

การศึกษาทบทวนมอสส์วงศ์ *Sematophyllaceae* ในประเทศไทย

Taxonomic revision of *Sematophyllaceae* (Musci) in Thailand

T. Boonkerd¹, R. Pollawat¹ and J.P. Frahm²

¹Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330

²Nees-Institute for Biodiversity of Plants, Bonn University, Germany.

The *Sematophyllaceae* has been firstly studied by V.F. Brotherus since 1908. Circumscription and affinities of the genera and family have been carried out by many bryologists since then. However, these taxonomic treatments were often weakly defined mainly due to the small differences in the peristomial structure, leaf papillosity, and the degree of alar differentiation. Up to now the most accepted scheme was proposed by Brotherus (1925). His classification based on variation in characters of alar organization. These collective characters were also used to subdivided the family into four subfamilies, viz. *Clastobryoideae*, *Heterophylloideae*, *Macrohymenioideae*, and *Sematophylloideae*. There are about 53 genera and over 600 species worldwide at present. In Thailand a taxonomic treatment of the *Sematophyllaceae* was carried out based on 1,634 specimens. These specimens were on loan from the main herbaria in U.S.A. and Europe and also included additional collections by authors. The intensive morphological studies were carried out in all organs of each specimen. An enumeration of this moss family included 24 genera, 95 species and 7 varieties. Among these 15 species are new records for Thailand and 3 species are probably new to science.

ความหลากหลายของเฟิร์นและพืชใกล้เคียงเฟิร์นบริเวณเขาเขียว อุทยานแห่งชาติเขาใหญ่

Diversity of ferns and fern allies at Khao Khiao Area in Khao Yai National Park

W. Khwaiphan (Student), T. Boonkerd (Thesis Advisor)

*Department of Botany, Faculty of Science, Chulalongkorn University, Patumwan,
Bangkok 10330*

Diversity of pteridophyte at Khao Khiao, Khao Yai National Park was explored from December 2003 to May 2005 at elevations ranging from 600 to 1,300 m above mean sea level. Two hundred and nineteen specimens were collected from their natural habitats and were determined into 113 species and 2 varieties, in 59 genera within 25 families. Among these, 22 families, 55 genera, 105 species and 2 varieties were ferns, while 3 families, 4 genera and 8 species were fern allies. Three families of ferns namely, Polypodiaceae, Thelypteridaceae, Dryopteridaceae, were among the common families which included 17, 13 and 12 species, respectively. As regard to habitat, there were 58 species of terrestrials, 30 species of epiphytes and 7 species and 2 varieties of lithophytes. However 18 species of ferns and fern allies could be found in more than one habitat. In addition, it can be concluded that 53 species and 2 varieties were found in tropical evergreen forest. While 34 species were found in hill evergreen forest and 6 species were found in grassland and secondary forest. However, 20 species grew in more than one forest types.

ความสัมพันธ์ด้านวิวัฒนาการชาติพันธุ์และฟีนิติกของเฟิร์นสกุล *Lepisorus* (J. Smith) Ching
(Polypodiaceae) และสกุลใกล้เคียง

**Phylogenetic and phenetic relationships of the fern
genus *Lepisorus* (J. Smith) Ching and related genera**

W. Chatan.¹ (student), T. Boonkerd² (Thesis Advisor), B.R. Baum³ (Thesis Co-Advisor)

¹The Biological Science Ph.D. Program, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330 ²Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330

³Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Canada

Lepisorus (J. Smith) Ching is a genus of the family Polypodiaceae, consisting of about 40 to 70 species, naturally occurs in tropical Africa and Asia, extending to Korea and Japan. At present, there are different in taxonomic treatments, which included or excluded the species of some genera from *Lepisorus* and its related genera. The objective of this research is to study morphological, anatomical and spore characters and also used these characters in investigating the phylogenetic and phenetic relationships of these genera. So far, fifty-six characters from 600 specimens have been examined including morphological, anatomical and spore characters. Up to now the most variation features were observed in rhizome scales and lamina morphology. All characters will be further used in multivariate analyses.

บททวนอนุกรมวิธานของเฟิร์นชนิดเชิงซ้อน *Microsorium punctatum* (L.) Copel.
(polypodiaceae)

**Taxonomic revision of fern, *Microsorium punctatum* (L.) Copel. Complex
(polypodiaceae)**

S. Petchsri¹ (Student), T. Boonkerd² (Thesis Advisor), B.R. Baum³ (Thesis Co-advisor)

¹The Biological Science Ph.D.Program, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330, ²Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330 ³Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Canada

Microsorium punctatum (L.) Copel. occurs naturally in various forest types. It is found from sea level to about 2,800 m altitudes and has its distribution in the palaeotropics and subtropics. At present, the taxonomic status and boundary of this species is still dubious due to its great variations in leaf form, leaf size and venation patterns. There are some species, for example *M. musifolium* Copel. and *M. glossphyllum* Copel, were treated as synonyms of *Microsorium punctatum*, but however they were recognized by some workers as distinct species. Moreover, cultivated plants have rather variations in frond forms. Some of these forms have been described as cultivars, i.e. *M. punctatum* cv. *grandiceps* Piggot. These variations do not match with the previous recognized systematic treatments. So, this species group was proposed as a species complex and worth investigating. From the study of 679 herbarium specimen deposited at BCU, BKF, K, B, L and P, it seems likely that more than one specie were clumped into a single species *M. punctatum* by some authors. So, the taxonomic status of this species will be re-investigated by using both classical, numerical and Molecular taxonomy.

