NOTES ON SOME AROIDS ALONG THE RIO NEGRO, BRAZIL

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The popular conception of the Amazon basin is a vast flat region covered with dense forest and inhabited largely by alligators, boa constrictors, and a bewildering array of plant life. While this conception contains elements of truth, it differs from reality in several respects. To begin with, much of the terrain is not especially flat, but is relieved by cliffs and ravines, rolling hills and rocky outcrops. The forest, though dense along the river margins, is often quite open away from the rivers, especially in those regions with sandy soils. And the flora, while quite diverse in some families, is poor in species for others, including the orchids and aroids. The Brazilian state of Amazonas, which covers more than 15% of the area of tropical South America, has an aroid flora of only about seventy species. Many of these aroids, including those along the Rio Negro, were first collected and studied in the 1850's by the English botanist Richard Spruce, but they have received little attention since and only a few are known in cultivation.

In the fall of 1978 I spent several months collecting plants along the Rio Negro in the western Amazon in connection with the Projecto Flora Amazonas, an ambitious undertaking to prepare a new flora of the Amazon. Although my chief research interests on this expedition were not directed to aroids, I was able to make observations and collections of a number of species.

We started off in Manaus, the capital city of Amazonas, where we spent several weeks collecting in nearby forests and making preparations for our river trip. Manaus is located on the banks of the Rio Negro a few miles above its junction with the Amazon, and the various bayous and creeks which run through the city are lined with thriving stands of *Montrichardia arborescens* (L.) Schott, a large terrestrial aroid which obviously benefits from the sewage-enriched waters of the city. Engler (1911) recognized two species of *Montrichardia*, and several others have been described on the basis of differences in leaf shape and spini-

Research supported by NSF grant No. INT 77-17714.

Figure 1. Juvenile form of an unidentified *Philodendron* near Manaus.

ness of the stems. However, it seems to me that the genus has only a single species which is both genetically variable and phenotypically quite plastic. Plants growing along small shady streams often have slender smooth stems only 1cm thick and deeply lobed, nearly tripartite leaves, while those of more open and sunny habitats have thicker, sometimes spiny stems to 7cm thick, and sagittae-cordate leaves. These extremes and various intermediates are to be found throughout Amazonia, depending on local habitat. There is little variation in flowers and fruits.

Though formerly Manaus could be reached only by boat, it is now connected to several branches of the Amazon highway system. Like all new roads in the tropics, these are simlutaneously a boon and a disaster for botanists. In the early stages they provide easy access to previously remote forests, but that access is equally open to the crowds of colonists who within a few years destroy the forests. The roads connecting to Manaus are at an intermediate stage where widespread destruction is evident but patches of good forest are still easily reached. During the first weeks we had an opportunity to collect plants along several of these roads.

Perhaps the richest locality for aroids was a tall forest near Igarape' Tarumã, a popular weekend bathing resort reached in 15 minutes from downtown Manaus by public transport. A half hour walk from the bus stop leads to a large area of only mildly disturbed forest abounding in palms, marantas, and aroids. At Tarumã, as elsewhere in Amazon, *Philodendron* is the most abundant and diverse aroid genus, in contrast to the rest of tropical America where anthuriums are pre-eminent.

One of the commonest species at Tarumã is *Philodendron distantilobum* Krause, a climbing species with finely divided pinnate leaves. This shows considerable variation in the width of the pinnae, with the most attractive clones having narrow pinnae deflected upward from the midrib. These forms seem hardly distinct from *Philodendron elegans* Krause of horticulture.

Figures 2 & 3. *Philodendron myremecophilum*: occurring in an ant-garden with *Aechmea* and *Peperomia*; ants feeding at the extrafloral nectaries.

Another species at Tarumã with horticultural potential is *Philodendron traunii* Engler, a self-heading species with persistent fibrous cataphylls, growing either terrestrially or epiphytically. In situations where they receive a high level of light the stiff, shovel-shaped leaves of *P. traunii* have bright red petioles and red veins, and are quite striking in appearance.

