PROGRAMME BOOK

Contributions of Flora Malesiana to the Welfare of People in Asia

LIPI

IX[TH] INTERNATIONAL FLORA MALESIANA SYMPOSIUM

BOGOR, 27[th]-31[st] AUGUST 2013

FLORA MALESIANA

CONTENT

WELCOME MESSAGE

It is a great pleasure to invite you to Bogor, Indonesia to participate to the 9th International Flora Malesiana Symposium. This year's symposium will be an important and comprehensive forum in which botanists will gain invaluable experience from the exchange of knowledge, ideas, and opinions on plant systematics (including fungi, mosses, ferns, and lichens). We will discuss finding new species, the distribution of the important plant species for health, foods, clothing, etc., anatomy and morphology of plants of the regions for the purpose of proper identification, understanding habitats of the floras, and how to protect those plants from over-exploitation and manage them sustainable for the future generations. We cordially invite you to attend and participate in this significant event.

Sincerely yours,

Dr. Joeni S. Rahajoe
Chairperson of the 9th International Flora Malesiana Symposium
Herbarium Bogoriense, Botany Division,
Research Center for Biology, Indonesian Institute of Sciences

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GENERAL INFORMATION

PRESENTATION AND VENUE

Paper submission for the proceedings

The proceedings of 9th International Flora Malesiana Symposium will be published in *Reinwardtia* (A Journal on Taxonomic Botany, Plant Sociology and Ecology) in 2014. Manuscript preparation should follow instructions to authors printed in the latest volume of *Reinwardtia*. Final manuscripts must be submitted to the Editor, *Reinwardtia*, Herbarium Bogoriense, Botany Division, Research Center for Biology-LIPI, Cibinong Science Center 16911, Indonesia (E-mail: reinwardtia@mail.lipi.go.id) by **31 Dec 2013** at the latest.

Symposium Venue

The IPB International Convention Center (IPB ICC), Bogor, West Java, Indonesia

IPB International Convention Center is strategically located in the heart of Bogor city, on the intersection of Padjajaran Rd. and Otto Iskandar Dinata Rd. IPB ICC is in the same modern complex with Santika Indonesia Hotel & Resort and Botani Square Mall which augment the comfort of the facilities.

The venue is within an easy walking distance to the Bogor Botanic Gardens. The Museum of Ethnobotany is located across the Gardens, connected to the old building of Herbarium Bogoriense.

IPB ICC is easily accessed from the Soekarno-Hatta, Jakarta International Airport by using DAMRI BUS which the shelter is just next to the IPB ICC complex. A range of other accommodation options are within walking distance, such as Permata Hotel and Amaris Hotel. Other nearby hotels are listed under accommodation.

GUIDED TOURS

Mid-Tour/ Thursday, 29 August, 2013

All participants will gather at the IPB ICC parking lot at 6:30 am for Tour to the Mt. Gede Pangrango National Park and Visit Herbarium Bogoriense; and 8.00 am at the Main Gate (Gate I) of Bogor Botanic Gardens for garden visit. The Committee will prepare snack and lunch with local dishes the trip. Please feel free to bring your own food if you think it is necessary for your save. The Committee do not allow you to collect any plant materials during the tour to the Bogor Botanic Gardens and Mt. Gede Pangrango National Park.
All of you will be grouped based on the destination of your trip, and it will be announced prior to the trip.

Visit to Bogor Botanic Gardens

Participants who will join the tour to the Bogor Botanic Gardens will be grouped into five groups. Each group will be accompanied by staff from BO and the Gardens. Each group will explore the Gardens through different tracks.

Visit Herbarium Bogoriense, Research Center for Biology, LIPI

Groups of participants who will join tour to the Herbarium Bogoriense will travel to Herbarium Bogoriense in Cibinong by bus from IPB ICC parking lot. During the tour each group will be accompanied by staff who will give a tour in the Herbarium to show the herbarium collection and to give a brief peek to the Herbarium processing rooms and Library. Participants are allowed to work on herbarium specimens or visit the library after the tour.

Time schedule of the mid tour program to Herbarium Bogoriense (BO)

Time	Activities
07:00-07:30	Gather at the parking lot of IPB ICC (symposium venue)
07:30-08:00	Travel from venue to BO at Cibinong
08:00-09:00	Introducing Research Center for Biology by BO staff
09:00-12:00	Tour at BO
12:00-13:30	Lunch at the meeting room
13:30-15:00	Free time
15:00-15:30	Back to Bogor

A Botanical trip to Mount Gede Pangrango National Park, West Java

About Mt. Gede Pangrango

Mount Gede Pangrango National Park (TNGGP) has an important role in the history of conservation in Indonesia. The existence of the National Park of Mount Gede Pangrango has an important meaning because the park is the first park designated as a nature reserve in the embryo of Indonesia and one of five national parks in Indonesia that was first exposed in 1980. TNGGP comprises an area of 22851.03 hectares which is covered by tropical mountain rain forest and conveniently just 2 hours (100 miles) from the metropolitan Jakarta. The area is located between the districts of Bogor, Cianjur, and Sukabumi (West Java) and this is a representative area of mountain rain forest ecosystem in Java.

When you do hiking in the area of TNGGP, you will enjoy the beauty of Indonesian forest ecology. Within the forest of TNGGP we can find "the giant tree" Rasamala (*Altingia excelsa*), "the insect hunter" or pitcher plants (*Nepenthes* spp.), various wild orchids, and even some plants that have not been scientifically known, such as luminous fungi. The area of TNGGP housed more than 1,500 species of flowering plants, 400 species of ferns, and more than 120 species of mosses. The enumeration of medicinal plants in TNGGP reveals 300 plant species used for folk medicine and ten of which are protected species. Besides the uniqueness of its plants, TNGGP is also home to many species of wildlife either protected or not, and has the most diverse bird species (c. 250 spp.) on the island of Java. Furthermore, the Park is also the habitat of various wildlife species, such as giant ladybugs, a beetle species, more than 100 species of mammals such as deer, mouse-deer, coyote, leopard, skunk, etc., and also home for nearly extinct spp., such as the Javan gibbon (*Hylobates moloch*), Javan Surili (*Presbitys comata*) and Javanese eagle (*Spizaetus bartelsi*).

Cibeureum Waterfall

Cibeureum waterfalls is located within the Mt. Gede Pangrango National Park and consist of the main Cibeureum waterfall and two other smaller, Cidendeng and Cikundul waterfalls. Cibeureum waterfall is the largest waterfall and the shortest in the region, which is more open and is located near the shelter so that more mobbed. Cibeureum name comes from Sundanese language meaning the Red River. The red color comes from the shades of red cliff walls formed by red algae that grow along the cliff walls.

Cidendeng waterfall, taller but slimmer in size, is located on the right side of Cibeureum waterfall. Whereas, Cikundul waterfall is situated in the rightmost of Cibeureum waterfall but in the higher position and somewhat hidden in an alcove between two cliffs. The three waterfalls are between 40-50 meters tall and are located at an altitude of 1675 m above sea level. The average rainfall in this area ranges from 3000-4200 mm per year. The average temperature varies between 18°C in Cibodas and less than 10°C in the peak Pangrango.

How to get to the waterfall

Cibeureum waterfall is located about 2.6 km (about 1-hour walking) from the entrance of the National Park. Along the way to this waterfall, we will pass Blue Lake and Gayonggong Swamp. After passing the wooden bridge in the Gayonggong Swamp we will be back to the rocky trail and arrive at the intersection called Panyancangan Horse. We then will need to make a right for the waterfall.

Things to be prepared for the trip:

- Field clothes, hat, shoes/boot
- Jacket/sweater
- Rain coat/umbrella
- Personal medicines
- Repellent

Detail schedule of the tour to Mt. Gede Pangrango National Park

Time	Activities
06:30 - 07:00	Gather at Botani Square Parking Lot (the same as the symposium venue)
07:00 - 07:15	Briefing
07:15 - 09:15	Travel: Bogor-Gede Pangrango National Park (Cibodas)
09:15 - 09:45	Welcoming at National Park
09:45 - 12:15	Tracking Cibodas-Cibeureum Waterfall
12:15 - 13:00	Break (Lunch & Praying)
13:00 - 15:00	Tracking Back to Cibodas
15:00 - 17:00	Back to Bogor

Post-Symposium Field Trips:

A Botanical trip to Mount Halimun-Salak National Park, West Java

2 – 5 September 2013

Mts. Halimun-Salak National Park is the largest remaining mountain rainforest in Java. This area is a natural forest ecosystem with high genetic resources and diversity of plants and animals. Natural conditions are relatively intact. The natural beauty and its biological diversity make this area becomes heaven for not only human beings but also for wildlife in it. Besides, this region has a function as water catchment which is vital for people living in the surroundings. The mountains is situated in the altitude of 500-1,929 m above sea level, consisted of plain mountains at 1,000-1,400 m above sea level and slope in about 75% of total mountain areas.

The Mts. Halimun-Salak is a habitat for Javan gibbon (*Hylobates moloch*) and several other endangered species, such as the Javan hawk-eagle (*Spizaetus bartelsi*), leopard (*Panthera pardus*), Javan Surili (*Presbytis comata*), as well as some plant species local endemic such as *Dipterocarpus hasseltii* and *Neesia altissima*. Many rare species of orchids can be found here, such as *Bulbophylum binnendijkii*, *B. angustifolium*, *Cymbidium ensifolium* and *Dendrobium macrophyllum*. Very common species at altitude of 500-1,000 m are rasamala (*Altingia excelsa*), puspa (*Schima wallichii*), saninten (*Castanopsis javanica*), k iriung anak (*Castanopsis acuminatissima*) and pasang (*Quercus gemeliflora*). Above 1,000 m up to 1,400 m in the sub montane forests we can find *Acer laurinum*, ganitri (*Elaeocarpus ganitrus*), *Eurya acuminatissima*, banyan (*Ficus* spp), ki leho (*Saurauia pendula*) and ki merak (*Weinmannia blumei*). At the 1,500 m above the forests are dominated by *Podocarpus* spp. and *Dacrycarpus* spp.

Registration

During on-site registration on either August 26 or August 27, please come to the registration desk to inform where you are staying. This information is needed for pick-up on September 2, 2013.
The Post Symposium Tour to Mount Halimun-Salak National Park cost USD 600 per person (includes tranportation, accomodation, guide, meal and snacks)

Organizer: Abdulrokhman Kertonegoro (Herbarium Bogoriensis)

BOTANICAL ILLUSTRATION WORKSHOP
1-2 September 2013

Instructor: Ms. Anita Sachs-Jansen (National Herbarium Nederland)

The workshop aims to bring the understanding of how important both botanical illustration and art to botanists. The use of illustration is valuable in making clearer the description of species. The presence of drawings in botanical research articles leads the readers to the right imagination of features meant by the authors. Ms. Sachs-Jansen who is also founder of the Dutch Society of Botanical Artists will share her exceptional drawing techniques for revealing details and textures of a plant or parts of a plant accurately.

The workshop costs USD 75 per person (includes transportation, drawing tools, lunch, certificate and snacks)
Limited space is applied (30 participants only)

Organizer: Lina S Juswara (Herbarium Bogoriense)

CONFERENCE PROGRAM OVERVIEW

MONDAY, 26 AUGUST 2013

VENUE / TIME	BORNEO ROOM	NEW GUINEA ROOM	SULAWESI ROOM	SUMATERA ROOM
14.00 – 17.00	REGISTRATION AT IPB CONVENTION HOTEL (IPB CH)			

TUESDAY, 27 AUGUST 2013

VENUE / TIME	BORNEO ROOM (BALL ROOM 2)	NEW GUINEA ROOM (BALL ROOM 3)	SULAWESI ROOM (MEETING ROOM E)	SUMATERA ROOM (MEETING ROOM F)
07.00 – 08.30	ARRIVAL & REGISTRATION OF GUESTS AND PARTICIPANTS AT IPB INTERNATIONAL CONVENTION CENTER (IPB ICC)			
08.30 – 08.45	ORGANIZING COMMITTEE WELCOMING MESSAGE Dr. Joeni S Rahajoe			
08.45 – 09.00	FLORA MALESIANA CHAIRMAN ADDRESS Prof. Dr. Dedy Darnaedi			
09.00 – 09.15	OPENING REMARK BY CHAIRMAN OF LIPI/ DEPUTY OF LIFE SCIENCES Prof. Dr. Lukman Hakim/ Dr. Siti Nuramaliati Prijono			
09.15 – 09.45	GROUP PHOTO AT BORNEO & NEW GUINEA ROOMS, PRESS CONFERENCE AT VIP ROOM			
09.45 – 10.45	KEYNOTE LECTURE Prof. Emil Salim			
10.45 – 11.15	MORNING COFFEE BREAK			
11.15 – 12.30	SESSION 1	SESSION 1	SESSION 1	SESSION 1
12.30 – 13.30	LUNCH			
13.30 – 15.00	SESSION 2	SESSION 2	SESSION 2	SESSION 2
15.00 – 15.30	AFTERNOON COFFEE BREAK			
19.00 – 21.00	SYMPOSIUM DINNER AT BORNEO & NEW GUINEA ROOMS Welcome message by Head of Research Center for Biology-LIPI			

WEDNESDAY, 28 AUGUST 2013

VENUE / TIME	BORNEO ROOM	NEW GUINEA ROOM	SULAWESI ROOM	SUMATERA ROOM
08.00 – 09.00	PLENARY ADDRESS Prof. Dr. Mien A Rifai			
09.00 – 09.30	MORNING COFFEE BREAK			
09.30 – 11.00	SESSION 3	SESSION 3	SESSION 3	SESSION 3
11.00 – 12.30	SESSION 4	SESSION 4	SESSION 4	SESSION 4
12.30 – 13.30	LUNCH			
13.30 – 15.00	SESSION 5	SESSION 5	SESSION 5	SESSION 5
15.00 – 15.30	AFTERNOON COFFEE BREAK			
15.30 – 17.00	SESSION 6	SESSION 6	SESSION 6	SESSION 6
18.30 – 19.30	BIODIVERSITY INFORMATICS DISCUSSION AT SULAWESI ROOM Registration required			

THURSDAY, 29 AUGUST 2013

VENUE / TIME	BORNEO ROOM	NEW GUINEA ROOM	SULAWESI ROOM	SUMATERA ROOM
06.30 – 17.00	TOUR TO HERBARIUM BOGORIENSE, BOGOR BOTANIC GARDENS OR MT GEDE PANGRANGO NATIONAL PARK Registration reguired, gather at IPB ICC Entrance Hall			

FRIDAY, 30 AUGUST 2013

VENUE / TIME	BORNEO ROOM	NEW GUINEA ROOM	SULAWESI ROOM	SUMATERA ROOM
08.00 – 09.00	PLENARY ADDRESS Prof. Dr. Peter C van Welzen			
09.00 – 09.30	MORNING COFFEE BREAK			
09.30 – 11.00	SESSION 7	SESSION 7	SESSION 7	SESSION 7
11.00 – 12.30	LUNCH			
12.30 – 13.30	POSTER SESSION			
13.30 – 15.00	SESSION 8	SESSION 8	SESSION 8	SESSION 8
15.00 – 15.30	AFTERNOON COFFEE BREAK			
15.00 – 17.00	SESSION 9	SESSION 9	SESSION 9	SESSION 9
17.00 – 18.00	FM BOARD MEETING AT VIP ROOM			
19.00 – 21.00	DINNER			

SATURDAY, 31 AUGUST 2013

VENUE / TIME	BORNEO ROOM	NEW GUINEA ROOM	SULAWESI ROOM	SUMATERA ROOM
08.00 – 09.00	PLENARY ADDRESS Prof. W John Kress			
09.00 – 09.30	MORNING COFFEE BREAK			
09.30 – 11.00	SESSION 10	SESSION 10	SESSION 10	SESSION 10
11.00 – 12.30	SESSION 11	SESSION 11	SESSION 11	
12.30 – 13.30	LUNCH			
13.30 – 15.00	SESSION 12	SESSION 12	SESSION 12	
15.00 – 15.30	AFTERNOON COFFEE BREAK			
15.30 – 17.00	CLOSING CEREMONY			

KEYNOTE LECTURE

FLORA MALESIANA AND SUSTAINABLE DEVELOPMENT

The world is faced with the challenges of the increase of population confronting natural resources from our only one earth. If today we have more or less 7 billion people, we may have in 2050 approximately 9 billion people. It requires more consumption and production of final goods derived from the exploitation of natural resources.

But natural resources in our planet are limited and finite. Development as we are used to conduct cannot be based on natural resource exploitation anymore. There is no sufficient resource available to support the conventional resource exploitation type of development.

Sustainable Development

The outlook, system and methodology of conventional development must change into sustainable development with a succinctly different paradigm**. First,** sustainable development must be based on sustaining natural resources while in process of development. It emphasizes *resource enrichment* rather than *resource exploitation.* **Second,** it maintains the intrinsic value of natural resources while raising its value added by the use of science and technology. **Third,** in using process, system and technology of development it chooses those that minimize its ecological footprint, at least below the capacity to enable the ecological system to sustain its life support system. **Fourth,** it is not driven by anthropocentric motivations as such, but rather by the recognition that there is a relatonship between God and Human, Society and Nature. In Bali it is called "*Tri-Hita Karana", Human living in harmony with God, Society and Nature.* **Fifth,** taken these factors into account, development becomes not only *economic development* as it is commonly understood, raising production and consumption for the ultimate satisfactions of human needs, but sustainable development raises also the need for *social development* to raise human well being in all its dimensions. "Man does not live by bread alone". There has to be also other human and social dimensions to be developed, like educaton, health, mutual cooperation, social inclusion, poverty elaviation, socialequity, etc. Elements that raises the quality of human beings. But man humans and society are no isolated islands. They live and survive within an ecological natural system. Therefore sustainable development must take into accounts humans and society's impact on the environment. Human and Natural Environment are interlinked in a "web of life", the ecosystem. Therefore sustainable development must be taken into account the fact that development is taking place in a web of ecosystems.

On the basis of these considerations, Sustainable Development that comprises of economic, sosial and environmental development, goes along three tracks simultaneously to reach for the goals of "Profit, People and Planet" as the essence of Sustainabale Development.

From this sustaibale development perspective it is clear that natural resources are not considered as an object of exploitation but of enrichment, to raise value added embodied in resources.

It is in this context that natural resources are not considered as an isolated item, but rather as a component of an ecosystem, more specifically in Indonesia as a tropical bio terrestrial and marine natural resources.

A New Approach

Indonesia's unique position as a archipelago with approximately 14.000 islands situated along the equator, surrounded by the Pacific and Indian Ocean and the Asian and Australian continents, make Indonesia's bioresources become highly diverse and magnificently rich. It is in this context that Indonesia plays a unique role as ecosystem for Flora Malesiana to flourish.

Malesiana's Flora, has unique and distinct features. It grows however in countries, which are developing in economies. As such, we in Indonesia suffers a serious backlog of not knowing what we have, let alone a complete data of taxonomy. This is clearly lacking, but more seriously are the facts that we don't know for sure what we have in the unexploited natural resources of our forests in many parts of Indonesian forests.

Indonesia population too are rapidly expanding from a current 243 million (2012) to 315 million (2050). And development is rapidly expanding to the unexploited forest and peat-land all over Indonesia. There is no time to wait until all our flora and fauna are well registered. The process of Taxonomy takes time and experts that we not have sufficiently. Development cannot wait.

Important here is to adhere to the principles of Sustainable Development and not emphasizing only *economics* but to consider also *social and environmental development.*

It is in this context that our limited experts on taxonomy needs to have the ability to communicate and provide relevant informartions on *Spatial and Economic Development Planners* to indicate the necessary *natural reserve areas* that may contain crucial data on flora and fauna, which also have the potentials to be enriched for further development. In the wake of sustainable development, environmental impact analysis, social accounting matrixes with spatial planning can be enforced to minimize destructive impacts of development on fauna-flora and ecosystems.

Another approach of development necessary when data on flora are limited is to turn the thinking upside down and start from "the output" necessary to conserve the relevant data of flora. Flora, fauna and biological resources in general have the potential to be developed for food, pharmacy, energy, material and others. Even with limited data of biological resources, certain area can be designated as *protected areas for food, pharmacy, etc.* Starting from the "end-product" it is possible to trace the required biological resources needed to be conserved in the region.

Important also is the need to get local people with local wisdom involved to protect areas useful for conserving biodiversity. In the *Halimun-Salak Mountain area* lives an ethnic group, *Kasepuhan,* which has the wisdom to grow twenty or so local rice seeds that have different features. In this context it is important that this wisdom can be spread all over the region and makes possible conservation of the unique rice plant .

There is the need that Taxonomist "g*oes down to people"* and educate the people on the ground on the uniqueness and usefulness of flora, fauna and biodiversity. The science on ecology, taxonomy of flora and fauna needs to be transformed at the people's and village' knowledge based movement. People needs to know the benefit of flora, fauna and ecosystem. They need being involved in activities “down to earth”, as the *Kasepuhan* ethnic groups have taught us on the existence of many rice diversities.

While data collection on flora Malesiana is of crucial importance, it is important to start also a “Save the Flora Malesiana Movement” by informing the people at the grassroot on the usefulness and strategies importance of the unique flora Malesiana resources the people have in their villages in the soils of Indonesia.

May God bless you in your deliberations.

Jakarta, 20 August 2013

Prof. Emil Salim
Professor of Environmental Economics, Universitas Indonesia

Day 1: Tuesday, 27 August 2013

ORAL PRESENTATION

Underline name is presenting author

* Corresponding Author

DAY 1: TUESDAY, 27 AUGUST 2013

07.00 – 08.30	**ARRIVAL & REGISTRATION OF GUESTS, PARTICIPANTS (AT IPB ICC)**
08.30 – 08.45	**ORGANIZING COMMITTEE WELCOMING MESSAGE** Dr. Joeni S Rahajoe
08.45 – 09.00	**FLORA MALESIANA CHAIRMAN ADDRESS** Prof. Dr. Dedy Darnaedi
09.00 – 09.15	**OPENING REMARK BY CHAIRMAN OF LIPI/DEPUTY OF LIFE SCIENCES** Prof. Dr. Lukman Hakim/ Dr. Siti Nuramaliati Prijono
09.15 – 09.45	**GROUP PHOTO**
	PERS CONFERENCE AT VIP ROOM
09.45 – 10.45	**KEYNOTE LECTURE** **“Flora Malesiana and sustainable development”** Prof. Emil Salim, Professor of Environmental Economics, Universitas Indonesia
10.45 – 11.15	**MORNING COFFEE BREAK**
11.15 – 12.30	**SESSIONS 1: TAXONOMY & SYSTEMATICS-1, BEGONIACEAE & GESNERIACEAE-1, ZINGIBERACEAE-1, ARECACEAE-1**
12. 30 – 13.30	**LUNCH**
13.30 – 15.00	**SESSIONS 2: TAXONOMY & SYSTEMATICS-2, BEGONIACEAE & GESNERIACEAE-2, ZINGIBERACEAE-2 & GENERAL TAXA, ARECACEAE-2**
15.00 – 15.30	**AFTERNOON COFFEE BREAK**
19.00 – 21.00	**SYMPOSIUM DINNER AT BORNEO AND NEW GUINEA ROOM** **Welcome message by Head of Research Center for Biology, LIPI**

Session 1

TAXONOMY & BIOSYSTEMATIC-1

Convener: Rugayah, Research Center for Biologi, LIPI
Chairperson: Richard MK Saunders, The University of Hong Kong
Venue: Borneo Room

11.15 – 11.30	Richard MK Saunders: Perianth evolution in the early-divergent family Annonaceae
11.30 – 11.45	TA Garzon *et al.*: Phylogenomics of the early-divergent angiosperm family Annonaceae: resolving intergeneric relationships in the recalcitrant Miliuseae tribe
11.45 – 12.00	Chin Cheung Tang *et al.*: Evaluating rapid evolutionary radiation in *Goniothalamus* (Annonaceae)
12.00 – 12.15	Bine Xue *et al.*: Segregation of the polyphyletic genus *Polyalthia* (Annonaceae)
12.15 – 12.30	Xing Guo *et al.*: Molecular phylogenetics of the *Dasymaschalon- Desmos-Friesodielsia-Monanthotaxis* lineage (Annonaceae)

Perianth evolution in the early-divergent family Annonaceae

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Despite the considerable taxonomic diversity of the Annonaceae, floral structure in the family is remarkably uniform in its underlying ‘Bauplan’: Annonaceae flowers are characterised by three perianth whorls (sepals, outer petals and inner petals), with three organs per whorl; and a floral vascular system in which the traces feeding the perianth organs are basally fused. The Annonaceae are of particular phylogenetic interest as they show several apomorphic characteristics, including a differentiated (dipartite) perianth of distinct sepals and petals, which is hypothesised to have evolved independently from that of eudicots. Important evolutionary changes in perianth morphology within the Annonaceae include: the origin of a dipartite corolla, with morphologically distinct outer and inner petals; the origin of partially enclosed pollination chambers; the compression of two perianth whorls into one; the gain or loss of a perianth whorl; and changes in perianth organ identity. Many of these changes have occurred in parallel on multiple occasions, suggesting that they either provide a major selective advantage (e.g., affecting pollination ecology or breeding system), or else that they are the consequence of common causal explanations. The latter is possibly due to the disruption of the homeotic control of organ identity during floral development, involving MADS-box genes.

Keywords: Annonaceae, calyx, corolla, homeosis, petals, pollination chamber, sepal

Phylogenomics of the early-divergent angiosperm family Annonaceae: resolving intergeneric relationships in the recalcitrant Miliuseae tribe

Lundberg, M., Garzon, T.A.* & Saunders, R.M.K.

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Evolutionary relationships among main lineages of the Annonaceae have become much clear in recent years. The still poorly resolved phylogeny of tribe Miliuseae (subfamily Malmeoideae), however, represents the largest impediment to understanding broad-scale evolutionary patterns within the family. The Miliuseae comprises 25 genera and ≈ 510 species of trees and shrubs with a centre of diversity in South East Asia, although the presence of small Central American and African clades raise questions about its origin. The most recent molecular phylogeny of the Miliuseae distinguished 20 well-supported clades based on chloroplast DNA regions. Relationships among the major clades were not supported, and the backbone of the phylogeny remains unresolved. Next-generation sequencing was used to sequence entire chloroplast genomes for 18 Miliuseae species, representing major clades recovered in previous phylogenies to improve the phylogenetic resolution within the tribe and to test biogeographical hypotheses. The complete chloroplast sequence is reported for first time in the Annonaceae. A large inversion in the large single copy (LSC) region of the chloroplast was detected for all members of the Miliuseae. Preliminary data suggest that the use of full chloroplast genome alignments increases the number of informative sites and phylogenetic support in deeper nodes of the phylogeny.

Keywords: Annonaceae, Next generation sequencing, phylogenomics, South-East Asia

Evaluating rapid evolutionary radiation in *Goniothalamus* (Annonaceae)

Tang, C.C.*[1], Thomas, D.C.[2] & Saunders, R.M.K.[1]

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Both intrinsic and environmental factors may result in changes in diversificationratein a lineage. Significant shifts in evolutionary tempo, including rapid evolutionary radiation, are of particular interest as they are key to understanding how factors such as the timing of diversifications, species attributes, environmental conditions and the size and complexity of geographical regions have shaped

current patterns of biodiversity. The Annonaceae is a species-rich family of early-divergent angiosperms, has previously been shown to exhibit a low extinction rate. However,a recent study indicated thatdiversification rates vary across the family: *Goniothalamus* has been highlighted as a genus that is most likely to have undergone rapid evolutionary radiation.This genus is comparatively species-rich (with c. 130 species), however, and has previously been estimated to be relatively young, with a crown age of only 10-3.6 Ma. Phylogenetic reconstructions, and divergence time and diversification rate estimations were used to identify rapid radiation of genera in the family, with particular emphasis on *Goniothalamus*. Possible causes of changes in diversification rate are evaluated to distinguish intrinsic causes (adaptive, including key evolutionary innovations) and environmental causes (non-adaptive, including biogeographical events, palaeoclimatic changes).

Keywords: Annonaceae, *Goniothalamus*, phylogeny, rapid radiation

Segregation of the polyphyletic genus *Polyalthia* (Annonaceae)

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The circumscription of the species-rich genus *Polyalthia* (Annonaceae, with ca. 155 species) has long been recognised to be highly problematic: as previously circumscribed, the genus was a morphologically heterogeneous assemblage lacking conspicuous synapomorphies, and was one of the most significant impediments to revisionary and floristic taxonomic research in the family. Recent molecular phylogenetic analyses have confirmed that *Polyalthia* is polyphyletic. A broader taxonomic sampling of *Polyalthia* species and associated taxa is included in the present phylogenetic analyses to enable the recognition of monophyletic genera with clearly defined diagnostic morphological characters. Bayesian, maximum parsimony and maximum likelihood analyses of chloroplast *matK*, *rbcL* and *trnL-F* sequences consistently gave congruent topologies, with *Polyalthia* species distributed in four well-supported clades. Based on molecular and morphological data, existing *Polyalthia* species are classified into the following four genera: (1) *Hubera*: a newly established genus consists of 27 *Polyalthia* species; (2) *Marsypopetalum*: six species, following the transfer of five *Polyalthia* species; (3) *Monoon*: a revived generic name with 56 species, following the transfer of 37 *Polyalthia* species, 18 *Enicosanthum* species, and *Woodiellantha sympetala*; and (4) *Polyalthia* s.str.: ca. 86 species, following the transfer of 11 *Haplostichanthus* species.

Keywords: Annonaceae, *Enicosanthum*, *Haplostichanthus*, *Hubera*, *Monoon*, *Polyalthia*, polyphyletic, *Woodiellantha*

Molecular phylogenetics of the *Dasymaschalon-Desmos-Friesodielsia-Monanthotaxis* lineage (Annonaceae)

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The *Dasymaschalon-Desmos-Friesodielsia-Monanthotaxis* lineage (the ‘desmoid clade’) comprises ca. 170 species of trees, shrubs and woody climbers distributed in tropical Africa and tropical Asia. Although the desmoid clade is very diverse in flower and fruit morphology, phylogenetic relationships of the constituent genera are poorly understood due to the limited taxon sampling and insufficient plasmid DNA data in previous studies. Based on plasmid and nuclear DNA sequence data, a multilocus phylogeny was reconstracted to improve the resolution of phylogeny and to test the hypotheses of generic monophyly. Preliminary results indicate problems in the existing delimitations of *Dasymaschalon* and *Friesodielsia*. *Friesodielsia* as currently circumscribed is polyphyletic, with African *Friesodielsia* species nesting within the African genus *Monanthotaxis*, and only distantly related to Asian representatives. Incongruence between plastid and nuclear topologies occur in *Dasymaschalon*: in the plastid tree, the majority of *Dasymaschalon* species form a strongly supported clade, but three species are more closely related to the Asian species of *Friesodielsia*; in the nuclear tree, however, *Dasymaschalon* is monophyletic. This incongruence may suggest reticulate evolution and chloroplast capture due to hybridization events emphasizing the importance of integrating plastid and nuclear DNA sequence data in Annonaceae phylogenetics.

Keywords: Annonaceae, *Dasymaschalon*, *Friesodielsia*, phylogeny.

Session 1

BEGONIACEAE & GESNERIACEAE 1

Convener: Mark Hughes, Herbarium Edinburgh & Deden Girmansyah, Research Center for Biologi, LIPI
Chairperson: Mark Hughes, Herbarium Edinburgh
Venue: New Guinea Room

11.15 – 11.30	Julia Sang: Diversity of *Begonia* (Begoniaceae) in Borneo – how many species are there?
11.30 – 11.45	Deden Girmansyah: Revision of Javanese *Begonia* (Begoniaceae)
11.45 – 12.00	Wisnu Ardi *et al*.: Studies on *Begonia* (Begoniaceae) from the Moluccas
12.00 – 12.15	Harry Wiriadinata & Deden Girmansyah: Notes on *Begonia* of the Lesser Sunda Islands
12.15 – 12.30	Chan Yoke Mui: Begonias of Peninsular Malaysia – the lesser known aspects of reproductive ecology and population dynamics

Diversity of *Begonia* (Begoniaceae) in Borneo – how many species are there?

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Based on the Southeast Asian *Begonia* database (http://elmer.rbge.org.uk/begonia), 95 species are recognised from Borneo. Later, 31 more species have been described, mainly from limestone areas in Sarawak, giving a total of 126 species currently known from Borneo. One of the few well-collected areas is Brunei (5765 km^2) that, with 16 species of *Begonia*, gives an estimated 1 species per 360 km^2. If this figure was extrapolated to estimate the total number of *Begonia* in Borneo (740,000 km^2), it would come to over 2000 species! But is Brunei typical of Borneo as a whole? Two factors suggest that the total will be lower: (i) the effect of habitat; (ii) local endemism. While limestone areas and mountains are particularly rich in begonias, other habitats are occupied by rather few species. Most species are known from a single locality with only a handful being widely distributed. Is this an artifact of the lack of widespread collecting? Two things are certain: there are already a large number of un-named *Begonia* specimens in local herbaria that represent new species, and there are large areas of Borneo that remain unexplored. In view of the current state of knowledge of habitat diversity and distribution, the possible size of the Bornean *Begonia* flora will be discussed.

Keywords: *Begonia*, diversity, Sarawak, Borneo

Revision of Javanese *Begonia* (Begoniaceae)

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The most recent published account of *Begonia* from Java (Backer & Bakhuizenv.d. Brink Jr.,1968) recorded 10 native species. Revision by the author shows that this total should be 14, based on correcting erroneous records, re-instating 3 synonyms to accepted species, 1 new record and 1new species. *Begonia lepida*, *B. vuijckii* and *B. repanda* are now considered accepted species, having previously been synonymised with *B. bracteata*, *B. mollis* and *B. isoptera* respectively. *Begonia atricha* Miq.was previously recorded only from Sumatra, but specimens from Java have been found. *Begonia hunteriana* Girm. *sp. nov.* is described from Ubrug Waterfall in West Java. Additionally, one new variety is proposed, *Begonia isoptera* var. *angustifolia* (Blume) Girm. Both the new variety and new species are described and illustrated. Full typification, taxonomic notes and a key to the identification of the Javanese species are presented. The typification of *B. isoptera* Dryand is discussed and an epitype designated. The distribution and ecology of all species will be described.

Keywords: *Begonia*, Java, Indonesia

Studies on *Begonia* (Begoniaceae) from the Moluccas

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The *Begonia* flora of the Indonesian archipelago of the Moluccas is poorly known. Since the description of *B. holosericea* (Teijsm. & Binn.) Teijsm. & Binn. c. 150 years ago only one other

endemic Moluccan *Begonia* species has been described: *Begonia sageaensis* Wiriad. Only six species of *Begonia* have been reported from the islands altogether, but this is certainly a vast underestimate. The six species reported from the Moluccas comprise two endemic Moluccan species, *Begonia holosericea* and *B. sageaensis*, as well as the more widely distributed *B. aptera* Blume, which also occurs on Sulawesi, and three closely related species (*B. brachybotrys* Merr. & L.M.Perry, *B. pseudolateralis* Warb., and *B. rieckei* Warb.) in the *Begonia reickei* species complex, which shows a wide distribution in Malesia east of Huxley's Line. Botanical expeditions from Bali Botanic Garden to Seram in 2009 and 2010 and joint expeditions from Bogor Botanic Garden and Fairchild Tropical Botanic Garden to Halmahera have brought in a total 16 species, of which 13 are putatively identified as new to science.
Keywords: *Begonia*, new species, Moluccas

Notes on *Begonia* of the Lesser Sunda Islands

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The Lesser Sunda Islands (LSI) to the east of Java are an archipelago composed of Bali, Lombok, Sumbawa, Flores, Sumba, Timor and many smaller satellite islands. An initial inventory of the *Begonia* of the LSI recorded 7 species (Hughes,2008), with 8 eight species sharing their distribution with Java and one species, *B. timorensis*, being endemic. Recent botanical exploration in LSI reveals that there are many new species still to be found: 3 species in Bali and 2 species in Lombok have recently been published. Two species from West Sumbawa, 2 species from Flores and 2 species from Sumba are currently being prepared for publication. The discovery of thesenew species on the various islands and habitats of LSI those holds a lot of potential for giving biogeographic insights into the evolution of the flora of the archipelago.
Keywords: *Begonia*, biogeographic, archipelago

Begonias of Peninsular Malaysia – the lesser known aspects of reproductive ecology and population dynamics

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Begonia is one of the biggest genera of Angiosperm with over 1,600 species worldwide. Recent advances have been made in terms of phylogenetic and systematic research on the genus, but there is a paucity of knowledge concerning reproductive ecology and population dynamics. As *Begonia* has both widely and narrowly distributed species, it is an excellent model for understanding speciation processes and the causes of rarity. In Peninsular Malaysia, we have initiated studies on the phenology and demography of three rare and threatened species. *Begonia aequilateralis, B. herveyana* and *B. tampinica* showed continuous flowering and fruiting in their populations. Demographic monitoring for four to five years showed stable population growth with minor fluctuations in recruitment. We are now extending the study into population genetics and incorporating a comparison of a widespread and a rare congener.

Keywords: Begoniaceae, demography, phenology, reproductive biology

Session 1

ZINGIBERACEAE-1

Convener: Jana Leong-Skornickova, Singapore Botanical Gardens & Marlina Ardiyani, Research Center for Biologi, LIPI
Chairperson: Axel D Poulsen, Natural History Museum, University of Oslo
Venue: Sumatera Room

11.15 – 11.30	Mark Newman & Jane Droop: Towards a new revision of the Zingiberaceae of Malesia
11.30 – 11.45	Marlina Ardiyani: Taxonomic revision of *Haplochorema* (Zingiberaceae)
11.45 – 12.00	Lim Chong Keat: Taxonomic uncertainties in Zingiberaceae: some examples in the genera *Alpinia* and *Zingiber*
12.00 – 12.15	Axel D Poulsen: Gingers of New Guinea
12.15 – 12.30	JLeong-Skornickova: Conservation of native Zingiberales in Singapore

Towards a new revision of the Zingiberaceae of Malesia

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The only revision of the Zingiberaceae of Malesia forms part of a world-wide revision in *Das Pflanzenreich*, dating from 1904. Since then some regional accounts have appeared, such as the Zingiberaceae of the Malay Peninsula, and Zingiberaceae of Java. In 2004, a *Checklist of the Zingiberaceae of Malesia* was published and, more recently, revisions of *Etlingera* in Borneo and Sulawesi. No single taxonomist will revise the Zingiberaceae in an area as large as Malesia so the task must be broken into manageable pieces to be fitted together later. The example of *Amomum* in Sumatra shows how this may be done.

Keywords: Zingiberaceae, *Amomum*, Sumatra, cooperation, regional accounts

Taxonomic revision of *Haplochorema* (*Zingiberaceae*)

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A small genus *Haplochorema* K. Schum. (*Zingiberaceae*) was originally known to consist of five species and one variety distributed in Borneo, and one species in Sumatra. A recent taxonomic revision of this genus suggests that *H. uniflorum*, previously synonymized with *H. decus-sylvae* by Valeton, should be treated as a separate species. *Haplochorema sumatranum* is proposed to be transferred to *Boesenbergia*, (*Boesenbergia sumatrana* (Burkill) M. Ardiyani *comb. nov.).* Six species and one variety are therefore recognized now in *Haplochorema* (*H. decus-sylvae*, *H. extensum*, *H. magnum*, *H. pauciflorum*, *H. pauciflorum* var. *bullatum*, *H. latilabrum* and *H. uniflorum*), at least two species found in West Kalimantan, however, remain yet to be described. *Haplochorema* is finally concluded to be an endemic genus to Borneo.

Keywords: Borneo, endemic, ginger, Sumatra, taxonomy, West Kalimantan, Betung Kerihun

Taxonomic uncertainties in Zingiberaceae: some examples in the genera *Alpinia* and *Zingiber*

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Current research to verify nomenclature of Malaysian Zingiberaceae shows that certain taxa are likely to be wrongly identified, owing to historical errors or assumptions. The presentation addresses some of the species that are common to Malaysia and Indonesia. Their taxonomic redetermination may lead to application of fresh names. In this account findings on selected *Alpinia* and *Zingiber* species are included, e.g. *A. assimilis* Ridl., *A. latilabris* Ridl., *A. malaccensis* (Burman *f.*) Roscoe, *A. capitellata* Jack, *Z. gracile* Jack and *Z. griffithii* Baker.
Keywords: *Alpinia,* taxonomy, *Zingiber,* Zingiberaceae

Gingers of New Guinea

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Wild gingers are common in the understorey of Malesian forests. In addition, many species are useful as food, medicine or have a potential as ornamentals. At the same time, very little attention has been made to sort out their taxonomy and clarify their distribution in New Guinea and nearby islands. Currently at least 200 species and eight genera of Zingiberaceaeare known from New Guinea but new fieldwork, molecular-based generic circumscriptions and subsequent revisions are likely to increase the numbers. The majority of the species are endemic or at least confined to areas east of Wallace's Line. In the presentation we will focus on the genera *Etlingera* and *Pleuranthodium* to exemplify challenges in achieving the goal of providing a complete account for New Guinea.
Keywords: biogeography, ground herbs, inventory, Papua, species richness, taxonomy, understorey, Wallace's Line, Zingiberaceae

Conservation of native Zingiberales in Singapore

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According to Singapore Checklist, 121 ginger species (sensu Zingiberales) were recorded from Singapore. However, only 26 species are considered to be native, with 11 species being assigned status of Presumed Nationally Extinct, and remaining species placed in Critically Endangered, Endangered or Vulnerable categories. Since January 2011, over 40 surveys of nature reserves and forested areas have been made with an objective to localise and closely monitor populations of the remaining native species. The ex situ and in vitro approaches have been employed to propagate materials for trial re-introductions. So far, 12 species in 6 Nature Reserves and Nature Parks were involved in trials, while larger scale introductions are under way. Preliminary results from our observations suggests that bees, flies and birds are engaged in pollination, while rodents and monkeys facilitate seed dispersal. Numerous Zingiberalean species native to S. America and Africa have been introduced to Singapore and heavily employed in streetscape greenery. As we have observed, some of these species easily naturalize, exhibit the behaviour of invasive plants and compete with native species. Further studies to understand the reproductive biology, combined with active management approach, is necessary to control the distribution of non-native species in forested areas.

Keywords: Costaceae, Marantaceae, invasive, IUCN categories, native, re-introductions, Singapore, Zingiberaceae

Session 1

ARECACEAE-1

Convener: Lauren Gardiner, Royal Botanic Gardens Kew & Himmah Rustiami, Research Center for Biologi, LIPI

Chairperson: Lauren Gardiner, Royal Botanic Gardens Kew

Venue: Sulawesi Room

11.15 – 11.30	Lauren M Gardiner *et al*.: Palms of New Guinea
11.30 – 11.45	John Dransfield & William J Baker: *Calamus* in New Guinea
11.45 – 12.00	Himmah Rustiami: *Calamus* in Sulawesi
12.00 – 12.15	Zumaidar *et al.*: *Salacca acehensis* (Arecaceae), A new species from Sumatra, Indonesia
12.15 – 12.30	Revis Asra *et al*.: Genetic diversity of threatened species *Daemonorops draco* using ISSR markers

Palms of New Guinea

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New Guinea is the largest tropical island in the world and the last remaining "black hole" in our knowledge of global palm diversity. Currently, 34 genera and ca. 250 species are recognised from the island. This highly endemic species richness is rivalled only by the slightly smaller island of Borneo (ca. 300 species). However, rates of discovery of new species in New Guinea are high, and may result in known diversity rising well beyond current estimates. A project to discover, document and describe the palms of New Guinea was initiated in the late 1990s, drawing in partners from across the globe, including Indonesia and Papua New Guinea. While the core product, a regional monograph of the island's palms, is yet to be produced, numerous taxonomic outputs have been delivered (specimens, monographs, new species, field guides) and important capacity building has taken place (e.g. postgraduate training, infrastructural investment). This talk will summarise the current status and future plans of the Palms of New Guinea project, and will highlight some of the many exciting discoveries that have been made, for example in rattans, arecoid and coryphoid genera.
Keywords: floristic, monograph, New Guinea, palms, Papua, revision

Calamus in New Guinea

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Calamus, the largest palm genus, is represented in New Guinea by three subgeneric groups. These groups, based on morphological characters and not fully corroborated with molecular data, are Section *Calamus*, Section *Phyllanthectus* and Section *Podocephalus*. Within section *Calamus* there is substantial variation and several discrete groupings are recognisable, defined by unusual characters rare elsewhere in the genus. In particular, the ocrea (an extension of the leaf sheath beyond the base of the petiole) is spectacularly elaborated in some species. In our work towards the account of the genus for the Palms of New Guinea project, we have recognised 55 taxa. Of the 57 accepted names recognised before we began our work, eighteen are now included in synonymy, twenty-seven are

accepted and twelve remain *incertaesedis*; these last are, for the most part, taxa described by Burret where types were destroyed during the bombing of the Berlin herbarium during the second World War. In all we have described and named 21 new species, seven already published and 16 in preparation. We have found the interpretation of variation among the higher montane species particularly challenging but we have taken a broad approach, with the resulting taxa generally having good geographic integrity. In this presentation, the astonishing variation in the genus will be highlighted.

Keywords: Arecaceae, Palmae, rattans, *Calamus*, Papuasia

Calamus in Sulawesi

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A revision of the rattans of Sulawesi was initiated in 2006. The aim was to develop an improved taxonomy and simultaneously gather information on aspects such as habitat, uses and vernacular names, to act as an essential basic resource for assessing the conservation status of rattans in Sulawesi and to safeguard their future as an invaluable non-timber forest product. As a result of the revision twenty nine species of *Calamus* are recognized as occurring in Sulawesi with four described as new. Twenty seven species were recognised by previous authors; however, in this study one species was treated as a synonym, twenty three species recognised and three species excluded. Several of the groups recognized by Beccari in his monographs of *Calamus* are represented in Sulawesi: Group V, Group XII, Group XIII, Group XIV, and Group XV. His groupings are mainly based on the presence or absence of a cirrus and a flagellum, armature of the leaf sheath and the structure of inflorescence. Kramadibrata and Dransfield added two groups – Groups XVII for species which have vestigial flagella and Group XVIII for *Calamus inops*and its relatives. The diversity of *Calamus* in Sulawesi will be discussed in this paper.

Keywords: *Calamus*, Indonesia, rattan, revision, Sulawesi

Salacca acehensis (Arecaceae), A New Species from Sumatra, Indonesia

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A study on Indonesian salak (*Salacca* spp.) has been undertaken, including cultivated and wild salak material. At present, genus *Salacca* consists of 22 species in the world, however Indonesia has only 6 species i.e. *Salacca sumatrana, S. zalacca*, *S. affinis*, *S. dransfieldii*, *S. vermicularis and S. wallichiana*. The last of these species is only known from the wild, so this study is focused on the wild and cultivated *S. sumatrana* and *S. zalacca*. *S. sumatrana* is the endemic species of Sumatra, while *S. zalacca* is widely distributed from Java, Sumatra, Kalimantan, Sulawesi, Bali, and Ambon. During this study it is found that *S. zalacca* has more than 10 cultivars. To study the genetic diversity of both wild and cultivated *S. sumatrana* and *S. zalacca*, AFLP techniques were applied. The analysis of this study is underway, and it is expected that an illustration of the genetic diversity for all cultivars can be drawn. Based on the above study, a new wild species was found amongst the specimens which were named as *S. acehensis*. These specimens were firstly saw by Mogea and identified as *S. acehensis* in 1975, but it never been validly published, so the name is 'nomennudem'. Therefore, this wild species is proposed and published as *S. acehensis* Mogea & Zumaidar. Based on the morphological characters, this species is closely related to *S. rupicola*. The differences of both species will be presented. Further study on the similarity of *S. acehensis* and *S. rupicola* need to be continued both compared with other species of Malesian region.

Keywords: *Salacca* spp., *S. acehensis*, new species

Genetic diversity of threatened species *Daemonorops draco* (Willd.) Blume using ISSR markers

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The analysis of the genetic diversity in five populations of the Dragon's Blood (*Daemonorops draco* (Willd.) Blume) has been applied by Inter Simple Sequence Repeat (ISSR) markers. The screening results from 15 ISSR primers are 5 of ISSR primers showed the clear and reproducible bands. It is based on the result of the data from the matrix binary that has been analyzed with POPGENE version 3.2, the highest number of the Genetic Diversity in Sepintun's population obtained 0.0969 average heterozygosis (H) and 0.146 average Shannon Index (I). The heterozygosis calculation of the total population (H_T) is 0.2571. The heterozygosis values within population (H_S=0.0704) is smaller than heterozygosis value between populations (D_{ST}=0.1867). By using clustering analysis program *Past version 32* to 43 individuals of *D. draco* are found that there are three groups of the *D. draco*. Group A consists of 8 individuals in the Bengayoan's population, group B consists of 9 units in the Nunusan's population and group C consists of three populations; Tebo, Sepintun and Mandiangin that consist of 10, 8 and 8 individuals. The genetic similarity varied among all populations is between 0.07-0.93.

Keywords: *Daemonorops draco*, genetic diversity, ISSR markers.

Session 2

TAXONOMY & SYSTEMATICS-2

Convener: Rugayah, Research Center for Biologi, LIPI
Chairperson: Richard Saunders, The University of Hong Kong
Venue: Borneo Room

13.30 – 13.45	T Chaowasku *et al.*: Molecular phylogenetics of the tribe Miliuseae: insights into generic delimitations and character evolution
13.45 – 14.00	Pui Sze Li *et al.*: Generic monophyly of *Disepalum* (Annonaceae): Correlating changes in floral morphology with changes in pollination system in *Disepalum*
14.00 – 14.15	Jasper JA Obico & Grecebio JD Alejandro: Molecular phylogeny of the Philippine endemic genus *Antherostele* Bremek. (Rubiaceae) inferred from ITS data (nrDNA) and its conservation status
14.15 – 14.30	Grecebio JD Alejandro: Molecular phylogeny and taxonomic revision of the Philippine endemic *Villaria* Rolfe (Rubiaceae): An update
14.30 – 14.45	Lyn ED Rosa-Paraguison *et al*.: Two additional genera in Philippine Rubiaceae from *Canthium* sensu lato & a new species of *Psydrax*: evidence from molecular & morphological data
14.45 – 15.00	Ong Poh Teck: A fruit fly pest as pollinator of *Bulbophyllum praetervisum*

Molecular phylogenetics of the tribe Miliuseae: insights into generic delimitations and character evolution

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Miliuseae (c. 510 species in c. 25 genera) are the largest tribe in the subfamily Malmeoideae, one of the four subfamilies recently recognized within Annonaceae, and constitute a substantial part of diversity in the family. The intergeneric relationships within Miliuseae, however, have been very poorly resolved. In the present study we use seven plastid markers (*rbcL* exon, *trnL* intron, *trnL-F* spacer, *matK* exon, *ndhF* exon, *psbA-trnH* spacer, and *ycf1* exon) constituting c. 7 kb to resolve the intergeneric relationships and clarify generic delimitations within Miliuseae, as well as understand

patterns of character evolution occurred in this tribe. The results support the establishments of two new genera, *Hubera* (segregated from the polyphyletic *Polyalthia*) and *Winitia* (segregated from *Stelechocarpus*). Besides macromorphology, pollen morphology (especially the different infratectal types: (a) more or less columellate/coarsely granular or (b) finely and densely granular) also plays an important role in circum scribing the two new genera. All genera in Miliuseae having two or more species included in the phylogenetic analyses are monophyletic with strong support except *Desmopsis*, which is recovered as paraphyletic with *Stenanona* nested within. The ancestral character reconstructions of several generative characters (petal shape and size, maximum ovule number per ovary, endosperm rumination types, flower sexuality, pollen dispersal unit, pollen infratectal types), which are generally diagnostically important at generic level, indicate considerable degrees of homoplasy and thus limited utility for subtribal recognition. Despite c. 7 kb of chloroplast DNAused, the backbone phylogeny of Miliuseae is still mostly poorly supported, necessitating more DNA regions (chloroplast or nuclear) with higher rate of evolution.

Keywords: Annonaceae, character evolution, generic delimitations, Malmeoideae, Miliuseae, molecular phylogenetics, new genera

Generic monophyly of *Disepalum* (Annonaceae): Correlating changes in floral morphology with changes in pollination system in *Disepalum*

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A taxonomic opinion regarding the delimitation of *Disepalum* (Annonaceae) has been divided it into: *Disepalum s.l.* (characterised by pollen octads and monocarps borne on a 'carpophore'); and *Disepalum s.str*. (restricted to those species with a calyx of only two sepals and a fused corolla). Three excluded species with typical trimerous floral structure have been placed to another genus *Enicosanthellum*. Phylogeny of *Disepalum s.l.* and its related taxa as a framework have been reconstructed to clarify the generic delimitation and to test the hypotheses regarding morphological character evolution and putative shifts of pollination system. Maximum parsimony, maximum likelihood and Bayesian methods based on sequences of chloroplast regions were used. A well-resolved and strongly supported topology was resulted that retrieved *Disepalum s.str*. and *Enicosanthellum* as a sister groups. Although this topology is consistent with both the narrow and broad delimitations of *Disepalum*, the distribution of morphological synapomorphies provides greater support to the inclusion of *Enicosanthellum* within *Disepalum s.l*. To investigate whether the morphological changes were possibly adaptive, characters of particular functional importance were mapped onto the phylogeny using a parsimony approach. Pollination studies on representatives of each clade are being undertaken to investigate evolutionary shifts of pollination system, and to test congruency with floral morphology.

Keywords: Annonaceae, *Disepalum*, phylogeny, floral morphology, synapomorphy, pollination system

Molecular phylogeny of the Philippine endemic genus *Antherostele* Bremek. (Rubiaceae) inferred from ITS data (nrDNA) and its conservation status

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Antherostele Bremek. is an understudied genus of Rubiaceae endemic to the Philippines comprising four named species of shrubs or small trees distributed in Luzon and Visayas. In this first molecular study of the genus, ITS (nrDNA) was utilized to test the monophyly of *Antherostele*, reconstruct its phylogeny, and resolve its placement in Rubiaceae. Furthermore, the conservation status of all species was reassessed. *Antherostele* is monophyletic and is nested within the tribe Urophylleae of subfamily Rubioideae. We confirm its segregation from *Urophyllum* and its placement within Urophylleae as proposed by earlier authors based on morphology. However, the relationships of members of Urophylleae remain unresolved. *Antherostele* is united by reflexed corolla, hairs on upper side of the corolla lobes and syngenesious stamens. The montane *A. luzoniensis* with small leaves is found to be sister to the rest of *Antherostele* species. *Antherostele* is hypothesized to have originated in montane regions and diversified into forms with larger leaves following dispersal to the shaded forest understory. Of the five species of *Antherostele* recognized in the study, two are endangered (*A. banahaensis*, *A. grandistipula*) and three, including a new species, are critically endangered (*A. callophylla*, *A. luzoniensis*, *A.* sp. nov.) according to IUCN criteria.

Keywords: *Antherostele*, critically endangered, endangered, IUCN, Philippines, Rubiaceae

Molecular phylogeny and taxonomic revision of the Philippine endemic *Villaria* Rolfe (Rubiaceae): An update

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The genus *Villaria* (Rubiaceae) is endemic to the Philippines. Traditionally, it has been placed in the tribe Gardenieae and later transferred to Octotropideae sensu Robbrecht and Puff. *Villaria* was placed among the ‘‘primitive’’ genera of the tribe, characterized by large fruits, horizontal ovules and numerous seeds. Parsimony and Bayesian analyses of the combined plastid (*rps*16 and *trn*T–F) dataset strongly support the monophyly of *Villaria* and its placement in Octotropideae. However, the phylogeny does not confirm the current informal groups in the tribe based on fruit size, ovule position, number of seeds and exotesta thickenings. Instead, a close relationship between *Villaria* and two ‘‘central genera’’ (*Hypobathrum* and *Pouchetia*) is revealed for the first time. This clade is sister to a group comprising ‘‘primitive’’ (*Fernelia*), ‘‘advanced’’ (*Kraussia* and *Polysphaeria*) and ‘‘central’’ (*Feretia*) representatives. *Villaria* is characterized by unilocular ovaries, parietal placentation and strictly horizontal ovules, a unique combination in Octotropideae. Diagnostic features of the genus should be reviewed in light of two unresolved “*Randia*” species (*R. lanceolata* and *R. stenophylla*) with bilocular ovaries. Analyses of these two “*Randia*” species using plastid markers show them nested within the *Villaria* clade. We also propose a new species (*Villaria uniflora* Arriola & Alejandro) distinguished by uniflorous inflorescences, infundibuliform calyx tube, triangular-ovate calyx lobes, and lanceolate stigmatic lobes. We recognize a total of eight *Villaria* species.

Keywords: Ixoroideae, Octotropideae, Philippines, *rps*16 intron, Rubiaceae, *trn*T–F region, *Villaria*

Two additional genera in Philippine Rubiaceae from *Canthium* sensu lato and a new species of *Psydrax*: evidences from molecular and morphological data

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Recent molecular and morphological revisions on the highly heterogenous *Canthium* Lam. (Vanguerieae), restricted the genus to taxa with supra-axillary spines. The absence of this character lead to the segregation of the satellite genera *Keetia*, *Pyrostria*, *Pysdrax*, *Cyclophyllum* and *Afrocanthium*. None of the published studies included endemic Philippine species of *Canthium*. This raises questions on the generic affinity of Philippine *Canthium* species since the majority of them are without supraaxillary spines. In the current study, three Philippine *Canthium* spp. were collected. Genomic DNA was extracted, amplified using specific nrDNA and cpDNA markers, sequenced and aligned with related sequences from GenBank. Cladistic analysis was done using Bayesian inference. The majority rule consensus tree revealed a well-supported Vanguerieae (PP=1.0). As expected, the three Philippine *Canthium* spp. did not group with *Canthium* sensu stricto. Instead, *Canthium wenzelii* nested within *Keetia* (PP= 0.81), *Canthium ramosii* with *Pyrostria* (PP = 0.65), and a probable new species nested with *Psydrax* (PP= 0.93). Our molecular results are supported by morphological features present in the three species. This is the first report of the presence of *Keetia*, *Pyrostria* and *Psydrax* in the Philippines.

Keywords: ITS, cpDNA, nDNA, *Canthium*, trnl-F, Vanguerieae

A fruit fly pest as pollinator of *Bulbophyllum praetervisum*

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Six fruit fly species from the genus *Bactrocera* namely *B. caudata*, *B. cucurbitae*, *B. dorsalis*, *B. hochii*, *B. tau* and *B.*sp (*dorsalis* complex) were observed to have visited flowers of *Bulbophyllum praetervisum* in Peninsular Malaysia. *Bactrocera cucurbitae* has been confirmed as a pollinator in which evidence of this fruit fly species pollinating flowers of *Bulbophyllum praetervisum* have been

photographed and videoed. A hint that flower of *Bulbophyllum praetervisum* produces zingerone was based on the observation of the fruit fly groups (*e.g.* methyl eugenol-sensitive fruit flies or raspberry ketone-sensitive fruit flies) that visited the flower. Analyzing the chemical profile of *Bulbophyllum praetervisum* flower and comparing the profile to *Bulbophyllum patens*, a species known to produce zingerone, further strengthened this hypothesis.

Keywords: *Bulbophyllum praetervisum*, *Bactrocera*, fruit fly, pollination

Session 2

BEGONIACEAE & GESNERIACEAE-2

Convener: Mark Hughes, Royal Botanic Gardens Edinburg & Deden Girmansyah, Research Center for Biologi, LIPI (Begoniaceae)

Ruth Kiew, FRIM & Abdulrokhman Kertonegoro, Research Center for Biologi, LIPI (Gesneriaceae)

Chairperson: Ruth Kiew, FRIM

Venue: New Guinea Room

13.30 – 13.45	Mark Hughes *et al.*: The impact of tectonics and typhoons on the colonisation of the Philippine archipelago by *Begonia*
13.45 – 14.00	Rosario R Rubite *et al*.: Evidence for a novel natural *Begonia* hybrid from Panay Island, the Philippines
14.00 – 14.15	Ching-I Peng & Yoshiko Kono: Cytological investigations in the genus *Begonia* (Begoniaceae)
14.15 – 14.30	Rafidah A Rahman & Ruth Kiew: Towards a revision of *Monophyllaea* (Gesneriaceae) from Peninsular Malaysia
14.30 – 14.45	Carmen Puglisi: Phylogenetic studies in the Old World Gesneriaceae: the *Boea* group
14.45 – 15.00	Lim Chung Lu & Ruth Kiew.: Sections in *Codonoboea* – the Peninsular Malaysian Scenario

The impact of tectonics and typhoons on the colonisation of the Philippine archipelago by *Begonia*

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Begonia is a mega-diverse genus and has a hotspot of diversity in Malesia. The Malesian region is heterogenous in terms of the occurrence of large cyclonic weather systems, which are absent from a ca. 4 degree region north and south of the equator. The Philippines experiences a succession of tropical cyclones from June to October, some of which bring extremely high winds and engulf the entire archipelago. In contrast equatorial Sulawesi is never directly exposed to high-energy cyclonic systems and sustained high winds are rare. The dust-like seeds of *Begonia* are potentially wind-dispersed, although current phylogenies of the genus show a dearth of long-distance dispersal events. Here two dated phylogenies of *Begonia* are compared, one from the Philippine archipelago and one from Sulawesi, and contrasting signals of dispersal looked for. The potential for weather patterns to shape wider patterns of biodiversity within the tropics will be discussed.

Keywords: *Begonia*, biogeography, Philippines, dispersal

Evidence for a novel natural *Begonia* hybrid from Panay Island, The Philippines

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Begonia is a mega-diverse genus and is an ideal model for examining modes of speciation in the tropics. In the Philippines, many *Begonia* species are narrow endemics, in particular those restricted to

forest on limestone. However, a small number have wider distributions which increase the potential for contact between species. Here we report the first account of Philippine *Begonia* hybridization in the wild from Bulabog Puti-an Natural Park in Dingle, Iloilo Province, Panay Island. A population with novel morphology was found growing on moist, coralline slopes at 200 m elevation. Based on a comparison of morphology, cytology and molecular evidence, we conclude that the *Begonia* population represents progeny from natural hybridization between *Begonia copelandii* Merr. and *Begonia rhombicarpa* A. DC.

Keywords*: Begonia,* natural hybrid, *Begonia* hybrid, Philippine, *Begonia* hybridization

Cytological investigations in the genus *Begonia* (Begoniaceae)

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The genus *Begonia*, comprising ca. 1,600 species classified in 66 sections, ranks the 6th largest genus of flowering plants in the world. In this study we report the chromosome number of over 200 species of *Begonia*, mainly from Asia, but also from America and Africa, that are in cultivation in the experimental greenhouses of Academia Sinica, Taiwan. Our results showed that somatic chromosome numbers of *Begonia* range from $2n$ = 14, 16, 18, 20, 22, 24, 26, 28, 30, 31, 32, 33, 34, 36, 38, 40, 41, 44, 45, 49, 52, 60, 64, 76 to 82. We also report case studies in which natural hybridizations were documented in part by cytological information, e.g. chromosome number, meiosis, karyotype, and genomic in situ hybridization (GISH). The original basic chromosome number of Begoniaceae may be X = 11 and that dysploidization, polyploidization and hybridization play major roles in their evolution.

Keywords: *Begonia*, chromosome number, natural hybridization

Towards a revision of *Monophyllaea* (Gesneriaceae) from Peninsular Malaysia

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Seven species and two varieties of *Monophyllaea* are reported from Peninsular Malaysia of which six are endemic. Recent field work has enabled the status of the species and varieties to be re-evaluated and provided more data on the habitats and distribution. This paper provides an overview of

Peninsular Malaysian *Monophyllaea* including morphological notes, distribution and conservation status and a key to their identification.

Keywords: *Monophyllaea*, Peninsular Malaysia, current status, morphological notes, distribution, conservation status

Phylogenetic studies in the Old World Gesneriaceae: the *Boea* group

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Since it was first published in 1785 many additional species have been ascribed to the genus *Boea* Comm. ex Lam. As the genus grew in size, it also grew in morphological diversity until it was recircumscribed by Burtt (Notes Roy. Bot. Gard. Edinburgh 41(3): 401-452. 1984). Burtt and other authors (e.g. Kiew, Weber and Burtt, Beitr. Biol. Pflanzen 70(2-3): 383-403. 1997) also established a number of new segregate genera. Today, the *Boea* group (i.e. *Boea*, the segregate genera and other close relatives) comprises over 200 species in some 15 genera, found from China to Australia and throughout Malesia from Sumatra to the Solomon Islands. Previous molecular studies suggested a much more complex structure to the clade than previously thought. Here we present the most up to date phylogeny, generated using one nuclear and two chloroplast markers and covering all genera known to belong to the *Boea* group. Our results highlight important discrepancies between the current taxonomy of the group and the inferred phylogeny. In an attempt to establish a natural classification of *Boea* and its allies, possible changes in the generic delimitations are proposed.

Keywords: Gesneriaceae, *Boea* group, phylogeny, ITS, trnL-trnL-trnF, ndhF-rpl32-trnL^{uag}

Sections in *Codonoboea* – the Peninsular Malaysian Scenario

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Codonoboea, the largest genus of Gesneriaceae in Peninsular Malaysia with 88 species, is variable in habit and morphology of the leaf, inflorescence including bracts, corolla, nectary, stigma and fruit. To make sense of this diversity and to aid identification, sections have been proposed to group together species with similar morphology. Sectional names first proposed when *Codonoboea* species were included in *Didymocarpus* are *Boeopsis*, *Codonoboea*, *Didymanthus*, *Heteroboea*,

Pectinati, *Reptantes*, *Salicini* and *Venusti*, with *Glossadenia*, being added after these species were transferred to *Henckelia*. A preliminary molecular phylogenetic study using ITS and *TrnL-F* sequences indicates that most of these sections are paraphyletic. The pros and cons of grouping *Codonoboea* species and recognising sections will be discussed.

Keywords: Gesneriaceae, *Codonoboea*, section, Peninsular Malaysia.

Session 2

ZINGIBERACEAE-2 & GENERAL TAXA

Convener: Jana Leong-Skornickova, Singapore Botanic Gardens & Marlina Ardiyani, Research Center for Biologi, LIPI

Chairperson: Marlina Ardiyani, , Research Center for Biologi, LIPI

Venue: Sumatera Room

13.30 – 13.45	J Leong-Skornickova & Vinita Gowda: Pollinator diversity and pollination biology of native gingers of Singapore
13.45 – 14.00	Florfe M Acma *et al.*: Phytochemical profile of *Amomum muricarpum* Elm. (Zingiberaceae), a Philippine native ginger
14.00 – 14.15	Ina Erlinawati *et al.*: Study of three genera of Araceae in Indonesia
14.15 – 14.30	Rina Ratnasih *et al.*: The utilization of DNA markers, *rcb*L and *mat*K to identify the population of *Amorphophallus* in Tanggamus Mountain, Lampung
14.30 – 14.45	Rodiyati *et al.*: Genetic diversity of *Amorphophallus muelleri* Blume in Java based on trnL and LEAFY sequences
14.45 – 15.00	Edward Tsen: A generic revision of the myrmecophylic understory tree genus *Ryparosa* (Achariaceae) Blume

Pollinator diversity and pollination biology of native gingers of Singapore

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Tropical forests are known for hosting unique and diverse plant-pollinator interactions. In this study, we documented pollinator species and pollination strategies in plants within the order Zingiberales that are native to Singapore. Out of the 26 native gingers recorded from Singapore, we focused on eight species that were in flower between April 2012-April 2013: *Alpinia aquatica*, *Amomum xanthophlebium*, *Hornstedtia scyphifera, H. conica*, *H. leonurus*, *Etlingera elatior*, *Globba leucantha*, and *Stachyphyrinium latifolium*. We investigated the following aspects of their pollination biology: flowering phenology, pollinator species, pollinator visitation rates, floral rewards (nectar and scent), fruit set, and disperser agents. We recorded a diverse group of insect (bees and flies) and bird (spiderhunters and sunbirds) pollinators visiting gingers. We found no correlation between nectar volume and pollinator species (r^2 = 0.26, p = 0.43), and floral morphology was not helpful in predicting their pollinator species (r^2 = 0.24, p = 0.45). Fruit sets were significantly low in most species and were highly correlated to pollinator visitation rates (r^2 = 0.86, p = 0.0003). Using camera traps we identified potential fruit dispersers to be either rodents or large mammals, although in most instances they were also found to be destructive in their activity.

