatra, which represents *A. simplex* in its largest aspect (leaves up to 35 cm long and 24 cm across). Other collections from the same areas indicate that these specimens represent only extreme individuals.

There are two areas where *A. simplex* appears to hybridize or intergrade with other species: Burma and Thailand, where it reaches the northwestern limit of its range, and the Philippines and Celebes, where it reaches the eastern limit of its range.

In Burma and western Thailand the occurrence of subsessile spadices (for example, on the single stem of *Kostermans 359* there is both flowering material with a clear stipe and fruiting material that shows no evidence of a stipe although the stipe is normally longest in fruiting material) and the vegetative variability of *A. simplex* make it difficult to be certain about determinations. It seems quite possible that the northernmost species with sessile spadices, *A. hookerianum, A. ovatum,* and *A. modestum,* as a group, are most closely related to *A. simplex* and/or *A. tenuipes.*

In the Philippines and Celebes it is quite possible that *A. simplex,* along with *A. nitidum* and *A. marantifolium,* contributed or contributes to the variability found there. I have no other explanation for why the distinctive characteristic-combinations defining these three species, while remaining valid elsewhere, seem to break down in the Philippines and Celebes. Unlike the other two species, *A. simplex* does occur in the Philippines (*A. nitidum* does reach Balabac Island, but it is only 60 miles from the Bornean coast).

The type of *A. schottianum* Miquel is: Java, Blambangan, *Horsfield s.n.* (holotype: K; isotype:

BM). The holotype, annotated by Miquel, does not bear the original field labels but only information written in what I presume to be Miquel's hand. The isotype bears only field labels in Horsfield's hand. There is another Horsfield specimen at Kew that may be type material; however, Horsfield labelled it as *"Arum"* while he labelled the isotype as *"Pothos."*

In the original description of *Aglaonema schottianum,* Miquel stated that it was close to *A. simplex.* Miquel's (1856) descriptions of *A. simplex* and *A. schottianum* are not mutually exclusive. The only real distinction that Miquel seemed to make was that the stipe was short "circiter 1½ lin." in *A. schottianum* but was "longuisculus" in *A. simplex.* Miquel had a keen eye to segregate a new species on the basis of a stipe 0.32 cm long instead of 0.4 cm or more as described and illustrated by Blume for *A. simplex.*

A review of the history of *A. schottianum* is necessary since its diagnostic characters changed as different authors sought other characters with which to separate this species from *A. simplex.* Schott (1860) says that he had not only seen dried material but also living material although he did not have colored plates prepared of the living material as he usually did. Schott first added a description of the spathe (note: Miquel's types are in fruit and lack spathe material), apparently basing it on Spanoghe material, which, although it is not cited by Schott, is in Schott's herbarium as a tracing annotated as *A. schottianum.* Schott noted that the spadix was about 1.5 inches ("subsesquipollicaris") long and slightly shorter than the spathe. At the same time, he noted that the spadix of *A. simplex* was finally almost longer than the spathe ("tandem fere spatha longior"). At this point it must be noted that the spathe/spadix ratio in *A. simplex* is virtually 1:1. In bud the spadix is shorter than the spathe, or in flower the spadix may equal or occasionally exceed the spathe but never by a significant margin. Indeed, I suspect that distortions introduced by pressing may affect whether or not the spadix is longer than or slightly shorter than the spathe when the original material actually indicated that the spadix equalled the spathe.

Engler (1879), apparently wishing to follow Schott in maintaining *A. schottianum,* introduced some errors. The most serious error was reversing the one character that Miquel had used in segregating *A. schottianum* from *A. simplex.* According to Engler, *A. simplex* has a short stipe ("breviter stipitati") while *A. schottianum* has a long stipe ("longe stipitati"). Another error introduced by Engler was that he described the spadix as 1.5 cm long. Apparently he meant 4 cm but forgot to change inches to centimeters in translating from Schott's "subsesquipollicaris." Curiously, Engler (1879) included two of the same specimens under both *A. simplex* and *A. schottianum,* including a syntype of *A. simplex.* The syntype of *A. simplex* is cited under *A. simplex* as "Kapandangan" and under *A. schottianum* as "Kapangdungor." The other specimen is *Zollinger 695B,* which was correctly cited under *A. schottianum* but incompletely cited under *A. simplex* as *"Zollinger 695."* Up to that time, no one had found anything significantly different between *A. schottianum* and *A. simplex.*

In a later publication, Engler (1915) maintained his earlier findings but introduced a series of new collections. New Malayan specimens were cited under *A. schottianum* although the type of this species was from the farthest eastern tip of Java and new Javanese specimens were cited under *A. simplex.* Ridley (1925), following these identifications, did not question whether or not *A. simplex* occurred in Malaya but simply accepted the name *A. schottianum.* Gagnepain (1942) included both species in Indochina, placing them together as not having the spadix surpassing the spathe and differing only in their leaf bases. Bakhuizen van den Brink (1957) was the first to identify *A. schottianum* with *A. simplex* in his treatment of Araceae of Java. I entirely concur with this disposition.

The type of *A. malaccense* is: [Malaya, Malacca] Pulo Bissar [Pulau Besar], *Griffith, E. India Co. 5985* (lectotype: K). Although Schott originally (1859) cited only "Malacca, Griffith," without citing a number or otherwise clearly designating a holotype, he did a year later (1860, p. 302) add the notation "*v. s. in Herb. Hook.*" There are two Griffith specimens from Malacca at Kew, one of which fits Schott's description better than the other. This I have selected as lectotype because Schott described the leaf-base as obtuse to very obtuse; the leaf-bases on *Griffith, E. India Co. 5984* (K) are subcordate and highly unequal. Also, Schott (1860) described the leaf-blade as 2.5–3 inches wide; *Griffith, E. India Co. 5984* has leaves fully 4 inches wide.

A specimen at Kew (*McClelland s.n.,* Burma, Phangrun Valley, Pegu ad Rangoon, 10 February) has been annotated by N. E. Brown as follows: "This is probably the type [of *A. malaccense*] rather than Griffith's speci-

mens, as the spathe and berries are undescribed." Since Schott, in his original (1859) and a subsequent (1860) description, cited only Griffith's material from Malacca, however, I have typified his *A. malaccense* on the Griffith material. The Schott descriptions support this typification since Schott (1859) described the leaf apices as acuminate to cuspidate, whereas they are merely tapered in McClelland's material, and in 1860 he described the petiole as 3.5–4 inches long, whereas one of the most conspicuous petioles on the McCelland specimen is fully 5.5 inches long.

The type of *Aglaonema longicuspidatum* is: Indonesia, Borneo, Bangarmassing, 1857–8, *Motley 876* (holotype: K). Study of Schott's descriptions indicates that the most distinctive features of the type are the long-cuspidate apex and the undulate margin of some of the leaves. Actually, the leaf apices are gradually long-acuminate, something which is frequently found, especially in the narrower-leaved *A. simplex*. The undulate margin appears to be nothing but an artifact of pressing, particularly since only two of the four leaves on the type show this characteristic. Engler (1879, p. 440) reduced *A. longicuspidatum* to synonymy of *A. simplex*.

The type of *Aglaonema propinquum* is: Indonesia, Borneo, *Korthals s.n.* (lectotype: L–898, 87–85). There are three duplicates in the Leiden herbarium, all annotated by Schott as *A. propinquum*. The lectotype was designed on the basis that it is represented by a tracing in the Schottian herbarium (*Schott, Aroideae 79*). Schott (1864) noted that this material was close to *A. malaccense* and *A. longicuspidatum,* both of which are synonyms of *A. simplex*. Engler (1879, p. 440) made *A. propinquum* a synonym of *A. schottianum,* which in turn I consider synonymous with *A. simplex*.

Aglaonema fallax Schott ex Engler (1879, p. 439) was published only as a synonym of *A. simplex*. Color drawings in Schott's herbarium (*Schott, Aroideae 43* and *44*), presumably prepared from cultivated material, indicate that its placement here is entirely correct.

The type of *Aglaonema birmanicum* is: Birma [sic], toward Nempean, low woods, *Griffith, E. India Co. 5981* (holotype: K). This locality is unknown to me although Hooker (1893) cites it as from "Upper Burma." The type and associated collections from Burma and western Thailand frequently have very short to obscure stipes. This occasionally happens throughout the range of *A. simplex* (*Scheepmaker s.n.* from Java has a stipe 0.2–0.5 cm long; *Rahmat si Toroes 4609* from Sumatra has stipes 0.3–0.6 cm long; several specimens from Borneo and Celebes have stipes 0.3 cm long). The fact, however, that all the Burmese specimens have short stipes (except *Helfer 5992* from Tenasserim and *McClelland s.n.* from Pegu, both of which have stipes 0.4 cm long) suggests that *A. birmanicum* is not a distinct species but some sort of integradation between *A. simplex* and a species with sessile spadices, possibly *A. ovatum*. The short peduncles preclude its being identified with *A. hookerianum*.

The type of *Aglaonema nicobaricum* is: India, Nicobars, 23 November 1884, *King's Collector 537* (lectotype: K; isolectotype: BM, CAL). *King's Collector 537* is selected as lectotype since the description of the spathe was obviously made from it and another collection for the Nicobars, *Kurz s.n.* (February 1875), lacks the spathe. In fruiting material the spathe is decurrent for 0.5 cm and the stipe is 0.7 cm long. Other specimens with leaves 1.5–2.5 times longer than broad are scattered throughout the range of *A. simplex*: Burma–*Meebold 15467;* Thailand–*Kostermans 359;* Sumatra–*Henderson SFN 20122, Bünnemeijer 4311, Meijer 5645;* Borneo–*Brooke 10700, Nicolson 1306;* Celebes–*Elbert 3169*. I have been unable to find any other distinguishing morphological characters that correlate with the broad leaves, and it is clearly impossible to draw an arbitrary line based solely on leaf width because the specimens, in toto, simply form a spectrum of leaf widths from 1.5–11 times longer than broad. Therefore, I am not even accepting any subspecific taxa based solely on leaf width. If later workers wish to do so, *A. nicobaricum* is the oldest specific epithet applicable to the broad-leaved specimens of the *Aglaonema simplex* complex.

The type of *Aglaonema angustifolium* N. E. Brown is: Great Britain, Kew Gardens, "Aroid from Pankore. Received from Mr. Curtis in 1893," 23 November 1894 [*N. E. Brown?*] (lectotype: K). The lectotype has some of the narrowest leaves in *Aglaonema simplex,* ten times longer than broad; however, the distinctiveness of this character begins to fade when one finds that the leaves of the syntype are only seven times longer than broad. Later collections from the type-locality (*Burkill 186* and *187,* from South Pangkore Forest Reserve) show even more variation in adjacent plants. *Burkill 187* can be indentified with the lectotype as the leaves are over eight times longer than

broad. *Burkill 186* has leaves only 4.3–4.6 longer than broad and is noted: "Seems to be an age form of specimen *HMB 187*. Both plants were growing adjacent." It is probable that Burkill, aware that he was in a variable population, collected extremes to demonstrate the range of variability. I strongly suspect he could also have collected intermediates. Intermediates certainly are known as Engler (1915, p. 20) pointed out when he reduced *Aglaonema angustifolium* to the rank of a forma. *Curtis 3820* (SING) from Wellesley has narrow leaves at the base up to 9.5 times longer than broad and upper leaves only 4.1 times longer than broad, clear evidence that the width of the leaves can be variable on the same plant. Equally narrow-leaved specimens have been collected in Borneo: (1) *Amjah 90,* (2) material in cultivation from Borneo named *A. elongatum* Alderwerelt, (3) material called *A. schottianum* var. *winkleri* Engler. There is no reason to believe that intergradations do not also occur here. Despite the striking aspect of individual narrow-leaved specimens, we seem to be dealing with something that is transient or a spectrum, not with a distinct taxon. Therefore, I am following Bakhuizen van den Brink (1957, p. 35) in completely synonymizing *A. angustifolium* with *A. simplex.*

Aglaonema simplex f. *macrophyllum* (Engler, 1898, p. 21), although a nomen nudum, can be associated with a preserved specimen (*Koorders 16179* [BO] from Tatokok, Celebes) and thus assigned to synonymy with *A. simplex.* When Engler first used the name (without description), he cited five specimens, *Koorders 16126, 16129, 16155,* and *16179* from Minhassa, Celebes, and *Warburg 14984* from Jolo, Philippines. The last-mentioned specimen, presumably formerly at Berlin, is no longer extant. Alderwerelt van Rosenburgh (1922, p. 323) undertook a discussion of some of the specimens of *A. simplex* f. *macrophyllum* at Bogor and stated that the petioles were 17.5–25 cm long. This at first appears to be a validating description for Engler's name, but van Alderwerelt van Rosenburgh went on to indicate that the material from which these measurements were taken actually belonged to another species, *A. oblongifolium* [*A. philippinense* herein]. He cited only *Koorders 16126, 16129,* and *16155* and stated that at Bogor there was no material of *Koorders 16129.* The other two specimens agreed "in [his] opinion more with *A. oblongifolium* than with *A. simplex.*" Since the one other specimen cited by Engler that was available to van Alderwerelt van Rosenburgh at Bogor, *Koorders 16179,* was not mentioned and (by my own measurements) has petioles only 9–13 cm long, it is apparent that he was not discussing or describing the taxon, but only the specimens that he was excluding. Association with *Koorders 16179* holds this name to the species in which it used by Engler and discussed by van Alderwerelt van Rosenburgh.