ความหลากหลายของกล้วยไม้บริเวณเขาเขียว อุทยานแห่งชาติเขาใหญ่

Diversity of orchids at Khao Khiao Area in Khao Yai National Park

A. Buakhlai (Student), T. Seelanan (Thesis Advisor)

Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330

Khao Khiao of Khao Yai National Park occupies about 60 square kilometers and situated between 600-1,292 meters above the mean sea level. The area is comprised of grassland and secondary forest, tropical rain forest and hill evergreen forest. The hill evergreen forest has high humidity and cool temperature all year round which results in high diversity of orchids. Thus the aim was to access orchid diversity in Khao Khiao area. Exploration and orchid collection in the field was carried out during December, 2003 to August, 2005. One hundred and fifty-five specimens were collected. They were identified to 106 species in 59 genera and five subfamilies. The subfamilies Epidendroideae and Vandoideae are found 65 and 29 species, respectively. The genera with highest number of species included *Dendrobium* (10 species), *Eria* and *Oberonia* (seven and six species respectively). It was found that four species were endemic to Thailand, of which three are rare orchids, namely *Calanthe hirsuta* Seidenf., *Dendrobium ciliatilabellum* Seidenf. and *Gastrochilus rutilans* Seidenf. In addition, a new record of orchids to Thailand was also found, *Bulbophyllum angustifolium* (Blume) Lindl. With respect to habits, the majority of orchids are epiphytic and terrestrial; for the latter, three mycotrophic orchids were included. With regard to distribution in Khao Khiao, 47 species grows in the hill evergreen forest while 27 species are in the tropical rain forest and only 9 in grassland and secondary forest. Besides, as many as 23 species were found in more than one forest type. The comparison of orchid diversity in Khao Khiao to those in other nearby National Parks, suggested that forest types and their climatic characteristics affect the distribution of orchids.

พืชวงศ์หญ้า (Gramineae) ในเขตอุทยานแห่งชาติภูเรือ จังหวัดเลย

The family Gramineae in Phu Rua National Park, Loei Province

C. Jaroenchai (Student), P. Chantaranothai (Thesis Advisor), A. Prajaksood (Thesis Co-Advisor)
Department of Biology, Faculty of Science, Khon Kaen University, Muang, Khon Kaen 40002

The taxonomic study of the family Gramineae in Phu Rua National Park, Loei Province was examined and studied between July, 2004 and July, 2006. Five subfamilies, 63 genera, 99 species and three varieties are identified. Descriptions, keys to taxa, photographs and line drawings are presented. Quite a few species are distributed in open areas of pine and dipterocarp forests. The most common genus is *Eragrostis*. *Heteropogon* and *Schizachyrium* are distributed in Thailand and all species can be found in the park.

ซิสเต็มมาติกส์ของพืชวงศ์หญ้าเผ่าย่อย *Ischaeminae* และ *Rottboelliinae* ในประเทศไทย

Systematics of the subtribe *Ischaeminae* and *Rottboelliinae* (Poaceae) in Thailand

*P. Traiperm*¹ (Student), *T. Boonkerd*² (Thesis Advisor), *P. Chantaranothai*³ (Thesis Co-Advisor),
*D.A. Simpson*⁴ (Thesis Co-Advisor)

¹The Biological Science Ph.D. Program, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330, ²Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330

³Department of Biology, Faculty of Science, Khon Kaen University, Muang, Khon Kaen 40002

⁴Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, U.K.

Up to now grasses are the fifth largest family of flowering plants and include 700 genera and 10,000 species worldwide. About 133 genera and 505 species are estimated to occur in Thailand. The economic importance of grasses is well known and play a dominant role in many natural and human-influenced ecosystems. A preliminary taxonomic account of the subtribe *Ischaeminae* and *Rottboelliinae* in Thailand is presented here. So far, 14 genera, 50 species and 2 infraspecific taxa have been enumerated and described. Among these, *Ischaemum* (13 species and 2 infraspecific taxa), *Eremochloa* (12 species) are the two largest genera from this study. It is expected that eight species are newly recorded for the country or probably new to science. Epidermal peels and transverse sections of leaf-blades have also been investigated in 25 species of the 14 genera from the two subtribes. The diagnostic anatomical characters include morphology of epidermal cell wall of the long cells in the intercostal zone, shape of subsidiary cells and silica bodies, macro-hairs, papillae, prickles, position of stomata, midrib and keel bundles, rib and furrows on the adaxial surface, shape and distribution of bulliform and colourless cells, and type of bundle sheath cells. It is evident that leaf anatomical characters are taxonomically useful for classification at the generic level.

กายวิภาคศาสตร์เปรียบเทียบเนื้อเยื่อชั้นผิวของลำต้นเหนือดินของพืชสกุล

Eleocharis R. Br. และ *Mapania* Aubl. (Cyperaceae) ในประเทศไทย

**Comparative anatomy of the culm surface of *Eleocharis* R. Br.
and *Mapania* Aubl. (Cyperaceae) in Thailand**

S. Pechcoth (Student), A. Thammathaworn (Thesis Advisor)

Department of Biology, Faculty of Science, Khon Kaen University, Muang, Khon Kaen 40002

The culm epidermis of ten taxa of *Eleocharis* and five taxa of *Mapania* was studied and compared using epidermal scrapes and light microscopy in order to investigate anatomical variations of potential for species identification. *Eleocharis* was characterized by 3-6 groups of silica bodies per cell. Each group was composed of large conical silica body with satellites, where as the crystals were absent in *Mapania* culm. The studied taxa were classified into 3 groups based on the presence or absence of silica bodies: 1. presence of conical silica bodies with satellites in the costal area *Eleocharis acutangula*, *E. congesta* var. *japonica*, *E. dulcis* var. *tuberosa*, *E. dulcis* var. *dulcis*, *E. ochrostachys*, *E. retroflexa* ssp. *chaetarina*, *E. spiralia* and *E. tatraquetra* ; 2. presence of conical silica bodies with satellites in the costal area and a wedge-shape crystal in the intercostals area *E. macrorrhiza* and *E. geniculata*; and 3. absence of silica bodies: *Mapania cuspidata*, *M. enodis*, *M. kurzii*, *M. palustris* and *M. tenuiscapa*. In addition, stomatal distribution in the intercostal area of the culm surface was provided for identification of the studied taxa.