To me the most interesting philodendrons in this area were two species of very plain appearance, *Philodendron myrmecophilum* Engler and *P.* c.f. *thaliifolium* Schott. These were most abundant in stands of dead trees that had been killed by flooding due to road construction, and in most, individual colonies of arboreal ants had constructed their homes among the roots. These were in fact the famous ant-gardens of the Amazon, arboreal ant nests harboring combinations of a dozen or so species of epiphytes, including gesneriads, bromeliads, epiphyllums, and peperomias. What was special about the ant-garden philodendrons, and had apparently not been noticed previously, is that they produce

Figures 4 & 5. Two of the many forms of the *Philodendron williamsii - P. speciosum* complex that abound along the Rio Negro.

abundant sugary fluid from a ring of nectaries located at the junction of the petiole and the leaf lamina, and the ants feed eagerly on this fluid. The nectaries are elements of a mutually beneficial relationship between ants and epiphytes in which the ants serve the philodendrons as pugnacious bodyguards and bring soil and debris to pack around the philodendron roots in building their nests, thus providing nutrition to the plants. In turn, the philodendron roots provide a framework for the nests and the nectaries are a source of food for the ants. Other ant-garden epiphytes, including the gesneriads, have extrafloral nectaries. The biology of these ant-gardens is reported in detail elsewhere (Ule 1901, Madison 1979a, 1979b).

The road from Manaus north to the Venezuelan border traverses a region of sandy soils and rather low forest not especially rich in aroids. However, several aroids are well established as roadside weeds, in-

Figure 6. Another variant in the *Philodendron williamsii - speciosum* complex, upper Rio Negro.

cluding *Philodendron goeldii* G.M. Barroso (formerly *Thaumatophyllum spruceanum* Schott). This is a self-heading species with pedately divided leaves, and like many of the other philodendrons of subgenus *Meconostigma* the ripe fruits, which we were lucky enough to find, are quite tasty with a flavor combining elements of pineapple and banana. *Philodendron goeldii* not only grows terrestrially in sandy soil at the roadsides, but also occurs in deep forest as a treetop epiphyte.

By the end of September we had completed our preparations for the river trip, but just before our planned departure the building at the botanical institute that housed our equipment, specimens, and cameras burned to the ground. We spent another week scrounging up substitute equipment and finally in early October set off in a small river boat on a 1000 mile journey up the Rio Negro toward the Colombian border.

Our boat, the Pyatã, had a slow speed diesel engine, and its steady *ga-dunk ga-dunk ga-dunk* came to permeate our lives. During the day a few of us would shoot ahead upriver in a speedboat, collecting plants along the river margins or occasionally entering the forest. When we had a full load of material we would drop back to the Pyatã to prepare our specimens.

Our collections from the lower part of the river were almost entirely of trees and woody vines. There were hardly any herbs or epiphytes to be had, and the aroids were represented chiefly by a single abundant species of *Philodendron* allied to *P. williamsii* Hook.f. These are massive epiphytes, in some areas adorning nearly every tree along the river, and with thick roots hanging sixty feet or more to the water. This species is apparently adapted to the river margins, for it is rare in the interior of the forest.

We travelled upriver in this fashion, making steady progress until we reached the mouth of the Rio Marié where we tied up for several days. Immediately on shore

Figure 7. Inflorescence of *Urospatha* c.f. *sagittifolia*

from our docking spot was a large stand of *Urospatha* c.f. *sagittifolia* (Rodsch.)Schott with the elegant helically twisted spathes typical of that species but differing chiefly in the marking of the spathe, which was pale yellow green with purple spots.

The best aroid find at Rio Marié was *Alloschemone occidentalis* (Poeppig)Engler & Krause, a genus of pinnate-leaved climbers that had been collected only twice before, in 1830 and in 1934. I had a premonition I might find this species, because in a Manaus bookshop I had seen a postcard of a river scene on the alto Rio Negro, and in the upper corner was unmistakably a leaf of *Alloschemone*. Although I had earlier considered this to be a species of *Scindapsus* (Madison 1976), examination of live plants showed it to be quite distinct. The species has several features unusual for the Araceae: full leaves are produced only at every fifth or sixth node with the other nodes bearing cataphylls, and the stem has a cambium which produces very thick corky wings in the older portions. Although *Alloschemone* was abundant in this forest, I was unable to find any flowering or fruiting material.

Two other aroids related to *Alloschemone* occur at the Rio Marié. These are species of *Rhodospatha* with thick leathery leaves, apparently allied to *R. pachysperma* Madison of Colombia in that each berry has only 1 or 2 fairly large hard seeds. Finding this type of seeds in a neotropical species is disturbing for it blurs the lines of generic distinction among the

Figure 8. Leaf of *Alloschemone occidentalis*.

