Aroids of the Penrissen Highlands, Sarawak

Peter C. Boyce
Honorary Research Fellow
Institute Of Biodiversity and Environmental Conservation (IBEC)
Universiti MalaysiaSarawak
94300 Kota Samarahan
Sarawak, Malaysia
phymatarum@gmail.com

Wong Sin Yeng
Department of Plant Science & Environmental Ecology
Faculty of Resource Science & Technology
Universiti MalaysiaSarawak
94300 Kota Samarahan
Sarawak, Malaysia
sywong@frst.unimas.my

Visitors to most of Sarawak's cities and larger towns - Kuching, Sri Aman, Sarikei, Sibu, Bintulu, and Miri - might easily gain the impression that Malaysia's largest state consists almost exclusively of rather monotonous expanses of meandering and intersecting river flood plains interspersed with large groves of nipa palms and mangrove. This is perhaps unsurprising given that all of Sarawak's major conurbations are situated on the estuaries of large rivers - a reflection of Sarawak's past (and to some extent current) dependency on river transport. However, in actuality Sarawak is the most mountainous state in Malaysia and although many of the mountain ranges are deep inland and not easily accessible, most of the main conurbations lie close to readily accessible pristine forested mountainous areas. The state capital, Kuching, is especially well-provided with easy-to-reach areas of outstandingly beautiful tree-clad uplands, preeminent of which is the Penrissen Range - locally called Puncak Borneo (which translates as Borneo Heights), a steep Paleogene sandstone escarpment thrust though surrounding Cretaceous limestone to the south of the likewise enchanting and geologically diverse horseshoe-shaped Miocene Bungo Range, with the southern precipitous edge of the Penrissen Range marking the boundary of SW Sarawak with the NW part of Indonesian Borneo (Kalimantan) - Figures 1 - 3 - and with the highest point, Gunung Penrissen, exceeding 1300 m (Figure 4). Less than one hour by good road from Kuching, the Penrissen Range is made even more readily accessible by the fact that the Borneo Highlands Resort, an exclusive golf club and spa resort artfully built on the historically logged-over plateau below the main range of peaks, maintains an excellent all-weather road enabling simple access to the base of the forested slopes and peaks that could otherwise only be reached by a demanding ascent on foot.

Figure 1. Map of west Sarawak with the Penrissen area indicated by a yellow rectangle.

Figure 2. Enlarged portion of the yellow rectangle from Figure 1. Note the horseshoe-shaped Bungo Range to the NE of the Penrissen Range.

Figure 3. Topographical map of Figure 2.

Figure 4. Gunung Penrissen viewed from the resort.

For several years we have been surveying the aroid flora of the Penrissen area, including the lowland approaches to the Penrissen Highlands, with their significant and outstanding largely undisturbed Karst limestone formations. In that time it has become clear that much of the terrestrial and rheophytic aroid flora of the Penrissen area are composed of undescribed species. Although still very much a work in progress, it is timely to offer an overview of what we know to date in advance of several technical papers that we have in various stages of preparation. This short communication deals with the aroid flora of the highlands itself. The equally fascinating flora of the lowland Karst will be the subject of another note in the future.

One of the first things to draw the attention on arriving at the resort is how cool it feels as compared with the lowlands. The main plateau below the peaks is at about 900 m and on average feels about 10°C (ca 25°F) cooler than the lowlands. This is, however, somewhat deceptive since the cooling of the almost constant breezes accounts for as much of the cooler atmosphere as do actual lower temperatures. Indeed, one of the main differences between the lowlands and highlands is the lower *night time* temperature of the highlands, where 15°C (59°F) is more typical than the 23° (ca 74°F) that is the average in Kuching.

Initially the area around the resort Club House and Golf Course, while beautifully maintained, seems rather sterile for anyone craving for the "jungle", but it is worth spending the time en-route to the trail head to look beyond the immaculately maintained areas of ornamental exotics. As stated above, the plateau was logged over in historical times, and consequently the stream that passes through the area was formerly a forest stream in which species adapted to higher light endure to this day and show every sign of flourishing. Among such are large clumps of an undescribed *Ooia* growing on the boulders virtually to the exclusion of any other aroid (Figures 5 - 8).