กายวิภาคศาสตร์เปรียบเทียบพืชเผ่า Scleriae (Cyperaceae) ในประเทศไทย

Comparative anatomy of tribe Scleriae (Cyperaceae) in Thailand

S. Boriboonwat (Student), A. Thammathaworn (Thesis Advisor), P. Chantaranothai (Thesis Co-Advisor)
Applied Taxonomic Research Center, Department of Biology, Faculty of Science, Khon Kaen University,
Muang, Khon Kaen 40002

The comparative anatomy of eighteen species of the Tribe Scleriae were investigated by epidermal peel, clearing and transverse sections of leaves, bracts and culms; and transverse of fruits. Morphological study of the fruits were performed under scanning electron microscope. The anatomical characters of leaves and bracts could be used for identification of the studied species are: presence or absence of trichomes, hypodermis, fibre strand in the margins of leaves and bracts, secretory cells in the outer layer of bundle sheath and air cavity in the mesophyll; the trichome types, distribution of stomata: connection of bulliform cells and the bundle sheath; and the mesophyll cells type; The presence or absence of the culm trichome, fibre bundle at the culm angles and cauline air cavities; the trichome types; and distribution of vascular bundles in the culms are useful for the species identification. The studied species are classified into two distinct group based on their pericarp surfaces: the smooth pericarp group composed of *S. corymbosa*, *S. lithosprema*, *S. oblata*, *S. poaeformis* and *S. tonkinensis* and the rough pericarps element are *D. caricinum*, *S. benthamii*, *S. biflora subsp. biflora*, *S. ciliaris*, *S. kerrii*, *S. levis*, *S. mikawana*, *S. neesii*, *S. purpurascens*, *S. rugosa*, *S. scrobiculata*, *S. sumatrensis* and *S. terrestris*. The pericarp of all species are comprised of small vascular bundles with two layers of parenchymatous bundle sheath, parenchyma and sclerenchyma ground tissues, and stoma lacking epidermis.

ความหลากหลายทางพันธุกรรมของพืชสกุลกระชาย (วงศ์ขิง) ในประเทศไทยจาก
ข้อมูลลายพิมพ์เอเอฟแอลพี

**Genetic variation of *Boesenbergia* (Zingiberaceae) in Thailand as revealed
by AFLP Fingerprints**

J. Techaprasan¹, C. Ngamriabsakul², T. Jenjittikul³ and S. Klinbunga^{1,4}

¹National Center for Genetic Engineering and Biotechnology, Klong Luang, Pathumthani 12120, ²Institute of Science, Walailak University, Thasala, Nakhonsrithammarat 80160, ³Department of Plant Science, Faculty of Science, Mahidol University, Rajhevee, Bangkok 10400, ⁴Center of Excellence for Marine Biotechnology, Chulalongkorn University, Pathumwan, Bangkok 10330

Genetic variation and interspecific relationships of 14 *Boesenbergia* species (17 taxa) found in Thailand were evaluated using AFLP technique. *Kaempferia parviflora*, a closely related species was included in the analysis. Four primer combinations generated a total of 704 fragments with 100% polymorphism. Mean distances calculated using Nei and Li distance were ranged from 0.4407 (*B. rotunda* 'Kraichai Dang' and *B. rotunda* yellow rhizome) to 0.9609 (*B. curtisii* and *B. prainiana*). The phylogram generated by Neighbor-Joining analysis revealed two separated lineages of *Boesenbergia* and the evolutionary radiation in *Boesenbergia*.

การสำรวจและรวบรวมพันธุ์พืชวงศ์ Gesneriaceae ในประเทศไทย

Survey and collection of Gesneriaceae in Thailand

P. Palee and V. Anusarnsunthorn

CMU Herbarium, Department of Biology, Faculty of Science, Chiang Mai University, Muang,
Chiang Mai 50200

Surveys and collections of Gesneriaceae in Thailand were performed as well as examination of herbarium specimens from various herbaria in Thailand. Their distributions are throughout Thailand. One hundred and four species with twenty-one genera were identified. Among these, 18 species and one variety of *Didymocarpus* Wall. have been revised. Two new species and one new variety have been recognized viz. *Didymocarpus jaesawnensis* Palee & Maxw., *Didymocarpus inflatus* Maxw. & Palee, and *Didymocarpus insulsus* Craib var. *payapensis* Palee & Maxw.. One species of *Trisepalum* (*Trisepalum prazeri* Burt) was a new record for Thailand. Further collection in the future should result more new species. However, many of previously recorded genera: *Calcareoboea*, *Corallodiscus*, *Cyrtandromoea*, *Damrongia*, *Didissandra*, *Orchadocarpus*, *Ridleyandra* still have not been found. Forest destruction, changing of ecosystem may result in declining number of species. Palynological study of 30 more species of Gesneriaceae was also performed by scanning electron microscope (SEM). Pollen morphology of some genera proved to have a significant taxonomic value.

ชิสเต็มมาติกระดับโมเลกุลของพืชสกุลปาหนันช้างและสกุลใกล้เคียงในเอเชียตะวันออกเฉียงใต้

Molecular systematics of the genus *Goniothalamus* and related genera in South-East Asia

M. Nakkuntod¹ (Student), T. Seelanan¹ (Thesis Advisor) R.M.K. Saunders² (Thesis Co-Advisor)

¹Department of Botany, Faculty of Science, Chulalongkorn University, Pathunwan, Bangkok 10330

²Department of Ecology and Biodiversity, The University of Hong Kong, Hong Kong

The genus *Goniothalamus* Hook. f. & Thomson is one of the largest genera of the family Annonaceae. Its members are widespread in tropical and subtropical Asia. Little is known of the phylogenetic relationships within the genus. Thus, to evaluate evolutionary history and relationships among its members and to understand the evolution of selected morphological characters, the *trnL-F* intergenic spacer and nuclear ITS region markers were employed. The results suggested that *Goniothalamus* is likely to be monophyletic, with the *G. tamirensis-G. elegans* clade being a sister group to the rest of the genus. The larger clade was divided into four recognizable subclades with uncertain relationships. Almost 43 morphological characters when evaluated on the molecular tree were homoplastic. However, as many as 9 characters were partially informative as these may serve as synapomorphic characters for some clades. The phylogeny was highly incongruent with Bân's classification; thus a new classification scheme should be proposed based on new evidence of molecular and morphological analyses.

