



FRIM in FOCUS

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This issue's focus

Forests' Non-Timber Bounty

Medicinal Plants,
Wild Produce,
Rattan & Bamboo

- Repelling Retroviruses • Pummelling Parasites • Soothing Balms
- Fighting Fat • Aromatic Remedies • Skin Whiteners
- Bring Out The Rotan • Betting On Bamboo • Forest Inventories
- Foreigners In FRIM • New FRIM Bookstore

Forest Produce

Scrutiny On The Bounty

More employment is generated by opportunities to collect, trade and process non-timber forest products, and at a far lower ecological cost to the forest, than by tropical timber exploitation. Evaluating our non-timber forest resources is the necessary first step to their sustainable use...

IT IS difficult for policy-makers to appreciate the value of our non-timber forest products (NTFPs) without an economic evaluation. Natural resource accounts are needed to formulate an NTFPs policy and ensure sustainable practices.

The lack of quantitative data on NTFPs, owing to their low priority as an

economic sector, their sheer abundance and range, and partial knowledge of their potential uses, are largely responsible for this.

Yet, it is common knowledge that fruits like 'petai' (*Parkia speciosa*) and 'jering' (*Pithecellobium jiringa*) are very popular with the local population and widely traded in the local markets – even

if we do not know much about the quantity and value of the trade of forest fruits.

Suffice to say that the value of NTFPs is fairly substantial, and in some cases (as in the case of 'petai')*, more beneficial than timber production.

While national forest inventories are adequate for us to determine the physical

More on page 3

From The Editor

TIGER'S MILK was credited with ridding our Prime Minister of his persistent cough last year, when all else failed. The headline-grabbing fungus belonging to the genus *lignosus* was not acquired at a pharmacy, clinic or hospital, but a 'kedai sinseh'. But then again, not every one of these ubiquitous Chinese medicinal shops would be stocked with the rare mushroom.

Traditional medicine is back in vogue, even if medicinal plants have long formed the potions of a poor man's medicinal kit. What used to be dismissed as quackery to be peddled on the sidewalk, is now deemed worthy of research.

Scientists scramble to evaluate them. Drug companies race to profit from them. And farmers gamble on their cultivation to earn some wages.

Every 120 species of plants found in tropical rainforests, in fact, yields a pharmaceutical promise for a wonder drug. Such a rotund ratio of conversion simply reflects the case that most medicines would not exist if it were not for plants.

Already, our rainforests contribute more than a quarter of the world's supply of medicines. Yet of the estimated 380,000 species of plants on the planet, less than 10 percent have been thoroughly screened for potential medicinal use.

And it is not helping matters to learn that plant habitats are daily disappearing: many medicinally valuable species will vanish before we can investigate them.

And so the task of acquiring and documenting primary data from our grannies, uncles and *kampung* folk, collecting and identifying the species used, verifying claims for cures and treatments and exploring new uses for these medicinal plants, ought to get going without delay. Some 1,000 Malaysian plants to date have been listed as having medicinal value.

This issue highlights a sample of the research going on at our Medicinal Plants division which is working towards the safety, efficacy and quality of herbal product development in this country, and the eventual formulation of drugs from our medicinal plants.

But we can't be too revealing. "We've got patents to acquire, our ideas can be stolen...", research officers explain, referring to work being carried out in collaboration with the Massachusetts Institute of Technology. Perhaps, in future, with patience and patents, we may have something more substantial to report, particularly in the areas of treating cancer, HIV and diabetes.

Making traditional medicine scientific, official and mainstream has been the path favoured by Japan, Korea, China and India, and it makes good sense. For folk medicine has many strengths when compared to its modern offshoot: treating the chronic, rather than the acute, dealing systemically, instead of symptomatically, with disease, and aiming to prevent, and not merely cure, our sicknesses.

The Government recognizes the economic potential of medicinal plants as reflected in its Third National Agricultural Policy (1998 to 2010) which also spells out the need for the sustainable cultivation and harvesting of these plants via agroforestry for the continued economic viability of this sector.

Besides medicinal plants (and not forgetting forest fauna and micro-organisms in forest soil as medicinal resources), other non-timber forest products highlighted include rattan and bamboo, and wild produce like the various assortments of leaves, fruits, shoots, roots, stems and seeds that go into making traditional salads like 'ulam', which have always been associated with health benefits.

And tending forests for their non-timber products which have long played a significant role in the subsistence economies of forest dwellers and the rural sector, may just be the answer to keeping our forests intact, as we merrily mint money from them while letting our trees remain. **UTP**

LEESU SEE



Cover photo: Panus giganteus - a saprophytic fungus often found around stumps, buried wood and dead roots. Fungi are an important source of medicinal plants

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From cover page

stocking and distribution of forest fruit trees, for example, additional surveys are necessary to determine the productivity and fruiting seasonality of such trees in different forest types. Identification to species level is also required and this does not need any extra time and labour, if done at the national forest inventory level.

More sampling plots in forest areas affected by shifting cultivation and recently logged-over forests need to be added in inventories to prevent NTFPs being overlooked in such instances. Forest reserves with NTFPs potential should be identified and this is quite easily done in the case of fruit trees when surveys are carried out during the fruiting seasons.

Also, an inspection of the forest fringes bordering villages during this period will indicate whether produce is being collected from the forest. This should ideally be followed by an inventory of the NTFPs in the area, and a resource map of NTFPs at the district and state levels can then be drawn up.

The actual steps involved in estimating the value of forest fruit trees include surveying local markets, identifying sources and local harvesters, setting up research plots to monitor flowering and fruiting, number of trees, production levels and quantity harvested, and identifying distribution channels.

Price determination of forest produce, based on ex-forest gate prices (at the village level where collectors sell their produce to local middlemen), can be one determinant of NTFPs evaluation.

The collection and monitoring of market prices and distribution of locally traded NTFPs needs to be done, and the Forest Department is well placed to tackle this given the large number of District Forest Offices. A system is already in place for

monitoring log flow from the forest to the sawmills, and this could be adapted for monitoring the market prices of NTFPs.

Apart from the NTFPs of rattan, bamboo and 'pandan' (*Pandanus amaryllifolius*), national forest inventories are skewed towards assessments of commercial timber species, and data on NTFPs are either lacking or stored away in files unanalyzed. It is about time that our NTFPs get some attention, and preferably from multi-disciplinary quarters besides environmental economists, such as our botanists, ecologists and zoologists. **FRIM**



WOON WENG CHUEN

Ripe for the picking... 'petai' is an important produce in the domestic and subsistence market

An edited extract from the doctoral thesis, The Economic Evaluation Of Parkia Speciosa (Petai) In Peninsular Malaysia by Dr Woon Weng Chuen (woonwc@frim.gov.my).