Although Ridley accepted the taxon *Aglaonema angustifolium* N. E. Brown in his works on the flora of the Malay peninsula (1907, 1925), he felt it necessary to distinguish the typical element described by Brown as *A. angustifolium* var. *undulatum.* His reasoning was that "the type-plant described by Brown was the very local form var. *undulatum.* The leaves of young plants of typical [i.e., common] *A. angustifolium* are almost black." This action resulted in his application of the name *A. angustifolium* to a taxon considered different from that represented by the type on which it was based and in the renaming of the typical element. This is, of course, inadmissible. *Aglaonema angustifolium* var. *undulatum* Ridley is a synonym both nomenclaturally and taxonomically of *A. angustifolium* N. E. Brown. The undulate margins occur in *A. simplex* in other localities.

The holotype of *Aglaonema borneense* is: Hort. Buitenzorg, January–February 1906, *Engler, Reise nach Java und Brit. Indien 4089* (B). According to Engler (1915), this material came from Borneo. The specimen has two detached leaves, one 7 cm wide and one 12 cm wide. The smaller leaf appears to be very thin and probably is immature. Since the larger leaf agrees very closely in all respects with *Nicolson 1306* and *Brooke 10700* from Sarawak, there is no reason to doubt the Bornean origin. The only deterrent in recognizing this as a broad-leaved specimen of *A. simplex* is that the spadix appears to be fully 1.5 cm short of the spathe apex. The spadix, however, has been sliced longitudinally and, since the cut was diagonal, it appears that a substantial portion was taken from the apex of the spadix. Engler indicated that his taxon was most closely related to *A. siamense* [*A. tenuipes* herein], but this is not supported by the spathe length in the two taxa (less than 2.5 cm in *A. tenuipes,* 5 cm in *A. borneense*). The species appears to be no more than another broad-leaved *A. simplex,* similar to that which was earlier described as *A. nicobaricum.*

Aglaonema schottianum var. *genuinum* f. *angustifolium* (N. E. Brown) Engler is a change in rank of *A. angustifolium* N. E. Brown. Engler cites only the

syntype, *Scortechini s.n.* There is no significant morphological difference between the types of *A. schottianum* var. *genuinum* f. *angustifolium* and *A. schottianum* var. *brownii* Engler (their types are even almost topotypes). Furtado (1937, p. 243) discussed this involved nomenclatural problem.

The type of *Aglaonema schottianum* var. *brownii* is: Perak, Dindings, Lumut, April 1898, *Ridley 9508* (lectotype: SING; isolectotypes: CAL, K); Perak, Dindings, Lumut, February 1899, *Ridley 10144* (syntypes: CAL, SING). Engler actually cited Prain as a parenthetical author (Engler's types are determined [in Ridley's hand] as *Aglaonema brownii* Prain). Prain was interested in Araceae and published several new species of *Typhonium* but never published anything on *Aglaonema*. Examination of the lectotype and syntype collections of *A. schottianum* var. *brownii* reveal them to be scarcely distinguishable from the type of N. E. Brown's *A. angustifolium*. The leaves are light green, extremely narrow, and the margins are crispulate.

Aglaonema schottianum var. *malaccense* is a change in rank of *A. malaccense* Schott. Engler does not cite Schott's types but his description of the leaves as being only three times longer than broad fits the types.

The type of *Aglaonema schottianum* var. *winkleri* is: Sudost-Borneo, zwischen M. Uja and Kundimbaru, July 1908, *Winkler 2727* (TBG or HBG). Unfortunately, I have not seen the type, but there is no reason to think that it does not exist. I have interpreted it on the basis of the illustration published by Engler (1915). As described and illustrated by Engler, this specimen with narrowly oblong leaves looks very much like *A. propinquum* Schott, which Engler places as a synonym of *A. schottianum*. The leaves, however, are slightly narrower, 4.5–5 cm wide instead of 5–7 cm wide. I see no reason to maintain this variety, especially when it seems possible that narrow leaves can be transient (see discussion under *A. angustifolium*).

The type of *Aglaonema brevivaginatum* is: Lingga Archipel, P. Lingga, Kp. Panggak, 60 m, 27 July 1919, *Bünnemeijer 7044* (holotype: BO–100314; isotypes: BO–100315, L–922,297–1858). This material appears to be no more than a rather small *Aglaonema simplex*. As the specific epithet implies, the petiolar sheath is very short, "½–1 (raro 1½–2) cm longa." On one isotype (L) I found a sheath 2.5 cm long, almost half the petiole length. Although short sheaths are not common in *A. simplex*, the sheath length is exceedingly variable, even on the same specimen, and it is impossible to segregate taxa on this characteristic alone. The following specimens also have sheaths less than 2 cm long: *Jelinek 32* from Nicobar and *Nicolson 1115* from Singapore.

The holotype of *Aglaonema elongatum* is: Cult. in Hort. Bog. as IX. 61 (Borneo) [March 1921 – fide description], *van Alderwerelt van Rosenburgh 355* (BO). In the original description it was reported that the plant had been collected on Mt. Tenampak in eastern Borneo by Amjah, a collector on Capt. van Genderen Stort's North Borneo Boundary Commission. The living plant is no longer at Bogor. The description reported the leaves five to seven times longer than broad and that the plant was nearest to *Aglaonema schottianum*, but unfortunately, nothing was mentioned about what made it different from *A. schottianum*. The leaves seem to be dark green, narrow, smooth margined, and gradually long-acuminate or tapered like the material that Ridley (1907, 1925) regarded as the most "typical" [i.e., common] form of *Aglaonema angustifolium*. As pointed out in the discussion of that synonym, however, the narrowness of leaves does not furnish enough evidence to warrant recognition of taxa.

The holotype of *Aglaonema emarginatum* is: Eiland Sebesi, 100 m, 29 April 1921, *Docters van Leeuwen 5412* (BO). The author gives no clue as to what species this specimen might be related nor how it is differentiated from other species. The leaves are "16–23 x 8–11 cm.," and thus clearly identical in size with those of *Aglaonema nicobaricum*.

The holotype of *Aglaonema grande* is: Cult. in Hort. Bot. Bog. XI. B. IX. 62, [March 1921 – fide description] *van Alderwerelt van Rosenburgh 361* (BO). According to the description, the living plant was collected in Borneo as *Nieuwenhuis 863*. I have not seen a specimen with this number collected by Nieuwenhuis or by any of the collectors who accompanied him: Amdjah, Hallier, Jaheri, Molengraff, or Sekarang. The author gives no clue, except the specific epithet, as to what distinguishes this taxon or its relatives. The type appears to be nothing but another broad-leaved *Aglaonema simplex*, this time with leaves "25–35 x 11.5–15 cm." It is larger, to be sure, than the large-leaved plants described as *Aglaonema nicobaricum* and *A. emarginatum* but that is hardly sufficient reason to maintain it, even at a subspecific level.

The type of *Aglaonema latius* is: Eil. Simaloer, 29 March 1919, *Achmad 1009* (lectotype: BO–100331;

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isolectotypes: BO–100332, L–992, 297–539); Eil. Simaloer, 12 June 1918, *Achmad 487* (syntypes: BO, L, U). I have designated *Achmad 1009* as lectotype since it has the widest leaves. Judging by the epithet, the author was emphasizing leaf width; in his description he states that the leaves are 10.5 cm wide. The leaves on *Achmad 487* are less than 10 cm wide but they are occasionally 10.5 cm wide on *Achmad 1009*. The author gives no clue as to related species. It seems clear, however, that the specimens represent another broad-leaved *Aglaonema simplex,* this time a bit smaller than the material described as *Aglaonema nicobaricum, A. emarginatum,* and *A. grande* but hardly warranting recognition as a distinct taxon. Even the author suggested that leaf width may not be very significant when he described the leaves as sometimes three times longer than broad.

The holotype of *Aglaonema nieuwenhuisii* is: Borneo, Soengei Bloe-oe [tributatry of Mahakan River], 1896–7, *Jaheri, Exp. Nieuwenhuis 673* (BO). Engler (1915) cited this collection as *Aglaonema minus* Hooker f., having longer petioles, the petiolar sheath more than 0.5 the petiole length, and a longer leaf blade. This is true. The only question is whether it should be recognized as a taxon within *A. simplex*. The main characteristic is that the leaves are very small, "9–12 x 4½–6 cm." Recently the Bailey Hortorium received photographs and a cutting of a similar plant collected in southeastern North Borneo by L. Maurice Mason. Considering the variability known to exist in *Aglaonema simplex,* I have decided not to recognize what amounts to a group defined merely as "'plants small."

The holotype of *Aglaonema simplex* f. *inaequale* is: Lingga Archipel, P. Singkep, Weg Manggoe, 50 m, Bosch, 2 August 1919, *Bünnemeijer 7189* (BO). In the original publication this collection was erroneously cited as *Bünnemeijer 7180*. I have no record of *Bünnemeijer 7180* but *Bünnemeijer 7189* is annotated by van Alderwerelt van Rosenburgh as *Aglaonema simplex* f. *inaequale* and bears the field note "Bloeikolf wit. Bloeischeede licht groen," which must be the basis of the part of the description reading "Spatha pallide viridis. Spadix albus." This taxon is not worthy of recognition. Leaves of most *Aglaonema* are unequal to a greater or lesser degree.

The type of *Aglaonema subarborescens* is: Sum[atra], W[ester] K[ust], G. Malintang, 1100 m, Bosch bij rivier, 5 August 1918, *Bünnemeijer 4311* (lectotype: BO-100506; isolectotypes: BO-100507–100508, L); Sum[atra] W[ester] K[ust], G. Sago, 1150 m, Bosch rand, 7 August 1918, *Bünnemeijer 4351* (*syntype:* BO). I have designated *Bünnemeijer 4311* (BO-100506) as lectotype since it has the largest leaves, 32.5 cm long and fully 24 cm wide. This exceptionally large size is approached in the genus only by *Aglaonema densinervium,* which differs in having the spadix over 1.5 cm short of the spathe apex. In all characters this material resembles *Aglaonema simplex*. Other collections from the same general locality, *Bünnemeijer 3631* (which was determined by van Alderwerelt van Rosenburgh as *A. simplex*), *Bünnemeijer 4311,* and *Meijer 5645* clearly indicate that the lectotype is, at best, only an extreme individual. It is desirable to be aware of these extremes, but I feel that formal recognition of them, even at an infraspecific level, will lead to confusion in such a variable species as *Aglaonema simplex*.

Aglaonema alpinum Elmer (1938, p. 3611) is based on: Philippines, Sorsogon, Irosin, Mt. Bulusan [3000 ft, wet humus-covered stony soil of densely wooded flats – fide description], July 1916, *Elmer 16520* (BO, CAL, GH, NY). Of the four duplicates of the type-collection known to me, only one (GH) has leaves 5.5 cm wide as described by Elmer. This binomial is invalid under Article 36 (ICBN, 1966) since it was published without a Latin description. The material falls nicely into *Aglaonema simplex* with its short peduncles, short petioles, and nonvariegated leaves. Unfortunately, most of the Philippine collections of what I regard to be *Aglaonema simplex* are in fruit, and it is difficult to be certain whether or not the spadix equals the spathe as it should in *A. simplex*. The only flowering material is *Zwickey 349* (GH) from Lanao. In two rather immature inflorescences the spathe seems to exceed the spadix by more than one centimeter but a third, rather passé, inflorescence appears to have the spadix equaling the spathe.

14. *Aglaonema cordifolium*

Aglaonema cordifolium Engler, 1915, p. 29, figs. 14A–C.