Figure 5. A new species of *Ooia* growing on exposed water-washed rocks.

Figure 6. A new species of *Ooia* growing on exposed water-washed rocks.

Figure 7. A new species of *Ooia* growing on exposed water-washed rocks.

The areas along the side of the golf course are interesting for the large numbers of Bornhardts with patches of moist forest between and drier forest on their tops. The moist forest in the gulches is home to several species of shade-requiring *Schismatoglottis*, such as *S. simonii* S.Y. Wong (Figures 9 - 13), a plant with strongly aromatic tissues (a rare occurrence in *Schismatoglottis*), petioles ribbed somewhat in the manner of celery, and distinctive white spathes that melt into a viscous brown mess at the conclusion of flowering. The occurrence of *S. simonii* at Puncak Borneo is rather unexpected as it is typically a species from lowland Karst limestone. Another *Schismatoglottis* present in the deep peat deposits between these house-sized sandstone boulders is an undescribed species with glossy emerald green leaves on deep plum-purple petioles (Figures 14 & 15). This species is remarkable in the manner in which older leaves, if they chance to become buried by leaf litter, are capable of producing plants from the junction of the leaf blade and the petiole (Figures 16 - 18).

Figure 8. Inflorescence of the new *Ooia*, with the nearside spathe artificially removed. The *Colocasiomyia* flies on the spathe interior are feeding on moisture secreted by glands.

Figure 9. *Schismatoglottis simonii* S. Y. Wong. This is a species more typically associated with forested lowland limestone.

Figure 10. *Schismatoglottis simonii* S. Y. Wong. Here the distinctive ribbed petioles are clearly seen. The tissues of the plant smell strongly of turpentine.

Figure 11. *Schismatoglottis simonii* S. Y. Wong. Inflorescence at pistillate anthesis.

Figure 12. *Schismatoglottis simonii* S. Y. Wong. Inflorescence at late staminate anthesis, with the spathe limb deliquescing.

Figure 13. *Schismatoglottis simonii* S. Y. Wong. An emerging inflorescence flanked by developing infructescences, the fruits are enclosed inside the persistent lower spathe. Note the scar on the lower spathe rim where the limb has been shed.

Figure 14. An undescribed *Schismatoglottis* species occurring in deep shade between large boulders.

Figure 15. Undersurface of the leaf blades of the *Schismatoglottis* in Figure 14. Note, too, the ribbed purple-red petioles.

Figure 16. Plantlet developing on an old leaf of the new *Schismatoglottis*.

Figure 17. Detail of the plantlet developing in Plate 16.

Figure 18. Root system of the plantlet developing in Plate 16.

The management of the Borneo Heights Resort maintains several excellent forest trails, including a 6.1 km (3.8 miles) trail to the summit of Gunung Penrissen. The Jungle Trail is ca 4 km (ca 2.5 miles) long with alluring mix of riverine, gallery, and ridge top vegetation runs along a series of ridges and valleys through beautiful upper hill oak-laurel forest at an average of 1000 m (3280 ft). Notwithstanding an abundant aroid flora other families in abundance include Zingiberaceae (Figures 19 & 20), Gesneriaceae (Figures 21 - 23), and the genus *Hanguana* (Hangunaceae: Commelinales), the last represented by three species, all undescribed - Figures 24& 25.

Figure 19. *Geocharis rubra*, a

Figure 20. A species of *Globba*, one of at least three *Globba*

Figure 21. *Agalmya*, a gesneriad that forms long

spectacular ginger occurring in areas of shady, moist forest.

species found in the Penrissen Range.

creeping/rooting stems on compacted peat deposits and occasionally climbs on tree trunks.

Figure 22. One of the several spectacular *Cyrtandra* (Gesneriaceae) occurring in the Penrissen highlands. These flowers are individually 6.5 cm (ca 2.5 inches) long.

Figure 23. *Cyrtandra* with solitary scarlet flowers.