**Based on annual returns multiplied over a minimum period of 15 to 20 years, the period before which trees can be felled for their timber*

Announcements

Notice **Chipboard**

Medicinal Plant Standardization Workshop

POST-HARVEST processing of herbs based on Good Agricultural Practice (GAP) and proper factory design for herbal product manufacture according to Good Manufacturing Practice (GMP) will be discussed at this June 10-12 workshop at FRIM. Other topics to be covered include the preparation of quality raw materials based on GAP, quality control in plant and essential oils extraction, and methods of chemical analysis. Participation in this workshop which is being co-organized by Universiti Sains Malaysia's Pharmaceutical Science Centre, is limited to 30 people only. Address enquiries to Zaridah Mohd Zaki (zaridah@frim.gov.my) or call her at Tel: 03-62797347.

Timber Drying Workshop

PRINCIPLES of kiln drying, kiln operation and drying schedules, drying defects and ways to minimize them are among the topics that will be covered in this workshop to be held from April 1 to 19 at FRIM. The course is a must for those wanting to be certified as qualified kiln drying operators. Address queries to: Pusat Pembangunan Kemahiran Industri Kayu (WISDEC), Lot 167, Jln. 3, Kompleks Perabot Olak Lempit, 42700 Banting, Selangor. Tel: 03-31492924; Fax: 03-31492122. Attention: Mohd Yusoff Ismail/ Saupi Mat Nawi.

Herbal Technology Centre

FRIM's newly set-up Herbal Technology Centre (HTC) aims to support the local herbal industry by offering extraction services and processing technology to clients. Efficient processing and extraction techniques such as freeze-drying and spray drying are carried out to prevent the loss of phytopharmaceuticals. Quality raw materials are sourced and used for processing. FRIM's Medicinal Plant research station in Maran, Pahang, is being developed as a medicinal plant plantation for this purpose. For more information on HTC and its services, call Mohd Shahidan Mohd Arshad (shahidan@frim.gov.my) at Tel: 03-62797368. **FRIM**

Towards quality herbal products...
An extractor at the HTC



Forest Inventories

The **Second** Time Around

A new inventory technique to evaluate second growth forests has been developed as primary production forests are expected to be fully exploited by 2010, while new forest management policies are needed

By Samsudin Musa (shams@frim.gov.my) and Christine Fletcher

FRIM has initiated a five-year project to assess the status of second growth forests.

The structure, composition and productivity of second growth forests will be quite different from the primary stands, as past logging practices had resulted in serious damage to the residual stand, affecting its regenerative capacity.

These forests contain less commercial species, and the size and distribution patterns of the trees are highly variable. Some states are already resorting to logged-over forests for re-logging.

The suitability of the Selective Management System which had been formulated for undisturbed forests and currently applied for managing the second growth forests, therefore needs to be revised.

The project took off in late 2001 and is currently at the phase where the selected study areas are being classified. A forest inventory was recently undertaken in the first selected study site in Pahang.

When forest areas are extensive, the ability to classify the forest accurately is an important step forward in subsequently reducing the intensity of ground inventory to assess the silvicultural condition of each forest class.

In this case, LANDSAT TM images were purchased for the marked study area and a Forest Canopy Density (FCD) mapper, a semi-expert system developed by the International Tropical Timber Organization, was used to produce the forest canopy density map.

The forest is assessed on the basis of canopy density. This is a departure from the standard forest classification undertaken based on the age of the forest since logging.

The latter practice does not provide a good basis for classification because past logging practices were not sufficiently supervised, and the intensity of logging resulted in a residual stand with a highly variable stocking distribution: within one age class, there would be areas ranging from well stocked to bare and open areas.

In the FCD approach, four indices – Advanced Vegetation Index (AVI), Bare Soil Index (BI), Shadow Index or Scaled Shadow Index (SI, SSI) and Thermal Index (TI) data – were used in the bio-physical modelling and analysis to produce the FCD map.

The map produced indicates the growth phenomena of the forests and the degree of forest density is expressed in percentages. Ground truthing is immediately carried out

randomly to confirm the density coverage and when satisfied, the map can be applied by the other project components. As an example, areas of forest canopy 0 - 30% density class cannot be re-logged and may need to be rehabilitated through intensive planting.

Once the forest has been classified, the next step is to ascertain the silvicultural condition of the forest classes by undertaking a ground inventory.

To ensure the reliability of the data, the number of sampling units required for each class is statistically calculated using a standard formula. The plots were then randomly distributed for the study area using 200m map grids. In this regard, the location of the sampling units were unbiased and determined prior to the field work.

A relatively new inventory design was also undertaken in which a systematic variable-plot sampling approach was applied. The plot design employs a combination of both variable plots (point sampling) as well as fixed plots. Trees with diameter at breast height (dbh) greater than 15 cm (selected with the use of selected basal area prisms) are enumerated in the variable plots, while the smaller-sized trees (less than 15 cm dbh) are enumerated with fixed circular plots.

The inventory was initiated with a training programme where participants were taught on the methodology for data collection and use of instruments such GPS (Global Positioning System) for locating plots and wedge prisms for tree enumeration.

Each day after the data was collected, respective crew members will recheck the field data and input them into the computer. The crew will also be informed of the plots to be inventoried the next day, and the co-ordinates inputted into the GPS. Each team will then plan their fieldwork for the next day.

Thus, by the end of the inventory period, all field data collected had already been verified and stored in digital format for subsequent analysis.

Results from the inventory exercises will subsequently be used to develop appropriate silvicultural prescriptions to enhance stand productivity. Financial assessments of the silvicultural and management options would then be developed to further determine or influence the selection of the optimum alternative to be implemented.

The Forest Through A Looking Glass

FOREST rangers Wan Husin Wan Isa, Harun Mamat and Harun Mohamad have become fast friends through the 30 years they have worked together at the Terengganu Forest Department.

Trekking jungles, hacking through undergrowth and sizing up trees are all in a day's work for these buddies, looking smart in their jungle gear and spiked boots, and armed with the tools of their trade: a compass, ropes, knives, a knapsack.

Recently, the men brought along some new equipment that is promising to markedly change the way forest inventories will be done in future: namely, a Global Positioning System (GPS) gadget that looks very much like a mobile phone, and a prism. Yes, that little glass thing we used to make magical rainbows with in school.

The men were among the 45 participants from the various State Forest Departments and employees from a local timber company who attended a month-long course on a new technique of second growth forest inventory in January.

The inventory is a groundbreaking collaboration between the State Forestry Departments of Perak, Pahang, Johore, Kelantan and Terengganu as well as timber concessionaire Kumpulan Pengurusan Kayu Kayan Terengganu and FRIM.

The pioneer inventory exercise is also a first not only in terms of its wide-scale partnership, but also in solely applying Forest Canopy Density maps as a guide in selecting areas for inventory. (See accompanying story 'The Second Time Around' on previous page.)

Altogether the men covered 10,000ha of forest in 750 plots at the Tekam Forest Reserve in Pahang where the FRIM-

supervised training took place.

Following the Terengganu team into the forest towards the end of the course, we saw how the men took to the new methodology with enthusiasm and skill, outclassing many men years younger.

"It's so much quicker," remarked Wan Husin, 48, as he lead his team up a particularly steep patch of hilly terrain overgrown with thorny shrubs. "What used to take us about an hour, now only takes some 20 minutes per plot," he said.

His colleague Harun Mamat, 47, added: "We don't have to use ropes to mark plot boundaries and we don't have to count every tree in the sub-plots. This also means we use fewer men in our inventories. Five, instead of eight will do."

