Mitsuru Hotta's Aroid Legacy

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Mitsuru Hotta (1937-2015), justly regarded as catalytic in the renaissance of interest in tropical Asian Araceae beginning in the 1960s, produced a remarkable legacy of published works. Although primarily species-level taxonomic in focus, notably for the Schismatoglottideae and Homalomeneae, groups in which he had an especial interest, (e.g., Hotta 1965b, 1966a,b, 1967), later, at least for aroids, Hotta's work incorporates one of the first vegetative morphometric analyses for aroids, (Hotta 1985; Hotta et al. 1985), and included or encouraged studies on speciation (Okada & Hotta 1987), population dynamics (Okada 1989), cytotaxonomy (Okada 1986), and pollination (Kato et al. 1989). Hotta's earliest papers dealt with aspects of the botany of Tonga (Hotta 1963), and the morphology of juvenile plants of *Arisaema* (Hotta 1964).

Hotta published 42 new aroid species (**Appendix A**), and additionally made new combinations for a further eight pre-existing taxa (**Appendix B**). Based on current taxonomic opinions 48 of Hotta's aroid species are still accepted either in the genus Hotta proposed, or as a new combination (**Appendix C**).

Hotta proposed four new genera, three of which, *Furtadoa*, *Pedicellarum*, and *Phymatarum* are currently accepted. The fourth, *Heteroaridarum*, was subsumed into *Aridarum* Ridl. by Bogner & Hay (2000) but is set to be both resurrected and expanded in light of extensive molecular and morphological analyses of *Aridarum*.

In addition to aroids, Hotta alone or jointly proposed 32 new taxa in other families (**Appendix D**).

Hotta's aroid eponymy are the genus *Hottarum* Bogner & Nicolson (**Figs 1-8**), *Schismatoglottis hottae* Bogner & Nicolson (**Figs 9-12**) and *Amorphophallus hottae* Bogner & Hett.

Figure 1. *Hottarum truncatum* (M.Hotta) Bogner & Nicolson

Figure 2. *Hottarum truncatum* (M.Hotta) Bogner & Nicolson

Figure 3. *Hottarum truncatum* (M.Hotta) Bogner & Nicolson

Figure 4. Habitat of *Hottarum truncatum* (M.Hotta) Bogner & Nicolson

Figure 5. *Hottarum* sp. nov.

Figure 6. *Hottarum* sp. nov.

Figure 7. *Hottarum* sp. nov.

Figure 8. *Hottarum* sp. nov.

Figure 9. *Schismatoglottis hottae* Bogner & Nicolson

Figure 10. *Schismatoglottis hottae* Bogner & Nicolson

Figure 11. *Schismatoglottis hottae* Bogner & Nicolson

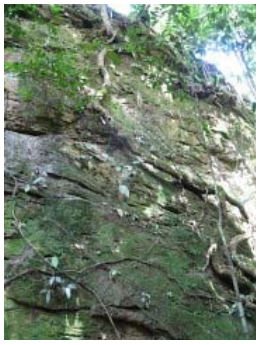

Figure 12. Habitat of *Schismatoglottis hottae* Bogner & Nicolson

Borneo

Researching for his Doctoral dissertation (Hotta 1969, 1970, 1971) Hotta spent from the end of September 1963 until late March 1964, with a brief period in Sabah, undertaking aroid-focussed fieldwork in Sarawak and Brunei (Hotta 1965a). These six months were formative for Hotta and in terms of species outputs are unmatched even by his Sumateran fieldwork in the 1980s.

Of particular note during this Borneo period is a week towards the end of March spent at Gunung Mulu, in NE Sarawak. During this time Hotta made the first systematic study of the remarkably rich aroid flora of the Mulu limestones. Taxonomic outputs from his time at Mulu include the description of several Mulu endemics: *Bucephalandra* (then *Microcasia*) *muluensis* (**Figs 13-18**), *Schismatoglottis multinervia* M. Hotta (**Figs 19-26**), the remarkable limestone chasmophyte *Schismatoglottis monoplecanta* M.Hotta (**Figs 27-33**), and *Schismatoglottis muluensis* M.Hotta (**Figs. 34-38**). Other notable species described from Mulu, although not restricted to there, are *Schismatoglottis colocasioidea* M.Hotta (**Figs 39-42**), *Alocasia sarawakensis* M.Hotta (**Figs 43-46**), and *Phymatarum montanum* M.Hotta (the last now considered synonymous with *P. borneense* M.Hotta).

