THE VEGETATION OF DOI CHIENGDAO A LIMESTONE MASSIVE IN CHIENGMAI, NORTH THAILAND

by

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During the Symposium on Ecological Research in Humid Tropics Vegetation at Kuching, Sarawak in July 1963, sponsored by the Government of Sarawak and UNESCO Science Co-operation Office for the Southeast Asia, a paper of the same title presented by the author was read and discussed. It was later published in the proceeding of the Symposium in 1965.

The paper was prepared in a rather limited time; besides the Appendix on Systematic List of Plants, intending to supplement the description of the vegetation, was through some mistake disregarded. It is therefore as an after-thought that the paper should be elaborated in this respect, which is the reason of this republishing.

INTRODUCTION

DOI CHIENGDAO is situated in the province of Chiengmai, North Thailand, between the latitude 19°24′ N, longitude 98°54′ E, and about 65 kilometres north of Chiengmai.

This limestone hill has been firstly visited by C. C. Hosseus during his 1904–1905 trip. A.F.G. Kerr in 1913 and 1921 made three consecutive excursions, and in 1937 R.M. de Schaunsee also paid a very short visit.

The author had the opportunity to frequent this interesting place accompanying foreign botanists: February 1958 with Thorvald Soerensen and Kai Larsen of Copenhagen; August 1958 with Kai Larsen, Bertel and Birgit Hansen of Copenagen; March 1959 with E.C. and L. Abbe of Minnesota; April 1960 with Ingrid Alsterlund of Gothenburg; December 1962 with J.A.R. Anderson of Kuching; November 1962 with M. E. D. Poore of Kuala Lumpur, and R. G. Robbins of Canberra.

TOPOGRAPHY

Doi Chiengdao is an eastern out-post of the Upper Tenasserim Range, situated on an almost flat alluvial plain of about 350 m. elevation in the broad valley of the Ping River, covering an area of about 60 sq. km. In profile it has steep slopes on all sides topped by three conical peaks. In ground plan it has a horse-shoe-shaped valley of very steep slopes with the three peaks arranged in juxtaposition. The highest peak is about 2200 m in altitude (Fig. 1)

The limestone starts from the foot hills to the summit, and owing to the geological record it has been estimated that the core of this massive is about 2200 m. Near the base a cavernous cave occurs, housing the famous Chiengdao Cave Temple. A running stream comes from this cave, in which species of Cyprinid fish abound. On the higher ridges and peaks, where erosion is very excessive, barren, eroded limestone is a common feature. The barren ridges and peaks abound with temperate species, and seem to mark the southernmost limit of their distribution. The valleys are covered with hill evergreen forest or the moist lower montane one, on a rich loamy soil. (Plate XI, Fig. 1).

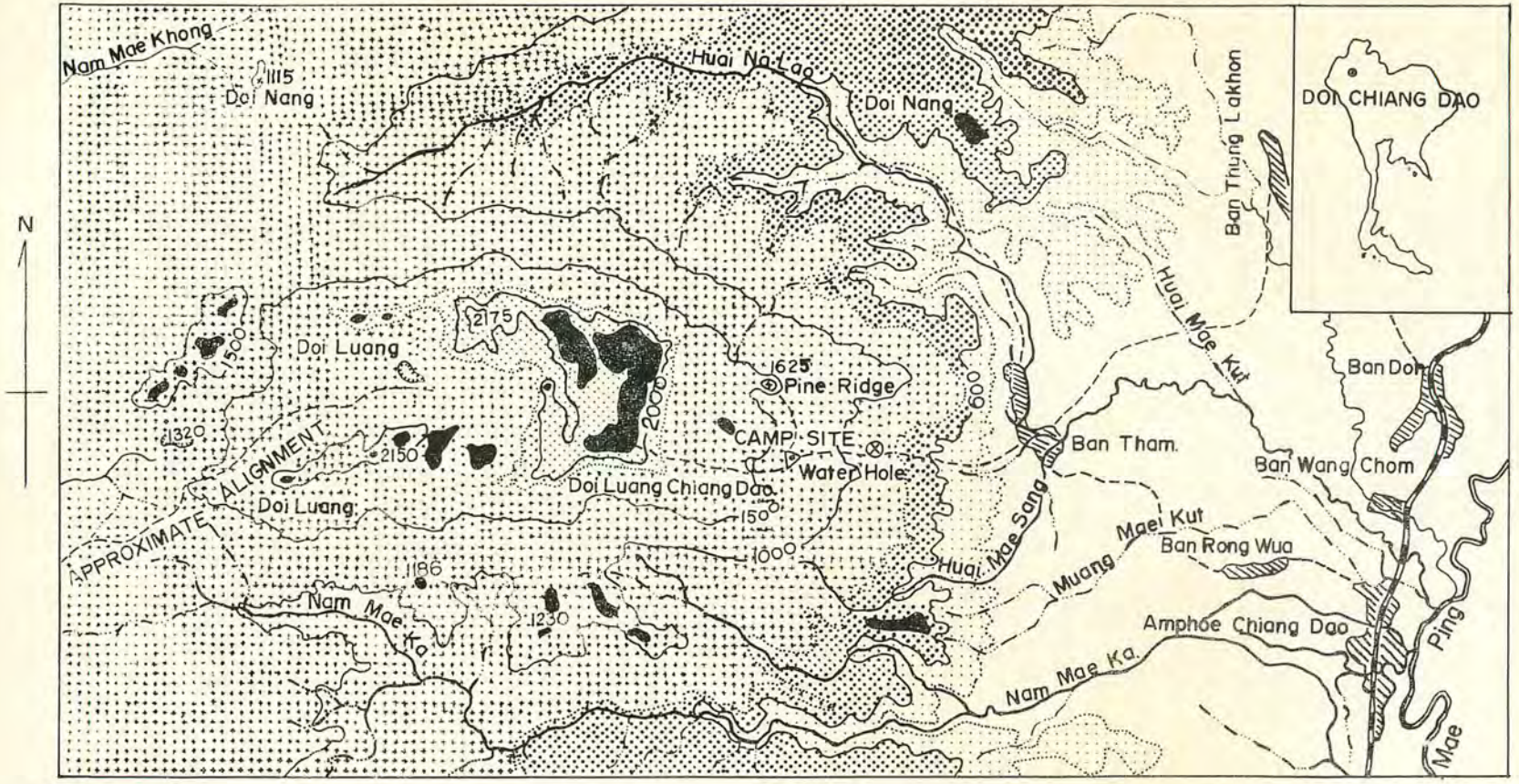
The highest water hole is at the 910 m elevation, where the remarkable change of the forest composition starts. Owing to the scarcity of water, working in the upper elevation especially on the barren ridges and peaks in the hot dry season is indeed very trying. It is more pleasant to work during the cold dry season.

The slope is about 60° and precipices are not at all uncommon. The ascents on the east and the northwest slopes are expedient, but it is more enterprising to ascend on the east slope, where vegetation type is varied at different elevation.

ECOLOGICAL FACTORS

There is no relevant climatological record of Doi Chiengdao. The rainfall is rather heavy, vividly shown by the occurrence of the dry evergreen and the hill evergreen forest at the foothills and the higher valleys, and the everflowing stream and water-holes. Temperature observed during the last trip in November is 13°C at the

Fig. 1. Map showing forest types of Doi Chiengdao
Scale 1 : 50,000



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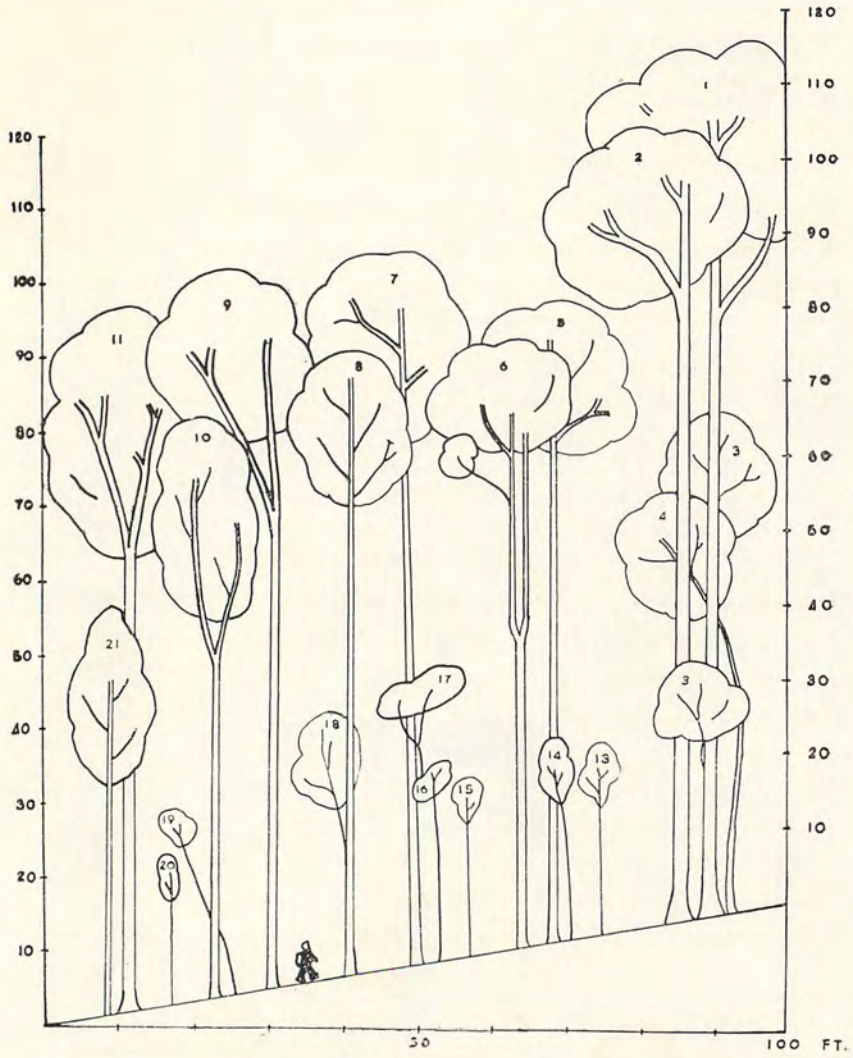

Fig. 2

Lower Montane Rain forest, Doi Chiengdao, 1700 m, Tree no. 1 : *Canarium* sp.; nos. 2, 10 ; *Lithocarpus magnificus;* nos. 3,20 : *Diospyros* sp.; nos. 4,18 : *Syzygium* sp.; nos. 5,7 : *Pterospermum grandiflorum;* nos. 6,11 : *Xerospermum glabratum* ; no. 8 : *Calophyllum polyanthum;* nos. 8,15,17 : *Vitex heterophylla;* no. 12 : *Antiaris toxicaria;* no. 13 *Symplocos* sp.; no. 14 : *Lansium domesticum;* no. 16 : *Neolitsea* sp.; no. 19 : *Brassaiopsis ficifolia;* no. 21 : *Lauraceae.*

minimum and 20°C at the maximum. In the hot dry season it is expected to be higher.