Keywords: birds, insects, mammals, nectar, plant-pollinator interactions, Zingiberales

Phytochemical profile of *Amomum muricarpum* Elm. (Zingiberaceae), a Philippine native ginger

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The study evaluated the phytochemical profile of *Amomum muricarpum* Elm., a Philippine indigenous ginger locally known as ‘tugis’. The qualitative phytochemical screening was performed through histochemical tests to determine the phytochemical content and its localization in different tissues including leaves, rhizomes and fruits. Ripe seeds gathered from the wild were planted in the Botanical Garden of Central Mindanao University, Bukidnon, Philippines. 80% successfully germinated and produced flowers and fruits 12 months after planting. Phytochemical screenings revealed that the

leaves, rhizomes and fruits contain alkaloids, carbohydrates, arbutin (except on the fruit), amygdalin, fixed oils and fats, saponins, tannins, and proteins, while tests for flavonoids, gums and mucilages were negative. Among present phytochemicals, alkaloids and arbutin were unevenly distributed in the leaf, rhizome and fruit extracts. Fats and oils were present in all tissues of the leaf, rhizome and fruit pericarp and showed that phytochemicals were mostly localized in vascular bundles in all regions of the leaf, in the ground tissue and vascular bundles of the rhizome, and in the vascular bundles of the fruit pericarp. Future research should focus on bioassay aspects and quantitative phytochemical aspects to harness the full potential of this species, which is locally used for curing stomach disorders.

Keywords: *Amomum muricarpum,* phytochemicals, histochemical, Zingiberaceae, alkaloids, vascular bundles

Study of three genera of Araceae in Indonesia

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Alocasia, *Colocasia* and *Remusatia* are among the genera of the *Araceae* family which have economic value, for example as food (*Colocasia*), medicinal plants (*Alocasia*), and as ornamental plants (*Alocasia*, *Remusatia*). Those three genera were previously treated as all belong to Tribe Colocasieae. Most recently Nauheimer *et al.* (2012), using plastid and nuclear DNA, *Alocasia* is basally sister to the Colocasieae+Areae. A total number of 295 specimens deposited in Herbarium Bogoriense (BO), Singapore Herbarium (SING), Bogor Botanical Garden Herbarium and recent collections collected from several locations in Indonesia such as Mount Wilis (East Jawa), Mount Watuwila and Natural Forest Ulungolaka (South East Sulawesi), and Gunung Leuser National Park, Ketambe (Aceh, Sumatera) were examined using morphologically based cladistics. For these three genera 21 species are recorded from Indonesia, comprising 17 species of *Alocasia*, three species of *Colocasia*, and one species of *Remusatia*. The presence of *Alocasia flemingiana* and *Remusatia vivipara* on several islands in Indonesia is newly reported. The grouping some species in the *Alocasia* clade support Hay's 1991 and 1998 groups, although these grouping are not well supported. This study will be expanded using anatomical data from selected species of those three genera in Indonesia.

Keywords: Colocasieae, *Alocasia, Colocasia, Remusatia,* Indonesia

The utilization of DNA markers, *rbc*L and *mat*K to identify the population of *Amorphophallus* on Tanggamus Mountain, Lampung

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Titan arum (*Amorphophallus titanum*), a member of Araceae family, is endemic to the northern part of on Sumatera. The spectacular titan arum produces the largest recorded unbranched inflorescence, which can reach 3.5 metres high. *Amorphophallus titanum* has two distinctive activity stages. This research was aimed at using genetic approaches to identify vegetative stages of the population suspected to be *A.titanum* within the area of Mount Tanggamus, Lampung. The genetic markers used in this identification process were *rbc*L and *mat*K, which are highly conserved regions of chloroplast DNA. The length of the nucleotide markers was 1281 bp and 1075 bp respectively. The *Amorphophallus* that we have investigated, including *A. titanum* from Botanical Garden Cibodas - are more closely related to *A. decus-silvae* than to *A. titanum*. We also found that the suspected population from Tanggamus Mountain has similar *rbc*L and *mat*K sequences to the titan arum from Cibodas Botanical Garden, although they differed slightly from the titan arum sequence on the GenBank Database. Further studies must be conducted to validate this result, using more markers.

Keywords: *Amorphophallus*, *rbc*L ,*mat*K, Tanggamus, Lampung

Genetic diversity of *Amorphophallus muelleri* Blume (Porang) in Java based on *trn*L and *LEAFY* sequences

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This research is to investigate genetic diversity of *Amorphophallus muelleri* Blume (Porang) in Jawa based on eight populations from East Java, five populations from Central Java, and one population from the West Java. Sequences were compared by *A. variabilis* Blume and *A. paeoniifolius* (Dennst.) Nicolson as outgroups. DNA was isolated from young leaves of three plants from each population and amplified using "c" (CGAAATCGGTAGACGCTACG) and "d" (GGGGATAGAGGGACTTGAAC) primers for *trn*L gene region and *FLint2* F1 (CTTCCACCTCTACGACCAGTG) and *FLint2* R1 (TCTTGGGCTTGTTGATGTAGC) primers for *LEAFY* gene region. The PCR products were sequenced using the same set of primers. The phylogenetic tree retrieved by using Neighbour Joining (NJ), Maximum Parsimony (MP), and

Maximum Likelihood (ML) showed that the populations were grouped to four major clades. Porang, even is known having apomix seed and commonly reproduces vegetatively, has genetic diversity within a population or between populations with dissimilarity distances reaching 10%. As a tree having the highest bootstrap, NJ tree indicated that most porang samples in Java were not clustered according to their population. It could be caused by seed exchange among populations during porang cultivation. Based on haplotype analysis, all plant samples from Wonogiri occupied at the branch nearest the outgroups showed that the wild porang population has not been introduced by seeds from other populations.

Keywords: *Amorphophallus muelleri*, Java, Porang, *LEAFY*, *trn*L

A generic revision of the myrmecophylic understorey tree genus, *Ryparosa* (Achariaceae) Blume

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The 26 currently circumscribed tropical trees in the genus *Ryparosa* Blume. (Achariaceae) are distributed throughout both the Oriental and Australasian components of the Malesian bioregion. The sole Australian species has recently risen to attention as a model organism of research in plant-animal interactions possessing potent cyanogenic chemical defences and multiple animal mutualisms. The species delineations throughout much of the genus are poorly resolved due to the difficulty and timing of capturing male and female floral morphologies in specimen collections and the oversight of key morphological features of ecophysiological significance. Most notably amongst these newly discovered characters are the production of ant reward food bodies and stem domatia which encourage myrmecophylic mutualisms to varying extents between species. This generic revision combines phenetic techniques of agglomerative classification of morphological and ecophysiological characters in concert with a phylogeny to resolve specific boundaries. The resolution of this important taxon is vital to extend the interpretation of the multiple animal interactions and defence traits to a biogeographical scale.

Keywords: Myrmecophylic, *Ryparosa*, Achariaceae, animal interactions

Session 2

ARECACEAE 2

Convener: Lauren Gardiner, Royal Botanic Gardens Kew & Himmah Rustiami, Research Center for Biologi, LIPI

Chairperson: Lauren Gardiner, Royal Botanic Gardens Kew

Venue: Sulawesi Room

13.30 – 13.45	Charlie D Heatubun & William J. Baker: The Palms of Raja Ampat Islands
13.45 – 14.00	Melissa Abdo: Preliminary study of Molluccan palms dispersed by Blyth's hornbill
14.00 – 14.15	Sarinah *et al.*: Palms diversity in five habitat types in Bangka Island, Indonesia
14.15 – 14.30	Rudi A Maturbongs: Biodiversity and spatial distributions of rattans in the Vogelkop area of West Papua Province, Indonesia: A research proposal
14.30 – 14.45	Dian Latifah *et al.*: Germination strategies of four palm species: *Arenga australasica*, *Calamus australis*, *Hydriastele wendlandiana* and *Licuala ramsayi*
14.45 – 15.00	General discussion

The Palms of Raja Ampat Islands

Heatubun, C.D.[1] & Baker, W.J. [2]

[1]Universitas Negeri Papua, Papua Barat, Indonesia

[2]Royal Botanic Gardens, Kew, UK

The Raja Ampat Islands north west of Western New Guinea are very interesting from a botanical point of view, especially in terms of their palm diversity. Based on six botanical explorations to that area, almost forty palms have been encountered, of which more than ten were endemic and rare, including one new taxa – which is ambiguously placed in Ptychospermatinae, but it may be described in the genus *Adonidia*. The geological history and the present position of the islands could be major factors for the peculiarities of their palm flora. Although this archipelago in general is associated to the main island of New Guinea, its palm flora is more like that of the Moluccas.

Keywords: Palms, Taxonomy, Biogeography, New Guinea, Raja Ampat Islands

A preliminary study of Molluccan palms dispersed by Blyth's hornbill

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The Indonesian province of North Maluku lies between Sulawesi to the west and Papua to the east, and the largest island in North Maluku is Halmahera. According to Kew's World Checklist for Arecaceae, there are about 46 species of palms that occur in the "botanical country" of Maluku, and at least half of these are believed to occur on Halmahera. Blyth's hornbill, *Aceros plicatus,* is a largely frugivorous bird that ranges from throughout the Molluccan islands into New Guinea and east into the Solomon Islands, and is relatively common throughout its range. On Halmahera, *A. plicatus* occurs in several habitat types including lowland and montane rainforests, agroforests (or *kebun campur),* and ecotonal areas at the margins of cleared landscapes or farmlands and forest edges. A preliminary study was carried out to understand the role that *A. plicatus* plays in plant dispersal. Findings indicate that Blyth's hornbill is an effective disperser of at least 9 palm species on Halmahera, including palms from varied habitat types.

Keywords: Seed dispersal, tropical ecology, Halmahera

Palms diversity in five habitat types in Bangka Island, Indonesia

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[3] Bangka Belitung University, Bangka Belitung, Indonesia

Palm exploration (Arecaceae) in five habitat types – hilly forest, lowland forest, swampy area, mangrove and coastal forests – in Bangka Island recorded 56 species from 19 genera, namely *Arenga, Areca,Calamus, Caryota, Cyrtostachys, Daemonorops, Eleiodoxa, Korthalsia, Metroxylon, Myrialevis, Licuala, Livistona, Nenga, Nypa, Oncosperma, Orania, Pinanga, Plectocomia*, and *Plectocomiopsis*. This is about 41% of 46 palm genera recorded in Indonesia. Palm species most commonly found in hilly forest habitat, lowland forest, and rarely found in mangrove area. We found also *Calamus manan*. This is a species of palm that has high economic value due to flexibility and strength. Many people have cultivated this species beside *Calamus oxleyanus*. *Eleiodoxa conferta*

with a yellow rind found at least in 5 populations and not far from the clump with normal fruit skin color (red) in the marsh habitat.

Keywords: palms, five habitat types, Bangka Island, Indonesia.

Biodiversity and spatial distributions of rattans in the Vogelkop area of West Papua Province, Indonesia: A research proposal

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Rattans belong to the Palm family (Arecaceae). These climbing palm have an important role in wide range of people lives in Indonesia, including in West Papua. The Papuans have used rattans for several purposes in their traditional livelyhoods. Since the year 2000, the data-base of rattans in Papua has been updated due to the progress of taxonomical research on palms, including rattan. During the time, many herbarium specimen of rattans have been collected from several locations across the Vogel Kop area, West Papua. Geologically the area is at the junction of a number of tectonic plates, which are interesting to studythe biodiversity of rattans on the different plates. Some of the specimens need to be observed deeply to elucidate their status, particularly rattan specimens came from the Arfak Mountains, Mt. Nenoti, and Sorong-Manokwari lowland. Spatial distribution of rattans based on habitat elevation in this area is noted. Demography-ecological data of rattans in each habitat (lowland 0 – 500 m asl., lower mountain > 500 – 1000 m asl., and upper mountain > 1000 m asl) will be recorded along transects (10 m x 500 m), with ten transects on each type of habitat. Importance Value Index (IVI) and Multi-variate Analysis of Ordination will be used to analyse the data.

Keywords: Biodiversity, Spacial distribution, Rattans, Vogel Kop, West Papua

Germination strategies of four palm species: *Arenga australasica*, *Calamus australis*, *Hydriastele wendlandiana* and *Licuala ramsayi*

Latifah, D.[1]*, Congdon, R.A.[2] & Holtum, J.A.[2]

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Palms (Arecaceae) are important component of many rainforests in tropical region. Many of them have also been cultivated widely as agricultural commodities with highly economical values; besides their importance in restoration of disturbed or marginal lands. Knowledge and application on germination strategies of palms are essential in the cultivation of palms. Many palms have seeds that do not germinate readily, even when light conditions are favourable. This research aimed to determine the effects of seed coat, light and temperature on palm germination with study species: *Arenga australasica*, *Calamus australis*, *Hydriastele wendlandiana* and *Licuala ramsayi*. Therefore treatments used in this research were to promote germination or break dormancy: physical treatments on seed coat as well as light and temperature treatments. The results showed that the hard seed coats of four palms slowed imbibition. Scarified seeds germinated best in *A. australasica*, *C. australis* and *L. ramsayi*. The germination of all seeds was inhibited by far red light. The red light requirement suggests that palm seeds prefer open areas. This implies that in the field, dispersal agents, canopy gaps or open areas may play important roles in promoting germination of some palms.

Keywords: Germination, palms, *Arenga australasica*, *Calamus australis*, *Hydriastele wendlandiana* and *Licuala ramsayi*.

Day 2: Wednesday, 28 August 2013

ORAL PRESENTATION

Underline name is presenting author

* Corresponding Author

DAY 2: WEDNESDAY, 28 AUGUST 2013

08.00 – 09.00	**PLENARY ADDRESS** **Do we need a different approach of teaching plant taxonomy?** **Prof. Dr. Mien A Rifai,** Professor of Plant Taxonomy, Indonesian Academy of Sciences/AIPI, c/o 'Research Center for Biology – LIPI'
09.00 – 09.30	**MORNING COFFEE BREAK**
09.30 – 11.00	**SESSION 3: PHYLOGENETICS-1, BEGONIACEAE & GESNERIACEAE-3, BIODIVERSITY INFORMATICS-1, LAURACEAE**
11.00 – 12.30	**SESSION 4: PHYLOGENETICS-2, PANDANACEAE-1, BIODIVERSITY INFORMATICS-2, PTERYDOPHYTE-1**
12.30 – 13.30	**LUNCH**
13.30 – 15.00	**SESSIONS 5: TAXONOMY & SYSTEMATICS-3, PANDANACEAE-2, ORCHIDACEAE, PTERYDOPHYTE-2**
15.00 – 15.30	**AFTERNOON COFFEE BREAK**
15.30 – 17.00	**SESSIONS 6: TAXONOMY & SYSTEMATICS-4, BIOGEOGRAPHY-1, TAXONOMY & SYSTEMATIC-5, PTERYDOPHYTE-3**
18.30 – 19.30	**BIODIVERSITY INFORMATICS DISCUSSION AT SULAWESI ROOM**

DO WE NEED A DIFFERENT APPROACH OF TEACHING PLANT TAXONOMY?

Mien A Rifai

Indonesian Academy of Sciences/AIPI

c/o 'Herbarium Bogoriense', Research Center for Biology–LIPI

Plant taxonomy has never been very popular with Indonesian university students, simply because the way it is presented fails to show clearly its usefulness to their daily life. One can easily appreciate the students' reluctance to enjoy the course because more often than not plant taxonomy instruction has always been stressed on memorizingthe numerous strange Latin plant names, remembering by heart the position of every taxon in its 'proper' systematic classification, making illustrations of flower analyses, and on the compulsory preparation of meaningless herbarium specimens not very much different from those practiced in kindergarten. Consequently the course given has not been adequate enough to build up their understanding of the meaning of biodiversity (including its aspects of study, utilize, and conserve) as required by the modern world society. It is very likely that the scarcity of capable Indonesia researchers to actively participate in completing *Flora Malesiana* project is the outcome of this unhealthy situation. In an attempt to remedy this embarrassing predicament a new approach is being taken to present a different taxonomic course based exclusively on cultivated plants, especially to make the students immediately aware that it has immediate relevant practical value to the public at large. Towards this end, the taxonomic laboratory practical and other related activities will be linked up with ethnobotany capable of producing information and data of local interest, and to ensure that the undergraduate research exercises as well as the postgraduate theses undertaken are geared to assist the speedy development of superior cultivars with their much needed distinct, uniform, and stable agronomic characters. A relevant textbook jointly written by numerous students and lecturers from many Indonesian universities is being prepared.

Session 3

PHYLOGENETICS-1

Convener: Julisasi T Hadiah, Bogor Botanic Gardens & Peter Wilson, Royal Botanic Gardens, Sydney, Australia
Chairperson: Julisasi T Hadiah, Bogor Botanic Gardens
Venue: Borneo Room

09.30 – 09.45	Sook-Ngoh Phoon & Crayn DM: Phylogeny of *Elaeocarpus* (Elaeocarpaceae): insights from four-locus molecular sequences
09.45 – 10.00	Bhanumas Chantarasuwan *et al.*: The taxonomy and phylogeny of *Ficus* subsection *Urostigma* (Moraceae)
10.00 –10.15	Millard Uy *et al.*: Taxonomic Revision and molecular phylogeny of the Philippine endemic *Greeniopsis*: Implications on natural products research, biodiversity conservation and education
10.15 – 10.30	Stefan Wanke *et al.*: A preliminary molecular phylogeny of *Aristolochia* subgenus *Pararistolochia* (Aristolochiaceae)
10.30 – 10.45	Jer-Ming Hu *et al.*: Phylogenetic relationships of the holoparasitic plant *Balanophora* (Balanophoraceae)
10.45 – 11.00	General discussion

Phylogeny of *Elaeocarpus* (Elaeocarpaceae): insights from four-locus molecular sequences

Phoon, S.N.[1, 2] & Crayn, D.M.[1, 2]

[1] Australian Tropical Herbarium and School of Marine and Tropical Biology, James Cook University Cairns Campus, Australia

[2] Centre for Tropical Biodiversity and Climate Change, James Cook University, Australia

The genus *Elaeocarpus* comprises about 350 species of mostly palaeo-tropical rainforest trees. Previous molecular phylogenetic studies in the genus mainly focused on the Australian species therefore phylogenetic relationships of the majority of the species are unknown. Furthermore, the results of these studies question the monophyly of the genus *Elaeocarpus*in that the genera *Aceratium* and *Sericolea* are weakly nested within its clade. This study uses a much-expanded dataset of plastid (*trnH-psbA*, *trnL-trnF* and *trnV-ndhC*) and nuclear (*Xdh*) markers of 113 species to test hypotheses regarding the monophyly of *Elaeocarpus* and relationships within it. Analyses of the *Xdh* sequence data suggest that *Elaeocarpus*, *Aceratium* and *Sericolea*are each monophyletic, while both the nuclear

and plastid sequence data confirm that they are closely related. Within *Elaeocarpus*, molecular evidence supports the current infrageneric classification, which is based solely on morphology. Eight clades are resolved, i.e. the *Acronodia*, *Monocera* and *Polystachyus* groups in the West Malesia, Group V subgroup A and subgroup D, Group VI, Group XI subgroup B in Australasia and one Asian clade. On the other hand, the basal relationships within *Elaeocarpus* clade are not well resolved. One possible explanation is that the genus underwent a rapid diversification after its split from *Aceratium* and *Sericolea*.

Keywords: *Elaeocarpus*, phylogeny, West Malesia, Australia.

The taxonomy and phylogeny of *Ficus* subsection *Urostigma* (Moraceae)

Chantarasuwan, B.*[1,4], Berg, C.C.[1], Baas, P.[1], Rønsted, N.[2], Kjellberg, F.[3] & van Welzen, P.C.[11]

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Ficus subsect. *Urostigma* is distributed from West Africa and Madagascar through mainland Asia to Japan and through Malesia to Australia and the Pacific. Variation in morphology is broad and confusing because many species share features with others, and some species can show characters considered to be typical of other sections: deciduous habit, leaves without articulation, dispersed staminate flowers, and ramiflory. *F. rumphii* Blume and *F. amplissima* Sm., previously placed in sect. *Leucogyne* by Corner (1959), were transferred to subsect. *Urostigma* by Berg and Corner (2005) but molecular phylogenetic research by Rønsted et al. (2005) showed that *F. rumphii* is embedded in subsect. *Conosycea.* Thus, the systematic position of both species is still doubtful. Our study will provide more data for understanding the taxonomic position of species of *Ficus* subsection *Urostigma*, by combining morphology, leaf anatomy and molecular data in phylogenetic analyses, which will unravel the evolution of the subsection and clarify relationships between the species, thus improving the classification and the recognition of taxa. Based on morphology, including leaf anatomy, 27 species could be recognized. Phylogenetic analysis shows that subsect. *Urostigma* is not monophyletic; *F. rumphii* should indeed be placed in the *Conosycea* clade, while *F. amplissima* should remain in *Urostigma*. *F. caulocarpa* (Miq.) Miq. and *F. virens* Aiton are polyphyletic and these species concepts should be re-evaluated.

Keywords: taxonomy, phylogeny, *Ficus* subsection *Urostigma*.

Taxonomic revision and molecular phylogeny of the Philippine endemic *Greeniopsis*: Implications on natural products research, biodiversity conservation and education

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Greeniopsis Merr. is a poorly known genus of Rubiaceae endemic to the Philippines. Based on morphology, it has been tentatively included in tribe Aleisanthieae but no molecular studies have been conducted hence its taxonomic position has remained contentious. In the present study, sequences of cpDNA (*rps*16, *trn*T-F) and nrDNA (ITS) regions of all species were generated to evaluate the monophyly and determine the position of the genus. Field reconnaissance and herbarium studies were done for the revision, database development (DELTA, INTKEY) and conservation status assessment. Parsimony and Bayesian analyses of the datasets strongly support the monophyly and inclusion of *Greeniopsis* in Aleisanthieae. Moreover, the combined plastid and ITS sequence analysis yielded similar tree topologies and morphology is very congruent with the latter. Comprehensive morphological examinations revealed, however, that woolly hairs on the abaxial leaf surface occur in only one *Greeniopsis* species and this can no longer be a synapomorphy for the tribe. Finally, most species were categorized as critically endangered and the adoption of e-taxonomy in the Philippines could be a good "crutch" to its current biodiversity and taxonomic dilemma, particularly in conserving and popularizing uncharismatic, cryptic, endemic species such as those in family Rubiaceae.

Keywords: *Greeniopsis*, uncharismatic, endemic, Rubiaceae, Philippines, ITS, *trn*T-F, *rps*16.

A preliminary molecular phylogeny of *Aristolochia* subgenus *Pararistolochia* (Aristolochiaceae)

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Aristolochia s.l. contains about 500 species, subdivided into three clades. Subgenus *Pararistolochia* currently comprises 34 species distributed in either tropical central and western Africa (11 species) or Australasia (23 species). In Australasia, species are found in New Guinea and eastern Australia. A single species (*A. decandra*) is known from Borneo. Recent molecular phylogenetic studies, indicated

a sister relationship between African and Australasian species, but only a single species from Australasia was included. Morphologically the subgenus is characterized by a 3-lobed perianth, a 6 - 24 lobed gynostemium and a berry fruit. All species are lianas or climbers but the latter lack the typical flattened stem. This study presents a preliminary phylogeny based on the chloroplast *trn*K-*mat*K-*trn*K-*psb*A region and includes representative sampling from the entire distribution area. The phylogeny strongly supports subgenus *Pararistolochia* as monophyletic. Furthermore, two main, geographically based, clades are recovered: an African and an Australasian clade, both highly supported. However, relationships within the Australasian clade are not fully resolved. The poorly sampled New Guinean species are nested amongst the Australian taxa possibly indicating exchange over former land bridges. Genetic divergence among these species is very low, possibly indicating recent radiation. However, most Australian species are recovered as monophyletic.

Keywords: Africa, *Aristolochia*, Australasia, disjunction, *Pararistolochia*, subgenus, Torres Strait.

Phylogenetic relationships of the holoparasitic plant *Balanophora* (Balanophoraceae)

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Institute of Ecology and Evolutionary Biology, National Taiwan University, Taipei, Taiwan

Balanophora (Balanophoraceae) is achlorophyllous root-parasitic plant, containing 15–17 species distributed mostly in temperate and tropical East Asia, with some species extending into tropical Australia, New Guinea, tropical Africa and Madagascar. Phylogenetic relationships among the species were reconstructed based on sequences of nuclear ribosomal 18S and ITS regions (~2.5 kb). The molecular phylogenetic analyses show *Balanophora* forms a well-supported monophyletic clade that supports the traditional delimitation of subgenera based on the floral characters of male flowers. The two agamospermic taxa *B. japonica* and *B. yakushimensis*, however, showed that they are sister group, and are closely related to, *B. laxiflora*, which differs from the traditional view. The associated hosts of *B. laxiflora* were also identified using PCR amplification from the directly connected root tissue. A diverse host range of *B. laxiflora* was confirmed, including taxa of *Elatostema, Acer, Morus, Ficus, Alnus*, *Rubus,* and *Ardisia*.

Keywords: *Balanophora*, Holoparasitic plant, Phylogeny, host identification.

Session 3

BEGONIACEAE & GESNERIACEAE-3

Convener: Ruth Kiew, FRIM & Abdulrokhman Kartonegoro, Research Center for Biology, LIPI (Gesneriaceae)
Chairperson: Abdulrokhman Kartonegoro , Research Center for Biology, LIPI
Venue: New Guinea Room

09.30 – 09.45	Abdulrokhman Kartonegoro & Daniel Potter: The Gesneriaceae of Mekongga Mt Sulawesi
09.45 – 10.00	Ruth Kiew *et al.*: Towards a Revision of the Gesneriaceae for the Flora of Peninsular Malaysia
10.00 – 10.15	David Middleton & Pramote Triboun: The Gesneriaceae for the Flora of Thailand
10.15 – 10.30	Wei Yigang *et al.*: Gesneriaceae of South China and its Conservation
10.30 – 10.45	Joanne Tan: Conservation of endangered Malaysian Gesneriaceae limestone species
10.45 – 11.00	General discussion

The Gesneriaceae of Mekongga Mountains, Sulawesi

Kartonegoro, A.*[1] & Potter, D.[2]

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Field exploration of the flora of the Mekongga Mountains area of Southeast Sulawesi was conducted from 2009 to 2011. Herbarium specimens were collected for further examination. During this exploration 22 species in 9 genera of the family Gesneriaceae were discovered. These comprise 2 species of *Aeschynanthus*, 4 species of *Agalmyla*, 1 species of *Codonoboea*, 7 species of *Cyrtandra*, 1 species of *Epithema*, 3 species of *Monophyllaea*, 2 species of *Rhynchoglossum*, 1 species of *Rhynchotechum* and 1 species of *Stauranthera*. Twelve of these species are endemic to Sulawesi while the rest are known to occur on neighboring islands or are more widely distributed. *Aeschynanthus crassifolius* and *Monophyllaea merrilliana*, previously known only from the Philippine Islands, are new records for Sulawesi. A new species of *Cyrtandra* collected in the Mekongga area, which resembles *C. gorontaloensis* from North Sulawesi, will be described.

Keywords: Endemic, Gesneriaceae, Mekongga Mountains, Sulawesi.

Towards a revision of the Gesneriaceae for the Flora of Peninsular Malaysia

Kiew, R.[1], Lim, C.L., Rafidah, A.R.[1], Yao, T.L. & Middleton, D.J.[2]

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[2]Royal Botanic Gardens Edinburgh, England

A multipronged approach has been adopted to expedite the revision of Gesneriaceae. On the one hand, international collaboration with the Royal Botanic Gardens Edinburgh has through molecular phylogenetic studies shed light on generic delimitation, for example, in banishing *Chirita* from Peninsular Malaysia (its species now being encompassed in *Damrongia* and the 'new' genus *Microchirita*); reinstating *Loxocarpus* as a genus; transferring *Henckelia* species to *Codonoboea* and synonymising *Trisepalum* into *Paraboea*. On the other hand, the opportunity of working locally has facilitated the discovery of new species by the exploration of botanically unknown areas, the assessment of conservation status is based on actual conditions on the ground, programmes for artificial propagation and breeding of species identified as critically endangered can be implemented; and experiments to grow variable species under controlled conditions can be set up. Finally, working as a team expedites progress.

Keywords: Flora, taxonomic revision, Peninsular Malaysia, Gesneriaceae.

The Gesneriaceae for the Flora of Thailand

Middleton, D.J.*[1] & Triboun, P.[2]

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[2]The Thailand Institute of Scientific and Technological Research, Thailand

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We estimate there are over 220 species of Gesneriaceae in around 30 genera in Thailand. With concerted field work in many parts of Thailand the number of species known from the country has increased enormously in recent years. These additional species are mostly newly described but species previously only known from neighbouring countries, particularly from Malaysia and Burma, have

also been discovered. Some recent finds which could not be accommodated within the existing generic framework have been described in new genera. On going molecular phylogenetic work has clarified and substantially altered the previous generic framework. This includes the large genus *Chirita*, which has been split into five genera, and the southern Thai and Malesian species of *Henckelia*, which have been moved to other genera, mostly *Codonoboea*. Many of the new species are locally endemic in limestone areas and many of these are not in protected areas. The taxonomic work needs to be accompanied by conservation measures.

Keywords: Gesneriaceae, Thailand, new genera, new species.

Gesneriaceae of South China and its Conservation

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[2]Gesneriad Conservation Center of China, Guilin, China

[3]Royal Botanic Garden Edinburgh, , UK

[4]The Gesneriad Society, USA

China is one of the main centers of diversification and differentiation of Old World Gesneriaceae. At present, 40 genera with more than 480 species are reported from China, of which 70% are endemic. Conservation assessments have been undertaken: 3 species (2 described) are Extinct in the Wild (EW), 42% are Critically Endangered (CR), 10% are Endangered (EN), 6% are Vulnerable (VU), 2.5% Near Threatened (NT), 12% Data Deficient (DD), only 27.5% are Least Concern (LC). One result of our assessments has been to ‘declare a biota in crisis’. More than half the Gesneriaceae of South China are in need of protection and conservation. To address this issue, the Guangxi Institute of Botany has a longstanding taxonomic and systematic research link with the Royal Botanic Garden Edinburgh and has recently signed a Memorandum of Understanding with The Gesneriad Society for this purpose. This partnership has resulted in the establishment of the Gesneriad Conservation Center of China at GIB. There are many issues involved in population decline and to better understand some of the causes. A much more work lies ahead to ensure the survival of the many Gesneriaceae species in South China.

Keywords: Conservation, Conservation assessments, Gesneriaceae, Gesneriaceae of South China, the Gesneriad Conservation Center of China.

Conservation of endangered Malaysian Gesneriaceae limestone species

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Most limestone hills in Peninsular Malaysia are under state land jurisdiction and are subjected to quarrying. Limestone vegetation is well known for its unique floristic composition; in Peninsular Malaysia at least 130 endemic species are confined to limestone. Three endemic limestone Gesneriad species namely *Paraboea bakeri*, *Senyumia minutiflora*, *Emarhendia bettiana* have been pushed to the brink of extinction due to ongoing and future scheduled quarry activities. Limestone hills habouring these species were surveyed and living plants were collected for *ex-situ* conservation in the Forest Research Institute Malaysia (FRIM). Besides vegetative propagation, seeds were germinated to produce large number of plants for future conservation programmes. Our conservation efforts include restoration studies to other similar limestone habitats, maintaining an *ex-situ* collection in our botanic garden and domestication of these species as ornamental plants. Finally efforts are made to increase public awareness of these most endangered species and the importance of conserving limestone hills that are so important for these unique plants.

Keywords: *Paraboea bakeri*, *Senyumia minutiflora, Emarhendia bettiana*, limestone, Gesneriaceae, *ex-situ*.

Session 3

BIODIVERSITY INFORMATICS-1

Convener: Campbell O Webb, Arnold Arboretum, Harvard University
Chairperson: Campbell O Webb, Arnold Arboretum, Harvard University
Venue: Sulawesi Room

09.30 – 09.45	Judy West & Michael Preece: World Flora Online – Flora Malesiana participation
09.45 – 10.00	Chuck Miller & Walter Berendsohn: The World Flora Online – Achieving Target 1 of the Global Strategy for Plant Conservation
10.00 – 10.15	Daniel Thomas *et al.*: Implementation of the e-Flora Malesiana: Demonstration and evaluation of database backbones and e-taxonomy tools
10.15 – 10.30	Walter Berendsohn: World Flora Online – a chance for establishing a global network of networks in phytotaxonomy?
10.30 – 10.45	Thomas Hamann & Andreas Müller: Digitalisation and mark-up of published Flora Malesiana volumes with FlorML for the creation of an e-Flora
10.45 – 11.00	General discussion

World Flora Online – Flora Malesiana participation

West, J.[1] & Preece, M.[2]

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Under the Global Strategy for Plant Conservation (GSPC), the CBD at its 10th Conference of the Parties in November 2010 agreed that the 16 targets of the GSPC will be achieved by the year 2020. The updated GSPC Target 1 builds on previous work and aims to complete an ambitious target of "*an online flora of all known plants*" by 2020. The *World Flora Online* (WFO) is an international collaboration involving botanical institutions worldwide, to develop the first-ever comprehensive, authoritative and accessible online resource for the world's approximately 400,000 known plant species. The WFO will improve access to, and analysis and management of critical botanical information for policy makers, planners, biodiversity conservation practitioners, land managers, botanists, ecologists, geneticists, other scientists and users of plant data worldwide. How can the Malesian and Australasian regions and our Flora Malesiana consortium contribute to this target and the development of the World Flora Online (WFO)? How can the Flora Malesiana project benefit from the WFO? As one of the countries in Malesia, Australia is well-positioned to participate and contribute to the WFO project, and to assist neighbouring countries such as those of Malesia and the southwest Pacific. Australia's participation in the WFO will be largely through the development, compilation and management of the *Flora of Australia Online* (*FoA Online*) as a collaborative venture of the Australian botanical community, and will extend to the species in common with Australia's northern Malesian neighbours. As a collaboration between regional herbaria and botanists, *FoA Online* offers a compelling model for botanical collaboration in the Malesian region. The Australian *National Species Lists* (NSL) project supported by the Atlas of Living Australia (ALA) has paved the way for open and shared nomenclatural and taxonomic data for the *FoA Online* system using international information standards in taxonomy and nomenclature. The information architecture based on the NSL enables the *FoA Online* to link to the *Australian Plant Name Index* and the *Australian Plant Census* for complete and authoritative nomenclatural and taxonomic information. It enables links to national and international compilations of biodiversity data such as the Australia's Virtual Herbarium (AVH), the Atlas of Living Australia (ALA), the Global Biodiversity Information Facility (GBIF) and the Encyclopedia of Life (EoL). In return these compilations enable access to wider pools of botanical data, and sophisticated mapping, spatial and other analyses.

Keywords: World Flora Online, biodiversity databases, information architecture.

The World Flora Online – Achieving Target 1 of the Global Strategy for Plant Conservation

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In its decision X/17, the Convention on Biological Diversity (CBD) adopted a consolidated update of the Global Strategy for Plant Conservation (GSPC) for the decade 2011–2020 at its 10th Conference of the Parties held in Nagoya, Japan in October 2010. The updated GSPC includes five objectives and 16 targets to be achieved by 2020. Target 1 aims to complete the ambitious target of *"an online flora of all known plants"* by 2020. A widely accessible Flora of all known plant species is a fundamental requirement for plant conservation and provides a baseline for the achievement and monitoring of other targets of the Strategy. The previous (GSPC 2010) target 1 aimed to develop "a widely accessible working list of known plant species as a step towards a complete world flora," and this target was achieved at the end of 2010, as The Plant List (www.theplantlist.org). Drawing from the knowledge gained in producing The Plant List, an online World Flora of all known plant species is

now underway. The structure of the Flora will be a framework capable of accommodating regional floristic information (at national or lower level) that can provide answers in both regional and global contexts. Enhancements will include more complete synonymy; geographic distributions to at least country level, drawing on national floras, checklists, and monographs; habitat data; identification tools, principally interactive keys, images, and descriptions; conservation status; and other enhancements as practicable, e.g., vernacular names. Much of these data already exist in digital or printed format, and they can be used to populate the Flora. However, the World Flora Online is much more than an information technology project and plant taxonomists will play a crucial role in resolving taxonomy that differs between geographic regions and in generating new floristic and monographic work to update old information and fill in the considerable gaps that exist. This presentation will describe the vision, progress to date and plans for this new and significant project.

Implementation of the e-Flora Malesiana:Demonstration and evaluation of database backbones and e-taxonomy tools

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Recent pilot projects have initiated a shift of Flora Malesiana (FM) from a purely static printed account to a dynamic online format:i) XML mark-upof published FM volumes used to populate the FM Data Portal, and ii) projects testing solutions for online publishing of new taxonomic contents. Two current projects, *Ferns of Sulawesi* and the *Sulawesi Begonia Data Portal*, using state-of-the-art database backbonesdynamically linked with webpages (*Scratchpads* and the *EDIT Platform*), are presented. The functionality of the underlying databases and associated remote collaboration options, bulk upload, image viewers and other features, and their suitability for the implementation ofmajor online florasare evaluated. The results indicate that current tools have reached a maturity that allowspractical implementation of an online platform not only integrating data from the legacy literature and other existing resources such as journal articles and specimen repositories, but also providinga collaborative framework for the creation and online publication of new taxonomic contents. Effective workflows for preparation and online publishing of taxonomic data, including preliminary results such as checklists and regional treatments, willenhance data accessibility and updatability, allow data annotation and peer evaluation, and facilitate the generation of new taxonomic contents.

Keywords: Common Data Model, e-Flora Malesiana, e-taxonomy, Scratchpads, Taxonomic Editor.

World Flora Online – a chance for establishing a global network of networks in phytotaxonomy?

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Taxonomists working on monographs, floras and checklists are traditionally users and members of networks. Individual authors are relying on the established network of world herbaria and the knowledge of colleagues about the local distribution of taxa, their help in doing fieldwork, etc. As a rule, Floras are regional networks of botanists – editorial standards and format have been agreed in close collaboration and (often) some institutions have taken a coordinating role. The collaborative character of taxonomic work is fostered by the usual complementarity of subjects implied in the specialisation of the individual taxonomist. In conclusion, we do have a traditional networking approach that we can build on for future developments. Increasingly, there are networks being established using on-line resources like websites and web-accessible databases to produce and to publish floras and checklists; as we hear there are various plans and concrete developments for floras in the Malesiana region as well. Another development in this arena is the setting up of networks to collaboratively create comprehensive global taxonomic treatments; examples include initiatives like e-Monocots, Palmweb, the Solanum Network, the Cichorieae network and a new initiative to create an international network for a Synthesis of Caryophyllales. The latter is presented as an example for the potential interlinking of individual, regional and taxonomic networks to produce the World Flora Online (WFO), demonstrating both the use of new content created in taxonomic networks and of published content drawn from existing floras. Called for by the global conservation community, WFO has been put on the global agenda by decisions of the SBSSTA and COP of the Biodiversity Convention. This will hopefully bring about increased funding opportunities on national and international levels. It is important that this funding is used to strengthen the actual taxonomic work and the networks underlying the WFO.

Keywords: Caryophyllales, Floras, Funding, Monographs, Taxonomy, World Flora Online.

Digitalisation and mark-up of published Flora Malesiana volumes with FlorML for the creation of an e-Flora

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In recent years, 11 of the 22 volumes of Flora Malesiana have been converted to XML to populate the FM Data Portal. The challenges with regards to mark-up of FM combined with stakeholder requirements are explained. The resulting custom XML schema used for this task, FlorML, which allows for very detailed mark-up of legacy taxonomic works, is presented. The development of the mark-up procedure, evolving from manual mark-up of single volumes to semi-automated mark-up of multiple volumes at once with Perl scripts, is discussed. The results show that it is possible to considerably speed up the mark-up process while retaining a high degree of data atomisation. However, several challenges remain with regards to the legacy data, some of which may require a reconsideration of stakeholder expectations. These are briefly discussed.

Keywords: legacy literature, e-flora, xml mark-up, automation, FlorML.

Session 3

LAURACEAE

Convener: JG Rohwer, Univ. Hamburg & D Arifiani, Research Center for Biology, LIPI
Chairperson: JG Rohwer, Univ. Hamburg
Venue: Sumatera Room

09.30 – 09.45	JG Rohwer: 30 years of work in the Lauraceae – a preliminary conclusion and a call for more cooperation
09.45 – 10.00	Rogier de Kok: The genus *Cryptocarya* (Lauraceae) in Peninsular Malaysia, Thailand and Indo-China
10.00 – 10.15	Deby Arifiani *et al.*: Phylogenetic relationships of *Endiandra* (Lauraceae) inferred from ITS (Internal Transcribed Spacer) sequences
10.15 – 10.30	Li Lang *et al.*: Molecular phylogenetic study of *Caryodaphnopsis* Airy Shaw (Lauraceae) and its tropical Amphi-Pacific disjunction pattern
10.30 – 10.45	Kuo-Fang Chung *et al.*: Flower biology and conservation genetics of Taiwan *Sassafras* (Lauraceae)
10.45 – 11.00	General discussion

30 Yers of work in the Lauraceae – A prelimenary conclusion and a call for more cooperation

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The author has been working in the Lauraceae over the past 30 years. During this time span, considerable progress has been made, in monographic work on minor to medium-sized genera, in floristic treatments, anatomical work, and in the elucidation of the phylogeny of the family. However, there are still some serious challenges to be met. Almost all of the major genera are still poorly understood, mainly because in times of “publish or perish” no single researcher can afford to spend years of his lifetime attempting to understand a group completely, before he or she can publish thebig monograph that would be so desperately needed. Therefore, we need a different approach. In other sciences, e.g. physics, progress is mostly achieved by large international research teams, in which no single person understands every detail, but everyone contributes to the common goal. Why not in botany? Couldn’t we build teams of field botanists recording everything about the living plant and its habitat, documented by high quality photos, researchers working in local floristics, who know their area and their flora very well, ethnobotanists documenting the local uses, plant morphologists and anatomists elucidating the structural details and their development, molecular phylogeneticists retracing the evolutionary lineages, and experienced colleagues bringing all the information into context? Not only science, but also all participants would benefit from such a network.

Keywords: Lauraceae, phylogeny, monographs, floristic treatments, new media.

The genus *Cryptocarya* (Lauraceae) in Peninsular Malaysia, Thailand and Indo-China

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The number of species of *Cryptocarya* R.Br. (Lauraceae) in Peninsular Malaysia and Thailand and Indo-China is almost same. However, there is only about a 50 % overlap in species composition between the two areas. While Peninsular Malesia is dominated by species which are common on the Sunda Plateau, and few endemics, Thailand and Indo-China have many species in common with

South China, and also have a higher percentage of endemic species. The main area of overlap is Peninsular Thailand, with many species only just crossing the border with Peninsular Malaysia. This could be an artefact of collecting, as there are significantly fewer specimens of this genus available for study from Thailand and Indo-China than there are from Peninsular Malesia, and many common species from both China and Peninsular Malesia are only represented by few specimens or even just one. An overview of the species from the area is given and their distribution patterns and morphology are discussed.

Keywords: *Cryptocarya*, Lauraceae, Peninsular Malaysia, Thailand, Laos, Vietnam, Cambodia.

Phylogenetic relationships of *Endiandra* (Lauraceae) inferred from ITS (Internal Transcribed Spacer) sequences

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The two genera *Endiandra* and *Beilschmiedia* are morphologically difficult to differentiate when flowers are unavailable. Within *Endiandra*, e.g., presence and morphology of the staminal gland is a floral character that is thought to be good for grouping the species. Here we report the result of a phylogenetic analysis among *Endiandra* species based on the ITS region of nrDNA. The present analysis included more samples of *Endiandra* than previous studies, and used *Cryptocarya* as the outgroup. Twenty-eight samples of *Endiandra*, *Beilschmiedia* and *Cryptocarya* were sequenced in this study. With some additional sequences from GenBank, a total of 31 taxa were used for phylogenetic analysis employing the maximum parsimony method. Our data are as yet insufficient to determine if *Beilschmiedia* can be separated from *Endiandra* or not. As expected, the presence of staminal glands is a plesiomorphic character. Most glandless species examined so far seem to form a monophyletic group, except *E. impressicosta*, which was found among the unresolved basal taxa.

Keywords: *Beilschmiedia*, *Endiandra*, Internal Transcribed Spacer (ITS) region nrDNA, phylogenetic analysis, sequences, staminal glands.

Molecular phylogenetic study of *Caryodaphnopsis* Airy Shaw (Lauraceae) and its tropical Amphi-Pacific disjunction pattern

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Caryodaphnopsis is a small genus (~14 species) of the Lauraceae. It has a tropical amphi-pacific disjunct distribution, 7 species in tropical Asia and 7 species in tropical America. The position of *Caryodaphnopsis* within the family is still controversial, and its intercontinental disjunction pattern has not been investigated with extensive sampling and precise time dating. ITS, RPB2 and LEAFY sequences of 10 *Caryodaphnopsis* species and 26 other Lauraceae species were analyzed with Maximum Parsimony and Bayesian Inference. Divergence time estimation employed Bayesian Markov chain Monte Carlo method under a relaxed clock. Ancestral distribution reconstruction employed Reconstruct Ancestral State in Phylogenies. Well-supported phylogenetic tree consists of four major monophyletic clades. The position of the *Caryodaphnopsis* clade is between the two top clades, one composed of Cinnamomeae, Laureae and the *Persea* group, and the other of *Neocinnamomum* and *Cassytha* species, whereas the basal clade is composed of the *Cryptocarya* group species. The divergence between Asian and American species within *Caryodaphnopsis* is estimated as mid-Eocene, and its ancestral distribution is on Laurasia. Therefore, we suggest that the amphi-pacific disjunction of *Caryodaphnopsis* resulted from the disruption of the boreotropical flora by climatic cooling during the mid- to late Eocene.

Keywords: amphi-pacific disjunction, biogeography, molecular phylogeny, *Caryodaphnopsis*, Lauraceae.

Flower biology and conservation genetics of Taiwan *Sassafras* (Lauraceae)

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Sassafras randaiense (Taiwan Sassafras), a member of the genus known for its classic Eastern North American-East Asian disjunction, is vulnerable and found only in isolated patches of small and declining populations. It is an ecologically and economically importanttree species endemic to Taiwan,

noted as the sole host plant for the highly endangered broad-tailed swallowtail butterfly. Moreover, this species is one of the five most invaluable broad leaf timber species. To facilitate its effective conservation, flower biology and conservation genetics of *S. randaiense* were investigated. By following the entire flowering periods of four trees in late winter in 2009 and 2010, we confirmed that *S. randaiense* is protogynous, as all known hermaphroditic Lauraceae; however, their sexual phases do not change synchronously as observed in avocado and predicted by earlier studies. Instead the female phase of each flower lasts for less up to 4 days, followed by the male phase. For each tree, female phase flowers were present for 8 to 13 days, and at the 7th day, portion of male phase flowers exceeded those of female phase, indicating that asynchronous dichogamy better characterizes the sexual system of *S. randaiense* and geitonogamy is possible with an individual tree. Population genetic structure and phylogeography investigated based on 17 microsatellite loci and chloroplast *rps16-trnK* and *psbD-trnT*intergenic spacers revealed low allelic diversity and deficit of heterozygotes within each populations and marked population differentiation, suggesting high level of inbreeding and limited gene flows among populations. These could have resulted in severe inbreeding depression manifested by a general low rate of seed germination and high rate of seedling mortality in the species. Based on species distribution modeling, it is predicted that, under the climatic scenarios projected by IPCC, *S. randaiense* would likely go extinct by 2080. Our data suggest actions such as germplasm preservation from different populations and increasing gene flow among populations to conserve genetic diversity and mitigate the effect of inbreeding depression.

Keywords: flower behavior, inbreeding depression, microsatellite, phylogeography, population genetic structure, *Sassafras randaeinse*, species distribution model.

Session 4

PHYLOGENETICS-2

Convener: Peter Wilson, Royal Botanic Gardens, Sydney, Australia & Julisasi T Hadiah, Bogor Botanic Gardens
Chairperson: Peter Wilson, Royal Botanic Gardens, Sydney, Australia
Venue: Borneo Room

11.00 – 11.15	Robert Morley: Understanding the evolution of the Malesian Flora using the interplay between palynology and molecular phylogenies
11.15 – 11.30	Peter G Wilson *et al.*: Phylogenetic analysis of *Xanthostemon* (Myrtaceae) with an emphasis on geography and character evolution
11.30 – 11.45	A Berhaman *et al.*: Phylogeny of Bornean *Tristaniopsis* Brongn. & Gris (Myrtaceae)
11.45 – 12.00	Made Pharmawati & IP Candra.: Low genetic diversity of Patchouli grown in Bali as detected using ISSR marker
12.00 – 12.15	Yi-Shuo Liang & Jenn-Che Wang: Phylogenetic study of Linderniaceae
12.15 – 12.30	General discussion

Understanding the evolution of the Malesian Flora using the interplay between palynology and molecular phylogenies

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Palynology can help in the interpretation of molecular phylogenies in three ways; by 1) providing a deep time record of vegetation and climate history; 2) providing dated records of pollen types which can be used to date clades and the timing of migrations and 3) recognising pollen morphological characters which may suggest the basis for differentiation of clades and identification of new species. Firstly the paper reviews the climate and vegetation history of the Sunda region for the last 50 Ma based on pollen records, and suggests the main times at which plants adapted to both perhumid and seasonal climates were able to disperse into or across Sundaland. It also considers the position and timing of likely dispersal bottlenecks, which it is believed should be clearly represented in molecular datasets. Secondly, the timing of dispersals *into* the region will be discussed with reference to the Dipterocarpaceae, which dispersed into Sundaland at a very early stage, and also, the Ericaceae, which

were probably much later immigrants. Thirdly, the genus *Alangium* will be discussed since it is remarkable in that almost all species can be differentiated on pollen alone. A new perspective of the origin and dispersal of this genus will be considered based on both palynological and molecular data.

Keywords: palynology, Sundaland, Dipterocarpaceae, Ericaceae, *Alangium*, climate history.

Phylogenetic analysis of *Xanthostemon* (Myrtaceae) with an emphasis on geography and character evolution

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The genus *Xanthostemon* comprises around 36 named species that occur in eastern parts of the Flora Malesia region: the Philippines, New Guinea and eastern parts of Indonesia, as well as in Australia, the Solomon Islands and New Caledonia. Two small related genera are recognised in New Caledonia. As presently defined, *Xanthostemon* can be divided into four groups of species based on placentation. One goal of the present study is to test the hypothesis that these groups should be recognised at generic rank. To do this, we used a dataset of plastid (*trn*H-*psb*A and *trn*K/*mat*K) and nuclear (ITS and ETS) markers for 34 taxa across all morphology-based groups, to test monophyly. Analysis of these data confirms monophyly of the tribe Xanthostemoneae but gives only limited support for some morphology based groups. Interestingly, a clade of red-flowered species is sister to all other species in some analyses but the main clades are geographically based. Almost all New Caledonian species are in a single, poorly resolved clade suggesting rapid diversification following a dispersal event. The two Indonesian species sampled, *X. verus* and *X. petiolatus*, group with related Australian taxa in analyses of the nuclear data but resolve separately with chloroplast data.

Keywords: *Xanthostemon*, Myrtaceae, phylogeny.

Phylogeny of Bornean *Tristaniopsis* Brongn. & Gris (Myrtaceae)

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The genus *Tristaniopsis* has a range extending from Australia and New Caledonia, though Malesia to southern Thailand and Burma. In Borneo, herbarium and field study has recognized of 22 species, including 11 new to science. Molecular studies using ITS (Internal Transcribe Spacer) nuclear ribosomal DNA, plus part of 2 plastid coding regions (*rbc*L and *mat*K) were carried out to assess relationships between these taxa, plus one species from Singapore and a few from New Caledonia and Australia, using *Whiteodendron* as an outgroup. Trees were generated using three methods: Neighbor-Joining, Maximum Parsimony and Maximum Likelihood. The data resolved *Tristaniopsis* according to the two geographic regions, Borneo, and non-Borneo. Each sub-clade received >90% support in all analyses but resolution was poor due to limited numbers of informative characters, only ITS gave clear support for the monophyly of the genus. Further work with more variable plastid spacer regions may greatly enhance resolution. Our analysis also included two samples of one species, *T. whiteana*, from disjunct locations. Although a good species morphologically, our sample from Sentosa (Singapore) was apparently not sister to our sample from Borneo. Although this finding is intriguing, testing hypotheses of dispersal vs. vicariance, or introgression vs. diversification, would require more extensive sampling across the geographic range of the genus.

Keywords: *Tristaniopsis*, Myrtaceae, phylogeny.

Low genetic diversity of Patchouli grown in Bali as detected using ISSR marker

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Patchouli is a bushy herb with a strong scent. Patchouli's essential oil is extracted from it leaves. The oil is used in perfumes, incense and traditional medicines. Development of Bali’s spa tourism industry has created high demand for raw materials including patchouli. The centre of patchouli cultivation in Bali is in Badung Regency but it is also grown in other areas, such as Buleleng Regency. High quality

patchouli oil comes from Aceh and Patchouli plants from Aceh (*Pogostemon cablin* (Blanco) Benth.) are considered high quality; Java patchouli (*Pogostemon heyneanus*) is of lower quality. Patchouli cultivated in Bali is believed to be Aceh patchouli. Molecular marker can be used to confirm patchouli cultivars. Leaf samples of patchouli from 12 areas in Badung and Buleleng Regency were collected. Patchouli samples of Lhoksumawe, Tapak Tuan, Sidikalang and Java were obtained from Balitro, Bogor. DNA was extracted in CTAB buffer. Seven ISSR primers were tested and only ISSR 981 and ISSR 855 showed polymorphism. Results from dendrogram analysis found that Java patchouli was separated from other patchouli cultivars, indicating that patchouli plants grown in Bali are cultivars from Aceh. However, all patchouli grown in Bali showed high similarity.

Keywords: ISSR markers, patchouli, Bali, Aceh

Phylogenetic study of Linderniaceae

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The Linderniaceae was previously treated as the tribe *Lindernieae* in Scrophulariaceae. Based on cpDNA phylogeny and stamen characteristics, Rahmanzadeh *et al.* (2005) raised the tribe to the rank of family. Oxelman *et al.* (2005) added two additional genera *Stemodiopsis* and *Micranthemum* to the family which was also accepted by Tank *et al.* (2006). This family is mainly distributed throughout Southeast Asia, Afrotropical and Neotropical areas. In the largest genus, *Lindernia* (c. 100 spp.), several sections have been treated previously as distinct genera. Phylogenetic relationships within Linderniaceae are confused and unclear based on morphology. The present study aims to reconstruct the phylogeny of Linderniaceae using the sequences of cpDNA *mat*K, *trn*L/F, and *rps*16 and partial nuclear gene *RPB2* from 60 species of 13 genera. For the largest genus, *Lindernia*, 10 out of 18 sections were sampled. Results show that *Stemodiopsis* is basal and distinct from other genera of Linderniaceae. The remaining taxa form a highly supported monophyletic group comprising several well supported clades. Taxa of *Lindernia* were spread throughout the clade and clustered with other genera, strongly suggesting that *Lindernia* is polyphyletic. Each well supported major clade is distinguished by autapomorphies. Based on the morphological and molecular evidence, we re-circumscribe some genera within Linderniaceae and propose upgrading several sections of *Lindernia* to generic rank.

Keywords: Linderniaceae, phylogeny, *Lindernia*, *Torenia*, *RPB2*, *matK*, *trnL/F*, *rps16*

Session 4

PANDANACEAE-1

Convener: Ary P Keim, Research Center for Biology, LIPI & Martin Callmander, Missouri Botanical Garden
Chairperson: Ary P Keim, Research Center for Biology, LIPI
Venue: New Guinea Room

11.00 – 11.15	Ary P Keim & Rugayah: Pandanaceae of Flora Malesiana in the past eight years (2005-2013): a state of the art
11.15 – 11.30	Martin Callmander *et al.*: Revisiting the systematics and biogeography of the Pandanaceae based on new phylogenetic and morphological evidence
11.30 – 11.45	Sven Buerki *et al.*: Temporal history of the screw-pine genus *Benstonea* (Pandanaceae): with an emphasis on Malesian species
11.45 – 12.00	Sri E Rahayu *et al*.: The genus *Freycinetia* Gaud. In Java : 41 years after Ben Stone
12.00 – 12.15	Nursahara Pasaribu & Rahmat: The diversity and distribution of Sumatran species of *Pandanus* Stickman
12.15 – 12.30	General discussion

Pandanaceae of Flora Malesiana in the past eight years (2005-2013): a state of the art

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The progress of researches in *Pandanaceae* conducted in Herbarium Bogoriense (BO) for the past eight years (2005 to 2013) encompassing various subjects from morphology, anatomy, taxonomy, ecology, ethnobotany, cytology, germination and seedling to folklore is presented in this synopsis. The results of explorations proceeded in Sumatra, Java, Borneo, Sulawesi, Molluccas, the Lesser Sunda Islands, and New Guinea are provided. Studies made on the other areas within Flora Malesiana such as Malaysia, Singapore, the Philippines, Papua New Guinea, and adjacent areas such as Japan, India, and Australia are also illustrated. Bioprospecting study of *Pandanaceae* has been focused on drugs discovery although the funding on this subject should be taken more seriously. Pandan

association with micro-fungi and bryophytes are studied as well. A special tribute to Rumphius as the first botanist that introduce pandan to the world of modern science is also induced.

Keywords: *Freycinetia*, Indonesia, Malesia, *Pandanaceae*, *Pandanus*, synopsis, taxonomy

Revisiting the systematics and biogeography of the Pandanaceae based on new phylogenetic and morphological evidence

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The Paleotropical dioecious monocot family Pandanaceae includes ca. 700 species assigned to five genera: *Pandanus* (c. 450 spp.), *Freycinetia* (c. 200 spp.), *Benstonea* (c. 60 spp.), *Martellidendron* (6 spp.) and *Sararanga* (2 spp.). We present here a new plastid molecular phylogenetic framework based on c. 300 spp. to assess the monophyly of the family and to test infra-generic classification of its largest and morphologically variable genus *Pandanus*. Key morphological characters have evolved independently several times in *Pandanus*, leading to a non-natural classification. A review of the systematics and biogeography of the family is discussed for the first time by emphasizing on the morphology of staminate and pistillate flowers. This study will ultimately lead to a new infrageneric classification of its largest genus and serve as a benchmark for future systematics studies on the Pandanaceae.

Keywords: Pandanaceae, *Pandanus*, phylogenetic inference, systematics, biogeography

Spatio-temporal history of the screw-pine genus *Benstonea* (Pandanaceae): with an emphasis on Malesian species

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Recent phylogenetic and morphological analyses allowed the description a new genus of screw-pines (Pandanaceae), *Benstonea* (ca. 60 species). This genus is distinctly characterized by stigmatic grooves on the adaxial face of the style and a reduced staminate flower with only 1(-3) stamens. The genus is distributed from India to Fiji with the centre of species diversity in the *Flora Malesiana* region (>90% endemism). Although there is strong morphological and molecular support for the recognition of this genus, the previous study did not resolve its position within the family. In this study, we propose to overcome this issue by inferring a new familial phylogenetic hypothesis based on a broader taxon sampling and additional DNA regions. A species-level phylogeny of *Benstonea* was produced – including >80% of the species diversity. This framework is used to infer the spatio-temporal history of *Benstonea* through the application of a constrained geographical model. This inference will be used to assess the effect of palaeogeographical events (e.g. the impact of the creation of SE Asia) on the diversification of the genus. Furthermore, the effect of climate change on the evolution and modern distribution of the genus is also discussed.

Keywords: *Benstonea*, biogeography, fossil evidence, Pandanaceae, SE Asia

The genus *Freycinetia* Gaud. in Java : 41 years after Ben Stone

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Pandan family (*Pandananceae*) is represented in Java by three genera, *Benstonea* Callm. & Buerki, *Freycinetia* Gaud. and *Pandanus* Parkins. The genus *Freycinetia,* commonly called as climbing pandan, has been known to occur in Java for a long time, however the taxonomy of the species is presently in a unsatisfactory state. This is to some extents attributed to incomplete collection of specimens, where the specimens have been collected mainly from the vicinity of Mt. Gede-Pangrango and Mt. Halimun in West Java and the collection from Central and East Java is extremely meager. Further intensive collection throughout Java is necessary and may end up in a discovery of undescribed taxa. Prior to this present study the last taxonomic account on the pandan flora of Java was Benjamin Stone's Studies in Malesian Pandanaceae VII, which was published 41 years ago. The status of some species is still more or less in question. This study was undertaken to have a better understanding of the morphology of the genus in order to make a better species delimitation, particularly for species found in Java. The result of this current study shows that as far as the genus *Freycinetia* is concerned there has been substantially no difference, except for the presence of *F. sumatrana* in Java, which is now confirmed, the placement *F. lombokensis* into a synonym of *F. javanica*, and the dissolution of two varieties within *F. imbricata* (*F. imbricata* var. *hispidula* and *F. imbricata* var. *kuchinensis*) and one variety within *F. javanica* (*F. javanica* var. *expansa*). This paper constitutes a part of the on-going study of *Panndanaceae* of Java

Keywords: *Freycinetia, Pandanaceae,* Java

The diversity and distribution of Sumatran species of *Pandanus* Stickman

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Pandanus Stickman is one of the four extant genera of *Pandanaceae*. The genus consists of approximately 700 species, in which most are trees. It has the broadest distribution of the four genera, occurring throughout the Old Word Tropics. Despite its stunning diversity in Malesia, the diversity of the genus in Sumatra is less studied compare to neighbouring areas like the Java, Malay Peninsula and Borneo. The present study recognizes twenty two species of *Pandanus* recorded for Sumatra based their habit, habitat and morphological characters, in which one is proposed as new species, namely *Pandanus riauensis* Pasaribu. Species of *Pandanus* in Sumatra occupy various types of habitats including, bushes, beaches, swamp areas and primary and secondary forests ranging from 0 to 2000 m altitudes. Most of the species are well distributed in the lowland areas predominantly along the streams, riverbanks and other wet areas.

Keywords: Ecology, morphology, *Pandanus*, *Pandanaceae*, Sumatra

Session 4

BIODIVERSITY INFORMATICS-2

Convener: Campbell O Webb, Arnold Arboretum, Harvard University
Chairperson: Campbell O Webb, Arnold Arboretum, Harvard University
Venue: Sulawesi Room

11.00 – 11.15	Lauren M Gardiner *et al.*: E-Monocot
11.15 – 11.30	Campbell O Webb *et al.*: Considerations for decentralized sharing of Malesian plant information using linked data infrastructure
11.30 – 11.45	Julie Barcelona: Co's Digital Flora of the Philippines: an online photo-illustrated checklist of Philippine vascular plants
11.45 – 12.00	Kwek Yan Chong *et al.*: Towards a Digital Flora of Singapore
12.00 – 12.15	Fitri Y Amandita *et al.*: DNA barcoding of vascular plants in Jambi, Indonesia
12.15 – 12.30	Ibrahim Djamaluddin *et al.*: GIS Web Server for Biodiversity information System

E-Monocot

Gardiner, L.M. & the e-Monocot project team
Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, United Kingdom

A consortium formed by RBG Kew, the Natural History Museum (London) and Oxford University, and funded by the Natural Environment Research Council in the UK, eMonocot is an e-taxonomy initiative that is providing the first web-based treatment for the world's monocot plants (constituting approximately 20% of all higher plants, some 70,000 species, and including numerous groups of the highest conservation, ecological and economic importance). eMonocot has the potential to revolutionise the way taxonomic data are organised and accessed by both the practitioners and users of taxonomy, targeted at biodiversity and environmental scientists, but also available to other users including volunteer biologists, horticulturists, schools and the general public. Available information will include nomenclature, taxonomic descriptions, images, identification guides and geographical, ecological, DNA sequence and conservation data, harvested from collaborating source systems, structured around a taxonomy derived from the World Checklist of Monocotyledons.
Keywords: collaboration, consensus, eTaxonomy, floristic, monograph, taxonomy, web

Considerations for decentralized sharing of Malesian plant information using linked data infrastructure

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An increasing amount of information about Malesian plants exists in digital form, including online revisions, herbarium records, photographs, taxon-specific portals, and ecological plot data. Theoretically, these data can be reconciled to create checklists, localized field guides, digital keys and other user-focused products. However, online data are often unstructured, and/or presented with insufficient metadata to allow either manual or automated 'stitching together.' A single, well-funded, centralized project would make important contributions, but such a solution is unlikely to be sustainable, or to entice many parties to release and share data, and is contrary to the decentralized way data grows best on the web. We argue that the most successful long term approach will be to utilize the decentralized, linked data ('semantic web') infrastructure. Standards for useful data models

will be set not by a standards organization, but rather by precedent. We discuss existing ontologies and vocabularies, and demonstrate our current implementation for field inventory of forest trees in Indonesia. Major adoption of these technologies will not happen, however, until simple, intuitive tools have been developed to allow botanists to annotate their data appropriately for publishing on the Semantic web, and we describe such vital products, some of which are under development.

Keywords: Data integration, interoperability, semantic web, ontologies, forest inventory

Co's Digital Flora of the Philippines: an online photo-illustrated checklist of Philippine vascular plants

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Leonardo L. Co, a Philippine plant taxonomist, devoted his life to studying the plant diversity of his country. His *magnum opus* was an updated version of Merrill's An Enumeration of Philippine Flowering Plants. Sadly, in 2010Co's life was tragically ended before he could complete this checklist. In November 2011, we launched the *Co's Digital Flora of the Philippines* website (CDFP; www.philippineplants.org) to host Co's unpublished checklist. Linked to this checklist are thousands of photos present on *PhytoImages* (www.phytoimages.siu.edu).The aim of this website is to present a continuously updated account of all native and naturalized species of vascular plants in the Philippines with multiple diagnostic photographs for each taxon. In this way, we wish to honor Co's contributions to Philippine botany and continue his legacy of freely sharing botanical knowledge to stimulate biological education, research, and conservation.

In this presentation, we report on our efforts of photo-documenting the Philippine flora for the CDFP project. We also discuss the role of social media (i.e., Facebook) in involving a diverse range of CDFP users who use and contribute to this website. We also provide examples of how plant photography projects can result in the discovery of undescribed species and range extensions.

Keywords: plant conservation, flora, Philippines, Phytoimages

Towards a Digital Flora of Singapore

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Several checklists have been produced for the flora of Singapore since 1900. In this digital age, the dissemination of information can be made even more rapid and accessible to scientists and non-scientists alike through media such as online databases, websites, blogs, and even smart-phone applications. We will provide an overview of recent developments of such open-access resources for the vascular plants of Singapore. The authors of these resources are diverse—ranging from hobbyists, to botanists, to a government agency. While diversity of interests and specializations is necessary to maximize the effectiveness of crowd sourcing, a framework for integration and standardization would help to improve the overall experience of the web-using, amateur botanist. We will show how we envision this framework to function, and the challenges that believe its implementation. Envolving beyond conventional methods of communicating scientific outputs will help to bridge the gap between scientists and the public, and re-invigorate public participation in natural history.