Doing away with fixed plots and the labour-intensive tasks that this entailed, also eliminated much of the non-sampling errors due to human factors, as well as making it more cost-effective.

Harun Mohamad, 47, said it was easy to determine plot positions with the use of the GPS gadget. The only hitch is that they cannot receive the satellite readings from noon onwards for some three hours. "We haven't yet figured out why," he said, adding: "Times like these we revert back to our compass."

No matter, the men continue with the job of measuring tree girths, identifying tree species and making tree counts to arrive at timber volume estimates of the forests they have inventoried – data that would prove useful for both loggers and researchers alike.

"One last thing," said Wan Husin, "could we request a botanist to come along with us? It would help us identify some of the more difficult-to-assess species."

FRIM hopes that this pioneer batch will go on to train more of their counterparts in future training courses facilitated by the Institute.

The inventory also collected information on rattan, palms, bamboo and other non-timber resources. **FIP**



PHOTOS: NAZARUDIN RAMLI

Men at work... Forest rangers (from left) Harun Mamat, Harun Mohamad and Wan Husin at the Tekam Forest Reserve and (right) measuring the girth of a red meranti



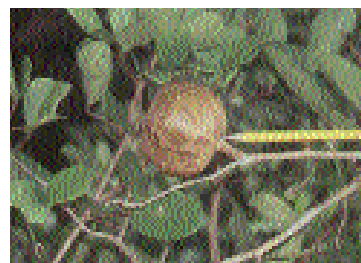


Anti-parasitic Drugs

Canonball-ing Parasites

AQUEOUS extracts of different plant parts of the Cannonball mangrove or 'nyireh bunga' (*Xylocarpus granatum*, **right**)* were tested in vitro against microfilariae of subperiodic *Brugia malayi*, the causative agent of lymphatic filariasis (LF) in Malaysia. LF is a vector-borne infestation with a wide distribution in the tropics and subtropics. The adult worms are entangled in the patient's lymphatic glands, tissues and body cavities. Its treatment is by synthetic chemicals such as diethylcarbamazine citrate (DEC), a drug which has been in use for over 40 years and associated with side effects such as rashes, gastrointestinal disturbances and headaches. Using non-linear regression analysis, the dried seeds of *X. granatum* showed the strongest activity against this parasite. However, further work is necessary to identify

the active compounds and ascertain the full extent of their microfilaricidal properties. **RF**



HARIZ ZIN

Extracted from the paper, *Microfilaricidal Activity Of Xylocarpus Granatum (Meliaceae) Against Subperiodic Brugia Malayi* by M.Z.

Zaridah (zaridah@frim.gov.my), Syed Zahir Idid, A. Wan Omar and S. Khozirah. *The species *Andrographis paniculata* ('hempedu bumi') and *Tinospora crispa* ('akar patawali') have also been investigated for anti-filarial properties

PHOTOS BELOW: B.K. ONG

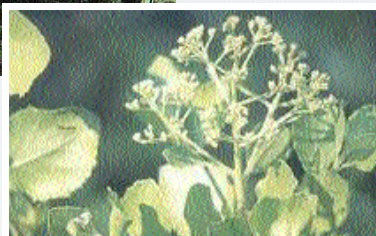
Repelling Retroviruses

Ulam Boosters



EXTRACTS of **(left)** *Diplazium esculentum* ('pakis') and **(below)** *Pluchea indica* ('beluntas') demonstrated high retroviral inhibitory activity.

Retroviruses have been associated with neurological



disorders, leukemia and immunosuppressive (such as HIV) diseases. The plants were among 26 species investigated for reverse transcriptase (RT) inhibitory activity of 'ulam': plants traditionally eaten as salads in the Malay community. RT is an enzyme needed in the early proviral DNA synthesis and is therefore a prime target for anti-retroviral therapy. RT inhibitory assays are used for in vitro screening of anti-retroviral compounds or RT inhibitors. The isolation and identification of RT inhibitors from these two plants by bioactivity-guided isolation will be carried out in future studies. **RF**

Extracted from the paper, *Inhibitory Effects Of Malaysian 'Ulam' On Reverse Transcriptase Activity* by B.K. Ong (ongbk@frim.gov.my), A. Abdull Rashih (arashih@frim.gov.my), A. Mohd Radzi and A. Mohd Ilham (ilham@frim.gov.my)

Quelling Inflammation

Forest Balms

THE leaf extract of *Solanum torvum* ('terung pipit') showed strong inhibitory effects on the platelet activating factor (PAF) receptor binding antagonist activity using rabbit platelets. Studies indicate that PAF may play a role as a mediator in a wide range of physiological activities that are linked with such clinical conditions as bronchial asthma, acute inflammation and allergy responses, and thrombosis. The anti-inflammatory activity of the plant seems to concur with the traditional uses of this species. The activity shown by the bioactive compound, ST3, was comparable to that shown by the reference drug, cedrol. Further work is in progress to identify the active component of ST3. **RF**

Extracted from the paper, *Inhibitory Effect Of Solanum Torvum (Solanaceae) On The Platelet Activating Factor Receptor Binding Antagonist Activity* by Rasadah Mat Ali (rasadah@frim.gov.my), B.K. Ong (ongbk@frim.gov.my) and Aznie Aida Ahmad

Aromatic Plants

Fragrant Cures

ESSENTIAL oils (hexane, chloroform and methanol) of the leaf and stem bark of *Cinnamomum impressicostatum* ('medang') were assayed against three types of micro-organisms, exhibiting moderate antifungal activity towards *Candida albicans*, *Microsporium canis*, *Trichophyton mentagrophytes* and *T. rubrum*. The chloroform extract showed the greatest activity over a wide spectrum of microorganisms. In another study, the chemical and biological properties of selected aromatic plants (*Cinnamomum sintoc* ['sintok'], *C. zeylanicum*, *Melaleuca cajuputi* ['cajuputi'] and *Baekia frutescens* ['cucur atap']) were investigated. Individual chemical components of sintok showed strong to moderate activity against all of the fungi tested. *Cinnamomum zeylanicum* displayed moderate activity against all the fungi and dermatophytes tested. Cajuput oils, used in traditional 'tiger balms', are currently being evaluated

More on page 12



Anti-inflammatory Drugs Soothing Swells

By Dr Rasadah Mat Ali (rasadah@frim.gov.my)

DESPITE the many anti-inflammatory drugs available, there is still a need to identify new ones with lesser side effects. Rheumatoid arthritis, for example, is currently treated with cortisone and prednisone and their latest derivatives, all of which are apt to produce side effects.

Medicinal plants used in traditional medicine offer a rich source of potential chemical compounds for the development of anti-inflammatory drugs. Several dermatologic products contain active ingredients of plant origin that can be isolated as pure compounds such as β -carotene, chrysarobin, anthralin, methoxsalen and salicylates.

A project to scientifically validate the ethnobotanical claims through confirmation of biological activities and identification of their active components has been initiated at FRIM. A range of Malaysian medicinal plants has been tested in-vitro and in-vivo for their anti-inflammatory activity.