Climatic seasons are in conformity with Chiengmai. The rainy season lasts from May to September, the heaviest rain-fall is in the month of September. The cold dry season lasts from October to February, and the hot dry season from March to April.

There is no evidence of grazing by domestic animals, even though patches of grassy swards are rather common on the east and west slopes. Game animals are relatively scarce, evidently bears and serows are present. The grassy swards are the effect of fire during the hot dry season due to the shifting cultivation of the hill tribe in the valleys. The fire even comes right up to the summit, following the grassy slopes and open ridges.

VEGETATION

The vegetation type can be classified into four categories based on the composition of the forest, elevation and the aspect of the slopes: a) Dry Evergreen forest, b) Moist Upper Mixed Deciduous forest, c) Hill Evergreen forest or Moist Lower Montane forest, and d) Open Hill Evergreen forest.

a) Dry Evergreen Forest

Within the elevation of 350–600 m the forest of evergreen nature is forming a narrow belt along the foothills and up gentle slopes. The dominant tree species are *Dipterocarpus turbinatus, Shorea thorelii,* and *Pterocymbium* sp.; secondary species are *Spondias pinnata, Dillenia aurea, Berrya ammonilla, Markhamia stipulata, Sarcosperma arboreum, Knema linifolia, Mitrephora* sp., *Phoebe* sp., and *Alseodaphne* sp. *Dendrocalamus hamiltonii* and *Bambusa tulda* are scattered along streams. An acaulescent *Cycas,* possibly new to science, is rather common. The ground cover consisted of *Cyclosorus cylindrothrix, Habenaria* spp., *Globba garrettii, Lobelia begoniifolia, Carex baccans, Carex speciosa* and *Acroceras tonkinensis.* Vines such as *Porana disciflora, Merremia umbellata, Gnetum montanum, Smilax lanceifolia, Smilax corbularia* and *Smilax perfoliata* are scattered.

b) Moist Upper Mixed Deciduous Forest

The forest type gradually changes from the dry evergreen type to a moist upper mixed deciduous one; it starts from the elevation of 600 m, beginning with a narrow belt of bamboo thicket of *Bambusa tulda* and *Dendrocalamus strictus*, of which the ground cover consists of *Microstegium vagans, Iphigenia indica, Habenaria* spp., interspersing with tree species such as *Berrya ammonilla, Pterocymbium* sp., and *Adina cordifolia.* Then the forest merges into a teakbearing area.

In a narrow strip between 700-850 m altitude, teak (*Tectona grandis*) is found associating with *Dillenia aurea, Markharmia stipulata, Lagerstroemia balansae, Premna tomentosa, Grewia disperma, Spondias pinnata, Dillenia pentaphylla; Bambusa tulda,* and *Dendrocalamus strictus* are scatteringly present. In a rather moist locality *Costus speciosus* is to be found. The common grass is *Microstegium vagans* and *Apluda mutica.*

Above the teak zone the composition of the forest is more open and besides species found in the teak-bearing area the following are sparsely present: *Pentacme suavis, Xylia kerrii, Cordia dichotoma, Pterocarpus macrocarpus,* and *Shorea talura. Dendrocalamus stsictus* forms a dense undergrowth, and the ground is covered with *Capillepedium assimile* and *Microstegium vagans,* which come up to breast high. Limestone boulders are more frequent from the elevation of 900 m upwards, where *Quercus kingiana* begins to occur. This is the transitional area between the Moist Upper Mixed Deciduous and the Open Hill Evergreen forest.

c) Hill Evergreen or Moist Lower Montane Forest

The forest of this type, known to some ecologists as the Moist Lower Montane forest, occupies the steep, narrow valleys between the elevation of 1300-1800 m altitude. It is within this area that the humidity is highest, suggested by the abundance of mosses, hepatics, ferns, and succulent species.

The upper layer is composed of *Lithocarpus magnificus, Lithocarpus xylocarpus, Calophyllum polyanthum, Canarium* sp., *Ficus altissima, Cephalotaxus fortunei, Cedrela toona, Xerospermum* sp. and *Antiaris*

toxicaria. The lower layer is formed by the following species : *Lithocarpus spicatus, Vitex heterophylla, Pterospermum* sp., *Lansium* sp., *Symplocos* sp., *Elaeocarpus* sp., *Sloanea tomentosa, Syzygium* sp., *Neolitsea* sp., *Alseodaphne* sp., *Diospyros* sp., *Polyalthia* sp., *Glochidion* sp., *Baliospermum* sp., and *Aglaia chittagonga.*

The undergrowth is composed of shrubby species such as : *Reinwardtia trigyna, Brassaiopsis ficifolia, Phlogacanthus curviflorus, Rapanea capitellata, Leea* sp., *Celtis* sp., *Chloranthus officinalis, Ardisia garrettii, Ardisia nervosa, Maesa montana, Caryota urens,* and seedlings of tree species. Lianes are frequent; *Calamus* sp., *Ventilago calyculata, Artabotrys* sp., *Symphorema* sp., and *Desmos* sp. are woody; *Pothos* sp., *Vitis* sp., *Dioscorea* sp., *Hedera himalaica, Raphidophora peepla,* and *Vanilla siamensis* are herbaceous.

Epiphytes are abundant, including *Agapetes hosseana, Peperomia* sp., *Lysyonotus serratus, Aeschynanthus lineatus, Petrocosmea kerrii, Chirita* sp., ferns of the genera *Drynaria, Davallia, Humata, Asplenium* and *Pyrrhosia* with a number of mosses. *Cymbidium, Dendrobium, Pholidota, Gastrochilus, Stauropsis,* and *Bulbophyllum* are common genera of epiphytic orchids.

A fairly dense ground cover of herbaceous species include *Catymbium, Piper, Strobilanthus, Elatostema, Alocasia, Aglaonema, Homalomena, Amorphophallus, Forrestia, Murdania, Gomphostemma,* and a number of *Euphorbiaceae.* Terrestrial ferns are of the genera *Leptochilus, Egenolfia, Athyrium, Microsorium, Asplenium,* and *Hymenophyllum.* Ground orchids are *Phaius flavus, Calanthe veratrifolia,* and *Calanthe cardioglossa.*

Limestone boulders are common phenomena in this type of forest, and abound with rock plants as *Peperomia, Elatostema, Chirita, Epithema, Calanthe, Hymenophyllum, Elaphoglossum, Asplenium,* mosses and hepatics.

On the steep slope of the higher elevation temperate species such as *Luculia gratissima, Vaccinium sprengelii, Lyonia ovalifolia, Acer garettii, Quercus floribunda, Ulmus* sp., *Fraxinus* sp., *Cornus oblonga,* and *Trachycarpus speciosus* are frequent.

With the help of Drs. Robbins and Poore, a profile has been made from a single strip of 100 ft at the elevation of about 1500 m to give a perspective idea (Fig. 2). In every case a single profile is not deemed typical, as it needs comparison with another profile. Anyhow this profile will give an idea that the forest in the steep, narrow valley is two-storied; the upper layer is formed by trees 1, 2, 5, 6, 7, 8, 9, 10, and 11, whereas trees 3, 4, 13, 14, 15, 16, 18, 19, and 20, belong to the lower layer. One might have the opinion that this second layer has three taller trees 3, 4, and 21, which is the actual second layer, and that the rest belong to the third layer. But after a careful study of the species in the transect, it can be surmised that in time this profile will segregate out into a more distinctly two-storied forest. For example tree 18 is going to grow up to the height of tree 4, while nos. 15 and 17 regarded as young members of the canopy at the present, are growing through.

b) Open hill evergreen forest

Within this type of forest the grassy sward is included. As it has been stated before that the grassy slopes are the effect of fire, it is to be surmised that before the destruction of fire they were of the open hill evergreen type.

This type of forest occupies the exposed limestone ridges, summits, and slopes. The forest can be divided into two zones, the lower occupies the 1100–1300 m elevation and the upper the 1500–2200 m.