Keywords: digital flora, Singapore, vascular plants, citizen science, bioinformatics

DNA barcoding of vascular plants in Jambi, Indonesia

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DNA barcoding aims at providinga fast, accurate, and easily accessible species identification system. The use of DNA barcoding is of particular relevance for the identification of plants in highly diverse but endangered tropical systems such as in the forests of Indonesia which are facing great threats. This research is taking place in Jambi Province (Sumatra, Indonesia), where most of the original forest cover has been converted into oil palm and rubber plantations. We aim to sequence the DNA barcodes of vascular plant species in logged-over old growth forest and three different transformation systems (jungle rubber, rubber and oil palm plantations) and then combine it with classic morphological species identification to establish a barcoding system for vascular plants in the regionand to make the

data available for the scientific community via DNA barcoding databases. Together with specimen data and high quality photographs of fresh and dried plant material this information should speed up plant research in tropical transformation systems.

Keywords: DNA barcoding, vascular plants, Jambi, barcoding database, transformation system

GIS Web Server for Biodiversity Information System

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Ecological protection strategies, designed by sharing information and integrating data, play an important role in defining interconnections and interdependencies in research as well as in increasing global awareness. The Geographic Information System (GIS) web server is one technology solution to improve the interoperability and sharing between the biodiversity databases of an organization and the databases of other research groups. In this paper, we have designed a database system integration framework based on GIS technology and developed a GIS server using the latest cloud-based technology to incorporate biodiversity databases. A GIS server is a WebGIS platform integrating multiple geodatabases and provides data display and query, allowing users to apply internet browsers to manipulate the functions and query the data, etc. To demonstrate the effectiveness of the GIS web server, plant survey data from Mt. Gede-Pangrango, West Java in Indonesia, is studied for utilizing biodiversity information. With the server system, users can query the survey data of each species, view the location and the photo of the species. Also, other advantages of the GIS web server include intelligent spatial query functions, and integrating other map services such as remote sensing, topography and land-use to species distribution map.

Keywords: Biodiversity Information, Database System, Web Server, GIS, Interoperability

Session 4

PTERYDOPHYTE-1

Convener: Dedy Darnaedi, Research Center for Biology, LIPI & Peter Hovenkamp, National Herbarium of Netherlands
Chairperson: Peter Hovenkamp, National Herbarium of Netherlands
Venue: Sumatera Room

11.00 – 11.15	Atsushi Ebihara *et al.*: Toward the publication of "Asian fern red list
11.15 – 11.30	Yeachen Liu & Wenliang Chiou: Insights on phylogeographic study of Asian *Athyrium* (Athyriaceae, Pteridophyta)
11.30 – 11.45	Michael A Sundue *et al.*: Phylogenetic of Grammitid Ferns: Impacts for the Flora Malesiana Region
11.45 – 12.00	Agung Sedayu *et al*.: The importance of ecophysiological characters in delineating the niche partition of *Cyathea contaminans* and *C. squamulata* (Cyatheaceae, Pteridophyta)
12.00 – 12.15	Azi Jamaludin & Alastair Culham: Systematics of Malaysian scaly tree ferns (Cyatheaceae) phylogenetics & computer-aided identification
12.15 – 12.30	Chunxiang Li & Yang Qun: Preliminary interpretations on diversification time of the fern genus *Athyrium* from fossil and molecular dating

Toward the publication of "Asian fern red list"

Ebihara, A.

National Museum of Nature and Science, Japan

While it is well known that cosmopolitan or widely distributed species are present in ferns and lycophytes, a number of narrowly distributed species, often threatened, are also present. Recently we compiled a list of narrowly distributed species of ferns and lycophytes in Asia by an international collaboration of 18 researchers (Ebihara *et al.*, Bull. Nat. Mus. Nat. Sci. B, 38: 93-119, 2012), which will serve as a prototype for a global red list. The newly compiled list, for which we combined country-level red lists and knowledge of the specialists, includes a total of 886 taxa (577 in SE Asia, 215 in E Asia and 101 in S Asia). However, information on the flora of countries/areas where checklists and/or red lists are not yet available is still lacking. The challenge will now be to collect detailed information on the distribution of the nominated taxa to apply the IUCN criteria to threatened species as well as to supplement information-poor areas. We are also preparing an integrated checklist of all the Asian ferns and lycophytes that will help clarify a whole picture of the flora of the Asian ferns and lycophytes.

Keywords: ferns, pteridophytes, red list, threatened species

Insights on phylogeographic study of Asian *Athyrium* (Athyriaceae, Pteridophyta)

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The genus *Athyrium* is mainly distributed in northern temperate and subtropical mountain areas. It is most diverse in Asia. In the western and south Pacific islands, *Athyrium* species occur in the mountainous middle to high elevations and exhibit high ratiosof endemism of this genus. The phylogenetic studies revealed remarkable relationships among these endemic taxa. The remaining *Athyrium* species are disjunctive distributing between the Himalaya and these islands. Their sister species are sometimes found as the endemic to Himalaya. Based on the geographic evens and species-diversify time, we proposed that these northern hemisphere plants may have extended their distributions to equatorial high mountains through Taiwan to the Philippines forward to Borneo and Java. This hypothesis may explain how these northern temperate species spread to south and tropical mountain regions.

Keywords: *Athyrium*, endemism, phylogeography

Phylogenetics of Grammitid Ferns: Impacts for the Flora Malesiana Region

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Grammitid ferns comprise a monophyletic group of ca. 900 species of tropical epiphytes distributed in humid montane forests of the world. Molecular phylogenetic studies have shown that several large genera occurring mostly in the Paleotropics (*Ctenopteris s.l.*, *Grammitis s.l.*) or mostly in the

Neotropics (*Lellingeria, Terpsichore*) were polyphyletic, necessitating nomenclatural innovations at the generic level. Although recent taxonomic and phylogenetic studies have made significant progress in delineating primarily Neotropical genera, our current research is primarily focused on Paleotropical taxa where about 2/3 of the diversity of the clade is held. We have conducted phylogenetic analyses of plastid DNA sequences of *rbcL*, *atpB*, rps4-trnS, and *trnL-trnF* IGS sequence data on 219 accessions of grammitid ferns representing 207 species and 31 presently recognized genera. There are six important features of our analyses: 1) grammitids are ancestrally Neotropical. 2) At least 13 dispersal events from the Neotropics to the Paleotropics have occurred; dispersal event from the Paleotropics to the Neotropics havenot occurred 3) Most dispersal events have not coincided with species radiations, although two have: first, the radiation of the Hawaiian endemic genus *Adenophorus* (10-12 species); second, a large clade estimated to comprise ~530 species. This large clade is primarily restricted to the Asia and the Pacific region, but with three dispersal events out of this region. Two species (*Notogrammitis crassa* and *N. angustifolia*) independently dispersed to Southern Chile, Southern Argentina, and South Atlantic Ocean islands, the former also reached South Africa. 4) African and Malagasy species are not part of this predominantly Asian clade. African species are all disjunctions from otherwise Neotropical genera (*Alansmia, Ceradenia, Cochlidium, Enterosora, Leucotrichum, Melpomene, Stenogrammitis*, and *Zygophlebia*) or from the circumtropic (but not Asia) *Grammitis s. s.* and the circumaustral *Notogrammitis*. 5) Several Paleotropical genera, as sampled so far, were supported as monophyletic (i.e., *Acrosorus*, *Archigrammitis*, *Calymmodon, Chrysogrammitis, Dasygrammitis, Micropolypodium, Notogrammitis, Prosaptia, Scleroglossum*, *Themelium*, and *Xiphopterella*); but, several genera were clearly not monophyletic (e.g., *Ctenopterella, Grammitis, Oreogrammitis*, *Radiogrammitis*, and *Tomophyllum*).

Keywords: Biogeography, generic circumscription, long-distance dispersal

The importance of ecophysiological characters in delineating the niche partition of *Cyathea contaminans* and *C. squamulata* (Cyatheaceae, Pteridophyta)

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Cyathea contaminans and *C. squamulata* are close relative species, reflected by their placement within a single subgenus, *Sphaeropteris*. In lowland West Java, they are abundantly found co-occurred in a single locality, however, there is no data on niche partition available in understanding the ecology of both species. In a highly deforested habitat as lowland West Java, ecological understanding is critical for their conservation. We noted only one investigator (Holttum, 1963) endeavored to distinguish their niche partitioning by defining light environment as their primary niche partition. This paper tries to follow Holttum's lead on whether light regime is indeed an ecological descriptor delineating the two species. We used several indices: *LDI* (Leaf Dissection Index), *SPI* (Stomate Pore Index), and *LMA* (Leaf Mass per Area) which were proven as traits positively correlated to light environment. Our observation revealed that *LDI* and *SPI* significantly demonstrated that *C. contaminans* is a species adapted to open areas while *C. squamulata* is adapted to shaded areas. *LMA* measurements did not signify light regime preference in both species. Along light gradients, both species behaved similarly to spermatophytes, as shown by their *LDI* and *SPI*, but not of *LMA*. We conclude that some light-related ecophysiological traits are good descriptor in differing *C. contaminans* and *C. squamulata* habitat preferences; however some traits are probably not clearly displayed by both species.

Keywords: Conservation, *Cyathea contaminans, Cyathea squamulata*, light environment, *LDI, LMA, SPI*

Systematics of Malaysian scaly tree ferns (Cyatheaceae): phylogenetics and computer-aided identification

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Scaly tree ferns (Cyatheaceae) have a complex classification history since the understanding of relationships among the component genera has always been dependent on the scale and indusium morphologies. Recent studies have led to the suggestion of Cyatheaceae being split into four genera (*Sphaeropteris, Cyathea, Alsophila*, and *Gymnosphaera+Alsophila capensis*) based on DNA sequence evidence,as opposed to the current classfication (*Alsophila*, *Cyathea*, and *Sphaeropteris*) that is widely used. In this study, initially two plastid DNA regions (*rbcL*and *trnH-psbA*) will be used to develop identification systems for the scaly tree fern family in Malaysia. In addition, a multi-access morphological key for field identification will be developed based around taxa recognised by extensive field sampling of the currently recognised species. It is hoped that this study will update the current classification of scaly tree ferns family in Malaysia as well as contribute tostabilisingthe Cyatheaceae classification in general.

Keywords: Cyatheaceae, scaly tree fern, Malaysia, multi-access key, rbcL, trnH-psbA, phylogenetics

Preliminary interpretations on diversification time of the fern genus *Athyrium* from fossil and molecular dating

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The extant *Athyrium* Roth is a worldwide fern genus of about 200 species, with a distribution center in the Himalayan and adjacent mountain regions. The oldest fossils assigned to it comprise fronds and spores preserved *in situ* from the Lower Cretaceous of northeast Asia. However, the molecular dating suggests that *Athyrium* diverged during the Eocene (~42.6 Ma). *Athyrium* fossils are the first unequivocal polypodiaceous ferns, while, they have not been accepted as definitely belonging to this fern lineage, their precise relationships within polypods are uncertain. Here we present some preliminary interpretations for the disparity in fossil and molecular age estimates, and new insights into the origin and evolution of the genus. We suggest that characters used to assign the Lower Cretaceous fossils are not synapomorphies for only the genus *Athyrium*, but are putatively plesiomorphic states for the stem group of the whole eupolypods II ferns, so the Early Cretaceous *Athyrium* most likely represents a stem-group member, and that lineage extinction during the early evolutionary stages of the genus resulted in missing nodes.

Keywords: *Athyrium*, Fossil, Phylogeny, Molecular dating

Session 5

TAXONOMY & SYSTEMATICS-3

Convener: Julisasi T Hadiah, Bogor Botanic Gardens & Peter Wilson, Royal Botanic Gardens, Sydney, Australia
Chairperson: Yuzammi, Bogor Botanic Gardens
Venue: Borneo Room

13.30 – 13.45	Richard CK Chung & E Soepadmo: Pollen morphology of Malvaceae subfamilies *Brownlowioideae, Grewioideae* and *Dombeyoideae* in Peninsular Malaysia and Borneo
13.45 – 14.00	M Harun-ur-Rashid *et al.*: Micro-morphological studies in the genus *Gmelina* L. (Lamiaceae) in Malesian region: its taxonomic relevance
14.00 – 14.15	Alexandra Konstantinova *et al.*: Fruit anatomy of Malesian genus *Osmoxylon* Miq. (Araliaceae)
14.15 – 14.30	Seda Segun *et al.*: 200 year old question: what is *Vitex rotundifolia*? Is it a species, or a subspecies, or a variety, or just an ecological cline
14.30 – 14.45	Mikhail Romanov & Bobrov Alexey VFCh: Fruit structure in Myristicaceae
14.45 – 15.00	Tri Harsono *et al.*: Distributon of germplasm of *Bouea* (Anacardiaceae) in Malesia

Pollen morphology of Malvaceae Subfamilies *Brownlowioideae*, *Grewioideae* and *Dombeyoideae* in Peninsular Malaysia and Borneo

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The pollen morphology of 68 species (126 samples) from 10 genera , i.e. *Berrya, Brownlowia, Colona, Diplodiscus, Grewia, Jarandersonia, Microcos, Pentace, Schoutenia,* and *Trichospermum* of Malvaceae subfam. Grewioideae, Brownlowioideae and Dombeyoideae from Peninsular Malaysia and Borneo was examined using light microscope (LM), scanning electron microscope (SEM) and transmission electron microscope (TEM). On the basis of aperture types, exine sculpturing and pollen shapes, three pollen types, the *Tilia*-type, *Grewia*-type and *Malva*-type are recognised. In the oblate *Tilia*-type and prolate *Grewia*-type, the pollens are colporate while in the spherical *Malva*-type are porate. The pollen morphological variation and similarity of the studied genera are discussed.

Keywords: Pollen morphology, Peninsular Malaysia, Borneo, *Grewioideae*, *Brownlowioideae*, *Dombeyoideae*

Micro-morphological studies in the genus *Gmelina* L. (Lamiaceaea) in Malesian region: its taxonomic relevance

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Foliar epidermal micro-morphological study on 18 taxa of the genus *Gmelina* L. from Malesina has been carried out to determine their taxonomic significance for the first time. The observation reveals that *Gmelina* species are hypostomatic and mostly anomocytic. Stomata are somewhat frequent in most of the species, but much more abundant in *G. moluccana*, *G. palawensis, G. paniculata*, *G. philippensis*, and in *G. racemosa*; although they are much less frequent in *G. delavayana*, *G. hainanensis, G. tomentosa* and in *G. uniflora*. The stomata are not visible in *G. hainanensis, G. lepidota*, and *G. racemosa* as the surfaces are almost completely covered by trichomes. A wide variety of trichome types have been found in this study. They are very variable both in size and density. Two main trichome types eglandular and glandular; and basically seven vestiture types *viz*. glabrous or glabrescent; glandular; glandular-pilose; glandular-tomentose; lepidote; tomentose; and stellate occur in *Gmelina*. Having both surfaces tomentose *G. tomentosa* is distinctive from all of its congeners; in contrast, both surfaces are glabrous to glabrescent in *G. moluccana*, *G. palawensis* and in *G. schelechteri*. Glandular trichomes are absent only from *G. tomentosa*, whilst eglandular trichomes are absent from G. *asiatica*, *G. delavayana*, *G. lepidoata*, *G. philippensis*, *G. spectabilis*, and *G. uniflora*. However, both types of trichomes are observed in *G. annamensis*, *G. arborea, G. chinensis*, *G. elliptica*, *G. hainanensis*, *G. racemosa*, and *G. tonkinensis*. Uniseriate, multicellular eglandular trichomes are widespread in almost all taxa examined, though unicellular trichomes were observed in *G. chinensis, G. lepidota* and in *P. divaricata*. *G. lepidota* is distinctive from all other species examined because its abaxial surface covers lepidote trichomes with distinct "*Patelliform*" multiseriate trichomes or filiform, unicellular eglandular trichomes. *G. moluccana* differs in having "*Asciiform*" glandular trichomes and conspicuous swollen inter-stomatal ridges. The distinct type "*Calvitium*" indumentum was observed only in *G. spectabilis* make these species readily distinguishable from all other members of the genus. A distinctive type of hyaline, sessile, peltate glandular trichome with a long central ray occurs in *G. schlechter* has not been observed in any other species of Lamiaceae or Verbenaceae; by which it can be easily distinguished from other species. None of these types have been reported earlier from any member of Lamiaceae or Verbenaceae.

Keywords: Micro-morphology, foliar epidermal anatomy, trichomes, Malesiana, *Gmelina*

Fruit anatomy of Malesian genus *Osmoxylon* Miq. (Araliaceae)

Konstantinova, A.I.

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Osmoxylon is the largest genus of Araliaceae in Malesian flora. According to Philipson (1976), 41 of its 50 species occur in Malesia. These plants possess several traits unusual for this family: peculiar inflorescences, petals fused at base, unique pollen structure. The genus has been poorly studied with no recent revision available and fruit anatomy uninvestigated to date. Mature fruits of 6 species (*O. pfeilii, O. serratifolium, O. talaudense, O. trilobatum, O. geelvinkianum, O. mariannense*) were studied. In *Osmoxylon*, seeds enclosed in pyrenes of endocarpic origin serve as diaspores. The diaspore releases through destruction of mesocarp layers adjacent to the pyrene. The pyrene is likely to have been capable of dehiscence and is still dehiscent (*O. serratifolium*), however, in most species the dehiscence is lost and only its vestiges can be traced anatomically. Noteworthy, although studied species are quite similar in pericarp histology, the diaspore (pyrene) shape is a good feature to diagnose certain species. Species with multilocular fruits (*O. geelvinkianum, O. mariannense*) demonstrate some carpological similarities to *Schefflera s.l.* polymerous groups (Pacific -"*Plerandra*" and Asian -"*Tupidanthus*"): almost or fully sessile discrete stigmata, seedless locules, etc.; – and differences due to lack of well-developed secretory system in *Osmoxylon*. Therefore, *Osmoxylon* represents quite an independent evolutionary trend in polymery origin within Araliaceae.

Keywords: *Osmoxylon*, carpology, fruit, diaspore, pericarp histology, morphology and anatomy, evolutionary trend, secretory system, pyrene

200 year old question: What is *Vitex rotundifolia*? Is it a species,or a subspecies, or a variety,or just an ecological cline

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In 1782 Carl Linnaeus described *Vitex rotundifolia* based on a *Thunberg* specimen from Japan. However, since then, different authors placed *V. rotundifolia* in different taxon as species, variety or subspecies; or even claimed that it was an ecological cline. Although today most of these names are accepted as synonyms, the discussion whether it is a subspecies of *V. trifolia* or a separate species as described by Linnaeus still continues. Here the taxonomic status of this plant is clarified according to the results of the morphological analysis of several characters.

Keywords: *Vitex rotundifolia,Vitex trifolia* var. *littoralis*, taxonomic status, morphological analysis

Fruit structure in Myristicaceae

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The family Myristicaceae is basal in Magnoliales and develops monomerous gynoecium/fruit in contrast to mostly polymerous ones in other families of the order (except Degeneriaceae). Supposedly the monomerous gynoecium/fruit of Myristicaceae and Degeneriaceae should not be recognised as synapomorphy. Should the pericarp structure in Myristicaceae be treated as the basal in Magnoliales? The fruit anatomy of Malesian *Gymnacranthera*, *Horsfieldia*, *Knema* and *Myristica* as well as neotropical *Otoba* and West African *Pycnanthus*, *Scyphocephalum* and *Staudtia* species of Myristicaceae was studied at developmental stages. The exocarp and the endocarp are represented by unspecialised epidermis. Most of the pericarp is composed by the multilayered parecnhymatous mesocarp with numerous scattered vascular bundles, secretory cells and usually some sclerenchymatous elements in the peripheral zone. The ventral and mostly dorsal slits (along which the fruits dehiscent) are very well develloped in all fruits studied and in some cases they are particularly distinguishable within the mesocarp due to sclerified walls. In general unspecialised exocarp and endocarp, and mostly homocellular mesocarp of Myristicaceae are plesiomorphic for the order Magnoliales. Similar to Myristicaceae pericarp structure is observed in indehiscent fruits of some Annonaceae. The indehiscent fruits of *Degeneria* differ from those of Myristicaceae by the mesocarp structure.

Distribution and Germplasm of *Bouea* (*Anacardiaceae*) in Malesia

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Bouea or Marian plum is one of the genus of Anacardiaceae which grow wildly in the Malesian region. The purpose of this study was to find the distribution and variation of the germplasm of marian plum. Observations on 105 sheets kept at the Herbarium Bogoriense, and living colections distributed from Sumatra, Java, Kalimantan, Ambon and Thailand were done. It was found that *Bouea* consisted of two species, *B. macrophylla* Griffit dan *B. oppositifolia* (Roxb.) Meisn. Based on the leaf form variation, *B. macrophylla* has relatively similar leaves for all cultivars, however the fruit colour is very different and can be divided into 2 groups i.e. light yellow fruits (*gandaria* cultivar found in in the city of Ambon and *merinya* cultivar found in Lhok Sukon dan Lhok Seumawe, Aceh) and the second group is fruit with brown spotted yellow (which grow in kundang, Bengkalis; Meranti Village, Padang Island, Riau; Batusangkar, West Sumatra; Jaka Baring, South Sumatra; Banjar Baru and Kota Baru, South Kalimantan; Bogor, Pantai Carita, Ciboleger, West Java). On the other hand, *B. oppositifolia* were consisted of three groups based on their leaves characters, i.e. obovate leaves known as *Ramania pipit* cultivar found in Wanariset Research Area East-Kalimantan; elliptic leaves locally known as *Raman* discovered at Sultan Syarif Kasim Nat. Park, Riau, and another cultivar called *haramania* in Padangbolak, North Sumatra; and linnearis leaves which do not have local name collected from Mt. Guntung-Sukadana-West Kalimantan. However, this *B. oppositifolia* can be grouped into 2 groups of fruit characters i.e., oblong, yellowish green, (found in Padangbolak-Sumut and Sutan Syarif Kasim-Riau National park); oblong, red fruit (found Bogor which was known being introduced from Yunan, South China). Among the prominent characteristics of the *Bouea*, cultivars grow in Ambon, Merinya Aceh and South Kalimantan are potentially useful for crossing to improve their quality and characters.

Keywords: *Bouea*, distribution, species, genetic resources, potential

Session 5

PANDANACEAE-2

Convener: Ary P Keim, Research Center for Biology, LIPI & Martin Callmander, Missouri Botanical Garden
Chairperson: Martin Callmander, Missouri Botanical Garden
Venue: New Guinea Room

13.30 – 13.45	Henk Beentje: The family Pandanaceae in Peninsular Malaysia
13.45 – 14.00	Altafhusain B Nadaf & Rahul Zanan.: An updated biodiversity status of Indian Pandanaceae
14.00 – 14.15	Rahul Zanan & Altafhusain B Nadaf: Phylogenetic assesment of the Indian screw-pine genus *Pandanus* (Pandanaceae)
14.15 – 14.30	Ruliyana Susanti & Eizi Suzuki: Growth strategy of two congeneric species *Pandanus furcatus* and *P. Nitidus*
14.30 – 15.00	General Discussion

The family Pandanaceae in Peninsular Malaysia

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Herbarium material of Pandanaceae is often unsatisfactory, and especially older types may just consist of a few carpels and part of a leaf. Field work is therefore essential – but may not always be very fruitful either, as many species are only fertile once every few years; especially male flowering material is very rare, as anthesis may be as short as three days. Despite such problems taxonomists need to provide usable accounts of this family, which has considerable diversity in Southeast Asia. I will highlight some of the problems as well as solutions in my treatment of Pandanaceae for the Flora of Peninsular Malaysia, where three genera are recognized: *Freycinetia* (8 species), *Benstonea* (13 species) and *Pandanus* (28 species).

Keywords: Pandanaceae, taxonomy, Malaysia, *Freycinetia*, *Pandanus*, *Benstonea*

An updated biodiversity status of Indian Pandanaceae

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The family Pandanaceae contains five genera *Freycinetia, Pandanus, Benstonea, Sararanga* and *Martellidendron*. Indian Pandanaceae is represented by three genera, *Pandanus* and *Benstonea* distributed in Southern and North-eastern India and *Frecynetia* restricted to Andaman and Nicobar Islands with two species. In the present study, the Indian Pandanaceae is revised and synonyms species are merged to come up with an exact number of species. Our extensive survey throughout India led in the discovery of 3 new *Pandanus* species (2 from Western Ghats - P. *palakkadensis* and *P. mangalorensis* and 1 from North East Himalaya - *P. martinianus*). The present taxonomic revision confirmed total number of *Pandanus* species to 14 that are distributed in the Southern India (8 species) and North East Himalayan region (5 species) with one species in Andaman and Nicobar Islands. The conservation status following IUCN Red list categories and criteria showed that 6 species are falling under threatened category with sub categories as Critically Endangered (*P. palakkadensis* and *P. mangalorensis*), Endangered (*P. unguifer* and *P. martinianus*) and Vulnerable (*P. diversus* and *B. thwaitesii*). 9 other species fall under Least Concern category (*P. furcatus, P. canaranus, P. foetidus*, *P. odorifer*, *P. kaida*, *P. leram*, *P. nepalensis*, *B. foetida*, *F. rigidifolia* and *F. insignis*) and *P. emarginatus* comes under Data Deficient category. Remaining two species *P. amaryllifolius* and *P. dubius* are exotic. Based on our study, we recommend including 6 threatened species in the IUCN Red List.

Keywords: Indian Pandanaceae revision, IUCN criteria, Critically endangered species

Phylogenetic assessment of the Indian screw-pine genus *Pandanus* (Pandanaceae)

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Indian Pandanaceae represents three genera viz., *Pandanus* (14 species), Benstonea (2 species) and *Frecynetia* (2 species) with totalling 18 species distributed in Southern and Northeastern India and

Andaman and Nicobar Islands. As per the Stone's (1974) infrageneric classification system, Buerki *et. al.* (2012) phylogenetic analysis, Callmander *et. al.* (2012) morphological analysis of genus *Pandanus*, Indian *Pandanus* species repressen three subgenera viz., *Rykia*, *Pandanus*, and *Kurzia.* North eastern Indian *Pandanus* species represent subgenus *Rykia,* Southern Indian *Pandanus* species represent subgenera *Rykia*, *Pandanus* and *Kurzia*. This infrageneric classification was assessed using 3 chloroplast DNA sequences - *trn*L (UAA) 5' - *trn*L (UAA) 3', *trn*L (UAA) 3' - *trn*F (GAA) and *atp*B - *rbc*L. In the present study, all *Pandanus* species from different subgenera were fairly represented in our analysis. The species from subgenus Rykia grouped together except *P. unguifer* and *P. martinianus* are distinctly grouped and shifting of *P. kaida* and *P. dubius* from subgenus *Rykia* to subgenus *Pandanus*. The study confirmed the positions of *P. amaryllifolius* under the subgenus *Kurzia*. Our results also supported subgenus *Acrostigma* as a separate from genus *Pandanus* and its recognition as a separate genus *Benstones* (*B. foetida* and *B. thwaitesii*). The analysis suggested that the *atp*B-*rbc*L, *trn*L-*trn*L and *trn*L-*trn*F sequences help in better understanding the biodiversity and evolutionary relationship among the species.

Keywords: Indian screwpines, choloroplast DNA, phylogeny

Growth strategy of two congeneric species *Pandanus furcatus* and *P. nitidus*

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Pandanus species distributed in the tropical and some subtropical area from coasts to mountains. *Pandanus* usually dominated in coastal areas, but rarely on mountains. Two congeneric species, *P. nitidus* and *P. furcatus,* are native in the foothill area of Mt. Gede Pangrango National Park, West Java, Indonesia. We studied their morphological characteristic and plant growth from stem elongation to understand their growth strategy. All individuals in transect (850m x 20m) were labeled and parameters of their morphological characters are measured. Similar numbers of individuals of the two species were found. Fruits and flowers were rarely found for both species. Seedlings of both species originated from sprouts but rarely from seeds. The two species had an overlapping distribution; in a small area they were found in a clump but the distribution tended to be random in a larger area. They seemed to prefer similar microhabitat. Both species had similar average stem elongation. The former tended to have stout and vertical stem, the latter had slender stem with many branches. This difference in morphology may enable their coexistence. In comparison with our previous study of coastal *P.*

odoratissimus, these two mountain *Pandanus* had much lower densities, fewer fruits, and lower percentage of seedling than those of *P. odoratissimus*, suggesting poor reproduction from seed.

Keywords: *Pandanus*, plant growth, congeneric species, Mt. Gede Pangrango National Park

Session 5

ORCHIDACEAE

Convener: Lina S Juswara, Research Center for Biology, LIPI & Irawati, Bogor Botanic Gardens
Chairperson: Irawati, Bogor Botanic Gardens
Venue: Sulawesi Room

13.30 – 13.45	Agustina YS Arobaya *et al.*: Phylogeny and evolution of the anthelope orchids: molecular studies to test controversial taxonomic concepts
13.45 – 14.00	Peter O'Byrne: On the evolution of *Dipodium* R.Br.
14.00 – 14.15	Andre Schuiteman *et al.*: The problematic systematics of *Eria* (Orchidaceae)
14.15 – 14.30	Tatik Chikmawati *et a.*: Taxonomic consideration on *Spathoglottis plicata* (Orchidaceae) based on morphological and isozyme data
14.30 – 14.45	Lina S Juswara & PA Fuerst: Systematics of subtribe *Goodyerinae* (Orchidaceae) inferred by chloroplast and nuclear sequences
14.45 – 15.00	Rusea Go: Advances in orchid diversity assessments in Peninsular Malaysia

Phylogeny and evolution of the antelope orchids: molecular studies to test controversial taxonomic concepts

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Dendrobium Sw. section *Spatulata* Lindl., commonly known as the antelope orchids, is a taxonomically challenging group consisting of about 75 primarily epiphytic species (Clements, 2002). The section is distributed from the Philippines southward to northern Australia (Queensland) and from Java eastwards to Samoa with a centre of diversity in New Guinea. Due to the high morphological variability, both in floral and in vegetative characters, phylogenetic relationships are still poorly understood and different taxonomic concepts have been proposed. Up to now, no satisfactory molecular phylogeny for the group exists. Thus molecular studies are needed to clarify phylogenetic relationships within this section. This project investigates the phylogeny and evolution of the antelope orchids based on molecular DNA sequence data and morphological data. Plant materials were obtained from fieldworks in Australia (Queensland) and Indonesia (West Papua) and living collections at the Australian Tropical Herbarium and Centre for Australian National Biodiversity Research. For molecular phylogenetic studies, two nuclear markers (ITS and *Xdh*) and two plastid markers (*ycf*1 and *mat*K) are used. The preliminary analyses of the sequence data provide first insights into the phylogeny and evolution of this charismatic group of orchids.

Keywords: *Dendrobium*, section *Spatulata*, molecular phylogeny, nr DNA (ITS and xdh), plastid DNA (ycf1 and *mat*K)

On the evolution of *Dipodium* R.Br.

O'Byrne, P.

Forest Research Institute Malaysia (FRIM) & Singapore Botanic Gardens, Research Associate

Dipodium R.Br. (Orchidaceae), a genus of c. 38 species, should be divided into an Australasian clade and a Malesian clade, based on morphological and geographic evidence. *Dipodium* section *Dipodium* and section *Leopardanthus* (Blume) O. Kuntze are re-defined to accommodate this change. An evolutionary scenario that explains this division is proposed. The lack of diversity of floral structure in the genus is caused by pollinator-specificity, while the diversity of plant form is caused by long-term environmental factors. An evolutionary explanation is provided for the complex involving *Dipodium fevrellii* J.J.Sm. and *D. pandanum* Bailey in New Guinea. The existence of a complex in Java involving *D. pictum* (Lindl.) Rchb.f. and *D. scandens* (Bl.) J.J.Sm. is predicted. The taxonomic difficulties caused by inter-breeding complexes in Borneo are noted.

Keywords: *Dipodium*, Evolution, inter-specific complex, Orchidaceae, New Guinea, section *Dipodium*, section *Leopardanthus*

The Problematic Systematics of *Eria* (Orchidaceae)

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In its traditional circumscription, *Eria* is the third largest orchid genus in Malesia, with approximately 300 species in the region. DNA-based analyses indicate that *Eria* s.l. comprises three main clades, which form a polyphyletic group within the tribe Podochileae together with the genera of the former subtribe Podochilinae (*Appendicula*, *Podochilus* and others) and the remainder of the Eriinae (*Porpax*, *Stolzia*, *Pseuderia*, *Ceratostylis*, *Epiblastus* and *Mediocalcar*). The other main clade in the Podochileae, the subtribe Thelasiinae, is sister to the Eriinae. The tribe Podochileae occurs only in Asia, Australasia and the Pacific, except for *Stolzia*, which is endemic in Africa. Most of the clades within *Eria* s.l. as inferred from phylogeny reconstructions agree with previously recognised sections of the genus. In recent years, many of these have been treated as genera (e.g. *Pinalia*, *Mycaranthes*,

Cylindrolobus). In most cases these are 'resurrected' genera formerly synonymised under *Eria*, rather than newly established ones. Here we compare the traditional sectional classification of *Eria* s.l. with the outcomes of our phylogenetic analyses, pointing out why it is problematic simply to raise the various sections to genus level.

Keywords: Eriinae, Podochileae, Phylogeny, Classification

Taxonomic consideration on *Spathoglottisplicata* (Orchidaceae) based on morphological and isozyme data

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Infraspecific classification of *S. plicata* based on morphological information resulted in two different systems. Additional information from different approaches, such as geographic distribution and isozyme characters, were used to enhance the classification process. The goal of the research was to reinspectinfraspecific classification of *S. plicata*based on morphological danisozyme evidences that correlated to its distribution. The research examined 193 individuals from 40 populations of *S. Plicata* from Java distributed in Java island. Which varied in their characters, especially the size and the color of the petals. The species also varied in three isozyme characters, aspartataminotrasferase (AAT), aminopeptidase (AMP), and esterase (EST). Isozyme characters of *S. plicata* were matching among individuals with similar morphological characters, regardless of their geographic origin. This result indicated that *S. plicata* with distinct characters was different phenotipically and genetically. Cluster analyses of *S. plicata* using UPGMA method grouped its populations with similar morphological characters into the same group, and separated the population with different morphological characters. Based on this result, we considered that *S. plicata* should be classified into variety levels.

Keywords: Isozyme, *Spathoglottis plicata*, infraspecific classification

Systematics of subtribe Goodyerinae (Orchidaceae) inferred by chloroplast and nuclear sequences

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Phylogenetic analyses using chloroplast and nuclear data of the orchids from the subtribe Goodyerinae were examined. Two hypotheses were tested the three genes could be used to explain evolutionary relationships of the subtribe and whether the hypothesis defined the genus *Pachyplectron* as sister to the subtribe can be supported. Eighty nine taxa, ca. 650 bps ITS, 49 taxa with 1501bps *rpl16*, and 48 taxa with 1142 bps *trnL* respectively were incorporated in the cladistic parsimony and Bayesian inference. The number of stigma was assessed its utility in grouping the subtribe into two and three groups based on Dressler and Szlachetko respectively and the placement of the genus *Pachyplectron* as sisters of subtribe Goodyerinae sensu Dressler proposed by Salazar *et al.* was being investigated.The results showed that neither the hypotheses based on Dressler and Szlachetkocould be supported by the three genes used. In contrast, the placement of the genus *Pachyplectron* as sister to the subtribe Goodyerinae is supported by the three genes.This study suggested that the delimitation of the genera within the subtribe needs to be revised due to lack of synapomorphic characters to define groups within the subtribe.

Keywords: Goodyerinae, Dressler, Szlachetko, Phylogeny, ITS, *rpl*16, *trnL*, Pachyplectron

Advances in Orchid diversity assessments in Peninsular Malaysia

Go, R.[1,2], Mustafa, M.[1], Tan, M.C.[2], Alia, F.[1], Ng, Y.J.N. [1], Abdullah, N. P.[3] & Abdullah, J.O.[4]

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Southeast Asia is one of the world's richest orchid diversity regions, with more than 10,000 species and about 3000 are found in Malaysia. The majority of Malaysia's orchids are found in Sabah and Sarawak with slightly less thanonethird found in Peninsular Malaysia. Schuiteman (1999) reported a total of 887 species in 143 genera of orchids found in Peninsular Malaysia, of which 198 species (22.6%) are endemic to Peninsular Malaysia. Ong*et al*. 2011, however reported 905 speciesin 143 genera. However, our comprehensive study on orchid's diversity in Genting Highlands (Ng *et al*., 2011) and Frasers Hill (Farah Alia *et al*., 2012) and numerous other botanical expeditions from late 2010 to 2012 has contributed another 28 species and 5 genera as new records. Further scrutiny of Ong*et al* (2011)'s species lists revealed that 32 species are either new species or new records to Peninsular Malaysia. Therefore, the combined total of recognised orchid species found in Peninsular Malaysia is 949 species in 152 genera. As studies of orchid diversity continue, the numbers of species are doomed to change positively with new survey to unbotanized area or negatively if forested area are vanishing.

Keywords: wild orchid, species richness, Peninsular Malaysia

Session 5

PTERYDOPHYTE-2

Convener: Dedy Darnaedi, Research Center for Biology, LIPI & Peter Hovenkamp, National Herbarium of Netherlands
Chairperson: Xian-Chung Zhang, Chinese Academy of Sciences, P.R. China
Venue: Sumatera Room

13.30 – 13.45	N Hidayah Yahaya *et al.*: What is *Nephrolepis exaltata* "*bostoniensis*"? Unravelling the origin of *Nephrolepis* hybrids and cultivars from molecular data
13.45 – 14.00	Muhammad Efendi *et al.*: A new cytotype of *Pteris ensiformis* var *victoriae* from the Malesian Region
14.00 – 14.15	Wita Wardani: Spore morphology of the *Asplenium tenerum* complex
14.15 – 14.30	Fulgent Coritico: Diversity of Cyatheaceae on Mindanao Island, Philippines
14.30 – 14.45	Wenni S Lestari *et al.*: Molecular phylogeny of Maidenhair Fern genus *Adiantum* (Pteridaceae) from Lesser Sunda Islands Indonesia based on rbcL Gene and trnL-F IGS
14.45 – 15.00	Paulina Bawingan *et al.*: Fern diversity, conservation status & distribution pattern in Mt Santo Thomas, Tuba, Benquet, Philippines

What is *Nephrolepis exaltata* "*bostoniensis*"? Unravelling the origin of *Nephrolepis* hybrids and cultivars from molecular data

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Hybridization, polyploidization, and reticulate evolution are the major mechanisms that shape the current fern diversity. The combination of these mechanisms eventually obscures the species circumscription and their phylogenetic relationships especially in a closely related fern species. The occurrence of hybrids and cultivar has compounded the existing problem in *Nephrolepis* which is known as a difficult genus due to intergrading and subtle morphological differentiation among its species. By integrating the implementation of chloroplast DNA, *psbA-trnH*, *trnG-trnR*, and low-copy

nuclear DNA gene, *gapCp* in the phylogenetic reconstruction, we attempt to clarify the origin of these hybrids and cultivar in *Nephrolepis*. Subsequently, the results have confirmed the conjectures on the hybrid status of *N.* x *hippocrepicis* and *N. exaltata* as well as revealing their progenitors. Two widespread species, *N. biserrata* and *N. cordifolia* were revealed as the central species in the formation of these hybrids. *Nephrolepis* x *hippocrepicis* was the result of interspecific hybridization between *N. cordifolia* and *N. biserrata* whereas *N. exaltata* derived from the latter two species and *N. brownii*. *Nephrolepis "bostoniensis"* on the other hand was derived from *N. cordifolia* and *N. exaltata*.
Keywords: *Nephrolepis*, hybrids, cultivars, *psbA-trnH*, *trnG-trnR*, *gapCp*

New cytotypes of *Pteris ensiformis* var *victoriae* from the Malesian Region

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Pteris ensiformis is a weedy fern species widely distributed from Srilanka, India, Nepal and China to the Malesian region. Based on the chromosome numbers and mode of reproduction *P. ensiformis* can be classified as 2x sexual; 3x apogamous; 4x sexual, 4x apogamous, and 5x apogamous type described from India, China and Malesian region. Green leave *Pteris ensiformis* var *ensiformis* consistently had a basic chromosome numbers x=29. White leave *Pteris ensiformis* var *victoriae* was reported from India and had different basic chromosome numbers with 2n=84 and 2n=168. However, new cytological records of *P. ensiformis* var *victoriae* from Gorontalo, North Celebes had chromosome numbers with 2n=58 (2x sexual) and from Lombok Island had 2n=87 (3x apogamous). These two cyto-types of *P. ensiformis* var *victoriae* are new record to the regions. In gross morphology, the diploid type is smaller in size; thinner but with firm stipe, smaller spore size than the triploid one. Futher study on *Pteris ensiformis* complex to clarified the species delimitation and it's relationship is in progress.
Keywords: Chromosome numbers, new cytotypes, *Pteris ensiformis* var *victoriae*

Spore morphology of the *Asplenium tenerum* complex

Wardani, W.
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The *Asplenium tenerum* complex consist of two taxa with a distinct frond form which some authors tend to include one as an infraspecific taxon of the other. This study was an attempt to document the spore morphology of the complex and to evaluate its utility in delimiting the two taxa. Spores were examined using light and scanning electron microscope. The spore shape is monolete and generally ellipsoidal, with size ranged between 29.9-43.2 X 18.3-27.4 μm where its polar diameter is slightly different between the two groups. Other characteristic and ornamentation is described.
Keywords: *Asplenium*, spore morphology, complex

Diversity of Cyatheaceae on Mindanao Island, Philippines

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Species richness, distribution and conservation status of the species of Cyatheaceae (the "scaly tree ferns") were determined based on field surveys from different places in Mindanao and herbarium data. A total of twenty species are known from the island belonging to three genera, *Alsophila, Gymnosphaera* and *Sphaeropteris*, with eight species in *Alsophila*, nine species in *Sphaeropteris* and three species in *Gymnosphaera*. As to the species richness, Mt. Apo has the highest number with 9 species, followed by Mt. Pantaron and Mt. Kitanglad with 8 and 7 species, respectively. *Sphaeropteris glauca* and *S. Lepifera* are common species found at elevations below 500 m asl. The study obtained the first records of *A. Robinsonii* and *A. Negrosiana* for the island of Mindanao. Assessment of the species revealed eleven Philippine endemics and five Mindanao endemics, viz. *A. apoensis, A. christii, A. rufopannosa, S. suluensis* and *S. zamboangana.* Furthermore, twelve species are considered nationally threatened, with seven species endangered and five vulnerable.
Keywords: tree ferns, species richness, assessment, Mindanao Island

Molecular phylogeny of Maidenhair Fern genus *Adiantum* (Pteridaceae) from Lesser Sunda Islands Indonesia based on *rbcL* Gene and *trnL-F* IGS

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The Lesser Sunda Islands composed of small islands scattered from Bali to Timor island. A total of 14 species of *Adiantum* was collected from this region and seven species from Java were used for this study. Two cpDNA regions (*rbcL* gene and *trnL-F* IGS) were chosen as marker and phylogenetic analysis was conducted using NJ and MP methods for separated data. The tree topology reconstructed by NJ and MP are congruence where tree divided into four main clades. Clade I is *caudatum* group where pinnate frond and prolonged whip-like stolon at the apex are the defining characters. Clade II is *A. capillus-veneris* group and sister to clade I. Clade III is *pedatum* group in which sister to clade I and II. Clade IV is monophyletic composed of pantropical species.
Keywords: Lesser Sunda, fern, *Adiantum*, cpDNA

Fern diversity, conservation status and distribution pattern in Mt Santo Tomas, Tuba, Benquet, Philippines

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Filipinos love the lady fern as a food delicacy and some would use some ferns for medicinal purposes like *Adiantum philippense* to treat diarrhea or *Dryopteris*as antihelminthiasis. Ferns abound in Mt. Santo Tomas, Benguet, northern Philippines. For the past thirty years, however, more than half of the mountain's forest has been slowly converted to agricultural and residential land resulting to destruction of the habitat of important flora and fauna. This study aimed to determine the diversity, conservation status, and distribution of the remaining fern flora of Mt. Santo Tomas. Collection was undertaken in two forest types of the mountain: pine forest and dipterocarp forest. We identified nineteen species belonging to twelve families. Using AFCOR to classify abundance of collected species, we identified five rare, nine occasional, one common, two frequent, and two abundant species.

There were more fern species collected from the dipterocarp forest than in the pine forest. The abundant species *Pteridium aquilinum* and the rare species *Chingia ferax* were collected in the pine forest; the four rare species belonging to the genera *Sphaerostephanos*, *Polypodium*, *Goniophlebium,* and *Selliguea* were collected from the dipterocarp forest. Distribution of the ferns in the mountain is affected by atmospheric temperature and humidity.The study showed that fern species abundance has decreased significantly in Mt. Santo Tomas. There is a need, therefore, to advocate for conservation and protection of the remaining forested area.

Keywords: Fern species abundance, fern diversity, fern distribution, Mt. Santo Tomas

Session 6

TAXONOMY & SYSTEMATICS-4

Convener: Rismita Sari, Bogor Botanic Gardens
Chairperson:Julia Sang, Botanical Research Centre, Semengoh, Sarawak Forestry, Malaysia
Venue: Borneo Room

15.30 – 15.45	Rismita Sari *et al.*: New record of *Rafflesia cantleyi* Solms-Laubach in Kalimantan
15.45 – 16.00	Ridha Mahyuni *et al.*: Notes on *Rafflesia* (Rafflesiaceae) in Sumatra with a new record and some notes on *Rafflesia gadutensis*
16.00 – 16.15	SM Mat Yunoh: The delimitation of *Rafflesia cantleyi* species complex
16.15 – 16.30	Pieter B Pelser: Host-specificity in Philippine *Rafflesia* (Rafflesiaceae)
16.30 – 16.45	Connie Geri & Julia Sang: *Rafflesia* (Rafflesiaceae) in Sarawak Malaysian, Borneo and its conservation status
16.45 – 17.00	S Syahida-Emiza & Engkik Soepadmo: A revision of the Malaysian Opiliaceae

New record of *Rafflesia cantleyi* Solms-Laubach in Kalimantan

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Rafflesia cantleyi Solms-Laubach was reported found in Temajuk Village, Subdistrict Paloh, District of Sambas, West Kalimantan in 2012, during Khatulistiwa Expedition which organized by Special Forces Command of Indonesian Army. This species was previously only recorded in Tioman Island and mainland of Malay Peninsula. *R. cantleyi* is the new record from Kalimantan. The habitat is in the Nature Reserve where the condition of the forest is relatively undisturbed. This species is characterized by its flower that has 5-6 lobes with pinkish-cream big warts. Compared with *R. azlanii* which found in Sabah, this species has less warts. In *R. azlanii* the whitish warts are scattered over the surface of the perigone dominantly almost cover all the surface of perigone.

Keywords: *Rafflesia cantleyi*, West Kalimantan, Malay Peninsula, new record

Notes on *Rafflesia* (Rafflesiaceae) in Sumatra with a new record and some notes on *Rafflesia gadutensis*

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Pulau Mursala is a small island in west of SibolgaTapanuli Tengah Distr, North Sumatra, Indonesia. The occurrence of the genus *Rafflesia* R. Br. (Rafflesiaceae) had never been reported. However, during a recent a *Rafflesia* population was detected. Field observations could be made and material was collected for comparison with that in the Herbarium Bogoriense (BO). It was concluded that they *Rafflesia gadutensis* Meijer, which is known from Padang, UluGadut, Tahura Moh. Hatta, Bukit Tinggi and Batu Berjulang. Notes on its morphology are given.The distribution of species is discussed.

Keywords: Mursala, *Rafflesia*, *Rafflesiaceae*, Sumatra

The delimitation of *Rafflesia cantleyi* species complex

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H.N Ridley first recorded *Rafflesia* in Peninsular Malaysia in Temenggor in 1910. Three species occur in Peninsular Malaysia; *Rafflesia azlanii*, *R. cantleyi* and *R. kerrii*. Both *R. azlanii* and *R. cantleyi* are endemic to Peninsular Malaysia. In recent years, many *Rafflesia* studies were undertaken in Peninsular Malaysia. Among them were population and phenological studies. With these studies, there is now a better understanding of population variation of the species. Of the three species, *R. azlanii* and *R. cantleyi* have overlapping characters. Solms described *Rafflesia cantleyi* in 1910 and in 2003 Latiff & Wong described *R. azlanii*. This paper discusses the delimitation of the two species, a new description of *R. azlanii* is provided to improve clarity of this species delimitation.
Keywords: Species Delimitation, *Rafflesia cantleyi*, *Rafflesia azlanii*, Peninsular Malaysia

Host-specificity in Philippine *Rafflesia* (Rafflesiaceae)

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Rafflesia plants live entirely within the tissues of their host plants and only emerge to produce their flowers. Because of this extremely intimate and dependent association, *Rafflesia* is an excellent subject for studying the role of host plants in parasite speciation. One aspect of this interaction is host-specificity. *Rafflesia* has been reported to exclusively parasitize *Tetrastigma* (Vitaceae) species; however, little is known about host-specificity at the species level. Although this might be partially due to a lack of focus on this aspect of the biology of *Rafflesia*, difficulties regarding the taxonomic identification of *Tetrastigma* plants might also be responsible. For example, there is no revision of the Malesian species of the genus, most species show large intra-specific variation in vegetative morphology, and flowering or fruiting *Tetrastigma* vines are rarely collected at *Rafflesia* sites. The Philippines is one of the main centers of *Rafflesia* diversity and home to ca. 10 species. As part of our studies on *Rafflesia* diversity, we sampled host plants at the majority of all known populations of Philippine *Rafflesia*. In this presentation, we will outline our molecular phylogenetic approach to

overcome some of the aforementioned species-identification problems in*Tetrastigma* and present the host-specificity patterns that we obtained.

Keywords: co-evolution, parasitic plants, *Tetrastigma*, molecular phylogenetics, taxonomy

Rafflesia (Rafflesiaceae) in Sarawak Malaysian, Borneo and its conservation status

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Three species of *Rafflesia* (Rafflesiaceae) are currently recognized in Sarawak, Malaysia: *R. tuan-mudae* Becc., *R. hasseltii* Suringar and *R. pricei* Meijer. We presence an overview of the distribution, ecology and conservation status of each species in Sarawak based on study of the species carried out in 2009 – 2013. We also review evidence for the presence of three unconfirmed species recently documented during our survey.

Keywords: *Rafflesia,* Sarawak, distribution, ecology, conservation status

A revision of the Malaysian Opiliaceae

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A revision of Opiliaceae was conducted for the Documentation and Inventory of Flora Malaysia Project. Six genera, *Cansjera, Champereia*, *Lepionurus*, *Melientha*, *Opilia and Urobotrya,* each with one species are recognised in Malaysia. *Melientha suavis* subsp. *macrocarpa* (earlier known endemic to Borneo) has been assigned to synonymy under *Melientha suavis* as the fruit size of the two subspecies is overlapping and no other morphological characters can be used to support the distinction. *Cansjera* and *Opilia* are often occurring in sandy beach and coastal heath forests, have been categorized as Near Threatened (NT); others are widespread in primary and secondary forest and have been categorized as Least Concern (LC). An identification key to the genera and species, full descriptions and geographical distribution and their conservation status are provided. The conservation assessment follows the guidelines and criteria of the Malaysia Plant Red List (2006).

Keywords: Conservation Status, Descriptions, Malaysia, Opiliaceae

Session 6

BIOGEOGRAPHY-1

Convener: Peter C van Welzen, Naturalis Biodiversity Center, The Netherlands
Chairperson: Peter C van Welzen, Naturalis Biodiversity Center, The Netherlands
Venue: New Guinea Room

15.30 – 15.45	Marc S Appelhans *et al.*: Phylogeny & phylogeography of *Acronychia*, *Euodia* & *Melicope* (Rutaceae) & hypotheses for differences in distribution & species richness
15.45 – 16.00	Fifi Dwiyanti: Phylogeographic structure of the commercially important tropical tree species, *Dryobalanops aromatica* Gaertn.f.(Dipterocarpaceae) revealed by microsatellite markers
16.00 – 16.15	Fabian Brambach: Elevational patterns and phytogeographical context of tree diversity in mountain rain forests of Central Sulawesi, Indonesia
16.15 – 16.30	Chen Junhao: A taxonomic and biogeographic assessment of *Timonius* (Rubiaceae) in Kinabalu Park, Borneo
16.30 – 16.45	Niels Raes *et al.*: Legume diversity as indicator for overall botanical diversity on Sundaland, Southeast Asia
16.45 – 17.00	General discussion

Phylogeny and phylogeography of *Acronychia*, *Euodia* and *Melicope* (Rutaceae) and hypotheses for differences in distribution and species richness

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Because of their wide distributions, which range from SE Asia, the Malesian region, Australia, to Pacific islands (and Madagascar in *Melicope*), the genera *Acronychia, Euodia* and *Melicope* (Rutaceae) are ideal examples to study Asian and Pacific biogeography. The center of species richness and endemicity of all three genera is New Guinea but the three genera differ greatly in terms of species richness (*Acronychia*: 48 spp., *Euodia*: 7 spp. and *Melicope*: about 230 spp.). Our molecular phylogenetic studies show that *Melicope* and *Acronychia* are closely related and that *Euodia* is sister to both. A number of monotypic or small genera mainly from New Caledonia and New Guinea need to be included in *Melicope* (*Comptonella, Platydesma, Picrella,* and *Sarcomelicope*), while others are closely related to *Euodia* (*Brombya*, *Perryodendron*, and *Pitaviaster*). Our molecular dating analyses suggest that the *Acronychia* – *Melicope* clade and the *Euodia* clade might have originated in the late Oligocene to early Miocene. Considering the similar age of the clades, the differences in species richness are striking and may be explained by differences in seed coat anatomy that enabled dispersal by endozoochory in *Acronychia* and *Melicope*. In this way, *Melicope* reached distant regions such as Madagascar, Hawai´i and the Marquesas Islands while *Euodia* remained restricted to New Guinea, Northern Australia and nearby archipelagos.

Keywords: biogeography, *Melicope*, phylogeny, Rutaceae, species richness

Phylogeographic structure of the commercially important tropical tree species, *Dryobalanops aromatica* Gaertn. f. (Dipterocarpaceae) revealed by microsatellite markers

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Dryobalanops aromatica Gaertn.f. (Kapur) is an economically important timber species that occurs naturally in Sumatra, the Malay Peninsula, the Lingga Archipelago, and Borneo. In order to better characterize geographic patterns of genetic variation, seven polymorphic microsatellite markers were analyzed in 5 populations of *D. aromatica* (N = 120 individuals) from the Malay Peninsula, Sarawak and the Lingga Archipelago. Gene diversity (H_E) ranged from 0.571 to 0.729. The level of genetic differentiation among the Malay Peninsula, Sarawak and the Lingga Archipelago was relatively high and statistically significant (F_{CT} = 0.168, P< 0.001). A neighbor-joining phenogram revealed two distinct groups: Sarawak and the Malay Peninsula-Lingga Archipelago. A high degree of genetic differentiation between the Malay Peninsula-Lingga Archipelago and Sarawak suggests that populations in each geological area might be the consequence of post glacial expansion from one or few refugia, but gene flow between different glacial refugia were restricted.

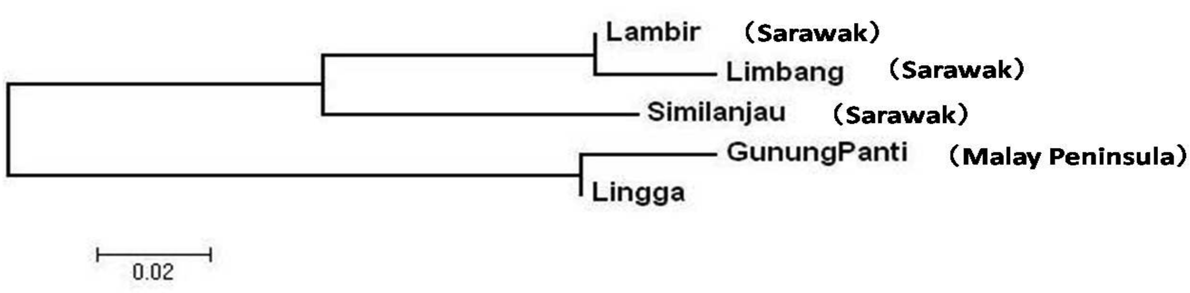

Fig. 1. Neighbor-joining (NJ) phenogram based on pairwise F_{ST} among the investigated *Dryobalanopsaromatica* populations.

Keywords: *Dryobalanops aromatica*, microsatellite, genetic diversity, genetic differentiation

Elevational patterns and phytogeographical context of tree diversity in mountain rain forests of Central Sulawesi, Indonesia

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Tropical rain forests are well-known for their enormous plant diversity, and in addition to high on-site diversity, tropical mountain rain forests show high species-turnover along elevational gradients. Beside ecological factors, the pool of available species influences community composition at a given site. We studied patterns of tree species diversity along an elevational transect in old-growth moist tropical forests in Lore Lindu National Park of Central Sulawesi, Indonesia. Diversity was assessed conducting plot-based inventories at 15 sites (each 0.24 ha-plots) from the submontane to the upper montane zone (700 - 2400 m a.s.l.). For each species encountered during the inventories we recorded the geographical distribution within and beyond Malesia to elucidate phytogeographical relationships.
Numerous new occurrence records for (Central) Sulawesi and undescribed species encountered by our study show that the island remains underexplored. Species diversity generally decreases with elevation but varies within elevational belts, possibly owing to soil properties. Members of the families Fagaceae and to a lesser extent Myrtaceae and Lauraceae are important components of the

forests along the whole transect while the upper montane zone was strongly dominated by conifers, especially of the family Podocarpaceae. Furthermore, we show that phytogeographical affinities of the tree communities vary among different elevations.

Keywords: environmental gradient, biogeography, tropical montane forest, Malesia, Wallacea, biodiversity hotspot, Fagaceae, Myrtaceae, tropical conifers

A taxonomic and biogeographic assesment of *Timonius* (Rubiaceae) in Kinabalu Park, Borneo

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Kinabalu Park is a centre of plant diversity in Borneo. The geologically diverse and isolated Kinabalu massif arguably has the richest flora globally. However, certain plant taxa such as *Timonius* remain poorly studied. The most recent floristic account recognised nine *Timonius* species whereas recent ecological collections appeared to represent more species. This study was conceived to revise Kinabalu *Timonius* and attempt a rarity assessment. Comparative studies of herbarium specimens and micromorphological studies of the lower leaf lamina surface were conducted. Species were recognised based on discontinuous morphological variation. This study recognises 15 *Timonius* species in Kinabalu Park, comprising four previously named species and 11 new species. Nine species are likely to be endemic to Kinabalu Park. Distinct hair types on the lower lamina surface are useful for distinguishing species. Also, the distribution of some *Timonius* species is possibly restricted to ultramafic substrates. Useful perspectives towards potentially understanding speciation on mountain habitats and reasonable approaches for a wider phylogenetic investigation of *Timonius* in Borneo are discussed. This study revealed diagnostic characters for recognising the Kinabalu *Timonius* and suggests that tropical plant diversity may be underestimated in areas such as Borneo.

Keywords: Endemism, Mount Kinabalu, rare plants, Rubiaceae, *Timonius*, ultramafic substrates

Legume diversity as indicator for overall botanical diversity on sundaland, South East Asia

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The Global Legume Diversity Assessment (GLDA) proposes the legume family (Fabaceae or Leguminosae) - one of the largest and economically important plant families - as a target for a global botanical diversity assessment project. Where in the Neotropics and Africa legumes dominate the rain forest in terms of diversity and abundance, the Dipterocarpaceae claim this role in South East Asia and on Sundaland in particular. This raises the question whether legumes are an indicator for overall botanical diversity on Sundaland? To answer this question we use the largest compiled database of collection records of the region and species distribution modelling techniques. As a proxy for total botanical diversity we selected seven other plant families; Dipterocarpaceae, Ericaceae, Fagaceae, Lauraceae, Moraceae, Myristicaceae, and Sapindaceae. Although the legumes were the most diverse family, the predictive power of legume diversity for overall botanical diversity was poor. This related to the fact the other seven selected families largely represent trees, whereas legume species more equally represent all different growth forms. After assigning individual legume species to different growth habits (tree, liana, herb, miscellaneous) we were able to predict 78% of the variance in botanical diversity on Sundaland. The lianas represent the single growth habit that best predicted (66%) the variance in botanical diversity. The herb and miscellaneous growth habits had an inverse relationship to botanical diversity. Legumes can be used as a predictor of overall botanical diversity in tropical and seasonal rain forests, but the relationship should be fitted for different biogeographic regions individually.

Keywords: Legume, indicator, Sundaland, Global Legume Diversity Assessment (GLDA)

Session 6

TAXONOMY & SYSTEMATICS-5

Convener: Julisasi T Hadiah, Bogor Botanic Gardens & Peter Wilson, Royal Botanic Gardens, Sydney
Chairperson: Lahiru Wijedasa, Singapore Botanic Garden
Venue: Sulawesi Room

15.30 – 15.45	David Purvis & Peter Wilkie: Making sense of old handwriting: examples from Sapotaceae
15.45 – 16.00	Joan Pereira *et al.*: Towards a revision of *Payena* (Sapotaceae) in Malesia
16.00 – 16.15	Michele Rodda *et al.*: Towards a revision of the genus *Hoya* (Apocynaceae – Asclepiadoideae)
16.15 – 16.30	Sota Yamamoto *et al.*: *Capsicum pubescens* in Java and Sumatra islands, Indonesia
16.30 – 16.45	Tze Leong Yao: A taxonomic revision of Peninsular Malaysian *Thottea* (Aristolochiaceae)
16.45 – 17.00	Fernando B Aurigue & Jorge R Sahagun: Why Filipinos are proud of Philippine Hoyas

Making sense of old handwriting: examples from Sapotaceae

Purvis, D. & Wilkie, P.

Royal Botanic Garden Edinburgh, Edinburgh, UK

A key activity in the production of the Sapotaceae account for Flora Malesiana is the databasing of herbarium specimens from across the region. One of the most time-consuming aspects of this is deciphering old hand written collection labels. This presentation will provide examples found in Sapotaceae, highlight how difficulties have been resolved and provide suggestions on how we can all make this process more efficient.

Keywords: handwriting, collector, Malesia, databasing

Towards a revision of *Payena* (Sapotaceae) in Malesia

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An overview of the genus *Payena* A. DC. from the Malesian region is provided. This includes a summary of the taxonomic research undertaken to produce the account for the Tree Flora of Sabah and Sarawak and current taxonomic and molecular phylogenetic research for the Flora of Peninsular Malaysia. Future plans to produce a revision of the genus across Malesia will also be outlined.

Keywords: *Payena*, taxonomy, molecular phylogenetics, Malesia

Towards a revision of the genus *Hoya* (Apocynaceae – Asclepiadoideae)

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Hoya R.Br. is one of the larger genera in Apocynaceae *s.l.* It has a broad distribution area extending from South Asia, across Southeast Asia, to the Pacific Islands. Highest species-richness has been observed in the Malesian Region. Since 2006 the authors have started taxonomic investigations on the genus to update the only available listing of all *Hoya* species, completed by Decaisne and now 169 years old, with the goal to prepare a modern generic revision. The talk will report the progresses made so far and the challenges lying ahead, in particular related to: (i) correct species identification, (ii) species complexes, (iii) taxonomic inflation, and (iv) extent of undescribed diversity.

Keywords: taxonomy, systematics, nomenclature, large genera, species complexes

Capsicum pubescens in Java and Sumatra Islands, Indonesia

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Capsicum pubescens originated in mid-elevation Bolivia and is still primarily cultivated in Andean South America and in the Central American highlands; however, its cultivation in the rest of the world remains unknown. The present study is the detailed report of *C. pubescens* as a well-utilized crop at the local level outside the Americas. Literature, specimen, field, and market surveys of *C. pubescens* were conducted in Indonesia to investigate its introduction into Indonesia and to reveal its present distribution and cultivation. Three specimens, which were collected in West Java in 1916 and stored as *Capsicum* sp., were re-identified as *C. pubescens*. Bandung and the surrounding highlands in West Java and the Dieng Plateau in Central Java are considered the center for *C. pubescens* cultivation and distribution on Java Island. Cultivation of *C. pubescens* was also confirmed in East Sumatra. Although *C. pubescens* normally bears purple flowers occasionally with a white center, mutant plants bearing pure white flowers were found throughout West and Central Java. It is unclear if the white flower type was introduced into Indonesia at the same time as the purple flower type, or if it has occurred as a mutation.

Keywords: Bandung, cultivation, Dieng Plateau, ethnobotany, specimen, tropical highlands, white flower type

A taxonomic revision of Peninsular Malaysian *Thottea* (Aristolochiaceae)

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Thottea (Aristolochiaceae) of Peninsular Malaysia is revised. Distribution maps are provided and conservation status is assessed. Nine new species, namely *T. anthonysamyi*, *T. kamarudiniana*, *T. longipedunculata*, *T. papilionis*, *T. piscodora*, *T. praetermissa*, *T. reflexa*, *T. ruthiae*, and *T. terengganuensis* are described and illustrated. *Thottea dependens* and *T. tricornis* are redefined and *T. parviflora* is lectotypified. *Thottea* is now represented by 16 species in Peninsular Malaysia.

Keywords: *Thottea*, new species, Peninsular Malaysia

Why Filipinos are proud of Philippine Hoyas

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The release of Philippine postage stamps featuring eight *Hoya* species promotes Philippine hoyas to the world and makes Filipinos proud of their native plant species. The diversity in Philippine hoyas and variation in color forms of certain species have intensified the interest of *Hoya* collectors and increased the demand for planting materials within and outside the Philippines. Filipino collectors of native hoyas have either turned their hobby into a sporadic small-scale business or ventured into international trading. Selling well-grown plants in various containers with or without flowers, or rooted or fresh cuttings, became the livelihood or additional source of income of wild-plant gatherers and commercial growers. New species and new color forms of old species are most saleable locally and abroad. Aside from the ornamental value of *Hoya*, at least three indigenous species have been recorded with medicinal properties. Their use in traditional medicine is seldom practiced nowadays but there is a wide potential application of compounds extracted from them for treatment of certain diseases.

Keywords: *Hoya*, medicinal property, native plant, ornamental value, Philippines, postage stamp

Session 6

PTERYDOPHYTE-3

Convener: Dedy Darnaedi, Research Center for Biology, LIPI & Peter Hovenkamp, National Herbarium of Netherlands
Chairperson: Wita Wardani, Research Center for Biology, LIPI
Venue: Sumatera Room

15.30 – 15.45	Peter Hovenkamp: First results of the analysis of Woodsiaceae from Mount Kinabalu
15.45 – 16.00	Xian-Chung Zhang: Relationships of ferns between Flora of China and Flora Malesiana
16.00 – 16.15	David Middleton & Stuart Lindsay: The ferns of Thailand, Laos and Cambodia
16.15 – 16.30	Sangeeta Rajbhandary & Rita Thapa: A synopsis of the genus *Pteris* L. in Nepal
16.30 – 16.45	Titien Ng *et al.*: Distribution maps and population size of the Golden Chicken Fern *Cibotium barometz* (Cibotiaceae) in Sumatra – Indonesia
16.45 – 17.00	General discussion

First results of the analysis of Woodsiaceae from Mount Kinabalu

Hovenkamp, P.

