

CHAPTER V

RESULTS

Three hundreds and fifty-seven specimens of ferns and fern allies were collected from October 1996 to February 1999. They are classified into 153 species, 56 genera and 24 families (Table 5.1).

Table 5.1 List of the Pteridophytes at Khunkorn Waterfall Forest Park.

Taxon	Habitat	Forest types
Class Lycopsidea		
Order Lycopodiales		
Lycopodiaceae		
<i>Lycopodium cernuum</i> L.	T	DMDF
<i>Lycopodium hamiltonii</i> Spring	E	HEF
Order Selaginellales		
Selaginellaceae		
<i>Selaginella amblyphylla</i> Alston	T	MMDF
<i>Selaginella ciliaris</i> (Retz.) Spring	T	MMDF
<i>Selaginella delicatula</i> (Desv.) Alston	T	HEF
<i>Selaginella helferi</i> Warb.	T	DMDF,HEF
<i>Selaginella inaequalifolia</i> (Hook. & Grev.) Spring	T	MMDF
<i>Selaginella involvens</i> (Sw.) Spring	E	HEF
<i>Selaginella kurzii</i> Baker	T	DMDF,HEF
<i>Selaginella lindhardii</i> Hieron.	T	MMDF,HEF
<i>Selaginella minutifolia</i> Spring	T	MMDF,DMDF
<i>Selaginella monospora</i> Spring	T	MMDF
<i>Selaginella pennata</i> (D.Don) Spring	T	DMDF,HEF

Taxon	Habitat	Forest types
Selaginellaceae (Continued)		
<i>Selaginella tenuifolia</i> Spring	T	MMDF
<i>Selaginella wallichii</i> (Hook. & Grev.) Spring	T	MMDF
Class Sphenopsida		
Order Equisetales		
Equisetaceae		
<i>Equisetum debile</i> Roxb. ex Vaucher	T	MMDF
Class Filicopsida		
Order Marattiales		
Marattiaceae		
<i>Angiopteris evecta</i> (Forst.) Hoffm.	T	MMDF
Order Ophioglossales		
Ophioglossaceae		
<i>Ophioglossum petiolatum</i> Hook.	T	MMDF
Order Filicales		
Aspleniaceae		
<i>Asplenium macrophyllum</i> Sw.	L	MMDF
<i>Asplenium nidus</i> L.	E	MMDF.DMDF, HEF
<i>Asplenium obscurum</i> Blume	L	MMDF
<i>Asplenium perakense</i> C. G. Matthew & H. Christ.	T	HEF
<i>Asplenium unilaterale</i> Lamk.	L	MMDF
<i>Asplenium yoshinagae</i> Makino	T	HEF
Athyriaceae		
<i>Athyrium dissitifolium</i> (Baker) C. Chr.	T	HEF

Taxon	Habitat	Forest types
Athyriaceae (Continued)		
<i>Diplazium esculentum</i> (Retz.) Sw.	T	MMDF
<i>Diplazium leptophyllum</i> H. Christ.	T	MMDF
<i>Diplazium muricatum</i> (Mett.) Alderw.	T	MMDF
<i>Diplazium petri</i> Tardieu	T	MMDF
<i>Diplazium polypodioides</i> Blume	T	MMDF
<i>Diplazium simplicivenium</i> Holttum	T	HEF
<i>Kuniwatsukia cuspidatum</i> (Beddome) Pic. Serm.	T	HEF
Blechnaceae		
<i>Blechnum orientale</i> L.	T	DMDF
<i>Brainea insignis</i> (Hook.) J. Sm.	T	DMDF,HEF
Cyatheaceae		
<i>Cyathea gigantea</i> (Wall. ex Hook.) Holttum	T	MMDF
Davalliaceae		
<i>Araiostegia pseudocystopteris</i> (Kunze) Copel.	E	HEF
<i>Araiostegia pulchra</i> (D. Don) Copel.	E	HEF
<i>Davallia trichomanoides</i> Blume var. <i>lorrainii</i> (Hance) Holttum	E	HEF
<i>Davallia trichomanoides</i> Blume var. <i>trichomanoides</i>	E	HEF
<i>Humata repens</i> (L. f.) Diels.	E	DMDF,HEF
<i>Leucostegia immersa</i> (Wall. ex Hook.) Presl	E	HEF
Dennstaedtiaceae		
<i>Hypolepis punctata</i> (Thunb.) Mett. ex Kuhn	T	HEF

Taxon	Habitat	Forest types
Dennstaedtiaceae (Continued)		
<i>Microlepia calvescens</i> (Wall. ex. Hook.) Presl	T	HEF
<i>Microlepia speluncae</i> (L.) Moore	T	MMDF,DMDF, HEF
<i>Microlepia strigosa</i> (Thunb.) Presl	T	HEF
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>latiusculum</i> (Desv.) Shieh	T	HEF
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>wightianum</i> (J. Agardh) Tryon	T	MMDF,DMDF, HEF
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>yarrabense</i> Domin	T	DMDF,HEF
Dicksoniaceae		
<i>Cibotium barometz</i> (L.) J. Smith	T	MMDF,DMDF, HEF
Dryopteridaceae		
<i>Arachniodes henryi</i> (Christ) Ching	T	DMDF,HEF
<i>Dryopteris cochleata</i> (D. Don.) C. Chr.	T	DMDF,HEF
<i>Pteridrys cnemidaria</i> (Christ) C. Chr. & Ching	T	MMDF
<i>Tectaria angulata</i> (Willd.) C. Chr.	T	MMDF
<i>Tectaria devexa</i> (Kunze) Copel.	T	MMDF
<i>Tectaria fauriei</i> Tagawa	T	MMDF
<i>Tectaria fuscipes</i> (Wall. ex Beddome) C. Chr.	T	MMDF
<i>Tectaria impressa</i> (Wall. ex Hook.) C. Chr.	T	MMDF,DMDF
<i>Tectaria polymorpha</i> (Wall. ex Hook. & Grev.) Ching	T	MMDF,DMDF, HEF