At the elevation of 1100 m, the formation consists of *Terminalia* sp. nov. *Cinnamomum* sp., *Diospyros striata, Sterculia siamensis, Firmiana tomentosa, Ficus microcarpa* var., *Zanthoxylum acanthopodium, Zizyphus incurva, Euphorbia lacei, Dracaena* sp., The only bamboo is *Dendrocalamus strictus.* Many attractive herbs, such as *Paphiopedilum bellatulum, Dichiloboea acaulis, Impatiens psittacina, Trichodesma calcareum,* and *Hemipilia calophylla* are found imbedded in rock crevices together with ferns of the species *Cheilanthes farinosa, Cheilanthes rufa, Davallodes membranulosum, Egenolfia sinensis, Asplenium grevilleanum, Lepisorus nudus, Pyrrhosia mannii, Pyrrhosia stigmosa,* and *Botrychium virginianum* var. *lanuginosum.* Epiphytes are common such as orchids

of the genera *Dendrobium, Eria, Bulbophyllum,* and ferns of the genera *Drynaria* and *Vittaria.* Along the ascending slope *Firmiana tomentosa* continues to occur up to the elevation of 1200 m, and is associated with *Quercus kingiana, Quercus helferi* with the ground flora composed of *Clematis wattii, Thalictrum foliosum, Silene burmanica, Spodiopogon lacei, Osbeckia garrettii, Blumea spectabilis, Gnaphalium hypoleucum, Campanumoea javanica, Carex speciosa, Paris pentaphylla, Exacum tetragonum* and *Perilla ocimoides.* From the altitude of 1300 m up the three oak species are replaced by *Quercus floribunda* with a number of shrubby trees as *Lyonia ovalifolia, Craibiodendron stellatum* and *Vaccinium sprengelii.* It is worthwhile to note here that species of the mixed deciduous type are also found sporadically, such as *Bauhinia racemosa, Markhamia stipulata,* and *Berrya ammonilla.*

As the forest is more open in nature, quite a number of grasses are represented; *Capillipedium assimile, Microstegium vagans,* and *Apluda mutica* are very common, intermixed with *Hyparrhenia rufa, Themeda arundinacea, Arundinella setosa,* and *Eulalia birmanica. Spodiopogon lacei* is to be found up to the elevation of 1400 m. Among the grasses *Habenaria dentata* is rather common together with *Artemisia roxburghiana* var. *acutiloba.* The only bamboo is *Dendrocalamus strictus,* and the elevation of 1400 m seems to mark the limit of its vertical distribution.

The true pine is represented by *Pinus insularis,* which confines itself to the east slope of about 1850 m altitude. Besides the pine many temperate species abound here, and form the ground flora of the higher zone, 1500–2200 m. They are enumerated as follows: *Inula rubicaulis, Pertya hossei, Tricholepis karensium, Senecio craibianus, Rhododendron ludwigianum, Gentiana australis, Swertia kachinensis, Habenaria dentata, Begonia puttii, Clematis subpeltata, Lespedeza decora, Veratrum chiengdaoense* and *Polypodium manmaiense* (Plate XI, Fig. 2).

On the open ridges of 1900 m and up to the summits, *Quercus floribunda* stops at about the elevation of 1900 m; and is replaced by *Quercus lanata* and *Quercus semecarpifolia.* All along these ridges and summits, small trees such as *Premna interrupta var. smitinandi, Rhododendron ludwigianum, Wightia speciosissima. Cycas pectinata,*

Trachycarpus speciosus, and *Prunus hosseusii* are scattered. Shrubs are *Cornus oblonga* var. *siamica, Rapanea capitellata, Rubus niveus, Rhamnus virgatus, Osyris arborea, Hypericum* sp., *Indigofera cylindracea, Indigofera stachyodes, Lespedeza harmsii, Flemingia ferruginia, Sophora dispar, Bauhinia brachyacarpa, Cotoneaster franchetii, Viburnum atrocyaneum, Alstonia rupestris,* and *Buddleia macrostachys.* Besides the ground flora mentioned above, the following temperate species are present: *Delphinium stapeliosmum, Corydalis siamensis, Dactylipappos scandens, Cardamine circaeroides, Geranium siamense, Impatiens kerriae, Impatiens muscicola, Boeninghausenia albiflora, Dumasia leiocarpa, Saxifraga gemmipara, Kalanchoe dixoniana, Sedum sarmantosum, Circaea alpina, Hydrocotyle sibthorpioides Hydrocotyle siamica, Bupleurum tenue, Trachydium cambogianum, Seseli siamica, Peucedanum siamicum, Selinum striatum, Rubia crassipes, Galium petiolatum, Galium panduanum, Valeriana hardwickii, Camchya loloana, Aster benthamii, Aster vestitus, Anaphalis margaritacea, Senecio nagensium* var. *lobbii, Senecio triligulatus, Sausurea venosa, Campanula colorata, Agapetes hosseana, Ceratostigma asperrimum, Ceratostigma stapfiana, Primula siamensis, Androsace axillaris, Lysimachia glaucina, Lysimachia oppositifolia, Lysimachia peduncularis, Gentiana hesseliana, Swertia calcicola, Swertia striata, Cuscuta reflexa, Phtheirospermum parishii, Pedicularis siamensis, Colquhonia occcinea, Fagopyrum cymosum, Polygonum arifolium, Lilium primulinum* var. *burmanicum* and *Carex phyllocaula.* Epiphytic orchids are abundant, e.g. *Dendrobium eriaeflorum, Dendrobium confinale, Eria exilis, Eria wildiana, Bulbophyllum lasiochilum, Bulbophyllum comosum,* and *Luisia amesiana* (Plate XII, Fig. 1,2).

CONCLUDING REMARKS

Ten botanical excursions made during the lapse of some fifty odd years have resulted in an accummulation of herbarium collections deposited in many herbaria, especially at the Royal Botanic Gardens, Kew, England. HOSSEUS' rather small collection had been worked out and published in 1910.

KERR's collection has been studied mainly by the late Prof. W.G. CRAIB and successively published during the course of 30

Fig. 1. Profile of Doi Chiengdao looking from the East.

Fig. 2. *Gentiana australis* at 1900 m. altitude, trailing on grassy slope.

Fig. 1. *Ceratostigma stapfiana,* a blue-flowered species, common among limestone boulders on ridges at 1900 m. altitude.

Fig. 2. *Schefflera siamensis* at 1900 m on limestone ridge.

years, between 1911-1941; after a lapse of 20 years Dr. E.C. BARNETT in editing volume III part 3 of the classical *Florae Siamensis Enumeratio* in 1961 added more records on the *Scrophulariaceae* and *Gesneriaceae* of these particular place. Through the energetic activity of Danish botanists more informations were successively made known to science during the course of 1961-65.

It is fundamental to gather these scattered records of Doi Chiengdao plants into one place, therefore an annotated list is herewith appended.

ANNOTATED LIST OF DOI CHIENGDAO PLANTS

ANGIOSPERMAE

I. DICOTYLEDONES

RANUNCULACEAE

Clematis wattii DRUMM. & CRAIB, 1200-1300 m, climbing in grassland; new record.

Clematis sp., 2000-2100 m, on exposed limestone rocks; new record.

Delphinium stapeliosmum P. BRUHL. var. *siamense* CRAIB, c. 2000-2100 m., open rocky ground.

Thalictrum foliosum DC., 1450 m., scrambling on barren slope between limestone rocks; new record.

Thalictrum sp., 2100 m., among limestone rocks on ridges; new record for Thailand.

MENISPERMACEAE

Cocculus laurifolius DC., 1100 m., dry limestone rocks; new record.

FUMARIACEAE

Corydalis siamensis CRAIB, 1900 m., crevices of limestone rocks.

Dactylicapnos scandens HUCTH. var. *siamensis* CRAIB, 1800 m., on abandoned clearing.

CRUCIFERAE

Cardamine circaeroides HK. F. & TH., 1800 m., under bushes in scrub jungle.

FLACOURTIACEAE

Flacourtia jangomas (LOUR.) RAEUSCH., 1400 m., scattered in evergreen forest; new record.

PITTOSPORACEAE

Pittosporum kerrii CRAIB, 1800-1900 m., limestone rocks and open evergreen on rocky peak.

POLYGALACEAE

Polygala lacei CRAIB, 1650-1770-2100 m., common in crevices, and on rocks.

CARYOPHYLLACEAE

Silene burmancia COLL. & HEMSL., 1700 m., open rocky slopes.

HYPERICACEAE

Hypericum nepalense CHOISY, 2000-2100 m., summit area among rocks; new record.

Hypericum cf. *patulum* THUNB., 1900-2200 m.,

GUTTIFERAE

Calophyllum cf. *polyanthum* WALL. ex PLANCH. & TRIANA, 1500 m., in evergreen forest; new record.

STERCULIACEAE

Firmiana kerrii (CRAIB) KOSTERMANS, 1100-1770 m., on rocks at top of peak.

Sterculia siamensis CRAIB, 1770 m. on rock.

TILIACEAE

Berria mollis WALL. ex KURZ, 600-800 m., scattered in mixed deciduous forest; new record.

Triumfetta cf. *pilosa* ROTH, 1900 m., on limestone ridge; new record.

LINACEAE

Reinwardtia trigyna PLANCH., 1400 m. evergreen forest; new record.

GERANIACEAE

Geranium siamense CRAIB, 2100 m., abundant on open rocky ground.

BALSAMINACEAE

Impatiens kerriae CRAIB, 1800 m., limestone rocks.

Impatiens muscicola CRAIB, 2100 m., on mossy rocks.

Impatiens psittacina HK. F., 1400-1600 m., in limestone rocks in evergreen forest.

Impatiens racemosa DC., 1700-1800 m., common weed on abandoned clearings.

RUTACEAE

Boeninghausenia albiflora RCHB., 1400 m., evergreen clearings.

Zanthoxylum acanthopodium DC., 1600-2000 m., open evergreen forest, on rocky ground.

MELIACEAE

Cipadessa baccifera MIQ., 1300 m., open evergreen jungle.

Amoora chittagonga HIERN, 1400 m., evergreen forest.

OLACACEAE

Schoepfia acuminata WALL. ex DC., 1100 m. open oak and pine forest; new record.

Schoepfia fragrans WALL., 1900 m. along edge of valley; new record.

CELASTRACEAE

Celastrus cf. *monosperma* ROXB., 2100 m., scrambling on open ridge; new record.

Maytenus curtisii (KING) DING HOU, 1900 m., scrambling on limestone ridge; new record.

RHAMNACEAE

Rhamnus virgata ROXB., 1600 m., limestone rocks.

Zizyphus incurva ROXB., 1100 m., limestone rocks.

Goudnia leptostachya DC., 1900 m. open ridge; new record.

AMPELIDACEAE

Ampelocissus bartata PLANCH., 1800-2000 m., over rocks on open ground.

Tetrastigma obovatum GAGNEP., 1400 m., dense evergreen forest; new record.