Naturalis Biodiversity Center, section Botany (formerly Nationaal Herbarium of the Netherlands)

The Netherlands

During and after the Naturalis/Sabah Parks 2012 expedition to the Kinabalu-Crocker Range National Park (Sabah), over 80 specimens of Woodsiaceae ferns were collected in the Kinabalu-Crocker Range National park and in Kuala Belalong, Brunei. From these collections, barcode markers *rbc*L and *trn*L-F were amplified and sequenced. In combination with morphology, this led to the recognition of at least 27 taxa, representing 2/3 of the known flora of the area for this family. Analysis of the barcode markers confirms recent studies on the generic subdivision of the family. I will discuss the utility of these markers in this group of ferns for the recognition of taxa at species level, and the implications of a wider comparison for the historical biogeography of this group. In the field, I gave special attention to collecting the underground parts of the plants, and I will also show the taxonomic utility of characters of the roots and rhizome in particular in the genus *Diplazium*.

Keywords: Woodsiaceae, Mount Kinabalu, Barcode markers, Historical biogeography, Morphology

Relationships of ferns between Flora of China and Flora Malesiana

Zhang, X.C.

The Herbarium, Institute of Botany, Chinese Academy of Sciences, China

The fern flora of China and the Malesiana Regions are the richest in Asia with more than 2000 species respectively. There are about 400 species of lycophytes and ferns are common to both floras. The families with more than 30 shared species are Polypodiaceae, Thelypteridaceae, Pteridaceae, and Hymenophyllaceae; and shared species over 20 are Aspleniaceae, Dryopteridaceae, Athyriaceae and Tectariaceae. Taxonomic revisions are still wanted to estimate correctly the number of shared species between China and Southeast Asia in some difficult groups.

Keywords: China, Malesia, fern

The ferns of Thailand, Laos and Cambodia

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Ferns are a large and conspicuous component of the plant diversity of Thailand, Laos and Cambodia but identifying the species is particularly difficult for the non-specialist. The ferns of Thailand were revised for the *Flora of Thailand* between 1979 and 1989 but since the completion of that account more than 70 additional species have been discovered. The last comprehensive revision of the ferns of Laos and Cambodia was by Tardieu & Christensen in *Flore Générale de l'Indo-Chine* between 1939 and 1951 since when there have been considerable changes in family and generic delimitation. A project to provide online information on all of the ferns of these three countries is well under way at the Royal Botanic Garden Edinburgh with factsheets on all species available at http://rbg-web2.rbge.org.uk/thaiferns/. Each factsheet has comprehensive nomenclatural information, descriptions, distribution information, and illustrations and photographs when available. The names of many species have been updated from previous published accounts of the ferns of these regions and new species and records can be readily added as they are found. A multi-access key is currently being developed and will be made freely available online once it is completed. The need for and content of the website will be discussed and the development of the key outlined.

Keywords: Ferns, Thailand, Laos, Cambodia, website

A synopsis of the genus *Pteris* L. in Nepal

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Pteris L. (Pteridaceae) is a large genus represented by 280 species globally and occupies variety of habitats. In Nepal 19 species and three subspecies of the genus was reported throughout the tropical, subtropical and temperate region. But out of 19; two species viz. *P. oppositipinna, P. subindivisa* are misapplied names for *P. linearis, P. subquinata*. Among these *P. oppositipinna* and *P. subindivisa* are not found in Nepal. Present study confirms presence of 20 species and four subspecies of *Pteris* in Nepal based on the information about morphology and their distribution patterns. Looking at the distribution pattern the degree of overlap between the Malesian and Nepalese Pteris was analyzed. Despite their geographic separation about 40% of *Pteris* species are common in Nepal and Malesia. Looking at the morphology some more species may be common. This leads to a comprehensive

revision for taxonomy and phylogeny of *Pteris*, which is urgently needed, and that could be done by cooperation between the two flora projects by preparing the account for the Nepalese and the Malesian *Pteris* species. This will greatly facilitate knowledge transfer and build scientific network and expertise in Nepal.

Keywords: *Pteris*, Nepal, Malesia, distribution

Distribution maps and population size of the Golden Chicken Fern *Cibotium barometz* (Cibotiaceae) in Sumatra – Indonesia

Praptosuwiryo, T.Ng.*[1], Rugayah [2], Pribadi, D.O. [1], Puspitaningtyas, D.M. [1], Hartini, S.[1], Fijridiyanto, I.A.[1] & Wawangningrum, H. [1], Atikah, T.D. [2], Wardhani, W. [2] & Munawaroh, E. [1]

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The golden chicken fern *Cibotium barometz* (Cibotiaceae) is tree fern species that is commonly recognized as ‘chain fern’ or ‘gouji’ in the medicinal plants trade. This species has been included in the CITES Appendix II since 1976. The distribution of *C. barometz* in Indonesia is limited. Sumatra is the only mainland where the population of this species is abundant. Study on the distribution and population size of the medicinal fern *C. barometz* in Sumatra have been conducted from 2005 to 2011. The objectives of these studies were: (i) To re-inventory and draw the geographical distribution map of *C. barometz* in Sumatra; (ii) to assess the status of the populations of *C. barometz* on the basis of population size of the adult plant; (iii) to record its ecological characteristics. In this study, populations were defined as spatially distinct assemblage of plants at certain sites, with no consideration of genetic structure of the populations. Three varians of *C. barometz* were recorded. The maps of geographical distribution of *C. barometz* with the population size data that includes five provinces is presented. West Sumatra shows the widest distribution of *C. barometz* (30 sites) with the largest population size at Bukit Alang Lauik, Nagari Labuh Gunung, Lareh Sago Halaban Subdistrict, Lima Puluh Kota District (8,531/Ha). Two populations of *C. barometz* in Jambi Province are in crital conditions with only 4 and 7 individuals, respectively, *viz.*: at Bukit Air Panas (Sungai Medang, Kawasan Wisata Air Panas Sunngai Medang, Desa Sungai Medang, Kec. Air Hangat, Kab. Kerinci) and Bukit Tapan (Taman Nasional Kerinci Seblat, Jalan Trans Sungai Penuh-Bengkulu Km 21- Km 22).

Keywords: Conservation, *Cibotium barometz*, ecology, geographical distribution, medicinal plant, population size, tree fern

Day 4: Friday, 30 August 2013

ORAL PRESENTATION

Underline name is presenting author

* Corresponding Author

DAY 4: FRIDAY, 30 AUGUST 2013

08.00 – 09.00	**PLENARY ADDRESS** **Malesian biogeography: dispersal and patterns** **Prof. Dr. Peter C van Welzen,** Professor of Tropical Plant Biogeography, Naturalis Biodiversity Center, The Netherlands
09.00 – 09.30	**MORNING COFFEE BREAK**
09.30 – 11.00	**SESSION 7: ECOLOGY-1, BIOGEOGRAPHY-2, LOCAL FLORA-1, FUNGI-1**
11.00 – 12.30	**LUNCH**
12.30 – 13.30	**POSTER SESSION**
13.30 – 15.00	**SESSIONS 8: ECOLOGY-2,BIOGEOGRAPHY-3, LOCAL FLORA-2 & SYSTEMATICS, ECOLOGY-3**
15.00 – 15.30	**AFTERNOON COFFEE BREAK**
15.30 – 17.00	**SESSION 9: ECOLOGY-4, PLANT CONSERVATION, LOCAL FLORA-3, BRYOPHYTE-1**

Plenary Address

DO WE NEED A DIFFERENT APPROACH OF TEACHING PLANT TAXONOMY?

Mien A Rifai

Indonesian Academy of Sciences/AIPI
c/o 'Herbarium Bogoriense', Research Center for Biology–LIPI

Plant taxonomy has never been very popular with Indonesian university students, simply because the way it is presented fails to show clearly its usefulness to their daily life. One can easily appreciate the students' reluctance to enjoy the course because more often than not plant taxonomy instruction has always been stressed on memorizing the numerous strange Latin plant names, remembering by heart the position of every taxon in its 'proper' systematic classification, making illustrations of flower analyses, and on the compulsory preparation of meaningless herbarium specimens not very much different from those practiced in kindergarten. Consequently the course given has not been adequate enough to build up their understanding of the meaning of biodiversity (including its aspects of study, utilize, and conserve) as required by the modern world society. It is very likely that the scarcity of capable Indonesia researchers to actively participate in completing *Flora Malesiana* project is the outcome of this unhealthy situation. In an attempt to remedy this embarrassing predicament a new approach is being taken to present a different taxonomic course based exclusively on cultivated plants, especially to make the students immediately aware that it has immediate relevant practical value to the public at large. Towards this end, the taxonomic laboratory practical and other related activities will be linked up with ethnobotany capable of producing information and data of local interest, and to ensure that the undergraduate research exercises as well as the postgraduate theses undertaken are geared to assist the speedy development of superior cultivars with their much needed distinct, uniform, and stable agronomic characters. A relevant textbook jointly written by numerous students and lecturers from many Indonesian universities is being prepared.

Session 7

ECOLOGY-1

Convener: Rochadi Abdulhadi & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Eizi Suzuki, Faculty of Science, Kagoshima University
Venue: Borneo Room

09.30 – 09.45	Aziah Muhammad *et al*.: A Preliminary investigation of the ecophysiology of mycoheterotrophic *Burmannia coelestis* D. Don (Burmaneacea) in Brunei Darussalam
09.45 – 10.00	Sulistijorini *et al.*: Change of structure and composition of understory plants at lowland rainforest transformation system
10.00 – 10.15	Freda Wong & Teodora Balangchod: Diversity of nontimber species in a communal forest in Bayabas, Sablan, Benguet Province, Philippines
10.15 – 10.30	Mahardika P Purba *et al.*: Population and ecological genetics in tropical forest ecosystem restoration
10.30 – 10.45	Tetsukazu Yahara *et al.*: Plant diversity assessments using a standardized transect method in Cambodia, Indonesia, Malaysia, Thailand and Vietnam
10.45 – 11.00	General discussion

A Preliminary investigation of the ecophysiology of mycoheterotrophic *Burmannia coelestis* D. Don (Burmaneacea) in Brunei Darussalam

Muhamad, A.[1], Tennakoon, K.[1], bin Abdul Majid, M.[1], Wang, H.C.[1], Abd Salam, S.[1]& Bolin, J.F.[2]
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[2]Department of Botany, Smithsonian Institution, Washington, DC & Catawba College, Department of Biology, Salisbury, North Carolina, USA

The ability of a plant to live on fungal carbon is known as mycoheterotrophy. Mycoheterotrophic plant species (MHP) lack chlorophyll and depend on symbiotic mycorrhizal fungus associating adjacent plants to indirectly obtain carbon and nutrient supplies. This intriguing process has fascinated botanists for centuries, yet many aspects of mycoheterotrophy have remained elusive for a long time. Here we report some the biological and ecophysiological characters related to mycoheterotrohic (previously and incorrectly termed 'saprophytic') nature of *B.coelestis* found in Brunei Darussalam. *Burmannia coelestis* showed low chlorophyll content index (CCI), and quantum yield (QY) than the

associating hosts living under same microhabitat conditions. However, there was no significant difference in chlorophyll *a* and *b* in relation to corresponding host plants. High quantum yield shown in the flowers of *B. coelestis* than its reduced leaves and stems indicated the significant role played by flowers in relation to the overall primary productivity of the plant. High stomata density in *B. coelestis* showed the ability of these plants to passively absorb nutrients from the adjacent hosts through the network of symbiotic mycorrhizas. The natural abundance stable isotope distribution profiling of $\delta^{13}C$ and $\delta^{15}N$ provided clear evidence of *B. coelestis'* scavenging of organic carbon and nitrogen form the adjacent hosts living in the immediate microhabitats.
Keywords: mycoheterotrophy, Burmannia, mycorrhizae, stable isotopes, achlorophylly.

Change of structure and composition of understory plants at lowland rainforest transformation system

Sulistijorini, Chikmawati, T. & Umbara, L.W.
Department of Biology, Faculty of Science and Mathematics, Bogor Agricultural University

Rainforest transformation system is conversion of natural forest into agricultural system or other function, lead to more open forest canopy and more light into the forest floor. Diversity of understory plants may be hardly affected by rainforest transformation system since most of the plants are harbored in shaded habitat of the rainforest. This research aimed to observe the change of structure and composition of understory plants in lowland rainforest transformation system. Sampling was conducted in the plots established at three different sites, representing rubber jungle, rubber plantation, and oil palm plantation at Sarolangun, Jambi, Indonesia. Understory plants investigated within a total of three 50 m x50 m permanent plots in each site with five subplots of 3 m x 3 m in each plot. Parameters on the diversity of understory plants in term of species richness and abundance .The number of species found in rubber jungle (36 species) much more than in the rubber plantation (25 species) and oil palm plantation (23 species). In the rubber jungle and rubber plantation *Dicranopteris linearis* was a species with importance value index (IVI) 59.84% and 40.08%) higher than other species. In the oil palm plantation *Clidemia hirta* and *Nephrolepis* sp. with IVI 29.18% and 28.69% were higher than it other species. Differences in the composition and structure of the understory vegetation in the three habitats were attributed to shading by trees and cultivation techniques.
Keywords: understory plants, rainforest transformation systems, shade plants, cultivation techniquese.

Diversity of nontimber species in a communal forest in Bayabas, Sablan, Benguet Province, Philippines

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Establishing a baseline data in a forest provides inventory of the floral composition. This is necessary for monitoring, sustainability and conservation efforts. The survey of plant species within forests provides information regarding plant status and allows for allocation of resources. Nontimber species are economically important especially to indigenous people as source of livelihood and food. In Benguet Province, Philippines, the Bayabas Communal Forest is one of the six declared communal forests in the Municipality of Sablan, which is a home for the indigenous group of *Ibalois*. The forest serves as source of firewood, food, and medicinal plants. Ecological survey of the Bayabas Communal Forest is significant for biodiversity studies since there is lack of published literature regarding its flora and it is one of the remaining forest patch in the Cordillera region. The 13-hectare communal forest was surveyed through gradsect method to determine the nontimber species in the area. There were 15 nontimber species identified belonging to two families of nonvascular plants (Lygodaceae and Pteridaceae) and eight families of vascular plants (Amaranthaceae, Araceae, Asteraceae, Maranthaceae, Palmae, Piperaceae, Poaceae, and Rubiaceae). Among the species identified, *Donnax cannaeformis* (G. Forster) K. Schaumann belonging to Marantaceae has the highest importance value (38.19%). *Donnax cannaeformis* (G. Forster) K. Schaumann is commonly known as bamban or banban in the Philippines and local communities use this as antidote to snake bites.

Keywords: Benguet Province, communal forest, diversity, forest patch, nontimber, indigenous group, *Ibalois*.

Population and ecological genetics in tropical forest ecosystem restoration

Purba, M.P.[1], Kjaer, E.D.[1], Siregar, I.Z.[2], Schmidt, L.H.[1] & Nielsen, L.R.[1]

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[2]Department of Silviculture, Faculty of Forestry, Bogor Agricultural University, Indonesia

The Harapan Rain Forest (HRF) in the Indonesian province of Jambi, Sumatra is one of the few protected areas in the lowlands of Sumatra. Forest ecosystem restoration on this scale has never been done before so will require the development of new techniques and approaches. One of the unique species which can be found in Harapan rainforest is Ironwood (*Eusideroxylon zwageri*) or locally known as Bulian or Ulin from the family of Lauraceae. Bulian/ Ulinis native to Sumatra and

Kalimantan. It is the most famous and well known durable hardwood timber tree species which is classified into Strength and Durability class I. Increase demand for this tree species has caused a high price and accelerated logging activities, hence, their potency and population decreased significantly. The information of genetic diversity of Ironwood is still limited therefore this species must be studied thoroughly using molecular techniques to identify genetic variation within and among populations in order to conserve the rapidly declining Ironwood populations. The availability of information genetic diversity of this species is essential for designing an appropriate sampling strategy for genetic conservation purposes. Genetic markers are needed to study many aspects of forest trees such as reproduction system, genetic diversity and gene flow. Another idea is to study the reproductive ecology of the Ironwood species. Focus is on seed dispersal, because this aspect seems to be un-solved, and the potential role of endangered animals is highly relevant in the conservation context. In order to clarify, the project will compare populations from Harapan rainforest with populations from less disturbed areas in national park –based on parentage analysis of seedlings and mature trees based on DNA markers (to be developed as part of the project).

Keywords: Ironwood, ecosystem restoration, population genetics, genetic diversity, tropical forest, conservation.

Plant diversity assessments using a standardized transect method in Cambodia, Indonesia, Malaysia, Thailand and Vietnam

Yahara, T.[1], Tagane, S.[1], Toyama, H.[1], Fuse, K.[1], Nagamasu, H.[2], Suzuki, E.[3], Fujii, S.[4], Naiki, A.[5], Phourin, C.[6], Darnaedi, D.[7], Ardiyani, M.[7], Syamsuardi, A.[8], Saw, L.G.[9], Lim, C. L[9], Suddee, S.[10], Rueangruea, S.[10], Marod, D.[10] & Dang, S.[11]

[1]Kyushu University, Japan, [2]Kyoto University, Japan, [3]Kagoshima University, Japan, [4]University of Human Environments, Japan, [5]Ryukyu University, Japan, [6]FA, Cambodia, [7]Research Center for Biology-LIPI, Indonesia, [8]Andalas University, Indonesia, [9]FRIM, Malaysia, [10]Forest Herbarium, Thailand, [11]ITB, Vietnam
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To assess current status of plant diversity in tropical Asia, we are recording all the plant species including herbs, shrubs, epiphytes, vines and trees within a standardized transect of 100m x 5m. We placed 15 transects, 10 transects and 7 transects in Gn Gede/Pangrango (Indonesia), Phnom Bokor (Cambodia) and Doi Inthanon (Thailand), along altitudinal gradients. We also placed additional transects in lowland Cambodia, SW and SE Thailand, S Vietnam, Malay Peninsula, W Sumatra and W Kalimantan. We took pictures, made specimens and collect DNA samples for all the species recorded. Until today, we made 12,603 specimens including sterile vouchers. The highest record of species richness within a transect was 396 species in W Sumatra, followed by 392 in W Kalimantan. In Indochina, the highest record was 341 species in Honba, Vietnam followed by 276 species in Bokor, Cambodia. Proportion of new species may be the highest in Honba, Vietnam. Conservation efforts in those areas are of primary importance. We are preparing open-resource database for those

collections including pictures and specimen images and we call international collaboration for this plant diversity assessment using a standardized transect method.

Session 7

BIOGEOGRAPHY-2

Convener: Peter C van Welzen, Naturalis Biodiversity Center, The Netherlands
Chairperson: Fabian Brambach, Gottingen University, Germany
Venue: New Guinea Room

09.30 – 09.45	Daniel J Murphy *et al.*: Dating divergences in *Acacia*
09.45 – 10.00	Chih-Chieh Yu & Chung Kuo-Fang: Out of Asia- the biogeographic origins of insular clades of *Berberis* s.s.
10.00 – 10.15	Darren Crayn *et al*.: The Sahul-Sunda floristic exchange: dated molecular phylogenies document post-Miocene intercontinental dispersal dynamics
10.15 – 10.30	Charles Cannon *et al*.: Archipelago wide land-area change during the Quaternary
10.30 – 10.45	Niels Raes *et al.*: Reconstructing the flora of Java
10.45 – 11.00	General discussion

Dating divergences in *Acacia*

Murphy, D.J.*[1], Brown, G.K.[2] & Miller, J.T.[3]
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The *Acacia s.s.* clade, with over 1000 species, forms a well known dominant element of the Australian flora; it also includes 18 phyllodinous taxa with distributions outside the continent, in Malesia and on islands of the Pacific and Indian Oceans. Dating divergences of the *Acacia* clade will allow investigation of what were the drivers for the lineage's diversification and the timing of biogeographical links between Australia and Malesia (and beyond). In the past, efforts to date divergences in *Acacia* have been hampered by difficulties in applying appropriate fossil dating constraints, in combination with the lack of a well-supported phylogeny. In this study, we use the

extensive Mimosoideae microfossil pollen record to provide reliable age constraints, and apply these to densely sampled molecular phylogenies to produce a comprehensive divergence dating study of *Acacia* and related mimosoid legumes. We describe and provide dating estimates for the major clades of *Acacia,* and include those *Acacia* species found outside Australia. From these results we infer the timing of diversification and biogeographic links to Malesia and oceanic islands beyond the region.

Keywords: phylogeny, Mimosoideae, legume, molecular dating, *Acacia.*

Out of Asia—biogeography of insular clades of *Berberis s.s.*

Yu, C.C[1] & Chung, K.F. [1]

School of Forestry and Resource Conservation, National Taiwan University, Taiwan (R.O.C.)

Species of *Berberis* s.s. are distributed widely across temperate, alpine, or semi-arid habitats of the Northern Hemisphere. In many western Pacific Islands, they are characteristic shrubby species prevailing in subalpine steppes and montane-temperate forests. However, the biogeographic origins of these isolated insular species have never been studied in modern phylogenetic context. Based on a worldwide sampling of *Berberis* s.s., the phylogenetic relationships of the barberries inhabiting western Pacific islands were examined using nrITS and six chloroplast markers. As a main result, we found that most insular lineages are derived from ancestors in continental Asia. Specifically the Japanese deciduous barberries are closely related to central and northern Asian species while the only alpine deciduous species in Taiwan is sister to taxa of Himalaya origin. For evergreen barberries that are represented predominately by sect. *Wallichianae*, we identify two independent migration events from southwestern China to Sumatra and toTaiwan and Luzon. Molecular dating indicates that these migrations had occurred during the late Tertiary to the Quaternary when deteriorating paleo-climate could have increased the seasonality in the region. The lower average annual temperature could have also provided more suitable and novel habitats for the colonization and expansion of *Berberis s.s.*to these islands.

Keywords: historical biogeography, phylogeny, disjunct distribution, tropical mountain flora.

The Sahul-Sunda floristic exchange: dated molecular phylogenies document post-Miocene intercontinental dispersal dynamics

Crayn, D.*[1,2], Costion, C.[1] & Harrington, M.[1]
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Since the collision of the Sunda and Sahul shelves in the early Miocene, the Malesian region has been an important stage on which exchange between Laurasian and Gondwanan floras has played out. The accumulation of dated molecular phylogenies of diverse Malesian lineages now allows deeper exploration of the dynamics of this exchange through time than has hitherto been possible.
We undertook a meta-analysis of published dated phylogenies of plant groups represented in Sunda and Sahul and identified clades that are disjunct across Wallacea. From these we determined rate and direction of lineage exchange (=migration) through time and related these exchange dynamics to changing landmass configurations and dispersal ecology. Our results suggest that long distance dispersal was not an important process contributing to the exchange between and assembly of Sunda and Sahul floras, because no disjunctions dated to earlier than c. 20 Ma were observed. Subsequently, despite the two shelves being in close proximity (<100 km) from c. 18 Ma, exchange was slow until the mid Miocene (c. 12 Ma) when New Guinea orogeny began to intensify. After this time, the exchange rate increased. The successful migrants were predominantly zoochorous, megathermal lineages supporting previous hypotheses of the importance of dispersal mechanism and phylogenetic niche conservatism in the assembly of Sundanian and Sahulian floras.
Keywords: Molecular phylogeny; Wallacea; dispersal; historical biogeography; Malesia; Australasia; flora; Wallace's Line; molecular dating.

Archipelago wide land-area change during the Quaternary

Cannon, C.
Texas Tech University and Xishuangbanna Tropical Botanical Garden

The effects of sea level change during the last two million years varied dramatically across the archipelago. While previous work has focused on Sundaland, an archipelago wide study reveals possible interesting effects on the other islands as well. In this study, I will highlight the major differences among the islands and the possible implications for connectivity and diversity. Ultimately, a close correlation between historic land area and plant diversity across the region may provide a straightforward explanation for diversity.
Keywords: ice ages, sea level, Wallacea, Philippines, Papua.

Reconstructing the flora of Java

Raes, N.[1], Frenken, M.A.[1], Saw, L.G.[2], van Loon, E.E.[3] & van Welzen, P.C.[1]

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[2]Forest Research Institute Malaysia (FRIM), Malaysia

[3]IBED - UvA, Amsterdam, the Netherlands

The earliest accounts of detrimental deforestation on Java date from 1850 by Junghuhn and Zollinger. Presently less than 10% of the natural vegetation cover of Java remains. Although vegetation descriptions and maps with the different forest types of Java do exist, notably the vegetation maps of van Steenis, Hannibal and Whitmore, these maps are largely based on expert opinion. With the ongoing digitization of botanical collections a wealth of information on collection localities of individual species have, and still are becoming available. By relating these specimens per species to spatial data of abiotic conditions, i.e. temperature, precipitation, soil pH, etc., allows predicting island wide distributions of individual species based on their abiotic niche conditions. This technique is known as species distribution modelling. Stacking of these maps results in a predicted presence/absence matrix for the whole of Java. We analysed this matrix with a partitioning around medoids (PAM) cluster analysis. We were able to distinguish six distinct vegetation types. We present the map of the 'Reconstructed flora of Java', identify characteristic species per vegetation type with an indicator species analysis, and quantitatively compare the results with the above mentioned maps using the map curves algorithm.

Keywords: Flora reconstruction, Java, species distribution modelling, vegetation types.

Session 7

LOCAL FLORA-1

Convener: Elizabeth A Widjaja, Research Center for Biology, LIPI & David Mabberley, Royal Botanic Gardens, Sydney

Chairperson: David Mabberley, Royal Botanic Gardens, Sydney

Venue: Sulawesi Room

09.30 – 09.45	Rogier de Kok & Gemma Bramley: Local floras, revisions or neither: what speed up the prodution of Flora Malesiana treatment?
09.45 – 10.00	Leng Guan Saw *et al.*: Flora of Malaysia – its challenges and future
10.00 – 10.15	Max van Balgooy & Elizabeth A Widjaja: Towards a flora of Bali, a cheklist
10.15 – 10.30	Elizabeth A Widjaja: Floristic study of Mekongga protected areas: towards establisment of the Mekongga National Park
10.30 – 10.45	Kwek Yan Chong *et al.*: The flora of a remnant freshwater swamp forest in Singapore
10.45 – 11.00	General discussion

Local floras, revision or neither: what speeds up the production of a Flora Malesiana treatment?

de Kok, R. & Bramley, G.

Royal Botanic Gardens, Kew, UK

The Flora Malesiana (FM) is still far from complete. What might speed up the production of family accounts? The Lamiaceae is represented by c. 300 species in Malesia; the FM account is now ready for submission to the Editors. As well as updates to Keng (1978), the Lamiaceae treatment has been put together using regional revisions, monographs and local flora accounts (The Tree Flora of Sabah and Sarawak and Flora of Peninsular Malaysia). The process has taken roughly 12 years, initially with one author, increasing to five core authors over the last five years. Whilst regional revisions and monographs have sped up production of the family treatment, arguably, writing local flora accounts has slowed it down. Co-ordinating multi-author accounts is time consuming, as is formatting those accounts to follow the various different requirements of Editorial Boards. However, local floras provide a much-needed resource to the scientific community and are often more accessible to users. In

the future, e-taxonomic platforms will be vital to make preliminary information for larger floristic areas widely available before the official accounts are complete: online species pages are an easy way to display nomenclatural information and distribution maps, as well as descriptions and images.

Keywords: Lamiaceae, Flora Malesiana, revisions, local flora.

Flora of Malaysia – Its challenges and future

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Malaysia has a rich flora of possibly well over 15,000 species of vascular plants. Located on the Sunda Shelf, its geography straddles over two regions, Peninsular Malaysia connected to mainland Asia and East Malaysia with the states of Sabah and Sarawak on the island of Borneo. Each region has its distinct floristic component and phytogeography. Peninsular Malaysia has about 8,300 species and East Malaysia estimated to have about 12,000 species. The challenges of running a viable Flora of Malaysia project include the following. The political history of the two regions charted differences in the documentation of the regional floras. The flora is better covered for Peninsular Malaysia and is rather poor for Sabah and Sarawak. Historically also, there is no dedicated botanical institution in Malaysia, most of the botanical research and documentation of our flora has been centred in forestry research institutions and local universities. The only dedicated botanical institution with active botanical research is found in the Singapore Botanic Gardens. However, in 1965 Singapore ceded out of Malaysia that resource was lost. A multi-phase approach has been adopted for the completion of a modern treatment for the Flora of Malaysia. The accounts started with the Tree Flora of Malaya. This completed in 1989. This then is followed by the Tree Flora of Sabah and Sarawak in 1991 and Flora of Peninsular Malaysia in 2005. After the completion of the Tree Flora of Sabah and Sarawak, it is planned that the Flora of Sabah and Sarawak to be initiated. Following the completion of the regional floras, the consolidation for a flora of Malaysia will then be considered. Its format and expression (e.g. print form or digital format or both) can be determined at a later stage. Running the current two flora accounts, the project faces challenges in manpower capacity, budget constraints, and institutional priority, needs and demands. The project is also mindful of regional projects such as the Flora of Thailand, Flora Malesiana and Flora of the Philippines. Our project has tried to tap into the expertise found in these other projects and we have benefited much by the collaborations given by many botanical institutions. Making the flora project more pertinent and useful to other stakeholders, our project has now included strong elements of conservation and conservation biology, we have now looked into producing other products other than the traditional publications of revision volumes and taxonomic revisions in journals.

Keywords: national flora, tree flora, Peninsular Malaysia, Sabah and Sarawak.

Towards a flora of Bali, a checklist

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The flora of Bali is poorly known. To remedy the situation a checklist has been compiled by Herbarium Bogoriense, Kebun Raya Eka Karya and Naturalis Leiden. The list, based on collections in the above institutes and literature, is certainly incomplete. We have focused on indigenous plant species, but naturalized and commonly cultivated species are also included. The distinction between naturally occurring and alien species is not always easy. The status of some species may have to be changed in future. Moreover, not all identifications are reliable. Here too changes can be expected. Therefore the checklist is to be regarded as provisional, but may serve as a basis for a flora of Bali. Thorough exploration of the island is needed before such a project can be undertaken.
Keywords: Flora Bali, indigenous, naturalized, cultivated.

Floristic study of Mekongga protected forest: toward establisment of the Mekongga National Park

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Mekongga is one of the highest mountains in Southeast Sulawesi. The Mekongga region was designated as a protected forest in 1994, after logging had been done in this area. A floristic study of this forest was conducted from 2009 through 2011 by visiting the area twice a year during the dry and wet seasons to collect flowering and fruiting plant specimens. Other species which was collected during ecological study were also recorded, but many of them cannot be identified because the plants were too young or in the steril condition. Specimens of 819 species in 162 families were collected, of which 5% (39 species) are endemic species and 11% (91 species) are introduced species from China, South America, India, or even Madagascar. New records for Mekongga were collected also for species originally known only in Java (50 species), Malaysia (35 species), the Philippines (28 species), New Guinea (14 species), Sumatra (13 species), Borneo (11 species), Moluccas (4 species), and Lesser Sunda Islands (3 species). Based on these data, it may be implied that these species apparently have migrated to Mekongga mostly from Java, then from Malaysia and the Philippines. More than 10 new species of, Poaceae (a bamboo) Orchidaceae, Gesneriaceae, Melastomataceae, Myrtaceae, and Araliaceae. are proposed from this area. Further study of the floristic account will be undertaken to

provide basic and supporting data in an effort to formulate an urgently needed proposal to designate the Mekongga area as a national park.

Keywords: Mekongga, floristic, national park, Sulawesi.

The flora of a remnant freshwater swamp forest in Singapore

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Periodically or permanently flooded lowland rain forests on peat and non-peat soils are challenging environments to work in. As a result, they may be under-studied compared to forests on relatively drier and more solid ground. The area known as the Nee Soon Swamp Forest, located within Singapore's Central Catchment Nature Reserve, contains the last remnant of primary freshwater swamp forest of a significant size for the city-state. This area has recently seen a number of rediscovered presumed nationally extinct species and new local records. We present the initial results from a set of nine vegetation plots that compare the flora of dry and wet areas within the Nee Soon area. Thirty-one more plots will be surveyed over the next year, and these will form the basis for eco-physiological measurements that aim to understand the vegetation-hydrology dynamics. We anticipate that the plots will reveal more floristic discoveries despite Singapore being already relatively well-botanized. Likewise, we expect that more botanical collections and studies in Malesia's swamp forests are necessary for a more complete understanding of the regional flora.

Keywords: freshwater swamp forest, floristics, rediscoveries, new records, urbanization, climate change.

Session 7

FUNGI-1

Convener: Iman Hidayat & Atik Retnowati, Research Center for Biology, LIPI
Chairperson: Iman Hidayat, Research Center for Biology, LIPI
Venue: Sumatera Room

09.30 – 09.45	Edwin R Tadiosa *et al.*: Occurrence and diversity of fungi in the national park and protected landsccape of Southern Tagalog Region, Philippines
09.45 – 10.00	József Geml *et al.*: High-throughput DNA sequencing provides first insights into the fungal diversity of lowland rainforests and montane cloud forests in Borneo
10.00 – 10.15	Atik Retnowati: The Agaricales of Bali
10.15 – 10.30	Kartini Kramadibrata: Glomeromycota on *Pandanus tectorius* in Java and Madura
10.30 – 10.45	Dewi Susan: Hyphomycetes on Pandanaceae in Indonesia
10.45 – 11.00	General discussion

Occurrence and diversity of fungi in the national park and protected landscape of Southern Tagalog Region, Philippines

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Protected areas in the Philippines are ideal study sites for fungi due to its superb climate, cold weather, and lush vegetation. Thus, our research study aims to determine the fungi present in the declared National Park and Protected Landscape in the Philippines' Southern Tagalog Region (PSTR). Four transect lines were established in each seven study sites from 100 m to 1050 m asl with 20 m x 50 m quadrat sampling each transect line (TL) and with an interval of 200 m between quadrats. The fungal species within the quadrats along the TL's were collected, identified and recorded. Opportunistic sampling method was also used during the survey.
A total of 235 species under 99 genera, and 42 families were collected from the study sites, with a high number of fungi collected in different substrates, i.e 100-105 species, collected from stump. Of

these, 218 belong to Phylum Basidiomycota, and 17 Ascomycota. These be part of Order Agaricales, Boletales, Cantharellales, Dacrymycetales, Geastrales, Gomphales, Hymenochaetales, Phallales, Polyporales, Russulales, Tremellales, Pezizales, and Xylariales. Among the collected species, *Hexagonia tenui*s, *Microporus xanthopus*, and *Schizophyllum commune* were recorded to be the most abundant. Eight species were noted as rare.

Among the significant findings include *Cymatoderma elegans*, *Ganoderma tsugae*, *Macrolepiota rhacodes*, *Cookeina sulcipes*, *and Galiella rufa*, as the new record fungal species in PSTR, and one possible new species of the genus *Hexagonia*. Further field surveys of the protected areas are anticipated to uncover a rich and diverse fungal flora in the area. Although generally well protected, the areas are currently experiencing some degree of anthropogenic disturbances such as carabao logging, minor forest products gathering, and *kaingin* making or slash-and-burn farming. Fungal diversity research efforts need to be encouraged to evaluate the effects of these human disruptions on the ecology of the national park.

Keywords: fungi, protected landscape, species abundance, species distribution, species diversity.

High-throughput DNA sequencing provides first insights into the fungal diversity of lowland rainforests and montane cloud forests in Borneo

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Borneo is one of the world's most biologically diverse areas and is famous for its high endemism. While the majority of biodiversity studies and conservation efforts have been focused on vascular plants and vertebrates, fungi, hyperdiverse group with key ecological functions, remain a largely unexplored. To partly fill this tremendous gap in our knowledge, we carried out diversity assessment by using next-generation DNA sequencing of soil fungal communities. Soil samples were taken in Kinabalu and Crocker Range Parks in Sabah, Malaysia along an altitudinal gradient, from Lowland and Hill Rainforest (150-1,200 m) and Lower Mountain Forest (1,200-1,900 m), to Upper Mountain Forest (1,900-2,700 m), Ultramafic Rock Forest (2,700-3,000 m), Lower Granite Boulder Forest (3,000-3,300 m), Upper Granite Boulder Forest (3,000-3,800 m), and Sub-alpine Meadows (3,200-4,095 m). We found that soil fungi are very diverse with more than a thousand species-level groups. In addition, fungal communities showed strong habitat partitioning with many taxa restricted to a certain vegetation type. Our study provides the first kingdom-wide fungal diversity assessment in Borneo and offers an unprecedented insight into changes in fungal community structure among the major elevational vegetation types. In addition, the accummulated data provide baseline information for future projects, with particular reference to altitudinal patterns in plant-fungal symbioses.

Key words: altitudinal gradient, fungi, ITS rDNA, Kinabalu, next-generation sequencing.

The Agaricales of Bali

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Species of Indonesian Agarics had been reported by foreign mycologists who actively collected and studied the taxa mostly from Java. Continuing their previous research,“The Agaricales of Java and Bali” project from 1998 to 2000 was carried out in order to explore the species of agarics in Java and Bali by Dennis E Desjardin and Egon Horak. Supported by type studies, recently collected specimens, and molecular data it is currently recognized approximately 15 Balinese species on a number of genera, *Marasmius, Gymnopus, Psilocybe, Lactarius*. To accomplish the information of Agaricales in Bali, a four year project was initiated. The first trip to Bali was conducted in May 2013, and it has been encountered 59 collections of Agaricales. These colections belong to 22 genera in 8 families, represent conservatively 53 species, and 3 out of 59 are unidentified due to the ambiguous characters either microscopic or macroscopic. Approximately 75 % of the species (41 spp.) belong to *Tricholomataceae* with the next group being the *Entolomataceae* (3 spp). Clearly, the most common agarics in Bali, both in abundance and species diversity, are white-spored and saprotrophic taxa. Some are ectomycorrhizal fungi, such as *Inocybe* and *Lactarius*, which associate with some mycorrhizal trees. Complete information on the diversity, genera encountered, potential value, and habitat of Agaricales collected, will be presented.
Keywords: Agaricales, Bali, ectomycorrhizal fungi, saprotrophic.

Glomeromycota of *Pandanus tectorius* in Java and Madura

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Glomeromycota is a group of fungi which usually symbiotic with most of terrestrial plants and produce arbuscular mycorrhiza inside the root. Information on its diversity, particularly in Indonesia remains underexplored, as a result this study is carried out in order to fill the gap on the information of Glomeromycata diversity. The soil samples collected from several national parks in West Java, central production of pandan and villages in West, Central and East Java including Madura island. Glomeromycota spores were isolated from soils around rhizosphere of *Pandanus tectorius*, and were identified using their morphological characters. Eleven species of Glomeromycota were identified that belong to genera *Acaulospora* (2 species), *Glomus* (3 species), *Claroideoglomus* (1 species), *Funneliformis* (1 species), and *Sclerocystis* (3 species). The record of each species is presented.
Keywords: Arbuscular fungi, rhizosphere, national park, coastal area

Hyphomycetes on Pandanaceae in Indonesia

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Hyphomycetes is a group of microfungi with asexual reproductive structure, and it usually called as fungi imperfecti. It grows in many natural substrates. Approximately 300 species has been described in Malesia, and 91 species of them were recorded grow on Pandanaceae. To accomplish the previous research, this study was carried out. Nine species of Hyphomycetes were found on dead leaves of *Pandanus* spp. from Ujung kulon National Park (West Java, Java) and Wawonii Island (South East Sulawesi). Those are *Helicoma state of Lasiosphaeria pezicula* (Berk. & Curt.) Sacc., *Helicosporium state of Tubeufia cerea* (Berk. & Curt.) Booth, *Periconia digitata* (Cooke) Sacc., *Polytretophora calcarata* Sierra, *Veronaea botryosa* Cif. & A.M. Corte, *Microdochium bolleyi* (R. Sprague) de Hoog & Herm.-Nijh., *Dictyosporum pandani* Whitton, McKenzie & K.D. Hyde, *Drechlera* sp. and *Helminthosporium* sp. *Helicoma state of Lasiosphaeria pezicula* (Berk. & Curt.) Sacc., *Helicosporium state of Tubeufia cerea* (Berk. & Curt.) Booth, and *Microdochium bolleyi* (R. Sprague) de Hoog & Herm.-Nijh. are noted as a new information for the availlable data of the list of fungi associated with Pandanaceae. All species will be described and presented.

Keywords: Hyphomycetes, Pandanaceae, Java, Wawonii, Indonesia.

Session 8

ECOLOGY-2

Convener: Rochadi Abdulhadi, Research Center for Biology, LIPI & Laode Alhamd, Research Center for Biology, LIPI

Chairperson: Tukirin Partomihardjo, Research Center for Biology, LIPI

Venue: Borneo Room

13.30 – 13.45	Annisa Satyanti: Functional importance of seed polymorphism: relationship between seed mass and seedling vigour of *Vatica pauciflora* (Korth.) Blume
13.45 – 14.00	Kamziah A Kudus & Khairul N Ya'akub: A comparison of vegetation of logged over forest area and unlogged forest area in Ulu Muda Forest Area, Kedah, Malaysia
14.00 – 14.15	N Shida Saari *et al.*: Establishment of 10-ha permanent plot in Ayer Hitam Forest Reserve, Puchong, Selangor, Malaysia: a step towards holistic conservation
14.15 – 14.30	Suzana Sabran *et al.*: Contribution of the Heart of Borneo (HoB) initiative towards botanical exploration in Sabah, Malaysia
14.30 – 14.45	Dian Rosleine: The effect of land ue history on natural forest rehabilitation at corridor area of Gunung Halimun National Park, West Java, Indonesia
14.45 – 15.00	General discussion

Functional importance of seed polymorphism: relationship between seed mass and seedling vigour of *Vatica pauciflora* (Korth.) Blume

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Seed polymorphisms are important from an ecological perspective. Seed size is embedded in a complex of attributes which together define the life history of a plant species. Seed mass,indicates the resources available to the seedling during establishment, governs the species' ability to establish under adverse conditions. It is also correlated with the species rate of growth. Seedling growth of *Vatica pauciflora*, and other Dipterocarpaceae members are somewhat delicate, especially when the

seeds are raised in nursery. This paper reports the results of an investigation into seed polymorphism, c.f. seed mass differences of *Vatica pauciflora* and seedling establishment. We addressed the following hypotheses: i) seed mass correlated to germination rate and seedling vigour, ii) seedling vigour was determined by the seed mass categories. Statistical test used were Kruskal Wallis test, and regression analysis. Seed mass did not affect the germination percentage. Seed mass, on the other hand, positively affect seedling length (χ^2= 38.564, p=0.00), leaf (χ^2= 9.867, p=0.00), aboveground biomass (χ^2= 28.331, p=0.00), belowground biomass (χ^2= 34.794, p=0.00), and diameter (χ^2= 30.519, p=0.00). The regression analysis resulted R^2 for seedling length, diameter, aboveground and belowground biomass were 0.214, 0.271, 0.288, and 0.315, respectively. Beyond the pertinence of plant resource allocation, seed production and seedling fitness shown, the result implies for the importance of seed size selection for silvicultural practice. Large seeds statistically advantageous for rapid early growth. This study is also relevant to the special importance of seed information for nursery planning in restoration projects and ex-situ conservation of endangered species.

Keywords: Dipterocarpaceae, germination ecology, resources allocation, seedling growth, life history.

A comparison of vegetation of logged over forest area and unlogged forest area in Ulu Muda Forest area, Kedah, Malaysia

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This study emphasizes on the quantitative analysis of trees between an unlogged hill forest area and a 9-years old logged over forest area in Ulu Muda Forest Reserve. Ulu Muda forest Reserve is a production forest located in the state of Kedah in Malaysia. Two plots of 1-hectare size were established within both forest area and divided into 100 10 x 10m quadrats. Only trees with dbh greater or equal to 5 cm were observed. The species name, dbh and tree height were recorded from the trees. The two plots were compared. The unlogged forest plot has lower number of individuals compared to the logged over forest area that has 2180 number of individuals. Family Euphorbiaceae has the highest FVI for both forest areas. Although the logged over forest area has the higher number of individuals, the most diverse plot were the unloged forest area with 1825 individuals and 179 species surpassing the logged over forest that only has a total of 152 species.

Keywords: hill forest, IVI, basal area.

Establishment of 10-ha permanent plot in Ayer Hitam Forest Reserve, Puchong, Selangor, Malaysia: a step towards holistic conservation

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Establishment of permanent plot is generally for obtaining long-term data on plant diversity, forest dynamic and species demographic information. 10-ha permanent plot in Ayer Hitam Forest Reserve (AHFR) was established to meet these objectives and the establishment completed in October 2012. AHFR, besides being a plot for comparative studies in urban settings, it was also the least chunk of the remaining forest left in Klang Valley. It was exceptionally interesting to know and document the biodiversity of this forest, not only due to the diversity of flora and fauna, but because of the indigenous people from the Temuan Tribe who co-existing part of the 1176.1 ha forest. Documented floristic composition of AHFR reveal a total of 370 species of trees, 68 species of herbaceous, 7 species of palms, 4 species of bamboos, 39 species of ferns and fern-allies and 43 species of mosses. Euphorbiaceae was the diverse tree family with 32 species and 17 genera. *Agrostistachys longifolia* var. *longifolia* (Euphorbiaceae) was recorded as dominance species in terms of stem density. The earliest published floristic data started in 1998 and classify the AHFR as 'Kelat-Kedondong-Mixed Dipterocarp type of lowland forest'. Distribution patterns of tree species in AHFR were reported as random and clumped. Despite of being the green lung for Klang Valley, AHFR also important to Temuan Tribe as it plays the significant role in their livelihood as they depend on the forest for food supplies. AHFR was believed to have been settled by the Temuan tribe 400 years ago and they perpetuate their legacy by naming important landmarks in the area. AHFR provides great opportunity for researchers to study and monitor the impacts of isolation, fragmentation and human disturbance on forest structure, forest dynamics and demographics. Apart from flora studies, a few series of fauna studies also have been documented for this forest by researchers and scientists from various disciplines. The establishment of the permanent plot is expected to cater for multi-discipline studies and expected to be formally designated as long-term Permanent Ecological Plot under Center for Tropical Forest Science (CTFS) global network of forest research plot.

Key words: Ayer Hitam Forest Reserve, Permanent plot, floristic study, long-term permanent ecological plot.

Contribution of the Heart of Borneo (HoB) initiative towards botanical exploration in Sabah, Malaysia

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The Heart of Borneo (HoB) declaration is a conservation agreement initiated by WWF and signed by three countries, i.e., Brunei Darussalam, Indonesia and Malaysia in Bali, Indonesia on 12th February 2007 to protect more than 20 million hectares of forested region on Borneo Island. These forested areas could be well protected when conservation management plan is in place. One of the crucial activities to facilitate the planning and formulation of conservation plan is to conduct scientific expeditions that include botanical exploration. The primary objective of the expedition is to identify the key conservation targets within the forest reserves. For the past five years, several expeditions have been conducted by the Sabah Forestry Department under the auspices of the HoB project to explore various forest reserves with conservation issues within the Heart of Borneo area. This paper will present the findings which include plant richness, endemism and plant conservation status in each forest reserves that has been explored.

Keywords: Heart of Borneo (HoB), botanical exploration, plant richness, endemism and plant conservation status.

The effect of land use history on natural forest rehabilitation at corridor area of Gunung Halimun National Park, West Java, Indonesia

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Economic development and population increase cause serious degradation of natural forests in Indonesia even in protected areas. Corridor area of Gunung Halimun Salak National Park as important habitat for endangered animals such as Javan gibbon (*Hylobates moloch*), Javan leopard (*Panthera pardus melas*), and Javan eagle (*Spizaetus bartelsi*) was degraded and fragmented due to conversion of natural forest into plantation, settlement, infrastucture development, mining, and illegal logging. However, little is known about recovery process in tropical degraded forest under different land use history. To clarify vegetation structure and forest recovery related to land use history we placed randomly 22 quadrats (11 quadrats each 10 x 10 m^2 in abandoned plantation, seven and four quadrats of 20 x 20 m^2 in disturbed and less disturbed forest, respectively). Three community groups can be distinguished as *Swietenia macrophylla – Agathis dammara* community in abandoned plantation, *Maesopsis eminii – Cyathea latebrosa* in disturbed forest, and *Castanopsis accuminatissima* - *Schima wallichii* in less disturbed forest. Below the plantation canopy, light tolerant species (*Clibadium surinamense*, *Eupatorium inulifolium*, and *Melastoma malabathricum*), weeds, grasses, and fern of *Dicranopteris linearis* were dominant. However, some planted exotic species such as *Bellucia pentamera, M. eminii, and Calliandra chalothyrsus* escaped from adjacent plantation to forest. The distant area from community keeps forest in good condition as indicated by the dominance of old forest species, such as *Castanopsis acuminatissima*, *Quercus oidocarpa*, *Schima wallichii*, and

Altingia excelsa. Forest regeneration in severe degradation area seems difficult to rely on natural succession. Therefore, human intervention by planting native species can be suggested to avoid invasive species occupancy as well as accelerate forest recovery.

Keywords: Gunung Halimun Salak National Park, tropical forest rehabilitation, land use, forest recovery.

Session 8

BIOGEOGRAPHY-3

Convener: Peter C van Welzen, Naturalis Biodiversity Center, The Netherlands
Chairperson: Charles Cannon, Naturalis Biodiversity Center, Netherlands
Venue: New Guinea Room

13.30 – 13.45	Charles Cannon & David Lohman: Near-sensing forest condition
13.45 – 14.00	Fitmawati *et al.*: Analysis of genetic diversity and mapping distribution pattern of *Mango* (Mangifera L.) in Central Sumatera
14.00 – 14.15	Matti Niissalo: When the fossils and molecular phylogeny do not meet – complex biogeography of the amphipacific tree genus *Sloanea* (Elaeocarpaceae)
14.15 – 14.30	Aurea L Feliciano *et al.*: Migration of *Lobelia zeylanica* (Campanulaceae) from Taiwan to the Ryukyu archipelago inferred from chloroplast DNA data
14.30 – 15.00	General discussion

Near-sensing forest condition

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With the rapid development of cheap but powerful handheld digital technology, like smart-phones, point and shoot cameras, and other digital devices, millions of people globally now have the capacity to collect detailed and high quality observations of the environment. In contrast to 'remote-sensing', this type of data can be taken at a wide range of physical scales, from the landscape (kms) to the macroscopic (mms) and can provide powerful data for monitoring forest change and recovery. Immediately prior to the FM9 conference, we led a field course jointly funded by the US NSF and Chinese NSF that brought together 30 graduate students from around the world to explore 'near-

sensing' protocols to capture, store, and disseminate high-quality data collected with widely-available affordable equipment, including an autonomous drone. We feel that these techniques can greatly expand both data collection and nature appreciation by the general public and research scientists a like.
Keywords: crowd-sourcing, citizen science, biodiversity, signposts

Analysis of genetic diversity and mapping distribution pattern Mango (*Mangifera* L.) in Central Sumatra, using spatial modeling

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Genetic diversity and genetic material resources are important for success of mango breeding programmes. Central Sumatra has a variety of habitat types and a high diversity of mango species. High deforestation made a serious impact on mango and resulted in genetic erosion. Exploration, inventory, characterization and pattern mapping of the distribution of wild mango species and mango cultivars are made to improve safe mango genetic resources. This research aims to describe the diversity and geographic distribution patterns of mangos. We used exploration and spatial modeling for this research. The results were 900 collections of mangos that include ten species (*M. foetida, M. indica, M. kemanga, M. laurina, M. odorata, M. quadrifida, M. sumatrana, M. torquendra, M. zeylanica* and *Mangifera* sp.). Mango does not have the same distributed in three province in Central Sumatra. In the lowland forest of Riau there are 10 species, five species in West Sumatra, and seven in Jambi.
Key words: diversity, spatial distribution , mango, Central of Sumatera.

When the fossils and molecular phylogeny do not meet – complex biogeography of the amphipacific tree genus *Sloanea* (Elaeocarpaceae)

Niissalo, M.A.*[1,2], Pennington, R.T.[2], Richardson, J.E.[2], Pennington, T.D.[3], Crayn, D.M.[4], Baba, Y.[4], Phoon, S.N. & Rousteau, A.[5]

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Sloanea (Elaeocarpaceae) is a large genus of rainforest trees with a disjunct distribution in the Old and New World tropics. We completed the first comprehensive molecular analysis of the biogeographic history of the genus, sampling two genes and 49 samples. We used Bayesian and parsimony methods to assess relationships of Old World and New World taxa as well as the named sections in the New World. We used fertile Paleocene fossils to date molecular phylogenies, and assessed the phylogenies to determine whether the family has gained its peculiar distribution via the Boreotropics or Antarctica. The fossils strongly suggest a New World origin for the genus and Boreotropical dispersal, as fossils have only been found from continental North America until the Eocene.
The genus is strongly supported as monophyletic. Analyses suggest that the old world clade of the genus is basal, with Asian species sister to the others, and biogeographic analysis suggests a Southern Hemisphere origin, although support for this remains weak. Our results also indicate a minimum age of 39 Ma for the diversification of the genus, far earlier than previous estimates. Fossil evidence very strongly supports Boreotropical dispersal, but no support can be found using molecular evidence. In future, increased gene coverage, and better sampling from both sides of Wallace’s Line may shed more light on this dilemma.
Keywords: *Sloanea*, Elaeocarpaceae, phylogeny, biogeography, fossil dating.

Migration of *Lobelia zeylanica* (Campanulaceae) from Taiwan to the Ryukyu archipelago from chloroplast DNA data

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A molecular phylogenetic analysis of *Lobelia zeylanica*, broadly distributed in tropical Asia, was conducted to elucidate its migration route to the northernmost populations in subtropic Yonaguni Island, the Ryukyu Archipelago of Japan. The present analysis using *rbcL* gene and *trnL-F* intergenic spacer region of chloroplast DNA revealed that all two Yonaguni plants and three of four Taiwanese plants shared identical sequences for the two markers. They formed a well supported clade with a Taiwanese remainder and were separated from plants from Malesian regions. The present study suggests that *L. zeylanica* likely migrated from Taiwan to Yonaguni Island.
Keywords: *Lobelia*, migration, phylogeography, Ryukyu, Taiwan.

Session 8

LOCAL FLORA-2 & SYSTEMATICS

Convener: Elizabeth A Widjaja, Research Center for Biology, LIPI & David Mabberley, Royal Botanic Gardens, Kew

Chairperson: Saw Leng Guan, FRIM

Venue: Sulawesi Room

13.30 – 13.45	Lahiru Wijedasa & Mark Hughes: Memecylaceae of Thailand & Peninsular Malaysia: A framework for Flora Malesiana account
13.45 – 14.00	Joffre A. Ahmad *et al.*: The flowering plants endemic to Brunei Darussalam
14.00 – 14.15	Nurul A. Latiff *et al.*: *Nepenthes* diversity and abundance in Brunei Darusalam
14.15 – 14.30	Jinshuang, M.A.: Chinese Floras: progress and prospect
14.30 – 14.45	David G. Frodin: Should a flora account be taken for granted? A fresh look at *Polyscias serratifolia* (Araliaceae)
14.45 – 15.00	Rachel Y. Acil *et al.*: Effectiveness of the barcoding regions, rbcL and matK, as well as 18S rDNA Sequences, in distinguishing morphologically distinct endemic *Nepenthes* species of the Philippines

Memecylacae of Thailand and Peninsular Malaysia: a framework for a Flora Malesiana account

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Memecylaceae is a pantropical family of plants comprising of six genera and about 600 species. In Asia it is represented by *Memecylon* L. and *Lijndenia* Zoll. & Mortiz. Molecular, taxonomic and ecological work on the family is limited with no monograph of the family. Through the close study of flowers and fruits in Thailand and Peninsular Malaysia we have found previously unused characters that have allowed us to effectively identify species, resolve species complexes and identify potential relationships between species. Here, we provide a synopsis of Memecylaceae in Malesia through the Flora accounts for Thailand and Peninsular Malaysia and certain enigmatic species found in the

region. A potential framework is presented for a regional monograph by outlining potential sections based on floral morphology, distribution and ecology.

Keywords: Memecylaceae, *Memecylon*, *Lijndenia*, Peninsular Malaysia, Thailand, Malesia.

The flowering plants endemic to Brunei Darussalam

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The flowering plants known only in Brunei Darussalam up to December 2012 have been verified and enumerated by reference to relevant scientific publications from 1990 to 2012, queries of online herbaria databases and correspondence with specialist sof the respective plant families. The findings have now been published as *The Flowering Plants Endemic to Brunei Darussalam 2012* (Henrot et al. 2013). Sixty five flowering plant taxa were maintained in this dossier of endemic Brunei plants: 1 at the genus level, 56 at the species level, 6 at the subspecies level and 3 at the variety level. The best represented plant families among the endemics are: Begoniaceae (15 taxa), Araceae (8 taxa), Gesneriaceae (7 taxa), Orchidaceae (5 taxa), Zingiberaceae (5 taxa), Arecaceae (5 taxa), and Myristicaceae (3 taxa). Most of the endemics (35 taxa) are herbs and only seven are trees or treelets. This endemic Brunei plants list can be expected to change in the future, for the following reasons: entries will be added as new species found restricted to Brunei Darussalam are described (e.g., 2 *Bulbophyllum* spp. in early 2013); names may be removed if some of the plants are subsequently found elsewhere. The likely 'anthropogenic endemics', i.e.,taxa that have become restricted to Brunei Darussalam because of loss of habitat elsewhere, have not been considered in this present list, even if the taxa are fairly certainly restricted to the Brunei area (Brunei and adjacent localities). Concern for continuing serious degradation of rain forests in the region includes consideration for how Brunei Darussalam could continue to serve as a critical refuge for such Bornean plants. Many of the flowering plants endemic to Brunei Darussalam are very rare or under collected: 15 are known from 1 collection only and 83% are known from 3 sites or less. Three areas of Brunei Darussalam have been identified which apparently have a distinctly higher density of endemics. In terms of their conservation: 55 of the endemics have all or at least 1 population in a protected forest: this stresses the importance of protected forests for their conservation. Ten of the endemics have no population in a protected area and can be considered as potentially threatened.

Keywords: Brunei Darussalam, conservation, flowering plants, endemic, anthropogenic endemics.

Nepenthes diversity and abundance in Brunei Darussalam

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The genus *Nepenthes* is known to be diverse in Bornean forests, and has been recorded in Brunei Darussalam in various forest types. We aim to investigate variation in *Nepenthes* species richness and abundance at five forest types throughout Brunei Darussalam: open secondary, heath, peat swamp, white sand and mixed dipterocarp forests. A total of thirty-nine 5 m x 5 m plots were set up in these forest types. Within each plot, *Nepenthes* species abundance was quantified, with *Nepenthes* voucher specimens collected and identified to determine species richness. No significant differences were detected either for *Nepenthes* species richness or abundance between the five forest types, despite records of *Nepenthes* in Brunei showing preferences for particular habitat types. We suggest that average species richness and abundance remained constant regardless of forest types in this study, but that these results would likely change if sampling intensity is increased in future studies.
Keywords: Borneo, pitcher plants, habitat, tropical forest.

Chinese Floras: progress and prospect

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In the past few decades, Chinese plant taxonomists have finished their floras twice both in Chinese (Flora ReipublicaePopularisSinica, FRPS, 1959-2004) and in English (Flora of China, FOC, 1994-2012), plus more than thirty kinds of various local floras at province and above. These floras, along with their contents, are fully reviewed,and a comprehensive and detailed analysis, especially with respect to the literature, specimens accumulation, research personnel, compilation and quality of floras, the current situation of Chinese plant taxonomy has been fully discussed.
Key words: Chinese, Flora, review.

Should a flora account be taken for granted? A fresh look at *Polyscias serratifolia* (Araliaceae)

Frodin, D.G.

Royal Botanic Gardens, Kew, UK

Polyscias serratifolia (Miq.) Lowry & G.M. Plunkett (2010), previously known as *Gastonia serratifolia* (Miq.) Philipson and so covered in *Flora Malesiana*, I, 9(1)(1979), is nominally a widespread species of small to large trees primarily of infra-maritime Malesia with two markedly disjunct localities in the Solomon Islands. With the recent breakup of *Gastonia* and its subsumation into an enlarged *Polyscias*, this species, along with *P. spectabilis* of (mostly) mainland New Guinea, is now referred to subgen. *Tetraplasandra* – but only by association with that presumed relative. But nothing should be taken for granted: further study and additional collections – particularly from central Malesia – suggest that *P. serratifolia s.l.* is not one but a complex of twenty or more species. By way of explanation, I shall examine a range of key morphological characters – notably from leaves, inflorescences, and fruits – and show that these putatively new and revived taxa represent varying, but recognisable, assortments of their states. A table of these taxa, with distinguishing features and presently known distribution, will be presented. It is hoped that this demonstration will stimulate field studies, formation of additional collections, and the collection of material for genomic analyses by those most effectively placed to do so. Indeed, many of the proposed taxa have not been re-collected for decades or – in some cases – more than a century, and there are surely other likely localities to be explored. I shall also describe how I put together my database, and offer some remarks with respect to currently available online information.

Keywords: Araliaceae, *Polyscias*, *P. serratifolia*, *P. spectabilis*, taxonomy, geography, collections, Central Malesia.

Effectiveness of the barcoding regions, *rbc*L and *mat*K, as well as 18S rDNA Sequences, in distinguishing morphologically distinct endemic *Nepenthes* species of the Philippines

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Thirteen endemic species of *Nepenthes* from different mountains in Mindanao and Luzon *(N. alata, N. bellii, N. ceciliae, N. copelandii, N. hamiguitanensis, N. merrilliana, N. micramphora, N. mindanaoensis, N. peltata, N. pulchra, N. saranganiensis, N. truncata,* and *N. ventricosa)* were collected. Major morphological characters of the leaf were described and measured. Numerical phenetic analysis partitioned the species into seven distinct groupings. Molecular analysis and DNA barcoding were done using three regions: *rbc*L, *mat*K, and 18S ribosomal DNA. All samples were correctly identified to genus level based on the three genes. The 18S sequences had the highest intergroup genetic divergence, followed by *mat*K while *rbc*L had the lowest. Phylogenetic analysis, using Maximum Parsimony plus bootstrap resampling, was done for *rbc*L and *mat*K respectively. For 18S data, maximum likelihood plus bootstrap was used. Trees were poorly resolved; only the three individuals of each *Nepenthes* species formed distinct clades. Although *rbcL* offers high universality, easy amplification and alignment, it does not discriminate to species level. Sequence variation in *mat*K enabled discrimination of only five species: *N. bellii*, *N. micramphora*, *N. mindanaoensis*, *N. peltata*, and *N. ventricosa*. Combining *rbc*L and *mat*K data gave less resolution. We conclude that the two recommended barcodes, *rbc*L and *mat*K, are not powerful enough to discriminate between the thirteen *Nepenthes* species.

Keywords: *Nepenthes*, *rbc*L, *mat*K, 18s rDNA, diversity, DNA barcoding.

Session 8

ECOLOGY-3

Convener: Rochadi Abdulhadi & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Laode Alhamd, Research Center for Biology, LIPI
Venue: Sumatera Room

13.30 – 13.45	Eizi Suzuki *et al.*: Vegetation and its changes in Pangandaran Nature Reserve, West Java, Indonesia
13.45 – 14.00	Diana Vivanti *et al.*: Study of succession on Damar (*Agathis alba*) forest in the Buyan Lake Bedugul, Bali
14.00 – 14.15	Vera B Lestari *et al.*: The land use change effect in Anjir Pulang Pisau Village, Central Kalimantan
14.15 – 14.30	Tri Mulyaningsih *et al.*: Eaglewood ecology in west Lombok forest
14.30 – 14.45	Suichiro Tagane *et al.*: Botanical survey in the Taman National Gunung Gede-Pangrango, West Java, Indonesia
14.45 – 15.00	General discussion

Vegetation and its changes in Pangandaran Nature Reserve, West Java, Indonesia

Suzuki, E.*[1], Rosleine, D.[2] & Masatatsu, K.[1]
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Pangandaran Nature Reserve (7°43' S and 108°40' E) is a mosaic of man-made grasslands and old secondary forests on a peninsula with 500ha on the southeastern coast of west Java. We made two 1-ha plots in secondary forests (Pn1 of ca.60yr and Pn2 of ca. 100yr) in 2010. All trees with DBH>= 4.8cm were recorded for species name, DBH, height and position in 2010, and the DBHs were re-measured in 2011 and 2013. Saplings (1 cm<= DBH < 4.8 cm) were recorded in 100 sub-quadrates of 5m x 5m in 2011 and 2013. A total of 2318 stems (DBH>= 4.8 cm) were recorded with 79 species, 61 genera in 36 families in the two plots. They have some similarity with vegetation on Krakatau Islands. In both plots, Myrtaceae was most frequent (Pn1: 45 %, Pn2: 28 %). The most dominant species in BA was *Syzygium lineatum* in Pn1, *Artocarpus elasticus* in Pn2. The total basal area (BA) of the trees

in Pn1 and in Pn2 were 23.7m^2/ha and 26.0m^2/ha in 2010, and 24.0m^2/ha and 26.1m^2/ha in 2013, respectively. The vegetation is still in secondary forest, it will be changed gradually.
Keywords: Lowland tropical forest, vegetation, dynamics, Myrtaceae, permanent plot.

Study on succession of Damar (*Agathis alba*) forest in the Buyan Lake, Bedugul, Bali

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Plantation of Damar (*Agathis alba)* forest in the site Buyan Lake Bedugul, Bali was done in supporting the society of Buyan Lake life. Since 1962 this area was abandoned by the society to leave the forest under succession stage. This study aimed to observe the occurance of natural succession on Damar forest production in site of Lake Buyan based on species composition, important value, and species diversity on each growth phase. The method used was a survey method with belt transect technique using 4800 m^2 area. The result of this study was 1) the highest species composition and diversity index was in the seedling phase, 2) the highest importance value in the seedling phase was *Trevesiasundaica*, *Ficus* sp. in the sapling and pole phase,and in the tree phase wasthe *Agathis alba*. 3) Dadap (*Erythrina* sp.), *Ficus* sp and the introduction plant *Agathis alba* were found in each growth phase. These spesies were important species in the successional processes and became a secondary damar (*Agathis alba*) forest.
Keywords: Buyan Lake, succession, Damar (*Agathis alba*).

The land use change effect in Anjir Pulang Pisau Village, Central Kalimantan

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The natural world provides various benefits through ecosystems. From ecosystems, human population derive benefits such as goods and products (e.g., fresh water, fuel), regulation of natural processes (e.g., climate, flooding, erosion), and nonmaterial benefits (e.g., recreation, aesthetic enjoyment). Land use change is an activity which has a significant impact on the world’s ecosystems. This research was conducted to find the effects of land use change in the Anjir Pulang Pisau Village, Central Kalimantan. A field trip was conducted to collect primary data applying in depth interviews

and Focus Group Discussion method. Effects of land use change in the Anjir Pulang Pisau village can be seen in changes of provisioning services. Provisioning services are the benefits obtained from the supply of food and other resources from ecosystems.

Keywords: land use change, provisioning services, Anjir Pulang Pisau Village, Central Kalimantan.