Figure 13. *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 14. *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 15. *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 16. *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 17. *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 18. *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 19. *Schismatoglottis multinervia* M.Hotta

Figure 20. *Schismatoglottis multinervia* M.Hotta

Figure 21. *Schismatoglottis multinervia* M.Hotta

Figure 22. *Schismatoglottis multinervia* M.Hotta

Figure 23. *Schismatoglottis multinervia* M.Hotta

Figure 24. *Schismatoglottis multinervia* M.Hotta

Figure 25. *Schismatoglottis multinervia* M.Hotta

Figure 26. *Schismatoglottis multinervia* M.Hotta

Figure 27. *Schismatoglottis monoplacenta* M.Hotta

Figure 28. Habitat of *Schismatoglottis monoplacenta* M.Hotta

Figure 29. *Schismatoglottis monoplacenta* M.Hotta

Figure 30. *Schismatoglottis monoplacenta* M.Hotta

Figure 31. *Schismatoglottis monoplacenta* M.Hotta

Figure 32. *Schismatoglottis monoplacenta* M.Hotta

Figure 33. *Schismatoglottis monoplacenta* M.Hotta

Figure 34. *Schismatoglottis muluensis* M.Hotta

Figure 35. *Schismatoglottis muluensis* M.Hotta

Figure 36. *Schismatoglottis muluensis* M.Hotta

Figure 37. *Schismatoglottis muluensis* M.Hotta

Figure 38. *Schismatoglottis muluensis* M.Hotta

Figure 39. *Schismatoglottis colocasioidea* M.Hotta

Figure 40. *Schismatoglottis colocasioidea* M.Hotta

Figure 41. *Schismatoglottis colocasioidea* M.Hotta

Figure 42. *Schismatoglottis colocasioidea* M.Hotta

Figure 43. *Alocasia sarawakensis* M.Hotta

Figure 44. *Alocasia sarawakensis* M.Hotta

Figure 45. *Alocasia sarawakensis* M.Hotta

Figure 46. *Alocasia sarawakensis* M.Hotta

The largest part of Hotta's Borneo sojourn was spent in what is now Bintulu Division, in the central north of Sarawak state. Here Hotta's discoveries went into overdrive - not surprisingly since almost every terrestrial aroid he encountered would at that time be undescribed - indeed to this day a substantial percentage of the aroids of Bintulu Division remain to be formally described. Among the remarkable plants he discovered and described is one of the most attractive *Pothos* species - *P. atropurpurascens* M.Hotta (**Figs 47-49**), and the extraordinary neotenic, shingling, climbing aroid *Rhaphidophora latevaginata* M.Hotta (**Figs 50-52**). Another *Rhaphidophora* described from Bintulu, the highly distinctive *R. subfalcata* M.Hotta subsequently turned out to be synonymous with an earlier described species, *R. megasperma* Engl. (**Figs 53-57**), neatly highlighting the difficulties associated with interpreting herbarium material of aroids. Other species of note discovered and described from Bintulu are the distichous-leaved *Homalomena geniculata* M.Hotta (**Fig. 58**), and two remarkably different *Alocasia* species, the gargantuan *Alocasia robusta* M.Hotta (**Figs 59-62**), and the diminutive montane *Alocasia peltata* M.Hotta (**Figs 63-66**); striking polarizations of this popular but nonetheless inadequately understood genus. These forgoing plants, as remarkable as they are, are still not the motherlode of Hotta's productive time in Bintulu. *That* designation unquestionably belongs to the tribe Schismatoglottideae, notably *Aridarum*, *Microcasia* as then circumscribed, and *Schismatoglottis*.

Figure 47. *Pothos atropurpurascens* M.Hotta

Figure 48. *Pothos atropurpurascens* M.Hotta

Figure 49. *Pothos atropurpurascens* M.Hotta

Figure 50. *Rhaphidophora latevaginata* M.Hotta

Figure 51. *Rhaphidophora latevaginata* M.Hotta

Figure 52. *Rhaphidophora latevaginata* M.Hotta

Figure 53. *Rhaphidophora megasperma* Engl.

Figure 54. *Rhaphidophora megasperma* Engl.

Figure 55. *Rhaphidophora megasperma* Engl.

Figure 56. *Rhaphidophora megasperma* Engl.

Figure 57. *Rhaphidophora megasperma* Engl.