Taxon	Habitat	Forest types
Gleicheniaceae		
<i>Dicranopteris curranii</i> Copel.	T	DMDF
<i>Dicranopteris linearis</i> (Burm.f.) Underw. var. <i>linearis</i>	T	DMDF,HEF
<i>Dicranopteris linearis</i> (Burm.f.) Ungerw. var. <i>montana</i> Holttum	T	DMDF
Hymenophyllaceae		
<i>Hymenophyllum acanthoides</i> (Bosch) Roscenst.	L	MMDF
<i>Hymenophyllum exsertum</i> Wall. ex Hook.	E	HEF
<i>Hymenophyllum polyanthos</i> (Sw.) Sw.	E	HEF
<i>Trichomanes bimarginatum</i> Bosch	L	MMDF
Lindsaeaceae		
<i>Lindsaea ensifolia</i> Sw.	T	MMDF,DMDF, HEF
<i>Sphenomeris chinensis</i> (L.) Maxon	T	DMDF
Lomariopsidaceae		
<i>Bolbitis appendiculata</i> (Willd.) K. Iwats.	L	MMDF
<i>Bolbitis heteroclita</i> (Presl) Ching ex C.Chr.	T	MMDF
<i>Bolbitis sinensis</i> (Baker) K. Iwats. var. <i>costulata</i> (Hook.) Tagawa & K. Iwats.	T	MMDF
<i>Bolbitis virens</i> (Hook. & Grev.) Schott var. <i>virens</i>	T	MMDF
<i>Elaphoglossum stelligerum</i> (Wall. ex Baker) Moore ex Alston & Bonner	E	HEF
<i>Elaphoglossum yoshinagae</i> (Yatabe) Makino	E	HEF
<i>Lomagramma grossoserrata</i> Holttum	T, L	MMDF

Taxon	Habitat	Forest types
Oleandraceae		
<i>Nephrolepis delicatula</i> (Dcne.) Pic. Serm.	E	HEF
<i>Nephrolepis falcata</i> (Cav.) C. Chr.	L	MMDF
<i>Oleandra undulata</i> (Willd.) Ching	T	DMDF,HEF
Parkeriaceae		
<i>Adiantum caudatum</i> L.	T	DMDF
<i>Adiantum philippense</i> L.	T	MMDF,DMDF, HEF
<i>Cheilanthes belangeri</i> (Bory) C. Chr.	T	DMDF
<i>Cheilanthes tenuifolia</i> (Burm.f.) Sw.	T	DMDF
<i>Pityrogramma calomelanos</i> (L.) Link	T	DMDF
Polypodiaceae		
<i>Aglaomorpha coronans</i> (Wall. ex Mett.)	E	MMDF,DMDF,
Copel.		HEF
<i>Arthomeris amplexifolia</i> (A. Christ)	E	HEF
Ching		
<i>Belvisia mucronata</i> (Fée) Copel.	E	MMDF,HEF
<i>Belvisia henryi</i> (C. chr.) Raymond	E	MMDF,DMDF
<i>Colysis pothifolia</i> (D. Don) Presl	T	MMDF
<i>Crypsinus cruciformis</i> (Ching) Tagawa	E	HEF
<i>Crypsinus oxylobus</i> (Wall. ex. Kunze)	E	HEF
Sledge		
<i>Drynaria parishii</i> (Beddome) Beddome	E	MMDF,DMDF, HEF
<i>Drynaria propinqua</i> (Wall. ex Mett.) J.	E	HEF
Sm. ex Beddome		
<i>Drynaria rigidula</i> (Sw.) Beddome	E	HEF
<i>Drynaria</i> sp.	E, L	MMDF
<i>Lemmaphyllum carnosum</i> (Hook.) Presl,	E	MMDF

Taxon	Habitat	Forest types
Polypodiaceae (Continued)		
<i>Lepisorus contortus</i> (A. Christ) Ching	E	HEF
<i>Lepisorus heterolepis</i> (Rosenst.) Ching	E	HEF
<i>Lepisorus nudus</i> (Hook.) Ching	E	HEF
<i>Lepisorus scolopendrium</i> (Ham. ex D. Don) Tagawa	E	HEF
<i>Lepisorus subconfluens</i> Ching	E	HEF
<i>Lepisorus suboligolepidus</i> Ching	E	HEF
<i>Leptochilus decurrens</i> Blume	T	MMDF
<i>Loxogramme sinensis</i> Ching	E	HEF
<i>Loxogramme involuta</i> (D. Don) Presl	E	HEF
<i>Microsorium cuspidatum</i> (D. Don) Tagawa	T	MMDF
<i>Microsorium membranaceum</i> (D. Don) Ching	E	HEF
<i>Microsorium pteropus</i> (Blume) Copel	L	MMDF
<i>Microsorium punctatum</i> (L.) Copel.	E	MMDF, DMDF
<i>Microsorium rubidum</i> (Kunze) Copel.	T	
<i>Microsorium zippelii</i> (Blume) Ching	E	MMDF
<i>Platyserium holttumii</i> de Jonch. & Hennipman	E	MMDF, DMDF
<i>Platyserium wallichii</i> Hook.	E	DMDF, HEF
<i>Polypodium amoenum</i> (J. Sm. ex Hook. et. Grev.) Mett.	E	HEF
<i>Polypodium argutum</i> (J. Sm. ex. Hook. et Grev.) Hook.	E	HEF
<i>Pyrrosia adnescens</i> (Sw.) Ching	E	DMDF
<i>Pyrrosia lingua</i> (Thunb.) Farwell. var. <i>heteractis</i> Hovenkamp	E	HEF

Taxon	Habitat	Forest types
Polypodiaceae (Continued)		
<i>Pyrrosia lingua</i> (Thunb.) Farwell. var. <i>lingua</i>	E	DMDF,HEF
<i>Pyrrosia mannii</i> (Gies.) Ching	E	HEF
<i>Pyrrosia mollis</i> (Kunze) Ching	E	DMDF
<i>Pyrrosia nuda</i> (Gies.) Ching	E	DMDF
<i>Pyrrosia stigmosa</i> (Sw.) Ching	E	MMDF,DMDF, HEF
<i>Pyrrosia tonkinensis</i> (Gies.) Ching	E	HEF
<i>Pyrrosia varia</i> (Kaulf.) Farw.	L	MMDF
Pteridaceae		
<i>Pteris aspericaulis</i> Wall. ex. J. Agardh	T	HEF
<i>Pteris asperula</i> J. S ex Hieron.	T	MMDF
<i>Pteris biaurita</i> L.	T	MMDF.DMDF
<i>Pteris linearis</i> Poir.	T	HEF
<i>Pteris longipes</i> D. Don	T	MMDF
<i>Pteris tripartita</i> Sw.	T	HEF
<i>Pteris venusta</i> Kunze	T	DMDF.HEF
<i>Pteris wallichiana</i> J. Agardh	T	MMDF
<i>Pteris vittata</i> L.	T	MMDF.DMDF
Schizaeaceae		
<i>Lygodium flexuosum</i> (L.) Sw.	T	MMDF,DMDF, HEF
<i>Lygodium polystachyum</i> Wall. ex Moore	T	MMDF,DMDF, HEF
<i>Lygodium salicifolium</i> Presl	T	MMDF,DMDF, HEF
Thelypteridaceae		
<i>Thelypteris arida</i> (D. Don) Morton	T	MMDF