Stem erect, to 1.2 cm thick. Internodes to 1 cm long. Petioles 7–9 cm long, 0.4 times as long as the leaf-blades. Sheaths membranous, 1 cm long, 0.1–0.3 times as long as the petiole. Leaf-blade broadly ovate, 10–21 cm long, 7–16 cm wide, length/width ratio 1:1.3–1.5; base cordate; apex acuminate with apiculum; variegation none; venation differentiated into 5–14 primary lateral veins diverging from midrib at 45°–60°. Peduncles 2–3 together, 5–7 cm long. Spathe 5 cm long,

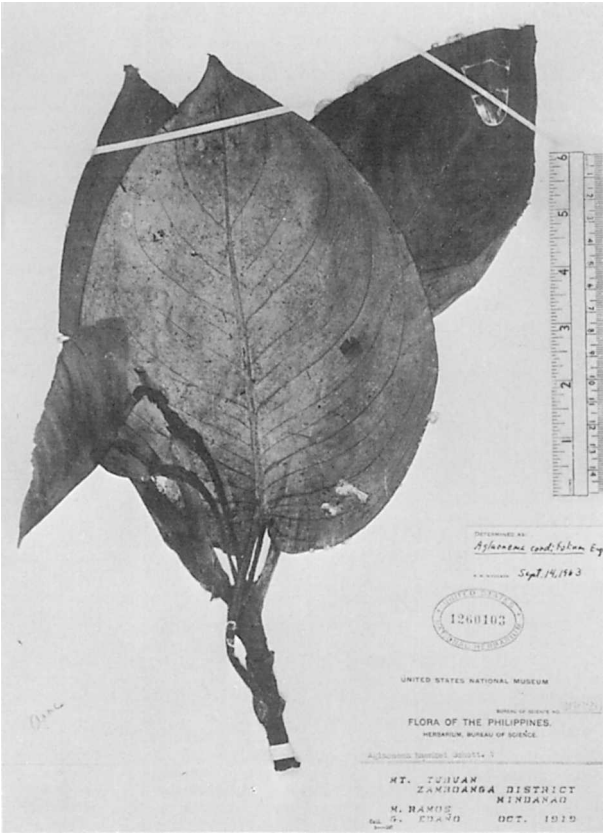

FIGURE 15.—Specimen of *Aglaonema cordifolium* Engler: *Ramos and Edano, BS 36626* (US).

2 cm wide, decurrent to 0.8 cm. Stipe 1–1.5 cm long. Spadix 2.5 cm long; pistillate portion 0.3–0.8 cm long, pistils ca. 20; staminate portion 2 cm long, 0.4 cm thick.

TYPE COLLECTION.—Philippines, Mindanao, Davao, Mt. Dagapan, Ebenenwald, June 1888, *Warburg 14604* (holotype: B).

DISTRIBUTION.—Known from only two collections in Davao and Zamboanga of southern Mindanao (Figure 8).

This species appears to be most closely related to *Aglaonema simplex* with which it shares the following characteristics: petioles less than one-half the blade length, petioles less than 10 cm long, and petiolar sheaths less than 10 cm long. Perhaps future studies will indicate that *A. cordifolium* is not a distinct species, but the specimens seem to be distinctive by the broadly ovate leaf with a cordate leaf base and an exceedingly short petiolar sheath, characters that make it advisable to maintain the species.

Herre 1179 from Negros Oriental, determined as *A. philippinense,* is very similar to *A. cordifolium,* at least in the appearance of the leaf-blades.

15. *Aglaonema marantifolium*

Aglaonema marantifolium Blume, 1837 ["1835"], p. 153, pl. 66 ["marantaefolia"].
Arum aquaticum Rumphius, 1747, p. 312, pl. 108.
Adpendix erecta Rumphius, 1747, p. 487, pl. 182: fig. 2.
Calla oblongifolia Roxburgh, 1814, p. 65.
Aglaonema oblongifolium (Roxburgh) Kunth, 1841, p. 55 [not Schott, 1829].
Scindapsus erectus Presl, 1851 ["1849"], p. 242.
Aglaonema novoguineense Engler, 1898, p. 2.

Stem erect or reclining in larger plants, 1–3 cm thick. Internodes to 2 cm long. Petioles (18) 21–31 cm long, (0.6) 0.8–1.0 (1.1) times as long as the leaf-blade. Sheaths with membranous margins, (11) 15–20 (25) cm long, (0.4 0.6–0.8 times as long as the petiole. Leaf-blades narrowly oblong, occasionally oblong, narrowly elliptic or oblanceolate, (22) 25–33 (40) cm long, (7.5) 10–15 (18) cm wide, length/width ratio 1:(2.2) 2.5–3.4; base obtuse to subrounded; apex acuminate, sometimes subrounded, obtuse or abruptly acuminate, often apiculate; variegation none; venation undifferentiated to weakly differentiated into 5–8 primary lateral veins diverging from the midrib at (30°) 40°–50° (65°); texture coriaceous. Peduncles 2–5 together, rarely solitary, (10) 13–19 (21) cm long, commonly about 0.5 the length of the petioles. Spathe green, turning yellow and withering in age, 4–7 (to 9 in fresh material) cm long, decurrent for 0.3–0.8 (1.0) cm. Stipe (0.7) 0.9–1.6 cm long. Spadix shorter than spathe by 0.3 the length of the spathe or more, 1.7–3.0 (to 4 in fresh material) cm long; pistillate portion 0.2–0.8 cm long, pistils 10–17 (22), the pistil with broad yellow stigma, the style distinctly contracted; staminate portion 1.2–2.0 (to 3 in fresh material) cm long. Fruits becoming bright red, 1.5–3.0 cm long, 0.7–1.7 cm wide. Seed clavate, to 2.5 cm long and 1.2 cm thick in fresh material.

TYPE COLLECTIONS.—Amboina, *Zippel s.n.* (lectotype: L); Banda, *Peitsch s.n.* (syntype: L). Blume (1837) noted that Zippel's specimen was mutilated (a piece of a leaf and a small piece of stem with six inflorescences attached). Peitsch's specimen is more complete but is sterile, and therefore I have selected Zippel's specimen as lectotype.

DISTRIBUTION.—Moluccas through New Guinea (Figure 2).

FIGURE 16.—*Aglaonema marantifolium* Blume (1837, pl. 66).

HABITAT.—Shady, damp places in lowland rain forests.

FLOWERING TIME.—Apparently nonseasonal.

Both *Arum aquaticum* and *Adpendix erecta* are typified by the pertinent Rumphian plates. Rumphius described *Arum aquaticum* as being decumbent with half the stem lying on the ground and half erect. He placed *Adpendix erecta* among the climbing aroids but noted that it does not fasten itself to trees but lazily lies on neighboring bushes. There is no difference between them as Merrill (1917, p. 217) recognized when he stated: "The figures and descriptions of both the Rumphian species cited above agree closely with *Aglaonema oblongifolium* Kunth [=*A. marantifolium*] as currently interpreted."

Calla oblongifolia is based on *Arum aquaticum* Rumphius. Most binomials in Roxburgh's *Hortus Bengalensis* are nomina nuda but a footnote to *Calla oblongifolia* refers to the description and place of Rumphius. It is interesting to note that Roxburgh (1814) reports that his plant was introduced from the Moluccas by C[hristopher] Smith in 1798. Even Roxburgh's drawing, published by Wight (1844), is *Aglaonema marantifolium* and not *A. nitidum* as most workers have assumed.

The Roxburghian epithet was transferred to *Aglaonema* by Kunth (1841), thus creating a later homonym of the superfluous name *Aglaonema oblongifolium* Schott (1829) (see *A. nitidum* for details).

Scindapsus erectus is based on *Adpendix erecta* Rumphius.

Aglaonema marantifolium f. *robustum* Engler (1883, p. 291) is based on *Beccari, P.P. 798* from Andai, site of a small village formerly about 20 kilometers south of Manokwari in West New Guinea. The name, however, was published without a description. Study of the original and other collections from the same general locality do not warrant validation of the forms, which Engler (1915) later ignored.

The type of *Aglaonema novoguineense* is: Territory of New Guinea, Suor Mana [vicinity of Astrolabe Bay?], 700 m, 12 June 1896, *Lauterbach 325* (lectotype: B). In the original description six syntypes were listed, all at Berlin. Only one remains and I have designated it as lectotype. The segregation of this species is probably largely due to Engler's overemphasis on the relative and subjective characteristic of strength of venation. He (1915) placed *A. novoguineense* in his classification as having subequal, thin, dense, subparallel primary venation and *A. marantifolium* as having primary veins slightly stronger ("paullum validiores") than the secondary veins. This distinction does not exist and even the type of *A. novoguineense* would key out to *A. marantifolium* either in Engler's or my own key.

Aglaonema marantifolium Blume is most closely related to *A. philippinense, A. densinervium,* and *A. commutatum.* Study of herbarium material suggests that *A. philippinense* may be intermediate between *A. marantifolium* and *A. simplex,* that *A. densinervium* may be an overgrown intermediate between *A. marantifolium* and *A. nitidum,* and that *A. commutatum* may be a subapomictic complex of variegated forms in which *A. marantifolium* has participated

along with other species. In the Moluccas and New Guinea all the specimens consistently have the spathe much longer than the rather aborted spadix, a shortly decurrent spathe, and a distinctly elongated stripe, usually much exceeding the length of the spathe decurrency. The specimens, however, from the Talaud Islands have rather short stripes, but they are longer enough than the spathe decurrency so that they can be included in *A. marantifolium* in its narrowest sense.

Field work in the Philippines, Celebes, and Moluccas, particularly if combined with cytological studies and breeding experiments, would be extremely desirable to determine whether or not, or to what extent, *A. marantifolium* is capable of interbreeding with other taxa.

16. *Aglaonema commutatum*

Aglaonema commutatum Schott, 1856, p. 123.

Stems erect, becoming decumbent in older and larger specimens, 20–150 cm tall, 0.5–6.0 cm thick. Internodes 0.4–2.5 cm long. Petioles 6–25 (35) cm long, (0.4) 0.5–1.2 (1.4) times as long as the leaf-blade. Petiolar sheaths membranous but occasionally scarious. Leaf-blades usually narrowly oblong-elliptic to lanceolate but occasionally ovate, elliptic or oblong, (10) 13–30 (45) cm long, (2.5) 4–10 (20) cm wide, length/width ratio 1:(1.8)2.3–3.7(6), base often unequal, broadly acute, obtuse or subrounded, occasionally subcordate; apex often apiculate, acuminate to gradually acuminate, rarely shortly acuminate or broadly acute; variegation confluent in bars along the primary lateral veins, rarely in irregularly scattered spots (var. *commutatum*); venation differentiated into 4–7 (11) primary lateral veins diverging from the midrib at (20°) 45°–70° (80°); texture coriaceous. Peduncles solitary to 6 together, (4.5) 7—15 (20) cm long. Spathe light green, sometimes white, (3) 3.5–9.0 (12) cm long, (2) 2.8–4.0 (4.8) cm wide, decurrent for (0.2) 0.4–1.2 (2.0) cm. Stipe (0.2) 0.4–1.1 (2) cm long, rarely surpassing the spathe decurrency. Spadix thin-cylindric (1.6) 2–6 (7) cm long, usually more than 1 cm short of spathe apex but occasionally equaling it; pistillate portion 0.3—1.0 cm long, pistils (7) 10–18 (22); staminate portion (1.1) 1.5–4.0 (6) cm long, 0.4–0.6 cm thick. Fruits turning yellow, then bright red, ellipsoidal to obovoid, 1.6–2.5 cm long, 0.4–1.7 cm thick.

Distribution (Figure 5).—Philippines and northeastern Celebes. The ability of this species to naturalize makes it difficult to be certain which collections are from the wild and which are escapes.

Flowering time.—June–September, the wet season in areas with pronounced seasons.

This species is quite variable but, with the exception of the typical variety, is always variegated in the same barred pattern. In some of the cultivars extreme variegation and albinism occur but the basic pattern is still evident. This consistent variegation pattern, coupled with its relatively restricted distribution, has led me to accept the complex as a single variable species.

The only hypothesis I can offer to explain the great variability in vegetative and reproductive characteristics is that it may have a hybrid origin. One of the most difficult areas in which to recognize and define species of *Aglaonema* is the area of the Philippines and Celebes. If all specimens from this general area are excluded from consideration, one has little difficulty in recognizing *Aglaonema marantifolium* (Moluccas and New Guinea), *A. nitidum* (most of western Malesia), and *A. simplex* (most of western Malesia). The moment one tries to include and account for the Philippine and Celebesian specimens, these otherwise distinct species begin to show extremely confusing exceptions and intergrades.

Aglaonema commutatum is one of the worst offenders in this regard. For instance, *Aglaonema marantifolium* has a long stipe and short spathe decurrency. These also occasionally occur in *A. commutatum*. *Aglaonema nitidum* has scarious petiolar sheaths. These also occasionally are found in *A. commutatum*. *Aglaonema simplex* typically has very short peduncles, but these also may occur in *A. commutatum*. Each of these characteristics is virtually definitive for the three principal species.

Why should the peripheral area of the Philippines and Celebes provide the exceptions? It seems reasonable to postulate a hybrid origin for the plants in this area, in particular for *A. commutatum*. This hypothesis is supported by what little cytological evidence is available. All chromosome counts of *Aglaonema commutatum* have been tetraploid or hexaploid and the plants were pollen-sterile and apomictic (see "Cytology," p. 6).

A number of specific taxa have been proposed that appear to fall into this complex. After study of the specimens, I found it possible to accept all of these taxa by expanding their original concepts. This seemed preferable to completely submerging them or to proposing a whole series of new infraspecific taxa.

It was surprising to me that some of the taxa are

apparently restricted to central Luzon and northeastern Celebes with nothing in between. This is only one of the many unsolved problems. Perhaps further field studies, particularly if combined with breeding experiments and cytological work, will clarify why simple morphology does not solve all the taxonomic problems.