Figure 58. *Homalomena geniculata* M.Hotta

Figure 59. *Alocasia robusta* M.Hotta

Figure 60. *Alocasia robusta* M.Hotta

Figure 61. *Alocasia robusta* M.Hotta

Figure 62. *Alocasia robusta* M.Hotta

Figure 63. *Alocasia peltata* M.Hotta

Figure 64. *Alocasia peltata* M.Hotta

Figure 65. *Alocasia peltata* M.Hotta

Figure 66. *Alocasia peltata* M.Hotta

Aridarum

Prior to Hotta's investigation *Aridarum* comprised a single species, *A. montanum* Ridl., described from a single individual by Ridley (1913). By

the 1960s *A. montanum* had not been recollected; indeed it has only very recently been refound far from the supposed Type locality (Boyce & Wong 2013). Hotta's fieldwork revealed two additional species he assigned to *Aridarum*, *A. caulescens* M.Hotta (**Figs 67-71**) and *A. longipedunculatum* M.Hotta (**Figs 72 & 73**). His field observations (although not stated in Hotta (1965b), almost certainly done at Mulu, where *A. purseglovei* is abundant on exposed shales along forest stream banks) also enabled him to correctly place Furtado's *Microcasia purseglovei* into *Aridarum* as *Aridarum purseglovei* (Furtado) M.Hotta (**Figs 74-77**). Remarkably there was more to come in the Kuching Herbarium (see below).

Figure 67. *Aridarum caulescens* M.Hotta

Figure 68. *Aridarum caulescens* M.Hotta

Figure 69. *Aridarum caulescens* M.Hotta

Figure 70. Habitat of *Aridarum caulescens* M.Hotta

Figure 71. *Aridarum caulescens* M.Hotta

Figure 72. *Aridarum longipedunculatum* M.Hotta

Figure 73. *Aridarum longipedunculatum* M.Hotta

Figure 74. *Aridarum purseglovei* (Furtado) M.Hotta

Figure 75. *Aridarum purseglovei* (Furtado) M.Hotta

Figure 76. *Aridarum purseglovei* (Furtado) M.Hotta

Figure 77. *Aridarum purseglovei* (Furtado) M.Hotta

Microcasia

In Hotta's time Beccari's *Microcasia* was still the subject of misinterpretation owing to errors in the original description of *Bucephalandra*, confusion that persisted until Bogner's critical paper on *Bucephalandra* (Bogner 1980) which showed the Type of *Microcasia*, *Microcasia pygmaea* Becc., belonged in *Bucephalandra*. Thus the three species assigned by Hotta to *Microcasia* (Hotta 1965b) are now in *Bucephalandra* - *M. muluensis* M.Hotta = *Bucephalandra muluensis* (M.Hotta) S.Y.Wong & P.C.Boyce; *M. oblanceolata* M.Hotta = *B. oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce **- Figs 78-83**), and *Hottarum* (*M. truncatum* M.Hotta = *Hottarum truncatum* (M.Hotta) Bogner & Nicolson). Nevertheless, Hotta's transferal of Furtado's *Microcasia purseglovei* (to *Aridarum*) makes it evident that Hotta was at least aware that *Microcasia* was heterogeneous.

Figure 78. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 79. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 80. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 81. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 82. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce

Figure 83. *Bucephalandra oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce

Schismatoglottis

The striking aspect of the new *Schismatoglottis* species Hotta described from Bintulu is just how distinctive they each are. *Schismatoglottis gamoandra* M.Hotta (**Figs 84-91**) remains still one of the most distinctive *Schismatoglottis* species yet described, notwithstanding that it may *just* be synonymous with *Schismatoglottis puberulipes* Alderw., a species based on fragmentary herbarium material from a cultivated plant of

imprecise origin. *Schismatoglottis erecta* M.Hotta (**Figs 92-95**), is highly individualistic, and reminiscent of *Piptospatha acutifolia*, described by Engler from Kalimantan Barat (Indonesian Borneo). This similarity was noted by Hotta, who transferred Engler's *Piptospatha acutifolia* into *Schismatoglottis* but unfortunately overlooked that the combination *Schismatoglottis acutifolia* pre-existed for a different species. A new name for Hotta's *S. acutifolia*, *S. schottii* Bogner & Nicolson (**Figs 96-98**), was proposed by Josef Bogner & Dan Nicolson (Bogner 1979).

