DAVIS EXPEDITION FUND

REPORT ON EXPEDITION/PROJECT

Expedition/Project Title: Systematics & Biogeography of Indonesian *Manilkara* (Sapotaceae)

Travel Dates: 27th January 2008 to 27th March 2008 (returned to the UK on 16/4/08)

Location: West Papua & Sualwesi, Indonesia

Group Members: Kate Armstrong (University of Edinburgh/RBGE), Charlie Heatubun (Universitas Negeri Papua), Rani Asmarayani (LIPI)

Aims:
- To collect fertile herbarium specimens and habitat data for five poorly known *Manilkara* species
- To collect fresh leaf material in silica gel for DNA extraction and sequencing
- To collect base-line data on the IUCN conservation status of *Manilkara* – an important timber tree
- To forge strong collaborative links between Indonesian botanists at Herbarium Bogoriense, Universitas Negeri Papua, the Royal Botanic Garden Edinburgh (RBGE) & The University of Edinburgh

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Introduction:
During February-March 2008 I travelled to the Indonesian islands of West Papua and Sulawesi to conduct botanical fieldwork as part of my Ph.D. research on the systematics and biogeography of the pantropical tree genus *Manilkara*.

Manilkara is a genus in the Sapotaceae consisting of *c*. 81 species distributed throughout the tropics (30 South and Central American, 37 African and 14 SE Asian-Polynesian). Its distribution in Asia stretches from India to Samoa. Indonesia lies at the centre of this distribution at the crossroads between an Asiatic flora to the west and an Australasian flora to the east. This biotic interface in combination with the exceptionally complex geological history of the region, make the Indonesian archipelago an interesting study area. The Indonesian species of *Manilkara* are central to understanding the group's speciation and biogeographical history in the region.

This fieldwork aimed to sample Indonesian species of *Manilkara* in order to gain an understanding of their ecology based on field observation and test hypotheses about migration and diversification patterns in the region.

Overall Aims:
- To investigate the effect of Wallace's Line as a biogeographical barrier for the tree genus *Manilkara* and its implications for biodiversity and geography in SE Asia.

- To examine diversification patterns of *Manilkara* in SE Asia in relation to the historical biogeography of the group in Africa and South/Central America.

Fieldwork Objectives:
- To collect fertile herbarium specimens and habitat data for five poorly known *Manilkara* species
- To collect fresh leaf material in silica gel for DNA extraction and sequencing
- To collect base-line data on the IUCN conservation status of *Manilkara* – an important timber tree
- To forge strong collaborative links between Indonesian botanists at Herbarium Bogoriense, Universitas Negeri Papua, the Royal Botanic Garden Edinburgh (RBGE) & The University of Edinburgh

Implementation and fieldwork schedule:

27/1/08 - Arrival in Bogor
28/1/08 - Begin research permit application process
07/2/08 - Complete research permit approval process in Jakarta
08/2/08 - Flight to Jayapura
09/2/08 - Collecting in Holtekamp & Skow (outside Jayapura)
10/2/08 - Collecting in Skow
11/2/08 - Offices in Jayapura for permissions
12/2/08 - Collecting in Cyclops Mtns.
13/2/08 - Collecting in Cyclops Mtns.
14/2/08 - Offices in Jayapura for permissions, collecting in Cyclops Mtns.
15/2/08 - Drove to Sanyatami village
16/2/08 - Camping and collecting in forest near Sanyatami village
17/2/08 - Collecting along roadside in Skamto (between Tami and Jayapura)
18/2/08 - Looked for *Manilkara* in around Jayapura
19/2/08 - Ship to Yapen
20/2/08 - Visited offices in Yapen to present paperwork for permissions
21-22/2/08 - Camping & collecting in Tatui village
23/2/08 - Collecting Ambaidiru village
24/2/08 - Collecting in Sarawandori
25/2/08 - Collecting at Pantai Pasir Lima
26/2/08 - PELNI ship to Manokwari
27/2/08 - Visited offices in Manokwari for permissions and dried specimens
28/2/08 - 3/3/08 - Forest department in Manokwari drying specimens
04/3/08 - Preparation for camping & drove to Ransiki
05/3/08 - Drove to Yaimeki, camping and collecting specimens around Yaimeki
06/3/08 - Drove back to Manokwari
07/3/08 - Packed specimens in Forest Department
08/3/08 - Flew to Sorong, met local counterpart in Sorong Forest Department
09/3/08 - Checked about boat to Waigeo, collecting around Sorong
10/3/08 - Flight from Sorong to Manado
11-12/3/08 - Manado, meetings with local colleagues
13/3/08 - Drove to Bilato & Forest Department offices in Gorontalo for permissions
14/3/08 - Collecting around Bilato
15/3/08 - Drove to Gorontalo
16/3/08 - Drove from Gorontalo to Dumoga and hiked into Bogani Nani Wartabone
17/3/08 - Collected specimens in Bogani Nani Wartabone N.P.
18/3/08 - Hiked out of park, drove from Dumoga to Manado
19/3/08 - Shipping of specimens and meetings in Manado, visit to Tomohon
20/3/08 - Flight from Manado to Jakarta
21-23/3/08 Easter holiday – businesses closed
24-27/3/08 Drying and sorting specimens, report writing