Parthenocissus semicordata PLANCH., 1300 m., open evergreen forest; new record.

ACERACEAE

Acer garrettii CRAIB, 1900 m., in the valley; new record.

STAPHYLEACEAE

Turpinia parva KOORD. & VALET., 900 m., in evergreen forest along stream.

ANACARDIACEAE

Rhus fulva CRAIB, 1300-2000 m, open evergreen forest.

Campylopetalum siamense FORMAN, 690 m, evergreen forest.

Allospondias lakonensis STAPF, 400-500 m, evergreen forest; new record.

Dracontomelum mangiferum BL., 400 m, evergreen forest by stream; new record.

PAPILIONACEAE

Indigofera cylindracea GRAHAM ex BAKER, 2100 m, open grassy ground.

Indigofera stachyodes LINDL., 2100 m, open rocky ground.

Lespedeza decora KURZ., 1650-1770 m, open grassy forest.

Lespedeza harmsii (SCHINDLER) CRAIB, 1800-2000 m, open grassy slopes.

Dumasia leiocarpa BENTH., 1900-2100 m.

Moghania ferruginea (GRAHAM ex BENTH.) H.L.Li, 1650 m, open savannah.

Sophora dispar CRAIB, 1600-2000 m, common in open savannah.

Smithia ciliata ROYLE, 1400 m, abandoned clearings.

CAESALPINIACEAE

Bauhinia brachycarpa WALL. ex BENTH., 1800 m, open grassy forest.

ROSACEAE

Prunus hosseusii DIELS, 1900 m, open ridge.

Rubus niveus THUNB., 1600-2100 m.

Rubus alceifolius POIR., 500-1400 m, scrub jungle and along edge of evergreen forest; new record.

Rosa indica LINN., 2100 m, open rocky ridge and overgrown clearings.

Cotoneaster franchetii BOIS, 2100 m, open rocky ground.

Eriobotrya bengalensis HK.F., 1600 m, open rocky forest.

SAXIFRAGACEAE

Saxifraga gemmipara FRANCH., 2100 m, limestone rocks.

CRASSULACEAE

Kalanchoe dixoniana HAMET, 1650-1770 m, on rocks.

Sedum sarmentosum BUNGE, 1770 m, on rocks.

COMBRETACEAE

Terminalia sp. nov. 1100 m, on limestone ridge; new record for Thailand.

MELASTOMACEAE

Osbeckia garrettii CRAIB, 1000-1400 m, open grassy forest.

ONAGRACEAE

Circaea alpina LINN., 2100 m, mossy rocks.

PASSIFLORACEAE

Passiflora siamica CRAIB, 450-840 m, along edge of evergreen forest.

CUCURBITACEAE

Melothria perpusilla COGN., 1800 m, abandoned clearing.

Gomphogyne heterosperma KURZ, on limestone.

Gynostemma pedata BL., 1500-1700 m, old clearings.

Zanonia indica LINN., 1100-1500 m, on rocky slopes.

BEGONIACEAE

Begonia putii CRAIB, 1900-2000 m, on rocks, open ridge.

Begonia yunnanensis LEVL., 1300-1900 m, open limestone ridge; new record.

Begonia vagans CRAIB, 1500-1850 m, on rocks, evergreen forest; new record.

UMBELLIFERAE

Hydrocotyle siamensis H. WOLFF, 2000 m.

Hydrocotyle sibthorpioides LAMK., 1700-2100 m, crevices of limestone rocks.

Bupleurum tenue HAM. ex D. DON, 1700-2000 m, open slopes.

Trachydium cambodgianum (H. de BOISS.) HIROE, 1650-1750 m, open savannah.

Seseli siamicum CRAIB, 1800-2000 m.

Heracleum burmanicum KURZ., 1600 m, rocky slopes; new record.

Heracleum siamicum CRAIB, 2100-2200 m.

Peucedanum siamicum CRAIB, 1100-2200 m, on rocky slopes and exposed limestone ridge; new record.

Selinum striatum BENTH. ex C.B. CLEARKE, 1800-2100 m.

ARALIACEAE

Schefflera siamensis W.W. SM. apud CRAIB, 1650-1750 m, common on rocks.

Brassaiopsis ficifolia DUNN, 1400 m, evergreen forest.

Hedera himalaica TOBLER, 1400 m, evergreen forest.

Tupidianthus sp., 1750 m, pine ridge; new record.

ALANGIACEAE

Alangium decipiens EVRARD, 500 m, evergreen forest.

CORNACEAE

Cornus oblonga WALL. var. *siamica* GEDDES, 2100 m, open rocky ground.

CAPRIFOLIACEAE

Viburnum atro-cyaneum C.B. CLARKE, 2180 m, on limestone ridge.

Lonicera hildebrandiana COLL. & HEMSL., 1600-1800 m, on limestone ridge.

RUBIACEAE

Hymenopogon parasiticus WALL. 1850-2100 m, limestone rocks.

Luculia gratissima SWEET, 1800 m, limestone rocks.

Argostemma pubescens GEDDES, 1800-2000 m, rocks crevices.

Anotis wightiana HK.F. var. *compressa* (WALL. ex D. DON.) CRAIB, 1400 m, open bank of stream.

Ophiarrhiza villosa ROXB., 1300 m, open grassy forest.

Mycetia chasalioides (CRAIB) CRAIB., 1500-1600 m, scattered in evergreen forest.

Leptodermis trifida CRAIB, 1770-1800 m, top of peak in rock crevices.

Rubia crassipes COLL. & HEMSL., 1650-2100 m, limestone rocks.

Galium petiolatum GEDDES, 1800 m, under bushes in evergreen clearings.

Galium punduanum WALL. ex CRAIB, 1650-2100 m, limestone rocks.

Tarenna vanprukii CRAIB, 600 m, evergreen forest.

VALERIANACEAE

Valeriana hardwickii WALL., 1650 m, open grassy forest; 1400 m, open evergreen forest.

DIPSACACEAE

Scabiosa siamensis CRAIB, 2000-2100 m, crevices of limestone rocks.

COMPOSITAE

Camchaya loloana KERR, 1100-2000 m, open limestone ridge.

Vernonia silhetensis (DC.) CRAIB, 1700-1800 m, limestone rocks.

Adenostemma lavenia O. KTZE., 600 m, evergreen forest.

Vernonia volkameriifolia DC., var. *siamica* HOSS., 1700 m.

Aster benthamii STEETZ, 2000 m.

Aster vestitus FRANCH., 2000 m.

Conyza japonica DC., 1500-1700 m, in abandoned clearings.

Blumea fistulosa KURZ, 400-1100 m.

Blumea spectabilis DC., 400-1100 m.

Laggera falcata O. KZE., 800-1100 m.

Anaphalis adnata DC., 1100-1800 m.

Anaphalis margaritacea BENTH., 1800-2100 m, old clearings.

Gnapthalium hypoleucum DC., 1200 m.

Inula cappa DC., 2280 m.

Inula nervosa WALL. ex DC., var. *purpurascens* HK.F., 2000-2100 m, rocky ground.

Inula rubicaulis C.B. CLARKE, 1350-2100 m.

Siegesbeckia orientalis LINN., 2100 m, open limestone slopes.

Vicoa cernua DALZ. & GIBS., 1100 m.

Artemisia roxburghiana BESS, var. *acutiloba* PAMP., 1400-1700 m, common on old clearings.

Gynura cusimbua S. MOORE, 1800 m, in abandoned clearings.

Senecio craibianus HOSS., 1650-2200 m, common among rocks.

Senecio nagensium C.B. CLARKE, var. *lobbii* CRAIB, 2160 m.

Senecio trilligulatus HAM. ex D.DON, 1900 m, open slope.

Saussurea venosa KERR, 2100 m, open rocky ground.

Leucomeris decora KURZ, 800-1100 m.

Tricholepis karensium KURZ, 1680 m.

Ainsliaea pteropoda DC., 1650-1770 m, among rocks.

Pertya hossei CRAIB apud HOSS., 1650-2100 m, common on rocky ground.

Gerbera piloselloides COSS, 800 m.

Crepis cf. *glomerata* DCNE., 2100-2200 m, in rock crevices.

Lactuca parishii CRAIB apud HOSS., 1800 m.

Lactura putii KERR, 1700-1900 m.

Sonchus arvensis LINN., 1600-1800 m, weed on Musor clearings.

Sonchus asper HILL, 1500-1800 m, weed of cultivated ground.

CAMPANULACEAE

Campanumoea javanica BL., 1100-1300 m.

Campanula colorata WALL., 1800-2100 m.

ERICACEAE

Agapetes hosseana DIELS, 2100-2180 m, epiphytic on the ridge.

Vaccinium sprengelii D.DON., 1200 m.

Craibiodendron stellatum (PIERRE) W.W. SM., 1200-1300 m.

Rhododendron ludwigianum HOSS., 1600-2180 m, limestone rocks along open ridges.

PLUMBAGINACEAE

Ceratostigma asperrimum STAPF ex PRAIN, 1700-2200 m, open rocky ground.

Ceratostigma stapfiana HOSS., 1900-2200 m.

PRIMULACEAE

Primula siamensis CRAIB, 1700-2000 m, crevices of limestone rocks.

Androsace axillaris FRANCH., 2100 m, open grassy ground; 1800 m, common under bushes on overgrown clearings.

Lysimachia glaucina FRANCH., 1700 m, scrub.

Lysimachia oppositifolia FLETCH., 1800 m, trailing over ground in scrub jungle.

Lysimachia peduncularis WALL. ex HK. F., 2100-2200 m, limestone ridges.

MYRSINACEAE

Ardisia garrettii FLETCH., 1800 m, common in evergreen forest.

Ardisia nervosa FLETCH., 700 m, evergreen forest by stream.

Ardisia corymbifera MEZ, 1700 m, evergreen forest.

Maesa montana DC., 1200 m, evergreen forest.

Maesa permollis FLETCH., 600 m, evergreen forest.

Maesa ramentacea DC., 1020 m, evergreen forest.