Key to the Varieties and Cultivars of *Aglaonema commutatum*

1. Petioles solid dark green.
  2. Variegation in irregularly scattered spots . . . . . 16a. var. *commutatum*
  2. Variegation in blotchy bars following the primary lateral veins.
    3. Petioles equaling to exceeding leaf-blades . . . . . 16b. var. *warburgii*
    3. Petioles shorter than leaf-blades
      4. Leaves large (more than 25 x 10 cm) with length/width ratio of 1:1.8–2.5 . . . . . 16c. var. *robustum*
      4. Leaves smaller, rarely over 25 cm long, less than 10 cm wide; length/width ratio 1:2.4–6.0
        5. Leaves less than 5 cm wide; length/width ratio 1:4.5–6.0 . . . . 16l. cv. 'Treubii'
        5. Leaves usually over 5 cm wide; length/width ratio 1:2.4–4.3.
          6. Leaves over 20 cm long, base obtuse to acute . . . . . 16d. var. *elegans*
          6. Leaves less than 20 cm long, base rounded to subcordate . . 16e. var. *maculatum*
1. Petioles variegated.
  7. Leaf variegation streaked . . . . . 16m. cv. 'Tricolor'
  7. Leaf variegation in blotchy bars following the primary lateral veins.
    8. Petioles more green than white.
      9. Leaves over 50% variegated above . . . . . 16i. cv. 'Parrot Jungle'
      9. Leaves less than 50% variegated.
        10. Sheath 0.5 times as long as petiole; petiole 0.9 times a long as blade . . . . . 16h. cv. 'Malay Beauty'
        10. Sheath 0.9 times as long as petiole; petiole 0.5 times as long as blade . 16j. cv. 'Pewter'
    8. Petioles more white than green.
      11. Leaves tricolored above . . . . . 16k. cv. 'Pseudobracteatum'
      11. Leaves bicolored above.
        12. Leaves variegated below . . . . . 16g. cv. 'Fransher'
        12. Leaves solid green below . . . . . 16f. cv. 'Albo-variegatum'

16a. *Aglaonema commutatum* var. *commutatum*

Aglaonema commutatum Schott, 1856, p. 123.

A. marantifolium β commutatum (Schott) Engler, 1879, p. 441 [sensu stricto].

The following is a translation of Schott's (1860, p. 304) most complete description of *Aglaonema commutatum:*

> Petioles sheathing almost all the way to the apex, 6.5–8.0 cm long. Leaf-blade oblong-lanceolate, base obtuse, margin weakly undulate, apex long-acuminate, on the upper side irregularly sprinkled with remote white-greenish spots. Veins spreading or erect-spreading, ±5 with 3–4 secondary veins between. Peduncles longish, thin. Spathe large, lanceolate-oblong, long-acuminate, whitish green outside, whitish inside. Spadix thin, slightly longer than spathe, the stipe longish, the pistils few, more or less in a single series. Stigma pale yellowish green, deeply excavated. Fruit elliptic, red. Seed elliptic.

TYPE.—Unpublished drawing, *Schott, Aroideae 38* (neotype: W).

This variety is unknown to me except for several drawings in the Schottian herbarium in Vienna and photographs appearing in the various editions of Graf's *Exotica* (1957, p. 71; 1959, p. 80; 1963, p. 118) as *Aglaonema cuscuaria.*

The typification of this well-known species was different than expected and deserves comments. As typified here and described by Schott (1856, 1860), the leaves have irregular and scattered spots, not the usual pattern of blotchy bars following the primary lateral veins. An unpublished plate found among Schott's reliquiae fits the description. A published plate by Schott (1858, pl. 59) does not show leaves that, in this case, are definitive. Therefore, I selected the unpublished plate (*Aroideae Nr. 38*) as neotype.

16b. *Aglaonema commutatum* var. *warburgii* (Engler) Nicolson, new status

Aglaonema warburgii Engler, 1915, p. 20.

Petioles green, 13–24 (27) cm long, 1.0–1.4 times as long as the leaf-blade. Petiolar sheaths 7–14 cm long. Leaf-blades 10.5–24 cm long, 4–8.5 cm wide, length/width ratio 1:2.2–2.8(3.1); variegation barred, along primary lateral veins; venation differentiated into 4–7 primary lateral veins diverging from the midrib at

FIGURE 17.—Neotype of *Aglaonema commutatum* var. *commutatum: Schott, Aroideae Nr. 38* (W).

(45°) 50°–70°. Spathe 3–4.5 cm long. Spadix 1.6–2.5 cm long, shorter than spathe by 0.8 cm (in the type) to equaling it; staminate portion 1.1 cm long, 0.4 cm thick.

TYPE COLLECTION.—North Celebes, Menado [August–September 1888] *Warburg s.n.* (holotype: B).

The type material shows the usual barred variegation pattern of *Aglaonema commutatum*. It is distinct by its long petioles, which equal or exceed the length of the leaf-blade. A long petiole is also usual in *A. marantifolium* and a relationship to that species is also indicated by the fact that the stipe often equals the spathe decurrency. The material seems to be morphologically distinct enough to warrant maintenance at the varietal level for the time being.

16c. *Aglaonema commutatum* var. *robustum*

Aglaonema commutatum var. *robustum* (van Alderwerelt van Rosenburgh) Nicolson, 1968, p. 125.

A. robustum van Alderwerelt van Rosenburgh, 1922, p. 328.

Petioles 15–35 cm long, 0.5–0.8 times as long as the leaf-blade. Petiolar sheaths 6–26 cm long. Leaf-blades 21–45 cm long, 11–20 cm wide, length/width ratio 1:1.8–2.5; variegation sometimes faint, along primary lateral veins; venation differentiated into 5–11 primary lateral veins diverging from the midrib at 65°–80°. Spathe 7–12 cm long, 3.5–4.8 cm wide. Spadix 4.5–6.5 cm long, tapered, equaling to 2 cm short of spathe apex; staminate portion 3.0–5.5 cm long, 0.4 cm thick.

TYPE COLLECTION.—Java, Bogor Botanic Garden, XI. B. IX. 152, *van Alderwerelt van Rosenburgh 358* (holotype: BO). *Nicolson 955* is clonotype material.

This variety was originally described as a species near *Aglaonema commutatum*. The variegation pattern is clearly the same. In habit the plants look like *A. marantifolium*, but the spathe decurrency is longer than the stipe, indicating that this material is not true *A. marantifolium*.

Bunting 1545 represents a smaller form. The leaves are only 21 cm long; however, the presence of extremely broad leaves (1:1.8–2.4) fits this variety.

16d. *Aglaonema commutatum* var. *elegans*

Aglaonema commutatum var. *elegans* (Engler) Nicolson, 1968, p. 125.

A. elegans Engler, 1915, p. 28, fig. 11.

Petioles 9–20 cm long, 0.4–0.7 times as long as the leaf-blade (equaling, fide Engler). Petiolar sheaths (4) 9–13 cm long. Leaf-blades 17–30 cm long, 5–9.5 cm wide, length/width ratio 1:(2.7)3–3.7; variegation in the form of bars following the main veins on the upper surface; venation differentiated into 4–7 primary lateral veins diverging from the midrib at (30°) 45°–70° (80°, fide Engler). Spathe (3.5) 4.5–7.0 (10.5) cm long, 2–3.9 cm wide. Spadix 2–7 cm long; staminate portion 1.5–5.7 cm long, 0.4–0.6 cm thick.

TYPE COLLECTION.—Java, Bogor Botanic Garden, *Engler, Reise nach Java und Britisch Indien 1905–6 n. 4070* (not found in B or BO). In the absence of a specimen, Engler's published illustration may be considered as type-material. It should be noted that Engler described the veins as diverging from the midrib at 70°–80° while the illustration shows the veins diverging at 45° or less.

DISTRIBUTION.—Philippines, central Luzon. Escapes from cultivation.

Engler indicated that his taxon was close to *A. commutatum* but was distinguished by its larger and more elongate leaves and especially by its elongate-

oblong spathe. The illustration of the spathe is not particularly distinctive nor are the measurements given in the description: "6–7 cm. longa 1 cm. ampla" (Engler apparently measured width without unrolling the spathe and, thus, his "1 cm. wide" would correspond to 2–3 cm wide in a flattened spathe). The distinctive character of the leaves can be summarized as a length of over 20 cm and more than 2.9 times the width.

The best approximation to Engler's description is made by *McGregor, Bur. Sci. 23077,* which even has the veins diverging at 70° from the midrib.

16e. *Aglaonema commutatum* var. *maculatum*

Aglaonema commutatum var. *maculatum* (Hooker f.) Nicolson, 1968, p. 125.

A. marantifolium var. *maculatum* Hooker f., 1865, pl. 5500.

A. commutatum var. *commutatum* of authors not Schott: Regel, 1865, p. 130, pl. 470.—Morren and deVos, 1882, p. 51.—Engler, 1915, p. 27, figs. 10G–P.—Birdsey, 1951, pp. 12–13.

A. marantifolium sensu Boynton, 1924, p. 165, pl. 302 [not Blume, 1837].

Petioles 6–13 (18) cm long, 0.5–0.9 times as long as the leaf-blade. Petiolar sheaths 3–11 cm long. Leaf-blades 10–20 cm long, 3.5–7.0 cm wide, length/width ratio 1: 2.4–3.4(3.7); variegation confluent in stripes following the primary veins on the upper leaf surface; venation differentiated into 4–7 primary veins diverging from the midrib at (35°) 45°–60° (70°). Spathe 3.5–6.5 cm long, 2.8–3.0 cm wide. Spadix 2–4.7 cm long, equaling to 1 cm short of spathe apex; staminate portion 1.5–4.0 cm long, 0.4–0.6 cm thick.

TYPE COLLECTION.—England, Chelsea, Royal Exotic Nursery, 25 March 1863 [without collector] (holotype: K). *Loher 2445* is mounted on the same sheet with the holotype.

DISTRIBUTION.—Central Luzon.

According to the holotype, this variety was imported from Manila by Veitch. According to Morren and de Vos (1882, p. 51), Linden exhibited it in Brussels on 19 July 1863. Most authors have used the binomial *A. commutatum* to refer to var. *maculatum,* probably because the typical variety (var. *commutatum*) is quite rare and not nearly so well known and widely distributed as var. *maculatum.*

This variety is apparently most closely related to var. *elegans.* As happens in that variety, occasional cultivated specimens show inflorescence characters of *A. marantifolium,* such as having the stipe more or less equaling the spathe decurrency. The similar length of spathe decurrency and stripe suggests that *A. marantifolium* may be related, even though the overall sizes of the plants are widely different.

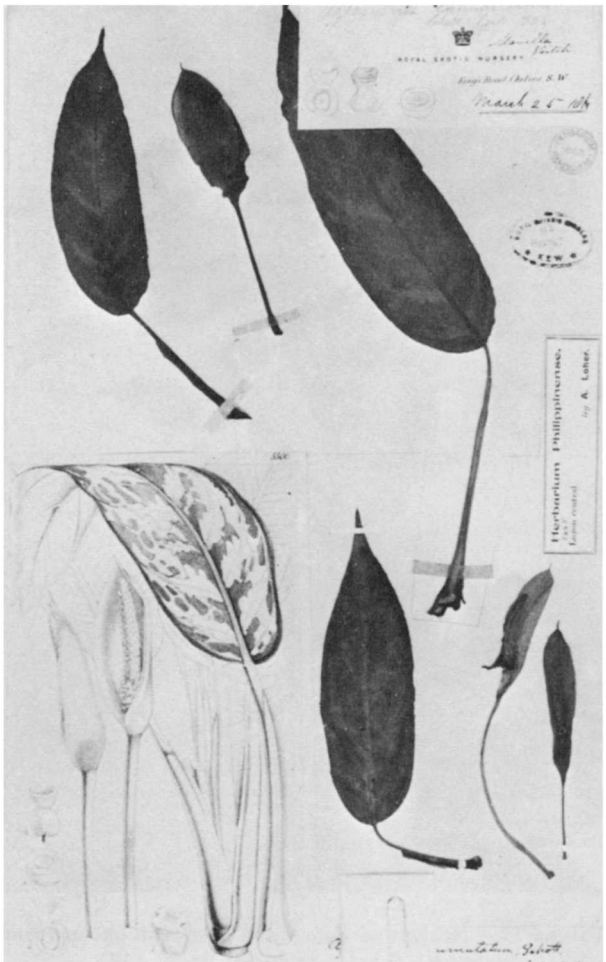

FIGURE 18.—Holotype of *Aglaonema commutatum* var. *maculatum* (Hooker f.) Nicolson: without collector (K). (Holotype upper half only.)

The wild usually differs from cultivated material in the petiolar sheath length. In cultivated material the sheath is (0.6) 0.7–0.9 (1) times as long as the petiole length, but in the cultivated material it is only (0.3) 0.5–0.6 (0.8) times as long.

The Cultivars of *Aglaonema commutatum*

The cultivar names known to me are discussed below in alphabetic order.

Mr. Nat De Leon of the Parrot Jungle in Miami, Florida, has done a great deal of breeding and selecting in *Aglaonema commutatum.* He is responsible for the origin of most of the commercial cultivars. Un-

fortunately, time was not taken to study his material and to obtain information directly from him. I have relied on the information published by Graf (1963, p. 1526–1527). The hybrid origin noted for several of the cultivars may simply be the result of apomixis rather than hybridization since apomixis, pollen sterility, and high polyploidy are well established in this species.