The technique traces the biochemical pathway of inhibition by extracts and its mechanisms of intervention. In vivo tests were

also conducted to determine the physiological condition of the extract/compounds on animals.

From our initial screening, four plants – *Thottea grandiflora* ('hempedu beruang'), *Solanum torvum* ('terung pipit'), *Sandoricum koetjape* and *Piper betle* ('sireh melayu') have been identified as having percentage inhibition of more than 90 percent. They were selected for further analysis using bioassay-guided fractionation and in vivo test. The in-vivo tests using tetradecanoylphorbol acetate induced Mouse ear oedema and Carrageenan rat paw oedema indicated that the four species had significant inhibitory activity.

Several active components have been isolated and identified from these species. The marker components have been identified from each species. Further work is underway to assess the suitability of these plants for herbal product development. **HT**

See also 'Forest Balms' on previous page



Calming... *Sandoricum koetjape* (left) and *Piper betle* are two natural anti-inflammatory plants



PHOTOS: RASADAH MAT ALI

Anti-obesity Drugs Fighting Fat

By Zamree Mohd Shah (zamree@frim.gov.my)

OBESITY contributes to the onset of many diseases including cardiovascular ailments, hypertension, diabetes and some cancers, but weight loss approaches have generally proven to be ineffective in the long-term.

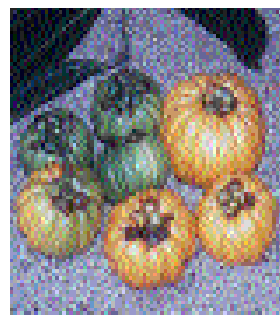
Most research and treatments for obesity currently focus on reducing calorie intake. Many anorectic drugs have unwanted side effects, while surgery, because of the risks involved, are only recommended for serious cases.

There is thus a need for new therapeutic techniques: drugs and natural products with minimum side effects. The focus has now been on the use of phytochemicals for controlling weight gain. In Malaysia, herbal remedies are commonly prescribed although these products are rarely evaluated for their efficacy and safety.

A bioactive compound, hydroxycitric acid (HCA) found in *Garcinia spp.*, is a potent inhibitor of fatty acid and cholesterol synthesis. Studies have shown that HCA decreases weight by

inhibiting lipogenesis, the metabolic process that changes carbohydrate into fat. HCA also lowers blood lipid levels.

Because it reduces both lipid synthesis and appetite, HCA is believed to be a potentially useful agent for weight control. Previous studies in our lab have found that the water extract of *Garcinia atroviridis* (a fruit known as 'asam gelugor' in Malay and endemic to Peninsular Malaysia) significantly reduced the body weight of rats, supporting evidence for the use of this plant in formulating anti-obesity drugs in future. **HT**



Flab-ulous fruit...
Ripe 'asam gelugor' fruits

WOON WENG CHUEN



Flower power... The garden taking shape at the Kepong site

Teamwork's the thing... Rajapakse (left, standing) supervising a group of FRIM staff at the garden

Horticulture

Growing Gardens With 'Curry Power'

A GARDEN without colour is like curry without spice. And spicing up FRIM's grounds with colour is what Mr Henry Rajapakse was commissioned to do.

The former curator of the Sri Lankan Royal Botanic Garden in Peradeniya last December completed a six-month contract to help draw up the masterplan for FRIM's botanic garden and campus.

Spectacular bamboo stands thick as tree trunks crackle in the wind by the banks of Mahaweli, Sri Lanka's longest river encircling Peradeniya like a languid behemoth. As this writer can attest to when visiting the place in the early 90s, the giant bamboo sirens must rate as one of the more striking features of Asia's best botanic garden.

Sprawling lawns, titanic trees, a spice corner featuring rare plants used in traditional Ayurvedic medicine and an orchid house of more than 300 varieties are some of the other attractions of this stately garden with more than 4,000 species and one of the best collections of plants in the world.

Decidedly, a respite from the violence that had been violating this Indian Ocean jewel of an island with the Tamil Tiger hotbed some 300 km away up north.

Rajapakse's particular focus at FRIM was the centralisation of the Institute's nursery and flower plots, and one would like to hope that something of that lovely Peradeniya 'spice' would flavour our garden as well.

At present the flower plots in the botanic garden number some 25 varieties of mostly exotics, because, said Rajapakse, we have only a few free-flowering trees of large, striking colour.

He had initiated a seed exchange programme with other botanic gardens in the world to gradually build up the FRIM garden with other varieties.

Rajapakse, who studied at the Geisenheim Horticulture University in Germany, explained a botanic garden should not be "seen all at once", but blocked from panoramic view by natural screens of vegetation, usually trees.

More on page 10

Research Fellows/Trainees/Partnerships

Welcoming Fo

During the course of any year, visitors from abroad come to beef up research in partnership with our researchers, undergo one form of training or another. We spoke to those who passed our way last year...



Rays of hope... Sugimoto and Noor Azlin work to ensure forest continuity and wildlife conservation by linking forest fragments via 'green corridors'

Forest Ecology

Corridors Of Succour

A S CROPS, roads, factories and cities eat up forests, fragments of habitats too small to support plants and animals are shrunk as to result in sickly forests from in-breeding.

Foreigners In Our Midst

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...h officers, or
...to some who



...what's left are
...imals, and so
...re on page 10

Forest Botany

Apocynaceae Now

"NOBODY was working on it at the time, so I picked it up."

British-born botanist Dr David Middleton was candid in explaining how, for the past decade, he came to study the Apocynaceae family of plants in Southeast-Asia.

The plant group is the subject of a chapter he is writing for the FRIM coordinated Tree Flora of Sabah and Sarawak project to provide comprehensive keys to all the tree species in the East Malaysian states.



ASMAR HASSAN

Have botany will travel...
Middleton scours Southeast-Asia for the Apocynaceae family of plants

So there was no consuming zeal born of childhood dreams. But the 38-year-old who is now attached with the Harvard University Herbaria at the varsity's Arnold Arboretum in the United States, quickly became absorbed in this very variable, diverse group of flora, from herbs to climbers, and trees to shrubs.

"Many are poorly known, particularly the climbers," he said. Middleton is focusing on the monographic and floristic studies of this plant group. Horticulture, traditional medicines and arrow poisons used by native hunters are some of the uses of these plants.

His interest in this region began with the Flora of Thailand project, on which he has published an account.

His next assignment will be to work on the Flora of Malesiana project, an on-going study initiated in the 1950s involving over 120 taxonomists from around the world, and all major herbaria in the Malesian region (Indonesia, Malaysia, the

Philippines, Papua New Guinea, Singapore and Brunei).

The project will represent the first scientific inventory of the some 42,000 flowering plants and ferns for semi-monographic, phylogenetic and biogeographical analysis, using macromorphology, DNA sequences and characters from pollen, leaf and wood anatomy.

Comparing the arboretum at Harvard and the herbarium in FRIM, Middleton said: "We have the diversity and the range of specimens, but you guys have the depth: a smaller range but more specimens and detail in each species."

One of the reasons why he likes his job so much is that he gets to travel, particularly to Asia which he has become quite fond of.