พรรณไม้วงศ์ไม้ก่อของไทย

Fagaceae of Thailand

C. Phengkla¹, T. Wongprasert², T. Boonthavikoon², P. Pholsena², T. Jonganurak²

¹Fellow of the Academy of Science, Royal Institute of Thailand ²Office of the Forest Herbarium, National Parks, Wildlife and Plant Conservation Department, Chatuchak, Bangkok 10900

A revision of the family Fagaceae of Thailand, with the financial support from Biodiversity Research and Training program (BRT) has resulted in, the successful cooperation among the researchers and BRT. In conclusion, the Fagaceae of Thailand consists of 119 species, 1 subspecies and 1 varieties. Three species are new to the botanical world, 35 species are new records and 9 species are endemic to Thailand. This shows the vast diversity of Thai plants that can be conserved and utilized. The basic knowledge from this research project should be implemented for economic value to improve the living standard of the people who inhabit the forest and the recovery of natural forest thereafter. Her Majesty the Queen has ever said: “People and Forest can be mutually dependent”.

ภูมิปัญญาท้องถิ่นในการใช้ประโยชน์ไม้วงศ์ก่อ
ของชุมชนทางภาคเหนือตอนบนของประเทศไทย

**Local knowledge in utilization of the family Fagaceae of communities
in Upper Northern Thailand**

S. Chunta¹ and M. Wongnak²

¹*Wiangkaen Hospital, Wiangkaen, ChiangRai 53710*

²*Queen Sirikit Botanical Garden, The Botanical Organization, Maerim, ChiangMai 50180*

This research project entitled “Local Knowledge in Utilization of the Family Fagaceae of Communities in Upper Northern Thailand” that aims to understand local knowledge on the uses of the Family Fagaceae and to gain local knowledge based information on the Family Fagaceae for further conservation strategy development. Data was collected in ChiangRai, ChiangMai and Mehongson Provinces. It found that people in upper northern Thailand have interaction with the Family Fagaceae in various dimensions including; 1) utilization of edible fruits for household consumption such as fruit fly, flour and food soup, and bark of some species is use for chewing with a betel palm, 2) using stems and branches for firewood, for mushroom media, houses’ construction, 3) utilization for financial purposes such as selling fruit, charcoals and flowers, 4) utilization as medicine; example boiling leave and then taking a bath for curing a rash, 5) using plants for ritual traditional and cultural events and, 6) use as associated trees in for a traditional conservation farming of indigenous tea <miang>.

มอโฟรเมตริกซ์และอนุกรมวิธานเชิงโมเลกุลของพืชสกุล *Afgekia* Craib (Fabaceae)

Morphometrics and molecular systematics of the genus *Afgekia* Craib (Fabaceae)

Y. Sirichamorn (Student), T. Boonkerd (Thesis Advisor)

Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330

Afgekia Craib is a genus of the tribe Millettieae in the family Fabaceae. According to Geesink (1984), there are three species within this genus and all of them are found in Thailand. They are Kan-pai or Tua-pab Chang (*A. sericea* Craib), Kan-pai Mahidol (*A. mahidolae* Burt et Chermisrivathana) and *A. filipes* (Dunn) Geesink). The first two species are rather similar in some aspects, while the third species, *A. filipes*, is quite remote. This discrepancy leads to uncertain taxonomic status and raises the question of the suitability of the species treatment in this genus. Therefore, this research aims to explore the taxonomic status of the species in the genus *Afgekia* based on morphological and molecular data that will serve as basic information and new additional data for phylogenetic relationship studies in this genus and related genera. The results of the morphological relationship study by means of Morphometrics showed that all 29 morphological characteristics used in Discriminant analysis are significant in separating the genus *Afgekia* into 3 species. Discriminant function 1, the most important function for separating the 3 species, is 99.7% correlated with 19 characters and the variance explained by this function is 88%. It is the most highly associated with "Pod width". The result from scatter plots which presents the group centroids of each species also supports the morphological similarity of Kan-pai (*A. sericea*) and Kan-pai Mahidol (*A. mahidolae*). According to the plots, however, the group centroid of *A. filipes* is apparently remote from the former two. This data shows that it might not be appropriate to place *A. filipes* in the genus *Afgekia*. Therefore, more data from this study are still needed to prove the suitability of species treatment in this genus.

มอร์โฟเมตรีของใบ ความแปรผันทางพันธุกรรม และวงศ์วานทางวิวัฒนาการ
ของกวาวเครือแดงในประเทศไทย

**Leaf morphometry, genetic variation, and phylogeny of
Red Kwao Krua, *Butea superba*, in Thailand**

J. Kaewmuangmoon¹ (Student), C. Chanchao² (Thesis Advisor), W. Cherdshewasart² (Thesis Co-Advisor)

¹Program of Biotechnology, Chulalongkorn University, Phatumwan, Bangkok 10330

²Department of Biology, Faculty of Science, Chulalongkorn University, Phatumwan, Bangkok 10330

Butea superba (Red Kwao Krua) is a Thai herbal leguminous plant. Its tuberous roots are widely used for increasing sexual vigor in males. Leaves of *B. superba* were collected from 25 locations throughout Thailand. For leaf morphometry, 9 leaf parameters (petiole length – PL; petiole diameter – PD; rachis length – RL; petiolet length – PLL; terminal leaflet length – TLL; terminal leaflet breadth – TLB; stipule length – SPL; angle of first leaf border (AB^o); and number of pairs of primary veins – NPV) were selected. The results indicated variation among cultivars from different locations. For example, in *B. superba*, AB^o of Chacherngsao cultivar is significantly different from those of Chantaburi and Buriram cultivars. For DNA analysis, genomic DNA was isolated from young and fresh leaves. Primers were designed from *rbcL* and *trnLF* genes. Under optimum conditions, product of about 300 bp from *rbcL* and 500 pb from *trnLF* were obtained. Sequences of all cultivars will be obtained and aligned. Then, genetic distance will be calculated for phylogenetic tree construction.