16f. *Aglaonema commutatum* cv. 'Albo-variegatum'

Aglaonema commutatum albo-variegatum Graf, 1953, illustr. 5: fig. 24 ["*albo-variegata*"]; 1957, p. 70; 1959, p. 76; 1963, p. 119.

Graf described this cultivar as a sport. In the published photographs it looks exactly like *A. commutatum* var. *maculatum* except that the petioles are white, not green.

16g. *Aglaonema commutatum* cv. 'Fransher'

Aglaonema 'Fransher' Graf, 1963, p. 1526.

This cultivar was noted by Graf as a hybrid, *A. treubii* × *marantifolium tricolor* [*A. commutatum* cv. 'Treubii' × *commutatum* cv. 'Tricolor'], and was named after Francis Scherr, founder of the Parrot Jungle in Miami, Florida. It is distinguished by variegated petioles, leaves heavily bicolored above, and speckled below along the midrib and lower main veins.

16h. *Aglaonema commutatum* cv. 'Malay Beauty'

Aglaonema 'Malay Beauty' Graf, 1963, pp. 117, 1527.

Noted by Graf as a free-growing horticultural variation of *A. commutatum* 'Pseudobracteatum' and perhaps a return toward normal from the extreme albino form. Graf also notes that this cultivar is called 'Pewter.' In the material available to me there are two specimens that would fit Graf's general description. *Bunting 1346* (Bamboo Nursery, Orlando, Florida, 3 April 1962) has petiole 12 cm long (0.5 times as long as the leaf-blade) and the petiolar sheath 10.5 cm long (about 0.9 times as long as the petiole). These measurements are similar to those of 'Pseudobracteatum.' I have identified this collection as 'Malay Beauty.' The other specimen with a much longer petiole was identified as 'Pewter.'

16i. *Aglaonema commutatum* cv. 'Parrot Jungle'

Aglaonema 'Parrot Jungle' Graf, 1963, pp. 117, 1527.

This cultivar is distinguished by having most of the leaf variegated above and none below. It was noted by Graf as a hybrid, *A. curtisii* × *pictum tricolor* [*A. nitidum* f. *curtisii* × *pictum* cv. 'Tricolor']. The distinctness of the putative parents suggests that they may have been misidentified.

16j. *Aglaonema commutatum* cv. 'Pewter'

Aglaonema 'Pewter' Graf, 1963, p. 1527 [under 'Malay Beauty'].

As discussed under 'Malay Beauty,' I have identified that cultivar with a specimen closely approximating *A. commutatum* cv. 'Pseudobracteatum' in its petiolar measurements. Another specimen, *Bunting 1372* (Ferrell's Shack, Winter Park, Florida, 4 April 1962), that I identify with 'Pewter,' has petioles 35 cm long (longer than the leaf-blade) and the petiolar sheath 18 cm long (about half the petiole length).

16k. *Aglaonema commutatum* cv. 'Pseudobracteatum'

Aglaonema pseudobracteatum Graf, 1953, p. 5, fig. 35.
A. 'Pseudo-bracteatum' Graf, 1957, p. 49; 1959, p. 39; 1963, pp. 37, 114.

This cultivar is distinguished by its massive variegation that eliminates most of the chlorophyll from both sides of the leaf and the petiole. The epithet is possibly a misapplication of *A. robelinii* lusus [sport] *pseudobracteosum* Engler (1915, p. 19, fig. 6). Engler applied this descriptive epithet to a plant with bractlike structures subtending the pistils, something not observed in living material nor in any of the descriptions or specimens of the cultivar under discussion.

16l. *Aglaonema commutatum* cv. 'Treubii'

Aglaonema commutatum cv. 'Treubii' Nicolson, 1968, p. 125.
A. treubii sensu Graf, 1953, p. 6, fig. 38; 1957, p. 69; 1959, p. 79; 1963, p. 117 [not Engler, 1898].

This cultivar is distinguished by its narrow leaves and long spathe (equaling the peduncle). Comparable spathe length is also found in *A. commutatum* cv. 'Pseudobracteatum' and var. *robustum*. This cultivar approaches *A. commutatum* var. *elegans* in its leaf shape and its long spathe. Perhaps it is only a selection or sport of that variety.

In the trade "treubii" is consistently used as a specific epithet for this cultivar, but it apparently represents a misidentification of *A. treubii* Engler (1898) as amended by Engler (1915). Engler's (1915) description clearly does not agree with the cultivated material in the following points: he described the variegation as being along the midrib ("juxta costam") and the leaf-blade as 7–12 cm wide (length/width ratio of 1:2.5–2.9). It is true that there is confusion about the identification of *A. treubii* Enger (see "Dubious Bi-

nomials," p. 60, no. 5) but it seems clear that the material in the trade is not truly *A. treubii* Engler.

I have seen two collections of this taxon from the Philippines that may have been from the wild but that I suspect were from cultivation. Since the taxon is only known from cultivation, it seems best to treat it as a cultivar.

16m. *Aglaonema commutatum* cv. 'Tricolor'

Aglaonema commutatum cv. 'Tricolor' Nicolson, 1968, p. 125.
A. marantifolium tricolor Graf, 1953, p. 5, fig. 30.

There are two specimens from Mindoro, Philippines (*Sulit and Conklin, PNH 16836, 17656*) that apparently belong to this taxon; rather than validate the taxon as a botanical variety, however, I prefer to treat it as a cultivar. This cultivar is distinguished by its hazy to streaked leaf variegation affecting both sides of the leaf and its mottled to pink petioles.

It should be noted that a usual character of *A. marantifolium* appears in the wild material of this cultivar; i.e., the stipe exceeds the spathe decurrency by 0.3 cm. The presence of this characteristic on Mindoro plants is exceptional as it normally is restricted to the Moluccas and New Guinea. This may be an indication that *A. marantifolium* had a part in the evolution of *A. commutatum*.

17. *Aglaonema crispum*

Aglaonema crispum (Pitcher and Manda) Nicolson, 1968, p. 126.
Schismatoglottis crispa Pitcher and Manda, 1892, p. 95 [as "*Schizmatoglottis*"].
Aglaonema roebelinii Pitcher and Manda, 1894, p. 31.
Schismatoglottis robelinii (Pitcher and Manda) Pitcher and Manda, 1895, p. 141, pl. 138.
Aglaonema robelinii lusus *pseudobracteosum* Engler, 1915, p. 19.

Stem erect, 40–120 cm tall, 0.8–3.0 [5, fide Alderwerelt] cm thick. Internodes about 1 cm long. Petiole 8–25 cm long, 0.4–0.7 times as long as the leaf-blade. Sheaths (4) 6–12 (18) cm long, (0.4) 0.6–1.0 times as long as the petiole. Leaf-blades elliptic to narrowly elliptic 14–32 cm long, (5) 7–12 (16) cm wide, length/width ratio 1:2–2.9 (3.5); base obtuse, subrounded or broadly acute; apex acuminate; variegation covering most of the upper surface of each half of the leaf-blade, leaving the midrib and marginal areas free; venation rather weakly differentiated into (4) 6–8 (10) primary lateral veins diverging from the midrib at 40°–60°; texture coriaceous. Peduncles 2–5 together, 4–14 cm long. Spathe fading from green to yellow, then black, 4–7 cm long, 2.0–2.5 cm wide, decurrent for 0.4–1.0 (1.5) cm. Stipe 0.3–0.7 (1) cm long. Spadix 2–3 cm long, 0.7–2.0 cm shorter than spathe; pistillate portion 0.2–0.4 cm long (to 1 cm in fruit), pistils 10–17; staminate portion 1.6–2.6 cm long, 0.2–0.3 cm thick. Fruits becoming yellow, then red, 1.5–2.0 cm long, 0.9–1.5 cm thick.

NEOTYPE.—Photograph labelled *Schismatoglottis roeblinii* on page 141 of Pitcher and Manda, *General Illustrated Catalogue of Plants* (1895). This same photograph also appears as *Schismatoglottis crispata* (not Hooker) in *Vick's Magazine* (1899, vol. 23, p. 71) and as *Schismatoglottis picta* (not Schott) in *American Gardener* (1898, vol. 19, fig. 122).

DISTRIBUTION.—Known only from Mt. Bulusan, Sorsogon Province, Luzon, Philippines, where it has been collected several times (Figure 5).

HABITAT.—In deep shade of primary dipterocarp forest from 300 to 950 m.

FLOWERING TIME.—August.

According to the label on a specimen of this species at Kew (without collector) it was given to Kew by Mr. Sander in 1881. In 1883 Linden's firm began offering *A.* (or *Schismatoglottis*) *roebelinii* under a variety of spellings. I presume, as did Wocke (1895) and Engler (1915), that these nomina nuda pertain to this species. In 1891 Pitcher and Manda listed *Schismatoglottis crispata,* possibly the same as *S. crispa* Pitcher and Manda, although it is impossible to be certain since no description was given.

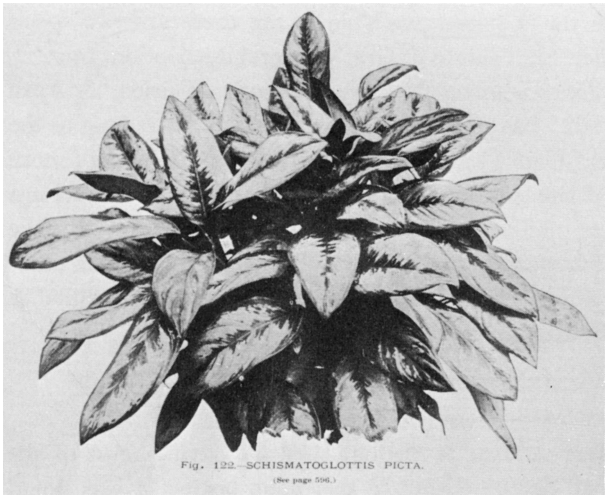

FIGURE 19.—Neotype of *Aglaonema crispum* (Pitcher and Manda) Nicolson.

Schismatoglottis crispa Pitcher and Manda was described thus: "Somewhat resembles *Dieffenbachia* in growth and has fine grayish green leaves, edged with dark green, the midrib being a lighter color." This description can be followed through subsequent catalogs of Pitcher and Manda's firm until it can be connected with the photograph published by Pitcher and Manda (1895) and called *Schismatoglottis roebelinii,* which I have designated as the neotype.

Unfortunately, I have not been able to see any of Sander's catalogs published between 1881 (when Sander material was made into a specimen at Kew) and 1892 when the hitherto obscure epithet *"crispa"* was published with a description. Sander's firm (still extant and run by a grandson) and Kew do not have catalogs. Until valid publication of *A. roebelinii* that antedates *"crispa"* can be demonstrated, I am obliged to adopt the oldest available epithet for this species. This is unfortunate because *"roebelinii"* is well known in the trade.

At least nine different spellings have been published for the hitherto most commonly used epithet: *roebelinii, rebellinii, röbellinii, roblenii, rebelini, röbelenii, röbelini, robeleni, robellini.* This epithet is believed to honor the probable collector, Carl Roebelen. According to van Steenis-Kruseman (1950, p. 444), Roebelen was collecting in the Philippines for Sander's company between 1880 and 1882. Bellaire and St. Léger (1900, p. 165), however, reported that "A. de Robelin" was being honored. I have no information on this person. According to Article 73 (ICBN, 1966), the original spelling of a name must be retained, except for correction of errors. Since there is some confusion about the correct spelling, it seems best to retain the original spelling.

Elmer (1938, p. 3614) misapplied the binomial *A. philippinense.* His description is based on two specimens, *Elmer 14993* and *15706,* identified herein as *A. crispum* and *A. simplex,* respectively. The description is based on *Elmer 14993.*

The relationship of *A. crispum* to other species is obscure. The long, scarious petiolar sheath is similar to that of *A. nitidum.* What is known of the cytology of cultivated material indicates that it is triploid (Pfitzer, 1957). There is a possibility that apomixis contributes to the stability of the distinctive features of this taxon; however, it should be maintained as a species until further information is available.

18. *Aglaonema stenophyllum*

Aglaonema stenophyllum Merrill, 1925, p. 452.