Figure 84. *Schismatoglottis gamoandra* M.Hotta

Figure 85. *Schismatoglottis gamoandra* M.Hotta

Figure 86. *Schismatoglottis gamoandra* M.Hotta

Figure 87. Leaf blade venation detail of *Schismatoglottis gamoandra* M.Hotta

Figure 88. *Schismatoglottis gamoandra* M.Hotta

Figure 89. *Schismatoglottis gamoandra* M.Hotta

Figure 90. *Schismatoglottis gamoandra* M.Hotta

Figure 91. *Schismatoglottis gamoandra* M.Hotta

Figure 92. *Schismatoglottis erecta* M.Hotta

Figure 93. *Schismatoglottis erecta* M.Hotta

Figure 94. *Schismatoglottis erecta* M.Hotta

Figure 95. *Schismatoglottis erecta* M.Hotta

Figure 96. *Schismatoglottis schottii* Bogner & Nicolson

Figure 97. *Schismatoglottis schottii* Bogner & Nicolson

Figure 98. *Schismatoglottis schottii* Bogner & Nicolson

Hotta's time in Brunei, aside from aforementioned *Schismatoglottis hottae* (**Figs 9-12**), *Bucephalandra* (then *Microcasia*) *oblanceolata* (M.Hotta) S.Y.Wong & P.C.Boyce, reveled yet more new *Schismatoglottis*, including the peculiar *Schismatoglottis platystigma* M.Hotta (**Figs 99-102**), the smallest then and still *Homalomena minutissima* M.Hotta (**Fig 103**), and what was used as the Type species for the genus *Phymatarum* - *P. borneense* M.Hotta (**Figs 104-108**).

Figure 99. *Schismatoglottis platystigma* M.Hotta

Figure 100. *Schismatoglottis platystigma* M.Hotta

Figure 101. *Schismatoglottis platystigma* M.Hotta

Figure 102. *Schismatoglottis platystigma* M.Hotta

Figure 103. *Homalomena minutissima* M.Hotta

Figure 104. *Phymatarum borneense* M.Hotta

Figure 105. *Phymatarum borneense* M.Hotta

Figure 106. *Phymatarum borneense* M.Hotta

Figure 107. *Phymatarum borneense* M.Hotta

Figure 108. *Phymatarum borneense* M.Hotta

As if these field-discoveries were not in themselves remarkable, Hotta concluded his time in Borneo with a visit to the herbarium in Kuching. Here he happened upon two specimens that later formed the basis for two new genera: *Pedicellarum* and *Heteroaridarum* (Hotta 1976). *Pedicellarum paiei* M.Hotta is a pothoid with remarkable pedicellate flowers (**Figs 109-112**). *Heteroaridarum borneense* M.Hotta (currently called *Aridarum borneense* (M.Hotta) Bogner & A.Hay - **Figs 113-116**) is a locally endemic rheophyte from the Matang Massif of NW Sarawak, where it occurs on vertical waterfalls and is unique for the fan-like arrangement of the leaves.

Figure 109. *Pedicellarum paiei M.Hotta*

Figure 110. *Pedicellarum paiei M.Hotta*

Figure 111. *Pedicellarum paiei M.Hotta*

Figure 112. *Pedicellarum paiei M.Hotta*

Figure 113. *Habitat of Aridarum borneense (M.Hotta) Bogner & A.Hay*

Figure 114. *Aridarum borneense (M.Hotta) Bogner & A.Hay*

Figure 115. *Aridarum borneense (M.Hotta) Bogner & A.Hay*

Figure 116. *Aridarum borneense (M.Hotta) Bogner & A.Hay*

Borneo 'revisited'

Although the main thrust of Hotta's Bornean aroid publications ended in 1976, he 'revisited' the extraordinary flora of Sarawak in two papers with Josef Bogner. One of these (Bogner & Hotta 1983a) described a species of *Hottarum* from central Sarawak - *Hottarum sarikeense* Bogner & M.Hotta), and the other (Bogner & Hotta 1983b) publishing a new *Schismatoglottis*, *S. mayoana* Bogner M.Hotta, from the Matang Massif. Although subsequently *S. mayoana* (**Figs 117-119**) has enjoyed a taxonomically and nomenclaturally peaceful existence, *Hottarum sarikeense* has been merged with *Schismatoglottis* (Hay & Yuzammi 2000), before being moved to a new genus, *Schottarum*, as *Schottarum sarikeense* (**Figs 120-122**) on the basis of molecular and morphological evidence (Boyce & Wong 2008; Low et al. 2014).