Taxon	Habitat	Forest types
Thelypteridaceae (Continued)		
<i>Thelypteris aspera</i> (Presl) K. Iwats.	T	MMDF,DMDF
<i>Thelypteris crinipes</i> (Hook.) K. Iwats.	T	MMDF
<i>Thelypteris dentata</i> (Forssk.) St. John	T	MMDF
<i>Thelypteris glandulosa</i> (Blume) Tagawa & K. Iwats.	T	MMDF
<i>Thelypteris hirtisora</i> (C. Chr.) K. Iwats.	T	DMDF,HEF
<i>Thelypteris lakhimpurensis</i> (Rosenst.) K. Iwats.	T	MMDF,DMDF, HEF
<i>Thelypteris nudata</i> (Roxb.) Morton	T	MMDF,DMDF
<i>Thelypteris ornata</i> (Wall. ex Beddome) Ching	T	MMDF
<i>Thelypteris papilio</i> (C. Hope) K. Iwats.	T	MMDF
<i>Thelypteris parasitica</i> (L.) Fosb.	T	DMDF
<i>Thelypteris siamensis</i> Tagawa & K.Iwats.	T	HEF
<i>Thelypteris subelata</i> (Baker) K. Iwats.	T	MMDF,DMDF
<i>Thelypteris terminans</i> (Hook.) Tagawa & K. Iwats.	T	MMDF.DMDF, HEF
<i>Thelypteris torresiana</i> (Gaudich.) Alston	T	MMDF
<i>Thelypteris truncata</i> (Poir.) K. Iwats.	T	MMDF
Vittariaceae		
<i>Antrophyum callifolium</i> Blume	E	MMDF.DMDF
<i>Vittaria angustifolia</i> Blume	E	HEF
<i>Vittaria sikkimensis</i> Kuhn	E	HEF

Note:- T=Terrestrial, E=Epiphytes, L=Lithophytes

MMDF = Moist Upper Mixed Deciduous Forest

DMDF = Dry Upper Mixed Deciduous Forest

HEF = Hill evergreen Forest

FERN ALLIES

Stem is usually dichotomously branched, erect, pendulous or prostrate with no leaf gaps. Leaves is usually simple, small, sessile with single veins, sessile. Leaf that bearing sporangia is called sporophyll. Sporophyll is usually different more or less from vegetative leaf and arranged in group mostly at the tip of a branch or a stem. Groups of sporophyll are called strobilus. Sporangia are produced at the lateral side of a stem, in the axial of a leaf or embedded in the base of a leaf.

CLASS LYCOPSIDA

Sporophyte with roots, stems and spirally arranged leaves (microphylls). Some with secondary thickening. Sporangium thick-walled, homosporous or heterosporous, borne either on a sporophyll or associated with one.

ORDER LYCOPODIALES

LYCOPODIACEAE

Terrestrial or epiphytes, leaves simple, with one simple vein, arranged in low alternating spiral or irregular whorls, or decussate; sporophylls like the foliage leaves or modified, sometime specialized and aggregated into distinct strobili; sporangia solitary, adaxial near leaf or axillary.

LYCOPODIUM

L., Sp. Pl.: 1100. 1753.

Terrestrial or epiphytes; stems elongate, dichotomous or sympodial; leaves microphyllous, each with a single vein, arranged in spirals; sporangia borne single in the axils or on the base of sporophylls; cone distinct or not; spore isosporous.

Key to the species

1. Terrestrial plants, creeping and erect, bearing many branches. Strobili sessile, solitary or two at each apex of ultimate branchlets **1. *L. cernuum***
1. Epiphytic plants; stems usually pendulous, dichotomously branching a few times. Sporophylls usually smaller than trophophylls, globose, bilabiate, forming no distinct cones..... **2. *L. hamiltonii***

1. *Lycopodium cernuum* L., Sp. Pl. 2: 1103. 1753; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 51. 1968; in Fl Thailand 3(1): 12. 1979; DeVol Fl. Taiwan vol. 1. 2nd ed: 35. pl. 4. 1980; Leistner in Schelpe & Anthony, Fl. South. Africa Pterid. 11. f. 4. 1986.—*Palhinhaea cernua* (L.) Vasc. & Franco, Bol. Soc. Brot., ser. 2, 41: 25. 1967.

Terrestrial plants. **main stem** of two kinds, creeping and erect, about 50-70 cm long, bearing many branched when growing in thickets or among tall grasses, densely covered with leaves, not dense on lower portion, weak and prostrate when growing on exposed hillsides; lateral branches densely covered with leaves, about 10 cm long, copiously branching. **Leaves** of main stems spirally arranged, linear, pointed at apex, 3-5 mm long, 0.5 mm wide, mostly entire, spreading or reflexed, keeled and decurrent on upper portion; texture thick but soft, yellowish green or paler. **Strobili** sessile, solitary or two at each apex of ultimate branchlets, cylindrical-conic, pendulous, up to 5 mm long, 3 mm wide; sporophylls ovoid, caudate at apex, appressed, pale yellowish, ciliate at margin, about 2 mm long, 0.7 mm broad. **Photo 92.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Kiu Thap Yang, Mae Lao, Doi Phachao), Chiang Mai (Doi Chiang Dao, Wang Tao, Doi Suthep, Mae Rim), Lampang (Mae Tam), Phitsanulok (Thung Salang Luang), Tak (Doi Musoe); NORTH-EASTERN: Loei (Phu Kraduang); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-WESTERN: Kanchanaburi (Wang Ka);

PENINSULAR: Chumphon (Bang Son), Surat Thani (Ban Don), Satun (Tarutao), Nakhon Si Thammarat (Thung Song, Ron Phibun), Trang (Khao Chong, Thale Song Hong, Sam Roi Yot), Songkhla (Saba Yoi), Nara-thiawat (Bacho, Nikhom Waeng), Yala (Gunong Ina, Ban To, Padang Besar).

Distribution.- Tropics and subtropics throughout the world (type from India.).

Ecology.- On mountain slopes and open areas at 670 m altitudes.

Vernacular.- Khut Khon (กุดขน) (Northern); ya kan phiang (หญ้าก้านเพ็ชง), yaeng yae (แยงแย้) (North-eastern); slap (สลาบ), dok hin (ดอกหิน) (South-eastern); rang kai (รังไก่อ), ruai kai (รวไก่อ), sam roi yot (สามร้อยยอด) (Peninsular).

Specimens examined.- P. Ratchata 210; T. Boonkerd 210, 318 (BCU).

2. Lycopodium hamiltonii Spreng., Syst. Veg. 5: 429. 1828; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 33. 1980; Tagawa & K. Iwats., Fl Thailand 3(1): 9. 1979.—*Lycopodium fordii* Baker., Handb. Fern Allies 17. 1887.