Stem erect, 25–100 cm tall, 0.6–3 cm thick. Internodes 0.5–1 cm long. Petioles (6) 7–17 (22) cm long, (0.2) 0.4–0.5 (0.8) times as long as the leaf-blade. Sheaths (3.5) 6.5–17 (22) cm long, (0.5) 0.8–1.0 times as long as the petiole. Leaf-blades sublinear to narrowly elliptic or lanceolate, (13) 20–35 (40) cm long, 2.9–7.5 (13) cm wide, length/width ratio 1 : (3.7) 4–9; base narrowly acute, rarely obtuse; apex gradually long acuminate; variegation usually none (but spots observable on lower leaf surface of *Nicolson 789*); venation more or less weakly differentiated into 4–12 primary lateral veins diverging from the midrib at 15°–30° (45)°. Peduncles 1–3 together, (5.5) 7.7–20 cm long. Spathe 5.5–7.5 cm long, 3–3.5 cm wide, decurrent for (0.4) 0.7–1.5 cm. Stipe (0.4) 0.5–1.0 cm long. Spadix 4.2–5.0 cm long, 1–1.7 cm short of spathe

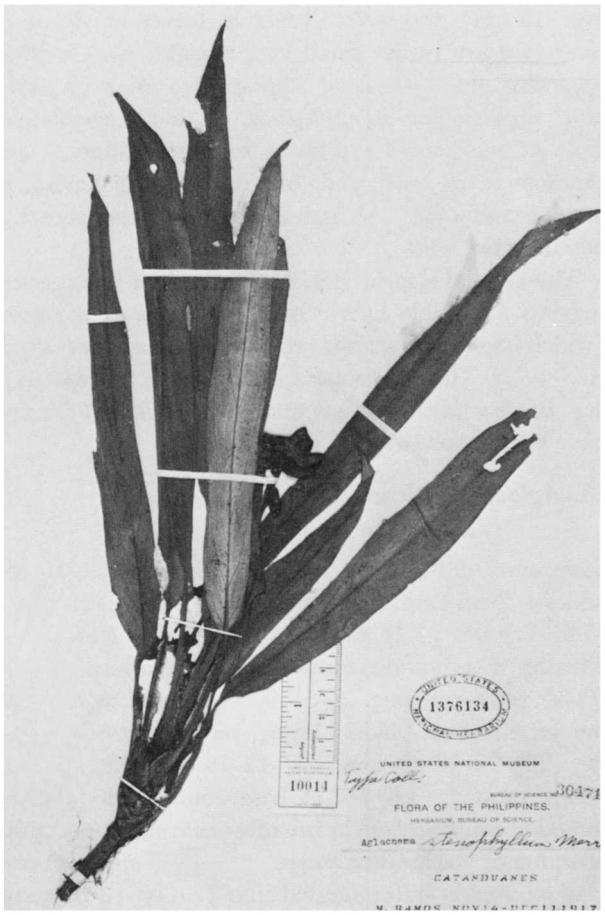

FIGURE 20.—Lectotype of *Aglaonema stenophyllum* Merrill: *Ramos, BS 30471* (US).

apex; pistillate portion 0.4 cm long, pistils 12–16 and slightly immersed, stigmas broad and styles contracted; staminate portion 3.8–4.6 cm long, 0.5–0.6 cm thick. Fruits green, turning yellow and then red, 1.5–1.6 cm long, 0.6–1.1 cm thick.

TYPE COLLECTIONS.—Philippines, Catanduanes, 14 November–1 December 1917, *Ramos, Bur. Sci. 30471* (holotype; PHN [lost]; lectotype: US): Samar, Catubig River, February 1910, *Ramos, Bur. Sci. 24141* (paratype: US); Tayabas [Camarines Norte], east coast, Mt. Cadig, December 1916, *Yates, Bur. Sci. 25413* (paratype: PHN [lost]; Biliran, June 1914, *McGregor, Bur. Sci. 18844* (paratype: PNH [lost]).

DISTRIBUTION.—Central Luzon to central Mindanao (Figure 8).

HABITAT.—Damp places in primary forest to 900 m.

This species is distinguished by its narrow leaves, long and scarious petiolar sheath, and long (usually over 10 cm) peduncles. Juvenile leaves of *A. densinervium are* rather small and elongate and have a surprising but superficial similarity to *A. stenophyllum. Aglaonema stenophyllum* is indistinguishable from *A. philippinense* so far as floral and inflorescence characters are concerned, but it differs in having a smaller petiole/blade-length ratio and a larger sheath/petiole ratio.

The general appearance of specimens of this species suggests a possible hybrid origin between *A. nitidum* (which has a long, scarious sheath) and narrow-leaved *A. simplex*. The short spadix (compared to the spathe) and the few pistils suggest that *A. marantifolium* may have been involved.

19. *Aglaonema densinervium*

Aglaonema densinervium Engler, 1906, p. 134.

Stem erect, 90–200 cm tall, 1.2–6.0 cm thick. Internodes 1–2 cm long. Petioles (14) 20–35 (50) cm long, (0.6) 0.7–0.9 (1.2) times as long as the leaf-blade. Sheaths membranous, sometimes subscarious, (8.5) 17–30 (45) cm long, (0.5) 0.7–1.0 times as long as the petiole. Leaf-blades elliptic, rarely narrowly elliptic, (22) 26–42 cm long, (9) 12–19 cm wide, length/width ratio 1:(1.8)2–2.7; base rounded to obtuse, sometimes subtruncate or broadly acute; apex abruptly acuminate; variegation none; venation undifferentiated or weakly differentiated into (7) 10–12 primary lateral veins diverging from midrib at 45°–60°. Peduncles 1–7 together, (13) 20–32 cm long. Spathe 6–11 cm long. 3–4 cm wide, decurrent for (0.5) 1–2 cm. Stipe (0.3) 0.5–1.2 (1.5) cm. Spadix 3–5.5 cm long, 1.5–3.5 short of spathe apex; pistillate portion 0.3–1.0 cm, the pistils 6–15, with contracted style and broad stigma; staminate portion 2.7–5.0 cm long, 0.4–0.8 cm thick, tapered. Fruits turning red, 1–2 cm long, 0.5–1.5 cm thick.

TYPE COLLECTION.—Philippines, Mindanao, Davao, near sea level, March 1904, *Copeland, Govt. Lab. 418* (holotype: B; isotype: US).

DISTRIBUTION.—Central and southern Philippines and northeastern Celebes (Figure 5).

HABITAT.—Near streams in disturbed or primary rain-forest up to 810 m.

Specimens of this species have been referred to *A. haenkei* (Presl) Schott (see "Dubious Binomials," p. 59, no. 2).

This species probably attains the greatest size of any in the genus, suggesting it may be related to the other two large species, *A. nitidum* and *A. marantifolium*. In many respects it combines characters of both: (1) the petiolar sheath may have a scarious or membranaceous margin, but it is nearly always membranaceous in *A. marantifolium* and scarious in *A. nitidum;* (2) the petiolar sheath is nearly equal to the petiole, as in *A. nitidum,* but the leaf-base usually is rounded to obtuse, as in *A. marantifolium;* (3) the spathe decurrency is rather long, like that in *A. nitidum,* but the stipe is rather long, like that of *A. marantifolium;* (4) the staminate portion of the spadix is rather long, like that in *A. nitidum,* but the pistils are few, as are those in *A. marantifolium;* (5) its distribution is intermediate and peripheral to both species.

Juvenile leaves of *A. densinervium* and unusually broad leaves of *A. stenophyllum* suggest a relationship that is unexpected when one compares the extremes of both.

As one might suspect from the key, it may be difficult to separate large *A. philippinense* from small *A. densinervium*. Although these two species may be closely related, the characters given in the key will usually distinguish them.

The Philippine material of *Aglaonema* is a rather confusing set of specimens that combine characteristics of *A. marantifolium, A. nitidum,* and *A. simplex*. To my mind, *A. densinervium* represents an overgrown intermediate between *A. nitidum* and *A. marantifolium*. It would be desirable to test this hypothesis with breeding and cytological studies. In the absence of such information, it is best to maintain it as a species.

20. *Aglaonema philippinense*

Aglaonema philippinense Engler, 1898, p. 21.
A. latifolium Engler, 1906, p. 134.

Stem erect to decumbent in older plants, 50–75 cm tall, 1–3.2 cm thick. Internodes 0.4–2.5 cm long. Petioles (6.5) 14–25 (35) cm long, (0.5) 0.7–1.0 (1.3) times as long as the leaf-blade length. Sheath membranous or scarious, rarely variegated (*Nicolson 829*), (5) 8–17 (25) cm long, (0.3) 0.5–0.8 (0.9) times as long as the petiole. Leaf-blades elliptic to narrowly elliptic, rarely oblong to narrowly oblong-elliptic, lanceolate or obovate, (11.5) 17–27 (39) cm long, (5) 8–13 (15) cm wide, length/width ratio 1:(1.6)2.1–2.9(3.8); base obtuse to rounded, rarely subcordate or broadly acute; apex often apiculate, acuminate, sometimes abruptly acuminate; variegation none; venation undifferentiated to weakly differentiated into 5–9 (15) primary lateral veins diverging from midrib at 45°–60° (75°). Peduncles 1–4 (5) together, (7) 8–17 (25) cm long. Spathe often apiculate, 5–9 cm long, 2–3.4 cm wide, decurrent for 0.5–1.5 cm. Stipe 0.3–0.8 (1.0) cm long. Spadix 1–2.5 cm short of spathe apex; 3–6 cm long; pistillate portion 0.2–0.4 cm long, pistils 8–13, stigma broad, style contracted; staminate portion 2.8–5.2 cm long, 0.3–0.5 cm thick. Fruits green, turning yellow and finally red, 1.1–2.0 (2.7) cm long, 0.6–0.9 (1.3) cm thick.

TYPE COLLECTION.—Philippines, Tayabas [Quezon], Atimonan August 1904, *Gregory, Govt. Lab. 86* (neotype: B).

DISTRIBUTION.—Philippines, Indonesia (Celebes), and associated archipelagos (Figure 8).

HABITAT.—Below 1000 m on slopes near streams in primary forests.

FLOWERING TIME.—May–July, correlating with the onset of monsoon.

Engler enumerated the following types in his original description of *A. philippinense: Gaudichaud s.n.* (B) from Manila; *Warburg 12494* from Monte Alban [Montalban]; and *Warburg 14604* from Mindanao. All of these were lost along with the Berlin herbarium except for *Warburg 14604,* which was later (1915) excluded by Engler and became the holotype of *Aglaonema cordifolium* Engler. Gaudichaud material from Manila does exist at Geneva, but it is annotated by Engler as *A. marantifolium.* Also, Engler (1915) cited Gaudichaud material from Manila in Paris as being *A. marantifolium.*

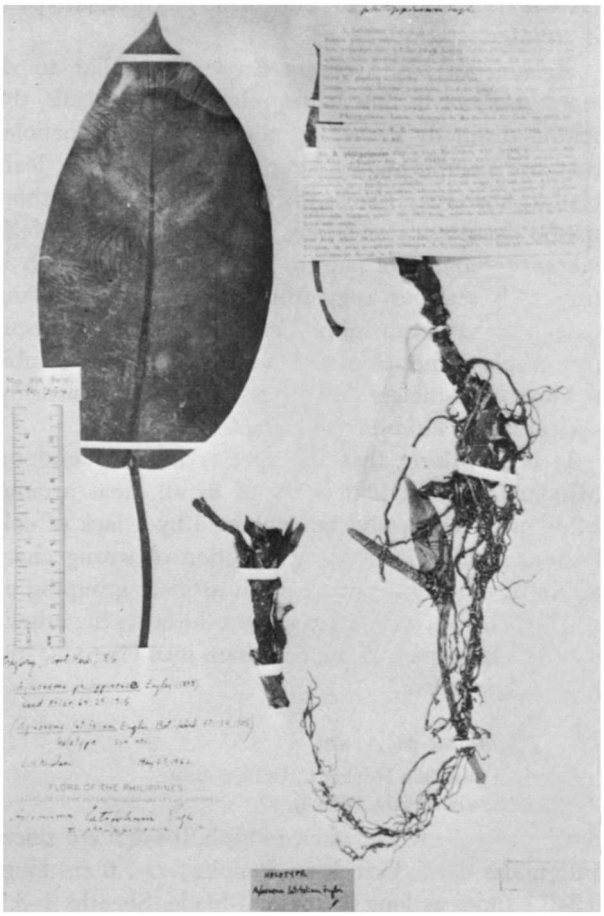

FIGURE 21.—Neotype of *Aglaonema philippinense* Engler, holotype of *Aglaonema latifolium* Engler: *Gregory, Govt. Lab. 86* (B).

In Engler's 1915 treatment of *A. philippinense,* one additional specimen was cited, the one selected here as neotype. It must be noted that the neotype of *A. philippinense* Engler (1898) is also the holotype of *A. latifolium,* which Engler published in 1906. Engler later, in 1915, indicated that he no longer regarded *A. latifolium* as distinct. In fact, he went so far as to redescribe *A. philippinense* (1915) with an almost exact copy of the original description of *A. latifolium,* in which the measurements are consistently larger than those appearing in the original description of *A. philippinense.* Since Engler and I are in agreement on the taxonomy, I have accepted the material introduced by Engler as neotype for *A. philippinense* although it is the holotype for *A. latifolium.*

Syntype material of the nomen nudum *A. simplex* f. *macrophyllum* Engler (1898, p. 21) is placed here

(*Koorders 16126, 16129,* and *16155*). The lectotype is *A. simplex.*

Aglaonema philippinense Engler is similar to *A. marantifolium* in that it has relatively few pistils, the spathe distinctly exceeding the spadix, and petioles that are comparatively long compared to the leaf-blades; however, it lacks the combination of the short spathe decurrency and long stipe characteristic of *A. marantifolium.* The margin of the petiolar sheath is frequently scarious, suggesting *A. nitidum,* but many specimens have a membranous margin. The specimens as a whole do not seem to have any significant combinations of characters that suggest a strong relationship with either *A. nitidum* or *A. simplex.*

It is surprising that the species is not found on Mindanao although it is found in all areas around Mindanao. This could be explained by a lack of collections from Mindanao or selection of wrong characters in the key resulting in an artifical grouping of specimens. I am inclined to suspect the latter hypothesis is true. This is part of the confusion involving all Philippine *Aglaonema.*

21. *Aglaonema pumilum*

Aglaonema pumilum Hooker f., 1893, p. 530.
A. marmoratum Engler, 1915, p. 17.