"It's great when your job becomes an excuse to travel." And who knows, he may move on to study other plant families. But for Middleton, it's Apocynaceae now. **FIF**

Timber Processing

Modelling Malaysia

TIMBER inspector Robert Cardoso regales you with stories from his native Ghana.

Creepy stuff like logging in the dead of night, and armed loggers not averse to murder in order to rob jungles of their forbidden spoils.

Illegal logging, said Mr Cardoso, is difficult to control in his country as elsewhere in the world, but his government is not giving up that easily.

Ghana's Timber Utilization Contract addresses the issue of unchecked depletion of forests, as well as such matters as the proper qualifications of foresters and the need for not sacrificing community interests.

Cardoso's real mission for coming here, though, was more industry-orientated: to source new product lines for Ghana's timber sector, and to upgrade the quality and increase the value-added inputs of Ghana's wood products to meet international standards.

Wood panel products, for instance, and lamination, a new concept in his country, are particular areas of his focus.

"I'm here to close the knowledge gap, and Malaysia is a model we're aspiring towards," said Cardoso, 52, and already a doting grandfather homesick for his kiddies. He

was in FRIM last year for a one-month training attachment sponsored by the Yokohama-based International Tropical Timber Organisation.

As head of the Forest Products Inspection Division of the Forestry Commission of Ghana, Cardoso is involved in the pre-shipment inspection of wood products.

He said the Ghanaian government, to encourage the local processing of wood for secondary and tertiary products, banned the export of its logs and imposed levies on its air-dried lumber and rough sawn timber.

Ghana's timber, forming the third-largest foreign exchange earner for the country, is leaning towards agroforestry and plantations, said Cardoso, following a worldwide trend. Ghana's eight million ha of virgin forests have now dwindled to some 1.6 million ha.

"We are working hard to preserve what we have," he added. **FIF**

RAHMUSUDEN



Out of Africa...
Cardoso talks to FIF about his coming to Malaysia and closing the knowledge gap

From previous page

Growing Gardens With 'Curry Power'

These screens must be strategically placed to arouse the curiosity of visitors stumbling upon, and surprised by, plots of sufficiently different specimens in terms of visual appeal.

Rajapakse is a believer of the 'talk to your plants' school. Apparently, a day's chatter with his blooms does wonders for their growth. "You can't just chuck them in the ground and expect them to grow well."

And so he made it a point to instill a real interest in plants among the workers engaged by FRIM to help him in his flower plots.

Coming as he does from a culture of

flower cultivation, owing in part to the Sri Lankans' profuse use of flowers in their worship, he has a natural inclination for all things floral, from petals to receptacles.

In his youth, plants and gardens had fascinated Rajapakse, who did training-cum-working stints in the botanic gardens of Singapore and Thailand during the course of his career.

What began as a hobby during his schooldays, is now a passion right through his retirement years. The 60-year-old grandfather of two lately acquired a cosy little cottage in Sri Lanka's hill and tea country in Kandy,

and looks forward to spending many cheery days tending to his acre of garden.

This is not his first time in Malaysia. In 1985, he did a short working stint in Penang's botanical garden. What he remembers most of that time, however, had nothing to do with plants.

Rajapakse, it turned out, was instrumental in banning cars into the area, fishing out a newspaper article to prove it. Yes, he was in the news all right.

"What's the point of having a park and allowing cars in?" he asked. Dare we hope it be the same for FRIM? **FIP**

From previous page

Corridors Of Succour

A novel way to halt this erosion of biodiversity in our increasingly urbanized landscape is the piecing together of these forest remnants to form what is termed as 'green corridors'.

The tracks of leftover greenery are usually uncultivated due to soil infertility or hilly terrain, but once linked together, can be habitats for common species of fauna and flora which need a large home range to feed and breed, acting as they do as bridges to food, mates and water sources in other forests.

This is where Mr Tatsushi Sugimoto comes in. An environmental civil engineer with a Tokyo-based company of engineering consultants, he is helping our Government come up with a model plan to establish green corridors throughout the country as part of the nation's Biodiversity Action Plan.

In the pilot phase of his project, he has proposed several sites surrounding Negri Sembilan's Pasoh Forest Reserve, part of which forms FRIM's oldest field research station.

Issues of land ownership, tree maintenance and widely separated fragmented forests are problems encountered in establishing corridors that are usually picked according to existing secondary jungle and tree cultivation.

In a field trip to one of the sites for example, we found that owners of the oil palm estate fringing the borders of the proposed riverine corridor were reluctant to have forest and fruit trees planted nearby for fear it would lure pests into the plantation.*

"We can throw the law at them to get them to comply, but that would be useless as we would be not around to see what they would do after we leave," says Dr Noor Azlin Yahya, citing a Department of Irrigation and Drainage requirement for vegetation buffer zones along river banks.

Noor Azlin heads the Environmental Education and Recreational Forest Unit at FRIM and is working with Sugimoto on the green corridor project.



T. LUCHEMENT

A seed-hunting we shall go... Schoolboys collecting seeds at FRIM

Meanwhile, Sugimoto carries out an inventory survey of birds, amphibians and mammals by 'camera trapping' in natural corridors to determine what sort of fauna live in fragmented forests.

To ensure continued viability of these corridors and because of a limited budget, he enlists the help of the community living in the vicinity of these straggly forests.

"We engage the help of rural farmers who already have orchards to maintain and plant fruit and forest trees in the corridors," says Sugimoto.

Another pool of willing, energetic labour, he says, are schoolchildren. "Pupils were a great help in seed collection and germination, and the planting of trees in an experimental site in FRIM grounds. I wish we could have more of them," says the 38-year-old father of three boys.

Looking at the self-effacing, bespectacled engineer, one would never have suspected that the man once made a livelihood out of ballroom dancing!

More on next page



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Corridors Of Succour

"I thrived on dancing competitions, but later had to opt out to become a dancing instructor. But I missed the excitement of the contests, and so went into engineering instead." No more pigeon-holed thinking about staid, Japanese scientists, that's for sure.

Sugimoto, whose previous job involved formulating EIA assessments and the enhancement of co-existing built and natural environments, was contracted by the Japan

International Cooperation Agency (JICA) to work for the NIES project, a FRIM/UPM/JICA collaboration to conduct environmental research.

So it's one less ballroom dancer in the world, but one heck of a researcher instead. **ETP**

**Permission to establish a green corridor at the site was subsequently granted and schoolchildren were employed for the task*

PHOTOS BELOW: A. ABDULL RASHID

Antioxidants/Skin Whitening Agents In All Fairness

By Vimala Subramaniam (vimala@frim.gov.my)

MELANIN pigments are derived from the oxidation of tyrosinase, the enzyme behind dark skin, and related metabolites. Antioxidants that inhibit tyrosinase oxidation can hinder the biosynthesis of melanin pigments and thus, whiten the skin tone of dark or coloured skin.

Skin whitening products have used synthetic antioxidants as skin bleaching agents such as 4-hydroxyanisole and hydroquinone. However, consumers today prefer natural products that work without the toxic and side effects that often occurs with chemical bleaching agents.