Figure 117. *Schismatoglottis mayoana Bogner & M.Hotta*

Figure 118. *Schismatoglottis mayoana Bogner & M.Hotta*

Figure 119. *Schismatoglottis mayoana Bogner & M.Hotta*

Figure 120. *Schottarum sarikeense (Bogner & M.Hotta) P.C.Boyce & S.Y.Wong*

Figure 121. *Schottarum sarikeense (Bogner & M.Hotta) P.C.Boyce & S.Y.Wong*

Figure 122. *Schottarum sarikeense (Bogner & M.Hotta) P.C.Boyce & S.Y.Wong*

Sumatera

From the beginning of the 1980s Hotta turned his attention to Sumatera (Hotta 1984, 1986a,b), and in particular the Homalomeninae (now Tribe Homalomeneae - Hotta 1982). One of his earliest publications at this time was description of an extraordinary rheophytic species from

West Sumatera which he described as a new genus - *Furtadoa* (Hotta 1981), with a single species: *Furtadoa sumatrensis* M.Hotta (**Figs 123-126**). *Furtadoa* while very clearly allied to *Homalomena* differs by having each staminate flower with an associated pistillode, unistaminate staminate flowers, and basal placentation. Hotta (1985) transferred a long-anomalous West Malaysian *Homalomena* into *Furtadoa* - as *F. mixta* (Ridl.) M.Hotta (**Figs 127-129**), in a paper that described five new *Homalomena* from Sumatera. Hotta's work on *Homalomena* continued with the production of a checklist for Malesia (Hotta 1986c), and later description of a species with monostaminate staminate flowers [*Homalomema monandra* M.Hotta - Hotta (1993b)] which seemed to partially bridge between *Furtadoa* and *Homalomena*, although lacking pistillodes, and with typical *Homalomena*-like parietal placentation. Although by now mainly looking at *Homalomena*, and increasingly involved with projects outside the Araceae, Hotta continued with other aroid genera from time to time, including a check-list of the genus *Anadendrum* (Hotta 1986d), and description of yet another striking rheophytic aroid, *Schsimatoglottis okadae* M.Hotta (Hotta 1987 - **Figs 130-133**). *Schismatoglottis okadae* was transferred to the resurrected genus *Apoballis* by Wong & Boyce 2010).

Figure 123. *Furtadoa sumatrensis M.Hotta*

Figure 124. *Furtadoa sumatrensis M.Hotta*

Figure 125. *Furtadoa sumatrensis M.Hotta*

Figure 126. *Furtadoa sumatrensis M.Hotta*

Figure 127. *Furtadoa mixta (Ridl.) M.Hotta*

Figure 128. *Furtadoa mixta (Ridl.) M.Hotta*

Figure 129. *Furtadoa mixta (Ridl.) M.Hotta*

Figure 130. *Apoballis okadae (M.Hotta) S.Y.Wong & P.C.Boyce*

Figure 131. *Apoballis okadae (M.Hotta) S.Y.Wong & P.C.Boyce*

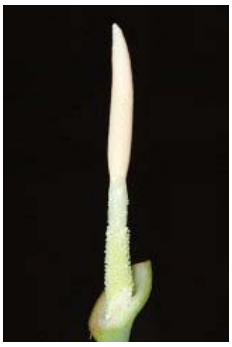

Figure 132. *Apoballis okadae (M.Hotta) S.Y.Wong & P.C.Boyce*

Figure 133. *Apoballis okadae (M.Hotta) S.Y.Wong & P.C.Boyce*

Hottarum

Mitsuru Hotta's eponymous rheophytic genus was subsumed into *Piptospatha* in 2000 (Bogner & Hay 2000). At that time *Hottarum truncatum* was known with certainty from only two collections, the Type, and an almost contemporaneous collection from a close-by locality along the same river. No other material could be incontrovertibly assigned to the species and no living plants were known in cultivation. And so the matter rested. Attempts to re-find *Hottarum truncatum* at the Type locality were in vain as much of the area has now been converted to *Acacia* plantation and in these situations rheophytes are among the first plants to die out as steams become clogged with exposed soil during the wet season while removal of the forest also allows light to reach the previously shaded areas favouring the growth of vigorous weedy species at the expense of the ecologically highly adapted rheophytes. Then, in 2013, a stroke of luck occurred when *H. truncatum* (**Figs 1-4**) was re-found in a remnant patch of riverine forest along the Sibu - Bintulu road, c. 40km SW from the Type locality, and was introduced into cultivation, where it proved to be easy, albeit slow-growing. As so often happens in these situations, almost at the same time a 'mystery' plant collected about 80km south of the locality, from Kapit, flowered in the research collection here and proved to be a second species of *Hottarum* (**Figs 5-8**). Subsequent molecular analyses of these plants, along with a wide range of *Piptospatha* and other Schismatoglottideae, and revealed that *Hottarum* is both distinct from, and indeed not even closely related to, *Piptospatha*.

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Appendix A

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Appendix D

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Burmanniaceae

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Convallariaceae

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Poaceae

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