Eaglewood ecology in West Lombok forest

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Gyrinops spp. (Thymelaeaceae) isagarwood producer, a kind of non-wood product that has high economic value. Continuous agarwood harvest by cutting trees of agarwood producer in the forest should not decrease population number, thus we never lost a kind of *Gyrinops*spp in tropical forest before search information on it, such as in India. In managing forestfor sustainable use,particularly for individual tree species that has commercial and ecological value, such as eaglewood tree species, population dynamic of the species is needed. Forest sustainable is not only emphasized on sustainable production, but also on its ecology, socio-economic and service cultural of species that is rare and threatened to extinct. To obtain sustainable product, regeneration capacity of such species of eaglewood in West Lombok forest, must be maintained. Forest area of West Lombok is 46,357.86 ha in wide, including primary and secondary forests, and then it is conducted delineation of ecological units by overlaying of five map kinds: 1) Map of West Lombok forest area height, 2) Map of West Lombok forest area elevation, 3) Map of West Lombok forest soil observation, 4) Map of West Lombok forest rainfall, and 5) Map of vegetation from air photograph of Data SPOT 2/4 LAPAN. Research population is intact natural ecosystem that has random vegetation distribution and relationship between eaglewood ecosystem and biotic and abiotic factors that influence them, such as kind of vegetation that contiguously live, air humidity and temperature, land slope and character of soil physic and chemical. Determination of sampling unit must be clear about the coordinate, hence it will be easily to be traced and determinate in field using GPS tool. There are 5 varieties of *Gyrinops versteeghii* spread out in west Lombok forest, e.g.: variety of beringin, buaya, Madu, pantai dan Soyun. Each variety has natural habitat which has specific on biotic and abiotic association on each growth level. Vegetation distribution patron in west Lombok forest is cluster, even on Seedling level, Sampling level, Poles level or Trees level. The degree of cluster is relative low, that is shown by Green's Index value low among 0.001-1.032.Importance value (I.V.) and Index of species diversity or The Shannon index (H') are relative low for all growth level from all varieties of eaglewood trees which are found e.g. Trees level: I. V.= 0.5- 3.1 and H' = 0,002-0,01, Poles level: I. V.= 3.4-7.3 and H' = 0.01-0.02, Sampling level: I. V.= 5.9-15.1 and H' = 0.02-0.05, Seedling level: I. V.= 8.5-15.6 and H' = 0.03-0.05.

Keywords: West Lombok, eaglewood, *Gyrinops versteeghii*.

Botanical survey in the Taman National Gunung Gede-Pangrango, W Java, Indonesia

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[3]Kyoto University, Japan

[4]Ryukyu University, Japan

To survey general flora and obtain quantitative data of species distribution in Gede-Pangrango National Park, West Java, Indonesia, we conducted botanical field survey using line-transect methods (100 x 4m: We divided each transect to ten sections of 10m x 4m). Fourteen transects were placed along mountain trails and at the altitude of from 1,400 to 3,03 m (near entrance gate to the summit of Gn. Pangrango). All vascular plant species including trees, herbs and epiphytes were recorded in each section, photographed, and collected as voucher specimens. In addition to these occurrence records, trees higher than 4m tall were measured their height and DBH. Totally 1,181 specimen were collected from 14 transects. Species richness was the highest in T2 at 1,470m (229 species) and the lowest in T9 at 2,959m (28 species). The results showed inverse relationship between species richness and the elevation, which decline rate was almost constant (-2 species per 100m). For tree species higher than 4m tall, totally 1,598 trunks consisting 143 species were recorded (8-53 species in one transect).
Keywords: botanical survey, Gede-Pangrango, Indonesia, transect.

Session 9

ECOLOGY-4

Convener: Rochadi Abdulhadi & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Julie Barcelona, *School of Biological Sciences, University of Canterbury*
Venue: Borneo Room

15.30 – 15.45	Kryssa D Balangcod *et al.*: *Chrysopogon zizanoides* (Vetiver Grass) as a potential plant for landslides bioengineering in Atok, Benquet, Philippines
15.45 – 16.00	Orlando G Apostol *et al.*: Use of plants as a common practice of mitigating landslides in Atok, Benquet, Philippines
16.00 – 16.15	Nahid I Afifi *et al.*: Soil stabilization of a landslide scar through revegetation using indigenous species such as *Thysanolaena maxima* in Poblacion, Atok, Benguet
16.15 – 16.30	Teodora Balangcod *et al.*: Slope stabilization using locally available Bamboo species and *Morus alba* in Benguet Province, Philippines
16.30 – 16.45	Jose Abucay: Physico-chemical properties of soil as related to vegetation pattern in a Natural Landslide Scar in Poblacion, Atok, Benguet, Philippines
16.45 – 17.00	General discussion

Chrysopogon zizanioides (vetiver grass) as a Potential Plant for landslide bioengineering in Atok, Benguet, Philippines

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It has been popularized worldwide that *Chrysopogon zizanioides*, more commonly known as vetiver grass, is being used for bioengineering to stabilize the soil. It has a fast growing rate and can hold the soil which indicates its ability to grow in steep slopes. Atok, Benguet which is found in northern Philippines is an area which is very prone to landslides due to its steep slopes which are exacerbated by heavy rain and typhoons. The objective of this study is to be able to use vetiver grass for the stabilization of a model landslide area in Atok, Benguet, and to monitor its growth performance under nursery conditions. A nursery has been established in Atok, Benguet for the propagation of the vetiver

grass and other species that can be used to stabilize landslides. Three sample plots were chosen randomly, having 30 pots per plot. The number of new shoots and their length were measured every month from planting. Results have shown that during the early stages of growth, vetiver grass has been able to develop new shoots. The longest shoot measured so far was 39 cm and the average number of new shoots is three per pot.
Keywords: vetiver grass, landslide, bioengineering, Atok.

Use of plants as a common practice of mitigating landslides in Atok, Benguet, Philippines

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The municipality of Atok is prone to landslide due to its topography and anthropogenic activities like swidden farming that affects soil quality. The research site is focused in Poblacion Atok, Benguet which is one of the selected program sites of UN-World Food Program for the disaster risk reduction and management. Fifty farmers or local residents were interviewed in three different barangays of the municipality to identify common practices of the local community in mitigating landslides. The experiences of the local community illustrate how indigenous knowledge can be used to cope up and contribute to disaster risk reduction. Findings show that the majority of the respondents (74%) use local trees and shrubs such as alnus, pine tree, coffee, Chinese bamboo, local sunflower “marapait”, trumpet plant and other grasses to conserve soil is traditionally planted to conserve soil, not only in their sayote swidden farms but also along the slide-prone areas such as roadsides. The choice of these plant species was identified mostly by local residents to facilitate the mitigation of landsides since they are fast growing and abundant in the area.
Keywords: Atok, Benguet, *Ibaloi* and *Kankanaey* tribes, disaster risk reduction, indigenous knowledge.

Soil stabilization of a landslide scar through revegetation using indigenous species such as *Thysanolaena maxima* in Poblacion, Atok, Benguet

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Thysanolaena maxima or the tiger grass is a perennial plant from the Graminae family. It is commonly known as the broom grass since its inflorescences are valued for making brooms. In addition, tiger grass is infamous for its potential in soil stabilization, capable of conserving soil and water. It also improves soil fertility in addition to the prevention of soil erosion. It grows faster on higher elevations and on steep slopes which is the characteristics of the study area in Atok, Benguet. The occurrence of landslides in Barangay Poblacion, Atok was initiated by typhoons specifically *Pepeng* (internationally named as *Parma*) in 2009 and also due to the steep slopes in the area. The study focuses on the evaluation of tiger grass as a potential species for soil stabilization to be used in a selected landslide in Atok, Benguet province, Philippines. More than 8,500 tiger grass seedlings were planted in the nursery in Atok, Benguet. Preliminary data shows that as early as the third week after plantation, new shoots are arising from each seedling with an average of two shoots per pot with the longest shoot measured at 42 cm. Measurement was done in three groups with thirty pots in each group, representing all the seedlings. The growth performance of tiger grass is being monitored monthly.

Slope stabilization using locally available Bamboo species and *Morus alba* in Benguet Province, Philippines

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Benguet province, is one of six provinces in the northernmost part of the Philippines. Because of its topographic characteristics and geographic location, Benguet province is one of the most vulnerable areas to disasters in the Philippines. During the rainy season, many steep slopes in Benguet are prone to erosion. Consequently, the occurrences of gigantic landslides has a strong impact on the lives of local communities. When landslides occur, most of the roads are closed for long periods of time making the farmers unable to transport their agricultural produce to the market. Plant species play a key role in rehabilitation of landslide scars to stabilize the soil and prevent further erosion. In Atok,

Benguet, indigenous plant species such as bamboo and *Morus alba* were evaluated based on their growth performance and potential to stabilize the soil on steep slopes and mitigate the occurrences of landslides. Four bamboo species namely: *Dendrocalamus merrillianus*, commonly called *bayog*; *Dendrocalamus asper*, giant bamboo; *Bambusa blumeana*, kawayang tinik; *Phyllostachys aurea* or Chinese bamboo; and *Morus alba* are potential species for soil bioengineering because of their fast growth from cuttings and rooting strategy. Additionally, bamboo and mulberry can also help mitigate climate change through carbon sequestration.

Keywords: Benguet province, Bioengineering, landslides, revegetation, soil erosion

Physico-chemical properties of soil as related to vegetation pattern in a Natural Landslide Scar in Poblacion, Atok, Benguet, Philippines

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Benguet is a landslide prone province of Cordillera due to its mountainous topography and several factors such as typhoons, heavy rainfalls, earthquakes and human intervention (e.g. road construction). Landslides greatly affect the vegetation pattern of an area. It washes off all the plant species along the slides leaving a nude land. Then, through the years, the landslide scar is revegatated by colonizing species. In this study, we examined the vegetation pattern and the physico-chemical characteristics of an old landslide scar, which was instigated by the 1990 earthquake and pronounced by typhoons *Ondoy* (Ketsana) and *Pepeng* (Parma) in 2009. The landslide with an area of 700 m^2 and a slope of 60° is located in Poblacion, Atok, Benguet, Philippines. We used transect and quadrat method to determine relative frequency of plants and to know dominant plant species. The soil physical properties, pH, moisture, organic matter, phosphorus and potassium were determined using the standard methods. The relationship of the physico-chemical properties with the vegetation was also examined. Among the plant species in the site, the *Moss* spp., *Paspalum longifolium* and *Eupatorium* sp. are the three most dominant species with an importance value of 30.365, 22.597 and 11.704 respectively. Mosses are most dominant for the reason that they are pioneer species for succession. Correlation analysis shows that the soil pH, moisture, organic matter and potassium were positively correlated with the plant frequency while phosphorus shows negative correlation which shows a dynamic interaction of the plant cover with the soil physico-chemical properties of the area.

Keywords: vegetation analysis, Benguet Province, Natural Landslides, soil properties

Session 9

PLANT CONSERVATION

Convener: Rochadi Abdulhadi & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Dian Latifah, Bogor Botanic Gardens
Venue: New Guinea Room

15.30 – 15.45	Christopher P Dunn: Considering Biological and cultural diversity in the context of botanical garden conservation strategies
15.45 – 16.00	Colin R Maycock *et al.*: Using high resolution species distribution models to identify the critical habitat of rare, threatened and endemic plant species in Sabah, Malaysia
16.00 – 16.15	Victor Amoroso: Assessment, distribution and conservation of threatened, endemic and rare Philippine vascular plants
16.15 – 16.30	Peter Wilkie: Taxonomy and conservation of Malesian Sapotaceae
16.30 – 16.45	John B Sugau *et al.*: Conservation status of the endemic dipterocarps species within the Heart of Borneo (HoB) in Sabah, Malaysia
16.45 – 17.00	Eyen Khoo *et al.*: IUCN Red Lists Assessment of endemic plants In Sabah, Malaysia

Considering biological and cultural diversity in the context of botanical garden conservation strategies

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Over the millennia, peoples and cultures across the world have developed deep relationships to the land and have discovered many valuable uses of plants. However, concerns continue to mount regarding impacts of global climate change, habitat loss, and other environmental changes on the world’s flora. Just as floristic diversity is eroding, so too are cultural and linguistic diversity. UNESCO estimates that 50% of all languages are endangered, with one language being lost every 2 weeks. As plants become increasingly rare, and ultimately extinct, the cultural values and significance they represent disappear. Thus, cultures risk losing critical elements of their identity. By the same token, as cultures and languages are lost, we lose traditional knowledge about plants, unique perceptions of time and of nature, and intellectual wisdom. Consequently, botanical gardens and other

conservation organizations should consider including both biological and cultural diversity within their conservation programs. It is not enough to consider solely the effects of environmental change on plant life within the current context of the GSPC and CBD (particularly Article 8(j)). Rather, we must actively engage in understanding the broader impacts of environmental change to “biocultural” diversity.

Keywords: Biocultural conservation, Botanical Gardens, CBD, GSPC, Languages

Using high resolution species distribution models to identify the critical habitat of rare, threatened and endemic plant species in Sabah, Malaysia

Maycock, C.R.*[1], Pereira, J.T.[2], Khoo, E.[2], Sugau, J.B.[2], Chen, T.E.[2], Nilus, R.[2] & Burslem, D.F.R.P.[3]

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One of the goals of Target 12 of the Strategic Plan on Biodiversity 2010-2020, is an improvement in the conservation status of those species that are most at risk by the Year 2020. To address this target, we require information on which species are most at risk of extinction and knowledge on their distribution. In this study we use high resolution species distribution models (SPMs) to reconstruct the “historic” distribution of rare, threatened and endemic plant species in Sabah. The SPMs are then weighted based on the species level of endangerment determined by the Sabah Plant Red List working group, as an initial attempt to identify critical habitat and priority areas for plant conservation in the State. Our results suggest that lowland forests in the north of the State contain the highest number of species of conservation concern, and should receive the highest priority for conservation and restoration efforts if we aim to achieve Target 12.

Assessment, distribution and conservation of threatened, endemic Philippine vascular plants

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A study was conducted to assess and determine the distribution of threatened, endemic and rare vascular plants in the Philippines. Collected specimens were identified using taxonomic keys from Floras and Monographs while the assessment of status was based on the Threatened Plants of the

Philippines (Fernando et al., 2008), Framework for Philippine Plant Conservation Strategy and Action Plan (DENR, 2006) and International Union for Conservation of Nature (2007). Moreover, the distribution of threatened species was taken from the labels of herbarium specimens deposited in Philippine Herbaria and from our botanical fieldworks. Field investigations and database of threatened plants from the Herbaria revealed 510 taxa of threatened vascular plants. Of these threatened taxa, 386 (76%) are Philippine endemics. The Philippine threatened plants include 109 pteridophytes, 15 gymnosperms and 386 angiosperms. There are 112 (22%) taxa in the Critically Endangered (CR) species category, 203 (40%) taxa in Endangered (EN) species category, and 190 (38%) taxa in the Vulnerable (VU) species category. The families Orchidaceae, Dipterocarpaceae, Arecaceae and Cyatheaceae have the most number of threatened taxa. Regardless of the endemism status, the island of Luzon is the habitat of 349 (68%) species of threatened plants, followed by Mindanao with 237 (47%) and Visayas with 137 (27%) species. Some conservation initiatives for these threatened plants are discussed.

Keywords: threatened, angiosperms, gymnosperms, pteridophytes, database.

Taxonomy and conservation of Malesian Sapotaceae

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Current taxonomic, phylogenetic and biogeographical studies in Sapotaceae are helping us understand this ecologically and economically important family better. Progress on the Sapotaceae account for the Flora of Peninsular Malaysia and Flora Malesiana will be discussed as will the utility of the large amount of distribution data gathered in the delivery of IUCN conservation assessments and the Aichi Biodiversity Targets.

Keywords: Sapotaceae, taxonomy, conservation.

Conservation status of the endemic dipterocarps species within the Heart of Borneo (HoB) in Sabah, Malaysia

Sugau, J.B.*[1], Pereira, J.T.[1], Nilus, R.[1], Maycock, C.R.[2], Ong, R.C.[1], Jumian, J.[1], Miun, P.[1], Dawat, J.[1], Majapun, R.[1] & Khoo, E.[1]

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Of the 196 taxa of dipterocarps found in Sabah, five of Sabah's endemic species were found within the Heart of Borneo (HoB) area. The conservation status of these five species, namely *Dipterocarpus*

ochraceus, *Hopea ovoidea*, *Shorea micans*, *Shorea symingtonii* and *Shorea waltonii* were assessed using the standard IUCN assessment tools based on estimating range from the extent of occurrence (EOO) and area of occupancy (AOO) and also using predictive model such as ecological niche models (ENM). The assessment determined that *D. ochraceus* as Critically Endangered B2a, *H. ovoidea* as Critically Endangered A2c (possibly extinct) and Data deficient, *Shorea micans* as Least Concerned, *Shorea symingtonii* as Vulnerable and *S. waltonii* as Endangered.

Keywords: Sabah, conservation status, Dipterocarpaceae, IUCN Red List, Heart of Borneo (HoB).

IUCN Red Lists assessment of endemic plants in Sabah, Malaysia

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In order to achieve the Aichi Biodiversity Targets, especially in terms of preventing the extinction of species and improving species conservation status, much ground work such as assessment of the species current conservation status has to be performed. Therefore, initial effort has been made in generating an up-to-date review on the conservation status of some of the endemic indigenous species in Sabah. Data sets collected through extensive surveys and expeditions are used to generate a preliminary IUCN status assessment of the indigenous species, with the initial focus on plant species which are endemic to Sabah. Aside from utilizing the IUCN Red List and Criteria 3.1 assessment guidelines, predictive model such as ENMs (Ecological Niche Models) is applied to generate an overview of population distribution based on biogeographical and environmental parameters. This exercise will assist in enhancing the IUCN Red List assessment by providing preliminary information on species' habitat availability, such as total habitat lost, estimation of remaining habitats that are located within protection forests and those in production forests. To date, a total of 36 species, derived from 19 families of flowering plants have been assessed, and the assessment work is still on going.

Keywords: IUCN Red List, biodiversity, conservation

Session 9

LOCAL FLORA-3

Convener: Elizabeth A Widjaja, Research Center for Biology, LIPI & Rogier de Kok, Royal Botanic Gardens, Kew

Chairperson: Rogier de Kok, Royal Botanic Gardens, Kew

Venue: Sulawesi Room

15.30 – 15.45	Péter Poczai & Jaakko Hyvönen: Diversification of the kangaroo apples (*Solanum* sect. *Archaesolanum*) in Papua New Guinea
15.45 – 16.00	Laura Jennings: Towards a “Generic Flora” of New Guinea tress
16.00 – 16.15	Gary W. Wilson & Fanie Venter.: Studies of *Nepenthes* in Austro-Papua
16.15 – 16.30	Barry Conn *et al.*: Morphological variation in *Polyosma* (Escalloniaceae) in Papua New Guinea and Australia
16.30 – 16.45	Thomas Starnes.: Identifying biodeiversity hotspots on the island of New Guinea: a case study using the keystone genus, *Ficus* (Moraceae)
16.45 – 17.00	Gavin Lee, Edi Permana, Bilal Sau, Iska Gusilman & Tjut Fatisa: Flora inventory program in PT. Weda Bay Nickel, Halmahera, North Maluku

Diversification of the kangaroo apples (*Solanum* sect. *Archaesolanum*) in Papua New Guinea

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Kangaroo apples, subgenus *Archaesolanum*, are a unique and still poorly known group within the genus *Solanum*. It is composed of eight species occurring only in the SW Pacific region (Australia, Tasmania, New Zealand, Papua New Guinea). The group is characterized by its unique chromosome number (x = 23), possibly resulting from an aneuploid loss from a polyploid (x = 24) ancestor. Interestingly, species have generated a further secondary polyploid series. Consequently, these diploids (x = 46, e.g. *S. aviculare*) could be better regarded as “tetraploids” – in terms of the x = 12, typical basic chromosome number of the genus – while tetraploids of the group (x = 92, e.g. *S. multivenosum*) are therefore better understood as “octoploids”. In other words, it is presumed that the early ancestor of this group has gone through a simple ploidy increase accompanied by a chromosome loss and then the duplication has been repeated. This unique feature makes *Archaesolanum* particularly interesting from an evolutionary standpoint. However, genetic relationships and how this interesting chromosome number has developed are unknown. Here we aimed to reveal phylogeny, historical biogeography and age of diversification of *Archaesolanum* with implications on their hybridization. We sampled all recognized species of the group and sequenced the *trn*T-*trn*F chloroplast region, and calibrated a molecular clock to estimate the age of the group. For polyploid evolutionary assessment we searched for paralogous copies of internal transcribed spacers of the rDNA region based on a qPCR approach. Distributional data was combined with the results of phylogenetic analysis to track the historical processes responsible for the current range of the group. Our analysis supported the monophyly of the kangaroo apples and the biogeographical disjunction between the two subclades within the group. Based on the divergence time estimates the most recent common ancestor of the kangaroo apples is from the late Miocene (~ 9 MY). Based on the age estimate the common ancestors of the kangaroo apples are presumed to have arrived in Australia by long-distance dispersal. The two distinct lineages within the group are assumed to have separated during the aridification of the continent and further speciated in the brief resurgence of rainforests in the Pliocene.

Keywords: Archaesolanum, biogeography, phylogeny, kangaroo apples, Solanum, Solanaceae

Towards a "Generic Flora" of New Guinea trees

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New Guinea is one of the most problematic areas of the Flora Malesiana region for botanists writing treatments because it is so biologically diverse and has a history of under-collection. We are writing a user-friendly, genus-level guide to help botanists, ecologists and conservationists wanting to identify the trees of the New Guinea region. I will outline the structure of our project, the format of the book and what our research has enabled us to learn about the diversity of tree species in New Guinea and how this compares to other areas in the Flora Malesiana region.

Keywords: Indonesia, Papua New Guinea, identification, rainforests, APG3, genera, keys, illustrations.

Studies of *Nepenthes* in Austro-Papua

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We report on the occurrence and ecology of species of *Nepenthes* in Austro-Papua. They include the widespread and generalist *N. mirabilis* and several endemics restricted to Cape York, Queensland. We describe resource and habitat partitioning and novel associations in species. We report on the discovery of two new species, one restricted to rain forest about mid-altitude karst formations in the Central District of Papua New Guinea and the other to lowland swamps on Cape York Peninsula, Queensland, Australia. We discuss the conservation of Austro-Papuan pitcher plants and curation of collections of them in the study area.

Morphological variation in *Polyosma* (Escalloniaceae) in Papua New Guinea and Australia

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Polyosma Blume is a genus of sub-canopy trees, consisting of 60 species extending from southern China, through South East Asia, Papuasia to Australia and New Caledonia.

This initial study aims to clarify morphological variation within the genus so that species, or species groups, can be better circumscribed using morphological features. Once the morphological variation is clarified, these concepts will be further tested using nucleotide sequence data.

Morphological variation of 30 species that occur in Papua New Guinea and Australia was assessed by way of a multivariate analysis of 27 characters (16 vegetative; 11 reproductive) from 105 samples. Eleven major species-groups were recovered from cluster and SSH analyses. Two species-groups were mono-specific, whereas, nine other groups had one or more species fused together based on morphological similarities. The five most useful features (Kruskal-Wallis values >50%), for circumscribing taxa were all vegetative and included indumentum and prominence of tertiary veins. Variation within two widespread species, *P. cunninghmaii* (Australia) and *P. integrifolia* (PNG), revealed two morphological sub-groupings in each. Within *Polyosma integrifolia*, two sub-groups were distinguished by degree of hairiness of the inflorescence and occurred at different elevations. The two morphological sub-groups within *P. cunninghamii* were distinguished by differences in leaf size, but were not correlated with distribution.

Keywords: *Polyosma*, Escalloniaceae, morphology, multivariant analysis, Papua New Guinea, Australia.

Identifying biodiversity hotspots on the island of New Guinea : a case study using the keystone genus, *Ficus* (Moraceae)

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Royal Botanic Gardens Kew, UK

The Island of New Guinea is floristically one of the most bio-diverse regions on earth, with an estimated 15,000 - 25,000 plant species, many of which are threatened or endangered. One genus of particular ecological interest is *Ficus* (Moraceae). Of the 367 species known from the Flora Malesiana region, 151 occur in New Guinea and c. 70% of these species are endemic. Figs are often described as 'keystone' species in tropical forests, providing a year-round food source for birds and mammals. Economic uses include cooking, textiles, dyes and medicine. With the ever-growing threat of deforestation, it is more important than ever to discover the areas which are likely to support the highest diversity of such species. This information can ultimately be used to direct conservation effort, or in the meantime to highlight areas in need of further botanical exploration. We used ecological niche modelling techniques on data gathered from >2000 *Ficus* herbarium specimens at the Royal Botanic Gardens, Kew to predict species' potential distributions. By then combining distribution models for all of the *Ficus*, can we then attempt to highlight areas of species richness for the genus? This is part of a wider project by the South East Asia & Pacific Regional Team at Kew looking at the biodiversity of New Guinea flora as a whole.
Keywords: *Ficus*, New Guinea, ecological niche modelling, Maxent, species distribution, sampling bias, biodiversity hotspots.

Flora inventory program in PT Weda Bay Nickel, Halmahera, North Maluku

Lee, G., Permana, E., Sau, B., Gusilman, I. & Fatisa, T.
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Halmahera Island lies in the north of the Wallacea bioregion and remains a hotspot for biodiversity, the flora of the region not with standing. The Island's geographical history, its remote location and the lack of extensive scientific surveys (both biological and physical) have conspired to create an area of both scientific and natural resource interest. The Weda Bay Nickel Project is a large Nickel and Cobalt development, with a resource potential of over 50 years and located in the central part of the island.
Baseline floristic studies combined with the lack of secondary data, has indicated the potential for localized endemism. In line with PT Weda Bay Nickel's commitment to 'No Net Loss and where necessary Net Gain of Biodiversity', the company has launched a Flora Inventory Program, as part the first step in the development of a Flora Biodiversity Management Plan. The paper details the

challenges faced through the early implementation of FIP how the FIP will be used as a tool for Management of Flora Biodiversity at the Weda Bay Nickel Project and future opportunities the FIP presents to both the company and its stakeholders in the Project. A few examples of the interesting discoveries made to date are presented.

Keywords: flora inventory, Weda Bay, Halmahera.

Session 9

BRYOPHYTE-1

Convener: Benito Tan, NUS, Singapore & Ida Haerida, Research Center for Biology, LIPI

Chairperson: Sri S. Tjitrosoedirdjo, SEAMEO BIOTROP

Venue: Sumatera Room

15.30 – 15.45	Benito Tan & Sri S Tjitrosoedirdjo: A decade of SEAMEO BIOTROP contributions to the Malesian bryology and lichenology (2001-2011)
15.45 – 16.00	Andrea G Azuelo *et al.*: Species richness of Bryophyte flora in Mt. Kalatungan, Bukidnon, Philippines
16.00 – 16.15	Aditya Rengganis *et al.*: Diversity of epiphytic Liverwort (Marchantiophyta) at two secondary forests in West Java, Indonesia
16.15 – 16.30	Nunik S Ariyanti *et al.*: Diversity of epiphytic Bryophytes at three tea plantations in West Java, Indonesia
16.30 – 16.45	Rindita & Lisdar I Sudirman: Study of corticolous Macrolichens diversity on *Canarium* trees in Bogor City, West Java
16.45 – 17.00	Saiful Bachri *et al.*: Bryophytes diversity of Mount Merbabu National Park, Central Java, Indonesia

A decade of SEAMEO BIOTROP contributions to the Malesian Bryology and Lichenology (2001-2011)

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The contributions of the SEAMEO BIOTROP biological program on the documentation and conservation of Malesian bryophytes and lichens are reviewed and discussed. For a long decade starting in 2001, the BIOTROP Institution at Bogor of Indonesia has organized at every two years interval an extensive and comprehensive 10-days workshop aiming to arouse the interest of and educate the nature workers and biology teachers on the regional biodiversity and ecological importance of these two groups of little known organisms. The lecturing topics and laboratory activities of the training workshop on local bryophytes and lichens are also presented. The SEAMEO BIOTROP program has held over the years a total of six workshops and trained and produced many who are now the active bryologists in a number of SE Asian countries. A great number of the workshop participants have been motivated to move on to study and complete their Ph D degree program from universities doing a research thesis on bryophyte systematics and ecology. The workshops also produced and published a good number of technical papers on the floristic inventory of the species diversity, especially for selected national parks in Indonesia and a book of Guide to the Liverworts and Hornworts of Java. This workshop started by the SEAMEO BIOTROP appears to be a useful model for training the future generation of specialists on a certain group of plants in the region.
Keywords: Bryophytes, lichens, training workshop, SEAMEO BIOTROP.

Species Richnes of Bryophyte Flora in Mt. Kalatungan, Bukidnon, Philippines

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The study inventories the species richness of bryophytes on Mt. Kalatungan, Bukidnon. Specifically, it aimed to: 1) identify the bryophytes species in the mountain sites of Mt. Kalatungan; 2) determine the species richness, composition and assess the ecological status of the bryophyte flora in relation to vegetation types; and 3) recognize the species collected as to their conservation status in terms of rarity, widespread, endemicity and vulnerability. A floristic survey was employed by recording all the species within the study area. The bryophytes were collected through transect walk (alpha taxonomy)

along the three vegetation types namely: dipterocarp, montane and mossy forests. Site validation was employed to establish one sample plot with a 20 x 20 m quadrat. Each species were classified, identified and described according to its diagnostic characters using field lens and microscopy examinations. The habitat preference for each species and their corresponding vegetation type was also assessed. Results of the study revealed a total of 218 species of bryophytes. Of these, 149 species~~,~~ 58 genera and 21 families of mosses were documented. The liverwort showed 62 species, 20 genera and 12 families. Taxonomic characters based on habit, leaf arrangement and orientation, stem structure and sporophyte characters were used to identify the bryophytes into families, genera and species. Several species were found to dominate at dipterocarp, montane and mossy vegetation, and were found growing at different substrates such as on tree trunks, decayed logs, litters, rocks and soil. Local assessment for the species was observed as rare and widespread. Five (5) species of bryophytes were listed as endemic, two (2) are endangered based from IUCN red listing criteria.
Keywords: floristic survey, conservation status, ecological distribution, nonvascular flora, bryoflora.

Diversity of Epiphytic Liverwort (Marhantiophyta) at two secondary forests in West Java, Indonesia

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Secondary forest can be a habitat type for epiphytic liverwort. This study aims to record the diversity of epiphytic liverworts in secondary forest. Sampling was conducted in two secondary forest sites. This exploratory study obtained 26 species, represent 15 genera. One species (*Frullania tamarisci*) is new record for the Indonesian flora, while one other species (*Lepidozia borneensis*) is new records for the flora of Java. This shows that knowledge of bryophyte flora in Indonesia is not yet complete. From research conducted in secondary forests we can still obtain a new record.
Keywords: Epiphytic, liverwort, secondary forest, new record, Java, Indonesia.

Diversity of epiphytic Bryophytes at three tea plantations in West Java, Indonesia

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Tea plantations provide substrates and microclimate for epiphytic bryophytes. An inventory of epiphytic bryophytes was conducted in three tea plantations in West Java, Indonesia, at 600, 1150, and 1600 m asl. At each plantation study site, three 30 m line transects that are 50 m apart were set along the contour of the plantation. The epiphytic bryophytes were observed at trunk and primary branches of five tea plants along each line transect at an interval of 5 m. Species diversity and abundance of epiphytic bryophytes were examined. A total of 90 species, including 42 liverworts and 48 mosses, were recorded in the plantations. Species richness and diversity of the epiphytic bryophyte communities increase with elevation. The abundance of bryophytes that expressed by percentage of trunk surface covered by all bryophytes species on each host plant did not show any clear elevation trend, though the percentage of trunk surface covered by bryophytes tends to increase with diameter of host plant canopy.
Keywords: bryophyte, epiphyte, tea plantation, altitudinal gradient, line transect.

Study of corticolous Macrolichens diversity on canarium trees in Bogor City, West Java

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Many studies about lichens and pollution have been carried out especially in northern hemisphere for over 40 years. But, the lichen research in South-East Asia is poorly known. Study about corticolous macrolichens diversity on *Canarium* trees in Bogor City was conducted during March 2012 until June 2013. Purposive sampling method was done in 3 sites with different pollution levels, inside and outside Bogor Botanical Garden. There were 9 macrolichens genera found, that are: *Canoparmelia*, *Coccocarpia*, *Dirinaria*, *Heterodermia*, *Leptogium*, *Parmotrema*, *Physcia*, and *Pyxine*. Cyanolichens *Coccocarpia* and *Leptogium* are sensitive genera that found only in the central of Bogor Botanical Garden, suggest that this area still in a good condition. *Dirinaria* referred as a tolerant genus, found in every site, but dominant in Botanical Garden side that adjacent to main road. *Pyxine* abundant on *Canarium* trees along busy road, while *Parmotrema* abundant inside the Botanical Garden. The diversity of macrolichens genera in Bogor city can be used for environmental bimonitoring. Pollution

data from Goodyear Indonesia and Bogor City Environmental Institution showed that SO2 content is far below the quality standard limit (14 – 55 µg/m3). Biomonitoring using these genera can be applied in another city in Indonesia.

Keywords: biomonitoring, Canarium trees, corticolous, macrolichens diversity.

Byophytes diversity of Mount Merbabu National Park, Central Java, Indonesia

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Mount Merbabu, with a height of 3 124 m asl, is a dormant strato volcano in Central Java, Indonesia, and closely located to the famous Mount Merapi. In 2004, an area of 57 km^2 within the mountain has been declared as a national park considering the flora diversity therein including bryophytes. The exploration study we conducted on the bryophyte diversities at Selo and Tekelan track of Mt. Merbabu in June 2010 revealed the presence of 57 species. These species represent 39 genera and 25 families consisting of hornworts, liverworts and mosses, with Dicranaceae (15 species) were the largest family. Forty species of the bryophytes found in the study sites are terrestrial growing on the soil and stones and 15 species are epiphytes growing on barks or tree trunks, and two species are terrestrial and epiphytic.

Keywords: bryophyte diversities, Mount Merbabu National Park, Central Java, Indonesia, *Dicranaceae.*

Day 5: Friday, 31 August 2013

ORAL PRESENTATION

Underline name is presenting author

* Corresponding Author

DAY 5: SATURDAY, 30 AUGUST 2013

08.00 – 09.00	**PLENARY ADDRESS** **The Future of Floras: From Dichotomous Keys to Genomes - The Next Generation** **Prof. W John Kress,** Professor of Systematic Botany, Smithsonian Institution, USA
09.00 – 09.30	**MORNING COFFEE BREAK**
09.30 – 11.00	**SESSION 10: TAXONOMY & SYSTEMATICS-6, ECOLOGY-5, FUNGI-2, BRYOPHYTES-2**
11.00 – 12.30	**SESSION 11: TAXONOMY & SYSTEMATICS-7, ECOLOGY-6, ETHNOBOTANY-1**
12.30 – 13.30	**LUNCH**
13.30 - 15.00	**SESSION 12: GENERAL SUBJECT, ECOLOGY-7, ETHNOBOTANY-2,**
15.00 – 15.30	**AFTERNOON COFFEE BREAK**
15.30 – 17.00	**CLOSING CEREMONY**

Plenary Address

THE FUTURE OF FLORAS: FROM DICHOTOMOUS KEYS TO GENOMES - THE NEXT GENERATION

W John Kress

United States National Herbarium, National Museum of Natural History, Smithsonian Institution, Washington, DC USA

For hundreds of years taxonomists have compiled information on species into floristic treatments of communities, states, nations, and regions of the world. These floras have made extensive contributions to our knowledge and understanding of the diversity of plant life on the planet and in many cases serve as the basic documentation for phylogenetic, biogeographic, ecologic, and conservation investigations. In a world where rampant degradation of habitats by humans is leading to the decline and possible extinction of plant species, the role of floras, and the taxonomists who are responsible for producing them, must expand. The information in floras can no longer be restricted to lists, inventories, descriptions, illustrations, and identification keys that often take years or even decades to publish. New technological tools can now be used to magnify the scope, use, and audience of floristic data as well as assist botanists in speeding up the process of species discovery and description. Open access publishing, universal on-line internet access, advanced image recognition capabilities, DNA barcoding, genomic resources, and rapid generation of mega-phylogenies will soon be added to the taxonomist's palette to compile the next generation of tropical floras.

Session 10

TAXONOMY & SYSTEMATICS-6

Convener: Julisasi T Hadiah, Bogor Botanic Gardens & Peter Wilson, Royal Botanic Gardens, Sydney
Chairperson: Harry Wiriadinata, Research Center for Biology, LIPI
Venue: Sulawesi Room

15.30 – 15.45	Gwynne Lim: Species limits and reproductive biology of *Tacca* (Dioscoreaceae)
15.45 – 16.00	Lim Chong Keat: The apomixis of Musaceae: field evidence from Malaysia, and taxonomic and phytological issues
16.00 – 16.15	Fitmawati *et al.*: Reinstatement of *Mangifera laurina* Blumea and the related species
16.15 – 16.30	Ivan A Savinov: Taxonomic revision of Asian genus *Glyptopetaum* Thwaites
16.30 – 16.45	Purnomo *et al.*: Variability & intra specific classification of *Dioscorea esculenta* (Lour.) Burk. based on morphological characrters
16.45 – 17.00	Hafni Rahmadani *et al.*: Genus *Merremia* Dennstedt ex Endlicher (Convolvulaceae) in Sumatra

Species limits and reproductive biology of *Tacca* (Dioscoreaceae)

Lim, G.

Department of Plant Biology, Cornell University

Commodore Matthew Perry Graduate Studies Program, the New York Botanical Garden

The genus *Tacca*, commonly known as bat lilies, comprises a group of pantropically distributed perennial acaulescent understorey herbs, with high diversity in Malesia. Representatives of the genus are easily recognized by their umbelliform displays of flowers subtended by dark purple, green or white showy bracts. They comprise 15 widely accepted species, but it is likely that current species limits may have subsumed multiple species, and more remain undescribed. They have minor value in agriculture and horticulture, as well as ethnomedicine. Existing published research and literature suggests that *Tacca* may be sapromyiophilous or selfing, however some field and experimental observations raise intriguing questions for our understanding of the reproductive biology and indicate that at least in some species, *Tacca* may be midge pollinated. The complex suite of behaviours exhibited by the inflorescence of *Tacca* will be discussed with respect to my hypothesis on the mechanism of potential pollinator attraction.

Keywords: midge pollination, scent volatiles, *Tacca*, taxonomy, sapromyiophily.

The apomixis of Musaceae: field evidence from Malaysia, and taxonomic and phytological issues

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Field evidence is presented to substantiate apomixis in native Musaceae, with discussions on questions of crossability, and uncertainties about *Musa acuminata* Colla and *M. balbisiana* Colla and authenticatable taxa; and also on the status of so-called cultivars and aspects of parthenocarpy which may relate to apomixis.

Keywords: Musaceae, apomixis, pollination, crossability, taxonomy, Colla taxa.

Reinstatement of *Mangifera laurina* Blume and related species

Fitmawati*[1], Hartana, A.[2], Rifai, M.A.[3] & Purwoko, B.S.[4]

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The relationship between *M. laurina* Blumea and its related species were studied. Parsimony analysis of morphological data and sequences of the intergenic spacer trnL-F were carried out separately. The morphological analysis showed a strong support for two sister groups and four species as monophyletic groups. According to the flowers characters, *M. rubropetala* Kosterm. is considered as synonymous with *M. indica* L. However, *M. laurina* Blume, *M. aplanata* Kosterm., and *M. lalijiwa* Kosterm. are considered separated from *M. indica* L. Among the four species, DNA sequences of *trn*L-F intergenic spacer are identical. Based on E-RAPD, *M. laurina* Blume and its related species could not be grouped, but in combination with morphological characters form four groups separated from the species. Morphological characters were considered important for defining species and infra-species taxa of *Mangifera*.

Keywords*: M. indica*, *M. laurina*, *M. aplanata*, *M. rubropetala, M. lalijiwa,* morphology, *trn*L-F, Enhanced-RAPD

Taxonomic revision of Asian genus *Glyptopetalum* Thwaites (Celastraceae R.Br.)

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Glyptopetalum is one of smaller genera of the family Celastraceae, comprises about 30 species similar morphological view from S and SE Asia. This taxonomic treatment founded on critical study of herbarium materials in E, K, P, C, BKF, CMU, PNH, HN, PE, CDBI, KUN, IBSC, and also on field trips in different countries of Southeastern Asia. 32 species taxa of *Glyptopetalum* are accepted here: India and Sri Lanka (3 endemics species), Bangladesh?, Myanmar (3 species), Thailand (6 species, 1-endemic), Indochina (12 species, 6 - endemics), China (11 species, 8 - endemics), Philippines and Indonesia (6 endemic species), Malaysia (2 species, 1 endemic subspecies). One new species, *G. vidalii* I. Savinov, from Laos and Thailand is described; one new record of *G. tonkinensis* Pitard from China (Yunnan) is determined. *Glyptopetalum* is closely related (and very similar) to genus *Euonymus* Tournef. ex L. The genus differs from *Euonymus* by one ovule per cell (against at least 2 in *Euonymus*), columella in capsule (its morphological nature unclear) and raphe branches on the seed. Species of *Glyptopetalum* are differs from each other by form and surface character of loculicidal capsule, and also by seed form, its size and peculiarities of its covered by aril and raphe branches. The species of *Glyptopetalum* are not to use in medicine or as food (their fruits are poisonous!). But because it taxon is closely allied to *Euonymus*, it may be use as source of bark latex (guttaperca) and some other biological active substances. This question to need in future studies.

Keywords: *Glyptopetalum*, Celastraceae, Asia, taxonomic treatment.

Variability and intraspecific classification of *Dioscorea esculenta* (Lour.) Burk. based on morphological characters

Purnomo[1], Daryono, B.S.[2] & Faizah, L.N[1]

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[2] Laboratory of Genetic, Faculty of Biology, Gadjah Mada University

Species of *gembili* (*Dioscorea esculenta* (Lour.) Burk.) is one of climber plant producing tubers belong to Dioscoreaceae. This plant species has morphological variation on its vegetative organs i.e. stems, leaves, and tubers. 18 accessions were collected from Karst ecosystems in Yogyakarta, Klaten, and Purworejo Indonesia. Tuber samples were collected using survey methods and cultivated as a living collection. Morphological observation based on IPGRI plant descriptor list for *Dioscorea*, tubers, stems, leaves, flowers, and fruits were scored and analyzed using UPGMA method. The result

shows that, diversity of *gembili* is quite high, ranging from 0.64-1.00 similarity values. Those accessions are divided into two cultivar groups: the first cultivar group has densely thorns roots, oblong to cylindrical tuber shapes with white to yellowish white tuber flesh. Those characters are similar to *D. esculenta* (Lour.) Burk. var. *Spinosa* (Lour.) Burk., whereas the second group shows rarely thorn roots, irregularly tuber shape, violet tuber flesh color, and the characters are similar to *D. esculenta* (Lour.) Burk. var. *fasciculata*(Lour.) Burk. This result revealed that variability of *D. esculenta* in Indonesia has high morphological characters variation.
Keywords: *Dioscorea esculenta*, morphology, variation, intra-species classification.

Genus *Merremia* Dennstedt ex Endlicher (Convolvulaceae) in Sumatra

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As account on the diversity of the genus *Merremia* in Sumatra have given. There are nine species (*M. cissoides, M. dissecta, M. emarginata, M. hirta, M. peltata, M. quinquefolia, M. tridentata* and *M. tuberosa*), two subspecies (*M. umbellata* ssp. *orientalis* and *M. tridentata* ssp. *hastata*), one variety (*M. boisiana* var. *sumatrana*) and two forma (*M. hederaceae* f. *pubescens* and *M. hederaceae* f. *barbata*) are recognized in this study. One species variety (*Merremia boisiana* var. *sumatrana*) is endemic in Sumatra. *Merremia emarginata* is a new record in Sumatra and *Merremia cissoides* is new record in Indonesia. One species (*M. tridentata*) and one subspecies (*M. tridentata* ssp. *hastata*) are excluded from the genus *Merremia* in this study. Key to the species and alphabetical species list are presented.
Keywords: *Merremia*, Convolvulaceae, Sumatra.

Session 10

ECOLOGY-5

Convener: Rochadi Abdulhadi, Research Center for Biology, LIPI & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Ruliyana Susanti, Research Center for Biology, LIPI
Venue: New Guinea Room

09.00 – 09.15	Siria Biagioni *et al.*: Long-term vegetation dynamics of mountain rainforests in Central Sulawesi (Indonesia)
09.15 – 09.30	Damayanti Buchori: Ecological and socioeconomic functions of tropical lowland rainforest transformation systems (Sumatra, Indonesia)
09.30 – 09.45	Yusi Rosalina *et al.*: Floristic composition and structure of a peat swamp forest in the conservation area of PT National Sago Prima, Kepulauan Meranti, Riau, Indonesia
09.45 – 10.00	Natalie Breidenbach *et al.*: Plant genetic diversity in tropical lowland transformation systems
10.00 – 10.15	Katja Rembold *et al.*: Vascular epiphyte diversity in different transformation systems in Sumatra, Indonesia

Long-term vegetation dynamics of mountain rainforests in Central Sulawesi (Indonesia)

Biagioni, S.*[1], Lembcke, P.[1], Wang, L.C.[2], & Behling, H.[1]

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In order to obtain a deeper understanding of future environment/ecosystem interactions in tropical ecosystems a long-term perspective of the interaction between vegetation dynamics, climate change and human impact in the past is needed. Due to the complexity of tropical ecosystems and site-specific differences on the sedimentary process, it is very important to have data from multiple sites in order to better identify the dynamics and vegetation community responses under different conditions (e.g. human land use change, climate change). We present the results of pollen, charcoal and diatoms analyses of three sediment cores located about 30 km apart, close to the north-eastern border of the protected area of the Lore Lindu National Park. The park is situated in Central Sulawesi and has been a UNESCO "Man and Biosphere Reserve" since 1977. The vegetation of the study region consists of species-rich tropical montane forest. The vegetation gradient ranges from lowland rainforests below 1000 m dominated by Fagaceae, to upper montane above 2000 m a.s.l. where conifers are well

represented. The climate of the area is best described by rainfall pattern with humidity increasing towards higher elevation. The interannual conditions are influenced by the occurrence of El Niño event which can lead to severe reduction in rainfall. The coring sites are located at different altitudes: 1) Rore Katimbu (1˚16'44'' S, 120˚18'34'' E) situated at about 2400 m a.s.l. within the upper montane forest, 2) Lake Kalimpaa (1°19'35''S, 120°18'32''E) at 1700 m a.s.l., within the mid-montane forest and 3) Lake Lindu (1˚19'16''S, 120˚04'36''E) at 1000 m a.s.l. surrounded by sub-montane forest. The three sites differ in level of human impact and the records span through the Holocene with similar temporal resolution. The multi-sites palaeoecological study allows us to test the following hypotheses: I) The response of the vegetation communities to climate change and ENSO events were different along the altitudinal and moisture gradients; II) The montane rainforest was impacted by human activities in the area only in recent times. The comparative study will lead to a better understanding of sensitivity/resilience of the LLNP vegetation towards long term stressed as a consequence of human activities and climate variability.

Keywords*:* palynology, charcoal analysis, human impact, climate change.

Ecological and socioeconomic functions of tropical lowland rainforest transformation systems (Sumatra, Indonesia)

Buchori, D.[1], Siregar, I.Z.[1], Alamsyah, Z.[2], Aiyen[3], Scheu, S.[4], Rembold, K.[4] & Fauzi, A.M.[1]

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Around the world, the expansion of agriculture and the extraction of natural resources are increasingly competing with natural ecosystems. In many tropical areas, rainforests are cleared in order to exploit timber and other forest products as well as plant crops for food, feed, and fuel use. Surprisingly, the determinants of different patterns of deforestation and the roles of resulting transformation systems of tropical rainforests for conserving biodiversity as well as ecological and socioeconomic functions have received little attention in scientific research so far. The EFF or TS Project (Ecological and Socioeconomic Functions of Tropical Lowland Rain Forest Transformation Systems) is an international, interdisciplinary research program which aims at providing knowledge-based guidelines on how to protect and enhance the ecological functions and services of tropical forests and agricultural transformation systems, while improving human welfare at the same time. The results are expected to contribute to the development of strategies for sustainable management of forest reserves and major rainforest transformation systems of the lowland tropics of Southeast Asia. Here, we would like to introduce this new project which are carried out in Jambi Province in Sumatra, one of the regions with the fastest and most complete transformation of tropical lowland rainforest worldwide.

The Project is run by a consortium of Indonesian universities (IPB, Universitas Jambi and Universitas Tadulako) in collaboration with University of Goettingen, Germany. It is projected to be a 12-year research collaboration funded through DFG and the Government of Indonesia.

Keywords: Transformation system, international research collaboration, biodiversity, landscape ecology.

Floristic composition and structure of a peat swamp forest in the conservation area of PT National Sago Prima, Kepulauan Meranti, Riau, Indonesia

Rosalina, Y.*[1,2], Kartawinata, K.[1,3,4] & Nisyawati[1],
Erwin Nurdin[1], & Jatna Supriatna[1]

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Study of the floristic composition and structure of apeat swamp forest in the conservation area within the sago plantation of the PT National Sago Prima of PT Sampoerna Agro Tbk. group, aims to get the latest information of the subject as a basis for future management of the conservation area. The study was conducted in January - February 2012 using the 25 quadrats of 20 x 20 m each, laid out systermatically, thus covering a total area of one hectare. The results showed that the regeneration of peat swamp forests in the study site is relatively high in species diversity. The total number of species found in the study area was 73 species of 38 families, consisting of 50 species (30 families) of trees, 42 species (24 families) of saplings, and 41 species (27 families) seedlings and ground cover. The tree density was 550 individuals/ha with a total basal area of 18.32 m^2. The species diversity was high as indicated by the Shannon-Wiener's Diversity Index of 3.05. Tree species with the highest Importance Values (IV) was *Pandanus atrocarpus* (IV= 45.86). The tree families with the highest IV were *Pandanaceae* (45.86), *Myrtaceae* (40.37), and *Dipterocarpaceae* (39.20). Structurally the forest was dominated by trees with diameters below 20 cm amounting to 408 trees/ha (74.05%). Vertically the forest canopy was dominated by trees in D and E strata with height of less than 20m, and density of 431 trees/ha(78.36%). Based on Jaccard Similarity index among all species, the forest could be considered as a *Pandanus atrocarpus-Blumeodendron subrotundifolium* association. Primary species with high economic values were still present in this forest. Eleven species found in the study area are listed in IUCN Redlist including *Shorea rugosa* (Critically Endangered), *Shorea tesymanniana* (Endangered), and *Gonystylus bancanus* (Vulnerable).

Keywords: Floristics and structure, peat swamp forest, conservation, Riau.

Plant genetic diversity in tropical lowland transformation systems

Breidenbach, N.*[1], Siregar, I.Z.[2], Rahayu, S.[3] & Finkeldey, R.[1]

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Tropical rainforests are converted to other types of land use throughout the globe. The transformation of natural ecosystems to managed systems frequently results in a loss of species diversity. In Jambi Province, Sumatera (Indonesia) tropical lowland rainforests are transformed into oil palm plantations, rubber plantations and ‘jungle rubber’. This project explores intraspecific genetic diversity of vascular plants in reference forests and the three mentioned transformation systems. In 32 plots (50 x 50 m) of these four different ecosystems, 10 individuals of 10 dominant species are sampled. Based on anonymous AFLP markers we aim to assess the consequences of land use changes on the genetic diversity of plants caused by the different species composition in each system.

Key words: Plant genetic diversity, AFLP, transformation system.

Vascular epiphyte diversity in different transformation systems in Sumatra, Indonesia

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The worldwide loss and degradation of tropical rainforests caused by deforestation and transformation into agricultural land also affects epiphyte communities. Due to their arboreal habitat, epiphytes are very sensitive towards changes in microclimatic conditions, making them an excellent model group to study the consequences of land cover change. Therefore, we investigated the consequences of transformation from lowland rainforest into monocultures for vascular epiphyte diversity in Jambi Province (Sumatra, Indonesia). In total 90 study plots (20 x 20 m) were established in Bukit Duabelas National Park and surrounding oil palm and rubber plantations (30 plots per transformation system). Each plot contained one main phorophyte which was investigated for vascular epiphytes. Additionally all vascular epiphytes growing within a 2 m zone above the base of each tree within the plot were recorded. We found a total of 54 epiphyte species belonging to 18 different families. While oil palm plantations contain the highest number of individuals (1806 individuals, 80%), forest plots had a much higher species diversity (45 species, 83%) compared to oil palm and rubber plantations. Further, epiphyte communities in plantations showed higher rates of generalists while forest epiphyte

communities are rather composed by specialists. Thus, even if epiphytes are very abundant in oil palm plantations, forest transformation clearly causes a loss of epiphyte diversity.

Keywords: vascular epiphytes, Sumatra, forest transformation, land cover change.

Session 10

FUNGI-2

Convener: Iman Hidayat & Atik Retnowati, Research Center for Biology, LIPI
Chairperson: Iman Hidayat, Research Center for Biology, LIPI
Venue: Sumatera Room

09.30 – 09.45	Nani Radiastuti *et al.*: Phylogenetic study of endophytic *Phomopsis* (fungi, anamorphic Diaporthales) from *Cinchona ledgeriana*
09.45 – 10.00	Iman Hidayat *et al.*: Diversity of *Oxydothis* (Fungi, Ascomycota) on Palms in Indonesia
10.00 – 10.15	Gayuh Rahayu *et al.*: Species of endophytic *Colletotrichum* from wild Zingiberaceae
10.15 – 10.30	Israwati Harahap *et al.*: The first phylogenetic study of *Kiliophora* (fungi, anamorphic Ascomycetes)
10.30 – 10.45	Kaylene Bransgrove *et al.*: Biodiversity and host specificity of the fungal endophytes of the wet tropics of North-East Queensland, Australia
10.45 – 11.00	General discussion

Phylogenetic study of endophytic *Phomopsis* (Fungi, Anamorphic Diaporthales) from *Cinchona ledgeriana*

Radiastuti, N.*[1], Rahayu, G.[1], Okane, I.[2] & Hidayat, I.[3]

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Phomopsis (Sacc.) Bubák, (teleomorph: *Diaporthe* Nitschke), lives as plant pathogens, saprobes or endophytes. This genus is characterized by having two types of conidia called α–conidia (fusiform) and β–conidia (filiform). In this study, a combination of morphological and molecular analyses involving sequence of ITS (Internal Transcribed Spacer) and EF α–1 (Elongation Factor α–1) generated several *Phomopsis* from leaf, petiole, fruit, and branch of *C. ledgeriana* collected from Gambung (West Java, Indonesia) the analyses reveals four distinct lineages. The first lineage was *D. endophytica* isolated from leaf, the second lineage was *D. musigena* from fruit, and the third lineage was *D. hongkongensis* from branch. The fourth lineage contained three *Phomopsis* isolates from branch and petiole were not included in the cluster from all other species of *Phomopsis*. Based on morphological, and molecular analyses to estimate the variation of the *Diaporthe* (*Phomopsis*) species occurring on *C. Ledgeriana* from *Cinchona* plantation in Gambung (West Java, Indonesia). This study showed that more than one species of endophytic fungi from the same genus can occupy the same host plant.

Keywords: *Cinchona*, Diaporthales, endophyte, phylogeny, taxonomy, Indonesia

Diversity of *Oxydothis* (Fungi, Ascomycota) on palms in Indonesia

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Oxydothis Penz. & Sacc. (*Xylariales*) is a common saprobic fungi found on monocotyledonous plants, in particular palms. Currently, 75 species have been described worldwide. Taxonomy status of *Oxydothis* within *Xylariales* is still confusing as several authors placed this genus within *Amphisphaeriaceae*, *Hyponectriaceae*, or *Clypeosphaeriaceae* based on morphological characteristic. In order to clarify the taxonomy status of the genus *Oxydothis*, molecular phylogenetic analyses based on sequence of 28S rDNA was carried out. Eleven species of *Oxydothis* associated with 15 species of palms collected from Bogor Botanical Garden (Indonesia) were described and illustrated. Those

species are reported here as new records for Indonesia. Phylogenetic analyses based on 28S rDNA sequences of several species of *Oxydothis* with closely related genera retrieved from GenBank database showed that this genus is best placed in the family *Amphisphaeriaceae*, rather than *Clypeosphaeriaceae* or *Hyponectriaceae*.

Key words: Fungi, Indonesia, *Oxydothis*, palmae, taxonomy

Species of endophytic *Colletotrichum* from wild *Zingiberaceae*

Nurdebyandaru, N.[1,3], Rahayu, G.*[1], Hidayat, I.[2] & Narisawa, K.[3]

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Information on endophytic fungi from cultivated *Zingiberaceae* was easily found, yet those from wild *Zingiberaceae* has not been reported. Three isolates of endophytic *Colletotrichum* spp. were isolated from two species of wild *Zingiberaceae* (*Alpinia malaccensis* and *Etlingera punicea*). Molecular analysis of their ITS (Internal Transcribed Spacer) sequence indicated that two isolates belonged to *C. gloeosporoiodes* complex and one isolate closed to *C. crassipes*. Of the two isolates in the *C. gloeosporoiodes* complex, one isolate each belonged to the musae subclade and kahawae subclade. Further analysis using other markers is needed for accurate identification to species level.

Key words: *Colletotrichum*, endophytes, *Zingiberaceae*, ITS

The first phylogenetic study of *Kiliophora* (Fungi, Anamorphic Ascomycetes)

Harahap, I.[1], Rahayu, R.[1] & Hidayat, I.* [2]

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Kiliophora Kuthub. & Nawawi (Type: *K. fusispora* Kuthub. & Nawawi) was firstly described based on conidiophores bearing spindle-shaped conidia. Only two species, viz, *K. fusispora* and *K. ubiensis*, have been described worldwide. During the study of fungal diversity on *Shorea* spp. in Indonesia, *Kiliophora ubiensis* was found on decaying leaves of *Shorea* spp., and this is the first report of *K. ubiensis* from Indonesia. Since the taxonomy placement of this genus in the kingdom Fungi is unknown, phylogenetic analyses was carried out based on its Internal Transcribed Spacer (ITS) rDNA

sequence. Phylogenetic tree generated from Maximum Parsinomy (MP) analyses suggested that *Kiliophora* should taxonomically be placed in the Amphisphaeriaceae (Xylariales).
Keywords: Amphisphaeriaceae, Anamorphic Fungi, Phylogenetic, ITS, *Kiliophora*

Biodiversity and host specificity of the fungal endophytes of the wet tropics of north-east Queensland, Australia

Bransgrove, K., Abell-Davis, S., Crayn, D. & Summerell, B.

Fungal endophytes live inside all plants and contribute to plant health, disease and insect resistance and drought tolerance. They also produce potentially useful secondary metabolites and antibiotics, but have not been investigated in the Australian tropics. To address this, the biodiversity, host specificity and mycogeography of the fungal endophytes of the rainforest of north-eastern Queensland, Australia are being investigated. This is being done with respect to a biogeographic corridor, the Black Mountain Corridor, situated north of Cairns.
Endophytes were isolated from leaves of the three haplotypes of *Elaeocarpus carolinae* from across the Wet Tropics and the Black Mountain Corridor. The haplotype of each host tree is being confirmed and the fungal isolates are being identified by molecular and morphological techniques. Preliminary results indicate that up to one hundred fungal taxa have been isolated from inside the leaves and that they are from a range of distantly related fungal genera. Patterns of host specificity and mycogeography will be elucidated as the taxon lists are finalised and species of fungi that are new to science will be described.
Keywords: Fungi, endophyte, rainforest, tropics, *Elaeocarpus*, Australia.

Session 10

BRYOPHYTE-2

Convener: Benito Tan, NUS, Singapore & Ida Haerida, Research Center for Biology, LIPI
Chairperson: Sri S Tjitrosoedirdjo, SEAMEO BIOTROP
Venue: Sumatera Room

09.30 – 09.45	Miftahul Jannah *et al.*: Taxonomy & distribution of crustose lichens in the forest of Tahura R Soeryo, Batu, East Java
09.45 – 10.00	Ida Haerida: Hepaticae of Bali
10.00 – 10.15	Etti S Siregar *et al.*: Radula (Hepaticae) of Mount Sibayak, North Sumatra, Indonesia
10.15 – 10.30	General discussion

Taxonomy and distribution of crustose lichens in the forest of Tahura R Soeryo, Batu, East Java

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Lichen is a symbiotic organism consisting of a photobiont (green algae or cyanobacterium) andamycobiont (fungal). A taxonomic study of the crustose lichens in the forest of TAHURA R. Soeryohad been conducted based on morphological, anatomical, and chemical characters. In this research we used the method of descriptive exploration to identify the crustose lichens and to study the distribution of the species in the forest of TAHURA R. Soeryo. Twenty species of crustose lichens with one unidentified species and one specimen identified to the group of family are reported. They are *Graphina*, *Graphis*, *Phaeographis*, *Pertusaria*, *Pachyphiale*, *Phlyctis*, *Lepraria*, *Lecanora*, *Lecania*, *Cyphellium*, and *Megalospora*. This research also found the new record species of *Megalospora kalbii* in Java. Crustose lichens are found in the areas with high light intensity of ≥ 1000 lux, average humidity of ≤ 90%, average temperature of 18-19^{o}C and at altitudes of ±1640 dpl. *Graphina ruiziana* could only be found at the altitude of ± 1780 dpl. The distributions of other species are presented also in the article.

Keywords: taxonomy, distribution, crustose lichen, Forest of TAHURA R. Soeryo.

Hepaticae of Bali

Haerida, I.

Herbarium Bogoriense, Research Center for Biology-LIPI

A preliminary Hepaticae inventory of Bali reports 18 genera of liverworts. Epiphyllous liverworts are abundant, most of them members of Lejeuneaceae family. One species is expected as new record for Bali i.e. *Cololejeunea indosinica* Tixier. Other new records or new species are expected to be found after identification process is completed.

Keywords: Bali, Cololejeunea indosinica, Hepaticae, Lejeuneaceae, new record.

Radula (Hepaticae) of Mount Sibayak, North Sumatra, Indonesia

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This study was conducted to explore the diversity of *Radula* on Mount Sibayak of North Sumatra, Indonesia. There are ten species of *Radula* on Mount Sibayak in North Sumatra, three of the species are new records for Sumatra (*R. gedena, R. lingulata* and *R. loriana*). An identification key of the species of genus *Radula* from Mount Sibayak, North Sumatra is provided.

Keywords: *Radula*, Mount Sibayak, North Sumatra.

Session 11

TAXONOMY & SYSTEMATICS-7

Convener: Julisasi T Hadiah, Bogor Botanic Gardens
Chairperson: Deden Girmansyah, Research Center for Biology, LIPI
Venue: Borneo Room

11.00 – 11.15	Jun Wen: A revised classification of *Vitaceae* in the Malesian region
11.15 – 11.30	A Latiff Mohamad: Completing the taxonomic revision of *Vitaceae* for Flora Malesiana
11.30 – 11.45	Ming-Jou Wu *et al.*: Taxonomic study of *Phyllanthus* section *Urinaria* (Phyllanthaceae, Euphorbiaceae sensu lato)
11.45 – 12.00	SK Ganesan: Towards an account of *Pterospermum* Schreb. (Dombeyoideae/ Malvaceae) for Malesia
12.00 – 12.15	Ana R Simoes & GW Staples: Clearing the Borneo mist: a revision of woody lianas (Convolvulaceae)
12.15 – 12.30	Yee Wen Low: On the scent trail: Taxonomic revisions in Malesian *Gardenia* (Rubiaceae)

A revised classification of Vitaceae in the Malesian region

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Vitaceae (the grape family) consists of about 15 genera and 900 species, with the Malesian region as an important center of diversity (165 species). Recent phylogenetic analyses suggested the need to redefine several genera. *Cayratia* is paraphyletic with *Tetrastigma* and *Cyphostemma* nested within it. *Pterisanthes* is nested within *Ampelocissus*. A clade including *Ampelopsis*, the African *Rhoicissus* Planch., the Australian *Clematicissus* Planch. and five species of *Cissus* L. from South America has been resolved as the first diverged lineage within Vitaceae, but *Ampelopsis* is paraphyletic. The phylogenetic evidence supports the recognition often genera from the Malesian region: *Ampelocissus* (60 spp., including 20 species of *Pterisanthes*, and the type species of *Nothocissus*), *Ampelopsis* (1 sp.), *Cayratia* (10 spp.), *Causonis* Raf. (9 spp., a segregate of *Cayratia*), *Cissus* (30 spp.), *Austrocissus* gen. nov. (4 spp.), *Leeampelopsis* gen. nov. (1 sp., a segregate of *Ampelopsis*), *Parthenocissus* (1 sp.), *Tetrastigma* (45 spp.), and *Vitis* (1 sp. native and 1 sp. cultivated). The new genus *Austrocissus* exhibits an intercontinental disjunct distribution, including four recently treated species of *Nothocissus* from New Guinea and Australia, plus a species formerly included in *Cissus* from the Neotropics.

Key words: Vitaceae, classification, *Austrocissus*, *Causonis*, *Leeampelopsis*.

Completing the taxonomic revision of Vitaceae for Flora Malesiana

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An overview of the family Vitaceae in the Malesian area with the current status of the revision for Flora Malesiana and the known number of genera and species is given. The Vitaceae is a family of 14-15 genera and over 1000 species in tropical to temperate regions of both hemispheres and in Malesia there are 9 genera (excluding *Leea*) with ca. 203 species. The genera *Vitis* (1 species, 1 introduced), *Ampelocissus* (34 species) and *Cissus* (19 species, 2 introduced) are circumtropical and the genera *Ampelopsis* (2 species) and *Parthenocissus* (2 species) are centred in North America and Central Asia. The genera *Cayratia* (16 species) and *Tetrastigma* (35 species) are confined to tropical and subtropical Old World. Only the genera *Nothocissus* (4 species) and *Pterisanthes* (20 species) are truly Malesian. They are woody climber; dioecious, monoecious, climb by means of leaf-opposed tendrils. Leaves simple or compound. Inflorescence oppposite the leaves, axillary or seemingly terminal, frequently cirrhiferous, dichotomous or umbellate cymes, racemose, thyrse or a panicle of flattened lamellae. Flowers 4 or 5- merous. Ovary superior, 2-locular, each locule with 2 erect ovules. Fruits a berry; pisiform, pyriform to oblong, pulpy, cerebriform, 1- to 4-seeded. Seeds obovate or elliptical in outline, smooth or rugulose; carinate; endosperm ruminate, simple to complex with lateral meristematic in growths. The generic delimitation and some specific taxonomic problems are discussed.

Keywords: taxonomic revision, Vitaceae, Flora Malesiana.

Taxonomic study of *Phyllanthus* section *Urinaria* (Phyllanthaceae, Euphorbiaceae sensu lato)

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Phyllanthus section *Urinaria* is distributed worldwide with the distribution centre in the Southeast Asia region. In a previous systematic revision, three subsections are classified in the section, which contain six species and one subspecies. In this study, light microscopy, scanning electron microscopy as well as transmission electron microscopy were used for comparing pollen and seed morphology and anatomical structures. As a result, seven additional taxa are recognized to be members of section *Urinaria*, and are grouped into subsections. The subsection *Urinaria* has been morphologically divided into two groups, one with spiral ornamentation on the seed surface and the other with radial ornamentation on the seed surface. Each group contains both diploid and tetraploid species. Markers of nuclear DNA (ITS and *PHYC*) and chloroplast DNA (*acc*D-*psa*l and *trn*S-*trn*G) will be used for reconstructing the phylogeny to discuss the relationship among subsections or species. Based on the differences in maternal effects in different organelles, clues hidden in the molecular data will be discussed to understand the possible evolutionary processes between diploids and tetraploids.

Keywords: Euphorbiaceae, *Phyllanthus*, Phyllanthaceae, phylogeny, polyploid formation, section *Urinaria*, taxonomic revision.

Towards an account of *Pterospermum* Schreb. (Dombeyoideae/Malvaceae) for Malesia

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A monograph of the ornamental and commercially important Asian tree genus *Pterospermum* Schreb. is currently being undertaken. In this paper I will present the taxonomic history of the genus, highlight new taxonomic and phylogenetic data, provide a summary of ecological observations and discuss the potential uses of Malesian species in urban forestry.