Maesa sublanceolata FLETCH., 1100-1300 m, open hill forest.

Embelia furfuracea WALL. ex DC., 1100 m, mixed deciduous forest.

Embelia stricta CRAIB, 1000 m, mixed forest.

Rapanea capitellata (WALL.) MEZ, 1800-2000 m, open hill evergreen forest.

SAPOTACEAE

Planchonella lenticellata FLETCH., 1300-2100 m, open evergreen forest.

SARCOSPERMACEAE

Sarcosperma arboreum BENTH., 600 m, evergreen forest.

EBENACEAE

Diospyros striata FLETCH., 1100 m, on limestone.

OLEACEAE

Jasminum nervosum LOUR., 1600 m, trailing over limestone rocks.

Jasminum scortechinii KING & GAMBLE, 1600 m, open evergreen jungle.

Fraxinus chinensis ROXB., 1800-1900 m, limestone rocks; new record.

APOCYNACEAE

Alstonia rupestris KERR, 1800 m, on limestone rocks in open evergreen forest.

Amalocalyx microlobus PIERRE ex SPIRE, 630-1300 m.

ASCLEPIADACEAE

Cryptolepis elegans WALL. ex D.DON, 900 m, evergreen forest.

Periploca purpurea KERR, 1600 m, climbing on trees in open evergreen forest.

Marsdenia calcicola KERR, 1800-2100 m, on limestone rocks.

Heterostemma gracile KERR, 1400 m, in scrub.

Hoya siamica CRAIB, 1500 m, dense evergreen forest.

Ceropegia sp., 2000-2100 m, limestone rocks.

LOGANIACEAE

Buddleja asiatica LOUR., 1200 m,

Buddleja macrostachya BENTH., 2180 m, on limestone of Peak III; 1900 m, open grassy slopes.

Fagraea obovata WALL., 1300 m, epiphytic in open evergreen forest.

Gelsimium elegans (GARDN. & CHAMP.) BENTH., 1400 m, evergreen jungle; new record, previously known only from Phu Huat, Nan at 1300 m, elevation.

GENTIANACEAE

Exacum tetragonum ROXB., 800-1300 m.

Gentiana australis CRAIB, 1650-1700 m, common on rocky ground.

Gentiana hesseliana HOSS., 1700-1900 m, among grass in open savannah.

Gentiana sp., 2000 m, open grassy forest.

Swertia calcicola KERR., 2000-2100 m, on rocks.

Swertia kachinensis LACE., 1650-1770 m, abundant in open savannah.

Swertia striata COLL. & HEMSL., 1700-1850 m, common on open rocky slopes.

BORAGINACEAE

Cynoglossum lanceolatum FORSSK., 1400 m, open waste ground.

Tournefortia intonsa KERR, 600-800 m.

Trichodesma calcareum CRAIB, 900 m, in crevices of limestone rocks.

CONVOLVULACEAE

Cuscuta reflexa ROXB., 1200-1800 m, rocky slopes.

Porana discifera SCHNEIDER, 1400 m, on bushes in scrub.

Porana racemona ROXB., 1400 m, scrub.

Porana spectabilis KURZ, 380 m, evergreen forest.

Merremia umbellata (LINN.) HALL.F., 500 m, edge of evergreen forest.

Agyreia splendens (ROXB.) SWEET, 1460 m, edge of evergreen forest.

Lettsomia maymyensis (LACE) KERR, 1400 m, edge of evergreen forest.

Lettersomia maymya W.W. SMITH, 1400 m, edge of evergreen forest.

SOLANACEAE

Solanum torvum SW., 1200 m, in old clearings.

Solanum verbascifolium LINN., 430 m, secondary forest.

Lycianthes biflora (LOUR.) BITT. var. *mollissima* (BL.) BITT., 1300 m, on limestone rocks.

Capsicum frutescens LINN., 600 m, village scrub.

SCROPHULARIACEAE

Staurogyne obtusa O. KTZE., 420 m, in evergreen forest.

Lindenbergia philippensis (CHAM.) BENTH., 450 m, limestone rocks.

Lindenbergia ruderalis (VAHL) O. KTZE., 400-500 m.

Torenia edentula GRIFF., 1400 m, open evergreen forest.

Alectra arvensis (BENTH.) MERR., 1100-1400 m, in open grassy forest.

Buchnera cruciata HAM., 1680 m, in grassy slope.

Sopubia trifida HAM., 990-1800 m, in open grassy slope.

Phtheirospermum parishii HK.F., 1680-1900 m, abundant among grass in open savannah, and crevices of limestone rocks.

Pedicularis siamensis TSOONG, 1900-2100 m, among rocks on limestone ridges.

Wightia speciosissima BL., 1800-2000 m, on trees and limestone rocks; new record.

OROBANCHACEAE

Aeginetia indica LINN., 1100 m, on limestone rocks; new record.

GESNERIACEAE

Aeschynanthus lineatus CRAIB, 1900 m, on trees in evergreen forest.

Aeschynanthus hildebrandii HEMSL., 1800-1900 m, on trees.

Aeschynanthus macranthus (MERR.) PELLEG., 430 m, in evergreen forest.

Lysionotus serratus DON, 1200-1400 m, on rocks in evergreen forest.

Stauranthera grandiflora BENTH., 430 m, on limestone rocks by stream.

Epithema carnosa BENTH., 1100-1700 m, on limestone rocks.

Rhynchoglossum obliquum BL., 1300 m, on limestone rocks.

Didymocarpus rodgeri W.W. SM. & BANNERJI var. *siamensis* W.W. SM., 1300-1500 m, on trees and limestone rocks in evergreen forest; new record.

Didymocarpus tristis CRAIB, 1200 m, on limestone rocks.

Paraboea glanduliflora BARNETT, 2000 m, on rocky slope.

Paraboea tomentosa BARNETT, 1050-1100 m, on limestone rocks.

Chirita micromusa BURTT, 600-650 m, on limestone rocks.

Boea harroviana CRAIB, 1100-1800 m, on limestone rocks; new record.

Boea glabrisepala (BURTT) BARNETT, 600 m, on limestone rocks.

Boeica fulva C.B. CLARKE, on rocks.

Ornithoboea arachnoidea (DIELS) CRAIB, 660-730 m, on limestone rock face.

Ornithoboea wildeana CRAIB, 1600-2000 m, on limestone ridges.

Dichiloboea albida BARNETT, 1500 m, among limestone boulders; new record.

Dichiloboea acaulis BARNETT, 1100-2100 m, on limestone rocks.

Dichiloboea birmanica (CRAIB) STAPF, 1100 m, on limestone rocks.

Petrocosmea kerrii CRAIB, 1400-2100 m, on shady rocks.

BIGNONIACEAE

Markhamia stipulata SEEM. var. *kerrii* CRAIB, 600-1300 m, in moist upper mixed deciduous forest and savannah.

ACANTHACEAE

Phlogacanthus asperulus NEES, 420 m, evergreen forest.

Phlogacanthus curviflorus NEES, 1700 m, not common in evergreen forest; new record.

Justicia khasiana C.B. CLARKE, 2170 m, on open ridge.

Andrographis laxiflora (BL.) LINDAU, 350 m, evergreen forest.

Peristrophe lanceolaria (ROXB.) NEES, 500 m, evergreen forest.

Eriostrobilus bombycina (IMLAY) BREM., 700 m, evergreen forest.

Goldfussia rex (C.B. CLARKE) BREM., 700-1200 m, evergreen forest.

Sericocalyx glaucescens (NEES) BREM., 350 m, evergreen forest.

Barleria cristata LINN., 1000 m, evergreen forest.

Strobilanthes corrugatus IMLAY, 1900-2000 m, common on limestone ridges.

Strobilanthes erectus C.B. CLARKE apud HOSSEUS, 2160 m, open ridges.

Strobilanthes lilacinus C.B. CLARKE, apud HOSSEUS, 2160 m, open ridges.

Strobilanthus serrulatus IMLAY, 1800 m, common in evergreen forest.

Rostrellularia chiengmaiensis BREM., 1850 m, common on limestone rocks.

VERBENACEAE

Verbena officinalis LINN., 600 m, in old clearings.

Callicarpa arborea ROXB., 1020 m, moist upper mixed deciduous forest.

Callicarpa rubella LINDL., 1200 m, grassy slope.

Tectona grandis LINN. F., 600-700 m, moist upper mixed deciduous forest.

Premna fulva CRAIB, 600 m, moist upper mixed deciduous forest.

Premna interrupta C.B. CLARKE var. *smitinandi* MOLD., 1800-2000 m, on open limestone ridge.

Clerodendrum colebrokianum WALP., 500 m, evergreen forest.

Clerodendrum deflexum WALL., 600 m, moist upper mixed deciduous forest.

Clerodendrum disparifolium BL., 1020-1200 m, open grassy slopes.

Clerodendrum serratum (LINN.) MOON, 1100-1800 m, open ridge.

Clerodendrum urticifolium (ROXB.) WALL., 1300 m, among limestone rocks; new record.

Vitex canescens KURZ., 600 m, moist upper mixed deciduous forest.

Vitex heterophylla ROXB., 1400 m, evergreen forest.

Vitex peduncularis WALL., 1000 m, open hill evergreen forest.

Vitex trifolia LINN., 1020 m, in old clearings.

Vitex vestita WALL., 1200-1300 m, scattered on grassy slopes; new record.

Caryopteris paniculata C.B. CLARKE, 1900 m, limestone ridge undershade.

Congea tomentosa ROXB., 600 m, moist upper mixed deciduous forest.

Garrettia siamensis FLETCH., 1200-1800 m, hill evergreen forest.

Symphoreme involucratum ROXB., 600 m, moist upper mixed deciduous.

Sphenodesme pentandra JACK, 390 m, evergreen forest.

LABIATAE

Salvia moorcroftiana WALL., 2000-2200 m, grassland on limestone in Karen's field.

Colquhounia coccinea WALL. var. *mollis* PRAIN, 1900-2180 m, on rocky ridge.