การศึกษานุกรมวิธานของพืชสกุลคราม (วงศ์ถั่ว) ในประเทศไทย

A taxonomic study of *Indigofera* L. (Leguminosae) in Thailand

S. Mattapha (Graduate student), P. Chantaranonthai (Thesis advisor)

Applied Taxonomic Research Center, Department of Biology, Faculty of Science, Khon Kaen University,
Muang, Khon Kaen 40002

A taxonomic study of *Indigofera* in Thailand have been carried out since June 2005. So far, 33 taxa have been recognized: *I. cf. aralensis*, *I. atropurpurea*, *I. caloneura*, *I. cassioides*, *I. caudata*, *I. colutea*, *I. dosua*, *I. emmae*, *I. galegoides*, *I. glabra*, *I. hirsuta*, *I. kerrii*, *I. lacei*, *I. laxiflora*, *I. linifolia*, *I. linnaei*, *I. nigrescens*, *I. nummulariifolia*, *I. reticulata*, *I. sootepensis* subsp. *sootepensis*, *I. sootepensis* subsp. *acutifolia*, *I. spicata* var. *spicata*, *I. spicata* var. *siamensis*, *I. squalida*, *I. suffruticosa* subsp. *suffruticosa*, *I. tinctoria*, *I. trifoliata* subsp. *trifoliata*, *I. trita* subsp. *trita*, *I. trita* subsp. *subulata* var. *scabra*, *I. wightii*, *I. zollingeriana*., *I. sp.1* and *I. sp.2*. *I. aralensis* is expected to be a new record for the country. The last two species are needed for further study.

ชีววิทยาของดอกที่มีความสัมพันธ์กับการถ่ายละอองเกสรและ
การติดผลของสะตอ (*Parkia speciosa* Hassk.)

**The floral biology in relation to pollination and fruit set of Stinkbean
(*Parkia speciosa* Hassk.)**

S. Wongchana¹ (Student), W. Wunnachit² (Thesis Advisor), S. Bumrungsri² (Thesis Co-Advisor)

¹Department of Plant Science, Faculty of Natural Resources, Prince of Songkhla University, Hat Yai Songkhla 90112, ²Department of Biology, Faculty of Science, Prince of Songkhla University, Hat Yai, Songkhla 90112

The study on floral biology in relation to pollination and fruit-set of stinkbean (*Parkia speciosa* Hassk.) was conducted at Trang Horticultural Research Centre in Trang province and Faculty of Natural Resources, Prince of Songkhla University in Songkhla province during January 2005 and December 2006. The study was designed into 2 aspects : phenological study on leaf flushing, flowering and fruiting and biology in relation to pollination of stinkbean. It was found that leaf flushing during December to January, flowering from March to May and fruiting in April. It's flower was characterised with compound inflorescence, consisting of capitula. A capitulum consists of many small flowers with different floral structure and function that can be divided into 3 types : staminodial flowers at the proximal end, nectar-secreting flowers at the middle, and fertile flowers at distal end. Each flower had 5 sepals and petals, 10-12 stamens. Only single carpel was found in fertile flower. The functional of flower and capitulum depend on size of pistil in fertile flower. The functional male flower had smaller pistil in fertile flower than functional hermaphrodite flower and capitula become male and hermaphrodite, respectively. Fruit set only found in hermaphrodite capitula. The flower opened at night and produced nectar. Cross pollination was necessary. Bat was important pollinator. The percentage of set fruit was 25.37 compare with total flowering.

มอร์โฟเมตรีของใบ ความแปรผันทางพันธุกรรม และวงศ์วานทางวิวัฒนาการของกวาวเครือขาว
ในประเทศไทย

**Leaf morphometry, genetic variation, and phylogeny of
White Kwao Krua *Pueraria mirifica* in Thailand**

T. Suwonvijitr¹ (Student), C. Chanchao² (Thesis Advisor), W. Cherdshewasart² (Thesis Co –Advisor)
¹Program of Biotechnology, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330
²Department of Biology, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330

Pueraria mirifica (white Kwao Krua) is a Thai herbal leguminous plant. Its tuberous roots are widely used for estrogen-replacement therapy. It has been reported that white Kwao Krua from different locations performs different estrogenic activity. In this study, leaves of *P. mirifica* were collected from many locations throughout Thailand. For leaf morphometry, 9 leaf parameters (petiole length – PL; petiole diameter – PD; rachis length – RL; petiolet length – PLL; terminal leaflet length – TLL; terminal leaflet breadth – TLB; stipule length – SPL; angle of first leaf border – AB°; and number of pairs of primary veins – NPV) were selected. The results indicate variation among cultivars from different locations. For example, AB° of the Maehongsorn cultivar is significantly different from those of Sakonnakorn and Uthaitani cultivars. For indicating genetic variation, genomic DNA was isolated from young and fresh leaves. Primers for the *trnL-F* gene were designed from the gene of other related species. Under optimum conditions, a product of about 400 bp was obtained. The sequence was shown and identity of the *trnL-F* product was 90-99% to recorded sequences in the databank. Sequences of all cultivars will be obtained and aligned. Then, genetic distances will be calculated for phylogenetic tree construction.