Keywords: *Pterospermum*, Malvaceae, Malesia, taxonomy, phylogeny, urban forestry

Clearing the Borneo mist: a revision of woody lianas (Convolvulaceae)

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The tribal classification in Convolvulaceae has been the subject of debate for over 100 years. The advances of molecular techniques allowed a clarification of the main phylogenetic relationships within the family but the classification of one particular tribe, "tribe Merremieae", could not be resolved. It was found to form a paraphyletic grade and no clear morphological characters were found to support it. *Merremia*, the largest genus in the "tribe Merremieae" (c. 100 species), was also resolved as paraphyletic. The genus has no monograph and no synapomorphies, much like the tribe, and through time has become an agglomeration of questionably related species (a "dustbin"). More recent molecular phylogenetic analyses addressing specifically the classification of this complicated tribe and its largest genus have shown with greater confidence that the tribe is not monophyletic and neither is *Merremia*. However, several clades within *Merremia* were found to be well supported and highly congruent with morphology and geography, and are now being taxonomically revised in order to help recircumscribe *Merremia* into a more natural gathering of species. One of the clades resolved by this new molecular phylogeny comprises large woody lianas with broad cordate leaves and corymbiform inflorescences. Although genus *Merremia* is pantropical, this particular clade is mostly distributed in SE Asia, with a significant number of species being endemic to Borneo. The clade is robustly supported in the molecular phylogenetic analyses (89/94/100) and by several morphological characters, such as the habit, the leaf shape, calyx shape and pollen morphology, leaving no doubt that this species are closely related and form a strongly supported natural group. My presentation will

discuss the newly proposed taxonomic revision of this complex of species from Borneo and surrounding areas, in the context of the molecular and morphological data that I have recently analysed.

Keywords: molecular systematics, pollen morphology, taxonomy, Convolvulaceae, *Merremi*, Borneo

On the scent trail: taxonomic revisions in Malesian *Gardenia* (Rubiaceae)

Yee, W.L.

The Herbarium, Singapore Botanic Gardens, Singapore

Gardenia J.Ellis (Rubiaceae) consists of about 200 species of mostly shrubs and trees. Found in the Old World tropics, extending from Africa into India, the Ryukyu Islands, Taiwan, Southeast China, through Indochina, the Malay Archipelago, Australia, and the Pacific Islands, about 30 species are estimated to occur in Malesia, occupying various habitats, such as freshwater swamp forests, limestone forests, montane forests, peatswamp forests, and even ultramafic forests. Reassessment of the genus for Malesia is much needed as various disparate taxa with strongly divergent morphological characters have been reclassified by various authors since the 1950s under other genera, including *Catunaregam*, *Kailarsenia, Porterandia, Rothmannia*, etc., leaving a much smaller and apparently better defined genus. Current revisions pertinent to the region include the clarification of the *G. elata* / *G. tubifera* complex and descriptions of some West Malesian taxa, as well as a revision of the genus for the Philippines. Current revisionary progress is discussed, firming up features that could be further tested using straightforward molecular approaches, including a stricter morphological generic delimitation, as well as useful features for distinguishing taxa and recognising members of apparently vicariant pairs. A continuing, island-by-island approach to the enumeration of Wallacean and East Malesian *Gardenia* also seems feasible, as indicated by largely different taxa from the various islands or island groups in preliminary assessments conducted so far.

Keywords: diversity, *Gardenia*, Malesia, molecular phylogeny, Rubiaceae, taxonomy.

Session 11

ECOLOGY-6

Convener: Rochadi Abdulhadi & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Tukirin Partomihardjo, Research Center for Biology, LIPI
Venue: New Guinea Room

11.00 – 11.15	Tukirin Partomihardjo: Landscape, vegetation and floristic diversity of Nusa Kambangan Island-Cilacap, Central Java
11.15 – 11.30	Julisasi T Hadiah: Plant diversity and vegetation structure of Batur Agung Cultural Heritage Site, Central Java
11.30 – 11.45	Corazon Alava: Ecosystematic studies of trees and Pteridophytes in two forests in Mindanao
11.45 – 12.00	Adi Susilo & Titi Kalima: The abundance and habitat of *Taxus sumatrana* (Miquel) de Laub. at Mt Kerinci, Kerinci Seblat National Park
12.00 – 12.15	General discussion

Landscape, vegetation and floristic diversity of Nusakambangan Island, Cilacap, Central Java

Partomihardjo, T.

Botanical Division, Research Center for Biology-Indonesian Institute of Sciences

The Nuskambangan Island is a unique small island, in particular for its biological and ecological aspects. The island supports the largest expanse of a Lowland Dipterocarp forest remaining in Java, providing a good picture of the original Javan lowland forest. The most interesting feature from the phytogeography point of view is the presence of a giant tree species *Dipterocarpus littoralis* of the Dipterocarp family, which to date dominates the lowland forests of Sumatra and Kalimantan. The species is endemic on the island with extremely rare population. Currently the population of this endemic species is seriously threatened by illegal felling and its habitat destruction. Other rare and unique species growing on this island include *Amorphophalus discus-silvae, Gonystylusmacrophyllus, Lithocarpus platycarpus, Rafflesia patma, Rafolvia serpentine, Anysoptera costata, Hopea sangal, Shorea javanica* and *Sindora javanica.* Recent exploration recorded at least 767 species of vascular plants occurring on Nusakambangan. The island supports at least nine vegetation types i.e. (1) mangroves, (2) sandy beach vegetation, (3) coastal mixed forests on steep slopes, (4) mixed forests

on hilly limestone, (5) lowland mixed dipterocarp forests, (6) old secondary forests, (7) scrub vegetation, (8) tree plantations (teak, *Paraserianthes*, coconut and rubber) and (9) gardens and paddy field. A number of caves on the limestone hills have considerable biological and ecological significance, hence need special protection. In addition the Portuguese fort, old light-house and beautiful beaches are of high touristic values, requiring worthy and appropriate management system. There are four gazetted nature reserves on the island, i.e. a tiny offshore island of Majetito protect “WijayaKusuma” (*Pisoniagrandis*); the KarangBolong Caves , covering 0.3 ha; and natural lowland forest areas of about 200 ha on the eastern tip and about 700 ha on the southwest corner of the island.
Keywords: Small island, flora, vegetation, endemic and rare species, conservation, tourism

Plant diversity and vegetation structure of Batur Agung Cultural Heritage Site, Central Java, Indonesia

Hadiah, J.T.

Bogor Botanic Gardens, Indonesia

The diversity of the flora and vegetation structure of BaturAgung Cultural Heritage Site (Batur Agung, Baseh Village, Kedung Banteng District, Banyumas Regency, Central Java, Indonesia) were investigated. The 1.8 ha natural forest was sampled using a line transect sampling of ten plots. A total of 68 species belonging to 56 genera and 40 families were documented. Based on the Importance Value Indexes, the dominating plants for each forest stratum are as follows: the canopy layer of the forest was dominated by trees of Pasang (*Lithocarpus* sp.), Janitri (*Elaeocarpus* sp.), Nangkahan (*Artocarpus* sp.), Matoa (*Pometia pinnata*), and Angsana (*Pterocarpus indicus*); the sapling was dominated by Wunen (*Antidesma* sp.) and Umbel-umbelan (*Saurauia cauliflora*); and the ground cover was dominated by *Homalomena* sp., Keji Beling (*Chloranthus elatior*) and a member of the Malvaceae (Sterculioideae**)**.
Keywords: Batur Agung Cultural Heritage Site, flora exploration, plant diversity, vegetation analyses, vegetation structure.

Ecosystematic studies of trees and Pteridophytes in two forests in Mindanao

Alava, C.

Bukidnon State University University, Malaybalay, Bukidnon,Philippines

Inventory of trees and Pteridophytes in two forests in Mindanao in Mt. Mayapay, Butuan City, Agusan del Norte and Mt. Nabalabag, Talakag, Bukidnon was conducted at the Western, Northeastern and Southern sides on established trails, and assessed using the belt transect method. Field sampling

resulted to a total of 1,607 tree individuals belonging to 63 species, 55 genera and 39 families; for Pteridophytes, a total of 5,613 individuals belonging to 104 species, 80 genera and 36 families. The dominant species for trees in Mt. Nabalabag is *Pentacme contorta,* a Dipterocarp while in Mt. Mayapay, *Ficus sp.,* a species of Family Moraceae. For pteridirophytes, the dominant species in Mt. Nabalabag is *Nephrolepis biserrata* (Oleandraceae) while in Mt. Mayapay, *Dicranopteris lineares* (Gleicheniaceae). Local assessment for trees showed 1 common species, 8 rare species, 3 depleted, 39 indeterminate and 6 unidentified. For pteridophytes, 13 common species, 16 rare species, and 33 indeterminate species. Species diversity is observed most at the upper portion of the mountains in the Northeastern side, the Southern and Western side for both study sites follow this. Species similarity in both mountains is greatest in sites 1 and 3. Of all species found in the study sites, seven (7) species of trees and fourteen (14) species of pteridophytes showed significant differences with some ecological factors. Statistical analysis showed significant differences between mountains, sites and locations.

Keywords: ecosystematic studies, trees and pteridophytes, biodiversity.

The abundance and habitat of *Taxus sumatrana* (Miquel) de Laub. at Kerinci Seblat National Park, Sumatra, Indonesia

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The study of *Taxus sumatrana* was conducted in the area of Kerinci Mountain, at Kerinci Seblat National Park, in April 2012. The research objective was to obtain data and information on abundance and habitat preference of *T. sumatrana*. Line plot systematic sampling method was used on the habitat of *T. sumatrana*. Two line plots of 20 x 120 m was laid at an altitude of 1400-1500 m asl and at altitude of 1800-1900 asl respectively. Another 20 x 100 m line plot was laid at 1800-1900 m asl. Each line plot was divided into 20 x 20 sub plots for tree enumeration sub plots of 10 x 10 m for pole stage enumeration, 5 x 5 m for sapling enumeration, and 2 x 2 m for seedling enumeration by nested system. The results revealed that the highest abundance of *T. sumatrana* was at the altitude of 1900-2000 m asl for tree stage by 62.50 individual/ha, for pole stage by 30 individuals/ha, for sapling stage by 120 individuals/ha and for seedling stage by 500 individuals/ha. Species diversity at the study site was relative low as shown by Shannon diversity index of less than 1.5 (H' < 1.5). The value of diversity index is influenced by the number of species present in a community, thus the lower index diversity of the related area, indicate the more unstable community. For the ecological and economical value, *T. sumatrana* need to be protected through conservation *in-situ, ex-situ*, including cultivation and genetic conservation for sustainable use.

Keywords: *Taxus sumatrana*, abundance, Mount Kerinci, Kerinci Seblat National Park.

Session 11

ETHNOBOTANY-1

Convener: Eko Baroto Walujo, Research Center for Biology, LIPI
Chairperson: Terry Sunderland, CIFOR Indonesia
Venue: Sulawesi Room

11.00 – 11.15	Wawan Sujarwo *et al.*: Conservation status of food plants based on local knowledge in Bali
11.15 – 11.30	Jayson Gayo & Teodora Balangcod: Most utilized plants for construction purposes among the local community of Sitio Beckes, Barangay Bayabas, Sablan, Benguet, Philippines
11.30 – 11.45	Carmelita G Hansel & N Mambering: Ethnomedicinal plant use in a Maranao village in Lanao del Sur, Mindanao Island, in Southern Philippines
11.45 – 12.00	N Husna Zaidi *et al.*: Utilization of the medicinal and aromatic plants by selected Orang Asli (OA) communities in Peninsular Malaysia
12.00 – 12.15	General discussion

Conservation status of food plants based on local knowledge in Bali

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A recent global analysis of extinction risk for the world's plants has revealed that the world's plants are as threatened as mammals, with one in five of the world's plant species threatened with extinction. This study provides an overview and critical discussion of food plants perceived by informants in Bali. The study was conducted in 13 Bali Aga villages of the Bali Island, Indonesia. Bali Aga refers the village where the descendents of the traditional inhabitants of Bali live. Data was obtained ethnobotanically by field observations, focus group discussions, and interviews. 381 food plants were identified; 180 species least concern, 4 species near threatened, 172 species vulnerable, 23 species endangered, and 2 species critically endangered. Amongst endangered species are those of: *Aleurites moluccana* (L.) Willd., *Basella rubra* L., *Bauhinia tomentosa* L., *Bambusa ooh* Widjaja & Astuti, *Caesalpinia sappan* L., *Carmona retusa* (Vahl) Masamune, *Citrus amblycarpa* (Hassk.) Ochse, *Citrus grandis* (L.) Osbeck, *Dinochloa sepang* Widjaja & Astuti, *Dioscorea nummularia* Lamk, *Elaeocarpus oxypiren* K. & V., *Garcinia balica* Miq., *Garcinia dulcis* (Roxb.) Kurz, *Garcinia parvifolia* (Miq.) Miq., *Gossypium herbaceum* L., *Gigantochloa baliana* Widjaja & Astuti, *Manilkara kauki* (L.) Dubard, *Myrmecodia armata* DC., *Myrmecodia tuberosa* (non Jack) Bl., *Nypa fruticans* Wurmb.,

Pinanga arinasae J.R.Witono, *Santalum album* L., *Schizostachyum castaneum* Widjaja. Critically endangered species attributed to food plants by the informants are *Coleus parviflorus* Bth. and *Corypha utan* Lamk.

Keywords: conservation status, food plants, local knowledge, Bali Aga.

Most utilized plants for construction purposes among the local community of Sitio Beckes, Barangay Bayabas, Sablan, Benguet, Philippines

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Ethnobotany is the study of the relationship between plants and people in a society. In the Philippines, most ethnobotanical studies were focused on larger tribes, i.e. the Ifugaos and Negritos, and concentrated on topics about medicine and food. This study aimed to document the traditional knowledge of the local community in Sitio Beckes on plants that are used for construction purposes, which can be used for further researches. Two fieldworks were conducted in 2012 to gather data from a sample of 16 respondents, mostly farmers, through the use of questionnaires. The study site is delimited at Sitio Beckes, of Barangay Bayabas, Sablan in Benguet. The results yielded three most utilized plants for construction purposes. First is the Adaan, *Wallaceodendron celebicum* commonly used for building houses and furnitures, second is the Kawayan, *Bambusa vulgaris* Linn. commonly used for building animal cages or fence, and third is the Mahogany, *Swietenia macrophylla* King commonly used for furnitures. The traditional knowledge and practices of utilizing these plants for construction purposes were used and tested by the former generations. These plants can produce a product that lasts for years making them able to preserve their abundant resources, rich environment and traditional knowledge for the next generation.

Keywords: ethnobotany, Sitio Beckes, construction purposes, Barangay Bayabas, Sablan, Benguet. *Wallaceodendron celebicum, Bambusa vulgaris, Swietenia macrophylla*, traditional knowledge.

Ethnomedicinal plant use in a Maranao village in Lanao del Sur, Mindanao Island, in southern Philippines

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The Maranaos are a Muslim ethnolinguistic group concentrated in the provinces of Lanao del Sur and Lanao del Norte on Mindanao Island in southern Philippines. Ethnobotanical field work was conducted in the Maranao village of Barangay Ambari, Pagayawan, Lanao del Sur from October 17, 2010 to November 6, 2010. Interviews and transect walks were done with 30 informants representing the household heads in the village. This led to to a listing and collection of 104 plant species that were used for medicinal purposes in treating 79 diseases. Eighty-five species were subsequently identified scientifically, distributed across 81 genera and 54 families. Family Asteraceae was the most represented plant family. As to habit, herbs made up 39.4% of the total medicinal plants used. The largest percentage of the medicinal plants was used to treat respiratory disorders (15.4%), followed by fever and aches and gastrointestinal illness (14.2%), and lastly by gynecological problems (11.9%). The leaf was the most common used plant part (62%) while decoction was the most common method of preparation (33.3%). Oral administration was the most common way of administering the traditional medicine (77.4%). Comparison of the plant listing in the present study with a prior study on medicinal plants used by the Maranaos by Flores *et al.* and with Quisumbing's comprehensive work on Philippine medicinal plants reveal previously unrecorded plant species. This increases the database for species that could be screened and tested for potential drug development.

Keywords: ethnobotany, traditional medicine, herbal medicine.

Utilization of the medical and aromatic plants by selected Orang Asli (OA) communities in Peninsular Malaysia

Nurul Husna, Z., N.H.*, Tan, A.L., Nurnida, M.K., Norshakila, Y., Intan Nurulhani, B., Lim, H.F., Nik Musaadah, M. , Fadzureena, J. & Norini, H.

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A study had been conducted at nine selected Orang Asli (OA) communities in Peninsular Malaysia which involved ten sub-ethnics; Semelai, Jahut, Jakun and Che Wong (Pahang), Jahai, Temiar and Semai (Perak), Bateq (Kelantan), Semoq Beri (Terengganu), Temuan (Selangor) and Kanaq (Johor). The aim of this study is to document their knowledge and utilization of medicinal and aromatic plants in their daily practices. It also aims to compare the diversity of the plant used and its usage among the

communities. A socio-economic survey and two capacity buildings were carried out on each community to document and compile the knowledge from community on the medicinal and aromatic plants used. A total of 1096 plant samples (163-Semelai, 106-Jahut, 138-Jakun, 85- Che Wong, 98- Jahai and Temiar, 87- Semai, 114- Bateq, 101- Semoq beri, 124- Temuan and 50- Kanaq) were documented from the ten sub-ethnics. Families that were commonly utilized by the communities were from Zingiberaceae, Fabaceae, Arecaceae, Poaceae, Asteraceae and Rubiaceae. Majority of the plants collected from the communities were used for post-partum, wound healing, aphrodisiac and fever. The plant parts that were commonly used were the roots in the form of decoction and leaves made into poultice.

Keywords: utilization, medicinal plants, Orang Asli, sub-ethnic.

Session 12

GENERAL SUBJECT

Convener: Rugayah, Research Center for Biology, LIPI
Chairperson: Rismita Sari, Bogor Botanic Gardens
Venue: Borneo Room

13.30 – 13.45	Metilistina Sasinggala & Harry Wiriadinata: *Begonias* as a model to stimulate students to learn plant taxonomy
13.45 – 14.00	Craig Wiliams: Bitten by the Bug!
14.00 – 14.15	Graziel DS Luis: Phytochemical screening and antimicrobial study of indigenous medicinal plant species in Atok, Benguet, Philippines
14.15 – 14.30	Lusia B Moses: Development of antioxidant herbal tea from leaves of *Clinacanthus nutans* (Burm. F.) Lindau
14.30 – 14.45	Piya Chalermglin & Anan Phiriyaphattharakit: *Jasminum* in Thailand
14.45 – 15.00	General discussion

Begonias as a model to stimulate students to learn plant taxonomy

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Indonesia is a mega diversity country, being extremely rich in plant species. In contrast, there are relatively few plant taxonomists in comparison to this species richness. Many universities in Indonesia do not have a herbarium with a complete sampling of their local flora, and many students are not interested in studying plant taxonomy. Begonias are an interesting large group of plants with many species that can be found in the wild, as well as having many species in cultivation. The genus has very unique characters, being easily recognized by the asymmetric leaf blade and unisexual flowers. There are many exotic species of *Begonia* around Tondano campus, Manado State University, as well as wild species outside the campus, which can be used to teach students about morphology, species descriptions, scientific names and classification, fenology, ecology and biogeography, plant conservation, etc. Furthermore, *Begonia* can also be used to broaden students'knowledge of the economic potential of their native flora for ornamental purposes. The genus *Begonia* is proposed as a teaching model to stimulate interest in plant taxonomy in Manado University.

Keywords: *Begonia*, plant taxonomy, lesson model, Manado University

Bitten by the bug!

Williams, C.

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As part of our survival instinct, we are programmed to notice things that move. The small group of plants that exhibit this behavior have a strong attraction for children and the gruesome allure of carnivorous plants, the fauna of a children's garden has a strong role to play. In highly urbanized Singapore, where casual contact with nature has been reduced, insects, including those that some adults might perceive as plant pests, evoke fascination, and an excited mix of attraction, fascination fear and repulsion in the young visitors to the Jacob Ballas Children's Garden. Experiences with many of these bugs would once have been part and parcel of the unconscious exploration that is part of growing up. Offering intimate encounters with these creatures at an early age may go some way to reducing the fear of the natural unknown which is apparent some of JBCG's visitors. Capturing any visitor's imagination is a powerful first step to education, and highlighting herbivores and their

predators in this setting, can offer a memorable introduction to plants foundation stone role in eco-systems.

Keywords: education, interpretation, garden ecology, plant/animal interactions, urbanisation

Phytochemical screening and antimicrobial study of indigenous medicinal plant species in Atok, Benguet, Philippines

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Atok, Benguet is a municipality located in the Northeast of the Philippines and is known for being highly susceptible to landslide. Selected indigenous plant species from Atok, Benguet were collected and tested for phytochemical screening and antimicrobial activity. Some of these are coffee (*Coffea* sp.), Angel's trumpet (*Datura arborea*) and what is commonly known as Ceylon tea (*Camellia sinensis*). These plants were selected mainly because they were found thriving in the municipality. Based on a separate study, these plant species can be used to revegetate landslide which are abundant in the area meaning that these plant species can adapt to the soil conditions even after landslide occurrence and can still be beneficial and valuable to the community. This study was conducted to test the plant species, which can be used for revegetation, for their phytochemical content and antimicrobial potential. Five hundred grams of air dried plant materials were macerated using methanol. The concentrated methanol extracts were then subjected for phytochemical screening and microbial activity. Based on the results, *Camellia sinensis* was found to have the most number of metabolites. It provided positive results for flavonoids, saponins, tannins, alkaloids, steroids and cyanogenic glycoside. For antimicrobial activity, the plant extracts were tested against four microorganisms namely *Streptococcus typhimurium*, *Bacillus cereus, Escherichia coli, Staphylococcus aureus*, and *Pseudonomonas aeruginosa* using disc-diffusion method. The extract from *Camellia sinensis* leaves was active against all the strains and is comparable to the results of the four antibiotics (Chloramphenicol, Vancomycin, Kanamycin and Streptomycin) used as positive controls. It was 30% - 87% as effective as the antibiotics against all strains. The presence of the different metabolites can be responsible for the good microbial activity of the *Camelli sinensis* extract.

Keywords: antimicrobial activity, Atok, disc-diffusion, indigenous, phytochemical screening

Development of antioxidant herbal tea from leaves of *Clinacanthus nutans* (Burm. F.) Lindau

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Clinacanthus nutans (Burm. f.) Lindau (Family: Acanthaceae) or commonly known as 'Sabah Snake Grass' in Malaysia is traditionally used for its medicinal properties. Despite all the studies on its pharmaceutical properties, there is no study has been performed to investigate the antioxidant activity on herbal tea from *C.nutans* leaves. This present study was conducted to develop herbal tea (fermented and unfermented) from leaves of *C. nutans* and investigate the phytochemicals and antioxidant properties *in vitro*. Total phenolics content (TPC), total flavonoids content (TFC), catechin content (CC) and antioxidant activities were determined in both freeze dried and microwave dried of unfermented and fermented leaves tea with different infusion time. Unfermented microwave dried leaves tea of *C. nutans* showed the highest content of TPC and TFC. All tea infusions showed effective reducing power and free radical scavenging activity when tested using DPPH (2,2-diphenyl-2-picrylhydrazyl) and ABTS (2,2'-azino-bis (3-ethylbenzothiazoline-6-sulphonic acid) free radical scavenging assays as well as FRAP (Ferric reducing/antioxidant potential) assay. However, antioxidant property is not significantly dependent with the increasing time of infusion ($P>0.05$). The free radical scavenging and reducing activities may be attributed by the presence of phenolic and flavonoid compounds in the infusions. The results obtained in the present study indicate that herbal tea from leaf of *C. nutans* has a potential as natural antioxidant for the protection of oxidative damage.

Jasminum in Thailand

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AFG Kerr, an Irish surgery doctor who served in the Royal Thai Government during 1907 – 1932, held a highest frequency survey expedition and the largest amount of specimen collection for the native *Jasminum* Thai species. In 1932, there were 45 *Jasminum* species native to Thailand which were recorded by W.G. Craib, in the book *Florae Siamensis Enumeratio*. Later on P.S. Green's revised it and published in the Flora of Thailand (2000). According to him, the native *Jasminum* species remained 31 species. In 2004, *Jasminum rufohirtum* Gapnep. was recorded as the latest native *Jasminum* species found. Recently a new species was found and name after H.M. King Bhumibhol of

Thailand on the 65th Anniversary Celebrations of his Accession to the Throne, as *J. bhumibholianum* Chalermglin in 2013. Then, it was suggested that there are 32 woody climbers and one small shrub of *J. siamense* Craib. Based on its distribution condition, there were seven species endemic to Thailand, namely, *J. annamense* (Wernham) subsp. *Kerrii* (Bhatnagar) P.S. Green, *J. bhumibolianum* Chalermglin, *J. calcicola* Kerr, *J. craibianum* Kerr, *J. funale* Decne subsp. *sootepense* (Craib) P.S. Green, *J siamense* Craib, and *J. stellipilum* Kerr. The most popular species grown in Thailand as economic crop was *J. sambac* (L.) Aiton, but its seeding had been imported from aboard.

Keywords: *Jasminum*, Thailand.

Session 12

ECOLOGY-7

Convener: Rochadi Abdulhadi & Laode Alhamd, Research Center for Biology, LIPI
Chairperson: Edy N Sambas, Research Center for Biology, LIPI
Venue: New Guinea Room

13.30 – 13.45	Erizal Mukhtar & Tsuyoshi Yoneda: Growth rate of several important tree species in relation to climate change during three decades in a tropical rain forest, West Sumatra
13.45 – 14.00	Diny Hartiningtias *et al.*: Phenological pattern analysis and community structure of Dipterocarpaceae in Way Canguk Research Center, Bukit Barisan Selatan National Park, Lampung
14.00 – 14.15	Lai Simin: Reconnecting biodiversity: The Kheam Hock Road Project
14.15 – 14.30	Moh Azani A *et al.*: Assessment of *Shorea bentongensis* Foxw. (Meranti mengkai) diversity as an endemic species and vegetation analysis in tropical lowland forest of Malaysia
14.30 – 14.45	General Discussion

Growth rate of several important tree species in relation to climate change during three decades in a tropical rain forest, West Sumatra

Mukhtar, E.*[1] & Yoneda, T.[2]

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Growth rate of several important tree species during three decades were analysed in relation to climate change in a foothill rain forest in Ulu Gadut, West Sumatra, Indonesia. The growth rate were calculated for *dbh* measument between 1981-1989, 1989-1996, 1996-2004 and 2004-2012. Relative Growth Rate of Diameter (*RGRD*) were various between emergent (*Swintonia schwenkii*), canopy (*Hopea dryobalanoides*, *Shorea maxwelliana* and *Mastixia trichotoma*), subcanopy (*Calophyllum soulattri*, *Gonystylus forbesii*, *Grewia florida* and *Cleistanthus glandulosus*) and pioneer tree (*Macaranga pruinosa*). The highest of growth rate was observed for pioner tree species (*Macaranga pruinosa*) but their growth trend to decreased during three decades. Between canopy tree species *Mastixia trichotoma* showed the higher growth rate. Growth rate trend of *Hopea dryobalanoides* was decreased. Between subcanopy tree species *Grewia florida* was showed higher growth rate. Growth rate of *Gonystylus forbesii* was decreased. The emergent tree species (*Swintonia schwenkii*) was showed lower growth rate. Furthermore, between canopy tree species, *Hopea dryobalanoides* and *Shorea maxwelliana* showed positive relation with rainfall but *Mastixia trichotoma* showed negative relation. Growth rate of all subcanopy tree species showed positive relation. Both emergent tree species and pioneer tree species were showed positive relation between their growth rate and rainfall. The relationship between their performances in the forest stand was also discussed in this paper.

Keywords: growth rate, emergent tree, canopy tree, subcanopy tree, Ulu Gadut, West Sumatra

Phenological pattern analysis and community structure of Dipterocarpaceae in the forest of Way Canguk Research Center, Bukit Barisan Selatan National Park, Lampung

Hartiningtias, D.*[1], Winarni, N.L.[2] & Andayani, N.[3]

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Research about phenology and community structure of Dipterocarpaceae in the forest of Way Canguk Research Station (WCRS) had been conducted. The research aimed to acknowledge phenological pattern and community structure of Dipterocarpaceae in WCRS and also the effect of phenological pattern to community structure of Dipterocarpaceae in WCRS. This research used phenological data provided by the Wildlife Conservation Society Indonesia Program (WCS-IP) during 1998—2011. Phenological observation of blooming, fruiting, and appearance of new leaves was conducted visually by binocular at every early month since February 1998. Observations were made in 100 plot of 10 x 50 m size each. Pattern analysis is based on diagram of each phenophase. Community structure data collection conducted on July to October 2012 by the transect line method with varying path length, which is 1200 m, 2000 m, and 2200 m long in accordance with the fixed transect of WCRS. Each line created plots 200 x 20 m with 200 m spacing of each plot. Total plot of the entire transect was 108 plots. Phenological patterns depicted in diagram form, while the community structure in the form of tables and maps. The results showed that the phenological pattern of blooming is sub-annual, Dipterocarpaceae is dominated by genus Dipterocarpus, and phenologycal pattern did not affect community structure of Dipterocarpaceae

Keywords: Bukit Barisan Selatan National Park, community structure, Dipterocarpaceae, phenology analysis

Reconnecting biodiversity: The Kheam Hock Road Project

Simin, L.

National Parks Board, Singapore Botanic Gardens

Much of Singapore's original vegetation has been lost even before British colonization began. Efforts to safeguard Singapore's last remaining biodiversity via gazettement of nature reserves and reintroduction of species into urban settings have been initiated in the last few decades. The Kheam Hock Road Project was conceived in 2012 and launched in February 2013 to create a biodiversity corridor between two key nature areas – Central Catchment Nature Reserve and the Singapore

Botanic Gardens. The Singapore Botanic Gardens, in collaboration with Horticulture and Community Gardening, Streetscape, National Biodiversity Centre and Conservation divisions, coordinated this project with the Singapore Chinese Girls School and residents of the Kheam Hock Road area. More than 60 species of trees and shrubs such as *Cratoxylum cochinchinense*, *Flacourtia inermis*, *Melastoma malabathricum* and *Syzygium zeylanicum*, have been planted by schools and residents since its initiation, creating habitats for species of butterflies, dragonflies and birds. Parents and students were trained in horticultural practices such as planting and plant propagation. Post-launch surveys conducted between March and May 2013 indicated an increase in bird species. Continuous efforts to enhance the greenery and biodiversity are on-going.

Keywords: Biodiversity, gardening, urban development, nature reserves, Singapore Botanic Gardens

Assessment of *Shorea bentongensis* Foxw. (Meranti mengkai) diversity as an endemic species and vegetation analysis in tropical lowland forest of Malaysia

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The study was conducted to assess diversity of *Shorea bentongensis* as an endemic species in tropical lowland forest, Malaysia. Belt Transect Method was used to collect data of all trees that having greater than 10 cm dbh in Compartments 13 and 14, Lentang Forest Reserve, Bentong, Pahang. Data collected were subjected to determined species richness, species diversity, similarity and rank abundance. The composition of the six hectare area study plots revealed the presence of 1979 individual trees representing 114 species and 36 families. 51 individuals belong to *S. bentongensis*. Species with highest relative abundance were *Syzygium cerinum* (0.8), *Syzygium chloranthum* (0.7) and *Syzygium syzygioides* (0.5). The most diverse plot was Plot 1 with 855 individuals and 91 species. The Jackknife estimate of species richness in Plot 1, Plot 2 and Plot 3 were 111.9, 99, and 90.9, respectively. Comparison of the three plots in the study area showed the highest species diversity index was H'=5.668 in Plot 1 where Plot 3 showed the lowest species diversity index with H'=5.216. The average of diversity index for Shannon-Wiener's index was 5.492 (greater than 5.0) which indicates high diversity. High value of Shannon-Wiener's index means that there was many (51 individuals) *S. bentongensis* scattered in six hectares area with a diameter of 10 cm to 90 cm. As *S. bentongensis* is an endemic species, we should conserve the species as mother trees that will provide wildings and seedlings in enrichment planting projects or *ex-situ* conservations in the future.

Keywords: Species richness, species diversity, species evenness, Important Value Index (IVI), endemic species, *Shorea bentongensis*, tropical lowland forest

Session 12

ETHNOBOTANY-2

Convener: Eko B Walujo, Research Center for Biology, LIPI
Chairperson:Terry Sunderland, CIFOR Indonesia
Venue: Sulawesi Room

13.30 – 13.45	M Elena Ragragio: Diversity of use and local knowledge of plant food resources of three Aeta communities in Pampanga Province, Luzon Island, Philippines
13.45 – 14.00	Aziah Muhamad: Use of plants in postpartum treatment: perceptions and practices among the indigenous tribes in Brunei Darussalam
14.00 – 14.15	Mohammad F Royyani & Joeni S Rahajoe: Behind the sacred tree: local people and natural resources sustainability
14.15 – 14.30	Taulana Sukandi & Titi Kalima: Tree species of peat swamp forest in Central Kalimantan (Indonesia): Diversity and utilization by local people
14.30 – 14. 45	Muhammad Zafar *et al.*: Medicinal plant biodiversity in salt range region of Punjab, Pakistan
14.45 – 15.00	General discussion

Diversity of use and local knowledge of plant food resources of three Aeta communities in Pampanga Province, Luzon Island, Philippines

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The plants used as food by the Aeta communities has changed after the eruption of Mt. Pinatubo in 1991. The ethnobotanical study of the plant food resources and traditional plant knowledge was conducted in three barangays (villages) of the Mag-indi and Mag-anchi enthnolinguistic groups of the Aeta. The 3 barangays (Camias, Villa Maria and Inararo) are located at the foothills of Mt. Pinatubo. A free, prior and informed consent was allowed by the community leaders. Sixty-nine informants/participants were interviewed from the 3 barangays. A total of 106 plants were used as food and for commercial crops. This is much less than the plants listed in the study of Fox (The Pinatubo Negritos in 1952). Most of the plants were available in the local markets. Some were planted

by the Aeta as source of income to buy rice and other necessities. An analysis of the results showed that the local knowledge is held mainly by the elders although some young people were also familiar with the plants. Likewise, the erosion of the plant knowledge may be due to habitat destruction, continuing commerce and interaction with the local people, and ease in procurement of rice and other food plants from the local markets. There is also a level of acculturation due to the incursion and influence of media in local TV.

Use of plants in postpartum treatment: perceptions and practices among the indigenous tribes in Brunei Darussalam

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People in Southeast Asia are widely reported to use plants in postpartum treatment which significantly involves herbal bath, body care and herbal decoctions. This study focuses on the use of plants as an ingredient in the preparation of postpartum treatment rituals by the indigenous tribes of Brunei Darussalam, specifically the Malays, Kedayans and the Muruts. Data collection is carried out in the three districts of Brunei Darussalam: Brunei Muara, Tutong and Temburong. Methodologically, in depth interview was conducted among individuals of age between 26 to 84 years old comprises of older generation, traditional healers, postpartum caregivers and parents. Unknown plants species are collected for identification purposes. There are about 93 plant species found during the study in which Muruts are utilizing about 13 plants species, Malays are utilizing 69 while Kedayans are utilizing 61 plant species in their postpartum treatment. Malays and Kedayans are found to mostly utilize the same plant species in their treatment. This study provides a novel insight that despite the vast modernization of healthcare in Brunei, the indigenous tribes are still using plants in the preparation of their postpartum treatment rituals.

Keywords: traditional medicine, postpartum, indigenous tribes, plants

Behind the sacred tree: local people and natural resources sustainability

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Local communities have their own means of maintaining their traditional knowledge and sustaining production system of natural resources by designating the resources sacred. Without the state influence, local people have their own strategies to conserve the environment and resources, which are more effective than those enforced by state. A study using the interview, participation observation, and ethnographic methods revealed that local people recognized two models of natural resources conservation. The firts model is the designation of a forest as a sacred site, aiming at maintaining the sustainabiliyu of sustaining ecosystem and the second model refers to adoption of a species as a sacred entity to sustain production system. Dynamic processes are operating in the sacredness of both forest and species.

Keywords: conservation, local people, sacred site, production system

Tree species of peat swamp forest in Central Kalimantan (Indonesia): diversity and utilization by local people

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Many peat swamp forests have been degraded due to overlogging and deforestation for other purposes. The objective of this study was to identify the composition, diversity, and utilization by local people of tree species in a peat swamp forest. The study was conducted in the forest had been degraded in Mantangai Sub-District (Central Kalimantan Province). A method of quadrats established in lines was applied for vegetation analysis. The Shannon-Wiener (H') and the Importance Value (IV) indices were used for analyzing the species diversity and the species importance respectively. Utilization of trees species by local people was identifiedby interviewing respondents in villages surrounding the forest area. The result showed that there were 2,564 individual specieson 1.28 ha area, consisting of 99 tree species and 10 non-tree species, 72 genus, and 46 families. The diversity of tree stage was moderate (H'=1.37) with the dominant species of *Calophyllum nodusum* Vesque (IV=66.29% and H'=0.14), and that of pole stage was also moderate (H'=1.69) with the dominant species of *Palaquium cochlearifolium* P.Royen (IV=22.06% and H'=0.08%). There were at least 15 tree species and three non-tree species currently used by local people for house construction, boat, furniture, handicraft, medicine, and mosquito repellent.

Keywords: species composition, species importance, degraded forest

Medicinal plant biodiversity in salt range region of Punjab, Pakistan

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The Salt Range is a hills system in the Punjab province of Pakistan, deriving its name from its extensive deposits of rock salts. The Salt Range is one of the most important and largest ranges of its type in Pakistan, Asia and the world as a whole with the average height 1000 m. Communities use different plants for protecting their houses, cultivated land and other plants to feed their roaming goats and sheep in the pastures and to protect some grass land in the range. Many plants are uprooted and many are heavily collected due to their medicinal uses at a local and national level. Land ownership conflicts are one of the reasons for the non-existence of positive developmental work in the area. human populations have long caused local extinctions of organisms (better documented for animals than plants), suffered periodic shortages of natural resources (for example, as demonstrated by recurrent famines) and been responsible for local environmental degradation (such as deforestation and soil erosion). The root cause of plant loss is the huge and growing size of the human population, creating pressure to destroy natural habitats, expand and intensify agriculture, and collect more resources from wild plants. Intensive farms contain little botanical diversity compared to their more traditional counterparts. This study was conducted in remote areas of Salt Range, Punjab, Pakistan. Area is unique with wild life biodiversity and diverse communities who heavily dependent on medicinal plant wealth of this range. Main emphasis of this study was to document indigenous uses of medicinal flora by interviewing native communities including men, women, herbalists and resource persons. The methodology comprised questionnaire methods to document indigenous knowledge of local communities who are the main user of plant resources in this region. In total of 40 medicinal plants were reported to be used as herbal medicines for various ailments. It is observed from this study that Salt Range medicinal flora currently faced the problems of threats including unscientific collection of medicinal plants by herbal sellers, herbalists and outsiders. It is suggested that conservation of medicinal wealth of Salt rang is given priority by ecologists, taxonomists and policy makers in order to intact and conserve this national heritage for future generation.

Keywords: Medicinal plants, salt range, Punjab, Pakistan

Friday, 30 August 2013
12.30 – 13.30
POSTER PRESENTATION

Underline name is presenting author

* Corresponding Author

POSTER TITLES

CODE	POSTER TITLES	AUTHOR
P-001	Molecular phylogenetic study of Sumatran *Impatiens* (Balsaminaceae) using Internal Transcribed Spacer (ITS) Sequences	Nanda Utami & Marlina Ardiyani
P-002	A taxonomic and phylogenetic study of *Limnophila* (Plantaginaceae) — toward resolving relationship between sections	Sze-Yi Tsai *et al.*
P-003	Phylogenetic studies in the Cryptocarya group (Lauraceae): more taxa needed from the Flora Malesiana region.	JG Rohwer *et al.*
P-004	Phylogenetic position of the endemic Philippine species of *Bikkia* Reinw. (Rubiaceae) inferred from DNA sequence data including a new inland forest species	Grecebio JD Alejandro *et al.*
P-005	Phylogenetic relationships and associated hosts of *Balanophora laxiflora* (Balanophoraceae) and allied taxa	Yun-Chen Hsieh & Hu Jer-Ming
P-006	Molecular phylogenetics of root-holoparasitic *Balanophora* (Balanophoraceae) and their associated insects	Su Huei-Jiun & Hu Jer-Ming
P-007	The phylogenetic analysis of Malesian *Hornstedtia* Retz. (Zingiberaceae) based on ITS sequences	Nurainas *et al.*
P-008	Marker assisted selection characters for high productivity of Sago Palm (*Metroxylon sagu* Rottb.)	Yeni Rahayu *et al.*
P-009	Identification and cloning of partial curcin gene sequences in *Jatropha podagrica* Hook. and *Jatropha pandurifolia* Andr.	Maricel Corpuz *et al.*
P-010	Do cuticle characters support the recognition of *Alseodaphne, Nothaphoebe* and *Dehaasia* as distinct genera?	Sachiko Nishida & H van der Werff
P-011	Is there any obligate apomixis in plants? A case study in *Elatostema* (Urticaceae)	Yu-Hsin Tseng & Jer-Ming Hu
P-012	An illustration of *Phytocrene macrophylla* in Bogor Botanic Garden	Victor Wong
P-013	Tuber morphological variations of *Dioscorea* spp. cultivars from Pasuruan, East Java	Fauziah & Lia Hapsari
P-014	Systematic significance of the leaf venation in Genus *Ficus* L. (Moraceae)	B Ummu-Hani & Affina E Aznal
P-015	Trichomes morphology in flower petal of Acanthaceae species	MAA Ahmad Juhari *et al.*
P-016	Systematic study of *Tacca leontopetaloides* in Indonesia	Rugayah *et al.*
P-017	Notes on the morphological characteristics of *Eurycoma* spp. observed and its status in Peninsular Malaysia	Tan Ai Lee *et al.*
P-018	Floral and leaf characters of some wild gingers (Zingiberaceae: Alpinioideae) in Mindanao, Philippines	Florfe M Acma *et al.*

CODE	POSTER TITLES	AUTHOR
P-019	Mophological diversity of Kemukus (*Piper cubeba* L.) in Java based on Herbarium Bogoriense specimen	Niken Kusumarini
P-020	Leaf flushing as taxonomic evidence of some *Diospyros* species	Eva K Putri & T Chikmawati
P-021	Pollen morphology of underutilised fruit species	Noor C Noor-Alam & I Salma,
P-022	Preliminary study of morphological variation of Kapulasan (*Nephelium ramboutan-ake)*	Nina R Djuita *et al.*
P-023	Seeking character-stated of Cassava's tuber	Sri Hartati, Wahyu Nirwanto *&* Andi Salamah
P-024	Orchid diversity and conservation assessment in Gunung Tahan Heath Forest Reserve Pahang (Peninsular Malaysia)	Siti F Md Isa & R Go
P-025	Orchid diversity in Gunung Api Purba Nglanggeran, Yogyakarta, Indonesia	Septy A Puspitasari *et al.*
P-026	Orchid diversity in Mekongga Mountainous Area, South - East Sulawesi, Indonesia	Diah Sulistiarini & Daniel Potter
P-027	The diversity of lowland orchids of Papua	Verena Agustini *et al.*
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P-001

Molecular phylogenetic study of Sumatran *Impatiens* (Balsaminaceae) using Internal Transcribed Spacer (its) sequences

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Impatiens L. (Balsaminaceae) is a large subcosmopolitan genus, comprising ca. 850 species with its main center of diversity in the old world tropics and subtropics. The genus was revised for Sumatra by Grey Wilson (1989) who recognized 29 species, of which 20 taxa were new. Recently, over the last ten years, increasing numbers of *Impatiens* species from Sumatra have been discovered as further exploration has been carried out. In this study, 25 samples of *Impatiens*, representing 17 species, were sequenced for the Internal Transcribed Spacer region from nuclear ribosomal DNA and the chloroplast *atp*B–*rbc*L intergenic spacer. These samples represent 16 endemic *Impatiens* species from Sumatra and one common species. Parsimony analyses were done with the addition of additional *Impatiens* sequences from GenBank. The results showed that Sumatran *Impatiens* species are distributed in several separate clades indicating multiple origins of the species in Sumatra.

Keywords: *Impatiens*, Balsaminaceae, biogeography, endemic, ITS, phylogeny.

P-002

A taxonomic and phylogenetic study of *Limnophila* (*Plantaginaceae*)—toward resolving relationship between sections

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The aquatic genus *Limnophila* (Plantaginaceae) is mainly distributed in Old World tropics and subtropics with the center of diversity in Southeast Asia. Former ly, taxonomists recognized 47 species divided into five sections based on leaf morphology. However, the aquatic habit often leads to high phenotypic plasticity, so using vegetative characters for distinguishing sections may lead to misunderstanding relationships within the genus. In our taxonomic study, leaf morphology, seed surfaces and stem transection of aerial parts were examined. For phylogenetic construction, we used cpDNA markers *ndhF*, *trnL/F*, and *trnG* from 22 species of four sections. Our analysis reveals that the genus is a highly supported monophyletic group. Except the first branch, all taxa form a well-supported clade comprising two main clades, one formed by members of sections *Connatae* and *Limnophila* (CL clade), the other includes sections *Striatae* and partial *Integrifolieae* (SI clade). The CL clade consists of two well-supported clades corresponding to the two sections. The section

Integrifolieae is polyphyletic because one taxon of this section is at the first branch while the other taxon is sister to section *Striatae*. Morphological characters including venation, blade shape, calyx striation and seed morphology are found to be congruent with the major clades. Based on this evidence, we discuss infrageneric classification and sectional circumscriptions.

Keywords: aquatic plants, heterophylly, *Limnophila*, *ndhF*, phylogeny, *trnG*, *trnL/F*.

P-003

Phylogenetic studies in the C*ryptocarya* group (Lauraceae): more taxa needed from the Flora Malesiana region

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The *Cryptocarya* group is the first major clade separating from the rest of the Lauraceae. It is estimated at some 500-700 species, of which a large proportion occurs in the Flora Malesiana area. A phylogenetic analysis based on 83 nuclear ITS and chloroplast *trn*K intron sequences of 62 species helped to identify the main clades within the group. Among the taxa from the Flora Malesiana region, *Triadodaphne inaequitepala* is nested within *Endiandra*, which otherwise appears to be monophyletic. *Cryptocarya* is clearly monophyletic as well, whereas *Beilschmiedia* is paraphyletic with respect to (at least) *Potameia* from Madagascar and *Yasunia* from South America, possibly also with respect to *Endiandra*. Both *Beilschmiedia* sensu lato and *Cryptocarya* originated in the Old World, and have reached the Americas more than once. Unfortunately, our analyses so far include only very little material from the FM region, although it may have played a key role in the initial radiation of the core *Cryptocarya* group (*Beilschmiedia* s.lat., *Cryptocarya*, and *Endiandra*). Therefore, we are looking for cooperation partners from this region.

Keywords: phylogeny, ITS, trnK intron, Lauraceae, *Beilschmiedia, Cryptocarya, Endiandra, Eusideroxylon, Potoxylon, Sinopora, Triadodaphne*.

P-004

Phylogenetic position of the endemic Philippine species of *Bikkia* reinw. (Rubiaceae) inferred from DNA sequence data including a new inland forest species

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Based on molecular data, the genus *Bikkia* Reinw. (coffee family) was formerly subdivided into two groups with contrasting habitat and corolla shape. Subsequently, one group was transferred to a genus of its own the *Thiollierea* Montrouz. (inland forest) leaving the *Bikkia* (coastal habitats) with about 10 species worldwide. In the Philippines, only *Bikkia philippinensis* Valeton is found in the coastal areas of Cebu and Siargao Islands. Recent observation of herbarium specimens at Central Mindanao University Herbarium (CMUH) revealed a diverging *Bikkia* species collected in the inland forest of Mt. Redondo, Dinagat Island. Comparative evaluation was conducted using morphology and nuclear rDNA (ITS region) and cpDNA (*rps*16 &*trn*L-F regions) was sequenced and analyzed from two isolates of *B. philippinensis* and four isolates of the *Bikkia* species from Mt. Redondo. The separate and combined most parsimonious trees showed that the inland forest *Bikkia* species from Mt. Redondo was nested within a group of purely coastal species of *Bikkia* (BS=90%) but not with *B. philippinensis*. The two Philippine *Bikkia* species also differ morphologically mainly in reproductive features. Therefore, we proposed the name *Bikkiaredondoensis* provided with botanical illustration as well as a discussion of the conservation status of the two Philippine *Bikkia*. Finally, *Bikkia* should not be restricted to include only coastal species.

Keywords: *Bikkia*, conservation, cpDNA, nrDNA, Philippine endemic.

P-005

Phylogenetic relationships and associated hosts of *Balanophora laxiflora* (Balanophoraceae) and allied taxa

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Balanophora laxiflora is a dioecious species, distributed in southern China, Vietnam, and Taiwan. Morphology of female *B. laxiflora* is similar with that of *B. japonica* and *B. yakushimensis*. No male individuals have been found for the latter two taxa, and the agamospermy of *B. japonica* has been confirmed in previous studies. We speculate that *B. japonica* and *B. yakushimensis* were probably derived from the female ancestor of *B. laxiflora*. This study increased sampling of *B. laxiflora*

individuals, using DNA data to examine whether the two allied taxa were derived from *B. laxiflora*. The result of this study reveals that, in Taiwan, *B. laxiflora*, *B. japonica* and *B. yakushimensis* each forms a monophyletic group, and *B. laxiflora* is a sister group to the clade composed of the other two taxa. By analyzing the phylogenetic relationships with the chosen intraspecific genetic variation of *B. laxiflora*, we found that a subset of populations forms a highly supported monophyletic group.
We also examined the host diversity of *B. laxiflora* by using PCR amplification of DNA markers from the associated roots. The results showed that hosts of *B. laxiflora* include *Elatostema*, *Acer*, *Morus*, *Ficus*, *Alnus*, *Rubus*, and *Ardisia*.

Keywords: *Balanophora*, parasitic plants, phylogeny, agamospermy, host, molecular identification

P-006

Molecular phylogenetics of root-holoparasitic *Balanophora* (Balanophoraceae) and their associated insects

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Balanophora is an herbaceous root-parasitic plant that represents the largest genus in Balanophoraceae. The genus contains 15-17 species and is distributed mainly in temperate and tropical Asia. To investigate relationships within the genus, we reconstructed the phylogeny based on nuclear ribosomal DNA sequences from 18S and ITS regions (~2.5 kb) using both fresh and herbarium specimens. Molecular phylogenetic analyses show that *Balanophora* forms a well-supported monophyletic clade, supporting the traditional delimitation of subgenera based on the floral characters of male flowers (except for *B. japonica*, which is a putative agamospermic species). Our results also suggest the character of female flower position should be down-weighted and the molecular phylogeny does not reflect the traditional delimitation of sections. Additionally, our studies show that larvae of several moths and weevils utilize inflorescences and tubers of *Balanophora* as brood sites. We employed the mitochondrial *CO1* and nuclear 18S regions to examine these insect larvae. The molecular evidence indicates that moths of the family Pyralidae are the major insect parasites of different *Balanophora* species.

Keywords: *Balanophora*, phylogeny, moths, weevils, parasites, brood sites.

P-007

The phylogenetic analysis of Malesian *Hornstedtia* Retz. (Zingiberaceae) based on ITS sequences

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An preliminary analysis to clarify the phylogenetic relationships of Malesian *Hornstedtia* has been conducted by the DNA sequences with ITS markers. Forty five samples representing 23 Malesian species (1-6 accessions per species) were analyzed in this study and supplemented with sequences of additional *Hornstedtia* species from GenBank. The outgroups consisted of six *Alpinia* spp., four *Amomum* spp., *Burbidgea nitida*, *Elettariopsis stenosiphon*, four *Etlingera* spp., *Geocharis fusiformis*, *Geostachys* sp., *Leptosolena haenkei*, *Siliquamomum tonkinense* and *Vanoverberghia sepulcheri* of which sequences were obtained from GenBank. Two groups of *Hornstedtia* can be recognized, supported by high value of bootstrap. Group I was supported by bootstrap values of 98% for all methods. Group II has bootstrap values at 94% for MP, 89% for ML and 71% for NJ method. Group I consists of *Hornstedtia* species only, while the Group II consists of a grade *with* other genera.

Keywords: ITS, *Hornstedtia*, phylogeny, Zingiberaceae

P-008

Marker assisted selection characters for high productivity of Sago Palm (*Metroxylon sagu* rottb.)

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In sago plantations, high production plants are preferred, and then the selection of seedlings is done to sustain productivity. This paper reports a study of the correlation between some of the vegetative characters with the productivity of sago palms. This study's aim is to determine the best characters for marker assisted selection of sago plants with high productivity. Twenty-five morphological and agronomic characters of spiny and spineless sago were analyzed. The results show that several characters were correlated to each other. One of these characters, the color of the shoot of sago seedlings, was positively correlated with length of trunk and number of leaflets. We conclude that the color of the shoots of sago seedlings is likely to be a selection marker for superior sago in the future.

Keywords: Marker Assisted Selection, *Metroxylon sagu* Rottb., Sago Palm, Spineless Sago, Spiny Sago, the color of sago seedlings.

P-009

Identification and cloning of partial curcin gene sequences in *Jatropha podagrica* Hook. and *Jatropha pandurifolia* Andr.

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Ribosome-inactivating proteins (RIP) inhibit protein synthesis in eukaryotic cells by catalytically damaging ribosomes. Their antiviral and antitumour activity is due to truncation of the translation of viral coat proteins. RIPs are abundant only in a few plant families, including the Euphorbiaceae. RIP genes were screened in *Jatropha pandurifolia* and *Jatropha podagrica* through PCR analysis, using the curcin (RIP) primers designed from *Jatropha curcas*. The genomic and cloned PCR products for *J. pandurifolia* and *J. podagrica* are 450 base pairs; about the same size as the PCR product for the *J. curcas* curcin gene (400 base pairs). Analysis of the amplified DNA products using BLAST showed 87%-90% homology of *J. pandurifolia*'s RIP gene sequence to the *J. curcas* precursor gene. The amino acid sequence deduced from the nucleotide sequence revealed possible ORFs in *J. podagrica* and *J. pandurifolia*. Alignment of the deduced amino acid sequence, through CLUSTAL W, of the cloned PCR products of *J. podagrica* and *J. pandurifolia*, to *J. curcas* curcin and other RIPs, revealed conserved regions, such as SYFF, ALD and EAA, which are putative active sites. PCR products of J. *podagrica* and *J. pandurifolia* are 674-678 bases and 555–590 bases in length, respectively. This is a new report of RIP genes in *Jatropha* that will shed light on the medical significance of RIPs.
Keywords: Ribosome-inactivating proteins, antiviral, antitumour, *Jatropha*, Euphorbiaceae

P-010

Do cuticle characters support the recognition of *Alseodaphne*, *Nothaphoebe* and *Dehaasia* as distinct genera?

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The Asian members of the *Persea* group sensu Li et al. (2011) are divided among the genera *Alseodaphne*, *Apollonias*, *Dehaasia*, *Machilus*, *Nothaphoebe* and *Phoebe*. A recent phylogenetic analysis (Li et al. 2011) has shown that *Machilus* and *Phoebe* are supported as monophyletic genera but evidence that the closely related genera *Alseodaphne*, *Dehaasia* and *Nothaphoebe* are monophyletic or not was equivocal. In this study we analyzed cuticle characters of 95 collections

belonging to the Asian members except for *Apollonias*. We anticipated two possible outcomes. If the genera were not monophyletic, we expected that the groups based on cuticle characters would consist of species belonging to different genera. If the genera were monophyletic, we expected that the groups based on cuticle characters would consist of species belonging to the same genus. We found 17 groups based on cuticles. Of these, 13 consisted of species of a single genus (one group included a single species and thus a single genus). The four mixed groups included mostly species of one genus with 1 or 2 species of a different genus. Our results support the recognition of *Alseodaphne*, *Dehaasia*, *Machilus*, *Nothaphoebe* and *Phoebe* as distinct genera.

Keywords: *Alseodaphne*, cuticle, *Dehaasia*, Lauraceae, *Machilus*, *Nothaphoebe*

P-011

Is there any obligate apomixis in plants? A case study in *Elatostema* (Urticaceae)

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Apomixis, the asexual reproduction by seeds, has evolved independently several times in over 400 angiosperm taxa from at least 40 families. Most apomictic plant species are facultative, which are able to produce sexual seeds, but it may be questioned if there exist any 100% obligate apomicts. Among 400 species in *Elatostema* (Urticaceae), nine possible apomictic species have been found. In Taiwan, there are fifteen *Elatostema* species, including taxa with monoecious, dioecious, monoecious and dioecious in same species, and female only species. In this study, two of female only species in Taiwan, *E. herbaceifoium* and *E. rivulare*, were examined to provide primary investigation into the potential evolution and mechanisms of apomixis. The phylogentic analysis shows that these two species evolved independently in different lineages in *Elatostema*. Compared with sexual counterpart ($2n = 2x = 26$), both species are polyploidy, triploid for *E. herbaceifolium* ($2n = 3x = 39$) and tetraploid for *E.rivulare* ($2n = 4x = 52$). Based on flow cytometric seed screen and embryogenesis, there is no any male contribution during the development of seed and endosperm. Therefore, these species should belong to an infrequent case of apomictic species-obligate autonomous apomixis.

Keywords: apomixis, *Elatostema*, Taiwan, obligate apomixis, polyploidy, flow cytometry

P-012

An illustration of *Phytocrene macrophylla* in Bogor Botanic Garden

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Morphological characteristics of the tropical woody liana *Phytocrene macrophylla* have been studied by many researchers. A series of bibliographic research on its taxonomic literature has been searched and it seems that special characters need to be drawn for taxonomical studies. Based on the multiple trips conducted for specimen study and photographic evaluation of the spongy stem of *P. macrophylla*, a botanical illustration of the species can be drawn. Its appearance was caused by what Timmermans termed "an anomalous secondary growth". In addition, an exhaustive examination of the plant components will help to arrive at a scientific evaluation by an accurate botanical illustration. The outcome represents a feasible and realistic iconographic watercolour sample of the dioecious liana.
The usability of the work is targeted to the educational field as a referential resource for instructors, scientific and botanical specialists. This botanical illustration will provide the scientific and botanical data which will be useful as a realistic tool of instruction and educational resource for the audience.
Keywords: *Phytocrene macrophylla,* spongy stem, education resource, botanical illustration

P-013

Tuber morphological variations of *Dioscorea* spp. cultivars from Pasuruan, East Java

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Dioscorea spp., the edible tubers of family *Dioscoreaceae*, which have heterogeneous perennials with many shared morphological, physiological and chemical contains. Dioscorea is also an important crop serves as a staple food and medicine, but it is also become an income for many smallscale farmers in the developing countries. *Discoreaceae* exploration collecting missions has been conducted in 4 Districts of Pasuruan, East Java. During the exploration it can be obtained 29 accessions of *Dioscorea* spp. It comprises of 4 species and 21 cultivars i.e. 12 cultivars of *Dioscorea alata* L. (Uwi Kelopo, Uwi Sego, Uwi Legi, Uwi Putih, Uwi Bangkulit, Uwi Jaran, Uwi Ungu, Uwi Ulo, Uwi Perti, Uwi Beras, Uwi Jaran Ungu and Uwi Elos; 6 cultivars of *Dioscorea hispida* Dennst. (Gadung, Gadung Jahe, Gadung Ketan, Gadung Kuning, Gadung Keripik and Gadung Lumut); 2 cultivars of *Dioscorea esculenta* (Lour.) Burkill. (Gembili and Gembolo) and 1 cultivar of *Dioscorea pentaphylla* L. (Uwi Soso'an). This paper presents the results of *Dioscorea* inventory by looking at the

morphological characterization of *Dioscorea* spp. tubers. The characters which observed based on IPGRI Descriptors list for Yam (*Dioscorea* spp.) including its potential utilization by local farmers and its organoleptics test results. The results showed that morphological characteristic features of *Dioscorea* spp. tubers were broadly varied among species and even within cultivars at the same species. *Dioscorea* spp. cultivars originated from Pasuruan were mostly differentted by its tuber shape, tuber flesh colour and cooked tuber flesh texture. From the interviews to local farmers, it showed that *D. alata* and *D. hispida* cultivars were still widely grown because of its high tuber yields and its taste are the most acceptable than other *Dioscorea* species. They used as alternative food source for scarcity time and used as personal consumption and low economically valued for local trade.

Keywords: morphological, variation, tuber, *Dioscorea*, Pasuruan

P-014

Systematic significance of the leaf venation in genus *Ficus* L. (Moraceae)

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A study was undertaken on 15 *Ficus* species in Peninsular Malaysia. The objective of this study is to determine taxonomic value of leaf venation that could be useful as additional data in classification and species identification i.e; veinlet, ultimate marginal and areolar venation. Based on these characters, the 15 *Ficus* species can be classified into eight groups. The presence of swollen veinlet on the leaf lamina can also be used as additional tool for species differentiation. This study has shown that the leaf venation has systematic value in the genus *Ficus* respectively especially in species identification and differentiation purposes.

Keywords: Moraceae, *Ficus*, leaf venation, leaf anatomy

P-015

Trichomes morphology in flower petal of Acanthaceae species

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A preliminary taxonomic study was carried out on seven Acanthaceae species namely as *Andrographis paniculata, Pseuderanthemum graciliflorum, P. carruthersii, Asystacia gangetica* ssp *micrantha*, *Ruellia repens*, *Justicia comata* and *J. betonica*. The study was undertaken to investigate the morphology of trichomes present on the surfaces of flower petal. Variations found in this study are in their types and density. Based on observation two forms of trichomes are present in all species study which is glandular and non-glandular trichomes. There are six types of trichomes found in this study. Trichomes types is shown to have systematic significance that can be used to differentiate and identify certain Acanthaceae species studied.

Keywords: trichomes; floral anatomy; Acanthaceae

P-016

Systematic study of *Tacca leontopetaloides* in Indoenesia

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Tacca leontopetaloides is a monotypic genus belongs to the family Taccaceae. The species as a pan-tropical species is widely distributed in Old and New World, from West Africa through S. E. Asia including Malesia, N. Australia to Polynesia. It is included one of tuber plant which has important value for food source, in which the tuber contain 90 % of carbohydrate. A series of integrated research activities have been conducted by Biology Research Center – LIPI in order to create alternative food especially for local community at littoral area. A part of the activities such as exploration (in several locations in Java and Bangka-Belitung-Sumatra), morphology, anatomy, and cytological studies have been carried out. Two variants, green and black, are recognized based on morphological observations: petiole, leaves venation, as well as receptacle colors. It is also supported by its leaf anatomy especially on the occurrence of palisade cells in black variants and none in the green ones. The chromosome number of the two variants is similar and confirms with that reported from Africa 2n=30.

Keywords: *Tacca leontopetaloides*, systematic, morphology, anatomy, cytology.

P-017

Notes on the morphological characteristics of *Eurycoma* spp. observed and its status in Peninsular Malaysia

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A study has been carried out on the genus *Eurycoma* Jack in Peninsular Malaysia that aims to ascertain the diagnostic characteristics of the two species that occur in Peninsular Malaysia.

Collections had been made at 15 localities comprising of forest reserves and plantations throughout Peninsular Malaysia covering the 5 regions (i.e. northern, western, eastern, southern & central). The sampling is done in that manner to capture the morphological variations from different habitat. Generally, both *Eurycoma* species were noted to be very similar. They could be clearly distinguished using their fertile parts. *E. longifolia* Jack have long drooping inflorescences or infructescences while in *E. apiculata* A.W. Benn, they are usually short, pointed upwards. It was also noted that there were small differences on the leaflet of *E. apiculata* where the apex of the leaflet was often abruptly pointed and the leaflet base was rounded with inconspicuous petiolule. On the other hand, *E. longifolia* leaflet apex was usually subacute while the leaflet base was slightly asymmetrical with short petiolule. Results from the leaflet cross-section showed the abundance occurrence of unicell trichomes on both adaxial and abaxial surface. This characteristic is absent in *E. longifolia.* The abundancy of *Eurycoma* spp. has decreased.

Keywords: *Eurycoma,* morphological characteristics, Peninsular Malaysia

P-018

Floral and leaf characters of some wild gingers (zingiberaceae: Alpinioideae) in Mindanao, Philippines

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This study focuses on morphology of six wild gingers (Zingiberaceae) in selected areas of Mindanao, Philippines. All six species were previously classified as members of the genus *Amomum*, but are currently recognized as members of four different genera, i.e. *Amomum maximum* Roxb., *A. muricarpum* Elm., *Etlingera dalican* (Elm.) Poulsen, *Etlingera philippinense* (Ridl.) R.M. Smith, *Geocharis fusiformis* (Ridl.) R.M. Smith, and *Hornstedtia conoidea* Ridl. The species thrive in forest edges, inside forest areas having partial shade, steep to flat areas and along river banks and were collected from Mt. Kitanglad, Bukidnon; Impalutao Forest Reserve, Bukidnon; Mt. Malambo, Marilog District, Davao City; Mt. Hamiguitan, Davao Oriental; Bislig Experimental Forest, Surigao del Sur and Bigaan Forest, Surigao del Sur.

Gross morphological studies, floral studies as well as leaf epidermal examinations were conducted. The shape, texture and length of ligule, length of petiole, texture and size of floral bracts, and characteristic of the labellum and calyx are diagnostic characters which can be used to separate the different species. Anatomical observations on the leaf epidermis have shown that *Amomum* have broad subsidiary cells and most of its stomata are located near the veins.

Keywords: *Alpinioideae*, *Amomum, Hornstedtia*, ligule, labellum, stomata, Mindanao.

P-019

Morphological diversity of Kemukus (*Piper cubeba* L.) in java based on Herbarium Bogoriense specimen

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Some cultivars of *kemukus* (*Piper cubeba* L.) ever known in West Java are true cubebs ('Rinu katuncur' and 'Rinu cengke') and false cubebs ('Rinu badak', 'Rinu carulang', 'Rinu pedes' and 'Rinu tembaga'). Taxonomic informations about these cultivars are not clear and not available. The aim of this research is to describe the diversity of *kemukus* in Java as a preliminary research based on the Herbarium Bogoriense (BO) speciments. Characterization was based on Radford (1986) and Vogel (1987). Characters were observed and used to distinguish the variations are leaf shape, leaf base shape, leaf tip shape, colour of upper-lower leaf surface, and type of vein leaf. There are six variations found in Java (Group I-VI). Identification key is constructed in order to differentiate each variation.
Keywords: *Piper cubeba*, morphology, Java

P-020

Leaf flushing as taxonomic evidence of some *Diospyros* Species

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People tend to use generative structures for plant identification. Nevertheless, generative structure availibility limits the identification practice for a plant with once-a-year fruit-bearing phase, such as *Diospyros* L. (*Ebenaceae*). On the other hand, leaf flushing characters are rarely used for plant identification. The unique leaf flushing characters of *Diospyros* have not been explored as a taxonomic evidence yet. Leaf flushing and its taxonomic implication were observed from eight species of *Diospyros* in Ecopark Cibinong Science Center LIPI. Routine observations and morphological characterization were done for three twigs, which have three flushing sets and an apical dormant bud, from each 22 individual trees of *Diospyros*. Morphological development observation showed that bud rhythmic growth produce flushing sets that were usually distinguishable from the previous sets. Leaf flushing time after a period of dormancy and small reduced leaf in some species indicated an arrested growth in the bud. Leaf flushing can be found every few months or all

year around with a period of 40-55 days for the formation of mature leaves. Leaf flushing provided 39 characters as taxonomic evidence of *Diospyros* observed.

Keywords: *Diospyros*, leaf flushing, taxonomic evidence.