Plants are a promising source of natural antioxidants. They soak up the sun's radiation and generate high levels of oxygen as secondary metabolites of photosynthesis. Oxygen is a free radical agent and is easily initiated by ultraviolet and heat to produce toxic, reactive oxygen species (ROS). To counteract these ROS, plants produce various natural antioxidant compounds.

Previous research has shown that natural antioxidants derived from plants have inhibited the tyrosinase activity strongly. Some of the skin whitening natural products in the market have used natural antioxidants such as vitamin C, glycoside and kojic acid to regulate the overproduction of melanin. Antioxidants inhibit the skin's own tyrosinase, and decompose existing melanin in the epidermis, achieving the same results as enzymes do in white skin.

However, our local medicinal plants have hardly been exploited for the development of such skin whitening products.

In FRIM, a study was carried out on 20 medicinal plants with antioxidant activity. These plants were tested for skin whitening properties using the tyrosinase inhibitory assay to identify natural skin whiteners.

Crude methanolic extracts of 250ug/ml were compared to a synthetic positive control, L-cystine. The young leaves of *Anacardium occidentale*

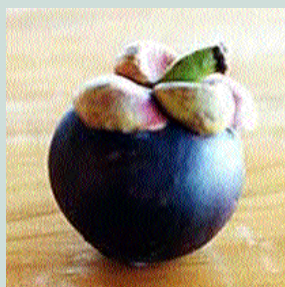
('gajus'), the galls of *Quercus infectoria* ('manjakani'), the skin of *Garcinia mangostana* (mangosteen) and the leaves of *Psidium guajava* (guava) showed high tyrosinase inhibitory activity i.e. 92.9 %, 93.8 %, 73.9 % and 60.7 % respectively.

Tyrosinase inhibitors have become increasingly important for cosmetic and medicinal products, primarily in relation to hyperpigmentation. Thus, these plants that showed high tyrosinase inhibitory activity have the potential to be developed as natural antioxidant skin whiteners in herbal cosmetic products.

Meanwhile, FRIM offers skin whitening testing services to herbal industries, companies, research institutes and universities. Plant extracts and products are tested for skin whitening properties using the tyrosinase inhibitory assay system. For further information, e-mail Vimala Subramaniam or call her at Tel: 03-62797355 or Fax: 03-62797859. **ETP**



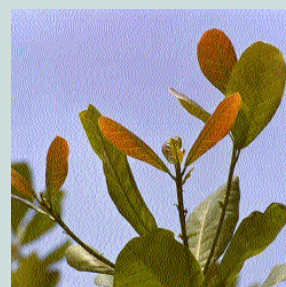
Guava



Mangosteen



Manjakani



Gajus

**Rattan Industries****Bring Out The Rattan**

Rekindling interest in rattan, one of the more important non-timber forest products used mainly in the manufacture of cane furniture, will augur well for the nation

By Raja Barizan Raja Sulaiman (barizan@frim.gov.my)

RAW rattan exports were banned in 1989 and later, the exports of semi-processed rattan were also restricted.

This was to force domestic rattan-based manufacturing enterprises to develop value-added products in order to capture a greater share of the earnings from the international rattan trade which is fetching higher prices for rattan and its top-grade products.

Rattan furniture and craft-making could become a viable local industry, but a steady supply of quality rattan is required and this can be a problem in the face of depleting wild supplies. Rattan currently has low priority in national forest and conservation policies.

Ensuring long-term supplies of good cane can only be sustained when rattan is grown large-scale, either in degraded logged forests or intercropped with trees in forest plantations.

With research carried out by FRIM and other institutions on improved planting techniques and plantation management systems, growth and maturity of rattan could be accelerated.

One area of focus is the production of new, genetically-engineered planting material with short maturity to shorten the long gestation period and harvestable age of rattan – one of the

reasons often cited by entrepreneurs for not being keen on rattan.

Methods of pretreatment of rattan poles directly in the field have also been developed to ensure the quality of the canes. Poor quality rattan is dotted with holes from powder post

beetles and black water spots, is uneven in color, and has rotten sections.

There are 106 rattan species in Peninsular Malaysia. However, only 30 species of these are collected and used by the industries. The high quality canes that dominate the trade are *Calamus manan*, *C. caesius*, *C. ornatus* and *C. scipionum*. Lesser-known canes are likely to be adopted should the rattan market continue to grow.

R.S. RAJA BARIZAN



Clearing the way... Genetically-engineered rattan, rattan plantations and market linkages for cottage industries can help revive the rattan industry

Rattan plantations could work well as a system of common village ownership and responsibility. Cottage industries in local communities including the development of market linkages have to be supported by the relevant agencies in rattan industries. Private or government incentives to stimulate the establishment of processing centres nearby are also needed.

New incentives should be offered such as tax rebates, low interest loans, long-maturing loans and security of tenure.

There also needs to be an upgrading of local skills and technology to compete with rattan furniture producing countries such as Taiwan, Hong Kong, China and Europe. **FRP**

From page 6

Insect Repellants That Smell Good

against dengue vectors and as potential larvacides. Preliminary results from a University Kebangsaan Malaysia study showed significant toxicity towards the mosquito, *Aedes aegyptii* and the common housefly, *Musca domestica*. Essential oils of plants have traditionally been used to flavour food and for cosmetic applications. This study is in line with more recent studies now focusing on the role of essential oil components as hepatoprotective, antiseptic, anti-fungal, anti-inflammatory, anti-tumourigenic and putative skin penetration enhancing agents. **FRP**

Extracted from the paper, *Aromatic Plants: Properties And Potential Uses Of Selected Species* by M. A. Nor Azah (norazah@frim.gov.my), M. Mastura (mastura@frim.gov.my), S. Vimala (vimala@frim.gov.my) and A. Abu Said, and the paper, *Antimicrobial Activity of Cinnamomum Impressicostatum* by M.A. Nor Azah, Mawardi Rahmani, A. Manaf Ali, Khozirah Shaari and Mastura Mohtar



Bamboo Industries

Betting On Bamboo

There is a sizeable market for it, there is no doubt about its quality and its cultivation is not a problem. China has an established industry, India is campaigning to go big on it, and even the European Community is interested. Yet bamboo as a substitute for timber and timber-based high valued-added products is not being taken up, notwithstanding depleting timber and the need for forest conservation

A MERE weed. This was what bamboo was once considered in forestry circles.

Although this 'weed' had been traditionally thoroughly made use of by rural folk and cottage industries for all manner of things: chopsticks, toothpicks, flutes, kite frames, kitchen utensils, farming implements, animal traps, mats, baskets, blinds, furniture and the stilts, splits and rafters for rural homes.

Today, bamboo is moving on to higher things. Research at FRIM has shown that it can quite ably substitute for timber and timber-based value-added products: bamboo boards, panels, parquets and laminates, for furniture and building construction. But local industries still prefer importing Chinese bamboo, rather than sourcing them from our forests, to make general utility items and craft.

To encourage risk-shy Malaysian entrepreneurs to venture into the bamboo industry by the "leading by example" approach, FRIM helped a firm to set up a model of an integrated bamboo plantation and parquet factory on a 500ha FELDA plot in Mempaga, Pahang.