Figure 24. Two of the three new species of *Hanguana* (Hanguanaceae) to be found in the Penrissen Range.

Figure 25. The third *Hanguana* - this producing large fruits ripening to black.

After an initial steep but mercifully brief accent clambering over entangled tree roots and boulders the Jungle Trail becomes reasonably level with the early portions following a wet ridge-line with significant peat deposits to either side. Species of *Homalomena* are common here, including *H. subcordata* Engl. (Figure 26), a new species of the *Homalomena* Hanneae Complex (Figures 27 - 29), and what is likely also a new species of the *Homalomena* Giamensis Complex (Figures 30 - 32), the last producing characteristic resin-like secretions from between the staminate flowers. A species of *Hestia* which differs from *H. longifolia* (Ridl.) S. Y. Wong & P. C. Boyce, regularly forms large stands in these shady moist trail-side peats (Figures 33 - 37). As the trail reaches slightly drier parts an *Alocasia* reminiscent of the limestone-obligated *A. ridleyi* A. Hay species begins to appear (Figures 38 - 41). On these slightly drier peat deposits below the trail there grows a *Schismatoglottis* belonging to the taxonomically difficult Asperata Complex, superficially somewhat similar to a new species known from the lowland limestone along the road to the foot of the Penrissen range, but among other characteristics differing by the matte, not glossy, leaf blade (Figures 42 & 43). Eventually the trail reaches a more open area of ridge-top *kerangas* - the local name for forest on podzolic soils - along a wide ridge that forms the edge of a forested escarpment falling almost 1000 m to an upland plateau. At the base of the escarpment lies the border with Indonesia. Along this escarpment perimeter *Alocasia peltata* M. Hotta makes its appearance in a deep green and a silver grey leaf-bladed morph (Figures 44 - 47). *Alocasia peltata* is a lower montane species, very seldom occurring below 1000 m (3280 ft). There are similar and very likely closely related *Alocasia* species in the NW Bornean lowlands, for example *Alocasia beccarii* Engl., which is also a species of *kerangas*, as well as in Peninsular Malaysia (*Alocasia perakensis* Hemsl.), and Sumatera (*A. kerinchiensis* A. Hay). In the brightest and driest situations an undescribed species of *Scindapsus* in the diverse and woefully under-described Coriaceus Complex occurs (Figures 48 & 49). Species of this complex, much like Neotropical *Stenospermation*, are vegetatively very similar, with almost smooth leaf blades, and particularly as herbarium material are nearly impossible to determine, and can only be successfully worked on from living plants. In the most exposed places but wetter depressions along this ridge there are a few plants of *Colocasia oresbia* A. Hay (Figure 50), a species that is indigenous on Borneo, as compared with taro - *C. esculenta* (L.) Schott, which is introduced as a carbohydrate crop and green vegetable and often occurs as a roadside escape from cultivation.

Figure 26. *Homalomena subcordata* Engl.

Figure 27. A new *Homalomena* in the species-rich Hanneae Complex.

Figure 28. Almost ripe infructescence of the *Homalomena* in Figure 27.

Figure 29. Another view of the almost ripe infructescence in Figure 28.

Figure 30. A new species of *Homalomena* of the Giamensis Complex displaying the typically bright green, somewhat rubbery leaf blades.

Figure 31. Inflorescence of

Figure 32. Detail of the

Figure 33. A species of *Hestia*, probably new, occurring on

the new *Homalomena* in Figure 30. Note the resin-like substance on the staminate portion of the spadix.

resin-like substance secreted from between the staminate flowers of the new *Homalomena* in Figure 30.

deep peat deposits.

Figure 34. A species of *Hestia*, probably new, occurring on deep peat deposits.

Figure 35. Detail of the leaf blade tip for the *Hestia*.

Figure 36. Developing infructescences on the *Hestia*.

Figure 37. Ripe infructescence of *Hestia*. The lower spathe has spilt longitudinally to reveal and release the fruits, most of which have fallen.

Figure 38. *Alocasia* species near to *A. ridleyi* A. Hay.

Figure 39. Synflorescence of the *Alocasia* cf. *ridleyi*.