P-021

Pollen morphology of underutilised fruit species

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In this study, pollen from 12 underutilised fruit species were obtained from collection at MARDI Headquarters in Serdang and Universiti Putra Malaysia, Serdang, Selangor. The collection was done on February 2012 in flowering season with the objectives to determine pollen morphological characters of 12 species of underutilised fruit species and to determine the closely related fruit species for the breeding programme. The species obtained were *Lepisanthes fruticosa*, *Eugenia uniflora L.*, *Phyllanthus emblica*, *Erioglossum rubiginosum*, *Pouteria campechiana*, *Tamarindus indica*, *Syzygium cumini*, *Syzygium polyanthum*, *Spondias dulcis*, *Ardisia crenata*, *Ardisia elliptica*, *Carissa carandas*. Pollen from fresh flowers were collected and dried in 50-60ºC oven for about 2 days. The pollens were acetolysed using method by Erdtman, 1970 and observed under the light microscope to measure polar diameter, equatorial diameter, wall thickness and P/E.100 ratio to obtain pollen shape. A dendogram was constructed by using all the characters. The study revealed that the similarity between *Syzygium cumini* (Kerian), *Syzygium polyanthum* (Serai Kayu) and *Ardisia crenata* (Mata Pelanduk) clustered in group V in the dendrogram was found to be the highest among the 12 underutilised fruit species. These species can be considered as the best candidate for the crop improvement programme.

Keywords: dendrogram, breeding, closely related, flowering season, acetolysis.

P-022

Preliminary study of morphological variation of Kapulasan (*Nephelium ramboutan-ake*)

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Kapulasan (*Nephelium ramboutan-ake*) is a member of the *Sapindaceae* family, whose population is already rare. These plants are spread across India, Burma, Indonesia, Malaysia, and Philippines. The aim of this study was to examine the variation of leaf and flower morphology of kapulasan in Bogor. The results showed that the leaflet number varied from 2 to 16 leaflets with entire or wavy leaf margin.The types of inflorescences were raceme and panicles. The flower had 4-6 sepals, 5-8 stamens,

2-3 ovaries, and 2-3 stigmas. The stigmas had a curved a form in common, but some plants were V shaped. The fruit skin bulges varied between solitary and grouped.

Keywords: *Nephelium ramboutan-ake*, morphological variation, leaf, flower.

P-023

Seeking character stated of Cassava's tuber

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Study about determination of stated-character of cassava's tuber has been conducted. We investigate five genotype of cassava. We used morphological characterization and isozyme to analyze some morphological of tuber characterization and want to know whether on cassava's tuber has stated-character or not. The dendrogram showed that through we couldn't determine stated-character through morphology's tuber. Eventhough, we found that isozyme banding pattern showed their own banding pattern of each cassava.

Keywords: cassava; dendrogram; tuber.

P-024

Orchid diversity and conservation assessment in Gunung Tahan Heath Forest Reserve Pahang (Peninsular Malaysia)

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Heath forest (also known as Kerangas forest) is a type of tropical moist forest occurs on acidic sandy soil often poor in nutrient. A study was conducted in Gunung Tahan, Pahang montane heath forest reserve to look into how especially the orchid species morphologically modified themselves to survive and thrive in the nutrient deprived heath forest. Thus, this study aims (i) to record orchid species diversity in heath forest Gunung Tahan, Peninsular Malaysia as well as to recognize their endemic species, (ii) to investigate orchid morphological modification that enables the species to thrive in heath forest environment, (iii) to evaluate their conservation status and issues of natural habitat conservation and natural change and (iv) to propose conservation strategies in order to sustain the orchids population in heath forests in Peninsular Malaysia. Ridley (1912) recorded 68 species with 8 species endemic to Gunung Tahan. Though many botanical explorations have been conducted in the

area in recent years, none of the data has been published; therefore there is no new record of orchid species from Gunung Tahan after almost 100 years from the earliest exploration. We believe there would be big changes on the recorded number of species owing to the rapid global climate change that affected the mountainous region significantly. This study would definitely give us further insight in how to conserve orchid species threatened by the global change or alterations caused by human activities or naturally.

Keywords*:* morphological modification; conservation, orchid; heath forest; Peninsular Malaysia.

P-025

Orchid diversity in Gunung Api Purba Nglanggeran, Yogyakarta, Indonesia

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Gunung Api Purba Nglanggeran, Yogyakarta is one of the National Geopark in Indonesia. This area is an interesting site to be studied because of the richness of its flora. This area also have a high human activities so it potential to threatened orchids. This research was conducted to inventory and identify of orchids species on Gunung Api Purba Nglanggeran. This research was used explorative method at the site with altitude 200 – 700 m above sea level. Through the intensive exploration 19 species of orchids have been identified. 11 species are determined as terrestrial orchid, namely *Zeuxine gracilis* (Breda) Blume., *Zeuxine odorata* Fukuy , *Crepidium koordersii* (J.J. Sm) Szlach, *Malaxis* sp. 1, *Malaxis* sp. 2, *Liparis* sp., *Peristylus goodyeroides* (D.Don) Lindl., dan *Nervilia plicata* (Andrews) Schltr., *Geodorum densiflorum* (Lam.) Schltr., *Goodyera* sp., *Pecteilis* sp. . Three species live as epiphyte, namely *Rhyncostylis retusa* (L.) Blume, *Polystachya* sp. dan *Eria retusa* (Blume) Rchb.f. . Five species as litophyte, namely *Luisia zollingeri* Rchb.f., *Coelogyne trinervis* Lindl., *Pholidota imbricata* (Roxb) Lindl. *Bulbophyllum* sp. and *Dendrobium crumenatum* Swartz.. All these species can find in the rain season, but in dry season only 8 orchids species.

Keywords: exploration, Gunung Api Purba Nglanggeran, orchid diversity.

P-026

Orchid diversity in the Mekongga Mountainous Area, South – East Sulawesi, Indonesia

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Mekongga is the highest mountain in South-east Sulawesi Province, which was formed from an atoll raised several hundred million years ago. This phenomenon has created the possibility for specific and perhaps endemic flora and fauna to occur in this area. Until now, the account of the flora of Sulawesi, especially orchid species, is very limited. During field explorations done from 2009 – 2011 in the Mekongga area, 33 orchid species were collected. Three species are endemic to Sulawesi: *Notheria diaphana*, *Dendrobium alderwereltianum* and *Bulbophyllum falculicorne*. There are also some new records found for Sulawesi of species originally only reported from New Guinea, such as *Glomera manicata*, *Phreatia calcarata*, *Cryptostylis carinata*, and *Epiblastus ornithidioides*. *Dendrochilum curranii* var. *serratoi*, was originally described from the Philippines, whereas *Goodyera reticulate* was originally reported only from Java and North Borneo. *Dendrobium acinaciforme* is also new for Sulawesi, although this species has been reported inform the Moluccas. More than 50% of the recorded orchids remain unidentified, and are proposed to be new species in several genera such as *Eria*, *Dendrobium* and *Coelogyne.*
Keywords: orchid, mekongga, endemic, new records, new species.

P-027

The diversity of lowland orchids of Papua

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Tropical orchids constitute the greater part of orchids diversity that can be found in anywhere in the world. More than 25,000 species were identified and 5000 species were found in Indonesia, from lowland to highland. In Papua, exploration of orchids has not been completed due to a complicated geographic mosaic. The study on diversity of orchids at lowland area of south and north Papua (not including Papua Barat Province) showed that there were approximately 139 species of 45 genera. The survey found *Bulbophyllum* 13 species, *Dendrobium* 52 species, *Grammatophyllum* 5 species, *Agrostophyllum* 4 species, *Coelogyne* 4 species, *Eria* 4 species, *Papiopedillum* 3 species, *Phaius* 3

species, *Phreatia* 3 species, *Plocoglottis* 3 species, whereas other genera were only found less than 3 species each. Data of species from other areas remained unknown. Further exploration still needed in regard to increase the number of orchid species and also possibility to find new species of orchids from area of Papua region. Beside that, the establishment of new regencies all around Papua in recent years gives adverse impact to the plant habitats including orchids species. It is an urgent task to study and document these species in the wild before it is too late.

Keywords: diversity, orchids, lowland, Papua.

P-028

Distributions of Vandaceous Orchids in Peninsular Malaysia

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Vandaceous orchids are represented by 83 genera and about 1200 species worldwide. Their distributions are mainly fall in tropical Asia region. These groups of orchids are represented by 44 genera with 172 species in Peninsular Malaysia which included the following common known genus, namely *Acampe, Aerides, Arachnis, Ascocentrum, Papilionanthe, Phalaenopsis, Renanthera, Rhynchostylis, Vanda* and *Vandopsis*. Some of the *Aerides, Renanthera* and *Vanda* species are used in generating hybrids with ornamental and fragrant properties. *Vanda helvola* is currently the only *Vanda* species in Peninsular Malaysia. It has both ornamental and fragrant characteristics. However, the status and distribution of vandaceous orchids are not updated due to the difficulties in discovering these mostly epiphytic orchids in the wild. Due to their great potential in commercial field, we reviewed the distribution of the vandaceous orchids in Peninsular Malaysia. This review may contribute to the rediscovering of more vandaceous orchids for their ornanmental and fragrant characteristics for commercial uses.

Keywords: distributions; vandaceous orchids; Peninsular Malaysia; *Vanda*; fragrant characteristics; ornamental values.

P-029

Orchid inventory in Bantimurung-Bulusaraung National Park

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Bantimurung Bulusaraung National Park (or abbreviated as Babul National Park), is located in South Sulawesi, covers an area of 43.750 hectares. Geographically, this area lies between 119°34'17" - 119°55'13" East longitude and 4°42;49" - 5°06'42" South latitude. Located in the transition area of Asia and Australia zone, the National Park has many unique flora and fauna.
Inventory of orchid species in Babul National Park has been conducted to study the orchid diversity in that area. There were approximately 60 orchid species found which consist of 33 genera, including 44 species of epiphytic orchids and 16 species of terrestrial orchids. The findings show that *Habenaria medusa* is very common terrestrial orchid whilst *Aerides inflexa* is very common epiphytic orchid in this area. The latter species has known as an endemic orchid of Sulawesi. The diversity of orchids in this area will aslo be presented and discussed.
Keywords: orchid, inventory, Babul National Park, South Sulawesi

P-030

Orchidaceae rescued from Bakun Hydroelectric Project (HEP) Dam, Belaga, Sarawak, Borneo

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The Bakun HEP is located on the Balui River about 37 km upstream of Belaga town, Sarawak. The reservoir of the dam covers an area of approximately 695 km^2, spanning over the Sg. Balui, Sg. Murum, Sg. Bahau and Sg. Linau. Most of the areas were covered by forests on mountainous terrain and steep slopes, while the reminder has lower slopes affected by shifting cultivation or covered by secondary forests. A Wildlife Rescue and Monitoring Plan (WiMOR) was carried out in order to save as many flora and fauna affected by the impoundment. Areas affected by the impoundment were all forests below 228 m a.s.l., where most of the rescue works were done from 2009 till 2011. More than 400 specimens of Orchidaceae were rescued, comprising likely more than 200 species from about 48 genera. The most abundant genus is *Bulbophyllum* with 81 specimens rescued, consisting of at least 40 species. To date, only 88 species have been identified. Of these, 12 species are endemic to Borneo and one species [*Dendrochilum rufum* (Rolfe) J.J.Sm.)] has only been recorded from Sarawak before. Some of the species rescued were rare and some have yet to be identified even with flowering

materials. The rescued orchids were then planted back at Bakun sites as well as for *ex-situ* conservation at Semenggoh. These records are valuable as the original localities and habitats were flooded forever, and probably some of the species are new to science.

Keywords: Bakun HEP, Orchidaceae, *Bulbophyllum*

P-031

P-032

Optimization of seed germination of an Indonesian threatened orchid *Dendrobium laxiflorum* J. J. Sm.: A perspective of *in vitro* orchid conservation

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Dendrobium laxiflorum is nationally listed as one of Indonesian threatened orchid species and is in the priority of conservation. One of conservation programs of this species is propagation through *in vitro* seed culture to generate a large number of seedlings with the first key step is seed germination. This paper highlighted optimization of seed germination of this orchid on media KC in three experiments (i) various inorganic nitrogen source and concentration (nitrogen sources: ammonium, nitrate, and ammonium nitrate; nitrogen concentrations: 0 mg/l; 63,75 mg/l; 127,50 mg/l; 255,00 mg/l; 382,50 mg/l; and 510,00 mg/l) (ii) vitamins and their concentration (vitamins: niacin, pyridoxine, and thiamine; vitamin concentrations: 0; 0,1 mg/l; 0,3 mg/l; and 0, 5 mg/l) (iii) and plant growth regulators 2,4-D (0 mg/l ; 0,1 mg/l ; 0,3 mg/l and 0,5 mg/l) and BA (0 mg/l ; 0,5 mg/l ; 1 mg/l ; 1,5 mg/l and 2 mg/l). The results of the experiments showed that ammonium nitrate with total nitrogen concentration 63,75 mg/l induced the highest percentage of seed germination. Thiamine was the best vitamin for seed germination of *D. laxiflorum*, and the highest percentage of seed germination was on thiamine with a concentration of 0,1 mg/l. 0,1 mg/l 2,4-D and 2 mg/l BA was also found significantly increased the percentage of seed germination. The results of these experiments were compiled to assess nutritional and cultural requirements for the efficient seed germination in *in vitro* propagation of this orchid that is vital in the conservation of this threatened orchid.

Keywords: *Dendrobium laxiflorum*; threatened orchid, seed germination, optimization.

P-033

Applying extreme learning machine to orchid species identification

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In recent years, information technologies have been introduced into biological sciences. Some have focused on plant taxonomy to help the deficiency of people's classification ability. In this paper, we proposed the new method for orchid species identification using image processing and pattern recognition. We use orchid flower image as input for the system, extract on the shape and color feature, and identify species by applying the one of soft computing method called Extreme Learning Machine (ELM). The comparative study on system performance is conducted between ELM and the method from the previous research-Probabilistic Neural Network (PNN). Results show that ELM method can recognize orchid species with accuracy 85.47%. The identification accuracy of ELM method is higher than PNN method.

Keywords: orchid species identification, extreme learning machine, image processing, shape and color feature.

P-034

Potential fragrance production and release sites of *Vanda mimi* Palmer

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Vanda Mimi Palmer (VMP) is commercially viable for its strong but sweet fragrance. However, little is known regarding the fragrance production and emission sites on the flowers. The anatomy of VMP flower was studied using scanning electron microscopy (SEM) and light microscopy, and the fragrance production glands and release sites were identified by histochemical assays and stainings. Examination of dissected floral parts using the human nose detected fragrance emission only from the petals and sepals. Fresh sepal and petal tissues were found to contain dense distribution of stomata and trichomes, concentrated mostly around the outer margins. The epidermal and sub-epidermal

layers of these tissues contain rich deposits of starch that can be correlated as the fragrance production site. Neutral red (NR) staining revealed the edges of the petals and sepals stained stronger than the rest of the tissues indicating more intense fragrance is being perceived. Knowledge of the fragrance production and secretion sites complemented our earlier molecular and biochemical work on VMP scent and this may have economic value for tapping the sites in bulk production of essential oils. Availability of the morphological information can be of taxonomical value for the identification of *Vanda* species.

Keywords*:* Orchid, morphology, trichome, stomata.

P-035

Flowering phenology of Pinang Gajah (*Nenga gajah* J. Dransf.) at Bogor Botanic Gardens

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Pinang gajah (*Nenga gajah* J. Dransf.) is a species of palm, grown in the collections at the Bogor Botanic Gardens, and categorized as vulnerable according to IUCN criteria (2012). This is due to the destruction of the natural habitat of this species, caused by high rate of deforestation. *Nenga gajah* grows naturally in Sumatra only, with a very limited distribution area in West Sumatra, Bengkulu, Jambi and Riau, in areas adjacent to the stream of water in forest and forest edges, up to 800 m above sea level. This flowering phenology study aims to determine flowering timings for the species, and the factors that influence the development of flowering, pollination and fruiting formation. Material observed comprises 7 collections from the Bogor Botanic Gardens and 1 collection from the Gardens' nursery, of varying ages. *Nenga gajah* flowering proceeds as follows: (1) initiation to bud inflorescences phase (flowers still covered by bract inside to bract opening) 8–9 months, (2) anthesis phase (flowers arranged in 2-4 rachillae to male flowers falling) 20 – 25 days, and (3) young fruit phase (female flowers anthesis until young fruit produced), 15 – 20 days. *Trigona* sp. is the only insect visitor and might be a pollinator during flower anthesis. The insect visits the flowers between the following hours: 07.00 – 09.00 and 15.00 – 15.00. In this study, development of flowering, pollination and fruit production were not directly affected by a number of environmental factors.

Keywords: *Nenga gajah*, flowering phenology, collection, Bogor Botanic Gardens

P-036

Preliminary study on artificial pollination of Bidang (*Borassodendron borneense* J. Dransf.) at Bogor Botanic Gardens

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Bidang (*Borassodendron borneense* J. Dransf.) is an endemic and dioecious palm species found in Borneo, and growing Bogor Botanic Gardens. This species grows naturally in lowland Dipterocarp forest. Preliminary studies on artificial pollination aims to obtain fruit, because male and female individuals are not located on adjacent sites. The collection was observed is one female individual of 11 years old located in II.F. 140. and two male individuals of 23 years located in XII.E.190 and 33 years located in II.F. 108. The pollen used for pollination were fresh pollen and stored pollen. On using fresh materials, pollen were attached to receptive female flowers, whereas when using previously stored pollen, pollen was spread directly onto the stigma of female flowers. The inflorescences phase on female and male as follows: (1) initiation phase, (2) bud phase, (3) receptive phase, and (4) fruit phase (only for female flowers). In female inflorescence, duration of initiation phase about 2 months, bud phase 10 – 15 days, 7 days of receptive phase and phase of young fruit 10 days. In male inflorescences, 2 months for initiation phase, bud phase 10 – 15 days, and 4 – 5 days for receptive phase. Female flowers that were successfully pollinated showed progress after 10 days. The use of fresh pollen for artificial pollination gave better results than using stored pollen.

Keywords : *Borassodendron borneense*, collection, Bogor Botanic Gardens, Artificial pollination.

P-037

The phylogeny and biogeography of the rattan *Calamus javensis* Blume complex (Arecaceae, Calamoideae)

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Calamus javensis Blume is known as a polymorphic taxon. It is widely distributed in South-East Asia from Southern Thailand to Sumatra, Java, Borneo and the Philippines. The leaves, spines and inflorescences show considerable variation within the distribution area. In an attempt to disentangle the species complex, several new species and varieties have been described, but all lack comprehensive information. A variety of apparently distinct taxa that are clearly related to *C. javensis* are presented, some of which occur sympatrically with typical *C. javensis*. Several have been described as separate species. Inadequate understanding of both the limits between closely related taxa and relationships among them have attributed to a growing problem in the field of taxonomy that

directly influences justified recommendations on conservation. To address these problems, a combination of taxonomic revisionary work based on thorough examination of herbarium records and material obtained via fieldwork, and phylogenetic and phylogeographic analyses based on molecular data will be performed. The results will provide valuable information regarding the genetic diversity within the complex and this in turn will help in understanding the morphological variation of the species complex and presents conservation category assessments.

Keywords: Arecaceae, *Calamus javensis*, phylogeny, phylogeography.

P-038

The unique characters of coconut (*Cocos nucifera* L, Arecaceae) in Bali, Indonesia.

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Coconut is one of important plant In Balim, beside of its economic value, it also used for religious related and medicinal purposes. Morphologically, some coconut plants differ in some characters, which is very unique and specific to its individual plant. Based on the unique characters, there were more than twenty unique coconuts identified that differ individually. Some of them are the *ancak* which has branched stems, the *be julit* has plicated lamina leaves, the *bingin* has the root growth from nodes stem, the *Bojog* has fruit husk colored like the hair of long tailed monkey. Differences in fruit color such as white, green, yellow and red were used to distinguish between the *bulan*, *gadang*, *gading* and *surya* coconuts respectively. Inflorenscentia spicata was characteristic of *bluluk*, while the *udang* and *mulung* were characterized by red mesocarpium. The *Rangda* coconut has petiole and the apex of the stem were twisted, the *menjangan* coconut has branched spikelet as in deer horn, the *sangket* has hoked primordial tip leaves. The coconut fruit with predominance husk and little seed is the *kebo*. The *sudamala* was characterized by many kinds of unique characters, which some of them are double spatha, and flat apex of male spikelet.

Keywords: specific morphology, tranditional medicine, unique coconut.

P-039

Amorphophallus titanum (Becc.) Becc. ex Arcang.: seed germination with mini flower phenomenon

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Amorphophallus titanum (Becc.) Becc. ex Arcang. is famous as the gigantic inflorescense. It is also a prospective plant with 20% glucomanan contents (Ananto, 2000). Various cultivation techniques have been conducted such as how to germinate the seeds. Previous studies by Roemantyo (1991) and Latifah *et al*. (2001) have not produced a faster and better germination rate. Therefore this research was aimed to test the following hypotheses: (1) Fruit epidermis and the pericarp inhibited the germination, (2) testa/seed coat inhibited germination, (3) GA_3 hormone promoted the germination rate. The germination pattern was also monitored. The experiments consisted of: (1) Experiment 1: sowing the fruit with the seeds inside and (2) Experiment 2 with two treatments: testa peeling and GA_3 hormone treatments.

The results of Experiment 1 showed that the fruit epidermis and the pericarp inhibited the germination for 124 days on the final day of the experiment. Experiment 2 resulted in: (1) the delay of the germination for 7-35 days caused by the testa/seed coat, (2) GA_3 hormone promoted the germination rate 2,19 coefficient of germination rate. In this experiment, there was a phenomenon of the initiation of four mini inflorescense at seedling stage that may be stimulated by the application of 1000 ppm GA_3 hormone; however further research was required. We also recorded developmental stages from the seed germination, first-leaf emergence and tuber development in series of photographs overtime during the experimental period referred to Kikuta et al. (1938) in another species of Aroid.

Keywords: germination, *Amorphophallus titanum*, GA_3 hormone, mini inflorescense.

P-040

Variations of *Durio* in Central Bangka Regency, Bangka Belitung Province Based on Morphological Characters

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Many species of *Durio (Bombacaceae)* produce edible fruits. A few species have been already cultivated in agricultural lands and back-yard gardens in Bangka Belitung Province, especially in the Central Bangka Regency, which is well known as the Durian centre. This study aimed to explore and observe the morphological characters of *Durio* cultivated by local people in Desa (*Village*) Namang,

Desa Air Mesu, and Desa Teru. The result showed that two species of *Durio*, were found in the above villages, i.e. *Durio zibethinus* and *D. kutejensis,* sixteen landraces of *D. zibethinus* were also planted in those villages. They could be identified by the crown shape, leaf shape, and fruit shape. The tree crown varies in shape from pyramidal, oblong, to semi circular. The leaf shape varies from oblong, ovate to lanceolate. The fruit may be oblong, globose or globose with 5-lobes in shape. .

Keywords: *Durio,* Central Bangka Regency, morphological character, cultivated.

P-041

Comparative leaf anatomy of *Pandanus*, *Freycinetia* and *Sararanga* (*Pandanaceae*) and their diagnostic value

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Study in leaf anatomy of 33 sample of the species classified under genus *Pandanus*, *Freycinetia* and *Sararanga* of *Pandanaceae* had been undertaken to unravel generic relationship among of these taxa with a view to provide a set of diagnostic characters for taxonomic identification. Four anatomical diagnostic characters had been identified at the generic level such as present and absent of papillae, stomatal arrangement type, present and absent of bundle sheath extension and hypodermal thickness and shape. *Pandanus* had papillae present, stomata amphistomatous, bundle sheath extension present and thin and rectangular hypodermis; *Freycinetia* lacked of papillae, stomata hypostomatous or amphistomatous, bundle sheath extension absent and hypodermis thick and hexagonal or rounded; meanwhile *Sararanga* poses papillae absent, stomata amphistomatous, bundle sheath extension absent and hypodermis thin and flatten. An identification key to the genera based on anatomical diagnostic characters is provided.

Keywords: leaf anatomy, *Pandanus*, *Freycinetia*, *Sararanga*, Pandanaceae.

P-042

Petiole anatomy of some species in *Schefflera* Spreng. (Araliaceae)

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A study was undertaken on petiole anatomy of five *Schefflera* Spreng species, namely as *S. obovatilimba,* S. *opacus, S. lineamentorum, S. lanata* and S. *Kinabaluensis.* The genus *Schefflera* is

belonging to the family Araliaceae. The objective of this study is to determine variations in the petiole anatomical characteristics that can be used to construct a dichotomy identification key of species in the genus *Schefflera*. Leaves samples were collected from various forest reserves in Peninsular Malaysia, then were fixed in AA (Acetic acid: Alcohol, in a ratio of 1:3), the petiole part then were sectioned using sliding microtome and were stained using safranin and alcian blue, mounted using Canada balsam and observed under light microscope. Findings in this study have shown that all species studied are having similar anatomical characteristics in the shape of petiole outline, in the presence of mucilaginous canal and in the petiole vascular bundles structure (distally form two concentric circles with the inner consists of vascular bundles with an inverse orientation). The variations are observed in the arrangement and number of vascular bundles. The occurrence of starch grains, crystals and schlerenchyma cells are some diagnostic anatomical characteristic that can be used in direct species identification. As a conclusion, the variations in the petiole anatomical characteristics is outstanding and can contribute in direct authentification of species and definitely has taxonomic value in the genus *Schefflera* respectively.

Keywords: Araliaceae, *Schefflera*, petiole anatomy, vascular bundle.

P-043

Leaf architecture of the *Daphniphyllum* (Daphniphyllaceae)

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Daphniphyllaceae is a monogeneric family with a main distributional range from tropical to subtropical South East or East Asia. Totally, *Daphniphyllum* consists of about 30 species in the world. Not many useful morphological characters can be found because of the reduced reproductive organs and the variable leaves, which has led to difficulties in intrageneric classification and species identification. To find out more good and diagnostic characters for the delineation of species in the family becomes important and necessary. This study attempts to evaluate the characters of leaf venation for taxonomy of the family.

We sampled 24 species leaves of *Daphniphyllum* and used clearing methods in this study. All observed leaves have pinnately veined. The pairs of lateral veins for all observed species fall about a range of 6-18 which may be helpful for taxonomy. The important findings of this study for taxonomy are 2° vein category (weak brochidodromous or brochidodromous), 3° vein category (gradually, abruptly or equally reticulate), and FEVs of minor vein (unbranched to 1- branched or 2 more branched). These features are helpful in distinguishing taxa of *Daphniphyllum*.

Keywords: Leaf venation, vein category, taxonomy.

P-044

Flowering and fruiting times of four species *Annona* (Annonaceae) in Purwodadi Botanic Gardens

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Annona is a genus belongs to Annonaceae family, consisting of numerous species that produce edible fruit. Four species namely *A.glabra, A. montana, A. muricata* and *A. squamosa* collections of Purwodadi Botanic Garden were recorded on its flowering and fruiting times, since November 2010 to April 2013. The data were scored and complemented with climate data (temperature, rainfall intensity, humidity) then analyzed using multiple linear regression analysis. The result showed that, humidity was the most climate factors that affected on the flowering and fruiting times of those species. Specifically, rainfall intensity (0-550 mm) affected to *Annona muricata*, temperature (25,56-28,33 °C) and humidity (66,83-85,02%) to *Annona squamosa*, and humidity to *A. glabra* (71,62-85,02%) and *A. montana* (71,62 to 82,94 %) as well. Flowering time of *Annona muricata* occur throughout the year and fruiting twice a year in wet month, while in *A. montana and A. squamosa* recorded once a year during the wet month. *Annona glabra* is in flowers and in fruits in wet and dry month, however, it flower three times a year and in fruit only twice a year.
Keywords: flowering and fruiting times, climatic factor, Annona, Purwodadi Botanic Garden.

P-045

Bud development and flowering phenology of *Rafflesia kerrii* in Lojing Highlands, Kelantan, Peninsular Malaysia.

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Rafflesia holds the record of the biggest flowers in the world and generates income for Malaysian eco-tourism industry. Extensive knowledge on the ecology of *Rafflesia* is required to develop strategies for conserving the interesting plant and providing information for tourist. Unfortunately, the lack of information about this plant is one of the main obstacles in its study. Fieldwork on *Rafflesia* is also difficult and takes a long time. Therefore, a study on bud development and flowering phenology of *Rafflesia* were carried out in Lojing Highlands, Gua Musang, Kelantan. A total of 17 populations were marked and monitored for a period of about 19 months (May 2011-November 2012). One taxa of *Rafflesi*a was recognized namely; *Rafflesia kerrii*. A total of 519

Rafflesia buds from 17 populations were observed. A total of 49.5% (257 buds) died before reached anthesis point. The highest mortality rates occurred in February when 39.4% (43 buds) died compared with April where is only 9.9% (10 buds) died. The mortality rates were highest at Population 12 where is about 100% of buds were found damaged. An average of 18 buds of *Rafflesia* died in each population. About 239 flowers bloomed from May 2011 until November 2012. An average diameter size of the flower was range between 50 cm and 90 cm in length. The buds with diameter between 8.0 cm and 9.0 cm took approximately 260 days to bloom. The most active host that was produced blooming flower, has stems between 10 cm and 15 cm diameter, consists of 50% out of all blooming flowers. The status of *Rafflesia* population in Lojing Highlands is more threatened and considered endangered because it is a species occur mainly just outside of protected areas. Conservation program should be introduced to protect the population of *Rafflesia* in this area.

Keywords: anthesis, bud development, mortality, Lojing Highlands, *Rafflesia kerrii.*

P-046

Phenology pattern of four Purwodadi Botanic Garden figs species (*Ficus benjamina, F. hispida, F. racemosa* and *F. virens*) collection during three years period

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Ficus, as one of Moraceae family which has high interval of adaptive life range. Some of the species from the genus of *Ficus* have known for their big role as conservation plant. This research was held to know the phenology pattern of four species of *Ficus* (*F. benjamina, F. hispida, F. racemosa* dan *F. virens*) as their respon of the macro climate in Purwodadi Botanic i.e; temperature, rainfall and humidity. Phenology activities observations on four *Ficus* species were carried out once a week for three years (2010-2012) by scoring (0-4) method on the abundance of leaves and fruits. Data were analyzed statistically and descriptively. Analysis result showed that phonological activities of four *Ficus* were closely related to rainfall. Falling leaves activity of *F.benjamina*, *F. virens* and *F. racemosa* increased by the decreasing of rainfall. However, those three trees did not experience in total fall leaves, while *F. hispida* did not show the same respon. The formation of young fruits on three trees (*F. hispida, F. virens* and *F. racemosa*) also related with the rainfall, whereas *F. racemosa* produce fruits throughout the year. On the other hand, the formation of young fruits on *F. benjamina* was related with the fluctuation of relative humidity.

Keywords: phenology activity, *Ficus,* climate factors, Purwodadi Botanic Garden

P-047

Do pollen morphology, diameter, viability and germination capacity of some wild bananas differ to cultivated bananas?

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The study was conducted using twenty banana varieties grown at the experimental garden of Botany Division of The Research Center for Biology LIPI to know if pollen morphology, diameter, viability and germination capacity of some wild bananas differ to cultivated bananas. Pollen of those banana varieties were freshly collected and prepared by an acetolysis preparation procedure to observe its morphology and diameter. The image of acetolyzed pollen preparation was captured by Nikon Eclipse 80i accommodated with monitor and the diameter of pollen was digitally measured by 'Motic Image Plus 2.05' computer program. Pollen viability was checked freshly by an acetocarmine test while its pollen germination capacity was by Sarfatti pollen germination solution. The result showed that though morphological aspects of pollen of those banana varieties were almost the same, pollen diameter of wild banana varieties tend to be lesser than cultivated bananas one. No specific relationship between the pollen diameter and pollen viability as well as pollen germination capacity. Pollen of wild varieties generally tended to be more viable and more able to germinate than cultivated varieties. Possible scientific implication of present study that should be traced in the genomic aspects of those banana varieties is also described.

Keywords: wild banana, cultivated banana, pollen, pollen diameter, viability, germination capacity.

P-048

Diversity and characteristic of pisang raja cultivars (*Musa* x *paradisiaca* L.) collection of Purwodadi Botanic Garden

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Being part of the center of bananas diversity, Southeast Asia region including Indonesia posseses great wealth of banana diversity. Pisang Raja is a well-known clone in Indonesia, Malaysia and the Phillippines. It characterized by its large fruit with thick coarse skin, orange; flesh creamy-orange, coarse texture and sweet tastes. It is big and vigorous clone resistant to Panama disease and Leaf spot but its fruits though sweet are not very attractive. Morphological observations have been conducted at Musa germplasm collections of Purwodadi Botanic Garden subjected to 17 different types of Pisang Raja cultivars originated from Yogyakarta, Central Java and East Java i.e. Raja Lumut, Raja Talun, Raja Ketan, Raja Siem, Raja Buntet, Raja Warangan, Raja Marto, Raja Bandung, Raja Mantri, Raja

Pulut, Raja Nangka, Raja Dengkul, Raja Gintung, Raja Prentel, Raja Lingi, Raja Kenanga and Raja Wesi. Pisang Raja, is such a hybrid and should correctly be written as Musa x paradisiaca L. since it is a triploid hybrid with 3 sets of genomes contributed by *M. acuminata* (A genome) and *M. balbisiana* (B genome), with possible genome configurations AAB and/or ABB. Taxonomic scoring results show that mostly Pisang Raja cultivars were grouped into AAB genome and five cultivars were grouped into ABB genome i.e. Raja Siem, Raja Bandung, Raja Mantri, Raja Prentel and Raja Wesi. An exception for Pisang Raja Kenanga was grouped into AAA genome. Their morphological characteristics were varies, mostly they have intermediate characters from their ancestral parents. This work is a part of a longer-term systematic evaluation of all *Musa* collection of Purwodadi Botanic Garden. It may provide a base for judging the rich local genetic variety of Indonesian bananas.

Keywords: Banana, characteristic, cultivar, diversity, *Musa x paradisiaca*, Pisang Raja, Purwodadi Botanic Garden.

P-049

An account of Sulawesi wild banana

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Many expeditions have been conducted to enumerate flora diversity in Sulawesi but few of them addressed the wild bananas. Only three *Musa* species (*Musa acuminata* Colla, *M. celebica* Warb. *ex* K. Schum. and *M. textilis* Née) have been reported from this island by Nasution. By examining 110 sheets specimens deposited in BO and several field works conducted in Sulawesi, six *Musa* species have been recognized. One species collected from Donggala, Central Sulawesi is considered as a new species. Two species (*M. balbisiana* Colla and *M. itinerans* Cheesman) are newly recorded and two species (*M. acuminata* var. *tomentosa* (K. Sch.) Nasution and *M. celebica* Warb. *ex* K. Schum.) are already known as endemic to Sulawesi. Circumscriptions for each species is delineated and identification key is formulated.

Keywords: *Musa*, new records, new species, Sulawesi, wild banana.

P-050

Diversity of *Indigofera* in Java and Madura

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The objective of this research was to know diversity *Indigofera* spp. in Java and Madura based on morphological characters. A total of 56 samples *Indigofera* plants used in this study were collected from Java and Madura which cover 5 province: Gunung Kidul, Bantul, Kulonprogo (Yogyakarta); Kebumen, Purworejo, Temanggung (Central Java), Pacitan, Tuban, Bangkalan, Pamekasan, Sampang (East Java); Cirebon, Pelabuhan Ratu, and Bogor (West Java); Serang, Cisimut, Sajira (Banten). The sample collection was conducted on July 2012 to September 2013. Identification of morphological characters was done by direct observation of all parts of the *Indigofera* plant (leaves, stems, flowers, fruits, seeds, trichome, etc.). Eigh species of *Indigofera* has been identified as *I. tinctoria, I. suffruticosa*, *I. arrecta, I. hirsuta, I. zollingeriana, I. trifoliata*, *I. linifolia*, and *I. galegoides*. Morphological characters that distinguish 8 species of *Indigofera* of 111 characters include: habit, leaves or leaflets, stipule shape, peduncle length of inflorescences, inflorescence type, bracts, flower size, dried foliage, calyx lobe length, calyx indumentum, calyx vexillary lobes, standard, wing petals, keel, anther, ends of staminal filaments, style, stigma, pod position with pedicel, remnant in base pod, pod valves, pod surface, pod shape, seed number, seed colour, seed size and trichome shape in all parts.
Keywords: diversity, *Indigofera*, Java and Madura.

P-051

Diversity of ramin (*Gonystylus spp.*) non bancanus in East Kalimantan, Indonesia

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Study of *Gonystylus* spp. diversity in East Kalimantan was conducted from June until December 2009 at five locations, i.e: PT. Inhutani II Concession Forest, Malinau in June 2009, Sungai Wain Protected Forest, Bukit Bangkirai and Wanariset-Samboja-Balikpapan in August 2009, PT. ITCI Forest Concession and Gunung Lumut Protected Forest-Paser District in December 2009. There are six *Gonystylus* species were found from this

study, namely; *Gonystylus affinis, Gonystylus brunnescens, Gonystylus consanguineus, Gonystylus forbesii, Gonystylus keithii and Gonystylus velutinus*. The species grown in primary forest with flat to hilly topography with altitude ranges from 20 to 500 m above sea level, on sand clay soil with pH between 5.1-6.8, soil moisture between 20%-75%. *Gonystylus brunnescens* was found abundant with the good natural regeneration, especially in Sungai Wain Protected Forest, Bukit Bangkirai and PT.ITCI Forest Concession, the other five species were found in small population, from 1 to 5 individuals in all locations visited.

Keywords: diversity, *Gonystylus spp*, East Kalimantan.

P-052

Myrtaceae: The diversity in Mekongga, South-East Sulawesi, Indonesia

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Myrtaceae (Jambu-jambuan) included a member of plant that known as a produces of essential oils, wood and fruits. In Indonesia there are about 30 genera and approximately 450 species.

In 2010-2012, inventory and exploration have been comes out in Mekongga. Mekongga is a mountain located on the island of Sulawesi, Indonesia Islands. This mountainous region stretches along the western province of Southeast Sulawesi and territory covers three districts namely North Kolaka, Kendari and Kolaka District. The highest peak reaches 2620 m asl.

From the results of the inventory and exploration in the mountainous region Mekongga have been collected by 7 genera, 25 species, including one species thought to be new species (*Syzygium* nsp.), tree species as new record (*Tristaniopsis microcarpa* ssp. *corymbosa*; *Eugenia sibuyanensis, E. burubidensis*).

Keywords: Myrtaceae, species, Mekongga, South-East Sulawesi.

P-053

Hoya and *Dischidia* (Apocynaceae–Asclepiadoideae) of Papua New Guinea

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The majority of *Hoya* and *Dischidia* species described from Papua New Guinea (PNG) are based on collections obtained during several general botanical explorations from the end of 19th century until the First World War. Key contributions in the knowledge of Asclepiadoideae in PNG were by German botanist Rudolph Schlechter.

Significant collections of PNG’s Asclepiadoideae were not made again until the 1990's, when Paul Forster and David Liddle discovered some new species and brought others into cultivation. With their contribution the number of *Hoya* species in PNG reached 75, a number comparable to that of areas much more thoroughly investigated such as the Philippines.

Available herbarium collections are geographically concentrated around major towns in Morobe and Madang Provinces. New collections from unexplored areas are thus likely to reveal novel taxa.

Due to the rapid loss of primary habitat in PNG by logging activities and by the needs of an expanding population, a decision was made to conduct extensive fieldwork throughout PNG for several years, aimed at collecting herbarium specimens and living plants of *Hoya* and *Dischidia* for cultivation in *ex situ* collections.

By the end of the second year, 36 field trips gained at least 54 *Hoya* and eight *Dischidia*, of which 14 are being described as new. Ten of the collected identified species were earlier known only from the type specimen, and about 50% of the overall collected taxa were never photographed before.

Keywords: endemism, new species, field exploration.

P-054

Diversity of *Pandanus* and *Sararanga* in Cyclop Nature Reserve and its surrounding area

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An exploration and inventory of Pandanus and Sararanga have been carried out around Base-G beach, Hamadi beach, and Cyclops Nature Reserve. The results recorded 1 species of *Sararanga* (*Sararanga sinuosa* Hemsley) and 16 species of *Pandanus* (*P. leptocaulis* Merr. & Perry, *P. odoardi*

Martelli, *P. leiophyllus* Martelli, *P. congregatus* St. John, *P.tectorius* Parkinson, *P. daymanensis* St. John, *P. dolichopodus* Merr. & Perry, *P. conoideus* Lam., *P. polycepalus* Lam., *P. dubius* Spreng, *P. galore* Stone, *P. iwen* Stone, *P. brosimus* Merr & Perry and the other three still unidentified *Pandanus* sp. 1, *Pandanus* sp. 2, *Pandanus* sp. 3). Identification key, description and its distribution will be presented in the paper.

Keywords : Base-G beach, Cyclop Nature Reserve, Diversity, Hamadi beach, *Pandanus*, *Sararanga*.

P-055

Acanthaceae of Gunung Baung, East Java

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A study on ground cover vegetation at the Gunung Baung Natural Recreational Park in Pasuruan, East Java was conducted with the aim to investigate the species richness, abundance and morphological variations of species of Acanthaceae. Five study sites were established in the area. A combination of transect and quadrat methods was used, where 50 quadrats of 2 x 2 m each was systematically distributed along 5 parallel transects in each of the five study sites. Four species of Acanthaceae were recorded, *i.e. Hypoestes polythyrsa, Sericocalyx crispus, Thunbergia alata* and *Thunbergia erect*a. Most of the species were found in the study site on the southeastern part of the Gunung Baung NRP. They were considered insignificant components of the ground cover vegetation since their importance values were small (IV < 10 %). The ground cover vegetation was instead dominated by other species, such as *Tithonia diversifolia* (IV=45.26 %) and *Mikania macrantha* (IV=21.86 %).

Keywords: Acanthaceae, ground cover vegetation, Gunung Baung, East Java.

P-056

The diversity of *Syzygium* species at Gunung Baung

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Syzygium is a genus in Myrtaceae that contains a large number of species. They are very diverse and have a wide distribution. The Gunung Baung Natural Recreational Park (GBNRP) in Pasuruan, East Java, is one of so many places where a relatively abundant species of *Syzygium* may be encountered. A study of diversity, distribution and morphology of *Syzygium* species was undertaken in the GBNRP. The inventory using the method of exploration and species characterization revealed the occurrence of six species in the area, *i.e. S. cumini, S. littorale, S. pycnanthum, S. polyanthum, S. racemosum,* and *S. samarangense.* The most abundant and frequent species encountered in the area was *S. pycnanthum*. Cluster analysis resulted in three grouping of species, reflecting the differences in morphology and field characters. Only *S. polyanthum* and *S. samarangense* that have been well known and cultivated by local people living in the vicinity of Mt. Baung. The other four species are considered wild whose potential uses are yet to be uncovered.

Keywords: *Syzygium*, diversity, Gunung Baung, East Java.

P-057

Diversity of *Durio kutejensis* in Indonesia

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The tropical fruit plants native from Indonesia which are starting rapidly to cultivation is Durio kutejensis or Lai. This species has superior characters than D. zibethinus that had already been widely cultivated in Indonesia, Malaysia, and Thailand. They are tree less than 8 m, fruiting 5-7 years old, blunt spines, aril strikingly colored, ripe fruit not odour, and storage time 7-8 after harvest. This study aimed to observe the morphology and trichome shape variations of D. kutejensis which collected from cultivation centers, such as: East Kalimantan Province (3 locations), North Kalimantan Province (5 locations), South Kalimantan Province (2 locations), Bangka Belitung Islands Province (1 location),

West Java Province (4 locations), and Banten Province (1 location). Based on 145 collection numbers, they were identified into 24 landraces. The landraces can be distinguished based on canopy shape (pyramidal, oblong, semi-circular, umbrella), branching forms (erect and spreading), leaf shape (oblong, oboblong, lanceolate), flower color (dark red, pink), fruit shape (globose, globose with 5-lobed, ovate, ovate with 5-lobed, oblong, oblong with 5-lobed), spine shape (pyramidal, caudate), flesh texture (soft, fibrous), flesh color (dark yellow, orange), fruit flesh thickness (0.5-1.5 cm), and the taste of sweet fruit like papaya flesh. The trichome shape covers the twig (complex peltate scale), leaf (complex peltate scale, cushion stellate hairs, flate stellate hairs, four-armed stellate trichomes with a central cushion), sepal (complex peltate scale, flate stellate hairs), petal (cushioned stellate hairs, simple hairs), and the skin fruit (stellate hair cushioned, four-armed stellate hairs).

Keywords: tropical fruit plant, *D. kutejensis,* superior character, morphology, trichome shape.

P-058

Diversity *Orthosiphon* in indonesia

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Orthosiphon is one of the genus of Lamiaceae, which used traditionally for herbal tea in Indonesia. Based on the revision of Flora Malesiana 1 vol 8 it is mentioned that there are 2 species of *Orthosiphon* in Malesia. After a general botanical collection done in Raja Ampat Island, a species of *Orthosiphon* was collected and planted in Bogor Botanical Gardens. Those new collections cannot be identified as species mentioned in the Flora Malesian. A study on the pollen morphology, nutlet and leaf surface of five taxa of *Orthosiphon* has been done by light and scanning electron microscope. Based on the pollen study, all taxa of *Orthosiphon* hava reticulate ornamentation as mentioned also by Madeline et al (1992) and an essential tool to classification within the family (Abu-Asab & Cantino 1992, 1993, 1994). The study on their seed morphological characters indicated that there are no important characters which can be used to identify at the species level. There are three *Orthosiphon* collection in Bogor Botanical Gardens which cannot be identified, i.e. collection from Waigeo island, West Papua; Sentul, West Java and from Central Kalimantan. Those species is very similar to *O. aristatus* (Blume) Miq., but it is differed due to the differences on its habit, leaves and inflorescence characters. Due to the morphological differences, it is suggested that those species is new species. Further study on those collections are needed to confirm those species are new for science.

Keywords: Lamiaceae, light microscopy, *Orthosiphon*, pollen morphology, SEM, seed, systematics.

P-059

Preliminary study of gingers of Lore Lindu National Park

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The ginger flora of the Lore Lindu National Park is very poorly known based on lack of collection and historical factors affected to Zingiberaceae collection from Sulawesi. An exploration and examination of Lore Lindu National Park in 2012 documented eight wild species (2 *Etlingera* sp., 2 *Amomum* sp., and 4 *Alpinia* sp.). One of the *Alpinia* species is indicated as new species. Taxonomic notes, ecology and geographical distribution of the recognized species are provided.
Keywords: Lore Lindu National Park, *Zingiberaceae*, Sulawesi.

P-060

Floral biodiversity in Melanesia: digitization and discovery

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The islands of Melanesia, consisting of the countries and territories of Fiji, New Caledonia, Vanuatu, Solomon Islands, Papua New Guinea (PNG), and the Indonesian provinces of Papua and West Papua, comprise more than 95% of the land area of the tropical Pacific Basin and are host to most of the region’s biodiversity. Melanesian biodiversity greatly exceeds that of North America and rivals that of the Amazon Basin, comprising some 10% of all the world’s species. However, there remains considerable speculation as to the size of the vascular flora, especially with published estimates for the largest island, New Guinea, ranging from 11,000 to 25,000 species. In addition, ~40% of the Melanesian biota has yet to be scientifically named and the geographic ranges of most species remain unknown, making the region one of the most poorly documented regions on planet Earth. As a first step to fully understanding the extent of biodiversity in the region, an online species checklist is being systematically developed from published scientific literature, online resources, taxonomic experts, and cross-correlated with specimen collections. Bishop Museum’s *Herbarium Pacificum* (BISH) is actively digitizing floral and algal collections from Melanesia, databasing collection label data, georeferencing locality data, imaging specimens, and making this information available online via the natural sciences collections portal (nsdb.bishopmuseum.org). Biodiversity surveys in PNG are being undertaken in remote, under-explored regions to document the flora. Other projects at the Bishop Museum, such as the Global Names Architecture and BiSciCol (Biological Science Collections

Tracker) projects are developing online tools to further increase accessibility and manageability of biodiversity data. Making this baseline biodiversity data available to conservation and spatial planners in Melanesia will better enable effective on-the-ground conservation action in the face of global climate change, including temperature and precipitation changes, ocean acidification, and sea level rise, and anthropogenic activities such as forestry, mining, and population expansion.

Keywords: Melanesia, online databases, vascular flora, algae, hotspot, botanical collections, biodiversity conservation, data management.

P-061

Global plants - a comprehensive database of plant type specimens and complementary content for the study of plant life

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Global Plants (plants.jstor.org) is a community-contributed database that features more than two million high resolution plant type specimen images and other foundational materials from the collections of more than 270 herbaria in 70 countries. Complementing the high resolution specimen images are extensive flora and other reference materials, collectors' correspondence and diaries, and tens of thousands of paintings, photographs, drawings, and other images. Global Plants strives to be a comprehensive resource for aggregating and exploring the world's botanical resources, thereby dramatically improving access for students, scholars, and scientists around the globe.

Global Plants is the outcome of the Global Plants Initiative (GPI). The Andrew W. Mellon Foundation, along with leading experts in the field, had developed the idea of creating a digital library of type specimen images and related material and as a result funded the initial digitisation activities in the Global Plants Initiative. Over 10 years, GPI has grown into an international partnership wherein herbaria work together to create a shared database of information and images of plants worldwide. In partnership with JSTOR, GPI is building a sustainable resource that the international scientific community can rely upon. JSTOR is committed to the preservation of this work for future generations. The Global Plants Initiative includes more than 270 contributing herbaria in 70 countries. The complete list of GPI partners is available at http://plants.jstor.org/action/community. Based on the subscription model successfully developed by JSTOR for digital holdings of print literature, the plans for long-term maintenance and sustainability of Global Plants are currently being finalized.

Keywords: Specimen images, Digitisation, Virtual herbarium, Type specimen, JSTOR, GPI, Global Plants.

P-062

Diversity of climbing plants in an isolated forest of Ayer Hitam Forest Reserve, Malaysia.

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Ayer Hitam Forest Reserve (AHFR) is one of remaining once large area of lowland forest in western part of Peninsular Malaysia. The forest with an area of only 1,176.1 hectares is surrounded by the housing development. This study was done to assess the diversity of climbing plants ranging from lianas, orchids, aroids, rattans and epiphytic climbers. In order to do that, a transect line were set up and all climbing plants were recorded and identified. The result revealed that a total of 47 families and 98 genera of climbers were recorded with the largest families is Fabaceae with 17 species from 7 genera, followed by Annonaceae with 15 species from 7 genera, Vittaceae with 12 species from 6 genera and Rubiaceae with 11 species from 6 genera. Agelaea is the most abundant species recorded during the study.
Keywords: Ayer Hitam Forest Reserve, climbers, lowland forest, climber diversity.

P-063

The mangroves of Raja Ampat, West Papua, Indonesia

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We studied the floristic compostion and structure of mangrove forests and mangrove species distribution at the Raja Ampat Regency, West Papua. We sampled the forests using (10x10 m) quadrats laid out contiguously along 9 transects of 60-450 m long, perpendicular to the coastlines. The transects were establishedon the islands of Batanta (6), Salawati(2). and Waigeo (1). Within quadrats and transects we recorded 17 mangrove species of trees with density of 768 stems/ha and basal area of 37.82 m^2/ha and tree height of 10 – 30 m. Overall, however, we registered 109species of 52 families occurring on the islands both within and ouside the quadrats, and each island contained a set of species with restricted distribution to each island. Two species possessed the highest importance value (IV), frequency, density and basal area, i.e. *Rhizophoraapiculata* (IV=168.06 %) and *Bruguieragymnorrhiza* (IV=67.18). They also showed the highest similarity (100 %) in their distribution, indicating highest degree of association. The mangrove at Raja Ampat may, therefore, be designated as *Rhizophoraapiculata-Bruguieragymnorrhiza* Association. Other species with highest degree of distributional similarity (100 %) but with low density, basal area and importance values

were *Barringtonia racemosa, Excoecaria agalocha, Hibiscus tiliaceus, Inocarpus fagifera, Lumnitzera littorea* and *Sterculia shillinglawii,* which are not true mangrove species, usually growing on less saline and more solid soils. The floristic composition of the transects in the three islands showed relatively high similarities of about 70 % and at higher similarities the transects in Batanta Island formedfour groups, Salawati Island two groups and Waigeo Island one group. Species diversity in Raja Ampat mangroves is higher than those in mangroves on other small islands in West Papua (Nanah Island, Ombre Island), Maluku (Buru Island, Kayeli Islands, Moti Island), West Sumbawa, Southeast Sulawesi (Wawonii Island), South Sulawesi(Polewali Island), Central Java (Nusakambangan Isand) and West Sumatra (Siberut). The mangrove forests of Raja Ampat by any means should be protected from all kinds of destruction and shoulod be made into conservation areas in order to sustain its ability to provide ecological services and non-destructive economic benefits.

Keywords: *Rhizophora apiculata-Bruguiera gymnorrhiza* Association, mangrove, Raja Ampat islands, West Papua.

P-064

Evaluation of mangrove forest timber resource and charcoal operation activity in Marudu Bay, Sabah

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Mangrove Forest at Marudu Bay was rich with resources such as timber, fisheries and others. It has also provided an important resource for coastal communities. Timber is one of the major components of mangrove forest. Due to the richness of the forest, the actual value of the forest usually underestimated. A study was conducted to evaluate the timber resource at Marudu Bay, Sabah. In particular, the objective of this study attempt to estimate the stumpage volume, and its relation with the charcoal production and to determine the most dominant species in Marudu bay. The data source was based on the survey conducted with 10 charcoal operators and the 1-ha inventory conducted in Marudu Bay. The volume equation of Rhizophora and Non-Rhizophora were combined with a diameter of species to calculate the stumpage volume. Several calculations on stumpage volume were carried out to determine the relation between species and species group. Result showed the most dominant species was *Rhizophora apiculata* with density 757m^2/ha, followed by *Rhizophora mucronata* 511m^2/ha. Though the area was dominated by *Rhizophora apiculata,* the highest estimated stumpage volume was conquered by *Rhizophora mucronata* with total volume 51.029m^3/ha and *Rhizophora apiculata was* 33.42m^3/ha. Total stumpage volume in the study area was 110.2426m^3/ha. For charcoal production, *Rhizophora* species were utilized and found in the Bangkita Forest (Rhizophora Forest) with the total area was 5,485.83 ha. The estimated stumpage volume for trees with a diameter greater than 12 (>12cm) was 65005.46m^3. There were 40 kilns in Marudu with the

total burning of charcoal production were 76 times per year with stumpage volume about 220.87m^3/year. Therefore, the Bangkita Forest in Marudu bay possibly will be last until 154 years if the number of kiln and total production remain the same for 154 years. Further research is needed to estimate the lifetime of the Bangkita Forest if the charcoal operation is increase or decrease.
Keywords: charcoal, stumpage volume, Rhizophora, Marudu.

P-065

Notes on tree species for restoration of five national parks

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Five National Parks (Sembilang, Cermai, Merapi, Bromo-Tengger and Manupeu) in Indonesia have been chosen for a JICA project to develop a model of park restoration A total of 200 tree species have been selected and included in the publication of a field guide to park restoration. Species selection was based on such criteria that species are locally abundant, easily planted, critically endangered, threatened to extinction, endemic and economically, ecologically and environmentally valuable. In 2012-2013 botanical explorations have been carried in the Sembilang National Park with special focus on mangrove species, in Ceremai, Merapi and Bromo-Tengger National Parks with special study on mountane rain forest species and in the Manupeu National Park on dry monsoon species. Some interesting species were collected and recorded. It was noted that *Tristiropsis canarioides* was endemic to Manupeu, *Kandelia candel* was classified as an endangered mangrove species in Sembilang, *Dipterocarpus hasseltii*, *Magnolia montana*, *Kibatalia arborea* were rare species, in Ceremai. Several species that were widely distributed in the 5 National Parks were *Engelhardia spicata*, *Dodonaea viscosa*, *Dysoxylum densiflorum*, *Macaranga tanarius*, *Schima wallichii*, *Ficus* spp., *Antidesma bunius*, *Magnolia glauca*, etc. New species of *Begonia*, and *Calamus* were recorded in the Manupeu National Park and will be published soon.
It is hope that the data of flora collected during the explorations could contribute to a better knowledge on the flora of the above-mentioned National Parks, and could be used as the basis for National Park Management, Conservation, Education and Recreation purposes.
Keywords: Restoration, field guide, National Parks.

P-066

Conservation of Indonesian *Hoya* (Apocynaceae: Asclepiadoideae): in Bogor Botanical Gardens

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The genus *Hoya* (Apocynaceae: Asclepiadoideae) has become popular as exotic ornamental plant in Europe, USA and Australia, while in Indonesia as the home country of many Hoya species is still neglected. Several species are become rare due to deforestation, mainly as Hoya species are epiphyte which depend on the present of trees as phorophyte (host). Since 1995, an *ex-situ* conservation strategy has been conducted in Bogor Botanic Gardens. There are three main activities have been done: (1) Inventory of Indonesian Hoya species, (2) Living collection management, (3) Sustainable Utilization. Based on the herbarium observation at BO and literature study, there are about 60 Hoya species occurred in Indonesia. Unfortunately, the revision of this genus has not finalized and is still incomplete. Forty four species have been collected and grown in Bogor Botanical Gardens, which consists of 19 species from Sumatra of 27 species, Java 13 species of 22 species, Kalimantan 16 species, Sulawesi 9 species, Moluccas 4 species, Papua 4 species, Lesser Sunda Island 3 (including 1 from Bali). only one endemic species from Sumatra has been conserved. The preliminary conservation status of these species was assessed based on the frequency of collecting by the Bogor Botanical Exploration teams and herbarium sheets observation at BO. Notes were made on the survivorship and in relation to the propagation technique of each species. A promotion of Hoya as an ornamental plant has been put as the priority on the utilization on Indonesian *Hoya* species, beside that a study on the revision of Hoya is also important to be promoted. A new Bogor Botanic Garden's variety from *Hoya diversifolia* had been obtained from mutation treatment. The new variety has different color in flower, i.e. corolla and corona. The previous species has pink color, and the new variety has white color. Registration for Plant Variety Protection is awarded to the Plant Variety Committee in Indonesia.

Keywords: *Hoya* (Apocynaceae: Asclepiadaceae), conservation, Botanic Garden.

P-067

Survey and conservation assessment of the flora of the Northern Territory, Australia

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The adequacy of survey of the Northern Territory (NT) flora for both floristic inventory and assessment of species against IUCN criteria was examined using herbarium collections and survey data. Knowledge of the flora and its distribution has improved dramatically over the past 60 years. However, substantial areas of land and many species remain poorly surveyed. Some 23% of the native flora is known from 10 records or less and a similar percentage is currently coded as IUCN Data Deficient or is not evaluated. The intensity of herbarium collections of native species is 13.2 specimens / 100 km^2 across the NT, but ranged from to 4 to 72 specimens / 100 km^2 for individual bioregions. To record 70% of the predicted maximum number of species for a one degree by one degree cell, 57 collections / 100 km^2 would be needed in the wet-dry tropical zone. The implications for conservation coding of the flora are discussed.
Keywords: conservation assessment, floristic inventory, IUCN criteria, Northern Territory, Northern Australia.

P-068

Conservation status of the Javan endemic plant species *Amorphophallus discophorus* Backer & Aldew. (Araceae)

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Amorphophallus discophorus Backer & Alderw. is one of the javan endemic plant species. This species is locally endemic to the slopes of Mt Wilis in Kediri Regency (East Java) at between 600 - 1300 m altitude. Poorly known species such as *A. discophorus* could be easily become extinct in the wild due to misharvesting of *A. muelleri* for commercial purposes and land converted in the last decade. Several fieldworks have been done. First fieldwork conducted in 1998–1999 in Kediri Regency failed to find *A. dicophorus*. A Second round of fieldwork in 2009–2011 at the type locality on Mount Wilis and surrounding areas in East Java also fail to find the species. Most recently fieldwork was conducted in April 2013 in Madiun Regency (East Java) and most of the forest is converted to timber and cassava plantations. Based on the field observations, it is predicted that *A. discophorus* presumably extinct in the wild.
Keywords:*Amorphophallus discophorus,* Araceae, extinct, Mount Wilis, East Java.

P-069

Vegetation analysis in the forest of Tesso Nilo National Park, Riau Province, Sumatra, Indonesia

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A vegetation study was carried out in the Tesso Nilo National Park, Riau. The total area of the National Park is 190.000 ha, including lowland forests located at the altitude of 100-200 m. Currently, most of the the lowland forest has been destroyed. The research sites were situated at the Setugal village, Kuantan Senggigi district. The general land use in the region include *Acascia* and rubber plantations, scrubs, secondary forests, and remnants of primary forest. The region has a very wet climate with annual rainfall of 2000-3000 mm, and its topography is relatifely flat and slightly undulating with a slope of 10-15^0.

This study, using the quadrat method, attempts to reveal the composition and structure of the vegetation at the Park. The result shows that the diversity of species in one-hectare area of the lowland forest was high. Is was supported by the data that recorded 212 species of trees belonging to 118 genera and 48 families. It was noted that the saplings consisted of 304 species of 144 genera and 55 families. At tree level, the dominant species were *Sloetia elongata* (IV=17.14), *Xylopia caudata* (IV=7.56), *Pimelodendron griffithianum* (IV=7), *Artocarpus elasticus* (IV=6,45). Tree species dominating the sapling stage were *Sloetia elongata* (IV= 11.63), *Pimelodendron griffithianum* (IV=6.98), *Barringtonia macrostachya* (IV=6.16), and *Saraca declinata* (IV=6.09).

Keywords lowland forests, species diversity, Tesso Nilo National Park, Sumatra.

P-070

Structure and composition of communities of herbs, epiphytes and seedlings in a coastal forest of the Sempu Island Nature Reserve, Malang, East Java

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A study on structure and composition of herbs, epiphytes and seedlings was undertaken at the Waru-Waru area. in the Sempu Island Nature Reserve, East Java Two plots of 1x50 m each were established in two sites, located at a distance of ± 0.5 km. A total of 67 species, 57 genera and 41 familys were recorded, with a high species index diversity (3.84 (H'). The number of species categorized as tree seedlings was higher than that of herbs and epiphytes. The families containing the

highest number of species were Euphorbiaceae (6 species) and Fabaceae (5 species). The dominant species at site I was *Rungia* sp and at site II *Pterospermum diversifolium*. The plant communities at the two sites were very dissimilar having a Similarity Index of only 21%. Among ten species with the highest importance values in site I *Piper* sp - *Syzigium* sp and *Ficus* sp-*Knema laurina* showed a highsest degree of association (± 98%), while in site II the species showing highest degree of association were *Ilex cymosa-Antidesma bunius* (± 95%) and *Microcos argentata-Knema* sp (± 90%.).
Keywords: structure, composition, herbs, epiphytes, seedlings, Sempu Nature Reserve, East Java.

P-071

Tree species composition of one-hectare sub-montane forest at Mount Salak, Bogor, Indonesia

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Mount Salak, formerly a protection forest mainly functioning as a water resource area, was designated as a part of the Gunung Halimun-Salak National Park in 2003. At high elevation, Mount Salak has a rugged and inaccessible topography with the first peak at the altitude of 2,211 m (Mt. Salak 1) and the second peak (Mt, Salak 2) at 2,180 m. A study on floristic composition was carried out in the relatively accessible sub-montane forest at the altitude of 1,200 m. The forest was sampled using a plot of 100 m x 100 m (1 ha), divided into 100 sub-plots of 10 m x 10 m. Each tree having girth at breast height ≥ 15 cm was, recorded for its species identity, girth/diameter, height to the first branch, and total height. The result shows that within the studied forest, 65 species belonging to 47 genera and 29 families were recorded. Trees having highest Important Values were *Arthrophyllum diversifolium, Schefflera aromatica, Schima wallichii, Macaranga triloba*, and *Acronichia pedunculata*. The important families occurring in the forest were Araliaceae, Rubiaceae, and Euphorbiaceae.
Keywords: Tree species, sub-montane forest, Mount Salak

P-072

Floristic and structural characteristics of a lowland forest of the Karimunjawa National Park

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The Karimunjawa National Park is located on the Island Karimunjawa, a small island situated northwest of the town of Jepara, Central Java., The Park covers a variety of marine and terrestrial ecosystems, including the lowland tropical rain forest ecosystem. The lowland forest, which is also a protection zone, covers an area of 1282.20 hectares. The area has undulating topography, consiststing of low plains with the altitudes of 65-506 m above sea level. Information on the biodiversity of the area, especially the ecology of plants, is still meager. In view of this situation a study was, therefore, undertaken in the lowland forest within the Park with the aim to find and reveal the diversity of plant species. It was initiated with a reconnaissance to determine the study sites, followed by the establishment of three permanent plots of 0.4 hectare each at the altitudes of 100 m, 200 m and 300 m. Each permanent plot was divided into 10 x 10 m quadrats for enumerating trees (DBH ≥ 10 cm) and a 5 x 5 m subquadrat was nested in each 10x10 m quadrat for recording saplings (DBH = 2-9.9 cm). Thus altogether 120 quadrata and 120 sub-quadrats were established. The results showed that *Polyosma integrifolia* was the dominant tree species in the study site. In permanent plot 1 at 300 m asl. at the tree stage *Polyosma integrifolia* had an important value (IV) of 12.76 % with basal area (BA) of 2.43 m^2/ha , while in the sapling stage the IV was 51.6 % with BA of 19.3 m^2./ ha In plot 2 at 200 m asl at the tree stage it had IV of 7.16 % with BA of 1.69 m^2/ ha and at the sapling stage the IV was 12.8 % with BA of 3.48 m^2/ ha. The trees and saplings of *Polyosma integrifolia* were not found in plot 3. As whole, at tree stage 26 species were recorded in plot 1, 26 species in plot 2 and 25 species in plot 3 . Whereas at the sapling stage 30 species were recorded in plot 1, 28 species in plot 2 and only one species in plot 3.

Keywords*:* *Polyosma integrifolia*, Karimunjawa National Park, Central Java.

P-073

The diversity and abundance of ground herbs in a lowland mixed Dipterocarp forest and a heath forest in Brunei Darussalam

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Herbaceous plants are important components of total plant species richness in tropical forests. Ground herb diversity and abundance were studied in a lowland Mixed Dipterocarp forest (Andulau) and a heath forest (Bukit Sawat) in Brunei Darussalam, Borneo. At each site, all ground herbs in twenty randomly selected 10 x 10 m subplots within a one hectare permanent plot were censused and identified. The study recorded a total of 20 families and 32 genera of ground herbs, with the family Zingiberaceae most abundant at both sites. Thirteen genera were recorded only at Andulau and 7 genera were exclusive to Bukit Sawat, with twelve genera common to both sites. Ground herb species richness appear higher at Andulau than Bukit Sawat (37 vs. 29), but this difference was not statistically significant. However, ground herb abundance and density were significantly higher at Bukit Sawat than Andulau (n = 846 vs. 385; 4230 vs. 1925 individuals ha^{-1}). The more open canopy at Bukit Sawat may provide higher light availability here than at Andulau, which is characterised by a closed canopy. We suggest that light availability is the most important environmental factor influencing ground herb density and abundance at these sites.
Keywords: Borneo, tropical forests, species richness, Zingiberaceae, light availability.