Epiphytic plants; **stems** usually pendulous, 10-15 cm long, dichotomously branching a few times, 1-1.5 mm in diam. near base. densely covered with leaves. **Leaves** dense, ascending, rarely subpatent, lanceolate or gladiate, acute to acuminate at apex, narrowing towards sessile or very shortly stalked base, middle or lower part the largest, about 1 cm long, 2 mm broad, green to yellowish green. **Sporophyll** usually smaller than trophophylls, globose, bilabiate, forming no distinct cones. **Photo 95.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Khun Mae Lan, Khun Kong San, Doi Suthep, Doi Inthanon), Mae Hong Son (Doi Khun Huay Pong), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao); SOUTH-WESTERN: Kanchanaburi (Sisawat); PENINSULAR: Nakhon Si Thammarat (Khao Luang).

Distribution.- Himalaya (type) to S. China and S. Japan, also in Indochina and Taiwan.

Ecology.- On mossy tree-trunks in Hill Evergreen forest at 1300-1,500 m altitudes.

Specimens examined.- P. Ratchata 182; T. Boonkerd & R. Polwath 5; T. Boonkerd 1255; S. Putiyananta 13; K. Suwatabandu 17; C. Khunwasi 5 (BCU).

ORDER SELAGINELLALES

SELAGINELLACEAE

Herbaceous, rooting at intervals, with or without branches on lower part; rhizophores present or absent, borne on stem at branches forks throughout, or confined to base of stems; leaves small, simple, with a single vein, always bearing on inconspicuous licle on the adaxial side at its base; vegetative leaves monomorphic or more or less dimorphic and arranged in two median and two lateral rows on the branches, the median leaves usually smaller and different shapes from the lateral leaves; sporophylls monomorphic or dimorphic, borne in compact strobili, microsporophylls with a single microsporangium, which contains a large number of microspores, megasporangium with four megaspores, microspores being much smaller and usually of a different color than that of the megaspores; strobili sometime ill-defined, terminal, cylindrical, quadrangular or flattened; sporangia round or oval, opening by a vertical slit.

SELAGINELLA

P. Beauv., Mag. Enc. 4: 478. 1804.

Terrestrial or epiphytes; stems erect or sometime prostrate or climbing; rhizophores usually present, stout or filiform, branching or dichotomously; leaves on aerial, dimorphic or monomorphic; sporophylls uniform and arranged spirally forming cylindrical spikes (strobilus), uniform

and arranged in four rows forming squarroid spikes, or dimorphic and arranged in four rows, the dorsal and ventral rows unequal; strobili solitary or forked; megasporangia lobed to ovoid; microsporangia reniform to ovoid, heterospores.

Key to the species

1. Sporophylls of spike monomorphic
 2. Stem growing indefinitely, up to 70 cm long
 3. Sporophyll ciliate or dentate
 4. Main stem without branches on the lower half; leaves on lower part of stem monomorphous; sporophyll minutely ciliate at margin6. *S. involvens*
 4. Main stems bearing rhizophores only on basal portion, pinnately branching upwards; lateral branch bipinnate; sporophyll entire or vary minutely dentate..... 3. *S. delicatula*
 3. Sporophyll entire
 5. Lateral branches pinnate; ventral leaves entire 14. *S. wallichii*
 5. Lateral branch bipinnate; ventral leaves entire, minutely dentate at apex 5. *S. inaequalifolia*
 2. Stem scandent, more than 2 m in height; sporophylls entire, with white cartilaginous membrane4. *S. helferi*
1. Sporophylls of spike dimorphic
 6. Dorsal leaves ovate or elliptic, broadest below the middle
 7. Main branches less than 5 mm broad including leaves
 8. Dorsal sporophylls dentate
 9. Main stems up to 25 cm long; ventral leaves unequally round at base; spike about 2 mm broad.....8. *S. lindhardii*
 9. Main stems up to 20 cm long; ventral laeves unequally cordate at base; spike about 3 mm broad 13. *S. tenuifolia*

8. Dorsal sporophyll ciliate
10. Main stems erect or ascending
11. Ventral leaves subdeltoid, ciliate at least near the base, moderately acuminate at apex, cordate at base; spike about 2 mm broad **7. *S. kurzii***
11. Ventral leaves ovate to oblong, dentate, round to moderately acute at apex, unequally round at base; spike about 2.5 mm broad **7. *S. minutifolia***
10. Main stems prostrate or creeping, rooting at intervals but mostly near base. Ventral leaves ovate-subdeltoid, acuminate at apex, round at base **2. *S. ciliaris***
7. Main branches more than 5 mm broad including leaves
12. Plant 30-35 cm long, bearing rhizophores throughout; ventral leaves serrate, round to moderately acute at apex; dorsal leaves ovate to suborbicular **1. *S. amblyphylla***
12. Plant 30 cm or more long ; ventral leaves dentate, obtuse at apex; dorsal leaf ovate to ovate-oblong **11. *S. monospora***
6. Dorsal leaves obovate; main stems suberect; ventral sporophylls densely long ciliate with pale hairs; dorsal sporophylls shortly ciliate at margin **12. *S. pennata***

1. *Selaginella amblyphylla* Alston, Bull. Fan Mem. Inst. Biol. 5: 287. 1934; Tagawa & K. Iwats., Fl Thailand 3(1): 27. f. 2: 17-19. 1979.

Plant 30-35 cm long. **Stem** prostrate, bearing rhizophores throughout, 1 mm in diameter, with leaves closely set almost to the base; main branches oblong, bipinnate; ultimate branches to 5 mm wide. **Ventral leaves** patent, oblong, gradually narrowing and falcate, acute apex, asymmetrically subcordate at base, 4.0 mm long 1.2 mm broad in main branches, edges serrate, densely serrate on basal portion with pale setae of 0.6 mm in length;

texture papyraceous, green, paler beneath, with distinct false veins at both sides of the midribs. **Dorsal leaves** ovate, long-mucronate at apex, nearly 0.7 mm in length with mucro, on main branches 1.0 mm both in lengths excluding mucro, dentate. **Spikes** 2.5 mm wide; ventral sporophylls similar to dorsal trophophylls, subtriangular with round at base, ciliate at margin.

Thailand.- NORTHERN: Chiang Rai, Chiang Mai (Doi Chiang Dao, Ban Mae Klang, Doi Suthep, Doi Inthanon-type), Lampang (Mae Mo); NORTH-EASTERN: Loei (Phu Luang, Phu Kradung); EASTERN: Nakhon Ratchasima (Khao Yai); SOUTH-EASTERN: Trat (Ko Chang); PENINSULAR: Krabi (Ko Lanta), Satun.

Distribution.- Myanmar and Yunnan.

Ecology.- On humus-rich mountain slopes in Mixed Deciduous forests at 750-800 m altitudes.

Specimens examined.- P. Ratchata 37 (BCU); Tagawa et al. No. T 935, T 19551; T. Smitinand No. 10465; Winit No. 1045; E. Hennipman No. 3347a, 3316; K. Iwatsuki & N. Fukuoka No. T 3188 (BKF).