Figure 40. *Alocasia* cf. *ridleyi* - inflorescence just before pistillate anthesis.

Figure 41. *Alocasia* cf. *ridleyi* - inflorescence just before pistillate anthesis with nearside spathe artificially removed.

Figure 42. An undescribed species of *Schismatoglottis* in the Asperata Complex.

Figure 43. Detail of the petiole of the new *Schismatoglottis* in Figure 42.

Figure 44. Green leaf bladed morph of *Alocasia peltata* M. Hotta.

Figure 45. Grey leaf bladed morph of *Alocasia peltata* M. Hotta.

Figure 46. *Alocasia peltata* M. Hotta, inflorescence at pistillate anthesis.

Figure 47. Mature infructescence of *Alocasia peltata* M. Hotta with the persistent lower spathe

beginning to be shed to exposed the ripe fruits.

Figure 48. A new species belonging to the *Scindapsus* Coriaceus Complex, species of which always occur in exposed, dry positions.

Figure 49. Inflorescence of the new species of *Scindapsus* Coriaceus Complex. At anthesis the very thick spathe barely opens. Inflorescences of the species in this complex are powerfully fragrant at anthesis.

Figure 50. *Colocasia oresbia* A. Hay, a Bornean-indigenous montane species.

After approximately 1 km (ca .7 miles) the trail turns north away from the border and enters a deep, wide stream valley with a much wetter ecology of deep leaf litter over yellow leached clays. Here the canopy is much loftier and consequently much less light reaches the forest floor and the terrestrial aroid flora changes. Notable are stands of a locally endemic as yet undescribed *Alocasia* appearing (Figures 51 & 52), two taxonomically new colonial *Schismatoglottis* species, including one with a striking metallic-iridescent leaf blade (Figure 53), and scattered individuals of *Amorphophallus infundibuliformis* Hett., A.Dearden & A.Vogel with its characteristic white-warted petiole (Figures54 - 56). The larger, taller boles along the trail support several species of both *Rhaphidophora* and *Scindapsus*, the most striking of which is *Rhaphidophora korthalsii* Schott with its markedly different juvenile and adult morphologies (Figures 57 & 58), and *Scindapsus glaucescens* (Engl. & K.Krause) Alderw. one of several large-growing species occurring on Borneo and distinct by the leaf blades waxy matte grey beneath and by the shoot tips sheathed in dense matted pale ginger fibres (Figures 59 & 60). The steep banks of the small streams in the valley provide sheltered conditions favouring *Pedicellarum paiei* M. Hotta, a curious species evidently very closely allied to *Pothos* but differing by having the individual flowers pedicellate (Figures 61 - 63). The small rocky streams are colonized by *Bucephalandra akantha* S. Y. Wong & P. C. Boyce, a recently described species restricted to acid geologies in NW Sarawak and adjacent Kalimantan Barat (Figures 64 - 67).

Figure 51. An undescribed species of *Alocasia* so far known only from the Penrissen Highlands.

Figure 52. Detail of the undersurface of the leaf blade of the *Alocasia* species in Figure 51.

Figure 53. A new species of *Schismatoglottis* with iridescent leaf blades.

Figure 54. *Amorphophallus infundibuliformis* Hett., A.Dearden & A.Vogel occurs sporadically on shaded deep peat deposits throughout western Sarawak.

Figure 55. *Amorphophallus infundibuliformis* Hett., A.Dearden & A.Vogel showing the distinctive large white warts on the petiole.

Figure 56. *Amorphophallus infundibuliformis* Hett., A.Dearden & A.Vogel - inflorescence at pistillate anthesis.

Figure 57. Juvenile shingling stage of *Rhaphidophora korthalsii* Schott.

Figure 58. Adult plant of *Rhaphidophora korthalsii* Schott.

Figure 59. *Scindapsus glaucescens* (Engl. & K. Krause) Alderw. Is one of several large-growing species occurring on Borneo. The leaf blades are distinctively waxy matte grey beneath.

Figure 60. Shoot tip of *Scindapsus glaucescens* (Engl. & K. Krause) Alderw. showing the diagnostic pale ginger fibres.