P-074

Germination and growth of tropical pioneers in Brunei Darussalam: The effects of temperature and seed size

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The effects of temperature and seed size on germination of tropical pioneer species have received little attention. This study aims to study the effects of temperature and seed size on germination of five common tropical pioneer species in Brunei Darussalam; *Melastoma malabathricum*, *M. beccarianum*, *Rhodomyrtus tomentosa*, *Dillenia suffruticosa* and invasive *Acacia mangium*. The species were grouped into small-seeded (seed mass ≤ 1 mg) and large-seeded (seed mass > 1 mg) species and we determined the germination responses (number of days for seeds to start germination and reach 50% germination), final germination percentages and relative growth rates (RGR) in different temperature using incubator chambers with 12 h-photoperiod. All species were treated with

constant temperatures of 20°C, 25°C, 30°C, 35°C and 40°C, and alternating temperatures of 30/25°C, 35/25°C and 40/25°C. Results demonstrated the possible influence of temperature on the germination of large-seeded *A. mangium* (13.86 ± 1.17 mg) as shown by its fastest time to germination and 50% germination across all temperature treatments, and its highest mean cumulative germination percentage (88 ± 2.8%) and fastest RGR in constant temperature of 30°C. The abilities of *A. mangium* to have faster germination and higher RGR than other native plants are the possible traits that made non-native *A. mangium* invasive in the secondary and degraded forests of Brunei. This study also shows the importance of understanding the effects of different environmental factors on seed germination that might contribute to the establishment and growth of pioneers.

Keywords: germination, tropical pioneers, seed mass, temperature and relative growth rates (RGR).

P-075

Analysis of gross primary productivity (GPP) in Bali Botanic Garden using landsat data

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Most models of ecosystem carbon exchange that are based on remote sensing use some form of the light use efficiency (LUE) model. The aim of this work is to analyze the distribution of annual Gross Primary Productivity (GPP) in the Bali Botanic Garden, Bedugul, Bali, using remote sensing imagery (Landsat 5 TM and 7 ETM+ on 1997 and 2002). The annual GPP at Bali Botanic Garden were estimated based on biophysical parameters derived from Normalized Difference Vegetation Index (NDVI) extracted from remote sensing data, incoming solar radiation and light-use-efficiency coefficient. The result showed annual GPP estimated using Landsat 1997 varied from 1282.50 gCm^{-2} yr^{-1} to 2843.97 gCm^{-2} yr^{-1}, while the Landsat 2002 estimate varied from 657.40 gCm^{-2} yr^{-1} to 2755.55 gCm^{-2} yr^{-1}. Total carbon assimilated by vegetation was also analyzed by summing up all pixels in study area for each year and by multiplying them with the width of the pixel to eliminate square meters. We found that total GPP (carbon assimilated by vegetation) in Bali Botanic Garden measured by Landsat 1997 was 27719.40 gC yr^{-1}, while in 2002 decreased to 25473.06 gC yr^{-1}. Using vegetation index retrieved from reflectance Landsat data, we found that the medium spatial resolution Landsat Imagery is potentially usable to estimate Gross Primary Productivity (annual photosynthetic productivity) in small forest garden.

Keywords: Gross Primary Production (GPP), Bali Botanic Garden, landsat imagery.

P-076

Climate change impact assessment on species distribution and genetic diversity of Alpine plants—insights from *Oreomyrrhis* Clade of *Chaerophyllum* in Taiwan

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Studies have predicted that alpine plants will be forced to migrate into higher elevations as current trend of global warming continues, resulting in drastic deduction in their distribution range. Consequently alpine vegetation is regarded as one of the most vulnerable ecosystems by global climate changes (GCC). However, species' survivorship and evolvability to cope with environmental changes also depend on genetic diversity. Therefore it is important to realize how the fluctuation of species habitat impacts genetic diversity at population level. Based on coordinates of collecting data and climate data of WORLDCLIM, we employed the program MAXENT to construct the distribution models of two endemic species of Apiaceae in high elevation of Taiwan, *Chaerophyllum involucratum* and *C. taiwanianum*, and used the models to project their past and future distributions during the last glacial maximum (LGM) and under the future climatic scenarios (i.e. B2B and A2A) predicted by Intergovernmental Panel on Climate Change (IPCC). Changes of projected distribution were used to evaluate the vulnerability of the species. The distributions were also integrated with phylogeographic data to predict the loss of genetic diversity under B2B and A2A. Based on the projections, distributions of both species were much wider during LGM compare to their present distributions. Under B2B and A2A, 18–497 m upward migration and 44.7-85.8% shrinking in distribution are projected in *C. involucratum*, while 17–476 m and 42.2-99.9% in *C. taiwanianum* are estimated. Populations in the northeastern part of the island are most vulnerable, with vulnerability decreasing southward. Based on deduction of distribution range, *C. involucratum* is projected to lose 5.3-21.1% of haplotypes in the chloroplast *atpB-rbcL* spacer, while 0-80% loss was predicted in *C. taiwanianum*. Because the northeastern populations also present hotspots of genetic diversity, their high vulnerability urges attention to monitor whether populations there would have shrunk as predicted. Furthermore, *ex situ* conservation such as germplasm preservation in seedbank should focus on populations harboring haplotypes that are projected to go extinct in the near future. For the reason that Taiwan is in Malesian region optionally, this case in Taiwan plays a important role in studies of Malesian region.

Keywords: species distribution model, global warming, conservation genetics, *Oreomyrrhis*, vulnerability, Apiaceae, MAXENT.

P-077

Potential local trees selecting for high carbon sequestration in low land ecosystem

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One way to control climate change is to reduce CO_2 emissions by conserving natural forests and increasing the trees population in degraded forests. Planting introduction tree species in degraded lands affected ecosystem imbalance. In contrast, revegetation with local tree species diversities would increase ecosystem services. This study aims to select local tree species that potentially high carbon sequestration, mainly in the dry lowland ecosystem. Selection of local trees was conducted in the local trees collection of Purwodadi Botanic Garden with measurement of diameter increment, biomass, carbon stock and CO_2 absorption. In addition, the propagation method and useful of local tree species also were collected. The results showed that 40 species of local trees stored high carbon above 10 $kg.th^{-1}.tree^{-1}$. From these tree species, 13 species (32,5%) belonging to legumes (Fabaceae) family. Kesambi (*Schleichera oleosa),* Cempaka *(Michelia alba),* Kedawung (*Parkia timoriana*), Angsana (*Pterocarpus indicus*), Kedoya (*Dysoxylum gaudichaudianum), Nyatuh (Madhuca longifolia), Saga (Peltophorum pterocarpum) and Kedondong hutan (Spondias malayana)* were 8 species of local trees that had high carbon sequestration (above 50 $kg.th^{-1}.tree^{-1}$). From the above 40 species, 16 species (40%) were easily propagated while the rest required seed dormancy breaking treatment.

Keywords: local trees, carbon, sequestration.

P-078

Characteristics of stomata on five species of low land trees with high carbon sequestration

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The increase of CO_2 concentration in the air has greatly raised world attention on trees with high carbon sequestration ability. Stomata is a vital part of a plant facilitating the absorbtion of atmospheric CO_2, making it inseparable to carbon sequestration ability. The present study, carried out at the Purwodadi Botanic Garden, aims to study stomata characteristics of selected five low land tree species in relation to their high carbon sequestration ability. The stomata characteristics investigated include density, area and type of stomata of *Schleichera oleosa, Michelia alba,*

Dysoxylum gaudichaudianum, *Madhuca longifolia* and *Artocarpus altilis*). In addition carbohydrate analysis. was carried out to determine the CO2 absorption ability. Regression anaysis was performed to determine the relationship between density and stomata area with ability of abssorbing atmospheric CO_2, while stomata types were observed with a microscope. The density (stomata/mm), width area (µm), and type of stomata for each species are *Schleichera oleosa* (3438, 77; 9,34; anomocitic), *Michelia alba* (1132,65; 23,31; paracitic), *Dysoxylum gaudichaudianum* (530,61; 35,44; anisocitic), *Madhuca longifolia* (357,14; 68,64; anisocitic), *Artocarpus altilis* (755,10 ; 38,11; paracitic). The results of these study showed that the CO_2 absorption ability of the investigated trees was directly proportional to stomatal density, while the stomata area was inversely proportional to the CO_2 absorption ability. *Schleichera oleosa* has the highest CO_2 absorption ability and highest stomata density but has the narrowest area of stomata.
Keywords: stomata characteristic, CO2 absorption ability, low land tree species.

P-079

Carbon stock of trees in coal mining concession forest at Sendawar, East Kalimantan, Indonesia

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Many research showed that the rapid change of future global environment due to increasing of atmospheric carbon has become one of main threats to human life. Forest is known to have many important functions in mitigating those threats by providing protection and enhancement of *water* resources, sustainable place for many species, source of fresh air, and function for atmospheric carbon sequestration. A research to observe the potential of forest characteristic related to its function as carbon stock is urgently needed, especially for forest located in mining concession. This research is aimed to identify species composition of tress which have dominant role for carbon stock in a forest which is located in mining concession of PT. Bharinto Ekatama, Sendawar-East Kalimantan. Field research has been conducted in 2012 and we have used sample plot method for trees category. The result showed that the estimation of carbon stock potential for tress was 71.25 ton/ha, with eight (8) highest contributor species: *Syzygium* sp (12.19 %), *Shorea parfivolia* (6.54 %), *Eusideroxylon zwageri* (5.17 %), *Canarium* sp (3.86 %), *Shorea* cf. *sarawakensis* (3.69 %), *Shorea fallax* (3.63 %), *Shorea palembanica* (3.33 %), and *Shorea leprosula* (3.24 %). This result is important to be used in determining species recommendation for reclamation stage that has potential in carbon stock by using local trees species.
Keywords: carbon stock, mining, Kalimantan.

P-080

Study of edaphic factors of bamboo population in Mount Baung Natural Park, Pasuruan, East Java

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Bamboo is one member of the Poaceae family. There are 1250 bamboo species in the world, an estimated 161 of them are in Indonesia. One of the bamboo forests in East Java is found at a conservation area namely Mount Baung Natural Tourist Park (MBNTP). The purposed of the research was to study the influence of edaphic factors to bamboo's growth. This research was carried out from September 2011 to Mei 2012. The edaphic data collected consist of texture and chemical properties. The principal component analysis (PCA) was performed to determine relationships between edaphic components and bamboo's occurrences. There were seven species of bamboo in MBNTP, namely, *Bambusa blumeana*, *Bambusa vulgaris*, *Dendrocalamus asper*, *Schizostachyum iraten*, *Gigantochloa atter, Gigantochloa apus,* and *Dinochloa matmat* (amount < 1%). Based on that edaphic factors data, it was showed that the edaphic factors affected the presence of bamboo in MBNTP. Phosphor (P) is one of the edaphic factors which contributing significantly to *B. blumeana*, *B. vulgaris*, *D. asper* and *S. iraten* presence in MBNTP. The result of PCA analysis showed that the angle was formed by the elements P and five of bamboo is an acute angle with an Eigenvalue > 1. From the analysis in the field it showed that the five bamboos grow in soil with high levels of P (reaching 27 me 100 g^{-1}). On Poaceae, phosphor is required for the cell elongation, stem diameter development and strengthening stem which make the stem stronger. Among the seven species bamboo in MBNTP, the presence of *G. apus* influenced by elements of Manganese (Mn) and Sodium (Na). In soil, element of manganese was dissolved at low soil acidity. When the soil pH is increasing, the solubility of manganese was decreased. Soil acidity in MBNTP is slightly acid (5.6 to 6.5), that can be one factor leading to the high solubility of Mn in the soil which are favored by *G. apus*. This bamboo in this area more commonly found in soil environments with low levels of Na (< 0.02%) and Mn (≤ 24 mg 100 kg^{-1}).

Keywords: edaphic, bamboo, Mount Baung.

P-081

Hydraulic architecture of tree species in cacao agroforests: Aboveground growth performance and xylem anatomic properties

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Wood density and xylem anatomical properties are usually regarded as core functional traits of tree aboveground growth performance. Since vessel size affects sapwood-specific conductivity to the fourth power, a strong positive correlation to plant growth is to be expected.
Here, we examined hydraulic properties of branch, root and stem tissue of *Theobroma cacao* and five common shading tree species (*Leucaena leucocephala, Gliricidia sepium, Gnetum gnemon, Erythrina subumbrans, Durio zibethinus)* from an agroforesty system in Sulawesi, Indonesia.
Our results show that there are significant differences in specific hydraulic conductivity and hydraulically weighted vessel diameter between species as well as between the root, branch and stem xylem within a given species. Distinct patterns due to biogeographical origin of the species are visible. Contrary to recently published results from primary forests in the same region, wood density showed a negative relationship to hydraulic conductivity. On the other hand across all investigated species basal stem increment was positively correlated with hydraulic conductivity underlining the importance of hydraulic conductivity for tree growth performance.
We conclude that (i) growth performance is strongly dependant on hydraulic conductivity; (ii) xylem anatomical patterns reflect species biogeographical origin and seem not to be modified due to habitat adaptation.
Keywords: tropical agroforestry, shade trees, hydraulic conductivity, wood density, stem increment.

P-082

Soil nutrient dynamic at three defined elevation in relation to host plant of *Rafflesia Kerii* in the highland of Kelantan, Malaysia.

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Host of *Rafflesia kerii* belongs to *Tetrastigma* species wildly grows in Lojing highland forest. The genus *Tetrastigma* is best known for its association with *Rafflesia* spp. *Tetrastigma* need nutrient to make photosynthesis and the nutrient is absorbed from soil to live. The number of *R. kerii* bud

population represented the productivity of *Tetrastigma* at one of defined elevations because of it supplies nutrient to *R.kerrii* bud. The average increment number of *R. kerrii* bud population monthly at each elevation are different. Three soil sample were taken at different elevation for soil nutrient analysis and compare with the average increment number of *R. kerii* bud. The highest average increment number of *R. kerii* bud is from sample three; 9 buds and the lowest is from sample one; 1 bud. The data of bud population were referred from May 2011 to November2012. The result from dependent t-test analysis show that on average, bud significantly greater than elevation (M=2.00, SE=0.83),t(41)=2.573, $p < .05$, r=0.59. So, there is significant differences between average increment number of *R. kerii* bud and elevation. By using Wilks' statistics from multivariate test, there was a significant effect of soil nutrient, $\Lambda = 0$ F(12,2)=1.4 $p < .05$. However, separate univariate ANOVAs on the outcome variables revealed significant treatment effects only on pH, F(2,0.42)=8.37. The other outcome variables revealed not significant treatment effects on CEC;F(2,4.09)=0.84 $p > .05$, OC;F(2,2.70)=1.36 $p > .05$, N; F (2,0.01)=0.63 $p > .05$, K; F (2,0.02) = 2.40 $p > .05$ and P;F(2,179.7)=0.6 $p > .0$. So, we conclude that the elevation and soil pH affect the bud population growth.

Keywords :*Tetrastigma*, *Rafflesia kerii* bud, soil test, statistics.

P-083

New record of Bryophytes Family from Giam Siak Kecil-Bukit Batu Biosphere Reserve, Riau Province

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Riau province has the largest peatland in Sumatra island, as shown in the Giam Siak Kecil-Bukit Batu biosphere reserve. This area plays an important role for conservation due to its high biodiversity. One of the important flora occurring in this region is moss. This lower plant groups can maintain the stability of micro climate. Research and publication of moss plants in this region have never been reported, therefore the study of Bryophytes in this conserved area is important. This study ai**ms** to determine the family of moss plants found at Giam Siak Kecil-Bukit Batu Biosphere Reserve. This study used exploration method. All of the samples were collected from three zones at the biosphere reserve, i.e. transition zone, buffer zone and core zone. A total of 17 moss families were recorded from study sites. 7 families of Marchantiophyta, i.e, Calypogeiaceae, Pallaviniaceae, Ricciaceae, Jungermaniaceae, Lepidoziaceae, Frullaniaceae, Lejeuneaceae, and 10 families of Bryophyta, i.e., Bryaceae, Dicranaceae, Sematophyllaceae, Calymperaceae, Fissidentaceae, Hookeriaceae, Hypnaceae, Leucobryaceae, Rhizogoniaceae and Thuidiaceae.

Keywords: Giam Siak Kecil-Bukit Batu Biosphere Reserve, exploration, moss, peatland.

P-084

Bryophytes diversity of Merapi Mountain National Park in Central Java, Indonesia

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Merapi Mountain is an active volcano, its latest eruption occurred in October of 2010. Merapi Mountain National Park is characterized by tropical rain forest on the southern slopes of Merapi Mountain. Eruption of the volcano in October 2010 spread hot clouds and caused forest fires that damaged most of the vegetation where the bryophytes inhabited. This study aims to record the species diversity sixteen months after the latest eruption. Sampling was conducted at three locations; Pronojiwo Hill, Kinahrejo, and Gandok. A total of 68 bryophyte species, representing 45 mosses, 20 liverworts and three hornworts. Epiphytic bryophytes were found in locations where trees still left (Pronojiwo Hill). The most abundant terrestrial bryophyte species found in bare areas was *Trematodon conformis*.

Keywords: Bryophyta, liverworts, mosses, Merapi Mountain, volcano eruption, *Trematodon.*

P-085

Bryophytes diversity at cemoro sewu track of Mount Lawu in East Java, Indonesia*

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Mountain areas have a high diversity of bryophytes. The exploration study we conducted on the bryophyte diversities at Cemoro Sewu Track of Mt. Lawu (3265 m asl) in April of 2012 revealed the presence of 91 species. These species represent 56 genera and 34 families consisting of one hornworts species, 30 species of leafy liverworts (15 families, 18 genera), one thaloid liverworts, and 59 species of mosses (17 families, 36 genera). Two families with the highest diversity on Mt. Lawu were Dicranaceae (21 species, eight genera), and Bryaceae (eight species, four genera). Bryophytes were found mostly terrestrial growing on rock substrate. Leafy liverworts have a higher diversity in the mountainous zone (2000-3000 m asl) than in sub-alpine zone (3000-3265 m asl). Diversity of mosses was high in the higher mountain zones as well as in the sub-alpine zone.

Keywords: Mount Lawu, tropical forests, biodiversity, bryophytes, liverworts, mosses, hornworts.

P-086

Preliminary study of Bryophyta in forest conservation area of Mount Eno, Linggang Bigung West Kutai District.

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This research was conducted at the Mount Eno's Conservation Forest, Linggang Melapeh Village, Linggang Bigung Subdistrict, West Kutai District and at Herbarium Bogoriense the Research Center for Biology-LIPI Cibinong, and the Laboratory of Physiology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Samarinda.

The forest is a local community conservation area and has been declared as a protection forest by government of West Kutai Regency at 2012. The methodology of this research was the cruising method (exploration and description). Research process involves: collecting the samples, creating herbarium collections, and then identifying the samples.

The results obtained 32 types of mosses (Musci class) and leafy liverworts (Hepatic class). Musci class consists of 4 orders, 6 family and 24 species. Hepatic class consists of 2 orders, 4 family and 8 species. Order Hypnales is the most dominant order among Musci which consists of 2 family (Sematophyllaceae and Hypnaceae) with 10 species members. The dominant substrates of Musci class and Hepatic class are the decayed wood, stone and soil.

Keywords: Mosses, Mount Eno.

P-087

Adaptations of ferns to epilithic mode of Life

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The objects of the study are epilithic ferns from different families. Their *sporophytes* have the following adaptations: *Biomorphological level*: nanism; tussock biomorphs; intermittent leaf fall; regulation of developmental rhythm according to the climate. *Organ and tissue level (fronds):* relatively thick leathery and thin carved fronds; reduction of leaf blades and ability to perform xerotropic movements; abscission layer and structures with shielding properties; heliomorphy; high density of mesophyll; succulentization; dense reticulum of areoles. *Cellular and subcellular levels*: collenchyma-like thickenings of cell walls in palisade tissue and epidermis; poikilochlorophytism; small cells; large intercellular spaces in high-mountain and arctic species; presence of hypodermis and water-retaining substances; polyploidy; apogamy. *Functional level:* thermodynamism; poikilohydry;

tolerance in respect of pH value of the substrate; intensification of the processes of photosynthesis and respiration; oligotrophy.

Two groups of *morphofunctional types* are distinguished: 1) *preadapted* to life on stony substrates. Their preadaptive mechanisms: biomorphs - long- and short-rhizomatous; plagiotropic, orthotropic and anisotropic; small- and large-rosette, rosetteless, diffuse-rosette; facultative and obligate bryophylly; poikilohygry; 2) *adapted to epilithic mode of life*. Their preadaptive mechanisms: facultative and obligate bryophylly, short-rhizomatous biomorphs; poikilohygry; adaptive mechanisms – tussock biomorphs; nanism; long branched root systems; intraprothallial self-fertilization, apogamy and apospory; thermodynamism.

Some example of tropical Malesian species will be discussed in this presentation.

Key words: platylithophytes, chasmophytes, nanism, geophytization, poikilohygry.

P-088

Chromosome numbers of some species of *Pteris* (Pteridaceae) in Java

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On going research on the cytology of some species of ferns genus *Pteris* L. (Pteridaceae) in Jawa are reported. *Pteris biaurita* and *P. tripartita* are diploid (2n=58). *Pteris ensiformis* var *ensiformis* shows the chromosome number of 2n = 87 (triploid) and 2n = 116 (tetraploid), while *P. ensiformis* var. *victroriae* reveals 2n = 58 (diploid). *Pteris fauriei* is apogamus triploid (2n=87). *Pteris multifida* and *P. vittata* are sexual tetraploid (2n=116).

Keywords: chromosome, ploidy**,** *Pteris*, Java.

P-089

A preliminary molecular phylogeny of Selaginellacceae of Peninsular Malaysia based on *RBCL a*nd *ATPB* markers.

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Selaginellaceae is a heterosporus ferns family where the evolution and classification is still poorly understood. The old classification using morphological data, place all taxa in a single genus, *Selaginella*. This study was carried out to construct phylogenetic tree and observe relationship between species of Selaginellaceae in Peninsular Malaysia by using molecular data from chloroplast genome *(rbcL* and *atpB*). A total of 16 taxa were used in this study are: *Selaginella argentea, S. frondosa, S. plana, S. ornata, S. roxburghii* var. *roxburghii, S. intermedia* var. *intermedia, S. intermedia* var. *dolichocentrus, S. mayeri, S. alutacia, S. minutifolia, S. morganii, S. pubescens, S. repanda, S willdenowii, S. stipulata* and *S. wallichii*. Two species were used as outgroups are *Huperzia lucidula* and *Isoetes laosiensis*. Phylogenetic analysis of combined dataset including indel-coded information was formed under parsimony inference. The results show all species of Selaginellaceae studied were divided into four groups which are Group A, Group B, Group C and Group D with highly supported (bootstrap values > 90 %). Group A includes *S. roxburghii* var. *roxburghii, S. intermedia* var. *intermedia* and *S. intermedia* var. *dolichocentrus* while Group B includes *S. ornata, S. pubescens, S. repanda*. Group C divided to two subgroups (namely C1 and C2 with highly supported bs = 100 %). The first group (C1) contains *S. minutifolia, S. morganii* and *S. alutacia* which have close relationships of bilateral strobili. The second subgroup (C2) contains *S. stipulata* and *S. wallichii, S. frondosa, S. plana, S. willdenowii* and *S. mayeri* while the last group is Group D with *S. argentea*. The results support a monophyletic of the Selaginellaceae.

Keywords: Selaginellaceae, molecular study, rbcL region, atpB region.

P-090

The wood-rotting fungi of the Philippines

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The wood-rotting fungi are large group of eukaryotic, achlorophyllous and spore-bearing organisms that constitute an abundant element of terrestrial biota in the Philippines. They are best known for the temporary shelf-like or bracket-like sporophore bearing sexual spores. This paper attempts to preliminary document all the macroscopic wood-rotting fungi occur in the different regions of the Philippines by preparing taxonomic accounts based on an extensive systematic collection and by facilitating the identification or recognition of each fungal species.

Using transect line (TL) method, more than 20 transect lines were established in the Philippines with 20m x 50m quadrat sampling each transect line. All in all, 400 quadrats were laid out. The fungal species within the quadrats along the TLs were identified and recorded. Simpson's Index was used in assessing diversity measured in terms of fungal species richness, abundance or evenness of spread of the species in the habitat.

Field sampling of wood-rotting fungi was resulted to 150 species, 33 genera and 21 families. Each species is described including substrata/ hosts, synonymies and habitats. Taxonomic keys are

provided for the identification of the families, genera and species. Highest diversity in terms of the number of species belongs to the family Polyporaceae, which is composed of 32 bearing basidiocarps that vary from leathery to woody. They are chiefly characterized by species bearing deep pores or tubes. Some of these species, being the most destructive fungi, are largely responsible for the decay of living trees.

Some of the important wood-rotting fungi that affect timbers are *Hexagonia tenuis, Trametes corrugata, Ganoderma applanatum, Microporus xanthopus*, *Cymatoderma elegans, Daedalea ambigua, Fomes pachyphloeus, Polyporus hirsutus, Pycnoporus sanguineus,* and *Daldinia concentrica*. This is the first report of wood-rotting fungi in the Philippines.

Keywords: wood-rotting fungi, eukaryotic, basidiocarps, taxonomic, decay.

P-091

Arbuscular Mycorrhiza colonization status of *Huperzia* spp. in Mt. Pangrango, West Java, Indonesia

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Mycoheterotrophic plants, such as *Huperzia* spp. (*Lycopodiaceae*), are partly or entirely non-photosynthetic plants that obtain nutrients from fungal symbiont (Arbuscular Mycorrhizal Fungi–AMF). *Huperzia* spp.–AMF association are poorly studied as compared to other mycoheterotrophic plant (e.g. *Orchidiceae*). Here, AMF colonization status of sporophytes of *H. selago* and *H. serrata* in Mt. Pangrango is described in order to provide useful information for the conservation purposes. Sporophytes of *H. selago* were collected from Pangrango Summit (PS) and Near the Summit (NS), and *H. serrata* were collected from Kandang Badak (KB) and near the Cibereum Water Fall (CF). The percentage of AMF colonization on roots of *H. selago* and *H. serrata* was determined by the gridline intersect method. The results showed that the percentage of AMF colonization (Avg±SD %) was varied among individuals at each site. Highest AMF colonization was found on *Huperzia* spp. collected from KB (14.4±8.60 %), followed by CF (11.6±10.7 %), and NS (9.77±7.96 %). Remarkably, characteristic of knobby vesicles were observed in *H. selago* from NS.

P-092

Preservation of *Nostoc* spp. (Cyanobacteria) isolated from Indonesian paddy fields using freezing method

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The algae preservation method is important step in order to maintain the sustainability of algal stock cultures. Sustainability means the cultures are always viable in terms of physiologically and genetically. Cryopreservation, lyophilization, and freeze-drying are several methods of preservation used for microorganism. Amongst all methods, freezing had been widely used in the preservation of *Nostoc* (Cyanobacteria). In the present study we investigated the application of deep freezer to preserve eight *Nostoc* strains. All strains *Nostoc* was collected from several paddy fields in Java, Bali, and Celebes, Indonesia. Before preservation, samples were added with protectant of 5% DMSO and combination of 5%DMSO+5%Trehalose. Samples were kept in -80^{0}C for 7 days (short term) and 3 months (long terms). The result showed that except strain GIA13a, all strains retained their growth. Scanning microscope electron showed that filaments of strain GIA13a were come apart, becoming single cells. Colony of strains preserved in long term preservation grew up slower compare to those in short term preservation. Light microscopic examination showed that filaments of preserved strains become shorter compare to the normal ones.

Keywords: DMSO, freezing, growth, *Nostoc*, preservation.

P-093

Antioxidative and anti-Alzheimer's potential of *Canarium odonthophyllum* (Kembayau), an edible fruit from Borneo island.

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Canarium odonthophyllum or locally known as "Kembayau" or "dabai" is a nutritious fruit but remain underutilized. This study was conducted to determine the antioxidant activity, phytochemicals (total phenolic, total flavonoid, total anthocyanin and total carotenoid contents) and acetylcholinesterase inhibitor potential of flesh and seed of the fruits extracts. All samples were freeze-dried and extracted using 80% methanol and distilled water. Antioxidants were analyzed using DPPH and ABTS free radical scavenging activity as well as FRAP assays. Anti-Alzheimer's potential was determined using acetylcholinesterase enzyme inhibition assay. The results showed that the total phenolic and total flavonoid contents were higher in the flesh with the values of 11.96 ± 0.05 mg gallic acid equivalent (GAE)/g and 10.11 ± 1.54 mg rutin equivalent (RU)/g, respectively. Total anthocyanin and carotenoid

content were also higher in the flesh of the fruit with the values of 12.75 ± 0.28 mg/100g and 2.84 ± 0.11 mg/100g. The flesh of the fruit also showed higher antioxidant activity as assessed using DPPH, FRAP and ABTS assays. However, anti-cholinesterase activity was higher in the seed part of *C. odonthophyllum* which showed that other phytochemical content (besides phenolic and flavonoid) might be the major factor to the observed effects. The same trend of phytochemicals, antioxidant and anti-cholinesterase activity were also observed in the distilled water extract. These findings suggested that *C. odonthophyllum* is not only nutritious but also displayed pharmacological properties.

Keywords: *Canarium odonthophyllum,* phytochemicals, antioxidant, acetylcholinesterase inhibition properties.

P-094

Phytochemicals and antioxidant properties of *Schistochilla aligera* and *Schistochilla blumei* from Mount Kinabalu, Sabah

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Bryophytes have been commonly used as herbal medicines in China, India and America since ancient times to treat cardiovascular diseases, tonsillitis, bronchitis, tympanitis, cystitis and skin burns. The purpose of this research is to determine the phytochemical contents and antioxidant properties of *Schistochilla aligera* and *Schistochilla blumei*. The total phenolic and total flavonoid contents were determined using spectrophotometry analysis while the antioxidant properties were assessed by 1,1-diphenyl-2-picridyl-hydrazyl (DPPH) free radical scavenging activity assay, ferric reducing ability of plasma (FRAP) assay and ABTS radical cation decolorization assay. The results from this study showed that the total phenolic contents of *Schistochilla aligera* ranging from 4.02 to 21.18 mg gallic acid equivalent/g of dry sample whereas the total phenolic contents of *Schistochilla blumei* were in the range of 4.49 to 24.24 mg gallic acid equivalent/g of dry sample. On the other hand, the total flavonoid contents of *Schistochilla aligera* were in the range of 3.59 to 17.55 mg catechin equivalent/g of dry sample and for *Schistochilla blumei* the total flavonoid contents 3.99 to 22.09 mg catechin equivalent/g of dry sample. The antioxidant activities of the selected bryophytes extracts were highly correlated with the phytochemical contents. Hence, the results from this study indicate that *Schistochilla aligera* and *Schistochilla blumei* have potential health benefits due to their phytochemicals and antioxidant properties.

Keywords: *Schistochilla aligera*, *Schistochilla blumei*, phytochemicals, antioxidant properties.

P-095

Phytochemical and antioxidant activity of *Garcinia dulcis*, a fruit from Borneo Island

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The genus *Garcinia* belongs to the family of *Clusiacea*. Some *Garcinia* species have been used extensively as traditional medicines to treat diseases. *Garcinia dulcis* or locally known as 'mundu' is an underutilized fruits indigenous to Borneo and its nutritional values are yet to be explored. The purpose of this research is to determine the phytochemicals content (total phenolic and total flavonoid) and antioxidant activity of *G. dulcis* based on its parts: peel, flesh and seed. The total phenolic and flavonoid contents of the fruit were tested using Folin-Ciocalteu's and Aluminium Colorimetric methods, respectively. The antioxidant assessment was conducted using 2,2-diphenyl-1-pycryl-hydrazyl (DPPH) free radical scavenging assay, Ferric Reducing Antioxidant Power (FRAP) and ABTS decolourization assays. The results showed that the peel of *G. dulcis* contained the highest total phenolic content (27.80 ± 5.01 µg GAE/g dry sample) followed by seed (26.2 ± 3.12 µg GAE/g dry sample) and flesh (18.49 ± 2.26 µg GAE/ g dry sample). For the total flavonoid content, the peel showed the highest value (16.45 ± 2.20 µg CE/g dry sample) and followed by flesh (12.11 ± 1.03 µg GAE/dry sample) and seed (9.51 ± 0.85 µg GAE/dry sample). The antioxidant activity was highest in the peel, followed by the seed and flesh. As a conclusion, it is suggested that all parts of *G. dulcis* may serve as a potential source of antioxidant.
Keywords: *Garcinia dulcis*, total phenolic content, total flavonoid content, antioxidant activity.

P-096

Antioxidant activity, total phenolic and flavonoid content of selected commercial seaweeds of Sabah, Malaysia

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Seaweeds, either fresh or dried have been consumed as food in Asian diet over centuries especially among people who live in the coastal area. There are many types of commercial seaweeds in Sabah market. The most popular is *Kappaphycus alvarezii*, an edible type of seaweed which is classified under division of Rhodophyta (red algae). This study aims to evaluate the phytochemicals and antioxidant activity of selected seaweeds commercially available in Sabah market. Three varieties of *Kappaphycus alvarezii* ('tambalang hijau', 'giant' and 'green flower' seaweeds) were used in this study. The extract was prepared using 80% methanol. The antioxidant activities were determined by three methods; DPPH radical scavenging assay, FRAP (Ferric reducing antioxidant power assay) and ABTS free radical decolorization assay. The total flavonoid content (TFC) of the extract was determined using Aluminium Chloride Calorimetric method and the results were expressed as catechin equivalents (CE) whereas the total phenolic content (TPC) of the extract was determined using Folin-Ciocalteu method and the results were expressed as gallic acid equivalents (GAE). Giant seaweed was found to have the highest TPC and TFC with the values of 49.04±6.05mg GAE/100g dried sample and 15.54±1.68mg CE/100g dried sample; respectively. Tambalang hijau and green flower displayed lower TPC and TFC. Tambalang hijau had 30.96±1.34mg GAE/100g dried sample of TPC and 7.72±2.89mg CE/100g dried sample of TFC, while green flower had 16.47±4.96mg GAE/100g dried sample of TPC and 4.64±1.18mg CE/100g dried sample of TFC. Giant seaweed also displayed the highest antioxidant activities as compared to tambalang hijau and green flower. As a conclusion, Sabah commercial seaweeds contained high phytochemical contents and displayed high antioxidant activity *in vitro*.

Keywords: Commercial *Kappaphycus alvarezii,* total phenolic and flavonoid contents, antioxidant activity.

P-097

The allelopathic potential of an invasive *Acacia* in Brunei Darussalam

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Acacia auriculiformis is one of the invasive plant species in Brunei Darussalam. The allelopathic effects of aqueous extracts of its phyllodes were investigated and measured in terms of the percentage seed germination and seedling growth (radicle and plumule lengths) of selected crops, native and invasive plants in Brunei Darussalam. In the preliminary study, the selected target species included two native shrubs; *Melastoma malabathricum* and *Rhodomyrtus tomentosa*, two invasive plants; *Acacia mangium* and *A. auriculiformis*, and two *Oryza sativa* (rice paddy) varieties; *'Laila'* and '*Pusu'.* Different concentrations of aqueaous extracts of *A. auriculiformis* were prepared by soaking different amount of phyllodes in distilled water for five days. The seeds of the target species were germinated in sterile petri dishes for 30 days, except for *R. tomentosa* (60 days) in seed germination chamber at 35^{o}C/25°C (day/night) over a 12-h photoperiod. In comparison to the control treatment (using distilled water), increasing phyllode leachates concentrations of *A. auriculiformis* decreased percentage germination, germination time and seedling growth of *M. malabathricum* and *R.*

tomentosa but not both Acacias. No results for rice seeds yet, as experiments are still ongoing. This study provides information on the negative allelopathic effects of invasive *Acacia* on native plants. Currently, the study is extended to investigate the allelopathic effects of these aqueous extracts on the seedlings growth and physiology of the selected plants.

Keywords: *Acacia auriculiformis*, allelopathy, aqueous extract, seed germination, seedling growth.

P-098

The future prospect of the use of rattan as food resources in Central Kalimantan

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Rattan plays an important role in the culture of the Dayak communities living near forest areas,, because their rattan as food resources . Young rattan shoot is cooked as a vegetable to make a dish "*sayur umbut rotan*". Stir-fried young rattan shoot cuisine is served at Dayak traditional ceremonies. The aims of this study is to identify and inventory rattan species used in Dayak food. The study was carried out at the villages of Katunjung and Kalumpang, Sei Ahaz, Katimpun, Mantangai Hulu, Kapuas by interviewing local community, making field observation and sample collection of rattan herbarium. The study recorded eight species of rattan use in Dayak food i.e. *Calamus caesius, C. trachycoleus, C. ornatus, Daemonorops crinitus, D. angustifolia*, dan *Plectocomiopsis geminiflora*. To prepare this beneficial utilization, it is recommended that these eight rattan species are cultivated in their garden.

Keywords: Rattan plant, traditional food, local communities.

P-099

The botany economy of the dusun people in Tikolod village, Tambunan district, Sabah, Malaysia.

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The ethnobotanical studies of the Dusun people in Tikolod village, Tambunan district, Sabah, Malaysia were conducted in July 25-30th, 2011 and in March 9-10, 2012. The result shows that there were160 species in 62 families of plants used. Among them, there were 83 speciesof vegetable plants (in 36 families), 75 species were medicines (in 44 families), 12 species (in 9 families) were used for

constructions and handicraft and eight species (in 6 families)were for musical instruments and animal traps. There were 24 species of plants which have two or more uses. About 87 species or 54% of them were native or from the natural forest nearby and 73 species or 45% of these plants were exotic (introduced plants). The most commonly usedplant families were from Poaceae (Gramineae) with fourteen species followed by Moraceae and Zingiberaceae with eight species each and Arecaceae (Palmae), Cucurbitaceae, Euphorbiaceae, Rutaceae and Solanaceae with seven species each.
Keywords: Ethnobotany, Dusun, Tambunan, Sabah, Malaysia.

P-100

Ethnobotany of *Tacca leontopetaloides* (L.) O. Kuntze as a food in Belitung and Bangka Islands, Bangka Belitung Province, Indonesia

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Ethnobotanical study of *Tacca leontopetaloides* was conducted on Bangka Belitung Province using open-ended interview methods, field observations, purposive sampling. *Tacca leontopetaloides* very little known and utilized by the local people in certain areas in Bangka Belitung Province, namely in Membalong and Simpang Pesak district. The plant has different local names in each region, such as in Belitung island known as "nubong" and "genubong", while in Bangka island, known as "keladi kecubung" but not known as food plant. In Belitung island, local people utilized tuber of the species to extract the flour in certain process. The tuber flour as a substitute for wheat flour used as an ingredient in the form of snacks, for example: cakes “rintak” and “chips”. “Rintak cake” is celebrate cake after fasting month. In the research locations, the species commonly grown in wild near the beach, also pick up from the small islands in surrounding.
Keywords: Ethnobotany, *Tacca leontopetaloides*, Food, Flour, Bangka Belitung Province.

P-101

Ethnobotanical study of Brangkuah community in Moyo Island, West Nusa Tenggara

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An ethonobotanical study at Moyo Island, West Nusa Tenggara has been carried out to record the traditional knowledge and utilization of plant based on their traditional knowledge. It is expected that

the traditional knowledge can play a role on the natural resource management system which can be used on conservation program. This research was conducted with observational methods in the Moyo forest and interviews with local people that has knowledge about utilization of plants. Based on this study it was recorded that there are 45 species used by Brangkuah cummmunity at Moyo Island, most of them are collecting from the forest, only food plant 37,5% (18 species) are cultivated. Beside as food, the local people also used plant for medicine 41,7% (20 Species) and building material 12,5% (7 species). The Brangkuah has started to cultivate several plants which used as building materiasl and food plants although they have been collected from the forest before. It can be concluded that Brangkuah community has conserved the useful plants for their daily life and also to protect harvesting from the wild. So it is expected that the flora will be sustained in the forest..
Keywords: Ethnobotany,Burangkuah, Moyo Island, West Nusa Tengggara.

P-102

Useful plants diversity in Alas Purwo National Park (APNP)

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A research was conducted in Alas Purwo National Park (APNP), East Java to collect and document useful plants used by local people. 147 plant species distributed in 51 families were collected. Of the total plant species 52 % were trees, 17 % shrubs, 4 % palms, 24 % herbs, and 2 % ferns. Several species are categorized as endangered species (Alstonia scholaris (L.) R. Br., Arcangelisia flava (L.) Merr., Merremia mammosa (Lour.) Hallier f., Parkia roxburghii G.Don, Piper retrofractum Vahl). Among the species collected, 101 species were used by local people including 98 of medicinal plant. Some of commonly used medicinal plants were Blumea lacera (Burm.f.) DC., Elephantopus scaber L., Gmelina elliptica Sm, Harrisonia perforata (Blanco) Merr., Mallotus paniculatus (Lam.) Müll.Arg, and Parkia roxburghii G. Don. 9 different plant parts were used separately or combined together by local people. The medicinal plants were mainly used for treatment of stomachache, diarrhea, skin diseases and wounds. After combination with previous data total 537 plant species have been documented from APNP for the first time.
Keywords: Alas Purwo National Park, useful plant, local people.

P-103

The use of plants from the Moraceae & Urticaceae traditional medicine

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Moraceae and Urticaceae are widely distributed in tropical areas, including Indonesia. Many species from these families were used as medicine, food crops, vegetables, ornamental plants, edible fruits, forages, spices, fibre, and timber. This study study was conducted to record the use of these families as traditional medicine. Field surveys were carried out by interviewing the tribals, i.e. *Sando*, elderly people, and herbal healers in West Java, Central java, East Java and Central Sulawesi. Some members of Moraceae and Urticaceae were used to treat headache, ulcer, stomachache, skin care, diarrhea, dysentery, tuberculosis, post-natal care, liver disease, cancer, cataract, breast tumor, and wounds.
Keywords: *Moraceae, Urticaceae*, traditional medicine

P-104

Useful plants diversity in Pakuli and Toro village, near Lore Lindu National Park, Central Sulawesi

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A research was conducted in Toro and Pakuli village, near Lore Lindu National Park, Center of Sulawesi to collect and document useful plants used by local people. In Pakuli village 178 plant species were collected and documented. Most of them were traditionally used to cure 71 ailments. The main ailments were cancer, head ache, influenza and wound. In Toro 219 species were found and recorded. 75 medicinal plants species were used to heal 33 ailments. The most common ailments were wound and fever.
Keywords: Pakuli village, Toro village, Lore Lindu National Park, useful plants.

P-105

The traditional medicinal uses of the Euphorbiaceae & Phyllanthaceae families

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Euphorbiaceae, the Spurge family, is a large family of flowering plants consisting of a wide variety of vegetative forms, composed of over 300 genera and 8,000 species. *Phyllanthaceae* are a morphologically diverse pantropical family of about 2000 species in c. 60 genera, which has been segregated from the Euphorbiaceae sensu lato (s.l.) along with Pandaceae, Picrodendraceae, and Putranjivaceae, following recent molecular work. Field survey information was gathered by making repeated queries time to time through interviewing the tribals, i.e. *Sando*, elderly people, and herbal healer. The field survey took place in Java (Halimun and Salak National Park, Gede Pangrango National Park, Ujung Kulon National Park, Alas Purwo National Park, Pangandaran National Preserve, Slamet Mount National Preserve, Baluran National Park, Meru Betiri National Park) and Central Sulawesi (Lore Lindu National Park). *Euphorbiaceae* and *Phyllanthaceae* are used as traditional medicine for wound, headache, antiviral, fever, cancer, antimicrobial, thyroid, appendicitis, itch, hair lice, malaria, ear ache, fracture, eye cleaner, etc.

Keywords: *Euphorbiaceae*, Phyllanthaceae, traditional medicine.

P-106

Potency and distribution of *Tacca leontopetaloides* as a local food ingredient for wheat flour substitute in Southern Garut, West Java, Indonesia

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In Indonesia, local food from the various types of tubers are not considered in proportion as the carbohydrate source that can replace rice or wheat flour. Therefore , government started to re-program nationally the development and utilization of tubers as food after the monetary crisis which affected on the food crisis occurring in the year 1997/1998. Ethnobotany research on potency and distribution of *Tacca leontopetaloides* as local food substitute for wheat flour in South Garut was done by June 2012. The method of this study was survey. Primary data was collected by direct observation in the field and interview with local communities. The field data was collected by random at 9 villages of 2 subdistricts (Pameungpeuk and Cikelet) of Garut Regency, West Java. Secondary data was collected by literature study in the library and internet. The results showed that Pameungpeuk and Cikelet Subdistricts are the distribution area of *Tacca leontopetaloides*, especially at Cikelet subdistrict . Distribution of *Tacca leontopetaloides* was at 6 - 10 m altitude, ambient temperature of 30-32 °C (shady place) and 34 °C (open area), and relative humidity of 57-73 %. At Cikelet Subdistrict, local people use the starch of *Tacca leontopetaloides* tuber for producing various food supplement to substitute wheat flour. The result of this research is expected to contribute in taking policy in the framework of development and conservation of a local plant for supporting of food sovereignty of local people.

Keywords: *Tacca leontopetaloides,* distribution, potency, local food resources, West Java.

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Plant diversity and its ethnobotanical potential of Wawonii Island, South East Sulawesi

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Wawonii island is one of the small island located in Shout East Sulawesi, with an area of 650 km2. Exploration and inventory activities in eight locations (Wawolaa, Langsilowo, Lampeapi, Wungkolo, Bobolio, Munse, Waworete, Dompo-Dompo) have been carried out. Approximately 980 species (belongs to 137 families and 559 genera) included fern and cultivated plant have been identified and then evaluated to their taxonomical status and its distributions. Fifty three species of them were new record for Sulawesi, 10 species need more taxonomical studied, nine species as endemic in Sulawesi. The distribution pattern of those species indicated that, only 3 % were common found in the whole areas, and more than 50 % distributed only in certain location. The richest species diversity occur in Lampeapi followed Waworete, Wawola, Munse, Wungkolo, Lansilowo, Bobolio and Dompo-Dompo Jaya, with 417, 302, 230, 206, 197, 179, 165, and 116 species respectively. From etnobotanical point of view, more than 150 species recorded have important value for many purposes such: food, traditional medicine, spice, cosmetic, mat materials, etc.

Keywords: plant diversity, economic potential, Wawonii island, S.E. Sulawesi.

P-108

Medicinal plants used by the Atinggola Healers, North Gorontalo, Sulawesi, Indonesia

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The present study was done to determine the medicinal plants used by traditional healers of the Atinggola Community who lives in the North Gorontalo, Gorontalo, Sulawesi. Data has been collected by survey method, and analyzed using the descriptive qualitative method. Based on this study, it was shown that there were 42 species (25 families) medicinal plants that can be used to cure some diseases by the healers, comprising: 13 species used to cure fever, 2 species to treat toothache, 2 species to treat malaria, 6 species for the treatment of urinary stone disease, 3 species to treat gastrointestinal diseases, 2 species to treat liver disease, 1 species to treat tonsillitis, 1 species for treating cancer, 1 species for treating allergies, 2 species to treat skin diseases (ulcers), 2 species to treat cough, 1 species to treat eye irritation, 1 to treat wound infections, 2 species of thrush, 2 species to restore power, 1 species of snake poison antidote. For example, to treat fever disease*, sarampah* used *Jatropha curcas* L., *Averrhoa carambola* L , *Averrhoa bilimbi L.*, *Zingiber purpureum* Roxb., *Euodia redlevi.*, *Flueggea leucopyrus.* On the other hand, to treat toothaches use *Acalypha indica* and *Hyptis capitata.* Furthermore Imperata *cylindrica* and *Centella asiatica* was used for the urinary stone disease treatment. *Physalis peruviana*was also used for treating diabetes. Unidentified species of Cyperaceae called *diata* in local name, was used to cure cancer. This medicinal plants were mostly used by boiling, squeeze, and scrape to thepart where it will be cured. Most of those species used for medicinal plant are still collected from the forest (23 species, 54,76%) and 19 species (45,24%) collected from cultivated plant. To preserve those species collected sustainably, it is necessary to propagate the species which is harvested from the forest.

Keywords*:* medicinal plant, Atinggola community.

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The utilization of 'sapupadang' *Baeckea frutescens* L. locally in Bangka-Belitung Islands

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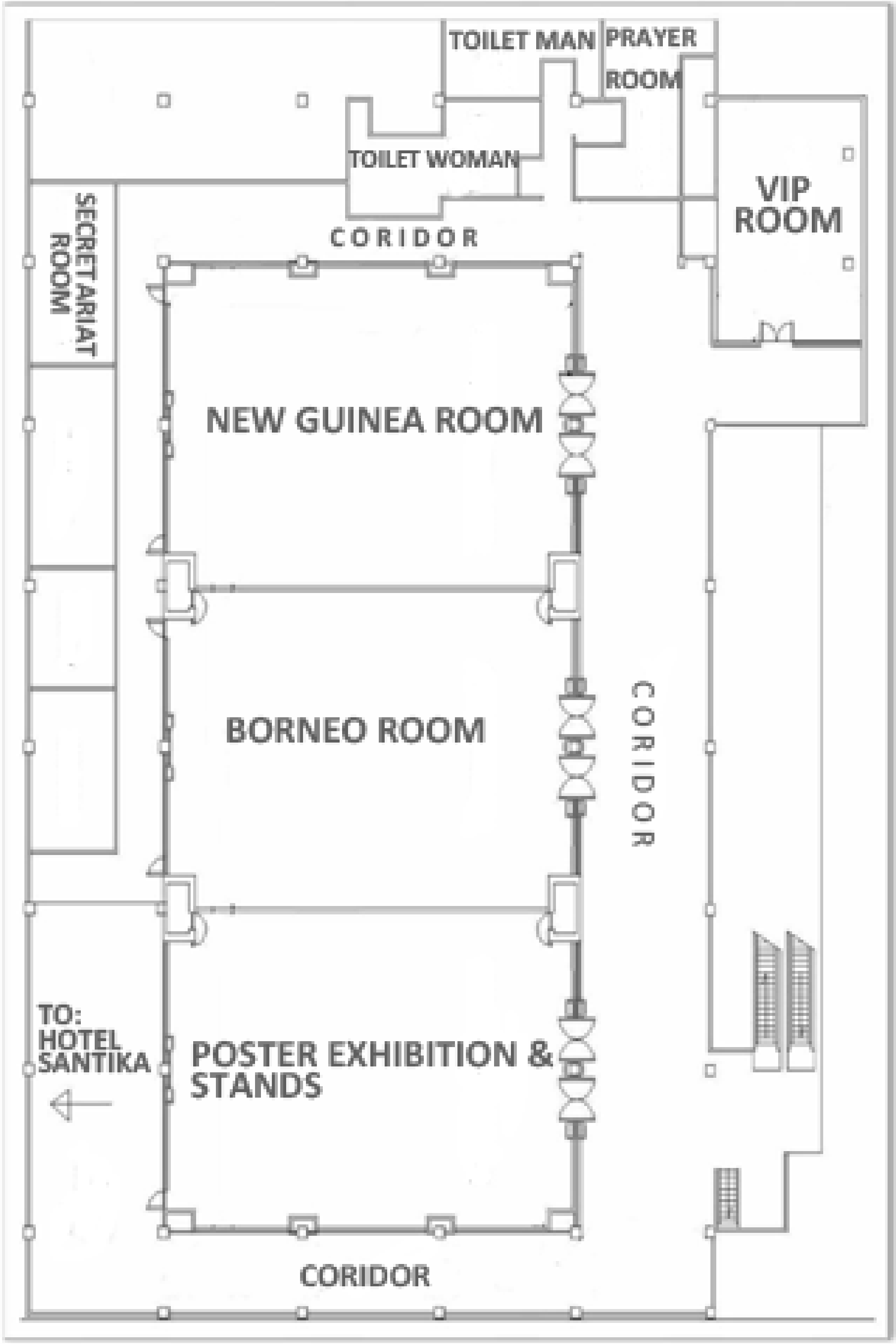
This purpose of the present study is to record the recent utilization of 'sapupadang', *Baeckea frutescens,* at Bangka Belitung Islands. The study/observation took place at a forest, people's resident and traditional market. The interviews are done to the broom maker, seller, traditional healer, and the elder people in the villages. It is know that there are four groups utilization of 'sapupadang' in Bangka Belitung Islands. The main uses for fuel wood, household appliances, ornamental plant and traditional medicine. The most common utilization are household appliances (garden broom) and ornamental plant (bonsai). There are changes on the land cover which have been used as plantation, mining, housing and industry recently. This action make the sapupadang habitat as well as the utilization of this plant become declining. The utilization of 'sapupadang' declines on their frequency as well as their quantity. The development are needed in the future so that the preservation of its habitat could be maintained as well as the preservation of its utilization can be benefit for the local people.

Keywords: *Baeckea frutescens* L., utilization, local people, Bangka-Belitung Islands

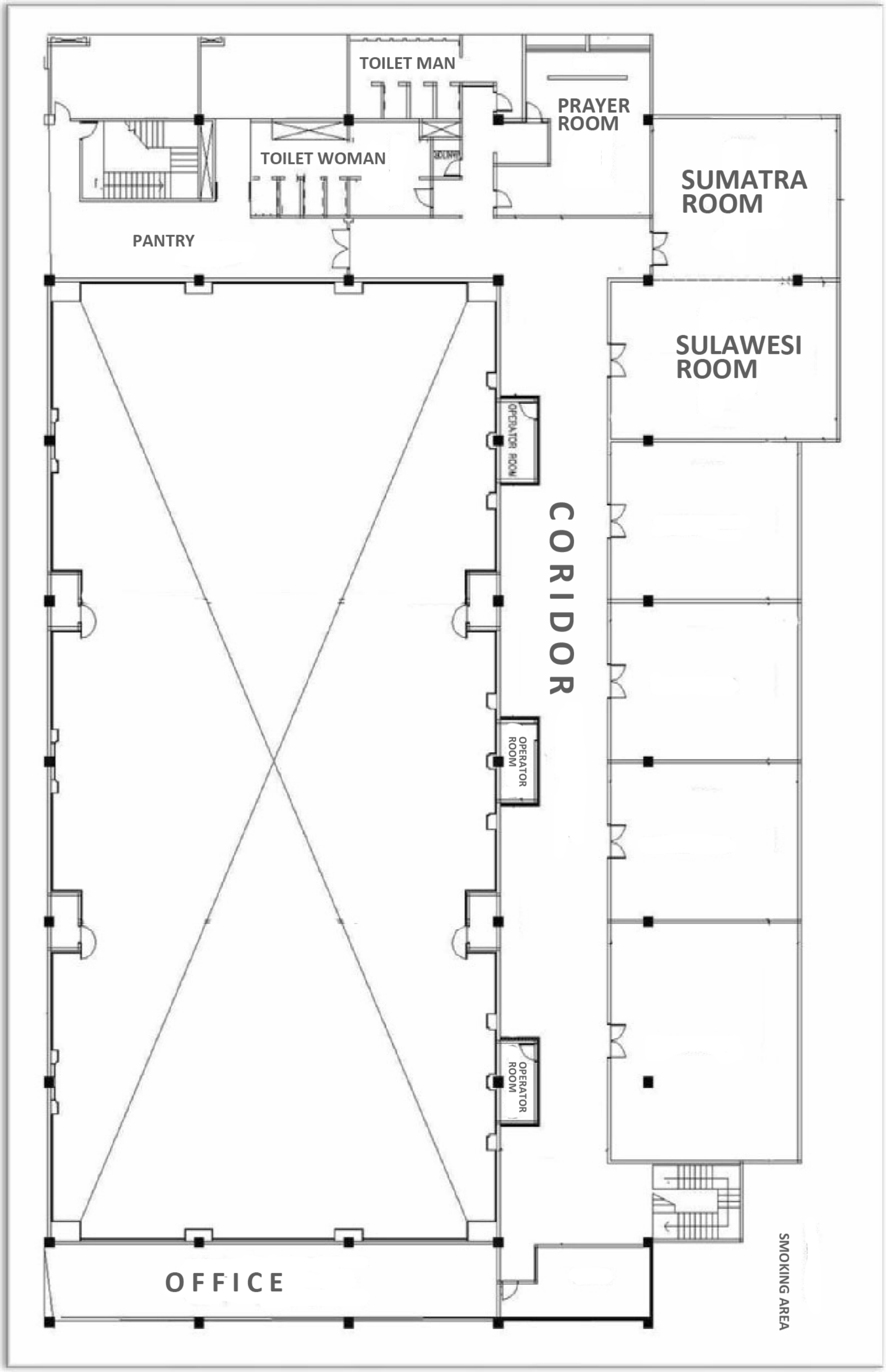
MISCELLANEOUS

CONFERENCE VENUE LAYOUT

FIRST FLOOR



SECOND FLOOR



GETTING AROUND IN BOGOR

Going to or from the Hotel to the Symposium venue or vice versa, you can take *Angkot* (*ung-ko:t*). *Angkot* is a public transportation we have here in Bogor. You can take the *Angkot* anywhere you need and it costs IDR 2.500 for one-way travel. Here is a list of *Angkot* lines which will take you from/to the hotel to/from the symposium venue:

Angkot Number	Route	Places passed by *ANGKOT*
01	CIPINANG GADING – CIPAKU – MERDEKA PP	Train Station, Royal Hotel, Sahira Hotel
01A	BARANANGSIANG – TAJUR – CIAWI PP	IPB ICC, Santika Hotel, IPB Convention Hotel, Amarossa Hotel. Ririn Hotel, Wisma Rengganis, Horison Hotel, Hotel Pakuan
02	SUKASARI – TERMINAL BUBULAK PP	Train Station, Main Gate Bogor Botanic Gardens, Hotel Sahira, Hotel Royal
03	BARANANGSIANG – TERMINAL BUBULAK PP	Train Station, Santika Hotel, IPB Convention Hotel, Permata Hotel, Amaris Hotel, Wisma Jalak Harupat, Sempur Park Hotel, Salak Hotel, Mirah Sartka Hotel, Pangrango Hotel, Mirah Hotel, Wisma Gunung Gede
05	CIMAHPAR – RAMAYANA PP	IPB ICC, Santika Hotel, IPB Convention Hotel, Permata Hotel, Amaris Hotel, Wisma Jalak Harupat, Sempur Park Hotel, Salak Hotel, Mirah Sartika Hotel, Pangrango Hotel, Mirah Hotel, Wisma Gunung Gede
06	CIHEULEUT – RAMAYANA PP	IPB ICC, Santika Hotel, IPB Convention Hotel, Permata Hotel, Amaris Hotel, Wisma Jalak Harupat, Sempur Park Hotel, Salak Hotel, Mirah Sartika Hotel, Pakuan Hotel, Horison Hotel
07	CIPARIGI – TERMINAL MERDEKA PP	Wisma Sudirman, Efita Hotel, Wisma Bogor Permai, Salak Hotel, Mirah Sartika Hotel

***Angkot* Number**	**Route**	**Places passed by *ANGKOT***
07A	**PASAR ANYAR – PONDOK RUMPUT PP**	Wisma Sudirman, Efita Hotel, Wisma Bogor Permai
08 (RED)	**WR. JAMBU – RAMAYANA PP**	Main Gate of Bogor Botanic Gardens, Santika Hotel, IPB Convention Hotel, Permata Hotel, Amaris Hotel, Pangrango Hotel, Wisma Jalak Harupat, Mirah Hotel, Sempur Park Hotel, Salak Hotel, Mirah Sartika Hotel, Sahira Hotel, Royal Hotel
09	**CIPARIGI – SUKASARI PP**	Santika Hotel, IPB Convention Hotel, Amarossa Hotel. Ririn Hotel, Wisma Rengganis, Horison Hotel. Hotel Pakuan, Wisma Gunung Gede, Pangrango Hotel, Permata Hotel, Amaris Hotel
10	**BANTAR KEMANG – SUKASARI – MERDEKA PP**	Train Station, Main Gate of Bogor Botanic Gardens, Hotel Sahira, Hotel Royal
11	**PAJAJARAN INDAH – PASAR BOGOR PP**	Amarossa Hotel, Hotel Ririn, Bus Station
12	**CIMANGGU – PASAR ANYAR PP**	Train Station, Efita Hotel, Wisma Bogor Permai, Wisma Sudirman
13	**BANTAR KEMANG - RAMAYANA PP**	IPB ICC, Santika Hotel, IPB Convention Hotel, Permata Hotel, Amaris Hotel, Wisma Jalak Harupat, Sempur Park Hotel, Salak Hotel, Mirah Sartka Hotel, Pakuan Hotel, Horison Hotel, Amarossa Hotel
16	**PASAR ANYAR – SELABENDA PP**	Efita Hotel, Wisma Bogor Permai, Wisma Sudirman.
08 (BLUE)	**PASAR ANYAR – CITEUREUP PP**	**Herbarium Bogoriense in Cibinong**, Wisma Bogor Permai, Efita Hotel, Papa Ho Hotel, Hotel Taman Cibinong I & II

Another public transportation which will take you from Bogor to another district such as to Cibinong (where the Herbarium Bogoriense is) is a small bus. There are two bus routes which will go to Herbarium Bogoriense in Cibinong from Bogor, i.e.:
Route Bogor-Depok
Route Bogor-Kampung Rambutan

You can always take a taxi from your Hotels to go anywhere you need.

BANKING INFORMATION

To exchange your money to Indonesian Rupiah (IDR) you may go to money changers and any banks. Below is list of Money Changers and Banks nearby the Symposium Venue

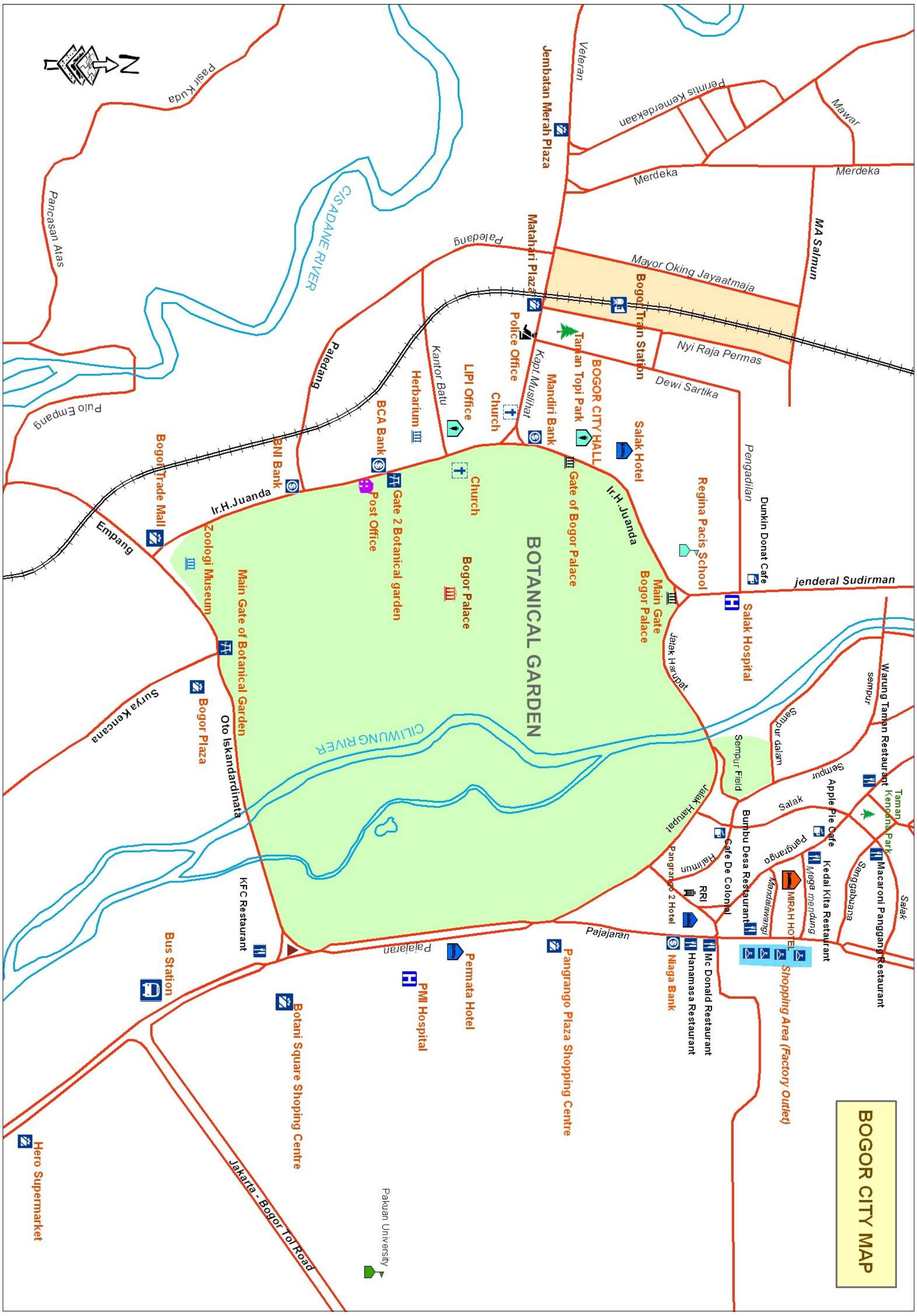
Table 1. List of Money Changers

No.	Name
1	**Money Changer in LG-1 Botani Square Mall** Telephone: +62 251 8400761 Time: 10:00 - 22:00
2	**P.T. Gede Agung Bagus** Jl. Siliwangi Telephone: +62 251 328063
3	**Dekok Money Changer (DMC)** TAMAN TOPI SQUARE, Blok A No.02 Jl. Kapten Muslihat Street, Bogor Train Stasiun (near MATAHARI Department Store)

Table 2. List of Banks (operation time usually 10:00-12:00 am)

No.	Bank Name	Address
1	Bank BCA	Jl. Ir. H. Juanda
2	Bank BNI (Persero)	Jl. Ir. H. Juanda No. 52
3	Bank Danamon	Jl. Ir. H. Juanda
4	Bank Mandiri	Jl. Ir. H. Juanda No. 14
5	Bank Niaga	Jl. Gunung Gede
6	Bank NISP	Jl. Ir. H. Juanda
7	Bank BCA at Puri Begawan	Jl. Padjajaran

BOGOR MAP


BOGOR CITY MAP
BOTANICAL GARDEN
CISADANE RIVER
CILIWUNG RIVER
Pasir Kuda
Pancasan Atas
Pulo Empang
Empang
Paledang
Ir.H.Juanda
Jalak Harupat
Oto Iskandardinata
Surya Kencana
Pajajaran
Jakarta - Bogor Tol Road
jenderal Sudirman
Pengadilan
Dewi Sartika
Nyi Raja Permas
Mayor Oking Jayaatmaja
MA Salmun
Merdeka
Mawar
Perintis Kemerdekaan
Veteran
Kantor Batu
Kapt. Muslihat
Sempur
Sempur dalam
Sempur Field
Salak
Pangrango
Halimun
Mandalawangi
Megamendung
Sanggabuana
Jembatan Merah Plaza
Matahari Plaza
Police Office
Bogor Train Station
Taman Topi Park
BOGOR CITY HALL
Mandiri Bank
Church
LIPI Office
Herbarium
BCA Bank
BNI Bank
Bogor Trade Mall
Zoologi Museum
Main Gate of Botanical Garden
Gate 2 Botanical garden
Post Office
Bogor Palace
Gate of Bogor Palace
Main Gate Bogor Palace
Salak Hotel
Regina Pacis School
Dunkin Donat Cafe
Salak Hospital
Warung Taman Restaurant
Taman Kencana Park
Apple Pie Cafe
Kedai Kita Restaurant
Macaroni Panggang Restaurant
Bumbu Desa Restaurant
Cafe De Colonel
RRI
Pangrango 2 Hotel
MIRAH HOTEL
Shopping Area (Factory Outlet)
Mc Donald Restaurant
Hanamasa Restaurant
Niaga Bank
Pangrango Plaza Shopping Centre
Permata Hotel
PMI Hospital
Botani Square Shoping Centre
KFC Restaurant
Bus Station
Bogor Plaza
Hero Supermarket
Pakuan University

BOGOR BOTANIC GARDENS MAP

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