นิเวศวิทยาการสืบพันธุ์ของไม้หมีเหม็นและคุณภาพเมล็ดพันธุ์
ของไม้เศรษฐกิจบางชนิดในวงศ์อบเชย

**The reproductive ecology of *Litsia glutinosa* and seed quality
of some economic trees in Lauraceae**

S. Ratee

Rajamangala University of Technology Isan, Muang, Nakhon Ratchasima 30000

The study was carried out during the year 2004 – 2005 at Nong Rawiang forest, Nakhon Ratchasima. The objectives were focussed on the phenology and pollinator of *Litsia glutinosa*, and also the pollen efficiency, the reproductive success, seed dispersal, seed germination of *L. glutinosa* in natural site and to test seed quality of *L. glutinosa* and *L. cubeba*. The results showed that growth and development of *L. glutinosa* flower started from the visible size to the time of anthesis was 34 and 30 days in male and female flowers, respectively. The proper time of anthesis was in June. Fruiting occurred in August to September and fell in October. The pollen viability and germination rate were 82% and 39%, respectively. *Eristalis arvorum* Fabr. and *Chrysomya* sp. were the most frequent dominant flower pollinators. The first pollinator species was preferred to male flower while the latter favored to female flower. The peak visitation period in male and female flowers were at 8.00 a.m. and 3.00 p.m., respectively. Reproductive success of *L. glutinosa* was 7.4% and seeds dispersed mostly by birds. *L. glutinosa* and *L. cubeba* had seed viability more than 88%. The standard germination test of *L. glutinosa* with seed stored for 6 months was 72%, and there were no seeds germinating of *L. cubeba* in all experiments. The germination of *L. glutinosa* in the natural site during June 2004 was very high germinated seedling, suggesting seed production had high success in the previous year. However, the survey in June, 2005 did not find any seedlings of this species.

พืชสกุลไทร (*Ficus* L.) ในภาคตะวันออกเฉียงเหนือของประเทศไทย

The genus *Ficus* L. in the Northeast of Thailand

W. Tanming (Student), P. Chantaranothai (Thesis Advisor)

Applied Taxonomic Research Center, Department of Biology, Faculty of Science, Khon Kaen University,
Muang, Khonkaen 40002

A taxonomic study on the genus *Ficus* L. in the northeast of Thailand was conducted from August 2005 to June 2006. Dried specimens in Thai herbaria and field collections were examined. Six subgenera and 45 species are enumerated: four species in subgenus *Ficus*, two in *Pharmacosycea*, six in *Sycidium*, seven in *Sycomorus*, four in *Synoecia* and 22 in *Urostigma*. A key to species, descriptions, ecological data, geographical distributions and photographs are provided.

อนุกรมวิธานของมะเดื่อบางชนิดและปฏิสัมพันธ์กับแมลงพาหะถ่ายเรณู

Taxonomy of some figs and their interactions with pollinators

Y. Tarachai¹ (Student), C. Trisonthi¹ (Thesis Advisor), S.G. Compton² (Thesis Co-Advisor)

¹Department of Biology Faculty of Science, Chiangmai University, Muang, Chiangmai 50200

²School of Biology, Faculty of Biological Science, University of Leeds, UK

Taxonomic study on some *Ficus* and interaction with pollinators were conducted from June 2005-June 2006 in Chiang Mai. There are 20 species, 8 monoecious and 12 dioecious plants identified. Interaction between figs and their pollinators was investigated by two aspects of the relationship between pollinators and male host plants experimentally. *Ficus montana*, one of dioecious figs, and its pollinator were examined. The first question was whether the pollinator females gain by carrying pollen into a fig and the second question was whether pollinated female flowers in male figs can produce seeds, if the pollinator fails to lay eggs in them. Pollinator progeny were produced in pollen-free figs, but in smaller numbers than in pollinated figs, and often the figs failed to develop at all. When pollinators were allowed to enter male figs, but not lay eggs, all the figs aborted before development was completed.

กายวิภาคศาสตร์เปรียบเทียบของใบพืชสกุล *Polygala* sect. *Polygala* (Polygalaceae)
ในประเทศไทย

Comparative leaf anatomy of Thai *Polygala* sect. *Polygala* (Polygalaceae)

N. Piwpuan (Student), A. Thammathaworn (Thesis Advisor)
Applied Taxonomic Research Center, Department of Biology, Faculty of Science, Khon Kaen University,
Muang, Khon Kaen 40002

Anatomical characters of seven species of the genus *Polygala* sect. *Polygala* were studied using light microscopy and permanent slides which prepared through paraffin embedded sections and whole blade clearing technique. The plant specimens used in this study were collected from the field between June 2004-November 2005. The objective of the present work was to construct a key based on leaf anatomical characters for the identification of Thai *Polygala* species. The investigated species shared many characters including the amphistomatic leaves with anomocytic stomata which are more on the abaxial surface than on the adaxial one, an undifferentiated hypodermis and dorsiventral mesophyll with the palisade layer towards the adaxial side. Both qualitative and quantitative characters are important for identification. So, the characters used in the constructed identification key are the presence of druse crystals and lysigenous cavities in mesophyll, trichome type, differences in anticlinal wall of epidermal cells, number of palisade layers and size of stomata. The studied plants were separated into two groups by mesophyll cells. The first group had druse crystals present in the mesophyll cells: *P. chinensis* L., *P. erioptera* DC., *P. logifolia* Poir., *P. persicariifolia* DC. and *P. triflora* L. In the second group the crystals were absent: *P. crotalarioides* Buch.-Ham. ex DC. and *P. polifolia* C. Presl.