2. **Selaginella ciliaris** (Retz.) Spring, Bull. Acad. Brux. 10: 231. 1843; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 49. pl. 10. 1980

Main stems prostrate or creeping, rooting at intervals but mostly near base. about 0.5 mm diam., bearing leaves closed together or overlapping at basal portion, bearing branches nearly to the base. **Ventral leaves** ovate-subdeltoid, acuminate at apex, round at base, about 2 mm long, 1 mm broad, minutely ciliate at base, white-margined. **Dorsal leaves** ovate, long acuminate at apex, cordate at base, ciliate at base, about 1.5 mm long, 1 mm broad. **Spike** about 4 mm broad, up to 1 cm long; sporophylls dimorphic; ventral sporophylls deltoid, long acuminate at apex, kelled, with long cilia; dorsal sporophylls oblong-lanceolate, narrowing towards acuminate apex,

about 2.5 mm long, 1.5 mm broad, white-margined, ciliate. **Photo 162, 163 and 166.**

Distribution.- Mainland China, Taiwan, The Philippines, India and Australia.

Ecology.- Terrestrial in exposed areas on mountain slopes at 670-800 m altitudes.

Specimens examined.- P. Ratchata 225, 226, 232, 235 (BCU).

3. Selaginella delicatula (Desv.) Alston, J. bot. 70: 282. 1932; in Fl. Gen. I. -C. 7(2): 576. 1951; Tagawa & K. Iwats., Fl Thailand 3(1): 22. 1979.—*Lycopodium delicatulum* Desv. In Lamk, Enc. Suppl. 3: 554. 1818.

Plant 20-25 cm tall, erect or ascending. **Main stems** 3-4 mm in diameter, bearing rhizophores only on basal portion, sparsely bearing leaves, pinnately branching upwards; lateral branches bipinnate, about 8 by 3 cm. **Ventral leaves** about 2 by 1 mm, patent, slightly ascending, oblong, more or less falcate, acuminate to aciculate at apex, cuneate at acroscopic and subcordate or auricled at basiscopic base. **Dorsal leaves** narrowly oblong, patent, more or less falcate, broadly cuneate at acroscopic and round to subcordate or auricled at basiscopic base, mucronate at apex, 2.5 by 1.2 mm, edges narrowly margined with cartilagineous membrane, subentire or vary minutely dentate at apex; texture herbaceous or softer, yellowish green. **Spike** monomorphic, about 1.2 mm in diameter; sporophylls ovate-subdeltoid, round to subcordate at base, gradually narrowing towards long-acuminate apex, about 2 by 1 mm, edges entire or vary minutely dentate.

Thailand.- NORTHERN: Chiang Mai (Chiang Dao, Ping Khong, Ban Mae Chia, Doi Suthep, Mae Klang), Mae Hong Son (Mae La Noi); NORTH-EASTERN: Phetchabun (Phu Miang); CENTRAL: Nakhon Nayok (Nang Rong), Saraburi (Muak Lek); SOUTH-EASTERN: Chanthaburi (Makham); SOUTH-WESTERN: Kanchanaburi (Sai Yok, Tha Ko); PENINSULAR: Ranong (Khao

Thalu), Surat Thani (Ko Tao, Surat), Phangnga (Thap Put), Nakhon Si Thammarat (Khiriwong, Khao Luang), Trang (Khao Chong, Nam Tai), Satun, Yala.

Distribution.- India to S. China and Taiwan, Indochina, Malesia (lectotype by Alston from Pisang Isl., Malaya).

Ecology.- On rather dry mountain slopes in light shade or in dense forests at 1,000 m altitudes.

Vernacular.- Kut pha (กุดผา) (Northern); phak kut hin (ผักกุดหิน) (South-eastern).

Specimens examined.- P. Ratchata 336, 354; T. Boonkerd 260 (BCU).

4. **Selaginella helferi** Warb., *Monsunia* 1: 107, 121. 1900; Tagawa & K. Iwats., *Fl Thailand* 3(1): 18. f. 2: 9-12. 1979.—*Selaginella willdenowii* auct. non (Desv.) Baker: *C. Chr., Contr. U.S. Natn. Herb.* 26. 335. 1931.

Stem scandent, more than 2 m long, 8-9 mm in diameter, sparsely bearing leaves; branches about 30-35 cm long, tripinnate, glabrous, bearing rhizophores on the basal portion; leaves sparsely on the main branches but densely on the lateral branches. **Ventral leaves** patent, oblong, less falcate, acuminate at apex, unequal or auricled at base, sessile, usually bearing small auricles forming pale at acroscopic base, edges with white cartilaginous membrane, entire, glabrous, 3.1-4.2 mm long, 1.5-2.3 mm broad; texture soft, green to deep green. **Dorsal leaves** appressed, falcate, long acuminate at apex, 1.5 mm long, 0.7 mm broad, edges with white cartilaginous membrane, entire, glabrous, green to deep green. **Spike** 4.0-4.2 mm in diameter, solitary at apex of lateral branches; sporophylls ovate to subtriangular, uniform, long acuminate at apex, 2.5-3.2 mm long, 1.3-1.5 mm broad, entire, with white cartilaginous membrane. **Photo 167-168.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Nam Mae Kok, Doi Phacho), Chiang Mai (Fang, Doi Chiang Dao, Dao Suthep, Doi Phra Dieng), Nan (Pha Sing), Phitsanulok (Thung Salaeng Luang), Tak (Mae Sot, Doi Musoe, Rahaeng); NORTH-EASTERN: Loei (Phu Luang); CENTRAL: Saraburi (Muak Lek); SOUTH-EASTERN: Chon Buri (Si Racha).

Distribution.- Assam, Myanmar (type), S. China (Kweichow & Kwangsi), and Indochina.

Ecology.- Scandents in rather shade Mixed Deciduous forests at 650-1,250 m altitudes.

Vernacular.- Ya rong hai (หญ้าร็องไห้) (Peninsular).

Specimens examined.- P. Ratchata 24, 41, 57, 129, 197, 203, 296; O. Thaithong S61; T. Boonkerd 26; R. Chaveerach 25 (BCU); E. Hennipman No. 3003, 3083; K. Iwatsuki et al. No. T 8607, T 10899, T 11005; M. Tagawa No. T 1103, T 1299, T 1300, T 3840. ; Winit No. 1041; M. Tagawa & N. Fukuoka No. T 2107, T3418 (BKF).

5. **Selaginella inaequalifolia** (Hook. & Grev.) Spring, Bull. Acad. Roy. Sco. Brux. 10: 145. 1843; Tagawa & K. Iwats., Fl Thailand 3(1): 20. 1979.—*Lycopodium inaequalifolium* Hook. & Grev. In Hook., Bot. Misc. 2: 391. 1831.