Results:

Eighty two specimens were made as part of this research. All were collected in sets of 3-5 duplicates to facilitate sharing between institutions. The top set of specimens has been deposited at BO (Herbarium Bogoriense), the main herbarium in Indonesia, with duplicates being sent to E (Royal Botanic Garden Edinburgh) and either the local Forest Department herbarium in Manokwari (West Papua) or Palu (Sulawesi) depending upon the locality where the specimen was collected. Specimens collected were primarily from the focus group family Sapotaceae (50 collections made), but also include other associated families upon which colleagues at BO and E are conducting taxonomic studies (namely Zingiberaceae, Begoniaceae, Gesneriaceae and gymnosperms). All collections have associated supplementary leaf material in silica gel for DNA analysis. (A list of specimens is provided below.)

Field-based observations and collections of *Manilkara fasciculata* have been very informative. The leaves of this species are extremely variable in size and shape with age, looking like two or more species depending upon the size and maturity of the tree. This information has not previously been recorded on herbarium

specimens and sterile material has, therefore, caused some confusion with another species (*Manilkara hoshinoi* from Polynesia) in the past. Field observation and the collection of specimens during this trip have, thus, proven very insightful and the generation of molecular data will help to clarify species limits.

Unfortunately, two of the endemic Indonesian species I was searching for could not be located in the field. I went back to all of the original collecting localities as recorded on herbarium specimens (from the 1940's - 60's) but much of the lowland coastal forest habitat had been cleared or selectively logged since the original collections of these species were made. I was, therefore, unable to find any specimens of *Manilkara napali* (endemic to the area around Jayapura, West Papua) or *Manilkara celebica* (endemic to Sulawesi). (Although – see below – a specimen collected at Kebun Raya Purwodadi is likely to be *M. celebica*.) It is possible that the species still exist in small isolated pockets of forest, but I now consider these two species to be threatened. Even *Manilkara fasciculata*, which is recorded from the Moluccas to Papua was only found at one of the localities visited – Yapen island. A fourth species, *Manilkara kauki*, is very widely cultivated on Java and Bali, but no wild-origin trees were located. It is believed to be an auspicious tree of Javanese kings and was therefore planted in villages for prosperity. Its small fruit is also edible and the wood is sometimes used for carving of masks and figures. Being a culturally important tree for the Javanese, it can be found planted on other islands in the Indonesian archipelago, wherever the Javanese have travelled. Since it is such a widely cultivated species in Indonesia, it is difficult to say where the species originated. At present, molecular evidence shows specimens from Thailand and Australia appearing in separate sub-clades suggesting different origins. Including the new samples from Indonesia in the phylogeny should help to answer questions about its origin and dispersal and how this has been affected by the geological complexity of the region.