Figure 61. *Pedicellarum paiei* M. Hotta.

Figure 62. Detail of the distinctive leaf-tip of *Pedicellarum paiei* M. Hotta, viewed from the undersurface.

Figure 63. Inflorescence of *Pedicellarum paiei* M. Hotta showing the individually pedicellate flowers. Image © Alison Church.

Figure 64. *Bucephalandra akantha* S. Y. Wong & P. C. Boyce is a recently described species restricted to acidic geology in NW Borneo.

Figure 65. Inflorescence of *Bucephalandra akantha* S. Y. Wong & P. C. Boyce at pistillate anthesis.

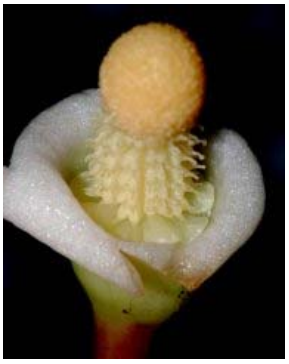

Figure 66. Inflorescence of *Bucephalandra akantha* S. Y. Wong & P. C. Boyce at late staminate anthesis - note that the shield-like staminodes have reflexed, blocking access to the developing fruits.

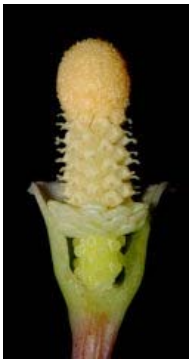

Figure 67. Inflorescence of *Bucephalandra akantha* S. Y. Wong & P. C. Boyce at late staminate anthesis with nearside spathe artificially removed to show the position of the reflexed shield-like staminodes.

Soon after the last of these forest streams the trail again rises to form a wide deep peat deposit running along a ridge, but in this case the ridge is heavily shaded and subsequently has a quite different flora to the earlier drier ridges. Two notable aroids occurring on these moist shaded peats are *Arisaema laminatum* Blume, which looks to

be a new record for Borneo of this species that was originally described from Jawa (Figures 68 - 72), although superficially similar plants are known from the Crocker Range in western Sabah, and an undescribed species of *Schismatoglottis* in the Patentinervia Complex (Figures 73 - 76).

Figure 68. *Arisaema laminatum* Blume - likely a new species record for Borneo.

Figure 69. *Arisaema laminatum* Blume.

Figure 70. *Arisaema laminatum* Blume.

Figure 71. *Arisaema laminatum* Blume - the dark band and white area are diagnostic for this species.

Figure 72. *Arisaema laminatum* Blume. Inflorescence with nearside spathe removed to reveal the spadix. This is a male plant. The sex of the inflorescences is regulated by the robustness of the plant. Young or weak plants flower male; robust mature plants flower female.

Figure 73. Undescribed species of the *Schismatoglottis* Patentinervia Complex.

Figure 74. Inflorescence of the *Schismatoglottis* species in Figure 73, at pistillate anthesis.

Figure 75. Inflorescence of the *Schismatoglottis* species in Figure 73, at pistillate anthesis.

The trees on this final ridge also support the juveniles of two further aroid species that are much more typically associated with limestone ecologies - *Rhaphidophora tenuis* Engl. (Figure 77) and what has typically been determined as *Pothos ovatifolius* Engl. (Figure 78), although it now seems increasingly probable that the species is restricted to the Philippines, and possibly eastern Borneo, and that the plant in western Borneo is undescribed.

Figure 76. Inflorescence of the *Schismatoglottis* species in Figure 73, at pistillate anthesis, with nearside spathe removed to reveal spadix.

Figure 77. Juvenile stage of *Rhaphidophora tenuis* Engl.

Figure 78. Juvenile stage of what has been identified as *Pothos ovatifolius* Merr. but which is probably an undescribed species.

To date the Penrissen Highlands has records for 44 species of aroid in 13 genera, of which probably 17 species (more than 38%) are taxonomic novelties. As a percentage of terrestrial and rheophytic aroids alone, this means almost 55% of species are undescribed.