Stem decumbent(?), often reddish, 0.3–0.5 cm thick. Internodes 0.3–1.3 cm long. Petioles 3.5–7.0 cm long, 0.3–0.7 times as long as the leaf-blade. Sheaths 1–3.5 cm long, 0.2–0.8 times as long as the petiole. Leaf-blades ovate to lanceolate, 8–13.2 cm long, 2.3–5.2 cm wide, length/width ratio 1:2–2.9; base often unequal, usually rounded, obtuse to truncate; apex gradually acuminate; variegation absent or ashy-blotched on the upper leaf surface; venation not or only weakly differentiated into 3–4 primary lateral veins diverging from midrib at 45°; texture rather coriaceous. Cataphylls frequent, interspersed with leaves, like brown paper, 3–4 cm long. Peduncle solitary, 3–5 cm long, often equaling the petiole. Spathe 2–4.5 cm long, 1–1.5 cm wide, decurrent for 0.4–1.0 cm. Stipe present(?). Spadix thin-cylindric, 0.8–2.0 cm short of spathe apex, 1.5–2.0 cm long; pistillate portion 0.2–0.4 cm long, pistils ca. 5; staminate portion 1–1.7 cm long, 0.2–0.3 cm thick. Fruits 1–1.5 cm long, 0.5–0.8 cm thick.

TYPE COLLECTION.—Burma Mergui, *Griffith s.n.* (lectotype: K); India, Assam, Lushai Hills, Chappedon, February 1827, *Wallich, E. India Co. 8960B* (syntype: not seen). There is some doubt about the identity of Wallich's collection since the locality, Chapa

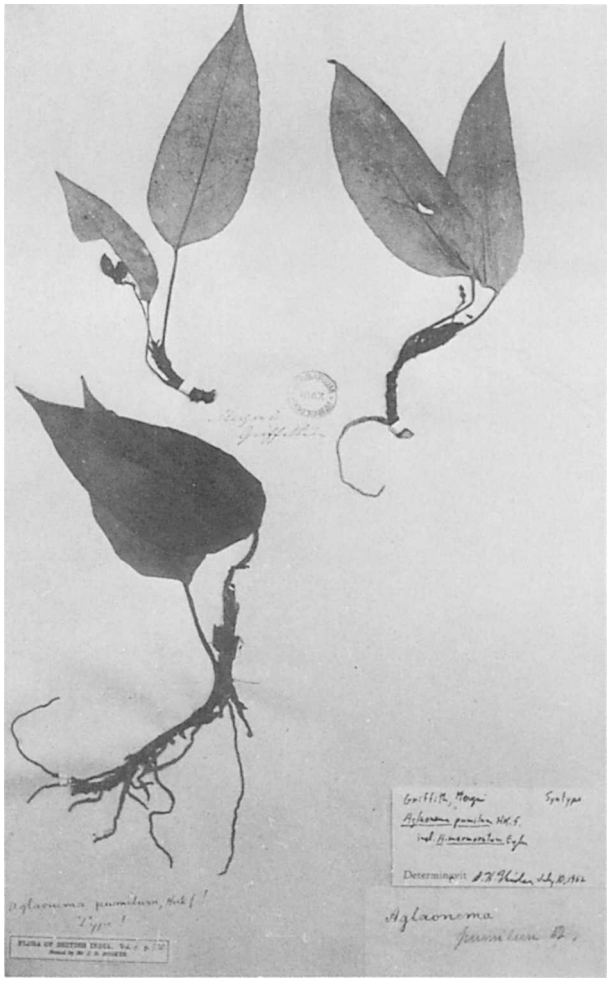

FIGURE 22.—Lectotype of *Aglaonema pumilum* Hooker f.: *Griffith s.n.* (K).

Tong Hill, is about 700 miles away from what appears to be the range of *A. pumilum.* I was unable to find Wallich's specimen at Kew, Calcutta, or any of the herbaria I visited. Since Griffith's specimen is in fruit, Wallich's specimen must be the basis of Hooker's description of the spathe.

DISTRIBUTION.—Lower Burma and peninsular Thailand (Figure 6).

HABITAT.—In evergreen forest.

Among the Schottian drawings at Vienna, "Schott, Aroideae Nr. 68" is labelled "8900 Wallich Cat. Chappedong, Feb. 1827 Herb. Benth." This label is incorrect. Study of *Wallich, E. India Co. 8960A* (not B) from Singapore clearly shows that this is the basis of *"Schott, Aroideae Nr. 68."* This error is critical since

Wallich, E. India Co. 8960A is the holotype of *A. minus* (*A. nebulosum* f. *nanum* herein).

The type of *A. marmoratum* is: Hort. Bot. Calcutta, 18 April 1896, *Prain s.n.* (holotype: CAL). Engler did not cite the collector's name, but he did cite a specimen flowering in Calcutta in April 1896. This specimen meets those requirements and has been annotated by Engler as *A. marmoratum.* I can see no reason to maintain *A. marmoratum,* except perhaps as a variegated form of *A. pumilum.* In the original description of *A. marmoratum,* Engler (1915) commented: "Species imperfecte cognite et fortasse cum priore [*A. pumilum*], cujus inflorescentia ignota, conjugenda." My studies indicate that Engler's hypothesis is correct.

The relationships of this species are obscure. There is a possibility that it should be placed in the section *Chamaecaulon* in that it may be repent, there are cataphylls among the leaves, and it usually has very short petiolar sheaths; however, it may only be decumbent, the cataphylls do not clasp the petioles as they do in *Chamaecaulon,* and one specimen, *Brown s.n.,* has sheaths 2–3.5 cm long. Gagnepain annotated the Thai collections as *A. costatum* var. *virescens.* The thin-cylindric spadix, however, much shorter than the spathe, is unlike that species.

There is also a possibility that the spadix is sessile and these is no stipe, indicating a possible relationship with *A. modestum* or *A. ovatum;* this seems rather dubious and *Brown s.n.* does not appear to have a stipe.

Dubious Binomials

1. *Aglaonema discolor*

Aglaonema discolor Hort. ex. Gentil, 1907, p. 11.—Engler, 1915, p. 34. [Nomen nudum.]

2. *Aglaonema haenkei*

Aglaonema haenkei (Presl) Schott, 1859, p. 30.
Caladium seguinum sensu Presl, 1827, p. 148 [not Ventenat, 1800].
Scindapsus haenkei Presl, 1851 ["1849"], p. 240.

TYPE.—Philippines, *Haenke s.n.* (not seen).

According to Steenis-Kruseman (1950, p. 209), about 9000 of Haenke's collections are in Prague, part in the National Museum, and part in the Charles (German) University. Through the kind efforts of Drs. A. Pilat and C. G. G. J. van Steenis, I had the opportunity to study all Presl types of Araceae from the Czechoslovakian National Museum. The type of *A. haenkei* was not there. It may be at Charles University.

A study of Presl's description (1851) suggests that *Scindapsus haenkei* is not an *Aglaonema* and may belong to the Monsteroideae. The following is a translation of the description of the inflorescence and flowers: "Spadix cylindrical, a third shorter than the spathe, sessile, covered with bisexual [his "pseudohermaphroditus"] flowers: filaments 4, flat, fuscous; anthers cordate, bilocular; ovary quadrangular, cuneate, apex truncate and with a short stigmatic chink." This description would fit a number of the Monsteroideae very nicely but none of the Philippine *Aglaonema* in which the spadix is not sessile, the flowers are clearly unisexual, the stamens are thick and never have flattened filaments, and the pistil is never quadrangular with a truncate apex.

Despite this description and apparently without seeing the type of *Scindapsus haenkei,* Schott (1859, p. 30) transferred the epithet to *Aglaonema.* Study of the Schottian drawings in Vienna and Cuming's specimens in Kew revealed that *Cuming 863* (K) is the basis of Schott's understanding of *Scindapsus haenkei* and not Haenke's material. This material, as well as subsequent material cited by later authors as *A. haenkei,* is treated herein as *A. densinervium.*

Cuming 863 (K), despite considerable usage as such, cannot even be considered as a neotype of *Scindapsus haenkei* since it does not agree with Presl's description of the inflorescence. Without seeing type-material I hesitate to treat *A. haenkei* as anything more than a dubious species although I strongly suspect it should be entirely excluded from *Aglaonema.*

3. *Aglaonema ?immaculatum*

Aglaonema ?immaculatum Hort. ex Engler, 1915, p. 33.

TYPE.—None cited, none found.

Engler described his plant as having an abbreviated stem, a glaucous, purple petiole, and a blade that was glaucescent above and purple and glaucous below. The plant was of unknown origin and cultivated at the Berlin-Dahlem Botanic Garden. It had not flowered and Engler stated that he was not certain that the plant belonged to this genus.

The information does not fit any *Aglaonema* known to me. It may be juvenile material of some species of *Homalomena* although glaucescence in that genus is not known to me. In view of the uncertainty, it is best to treat *A. immaculatum* as a dubious binomial.

4. *Aglaonema maculatum*

Aglaonema maculatum Blume, 1837 ["1835"], p. 154.
Dracunculus Luzonis primus Camellus, 1704, p. 36.

HOLOTYPE.—Plate 195 by Kamel (Camellus) in Hans Sloane MSS. No. 4082 (British Museum of Natural History, Bloomsbury).

This species began its career as a "species dubium" and has remained as such although Merrill interpreted it in 1923. His disposal, however, was not satisfactory. The only clues were given by Kamel (1704): the plant came from Leyte and "Omauvana"; it was called "Gavay sin buaya" and "Panan quilon"; the leaves are covered with white spots ["folia . . . albis conmaculata notis"]; like "Pilá" and "Papaiya," scrapings of the roots when mixed with a little salt are efficacious in treating skin problems caused by contact with the irritating hairs ["pilosae"] of a plant called "Erucae Basul."

FIGURE 23.—Holotype of *Aglaonema maculatum* Blume.

Merrill (1923) stated:

> For some years I thought that this [i.e., *A. commutatum*] might be *Aglaonema maculatum* Blume. . . . I now suspect *Aglaonema maculatum* to be a form of *Aglaonema oblongifolium* Kunth [treated herein as *A. marantifolium*]. There is no evidence that *A. commutatum* Schott is of ancient cultivation in the Philippines.

Merrill was not aware of the fact that *A. commutatum* is native to the Philippines. Also, Merrill did not realize that *A. crispum*, another species with variegated leaves, is native to the Philippines.

Unfortunately, neither Kamel's drawing nor his description provide sufficient evidence for deciding whether *A. maculatum* really pertains to *A. commutatum* or *A. crispum*.

5. *Aglaonema treubii*

Aglaonema treubii Engler, 1898, p. 22; emended by Engler, 1915, p. 19, fig. 5.

LECTOTYPE.—Figure 5 in Engler (1915).

In the original description of *A. treubii*, Engler cited two specimens, *Koorders 16173* and *16146* from Minahassa, Celebes. He also noted: "Vide quoque specimina in horto Bogoriensi culta." Later, Engler (1915) emended his description, excluded the specimens from the Celebes (transferred to *A. haenkei*), and cited only "Bot. Garten Buitenzorg." Unfortunately, the original material at Bogor is no longer extant. It seems logical to accept Engler's (1915) drawing as a lectotype. The drawing of the inflorescence seems to me like *A. simplex*. The general aspect of the plant and the large number of pistils supports this disposition; however, it should be noted that Engler (1915) described the leaves as marked with irregular variegations along the midrib. Although this pattern is unknown to me in *Aglaonema*, except in *A. vittatum* Engler, it frequently occurs in *Schismatoglottis* and *Dieffenbachia*.

The two syntypes of *A. treubii*, *Koorders 16146* and *16173*, cannot be identified. The former collection (BO) has only seeds. The latter collection is only a leaf (L) and a sheet with labels (BO). They do appear to belong to the genus *Aglaonema*.

Excluded Species

1. *Aglaonema? cuscuaria* (Aublet) Miquel, 1856, p. 217 [=*Scindapsus cuscuaria* (Aublet) Presl, 1851 ("1849"), p. 242].

2. *Aglaonema griffithii* Schott, 1856, p. 123 [=*Aglaodorum griffithii* (Schott), 1858, p. 58].

3. *Aglaonema mannii* Hooker f., 1869, pl. 5760 [= *Culcasia mannii* (Hooker f.) Engler, 1887, p. 84].