Main stem erect, about 50 cm high, bearing dorsal and ventral leaves distant at base; lateral branches narrowly oblong, about 15 by 3.5 cm., bipinnate, 3-7 pairs; pinnae of lateral branches usually more than 1 cm apart, ascending, linear-lanceolate, about 2.5 by 0.5 cm. **Ventral leaves** narrowly oblong, falcate, auriculate at apex, margin with narrowly cartilaginous membrane, entire, wide at base, about 5 by 2 cm, forming angles of about 60° to axes. **Dorsal leaves** imbricate, ovate with long acuminate paex, about 3 by 1.5 mm, minutely dentate at apical margin. **Spike** monomorphic, about

5 by 1.2 mm in diam.; sporophyll oblong-subtriangular, long-acuminate at apex, about 1.5 by 0.8 mm, entire.

Thailand.- NORTHERN: Tak (Doi Musoe).

Distribution.- Madras (type), Assam and Myanmar.

Ecology.- On moist shade slopes near sterams at 680-1,000 m altitudes.

Specimens examined.- P. Ratchata 347; T. Boonkerd 1478 (BCU).

6. ***Selaginella involvens*** (Sw.) Spring, Bull. Acad. Roy. Sci. Brux. 10: 136. 1843, emend. Hieron., Hedwigia 50: 2. 1911; DeVol, Fl. Taiwan vol. 1. 2nded.: 45. 1980; Tagawa & K. Iwats., Fl Thailand 3(1): 24. 1979.—*Lycopodium caulescens* Wall. ex Hook. & Grev. in Hook., Bot. Misc. 2: 382. 1831.—*Selaginella japonica* Moore ex Macnab, Trans. Bot. Soc. Edin. 9: 8. 1868.—*Selaginella caulescens* (Wall.) Spring, Bull. Acad. Brux. 10: 137. 1943.

Main stem terete, erect, without branches on the lower half; rhizomes widely creeping under mosses, branching, bearing light brown leaves. about 1 mm diam.; main erect stems up to 12 cm long, bearing appressed uniform leaves in lower portion; leaves on lower part of stems monomorphous. ovate, nearly equal sided, with a definite midrib, margin entire or more or less ciliate towards apex; lateral branches tripinnate. **Ventral leaves** ovate-oblong to broadly ovate, with falcate on upper portion, acute at apex, round to cordate at base, ciliate near base, about 1.5 mm long, 1 mm broad, yellowish green, sometime reddish. **Dorsal leaves** elliptic, unequal-sided, acuminate at apex, oblique at base, serrate at margin **Spike** tetragonal, about 1 mm in diam.; sporophyll monomorphic, ovate-subtriangular, acuminate-aristate at apex, about 1 mm in length, with minutely ciliate at margin. **Photo 172-173.**

Thailand.- NORTHERN: Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Doi Pha Mon, Mae Klang, Doi Inthanon), Phitsanulok (Phu Miang), Tak (Khao Phra Wo); EASTERN: Chaiyaphum; CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao), Trat (Ko Chang, Ko Kut); PENINSULAR: Trang (Khao Chong).

Distribution.- Ceylon, India, Myanmar, China, Indochina, S. Korea, Japan (type) to Taiwan, Borneo, Celebes and Flores.

Ecology.- On mossy tree-trunks in rather light forests at 1,400 m altitudes.

Vernacular.- Foen pheng (เฟื้องฟ้า) (North-eastern).

Specimens examined.- P. Ratchata 176; O. Thaithong 63 (BCU); M. Tagawa et al. No. T 9982; K. Iwatsuki & N. Fukuoka No. T 7206; K. Iwatsuki, N. Fukuoka & A. Chintayungkun No. T 9575; E. Hennipman No. 3339 (BKF).

7. *Selaginella kurzii* Baker, J. Bot. 23: 149. 1885; Tagawa & K. Iwats., Fl Thailand 3(1): 30. 1979.

Plant small, up to 20 cm long. **Main stem** erect or ascending, bearing the branches nearly to the base, bearing rhizophores usually in lower part but rarely also on middle portion, about 0.8 mm in diam.. bearing leaves closely together, main branches oblong-lanceolate; ultimate branches to 2 mm wide. **Ventral leaves** subdeltoid, ascending, often appressed on the main stems and main branches, about 2 mm long, 1.2 mm broad, ciliate at least near the base, moderately acuminate at apex, cordate at base; texture thin, light green. **Dorsal leaves** ovate, long acuminate at apex, round at base, ciliate. **Spike** about 2 mm broad, 0.5 cm long, sporophylls dimorphic; ventral sporophylls oblong-lanceolate, acuminate at apex, round at base, ciliate at base, shortly dentate at apical portion; dorsal sporophylls oblong-subdeltoid, long

acuminate at apex, round or broadly cunate at base, ciliate at margin, pale green, white-margined. **Photo 164.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao, Doi Suthep, Doi Inthanon, Mae Klang), Lamphun (Doi Khun Tan), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Khon Kaen (Pha Nok Khao); EASTERN: Nakhon Ratchasima (Sikhiu); CENTRAL: Nakhon Nayok (Khao Yai); south-western: Kanchanaburi (Plati).

Distribution.- Assam to Myanmar(type) and Malaysia.

Ecology.- On moist mountain slopes at 750-1000 m altitudes.

Specimens examined.- P. Ratchata 39, 72, 242; O. Thaithong S74 (BCU).

8. *Selaginella lindhardii* Hieron., Bull. Herb. Boiss. 2. 5: 723. 1905; Tagawa & K. Iwats., Fl Thailand 3(1): 29. 1979.

Main stem erect, up to 25 cm long, about 1 mm in diam., sparsely bearing leaves, bearing the branches nearly to the base and bearing rhizophores only in lower part; main branches bipinnate, linear-lanceolate; ultimate branches to 2.5 mm wide. **Ventral leaves** oblong-subtriangular, moderately acute at apex, unequally round at base, about 2.2 mm long, 1.5 mm broad, patent or ascending; texture thin, yellow-green, shortly dentate at margin. **Dorsal leaves** elliptic with long tail, narrowly round at base, about 1 mm long including tails, 0.3 mm broad, yellow-green, thin, edges shortly dentate. **Spike** about 2 mm broad, up to 1 cm long; sporophylls dimorphic; ventral sporophylls ovate-subtriangular, round at base and long acuminate apex, 0.6 mm long, 0.5 mm broad, dentate at margin; dorsal sporophylls oblong-lanceolate, slightly round at base, acuminate at apex, up to 1.2 mm long at basal part, 0.5 mm broad, dentate. **Photo 169 and 171.**

Thailand.- NORTHERN: Tak (Rahaeng-type); CENTRAL: Bangkok; SOUTH-WESTERN: Ratchaburi (Ang Hin).

Distribution.- Endemic.

Ecology.- On moist slopes along the roads in open areas at 800-1,000 m altitudes.

Specimens examined.- P.R. 21, 215, 243, 299, 330, 335 (BCU).