I also received two *Manilkara* specimens from Kebun Raya Purwodadi, (a national botanic garden in east Java). Although these specimens are sterile, they have interesting leaf morphology. One specimen from Purwodadi was originally collected in Sulawesi and may be a juvenile form of *Manilkara celebica*. It will be very interesting to see how these species are related to others by including them in the molecular phylogeny.

Conclusions:

Although only few populations of *Manilkara* were found, the information gained from the specimens collected has been insightful and will contribute valuable data towards a taxonomic revision, phylogenetic reconstruction and analysis as well as conservation assessments of *Manilkara* species in Southeast Asia. Because we currently have very few Sapotaceae specimens from Papua and Sulawesi, the additional Sapotaceae specimens collected will also be of great value for continuing collaborative research on the family between RBGE and Indonesian researchers at the Herbarium Bogoriense and there has already been discussion of beginning molecular analysis on them.

Likewise, there are few modern collections of Zingiberaceae from these islands. One species in particular is believed to have been re-discovered. KA 377, *Alpinia chrysogynia (K.Schum.)K.Schum.* is the first and only other known specimen made of this species since it was originally collected in the 19th century.

The importance of lowland, coastal forest conservation has been highlighted during this trip. Lowland areas are much more densely inhabited than highland areas and are, therefore, heavily impacted by the growing resource needs of an expanding population. Many accessible areas have been logged and in some places the logged forest has been converted to palm oil or coconut palm plantations. In northern Sulawesi the deforestation is acute. There the only primary forest witnessed was in Bogani Nani Wartabone National Park itself – and even within the park, near the periphery, there are slash & burn clearings for gardens and extensive rattan harvesting. Many local people say that the deforestation has become worse in the past 10 years or so with political change in the country and migrants from other islands becoming bolder about carving out their own patch of forest to sustain their families. There is also a commonly held view in Sulawesi that there is still plenty of forest left on other Indonesian islands (i.e. Kalimantan or Sumatra), so there is no need for them to worry about a little deforestation in Sulawesi. However, the situation is reportedly the same on Kalimantan, with people cutting forest and saying that there is still plenty of forest left on other islands such as Sulawesi.

Having said this – of the areas I visited - there are still large stretches of pristine forest in West Papua and Bogani Nani Wartabone National Park in Sulawesi, doubtless with numerous species yet to be documented. The rediscovered *Alpinia* species is just one example. Therefore, in conjunction with conservation, this fieldtrip has also highlighted the urgent need for more botanical exploration. My visit has paved the way for other RBGE researchers, particularly in West Papua, an area that has, in the past, been notoriously difficult to get permission to visit. So, it is hoped that there will be future joint RBGE-LIPI research projects in this biogeographically fascinating area and RBGE colleagues are already planning a research trip to West Papua to study *Rhododendron* next year.

Acknowledgements:

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- Carnegie Research Grant from the Carnegie Trust
- Monica Cole Research Grant from the Royal Geographical Society
- Davis Expedition Fund from the University of Edinburgh
- Systematics Research Fund, from the Systematics Association