การศึกษาอนุกรมวิธานพืชวงศ์ *Stemonaceae* ที่พบในประเทศไทย

Taxonomic studies of family *Stemonaceae* in Thailand

P. Inthachub (Student), S. Vajarodaya (Thesis Advisor)

Department of Botany, Faculty of Science, Kasetsart University, Chatuchak, Bangkok 10900

Preliminary study of *Stemonaceae* in Thailand from the collections of herbarium specimens; The Herbarium of Department of Agriculture (BK), Royal Forest Department (BKF), and Herbarium of Department of Biology, Chiang Mai University (CMU) is presented 2 genera 7 species. These are *Stemona* including *Stemona aphylla* Craib, *S. burkillii* Prain, *S. collinsae* Craib, *S. curtisii* Hook.f., *S. kerrii* Craib and *S. tuberosa* Lour.. *Stichoneuron*, with only one species, *Stichoneuron caudatum* Ridl

ความหลากหลายของพรรณไม้เขาหินปูนในภาคตะวันออกเฉียงใต้ของประเทศไทย
Species diversity of vascular plants in limestones in Southeastern Thailand

P. Phonsena, P. Panyarat and P. Kan-urai
The Forest Herbarium, National Park, Wildlife and Plant Conservation Department, Chatuchak,
Bangkok 10900

The first year of a project on the species diversity of vascular plants in limestones in southeastern Thailand was explored from May 2006 in 7 limestone hills. Species diversity, morphological characters, distribution, ecological data and status were examined. Many endemic, rare and endangered species, such as *Wrightia sirikitiae* D.J. Middleton & Santisuk and *Santisukia kerrii* (Barnett & Sandwith) Brummit have been found in this study areas, whilst *Cirromitra* and *Sinobaijana* (Cucurbitaceae) are expected to be new genus. It is expected that numerous new country and regional distributional records will be made, as well as the discovery of many taxa previously unknown to science. Plant inventory data derived from this project will also be used for the Flora of Thailand project and will form an important resource for critical conservation initiatives in Thailand and nearby countries.

ความหลากหลายของพืชสมุนไพรและแนวทางการใช้ประโยชน์อย่างยั่งยืน

ณ อุทยานแห่งชาติภูหินร่องกล้า จังหวัดพิษณุโลก

Species diversity of medicinal plants and its tendency for sustainable use at Phu Hin Rong Kla National Park, Phitsanulok

O. Kudjabnak¹ (Student), D. Wattanachaiyingcharoen² (Thesis Advisor), K. Proumtep¹ (Thesis Advisor)

¹*Biology Department, Faculty of Science, Naresuan University, Muang, Phitsanulok 65000*

²*Agriculture Natural Resources and Environment, Naresuan University, Muang, Phitsanulok 65000*

This study focuses on the species diversity and sustainable utilization of medicinal plants in Phu Hin Rong Kla National Park, Phitsanulok during May 2003 – December 2004. The study area is located at Phu Hin Rong Kla near the head office, Mh Huynamyang, Pacutong, Samnakoumnatrat, Kang hospital and Banrongkla undang waterfall, Pacharin base, Lanhinpum, 105 species of flowering medicinal plants were collected from Phu Hin Rong Kla National Park. They comprised 63 families and 94 genera. Among these, the Asteraceae were the richest in number of genera and species recorded with 6 species and 6 genera. Full descriptions of the genera and species; and keys to genera and a key to species are given together with references for each species. The specimens and material collected are deposited at the Biology Department, Faculty of Science and Faculty of Agriculture Natural Resources and Environment, Naresuan University.

การเร่งการกลับคืนของความหลากหลายทางชีวภาพในพื้นที่ไร่ร้าง
บริเวณภาคเหนือของไทยปีที่ 3

**Accelerating the recovery of biodiversity in an abandoned agricultural field
in Northern Thailand**

P. Wangpakapattanawong (Postdoctoral Researcher), S. Elliott (Advisor)
Department of Biology, Faculty of Science, Chiang Mai University, Muang, Chiang Mai 50200

The framework species method of reforestation, developed by The Forest Restoration Research Unit (FORRU) at Chiang Mai University, has been used successfully to restore evergreen forest on degraded former agricultural sites in Doi Suthep-Pui National Park, Chiang Mai. However, this method has never been fully replicated in other areas of northern Thailand. This paper reports results of an attempt to test the FORRU reforestation techniques at Ban Toong Yah, Mae Chaem district, Chiang Mai, at a similar elevation as FORRU's original plots at Ban Mae Sa Mai, Mae Rim district, Chiang Mai. Seventeen species of framework tree seedlings were planted in June 2004. The monitoring of the 22-year old saplings in February 2006 showed that the species with the highest survival rate was *Lithocarpus elegans* (27%). All the seedlings had the survival rates lower than FORRU's acceptable level, which was 50% after 2 growing seasons. The planting area was an open area exposed to strong winds, which likely resulted in the extremely low survival percentages of the seedlings. In addition, FORRU normally prepares the planting sites using chemical herbicides, which is an effective site preparation method. However, chemical herbicides were not used in this research in an attempt to compare performances of the seedlings planted in other planting sites prepared with the FORRU's common method and reduce reforestation cost. The planting site of this research was dominated by *Setaria geniculata* and *Pteridium aquilinum*, with more than 90% cover. Therefore, forest restoration work in the future should carefully consider this factor.

การพัฒนาารูปแบบของไม้ดอกหอมในต้นไม้ประดับและน้ำมันหอมระเหย

Development of fragrant flower plants for the purposes of decoration and essential oils

P. Chalermglin, P. Kengkarj, J. Srithongkul and A. Phiriyaphattharakit
Thailand Institute of Scientific and Technological Research, Klong Luang, Pathumthani 12120

A study of 30 rare and fragrant flower species to develop them for decorating purpose found that *Goniothalamus marcanii*, *Manglietia utilis*, *Magnolia rajaniana*, *Magnolia floribunda* and *Tamilnadia uliginosa* were very suitable using seeding techniques whereas *Friesodielsia desmoides*, *Goniothalamus tapis* and *Schoutenia glomerata* ssp. *peregrine* were very good using cutting techniques. The marcotting technique was a very suitable for *Gardenia thailandica* and grafting was very appropriate technique for *Magnolia sirindhorniae* and *Mitrephora sirikitiae*. The data from seedling cultivation revealed that *Goniothalamus tapis* and *Ixora stellulata* should be treated as pot plants. *Uvaria grandiflora* and *Friesodielsia desmoides* were very good for climbing in the field while *Goniothalamus laoticus*, *Mitrephora maingayi*, *Gardenia thailandica*, *Mitrephora tomentosa*, *Rothmannia wittii*, *Schoutenia glomerata* ssp. *peregrine*, *Manglietia utilis*, *Magnolia baillonii*, *Magnolia sirindhorniae*, *Magnolia rajaniana*, *Tamilnadia uliginosa*, *Mitrephora winitii* and *Gardenia sootepensis* were very dominant as outdoor trees. Pruning and maintenance with care trained them to be beautiful decorating plants.