9. **Selaginella minutifolia** Spring, Mém. Acad. Roy. Sci. Belg. 24: 239. 1850; Tagawa & K. Iwats., Fl Thailand 3(1): 28. 1979.

Main stem erect, plant less than 10 cm long, 0.7 mm in diameter, moderately sparsely bearing leaves but densely on main branches; main branches simple to pinnate, ovate-oblong, bearing rhizophores on the basal portion. **Ventral leaves** ovate to oblong, patent to ascending, round to moderately acute at apex, unequally round at base, 3.0 mm long, 1.7 mm broad, edges with narrow white margined, dentate; texture thin, yellow green to pale green. **Dorsal leaves** elliptic with long-aristate apex, cuneate at base with narrow white margined, dentate; texture thin, yellow green to pale green, 0.6 mm long excluding tail, 0.2 mm broad. **Spike** about 2.5 mm broad; sporophylls dimorphic; ventral sporophylls deltoid-subtriangular, round at base, long acuminate at apex, 1.2 mm long, 0.4 mm broad, dentate to ciliate at margin; dorsal sporophylls elliptic unequally round at base, acute at apex, 2 mm long, 0.5 mm broad, edges ciliate. **Photo 160-161.**

Thailand.- NORTHERN: Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep), Phitsanulok (Thung Salaeng Luang); PENINSULAR: Ranong (La-un), Trang (Khao Chong).

Distribution.- Myanmar(type), Malaysia, and Indochina (Cambodia & Cochinchina).

Ecology.- On moist slopes or in open areas along the roads at 670-750 m altitudes.

Vernacular.- Kut yi (กุตยี่) (Northern).

Specimens examined.- P. Ratchata 230, 231; O. Thaithong 22, 25 (BCU); K. Iwatsuki, N. Fukuoka & A. Chintayungkun No. T 9551; M. Tagawa No. T 3953; T. Shimizu et al. No. T 18942, T 19655 (BKF).

10. Selaginella monospora Spring, Mem. Acad. Roy. Sci. belg. 24: 135. 1850; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23. 48. 1968; Tagawa & K. Iwats., Fl Thailand 3(1): 28. 1979.

Plant 30 cm long or more than. **Main stem** prostrate, about 3 mm in diameter, with leaves 2.5 mm apart and closely set almost to the base, bearing rhizophore throughout; main branch oblong to oblong-lanceolate, bipinnate; ultimate branches to 6 mm wide. **Ventral leaves** patent, oblong, gradually narrowing towards acute apex, asymmetrically subcordate at base, about 1.5 to 2 time longer than broad, about 3.5 by 1 mm, edge dentate, basal portion with pale setae of 0.3-0.5 mm in length; texture papyraceous, green, paler beneath. **Dorsal leave** ovate to ovate-oblong, dentate, with long-mucronate at apex with mucro of nearly 1 mm in length, about 2 mm with long tail, 1.5 mm wide, round at base. **Spike** about 3 mm broad; sporophylls dimorphic; ventral sporophylls oblong-subdeltoil, about 1.5 by 0.8 mm, ciliolate, long acuminate at apex, round at base; dorsal sporophylls oblong-lanceolate, round at base, moderately acute at apex, ciliate at margin. **Photo 175-176.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao); PENINSULAR: Nakhon Si Thammarat (Khao Luang).

Distribution.- N. India (type), S. China, Myanmar and Indochina.

Ecology.- On exposed slopes or on mountain ridges at 700-800 m altitudes.

Specimens examined.- P. Ratchata 352 (BCU).

11. *Selaginella pennata* (D. Don) Spring, Bull. Acad. Roy. Sci. Brux. 10: 232. 1843; Tagawa & K. Iwats., Fl Thailand 3(1): 26. 1979.— *Lycopodium pennatum* D. Don, Prod. Fl. Nepal.: 18. 1825.— *Selaginella bisulcata* auct. non Spring: Hosseus, Beih. Bot. Centr. 28(2): 367. 1911.

Main stem suberect, 30-40 cm long, 2-2.5 mm in diameter, sparsely bearing leaves and bearing rhizophores only in lower part; main branches oblong; ultimate branches about 8 mm broad. **Ventral leaves** oblong, patent, round to minutely mucronate at apex, unequally round at base, 4-5 mm long, 2 mm broad on main branches, shortly ciliate at margin; texture thin, light green or reddish-brown on upper portion. **Dorsal leaves** obovate, broadest at upper portion, round at apex with mucronate, about 0.8 mm in length unequally cordate at base, 2 mm long excluding mucro, 1 mm broad on the main branches, edges ciliate, the upper part larger than lower. **Spike** 1.5 mm in diameter; sporophylls dimorphic; ventral sporophylls oblong to subtriangular, 2.5 mm long, 2.5 mm broad, long acuminate at apex, densely long ciliate with pale hairs about 0.5-0.6 mm in length; dorsal sporophylls oblong, 2.5 mm long, 1-2 mm broad, shortly ciliate at margin, acute to acuminate at apex; texture thin, light green or reddish-brown. **Photo 153-154.**

Thailand.- NORTHERN: Chiang Mai (Doi Phahom Pok, Fang, Doi Chiang Dao, Doi Buak Ha, Doi Kiu Lom, Sop Aep), Mae Hong Son (Mae La Noi), Phrae (Mae Ban), Nan (Pha Sing), Phitsanulok (Thung Salaeng Luang), Tak (Doi Musoe); NORTH-EASTERN: Loei (Phu Luang, Phu Kradung); CENTRAL: NaKhon Nayok (Khao Yai); SOUTH-WESTERN: Kanchanaburi (Bangkasi, Sai Yok).

Distribution.- N. India (type) and Myanmar.

Ecology.- On moist mountain slopes and light shade in Mixed Deciduous and Hill Evergreen forests at 700-1250 m altitudes.

Vernacular.- Ya non bua (หญ้านอนใบ), kut hom (กุดหอม) (Northern).

Specimens examined.- P. Ratchata 30, 70, 204, 236, 333, 337 (BCU); K. Iwatsuki, N. Fukuoka & A. Chintayoungkun No. T 9702; E. Hennipman No. 3160a, 3160 (BKF).

12. Selaginella tenuifolia Spring, Mém. Acad. Roy. Sci. Belg. 24: 253. 1850; Tagawa & K. Iwats., Fl Thailand 3(1): 29. 1979.