4. *Aglaonema palustre* Teijsmann and Binnendijk, 1863, p. 399 [=*Aglaodorum griffithii* (Schott) Schott, 1858, p. 58].

5. *Aglaonema? pygmaeum* Hasskarl, 1842, p. 10 [=*Homalomena pygmaea* (Hasskarl) Engler, 1898, p. 18].

6. *Aglaonema subundulatum* Zollinger ex Schott, 1856, p. 123 [=*Schismatoglottis subundulatum* (Schott) Nicolson, new combination].

Aglaonema subundulatum was provisionally published by Zollinger (1854, vol 1, p. 76) and was later validated by Schott (1856). A specimen of *Zollinger 1075* in the Drake herbarium (Paris) has Zollinger's handwritten labels identifying it as *Aglaonema subundulatum*. It clearly belongs to the genus *Schismatoglottis*. Also at Paris there is a duplicate seen by Engler (unlike the specimen in the Drake herbarium) that lacks Zollinger's identification and is the holotype of *Schismatoglottis celebica* Engler (1898, p. 19). Schott's epithet clearly has priority over Engler's and I, therefore, propose the new combination above.

Identification List

In this list there are ennumerated the fertile, numbered collections of *Aglaonema* that I have studied. Sterile specimens are usually omitted, as are specimens without a collector or number. The numbers in italics refer to the taxa as numbered in this work; types are indicated by "(T)" after the collector's number.

The collector's name is always used unless it did not appear on the duplicates (for example, "*King's Collector 10421*" is used rather than "[*Kunstler*] *King's Collector 10421*"). Kunstler's name does not appear on any of the duplicates of this particular number. Only by comparison of the date and locality of the collection with information given by van Steenis-Kruseman (1950, p. 282) can it be shown that Kunstler was Sir George King's collector in this case. As another example, "*Koorders 26731*" is used rather than "*Mangoenkromodiredjo, Koorders 26731*" since the actual collector's name appears only on the first duplicate. This policy means that any duplicate will immediately be recognizable from the citation (the purpose of citing specimens) although, in these very rare cases, the actual collector's name is not cited.

The number of a collection is cited directly after the collector's name if the number belongs to a single numerical series belonging to the collector. If the collector, however, used several numerical series (i.e., Beccari used several series that were called "Piante Bornensi," "Piante Papuanae" etc.) or the numerical series did not belong to the collector, then special abbreviations are interposed between the collector's name and the number. These abbreviations are becoming standardized (Jacobs, 1968). Jacobs' abbreviations have been adopted with the following additions: BGL=Bureau of Government Laboratories, Philippine Islands (this series was used by collectors such as Bolster and Elmer in the early 1900s). EIC=East India Company (this series was applied to specimens in the museum of the East India Company that were distributed and numbered by Wallich in the early nineteenth century; the specimens were collected by many different collectors such as De Silva, Gomez, Griffith, Helfer, Porter, and Wallich in India, Burma, Pakistan, Nepal, and Malaya). PGH=Philippine Government Herbarium (this series was used by collectors such as Copeland and Gregory in the early 1900s). REP=Reporter for Economic Products (this series was used in India, Pakistan, and Burma by collectors such as Burkill, Das, and Hooper, in the early 1900s).

Abraham 3106: *16e;* 3107: *1b;* 3108: *2b*. Achmad 487 (T), 1009 (T): *13*. Adelbert 205: *13;* 239: *15;* 243: *13*. Ahmad 89: *13*. Ajoeb Exp. Jacobson 509: *6*. van Alderwerelt van Rosenburgh 340: *2a;* 244: *6;* 245: *2a;* 352: *17;* 353: *6;* 355 (T): *13;* 356, 357: *6;* 358 (T): *16c;* 360, 361 (T): *13;* 368: *6;* 369: *4;* 372 (T): *10a*. Alston 780: *17;* 790: *6;* 792: *2b;* 13564: *10b;* 13565, 13566: *13;* 13567: *16e;* 13568, 14017, 14601: *6;* 15396: *4;* 15398: *15;* 16053, 16431: *19;* 16477: *16b;* 17072: *2a*. Alvins 580: *13;* 1887: *10a;* 1974: *7b;* 2109, 2115: *13*. Amdjah Exp. Genderen Stort 90: *13;* Exp. Nieuwenhuis 384: *7b;* 474, 482, 550: *10a*. Anderson SAR 2812, 8023, 8056: *7b;* 11715: *13;* 12331: *10a;* 12533: *13*. Añoneuvo PNH 13521: *19;* 13751: *18*. Asdat 53: *10a*.

Backer 7034, 14931, 21039, 23130, 23738, 24852, 30568: *13*. Bailey and Bailey 229: *16e;* 230: *17*. Baker 5575: *13*. Bakhuizen van den Brink 1735, 2245, 3129, 4926, 6249, 7691: *13*. Bakhuizen van den Brink Jr. 1339: *13;* 2040: *16e*. Balansa 266, 2049, 2052, 2064: *3*. Bartlett 6649: *6;* 6739: *9?;* 6854: *16d;* 7688, 7708, 8169: *6;* 14663, 14889: *20*. Beccari P.B. 159: *7b;* 1279: *10a;* 1615: *13;* 2051: *10a;* P.P. 798: *15*. Beguin 1175: *15*. Beumèe 1914, 2373, 3669, 5042, 5684, 6750: *13*. Bloembergen 4222: *20;* 4230: *13;* 4451: *20;* 4623: *13*. Boerlage 522: *15*. Bolster BGL 130: *20*. Bon 2540, 3712: *3a*. Borrsum Waalkes 263, 422: *13;* 3107: *15*. Broadway 9180: *16e*. Brooke 8450: *13;* 8797, 8872, 9382: *7b;* 9876, 10700: *13;* 10717: *7b*. Bünnemeijer 513, 630: *6;* 1859, 2033, 2080: *13;* 2102, 2105: *7b;* 2215, 2232, 3631: *13;* 4161, 4283: *6;* 4311 (T): *13;* 4343: *6;* 4351 (T): *13;* 4499, 4636, 4671, 4992, 5477: *6;* 5917: *13;* 6601: *8;* 6876, 6953: *13;* 7039 (T): *7b;* 7044 (T), 7113: *13;* 7161, 7163: *8;* 7179, 7189 (T): *13;* 7345: *8;* 7382: *13;* 9105,

9261, 9391, 9510: *6;* 7813: *13.* Bunting 275: *10b;* 276: *20;* 1346: *16h;* 1369: *16m;* 1370: *16l;* 1371: *10b;* 1372: *16j;* 1457: *16l;* 1544: *1b;* 1545: *16c;* 1546: *16l;* 1548: *6.* Burdick 4093: *17.* Burkill SFN 912: *13;* 3086, 3136, 6301: *10a;* 6524, 7018, 7648: *7b;* R.E.P. 28046, 36623: *5;* and Haniff SFN 12966: *13.* H. Burkill 1862: *10a;* 1888: *7b;* and Shah 186, 197: *13.* Buwalda 4732, 5776: *15;* 6338: *6;* 6629: *8.*

Cadière 27: *3a;* 29: *4.* Castro PNH 6498: *18;* 6549: *20.* Celestino and Ramos PNH 23072: *20.* Chevalier 32003: *12;* 32011 (T): *11.* Chun 6426: *4.* Clarke 8266 (T): *5.* Clausen 76: *4;* 82, 85, 429: *16e.* Clemens 1113: *15;* 10003, 10442: *13;* 10490: *15;* 17640: *20;* 20686: *13;* 21950: *10a;* 22366: *13;* 22479: *10b;* 22555: *16d;* 22556: *16e;* 22581: *20;* 26142, 26703: *10a;* 26820, 29133, 31149, 40985: *13.* Cloun 6426: *4.* Collins 581, 766: *12.* Copeland PGH 418 (T): *19.* Corner SFN 32462: *7b;* and Ngadiman SFN 37088a: *13.* Cramer 20: *6;* 52: *13;* 53: *6.* Cuming 863: *19.* Curtis 1326: *10a;* 1721, 1881 (at Kew): *13;* 1881 (at SING): *10a;* 2636, 2679: *13;* 2813 (T): *2a;* 2834: *16d;* 3820, 3821: *13.*

Dames 39: *6.* Danser 7811: *13.* Darnton 481: *13.* Das REP 34952: *5.* Derry 572, 613: *7b.* De Silva EIC 4441: *5.* Docters van Leeuwen 5384, 5412 (T): *13.* Dress 1667: *16e.*

Eberhardt 4196: *3.* Edaño BS 24790: *13;* 24914: *19;* 26794: *20;* 26856: *16e;* 46049: *20?;* 76362: *16e;* 77358, 78290: *20;* PNH 3589, 4118, 6731: *20;* 15341: *18;* 15544: *19;* 21909: *20;* and Guttirez PNH 38450: *13.* Elbert 3160, 3169, 3207: *13.* Elmer 6759: *16e;* 10119: *19;* 14993: *17;* 15706, 16520 (T): *13;* 17668: 20?; 18182: *13;* BGL 6433: *20.* Endert 4680: *13.* Engler Exsicc. 73: *16e;* 74 (T): *4;* 288: *13;* Reise Java 4070 (T): *16d;* 4080 (T): *2b;* 4089 (T): *13.* Evrard 478: *12.* Eyma 2819, 3480: *15.*

Falconer 327: *13.* Fénix BS 12585: *20;* 26139: *19;* 29899: *18.* Forbes 298, 1259: *13;* 1685: *6.* Forman 158, 321: *13.* Fox PNH 4685, 4822, 4999, 8938: *20.* Frake PNH 38043, 38288, 38338: *13.* Franck 1377: *4.*

Galoengi 422: *13.* Gamble 6766A, 7888: *5.* Gibbs 6164: *15.* Godefroy 169: *12;* 316: *11.* Gomez EIC 8961B: *13.* Gregory BGL 86 (T): *20.* Griffith EIC 5981 (T): *13;* 5982: *5;* 5984, 5985: *13.* Guillou 23: *15.*

Haan 10, 48, 97: *7b.* Hallier 242, 676: *7b;* 1769: *10a;* 2003: *7b;* 3034, 3350: *10a.* Hance 11459: *4.* Haniff and Nur SFN 2906, 7159: *10a;* 10124: *13;* 10365: *10a.* Harmand 1435 (Pierre 3347) (T): *3.* Helfer EIC 5992, 5993: *13;* 5994 (T): *10c.* Henderson SFN 18221, 18500, 20122: *13;* 21853, 22293, 22879, 29145, 29635: *10a.* Henry 12287: *3.* Herre 1179: *20.* Hewitt 11: *13;* 13: *10a;* 43: *7b.* Holttum 9341, 10297: *10a.* Hooker and Thomson 2131: *5.* Hooper REP 25974: *5.* Horsfield 193: *13.* Hume 7245: *7b;* 9260: *10a.* Huttleston 1887: *13;* 1907: *9.*

Iboet 244, 391: *13.* Ilias Paie SAR 8320: *13.* Irsan 34: *13.*

Jacobson 127: *6.* Jaheri Nieuwenhuis Exped. 673 (T): *7b;* 1567: *13.* Jelinek 196: *13.*

Kamphoevener 2578: *13.* Kanjilal 6363: *5.* Karta 75: *16e.* Kasin 607: *3.* Keith 9419: *13;* SFN 44593: *13.* Kerr 1160 (T): *4;* 2070, 3005, 7010: *12;* 7087: *1a;* 7966: *11;* 9020, 10765 (mixed with *11*): *12;* 10864, 11558: *10a;* 12868: *11;* 12893, 13968: *10a;* 14369: *12;* 14562: *10a;* 14658, 17581: *12;* 18786: *10a;* 18880, 19096: *12;* 19365: *21;* 19440: *12;* 19527, 19729: *11;* 20370 (T): *3b;* 20525: *11;* 20899: *3;* 21263: *2b;* 21776: *3.* Kiah SFN 35006: *10a;* 35244: *12;* 35294: *13;* 36967 *10a.* King's Coll. [Kunstler] 537 (T), 4023: *13;* [Chaudering] 5652: *10a;* [Kunstler] 6158: *13;* 10421 (T): *7b.* Kjellberg 474: *20;* 1768: *13.* Kloss 55, 66: *13;* 6724: *10a;* SFN 14670: *13.* Kondo and Edaño PNH 38823: *20.* Koorders 16126, 16129: *20;* 16146 (T); *dub. bin. 5;* 16155: *20;* 16173 (T): *dub. bin. 5;* 16174: *19;* 16179: *13;* 19434: *16b;* 19646: *20;* 20336, 20674, 20700, 26105, 26240, 26241, 26731, 30001, 30105, 30809, 30811, 31125, 31126, 32000, 33472, 33474, 33905, 34995, 40678, 40698, 41196: *13.* Kostermans 359: *13;* 2881: *15;* 10522, 10569: *13;* and Anta 244, 782: *13;* et al. 218: *13;* Kwae Noi River Exped. 359 (mixed with *3*), 998: *2d;* 1129: *13.* Kurz 240, 263, 1901, 2664: *13.* Kuswata and Soepadmo 85: *15.*

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