การประยุกต์ภูมิสารสนเทศในการจำแนกพื้นที่ชุ่มน้ำในพื้นที่กรุงเทพมหานครและปริมณฑล

Application of Geo-Informatics for wetland classification in Bangkok and Vicinity

K. Ninlapat (Student), Y. Trisurat (Thesis Advisor)

Department of Forest Biology Faculty of Forestry, Kasetsart University, Chatuchak, Bangkok 10900

Application of Geo-Informatics for Wetland Classification in Bangkok and Vicinity was conducted during July 2005 to June 2006. The objectives of the study were to create a GIS database for classifying and delineating wetland types according to the Wetland Classification System of Thailand, and to assess the status and changes in wetlands between 1998 - 2004. Primary data consisted of 6 layers, viz. land use, river status, water body status, water body size, and irrigation canals. These layers were derived from visual interpretation and digital image processing of Landsat - 5 TM. Secondary data included 4 layers, viz. study area boundary, irrigation area, soil group, and river and stream network. Spatial data were analyzed by GIS software based on Wetlands Classification System of Thailand comprising 5 levels, viz. Type, System, Subsystem, Class and Subclass. The results showed that Bangkok and Vicinity contains both freshwater and saltwater wetlands. They are classified into 5 systems namely marine/coastal, estuarine, riverine, lacustrine and palustrine. Furthermore, these wetlands can be subdivided into 23 subclasses. The coverage of each wetland type is being analyzed.

การพัฒนาระบบฐานข้อมูลสารสนเทศภูมิศาสตร์ความหลากหลายทางชีวภาพ ป่าฮาลา-บาลา
ภาคใต้ของประเทศไทย

**Database and geographic information system development on biodiversity
in the Hala-Bala forest in Southern Thailand**

*T. Anman, P. Mipokasap, K. Deedumjan, A. Sritakae and W. Cheunban
National Center for Genetic Engineering and Biotechnology, Klong Luang, Pathumthani 12120*

The Hala-Bala Wildlife Sanctuary was considered as one of the most important tropical rain forest in Thailand. This so called Indo-Malaysia rainforest type was recognized as high biological diverse sanctuary. To manage and conserve this invaluable natural resource, Database and Geographic Information Systems (GIS) development has been established. The primary objective of the project is to collect the information about flora and fauna diversity within the sanctuary using database and the recent developed technology, geographic information systems, as a tool of data store and management. According to field survey, it was found that 2,500 individual plants observed along the nature trail comprise 327 species 196 genera and 79 families. All of plant data, consisting of nomenclature, plant classification, morphology and plant habit are stored in the relational database. The spatial distribution of 24 wildlife species, including mammal and bird, were collected and inputted into GIS data layers. In addition, physical geographic and socio-economic data were also included in the GIS database e.g. geology, elevation, slope, watershed quality, and stream aquifer. Under this project, the database of research carried out in Hala-Bala forest was also established in order to enhance the knowledge pool for management and conservation of the area which to date there are 39 topics. Eventually, the graphic user interface of the database and GIS program was developed for the convenience of the end user to be able to input, edit, display, retrieve and analyze both existing data and the new data to be inputted in the future. This study helps us gain more insight into the possibility as well as difficulties when the GIS and database, called as Bala Info, are used for such biodiversity application.

องค์ความรู้เรื่องพืชป่าที่ชาวเขาใช้ประโยชน์ทางภาคเหนือของไทย (ระยะที่ 3)

Current knowledges on wild plants utilized by hilltribes of Northern Thailand (third phase)

S. Areekul

Senior Royal Project Researcher, Kasetsart University, Chatuchak, Bangkok 10900

Further investigation on wild plants in the areas of 36 development centers of the Royal Project revealed that at least an addition of 401 plant species have been utilized by hilltribes for their livings. Among them, 198 plant species have been described in detail which included the information on scientific and vernacular names; plant description, propagation and distribution; hilltribes, native and foreign uses; nutritive, medicinal, plant protective and other properties; and their phytochemical constituents from scientific documents. This study is continuing on the remainder of 203 plant species and expecting to complete within this year.

การประเมินมูลค่าประโยชน์ด้านนันทนาการของอุทยานแห่งชาติภูกระดึง

An evaluation of recreation benefits of Phu Kradueng National Park

S. Rattanataveesopon (Student), S. Bejranonda (Thesis Advisor)

Department of Economics, Faculty of Economics, Kasetsart University, Chatuchak, Bangkok 10900

The objectives of this research were to determine the factors that affect visitors' willingness to pay for recreational services of Phu Kradueng National Park, to measure the recreation benefits of the park, to estimate the changes in recreation demand and recreation benefits in case of a cable car project. The data was collected from 368 visitors by questionnaire during October-December, 2005. The recreation benefits were estimated by using Zonal Travel Cost Method (ZTCM). The research found that at the 0.05 significance level, the only factor affecting the frequency of trips was the travel cost. Recreation benefits of Phu Kradueng National Park were 76,427,964 Baht in 2005. In case of a cable car project, the factors affecting the frequency of trip were travel cost, member of group, income, length of stay and age. Recreation benefits in case of existing of cable car project was 134,895,890 Baht. The recreation demand and recreation benefits will increase if a cable car project exists. Monetary recreation benefits can be used to estimate the effect of cable car project due to recreation demand and recreation benefits changes.