Colquhounia elegans WALL. var. *typica* PRAIN, 2000 m, on grassy slopes.

Leucas collettii PRAIN, 2200 m, open limestone ridges.

Leucas mollissima WALL., 1100 m, on limestone rocks.

Gomphostemma phlomoides BENTH., 1700-2180 m, among limestone boulders on grassy slopes.

Teucrium quadrifarium HAM., 2100 m, on limestone rocks.

Teucrium tomentosum HEYNE, 2100 m, Karen's field, on limestone.

Coleus atropurpureus BENTH., 1100 m, open limestone ridges.

Plectranthus hispidus BENTH., 1100-1300 m, on limestone rocks among bamboos.

Plectranthus incisus BENTH., on limestone rocks among grasses and bamboos in grassland.

Plectranthus menthioides BENTH., 2000-2200 m, on grassy slope.

Plectranthus racemosus HEMSL., 2000 m, on limestone in grassy swards.

Plectranthus striatus BENTH., 1900 m, open limestone ridges.

Perillia ocimoides LINN., 1300 m, on limestone ridges.

Colebrookia oppositifolia SMITH, 1700-1800 m, open limestone ridges.

Dracocephalum longipedicellatum MUSHL., 450 m, evergreen forest along Mae Ping River.

Phlomis albiflora HEMSL., 2000 m, grassland.

Dyssophylla gracilis DAK., 400 m, between Wann Bao and Chiengdao in swampy area.

POLYGONACEAE

Polygonum arifolium LINN., 1800-2000 m, on limestone ridges.

Polygonum chinense LINN., 1300-1900 m, gravelly soil, new record.

Polygonum damrongianum HOSSEUS, 1400-2100 m, clearings in evergreen forest and open limestone ridges.

Polygonum flaccidum MEISSN., 500 m, evergreen forest by stream, new record.

Polygonum plebejum R. BR., var. *indicum* HK.F., 350 m, evergreen forest.

Fagopyrum cymosum MEISSN., 2000 m, among rocks.

AMARANTHACEAE

Aerva sanguinolenta (LINN.) BL., 2100 m, common, rocky ridge; new record.

Deeringia amaranthoides (LAMK.) MERR., 2100 m, not common, limestone ridge; new record.

PIPERACEAE

Piper sp., 2100 m, limestone ridge.

Peperomia sp., 1100 m, bare limestone rocks.

CHLORANTHACEAE

Chloranthus kachinensis KING & PRAIN, 1200-1300 m, open slopes.

Choloranthus officinalis BL., 1400 m, evergreen forest.

MYRISTICACEAE

Knema linifolia (ROXB.) WARB., 600 m, evergreen forest.

LAURACEAE

Cinnamomum caudatum NEES, 1100 m, limestone ridges; new record.

Cinnamomum iners BL., 420 m, evergreen forest.

Actinodaphne angustifolia NEES ?, 1400 m, evergreen forest.

Beilschmiedia sp., 1900-2000 m. scattered, limestone ridge.

Litsea sp., 1500 m, common, hill evergreen forest.

LORANTHACEAE

Scurrula ferruginea (JACK) DANSER, 1900 m, on oak trees.

BALANOPHORACEAE

Balanophora sp., 1300-1500 m, rocky slopes.

SANTALACEAE

Osyris arborea WALL., 2160 m, on open ridges.

EUPHORBIACEAE

Euphorbia lacei CRAIB, 1100 m, on limestone ridges.

Glochidion assamicum HK.F., 420 m, evergreen forest.

Phyllanthus emblica LINN., 1200-1300 m, open grassy slopes.

Mallotus philippinensis MUELL.-ARG., 1100 m, open limestone ridges.

Bischofia velutina BL., 390 m, evergreen forest.

BUXACEAE

Sarcococca balansae GAGNEP., 1900-2000 m, limestone ridge; new record.

Sarcococca pruniformis LINDL., 2000 m, limestone ridge; new record.

ULMACEAE

Ulmus lancifolia ROXB. ?, 1800, open limestone ridges.

Celtis tetrandra ROXB. ?, 1700 m, on limestone ridges.

MORACEAE

Ficus altissima BL., 500-1400 m, evergreen forest.

Ficus auriculata LOUR., 1300 m, evergreen forest.

Ficus cyrtophylla WALL. ex MIQ., 1500 m, evergreen forest.

Ficus geniculata KURZ, 500 m, evergreen forest.

Ficus glaberrima BL., 500 m, evergreen forest.

Ficus hirta VAHL, 350 m, evergreen forest.

Ficus hispida LINN. F., 400-500 m, evergreen forest.

Ficus microcarpa LINN. F., forma *eubracteata* CORNER, 1100 m. limestone ridges.

Ficus montana BURM. F., limestone rocks in evergreen forest; new record.

Ficus obtusifolia ROXB., 500-600 m, evergreen forest.

Ficus pubigera WALL. ex MIQ., 1400 m, evergreen forest.

Ficus rumphii BL., 350 m, evergreen forest.

Ficus subulata BL., 350 m, evergreen forest.

Ficus tinctoria FORST.F. subsp. *parasitica* (WILLD.) CORNER, on rocks in evergreen forest.

Ficus tinctoria FORST.F. subsp. *parasitica* (WILLD.) CORNER var. *anastomosans* (WALL. ex KURZ) CORNER, 1400 m, on rocks in evergreen forest.

Morus laevigata WALL., 500-600 m, evergreen forest.

Antiaris toxicaria LESCHEN., 1500 m, evergreen forest.

URTICACEAE

Laportea disepala (GAGN.) CHEW, 1500 m, scattered among limestone boulders; new record.

Girardinia heterophylla DCNE., 1400 m, on rocks in evegreen forest.

Elatostemma sessile FORST., 1400-1500 m, on rocks in evergreen forest.

Pouzolzia sp. 1400-1500 m, on rocks in evergreen forest.

JUGLANDACEAE

Engelhardia spicata BL., 600 m, moist upper mixed deciduous forest.

BETULACEAE

Betula alnoides HAM., 1700-1800 m, evergreen forest in the valley.

Carpinus viminea WALL. 1700-1800 m, evergreea forest in the valley.

FAGACEAE

Quercus floribunda LINDL., 1200-1900 m, open slopes.

Quercus helferiana DC., 1100-1200 m, open slopes.

Quercus kingiana CRAIB, 900-1200 m, open slopes.

Quercus lamellosa SMITH, 2000 m, open ridges.

Quercus lanata SMITH, 2000-2200 m, limestone ridges.

Quercus mespilifolioides A. CAMUS, 1030 m, open slopes.

Quercus semecarpifolia SMITH, 2200 m, on the summit.

Lithocarpus magnificus (BRANDIS) A. CAMUS, 1400-1500 m, evergreen forest.

Lithocarpus spicatus (SMITH) REHDER, 1400-1800 m, in evergreen forest and open slopes.

Lithocarpus trachycarpus (HICK. & A. CAMUS) A. CAMUS, 1200 m, open slopes.

Lithocarpus xylocarpus (KURZ) MARKGR. apud ENGLER, 1400-1500 m, evergreen forest.

II. MONOCOTYLEDONES

MUSACEAE

Musa acuminata Colla, 400-500 m, evergreen forest.

Zingiberaceae

Hedychium sp., 1100-2000 m.

Gagnepainia godefroyi K. SCHUM., 450-550 m, among rocks.

Globba garrettii KERR, 540 m, evergreen forest.

Globba sp., 500-1500 m, on rocks in evergreen forest.

LILIACEAE

Asparagus filicinus HAM., 1350 m, among rocks in open grassy slope.

Disporum pullum SALISB., 1250 m, open grassy slopes.

Veratrum chiengdaoënse K. LARSEN, 1800-2200 m, among rocks.

Ophiopogon sp., 2000 m, limestone ridge.

Chlorophytum cf. *orchidastrum* LINDL., 2100 m, in rock crevices.

Iphigenia indica KUNTH, 800 m, in moist upper mixed deciduous forest.

Lilium primulinum BAKER var. *burmanicum* (W.W. SM.) STEARN, 1800-1900 m, grassy slopes.

Trilliaceae

Paris polyphylla SMITH, 1200 m, grassy slope.

SMILACACEAE

Smilax corbularia KUNTH var. *hypoglauca* (BENTH.) KOYAMA, 600 m, evergreen forest.

Smilax lanceaefolia ROXB., 600-1400 m, evergreen forest.

Smilax perfoliata LOUR., 600-1400 m, moist upper mixed deciduous and evergreen forest.

COMMELINACEAE

Spatholirion sp., 2100 m, grassy slopes.

ARACEAE

Arisaema trifoliatum GAGNEP., 1800-2000 m, limestone ridges.

Arisaema garrettii GAGNEP., 440-500 m, evergreee forest.

Arisaema kerrii Craib, 1600-2100 m, limestone ridges.

Remusatia garrettii GAGNEP., 700 m, evergreen forest.

Remusatia vivipara SCHOTT, 640 m, evergreen forest.

Gonatanthus pumilus ENGL. ex KR., 1300 m, open hill forest.

Colocasia kerrii GAGNEP., 770 m, evergreen forest.

Alocasia macrorrhiza SCHOTT, 1600 m, evergreen forest.

Rhaphidophora peepla SCHOTT, 1400-1900 m, on tree in evergreen forest.

Pothos yunnanensis PRESL, 1400-1600 m, evergreen forest.

PALMAE

Trachycarpus excelsa H.WENDL., 1900-2000 m, open limestone ridges; new record.

Calamus sp., 1200-1500m, in evergreen forest.

PANDANACEAE

Pandanus furcatus ROXB., 500 m, evergreen forest.

TACCACEAE

Tacca paxiana LIMPR.F., 600 m, evergreen forest.

ORCHIDACEAE

Paphiopedlum bellatulum (RCHB.F.) PFITZ., 1100-1600 m, on limestone rocks.

Herminium angustifolium BENTH., 600 m, evergreen forest, 1900-2100 m. in rocks crevices and among grasses in summit area.