Monsteroideae. But then nature is notoriously indifferent to our carefully constructed schemes of classification, and such exceptions are to be expected.

From the Rio Marié we continued upriver at a slow pace to São Gabriel where a series of whitewater rapids denies further progress to large boats. Here we tied up for a week and made collections in several nearby forests. Up to this point we had not seen a single *Xanthosoma* or *Caladium*, surprising considering their abundance elsewhere in the neotropics, but at São Gabriel I at last found a small population of a caladium

Figure 9. A *Caladium* species with tripartite leaves, allied to *C. macrotites.*

Figure 10. Leathery leaf of *Anthurium ptarianum* on the Serra Curicuriarí.

allied to *C. macrotites* Schott, a tiny species with variegated ternate leaves. This was native to an open forest on white sand soil of which the chief understory plant was a small cycad, *Zamia* sp.

Also growing on open sandy soil along the road from the port to town were two other aroids, a bird-nest anthurium (aff. *A. solitarium* Schott) and large stands of the giant *Philodendron speciosum* Schott. Both were abundantly flowering and fruiting and seemed well established in the man-made habitat they occupy.

Collecting inland from the river at a tall forest near the São Gabriel airport I turned up an apparently undescribed species of *Dieffenbachia* with thick, entirely green leaves and 8 tiny inflorescences produced at each node. Also abundant in this forest was *Heteropsis spruceana* Schott, a shrubby vine that hardly looks like an aroid at all. Its long aerial roots are collected by the natives who strip off the cortex and use the remaining fibers for basket work and wicker work of the highest quality. When fresh these decorticated roots are as tough and as flexible as nylon parachute cord.

São Gabriel was our turning-around point, but instead of heading directly back to Manaus we nosed up the Rio Curicuriari', a

Figure 11. *Philodendron speciosum* abounds along the road from Porto Camanaus to São Gabriel.

branch stream, until we were near the base of an isolated sandstone mountain, the Serra Curicuriari' Two of us made a three day trip to climb the mountain, at the top of which we found an elfin forest rich in bryophytes and orchids. But more interesting was a zone of taller wet forest just below the peak. The dominant understory plant in this zone is a species of *Zamia* with spiny leaves up to 3m long and fat cones up to 25cm tall. Growing terrestrially among the zamias were two anthuriums, one still unidentified and the other *Anthurium ptarianum* Steyermark, new to Brazil. The latter species is endemic to the sandstone mountains of the Guiana shield, and was previously known from Venezuela and from the Cordillera Macarena in Colombia where it was described as *Anthurium idroboanum* Schultes. Also common in this forest was an epiphytic aroid, *Stenospermation spruceanum* Schott, with bright yellow fruits.

Figures 12 & 13. *Heteropsis spruceanum*. 12. The author seated on bundles of decorticated roots of *Heteropsis*, destined for the basket-weaving industry. In the background are baskets of white clay and bundles of fibers of a palm, *Leopoldina* sp., used in the manufacture of brushes. 13. A fruiting branch of *Heteropsis spruceanum*. (Fig. 12 photo by H. A. Kennedy).

Figure 14. *Philodendron goeldii* near Manaus. In the upper right is a palmatisect leaf of *Anthurium eminens*.

Our trail from the Curicuriarí back to the boat traversed a grove of very elegant small palms *(Lepidocaryum* sp.), and we returned to spend half a day collecting seeds of this for the Palm Society, finding at the same time *Spathiphyllum cannaefolium* (Dryand.) Schott along a stream.

By this time the crew of the Pyatã was getting restless, and so reluctantly we headed downriver back to Manaus. Although we had abundant plant collections stored in the hold it was clear that they represented only a fraction of the material in the area. Our collection of 36 aroid species from the Rio Negro probably includes most of the commonest ones, but undoubtedly many rare species of local distribution remain to be discovered.

Literature Cited

Engler, A. 1911. Araceae-Lasioideae. Das Pflanzenreich IV 23 C.

Madison, M. T. 1976. Alloschemone and Scindapsus. Selbyana 1- 325-327.

_____. 1979a. Epiphytes and Ants. Bull. Marie Selby Bot. Gard. 6: 1-4.

_____. 1979b. Additional observations on the ant-gardens of Amazonas. Selbyana 5 (in press).