Although facing teething problems at the moment in terms of machinery design and funding, nobody disputes the fact this is indeed the way to go. In the meantime, some suggestions on how

to get our bamboo industries going include:-

- Promoting bamboo as a source of high valued-added products such as laminated panels,
- Improving product design using bamboo as a raw material,
- Establishing a timber-based agency to market bamboo products for domestic consumption and export,
- Establishing an agro-based agency (involving bodies like the Agricultural Department, Bank Pertanian, FELDA, FELCRA and RISDA for example) to supervise rural community forestry in forest rehabilitation schemes with bamboo plantations,
- Leasing natural bamboo stands in forests to entrepreneurs,
- Converting large areas of unproductive forests into bamboo plantations,
- Growing bamboo on marginal and idle land and
- Providing attractive loans and interest rates to attract bamboo plantation investments.

As a commercial crop, bamboo is one of the fastest-growing (culms are harvestable after three years) and most productive (harvestable for 20 years or more if properly maintained). There are some 421,722ha and 70 species of bamboo, occurring mainly as natural stands in ex-logging areas.

However, planting bamboo in rehabilitated logged-over forests, rather than harvesting them from the wild, is the best option not only because of sustainable considerations, but also because most of the thick-walled species suitable for processing can only be domesticated and planted. As a bonus, bamboo is a choice plant to grow in deforested lands as an agent in erosion control: its roots provide a thick netting for watershed conservation, and its leaf litter reduces rainfall runoff.

It also makes more sense to harvest bamboo instead of timber in second-growth forests if the stands exceed more than 70 percent of other vegetation such as secondary growth timber, or where such timber is of inferior quality. Therefore it should be one of the priority species in agroforestry, intercropped with forest trees for its culms and shoots (a food source we have been importing from China, Thailand and Taiwan for the past 30 years). **EIF**

From the paper, Availability Of Non-Wood Resources: Bamboo As An Alternative To Rubberwood by Azmy Mohamed (azmy@frim.gov.my) and Abdul Razak Othman (abdrazak@frim.gov.my)



PHOTOS: ABDUL RAZAK WAHAB

Trumpeting bamboo's best... A band of wind instruments and (inset) laminates made from bamboo

FRIM Publications

Leaf Through These Forestry Pages...

Several publications on tropical forest science and products have been produced by FRIM's Publications Unit over the years. We highlight some of the main works on sale at the Institute's new-look bookstore

Malayan Forest Records

OUR cream of the crop publication series, these are the FRIM 'classics' that are comprehensive and in-depth treatments of a subject, thus serving as authoritative reference texts. Books in this series include the *Pocket Checklist Of Timber Trees*, *Manual Of Malayan Silviculture For Inland Forest*, *Structure And Identification Of Malayan Woods*, *Planting Quality Timber Trees In Peninsular Malaysia*, *Orang Asli, Forest And Development* and *Termites Of Peninsular Malaysia* (see review on next page).

Journals

THE Journal Of Tropical Forest Science and Journal Of Tropical Forest Products are internationally-referred quarterlies on tropical forestry and products research.

Research Pamphlets

TOO lengthy to be included in a journal, these are essentially technical papers detailing the nitty-gritty of experiments on a particular subject. They can also include extensive literature reviews. *Effects Of Logging Operations On Soil Physical Properties And Soil Erosion In A Hill Dipterocarp Forest Of Peninsular Malaysia* and *Design And Methods For The Study On Tree Demography In A Hill Dipterocarp Forest At Semangkok Forest Reserve, Peninsular Malaysia* are some examples.



FRIM Technical Information Handbook (FTIH), FRIM Technical Information (FTI)

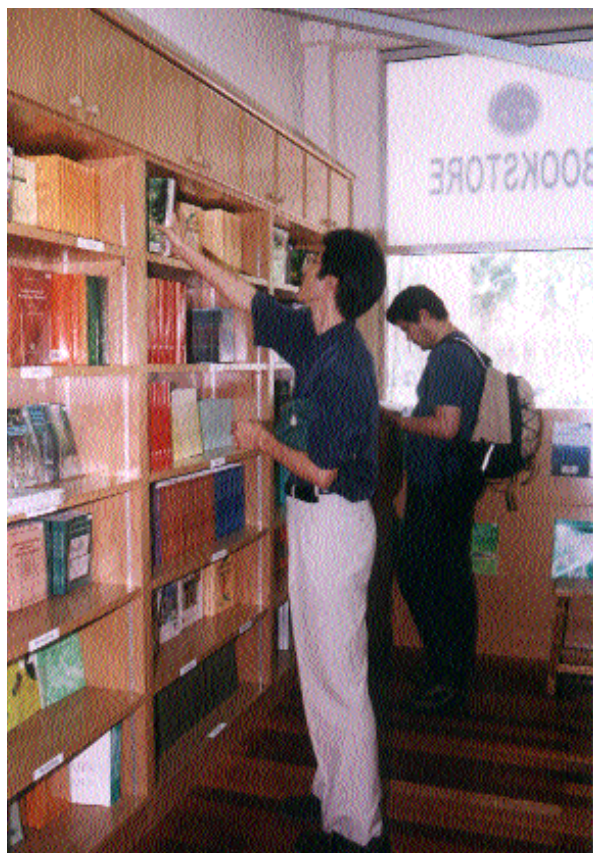
PRACTICAL, concise and of direct relevance to industries, these are articles written in layman language (FTI) or booklets describing step-by-step explanations of a particular process, method or approach (FTIH). They include *Guidelines For Control Of Exposure To Hazardous Wood Preservatives*, *EIA Guidelines For Harvesting Of Natural Forests*, *Selective Management System Analytical Tools*, *A Quick Guide To Problems, Causes And Remedies In Wood Moulding Production* and *Pioneer Species For Fast-growing Tree Plantations In Malaysia – An Evaluation*.

Timber Technology Bulletin

THESE leaflets provide short, easy-to-read and useful information on timber and the wood-based industries.

Tree Flora Of Sabah And Sarawak

FOUR volumes of this series on the study of trees in East Malaysia have already been produced in collaboration with



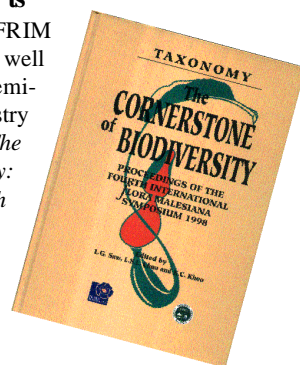
ASMAR HASSAN

Aiming to be a popular store... FRIM's new bookshop

other organisations. Another four volumes are slated to be published over the next five years, and the findings will aid the implementation of the National Biological Diversity Policy. To date, 1,484 species of trees in Sabah and Sarawak have been documented since 1991.

Proceedings, FRIM Report

THE full proceedings of FRIM conferences and workshops, as well as working papers and semi-technical publications on forestry and forest products research. *The Cornerstone Of Biodiversity: Proceedings Of The Fourth International Flora Malesiana Symposium* and *Proceedings Of The Colloquium On Rubberwood Resources And Technologies* are examples.