Brachycorythis acuta (RCHB.F.) SUMMERH., 940 m, moist upper mixed deciduous forest.

Brachycorythis helferi (RCHB.F.) SUMMERH., 1600 m, grassy slopes.

Hemipilia calophylla PAR. & RCHB.F., 1100-2000 m, on limestone rocks.

Habenaria corymbosa PAR. & RCHB.F., 600 m, evergreen forest.

Habenaria rhodocheila HANCE, 600 m, evergreen forest.

Habenaria columbae RIDL., 1500 m, among limestone rocks.

Habenaria dentata (SUR.) SCHLTR., 1500-1700 m, grassy slopes.

Habenaria oligoschista SCHTR., 1800 m, among rocks.

Peristylus prainii KRZL., 510 m, evergreen forest.

Peristylus goodyeroides LINDL., 1500 m, grassy slopes.

Vanilla siamensis ROLFE ex DOWNIE, 800-1500 m, evergreen forest.

Nervilia crispata (BL.) SCHTR., 900 m, grassy slopes.

Nervilia cacicola KERR, 900 m, grassy slopes.

Nervilia aragoana GAUD., 900-1100 m, grassy slopes.

Anoectochilus burmanicus ROLFE, 600 m, evergreen forest

Corymborchis veratrifolia BL., 650 m, evergreen forest.

Tropidia angulosa BL., 440 m, dry evergreen forest.

Coelogyne huettneriana RCHB.F., 1100 m, on trees and rocks.

Coelogyne trinervis LINDL., 1100 m, on trees and rocks.

Coelogyne suaveolens (LINDL.) HK.F., 900-1100 m, on trees.

Coelogyne longipes LINDL., 1100-1800 m, on trees.

Malaxis siamensis (ROLFE ex DOWNIE) SEID. & SMIT, 1900 m, on rocks.

Oberonia hosseusii SCHLTR., 1990 m, on trees.

Oberonia iridifolia (ROXB.) LINDL. var. *denticulata* HK.F., 900 m, on trees.

Oberonia lunata (BL.) LINDL., 1600 m, on trees.

Oberonia myosurus LINDL., 1100-1900 m, on trees.

Liparis jovis-pluvii PAR. & RCHB.F., 620 m, on trees.

Liparis longiscapa (ROLFE) GAGNEP., 620 m, evergreen forest.

Liparis viridiflora (BL.) LINDL., 650 m, on trees; 1400-1700 m, on rocks in evergreen forest.

Thunia alba RCHB.F., 1200 m, on rocks and trees.

Ephemerantha plicatile (LINDL.) HUNT & SUMMERHAYES, 1100 m, on trees.

Dendrobium infundibulum LINDL., 2200 m, on trees.

Dendrobium trigonopus RCHBF., 1800 m, on trees.

Dendrobium aggregatum ROXB., 400-900 m, on trees.

Dendrobium capillipes RCHB.F., 1700-1800 m, on trees.

Dendrobium chrysotoxum LINDL., 800-1000 m, on trees.

Dendrobium thyrsiflorum RCHB.F., 800-1000 m, on trees.

Dendrobium chrysanthum WALL., 900-1100 m, on trees.

Dendrobium moschatum SW., 600-900 m, on trees.

Dendrobium pulchellum ROXB., 400-600 m, on trees.

Dendrobium dixanthum RCHB.F., 800-1000 m, on trees.

Dendrobium hildebrandii ROLFE, 800-1000 m, on trees.

Dendrobium falconeri HK., 1800 m, on trees and rocks.

Dendrobium crystallinum RCHB.F., 800 m, on trees.

Dendrobium nobile LINDL., 600-800 m, on trees.

Dendrobium crassinode BENS. & RCHB.F., 900-1100 m, on trees.

Dendrobium crepidatum LINDL., 900-1100 m, on trees.

Dendrobium findleyanum PAR. & RCHB.F., 900-1100 m, on trees.

Dendrobium pierardii ROXB., 400-1100 m, on trees and rocks.

Dendrobium primulinum LINDL., 800-1100 m, on trees.

Dendrobium wattii (HK.F.) RCHB.F., 1900 m, on trees.

Dendrobium delacourii GUILL., 350-1700 m, on trees and rocks.

Dendrobium bicarmeratum LINDL., 1500-1900 m, on trees and rocks.

Dendrobium eriaeflorum GRIFF., 1800 m, on trees.

Dendrobium confinale KERR, 1850-1900 m, on trees on open ridges.

Dendrobium dixonianum ROLFE ex DOWNIE, 1650-1800 m, on trees.

Dendrobium wilmsianum SCHTR., 1800-2000 m, on trees and rocks.

Dendrobium parcum RCHB.F., 1300 m, on trees.

Dendrobium secundum (BL.) LINDL., 350-1100 m, on trees.

Eria dasyphylla PAR. & RCHB.F., 1000-1900 m, on trees and rocks.

Eria exilis HK.F. 1800 m, on trees.

Eria pulchella LINDL., 1200 m, on trees and rocks.

Eria pannea LINDL., 350-1100 m, on trees and rocks.

Eria truncata LINDL., 1200 m, on trees.

Eria acervata LINDL., 1100 m, on trees and rocks.

Eria spicata HAND.-MAZZ., 2100 m, on trees.

Eria wildeana ROLFE ex DOWNIE, 1650-1800 m, on trees.

Eria pubescens WIGTH, 1600 m, on trees.

Porpax fibuliformis (KING & PANTL.) KING & PANTL., 1100 m, on trees, limestone ridges.

Porpax meirax KING & PANTL., 1900-2000 m, on trees, limestone ridges.

Phajus flavus (BL.) LINDL., 1600 m, evergreen forest.

Calanthe cardioglossa SCHTR., 1500 m, in humus and on rocks.

Pachystoma senile (LINDL.) RCHB.F., 1300 m, grassy slopes.

Bulbophyllum comosum COLL. & HEMSL., 1850-1900 m, on trees and rocks.

Bulbophyllum craibianum KERR, 1300 m, on trees.

Bulbophyllum lasciochilum PAR. & RCHB.F., 1800 m, on trees.

Bulbophyllum odoratissimum LINDL. 1850 m, on trees and rocks.

Geodorum purpureum R.BR., 400 m, evergreen forest.

Cymbidium lowianum RCHB.F., 1600 m, on trees.

Cymbidium siamensis ROLFE ex DOWNIE, 1300 m, grassy slopes.

Cymbidium simulans ROLFE, 1000 m, on trees.

Cymbidium traceyanum HORT. ex O'BRIEN, 1500 m, on trees.

Palaenopsis cornu-cervi (BREDA) BL. & RCHB.F., 600-1500 m, on trees and rocks.

Aerides crassifolium PAR. & RCHB.F., 600 m, on trees.

Sarcanthus racemifer RCHB.F., 1200 m, on trees.

Arachnanthe cathcartii BENTH. & HK.F., 1500 m, on trees.

CYPERACEAE

Cyperus cyperoides (LINN.) O.KZE., 1800-1900 m, grassy slopes.

Cyperus haspan LINN., 350 m, bank of stream and wayside weed.

Cyperus pulcherrimus WILLD., 350 m, bank of stream and wayside weed.

Cyperus rotundatus LINN., 350 m, bank of stream and wayside weed.

Fimbristylis aestivalis WALP., 350 m, bank of stream and wayside weed.

Fimbristylis dichotoma VAHL, 350 m, bank of stream and wayside weed.

Kobresia sp., 2000 m, limestone pockets open ridges.

Bulbostylis densa (WALL). HAND.-MAZZ., 1850 m, open slopes.

Carex baccans NEES, 850 m, evergreen forest.

Carex continua C.B. CLARKE, 750 m, moist upper mixed deciduous forest.

Carex phyllocaula NELMES, 1800 m, among rocks.

Carex pterocaulos NELMES, 1200 m, open slopes.

Carex speciosa KUNTH, 1050-1800 m, grassy slopes and among rocks.

Carex tricephala BOECK. 1200 m, grassy slopes.

GRAMINAE

Arundinella cochinchinensis KENG, 300 m, evergreen forest.

Arundinella setosa TRIN., 1700-1900 m, open grassy slopes.

Eleusine indica (LINN.) GAERTN. 350 m, evergreen forest.

Eragrostis tenella (LINN.) P. BEAUV. ex ROEM. & SCHULT., 350 m., evergreen forest.

Leptochloa chinensis (LINN.) NEES, 350 m, wayside weed.

Oryza granulata NEES et ARN, ex STEUD., 470 m, moist upper mixed deciduous forest.

Sporobolus diander (RETZ.) P. REAUV., 350 m, wayside weed.

Thysanolaena maxima (ROXB.) O.KTZE, 350-800 m, moist upper mixed deciduous forest.

Axonopus compressus (SW.) P. BEAUV., 350 m, evergreen forest.

Brachiaria kurzii (HK.F.) A. CAMUS, 350 m, mixed deciduous forest.

Brachiaria reptans (LINN.) CARD. & C.E. HUBB., 350 m, by a small stream.

Brachiaria setigera (RETZ.) C.E. HUBB., 350 m, by a dried up stream.

Cyrtococcum accrescens (TRIN.) STAPF., 350 m, by a dried up stream.

Cyrtococcum oxyphyllum (STEUD.) STAPF., 700 m, moist upper mixed deciduous forest.

Digitaria timorensis (KUNTH) BAL., 350-700 m, moist upper mixed deciduous forest.

Oplismenus burmanii (RETZ.) P.BEAUV., 350 m, by a small stream.

Oplismenus compositus (LINN.) P.BEAUV., 350-500 m, moist upper mixed deciduous forest.

Panicum notatum RETZ., 350-800 m, moist upper mixed deciduous forest.

Paspalum conjugatum BERG., 350-800 m, moist upper mixed deciduous forest.

Setaria palmifolia (KOENIG) STAPF, 500 m, evergreen forest.

Setaria plicata (LAMK.) T. COOKE, 350 m, dried up stream.