List of herbarium specimens deposited at BO:		
Coll. number	**Species**	**Family**
KA300	*Hornstedtia sp.*	Zingiberaceae
KA301	*Amomum cf. aculeatum*	Zingiberaceae
KA302	*Planchonella sp.*	Sapotaceae
KA303	*Planchonella sp.*	Sapotaceae
KA304	*Madhuca sp.*	Sapotaceae
KA305	*Pouteria sp.*	Sapotaceae
KA306	*Pleuranthodium sp.*	Zingiberaceae
KA307	*Pouteria luzonensis var. papuana*	Sapotaceae
KA308	*Pouteria sp.*	Sapotaceae
KA309	*Chrysophyllum sp.*	Sapotaceae
KA310	*Palaquium ambonensis*	Sapotaceae
KA311	*Palaquium sp.*	Sapotaceae
KA312	*Planchonella sp.*	Sapotaceae
KA313	*Payena sp.*	Sapotaceae
KA314	*Palaquium sp.*	Sapotaceae
KA315	*Parartocarpus sp.*	Moraceae
KA316	*Palaquium lobbianum*	Sapotaceae
KA317	*Payena sp.*	Sapotaceae
KA318	*Pouteria sp.*	Sapotaceae
KA319	*Burkella sp.*	Sapotaceae
KA320	*Pouteria sp.*	Sapotaceae
KA321	*Planchonella sp.*	Sapotaceae
KA322	*Riedelia sp.*	Zingiberaceae
KA323	*Riedelia sp.*	Zingiberaceae
KA324	*Pleuranthodium sp.*	Zingiberaceae
KA325	*Alpinia sp.*	Zingiberaceae
KA326	*Burkella magusum*	Sapotaceae
KA327	*Madhuca sp.*	Sapotaceae
KA329	*Riedelia coralline*	Zingiberaceae
KA330	*Pouteria sp.*	Sapotaceae
KA331	*Palaquium sp.*	Sapotaceae
KA332	*Manilkara fasciculata*	Sapotaceae
KA333	*Manilkara fasciculata*	Sapotaceae
KA334	*Manilkara fasciculata*	Sapotaceae
KA335	*Manilkara fasciculata*	Sapotaceae
KA336	*Manilkara fasciculata*	Sapotaceae

KA337	*Manilkara fasciculata*	Sapotaceae
KA338	*Palaquium lobbianum*	Sapotaceae
KA339	*Manilkara fasciculata*	Sapotaceae
KA340	*Aeschynanthus sp.*	Gesneriaceae
KA341	*Manilkara fasciculata*	Sapotaceae
KA342	*Manilkara fasciculata*	Sapotaceae
KA343	*Manilkara fasciculata*	Sapotaceae
KA344	*Manilkara fasciculata*	Sapotaceae
KA345	*Auraucaria cunninghamii*	Auraucariaceae
KA346	*Agathis labilardierii*	Podocarpaceae
KA347	*Podocarpus blumei*	Podocarpaceae
KA348	*Begonia sp.*	Begoniaceae
KA349	*Begonia sp.*	Begoniaceae
KA350	*Aeschynanthus sp.*	Gesneriaceae
KA351	*Begonia sp.*	Begoniaceae
KA352	*Aeschynanthus sp.*	Gesneriaceae
KA353	*Manilkara fasciculata*	Sapotaceae
KA354	*Manilkara fasciculata*	Sapotaceae
KA355	*Manilkara fasciculata*	Sapotaceae
KA356	*Manilkara fasciculata*	Sapotaceae
KA357	*Manilkara fasciculata*	Sapotaceae
KA358	*Manilkara fasciculata*	Sapotaceae
KA359	*Manilkara fasciculata*	Sapotaceae
KA360	*Palaquium sp.*	Sapotaceae
KA361	*Parartocarpus sp.*	Moraceae
KA362	*Manilkara fasciculata*	Sapotaceae
KA363	*Mimusops elengi*	Sapotaceae
KA364	*Begonia sp.*	Begoniaceae
KA365	*Vitex sp.*	Verbenaceae
KA366	*Maesa sp.*	Maesaceae
KA367		Unknown
KA368		Capparidaceae
KA369	*Solanum sp.*	Solanaceae
KA370	*Palaquium sp.*	Sapotaceae
KA371	*Amomum sp.*	Zingiberaceae
KA372	*Begonia sp.*	Begoniaceae
KA373	*Etlingera sp.*	Zingiberaceae
KA374	*Begonia koordersii*	Begoniaceae
KA375	*Begonia cf. aptera*	Begoniaceae
KA376	*Begonia koordersii*	Begoniaceae
KA377	*Alpinia chrysogynia*	Zingiberaceae
KA378	*Manilkara fasciculata*	Sapotaceae
KA379	*Manilkara kauki*	Sapotaceae
KA380	*Manilkara kauki*	Sapotaceae
P199701118/50118	*Manilkara sp.*	Sapotaceae
P198502265/DGMT174	*Palaquium sp.*	Sapotaceae