More on next page

A Mighty, Mite-y Account

This first comprehensive account of the Peninsula's termites by the late Dr Tho Yow Pong is an invaluable reference for the region's foresters, agronomists, ecologists and applied entomologists

Termites Of Peninsular Malaysia by Tho Yow Pong; Edited by Laurence G. Kirton; 1992/224 pages; RM30/USD30; Order Code: MFR 36

Review by Dr Joanna Darlington

THE book starts off with a concise summary of the biogeography of the region, and presents a realistic view of the intellectual and practical limitations of termite taxonomy. A pictorial guide to the termite genera follows and consists mainly of a key to the soldier castes (pp. 26-37).

It is elegantly laid out, and profusely illustrated with line drawings of every genus. The large page size is particularly helpful here. This key is a pleasure to use, and far more user-friendly than most taxonomic keys, even for people with little or no previous experience.

A systematic documentation of the termite fauna comes next, and constitutes the bulk of the book. Here Tho lists all the 175 species in 42 genera that have ever been recorded from Peninsular Malaysia. Of these, 131 species in 40 genera were either collected by Tho himself, or are in the collection of FRIM.

Nearly half of all the species represent new, unpublished records for Malaysia. There are 45 undescribed species, one of which belongs to an undescribed genus. Tho very correctly proposes no specific names for these, referring to them by code letters only. A clear impression is given that much work still

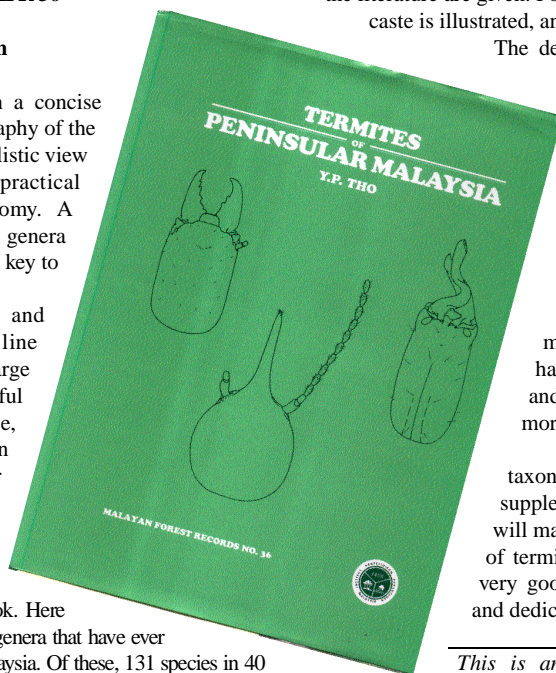
needs to be done on the termite fauna of the region.

For every species listed, a brief synonymy and critical review of the literature are given. For the majority of the species the soldier caste is illustrated, and occasionally the alate.

The descriptions vary but are usually brief, sometimes quoting a few measurements. The treatment is inevitably patchy, as some taxa are much better known than others. This does not aim to be an exhaustive taxonomic monograph, but it is a very useful work of reference, and a summary of the present state of knowledge on Malaysian termites.

The curiously cramped text, with minimal spaces between words, is rather hard on the eye. However, the quantity and very high quality of the line drawings more than compensates.

This book will not replace any of the taxonomic papers already published, but will supplement them. I hope and believe that it will make a positive contribution to the future of termite work in the region, and serve as a very good memorial to an enthusiastic, active and dedicated man. **FIP**



This is an edited extract of the review that appeared in the Bulletin Of Entomological Research 84(3): 442, September, 1994. Dr Darlington, a specialist on the ecology of tropical termites, is currently attached to the University Museum Of Zoology, Downing Street, Cambridge, England

From previous page

Siri Alam Dan Rimba

WRITTEN in the Malay language, these books on the environment and forest are for the general reader.

Non-FRIM Publications

PUBLICATIONS by PROSEA (Plant Resources Of South-East Asia) and APAFRI (Asia-Pacific Association Of Forestry Research Institutions) are also available at the store. PROSEA publications are a series of illustrated multi-volume handbooks on various aspects of plants in the region, such as their uses, distribution, botany, ecology, agronomy, silviculture, diseases, pests, harvesting, genetic resources and

breeding. APAFRI titles include *Agroforestry For Sustainable Development And People Empowerment*, *Successful Development Of Acacia Species In Vietnam*, *Watershed Resources Management*, *The Role Of Research And Development In Sustainable Utilization Of Matang Mangroves In Malaysia*, *Poplar Breeding*, *Cultivation Technologies And Extension In China* and *Recent Developments In Forestry And Environment*. The bookstore hopes to include more such publications on tropical forest science and products by other publishers in future. **FIP**

For more information, contact Ms Ho Yuen Foon (hojf@frim.gov.my)

Announcement

Conference On Forestry And Forest Products Research: Forestry For Society **Crown Princess Hotel, Kuala Lumpur: 7 - 9 October 2003**

Background & Objectives

THE biennial national Conference on Forestry and Forest Products Research (CFFPR), is designed to bring out the latest R&D findings in forestry and forest products to the private sector, researchers, academicians, forest managers, NGOs, industrialists, and policy makers. Individuals involved in forest management, natural resources management, landuse planning and development, forestry and forest products, forest certification and auditing and environmental policies, are also being targeted. The theme of this conference will be Forestry For Society. Discussions will embrace issues pertaining to forest plantations, second growth forests, and improved processing and utilization of wood and non-wood products. Issues such as the conservation of biodiversity, non-wood products, forest ecology, socio-economics and the potential of new developments in forest industry will also be highlighted. In bringing these issues into discussion, the conference aims to explore potential solutions.

Call For Papers/Posters

Those interested in presenting papers or posters at the conference are required to send their abstracts. Key dates are as follows:

- | | |
|---------------|---------------------------------|
| 1 May 2003 | Submission of abstracts |
| 1 June 2003 | Notification of accepted papers |
| 1 August 2003 | Submission of full papers |

Abstracts & Papers

Abstracts and full papers should be written in English. Please submit abstracts and full papers to the secretariat at the address below or by e-mail to cffpr2003@frim.gov.my.

Important Instructions

(for both paper and poster presentations)

- Please prepare in Microsoft Word in Times New Roman font
- Title - bold, 14 pt and in upper case letters
- Author's name(s) - bold and 12 pt
- Author's address(es) - 10 pt, no abbreviation, if more than one author indicate address of each author numerically in superscript. Include fax number(s) and e-mail address(es)
- Text of abstract - 10 pt, no abbreviations, no references, one paragraph, no more than 250 words long. Plant names should be in italics or underlined. Use standard symbols for measurement and the International System (S.I.) for units.

Registration Fee

The Conference fee, which covers a full set of papers/ proceedings, tea/coffee breaks, lunches, and conference bag, is as follows:

Full Fee	: RM550
Students	: RM250

Proof of student status should be given.

Enquiries

The Secretariat
Conference On Forestry And Forest Products Research 2003
Forest Research Institute Malaysia
Kepong, 52109 Kuala Lumpur, Malaysia
(Attn: Dr Norini Haron/Dr Lim Hin Fui)