Apluda mutica LINN. var. *aristata* (LINN.) PILGER, 500-1900 m, moist upper mixed deciduous forest, and open ridges.

Arthraxon prionoides (STEUD.) DANDY, 1100 m, on limestone rocks.

Capillipedium assimile (STEUD.) A. CAMUS, 800 m, among bamboo thickets.

Capillipedium parviflorum (R.BR.) STAPF, 1200 m, grassy slopes.

Capillipedium parviflorum (R.BR.) STAPF var. *villosum* HAECK., 600 m, moist upper mixed deciduous forest.

Coelorhachis striata (NEES ex STEUD.) A. CAMUS, 360-600 m, evergreen forest.

Hyparrhenia rufa (NEES) STAPF, 1300-1800 m, open grassy slopes.

Imperata cylindrica (LINN.) P. BEAUV., 800-1300 m, open grassy slopes.

Microstegium vagans (NEES ex STEUD.) A. CAMUS, 350-1000 m, moist upper mixed deciduous forest.

Pogonatherum crinitum (THUNB.) KUNTH, 350 m, on rocks by stream.

Saccharum procerum ROXB., 350 m, along edge of evergreen forest.

Spodiopogon lacei HOLE, 1100-1300 m, open grassy slopes.

Themeda arundinacea (ROXB.) RIDL., 1300 m, grassy slopes.

Themeda triandra FORSSK., 1300 m, grassy slopes.

Bambusa burmanica GAMBLE, 470 m, moist upper mixed deciduous forest.

Bambusa tulda ROXB., 350-600 m, evergreen forest.

Dendrocalamus hamiltonii NEES et ARN. ex MUNRO, 500-700 m, evergreen forest.

Dendrocalamus strictus NEES, 350-1100 m, rocky slopes and ridges.

GYMNOSPERMAE

GNETACEAE

Gnetum montanum MKGR., 1080 m, evergreen forest; new record.

CYCADACEAE

Cycas pectinata GRIFF., 1700-1800 m, open ridges; new record.

Cycas micholitzii var. nov., 400-500 m, evergreen forest; new record.

CEPHALOTAXACEAE

Cephalotaxus cf. *griffithii* HK.F., 1400-1500 m, evergreen forest.

PINACEAE

Pinus insularis ENDL., 1600-1850 m, open slopes; new record.

PTERIDOPHYTES

I. LYCOPODIINAE

LYCOPODIACEAE

Lycopodium carinatum DESV., 1500 m, on trees.

Lycopodium cf. *hamiltonii* SPRENG, 1700 m, on small trees.

SELAGINELLACEAE

Sellaginella argentea (WALL.) SPRING., 1600 m, on limestone ridges.

Selaginella pennata (DON) SPRING., 900 m, open slopes.

Selaginella repanda (DESV.) SPRING., 2000 m, on limestone ridges.

II. FILICINAE

OPHIOGLOSSACEAE

Botrychium lanuginosum WALL., 1100 m, in rock crevices.

Helminthostachys zeylanica (LINN.) HK., 600 m, evergreen forest.

SCHIZAEACEAE

Lygodium salicifolium PR., 800 m, open slopes.

POLYPODIACEAE

Pyrrhosia mannii (GIES.) CHING, 1100-1600 m, on limestone rocks and tree trunks on open ridges.

Pyrrhosia mollis CHING, 1100-1650 m, on rocks.

Pyrrhosia stigmosa (SW.) CHING, 1020-1100 m, on trees in evergreen and open ridges.

Lemmaphyllum carnosum PRESL., 1700-2000 m, evergreen forest; new record.

Lepisorus nudus (HK.) CHING, 1100-1400 m, in rock crevices and on tree trunk in hill evergreen forest.

Colysis elliptica (PRESL) CHING, 1600 m, evergreen forest.

Coniogramme fraxinea DIELS, 1600 m, evergreen forest.

Loxogramme involuta (DON.) PR., 1800 m, on mossy limestone rocks, and trees.

Microsorium heterocarpum (BL.) CHING, 1600 m, evergreen forest.

Microsorium zippelii (BL.) CHING, 1900 m, on rocky slopes.

Drynaria quercifolia (LINN.) J. SM., 100 m, on trees; new record.

Leptochilus decurrens BL., 1600 m, on rocks.

Leptochilus axillaris KAULF., 500 m, creeping on trees by stream; new record.

Phymatodes oxyloba PRESL., 1600 m, on rocks.

Phymatodes revoluta MOORE, 2000 m, on trees and rocks.

Crypsinus griffithianus (HK.) COPEL., 2100 m, creeping on trees; new record.

Crypsinus laciniatus (PRESL) HOLTT., 1000 m, on rocks; new record.

Polypodium amoenum WALL., 2100 m, on trees open ridges; new record.

Polypodium manmaiense C. CHRIST., 1300-1800 m, on limestone rocks.

THELYPTERIDACEAE

Cyclosorus cylindrothrix (ROS.) CHING, 350-1000 m, among bamboos.

Abapcopteris urophylla (WALL.) CHING, 1600 m, evergreen forest; new record.

DENNSTAEDTIACEAE

Microlepia hirta PRESL., 1000 m., evergreen forest; new record.

Microlepia platyphylla (DON.) J. SM., 1500 m, evergreen forest.

Sphenomeris chusana (LINN.) COPEL., 1400 m, evergreen forest.

Leucostegia immersa (WALL.) PRESL. var. *amplissima* v. A. v. R., 1300-1900 m, on rocky slopes.

Araiostegia pulchra (DON) COPEL., 1900-2000 m, on limestone rocks and trees.

Davallodes membranulosum (WALL.) COPEL, 1100 m. on trees.

Pteris biaurita LINN., 700 m, evergreen forest; new record.

Pteris pellucida PRESL., 540 m, mixed deciduous forest; new record.

Pteris sp. 1900-2100 m, crevices of limestone.

Asplenium caudatum FORST., 650 m, evergreen forest.

Asplenium exiquum BEDD., 2100 m, on rocks, new record.

Asplenium grevillei WALL. ex HK. & GREV., 1100 m, on limestone rocks.

Asplenium cf. *crinicaule* HANCE, 1500 m, on rocks.

Asplenium tenuifolium DON, 1100 m, on rocks.

Egenolfia sinensis (BAK.) MAXON, 1400-1900 m. open grassy slopes, and among rocks in evergreen forest.

Polysticum cf. *aculeatum* (LINN.) SCOTT, 1600 m, evergreen forest.

Dryopteris heterocarpa (BL.) O. KTZE., 1300 m, ledge of rocks.

Dryopteris setigera (BL.) O. KTZE., 1500 m, evergreen forest.

Tectaria macrodonta C. CHR., 430-440 m, evergreen forest.

Tectaria tenerifrons (HK.) COPEL, 490 m, evergreen forest.

Diplazium dilatatum BL., 1500 m. evergreen forest.

Diplazium japonicum BED., 650 m, evergreen forest.

Diplazium polypodioides BL., 1500 m, evergreen forest; new record.

Hypodematium sp., 1800 m, foot of precipiece; new record.

ADIANTACEAE

Onychium lucidum SPRENG, 2100-2200 m, on limestone slopes.

Cheilanthes farinosa (FORSSK.) KLF., 1100-2000 m, on rocky slopes.

Cheilanthes rufa DON, 1050-1800 m, on limestone rocks.

Adianthum flabellulatum LINN., 1600 m, evergreen forest.

Adiantum philippinese LINN., 800-1500 on rocks.

N.B.

The arrangement of this list is as follows :– *Angiospermae-Dicotyledonae* after BENTHAM & HOOKER with some modification by CRAIB, *Angiospermae-Monocotyledones* after HUTCHINSON, and *Pteridophytes* after HOLTTUM.

The list contains some 570 species with the inclusion of the vascular cryptogams; 64 species are new records to this limestone mountain, and of all these 3 species are new for Thailand. The omission of mosses is evident due to the need to further study by specialists; also there are still some more unidentified flowering plants excluded from this list, pending the study by specialists.

The 570 known species are broken down in the following table :–

Plant Group	Families	Genera	Species
Monocotyledones	13	88	172
Dicotyledones	84	250	335
Gymnospermae	4	4	5
Pteridophytes	8	35	58
Total	109	377	570

There are 40 families with only one species represented, these are mostly representatives of the temperate elements.

The largest family is represented by the *Orchidaceae* with 30 genera and 88 species, followed by the *Graminae* of 28 genera and 39 species, and the *Compositae* of 26 genera and 34 species.

Of the 88 orchid species only 2 species are endemic, i.e. *Oberonia hosseusii* and *Dendrobium confinale;* the following species are of wide distribution :— *Phalaenopsis cornu-cervi, Eria pulchella, Eria pannea, Pachystoma senile, Cymbidium simulans, Oberonia iridifolia, Liparis viridiflora, Ephemerantha plicatile, Dendrobium pierardii, Peristylus goodyeroides,* and *Corymborchis veratrifolia.* The true limestone species are *Paphiopedilum bellatulum, Hemipilea calophylla,* and *Habenaria rhodocheila.*

The 39 species of grasses are mostly lowland plants found scattered along trails and stream banks; species belongine to the high elevation, and confining to either the grassy slopes or rocky ridges are:— *Spodiopogon lacei, Arundinella setosa, Arthraxon prionoides, Capillipedium parviflorum,* and *Hypharrhenia rufa.*

The *Compositae* is a good representation of the northern elements as only *Adenostemma lavenia, Blumea fistulosa, Laggera falcata, Siegesbeckia orientalis, Inula cappa* and *Sonchus asper* are very widespread.

Endemic species are all 64 and is about 10% of the total number; the following families bear only endemic species :— *Fumariaceae, Pittosporaceae; Sterculiaceae, Geraniaceae, Combretaceae, Passifloraceae, Melastomaceae, Cornaceae, Dipsacaceae, Sapotaceae,* and *Ebenaceae.*

As the northern elements are predominating, the vegetation is thus belonging to the Indo-Burmese and South-Chinese floristic tendencies.

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