Plant small, up to 20 cm long, erect. **Main stem** to 1.5 mm in diam., bearing branches in the middle to the upper portion, bearing leaves about 2 mm apart, bearing rhizophores only in lower part; main branches bipinnate, linear-lanceolate; ultimate branches to 2.5 mm wide. **Ventral leaves** oblong-subdeltoid, unequally cordate at base, narrowing towards moderately acute apex, about 2 mm long, 1.2 mm wide, patent or ascending, edges dentate; texture thin, pale green or yellowish. **Dorsal leaves** ovate or elliptic with long tails, round or cuneate at base, edges dentate, yellowish, about 2 mm long including tails, 0.7 mm wide. **Spike** about 3 mm broad; sporophylls dimorphic; ventral sporophylls ovate-subtriangular, with slightly round at base and long acuminate apex, about 0.8 mm including tails, dentate at margin; dorsal sporophylls oblong-lanceolate, unequally rounded at base, acute to acuminate at apex, dentate at margin. **Photo165 and 170.**

Thailand.- NORTHERN: Chiang Rai (Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao), Lamphun (Doi Khun Tan), Phrae (Mae Ban).

Distribution.- N. India(type) to Myanmar and Laos.

Ecology.- On moist slopes in light shade areas at 650-750 m altitudes.

Specimens examined.- P. Ratchata 26, 239 (BCU).

13. Selaginella wallichii (Hook. & Grev.) Spring, in Mart. Fl. Bras. 1(2): 124. 1840; Tagawa & K. Iwats., Fl Thailand 3(1): 20. f. 2: 15-16. 1979.—
Lycopodium wallichii Hook. & Grev. in Hook., Bot. Misc. 2: 384. 1831.

Main stem erect or suberect, 2 mm in diameter near base; sparsely bearing leaves and bearing rhizophores only near base, the upper portion are dark or black; main lateral branches oblong-lanceolate, about 10-15 cm long, 4-5 cm broad, about 8-10 pairs of branches below distinct terminal ones; pinnae of lateral branches 6-8 mm apart, little falcate, forming angles of about 45° to axes, linear-lanceolate, up to 3.5 cm long, 7 mm wide. **Ventral leaves** oblong to lanceolate, falcate, acuminate at apex, 3-4 mm long, 1-1.5 mm broad, round to unequally at base, texture herbaceous, green to yellow-green, edges entire with narrow cartilaginous membrane. **Dorsal leaves** appress, 2 mm long, 0.8 mm broad, falcate, acuminate at apex, edges entire with narrow cartilaginous membrane, green to yellow-green. **Spike** 1-1.2 mm in diam., about 1-1.5 cm long; sporophylls monomorphic, oblong-subtriangular, 1.3-1.5 mm long, 0.8-1 mm broad, acuminate at apex. **Photo 155-156.**

Thailand.- PENINSULAR: Ranong (Nam Chuet), Surat Thani (Ban Kop Kaep), Nakhon Si Thammarat (Khiriwong, Khao Luang), Yala.

Distribution.- S. Myanmar, Indochina, Malaya (type), Sumatra and Borneo.

Ecology.- Terrestrial near streams in Mixed Deciduous forest at 650-700 m altitudes.

Specimens examined.- P. Ratchata 4, 9, 201; T. Boonkerd 1124 (BCU) ; K. Iwatsuki et al. No. T 4508, T 8442; K. Yoda No. 607; K. Larsen & S.S. Larsen No. 32841, 32905; E. Hennipman No. 3781(BKF).

CLASS SPHENOPSIDA

Sporophyte with roots, stems and whorled leaves. Some with secondary thickening. Sporangia thick-walled, homosporous (or heterosporous), usually borne in a reflexed position on sporangiophores arranged in whorls. Antherozoids multiflagellate.

ORDER EQUISETALES

EQUISETACEAE

Stems articulated; leaves whorled, at node, partly fused, single-veined leaves; sporangia many, borne on peltate sporangiophore, sporangiophores combined into a strobilus.

EQUISETUM

L., Sp. Pl.: 1060. 1753.

Plants monomorphic; stems with nodes and internodes, the surface with grooves and ridges, the nodes bearing roots; branches, and leaves in whorls; leaves sphenophyllous, uninervate, small, fused to the next ones to form a sheath at each node, the upper portion free forming the teeth; cones terminal on stems or branches; sporangiophores hexagonal, peltate, bearing many sporangia; spores isosporous, mixed with the elators.

Equisetum debile Roxb. ex Vaucher, Monog. Prel.: 387. 1822; Tagawa & K. Iwats., Fl Thailand 3(1): 34. f. 1:1-3. 1979.

Rhizome creeping, brown, aerial stem green, to more than 1 m tall, main stem nodes and internodes, grooved, about 18-20 grooves, the nodes bearing root in lower portion, bearing branches at the nodes, and leaves in whorls; sheath about 8 mm long, fused to the neighboring ones at each nodes, the upper portion free forming the teeth, green or brown at above portion; teeth thin, pale green to brown, caducous, about 5 mm long. **Cones** solitary, terminal on the aerial stems or branches, about 0.5-1 cm long, oblong, cuspidate at apex, sessile.

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Saket, Doi Mae Klang, Doi Inthanon, Mae Rim, Bo Luang), Lampang (Muang Ngao); NORTH-EASTERN: Phetchabun (Lom Sak, Nam Nao); EASTERN: Chaiyaphum;

SOUTH-EASTERN: Chanthaburi (Khao Soi Dao), Trat; SOUTH-WESTERN: Kanchanaburi (Song Tho, Kha Thalai).

Distribution.- India (type) to S. China, Indochina and Taiwan, through Malesia to Polynesia.

Ecology.- Terrestrial on wet ground in open areas at 670 m altitudes.

Vernacular.- Ya nguak (หญ้าเงา), ya thot bong (หญ้าถอบ้อง), ya hu nuak (หญ้าหนูหนาก) (Northern).

Specimens examined.- P. Ratchata 212; T. Boonkerd 1331; K. Suwatabandhu 283 (BCU).

TRUE FERNS

CLASS FILICOPSIDA

Rhizome may erect or creeping under or over the ground surface, protected when young by hairs and scales or only one of them. Some erect rhizome are short, covered with tuft of frond upon. Young frond of ferns that always coil, mature and young frond are comprise of two main part, the stalk which is called a stipe and the expanded part which is called lamina or blade. Sorus (plural, sori) is a group of sporangia. Sporangia thick or thin-walled, homosporous or heterosporous, borne terminally on an axis or on the frond, where they may be marginal or superficial on the abaxial surface.

ORDER MARATTIALES

MARATTIACEAE

Terrestrial ferns; rhizome short, fleshy; fronds bipinnate with free veins; stipes fleshy with a pairs of stipules at the base; synangia large, arranged in closely arranged, opening by a slit.

ANGIOPTERIS

Hoffm., Comm. Soc. Reg. Gott. 12: 29. 1796.

Rhizome short, fleshy, bearing several large fronds in a tuft; stipes fleshy, green, swollen at base, with scattered whitish streaks at both sides; fronds bipinnate, pinnae and pinnules swollen at base; veins all free, recurrent veins often present between three veins, running from margin towards costa; sori with two close rows of synangia; sporangia dehiscing along slits on the side facing the veins.

Angiopteris evecta (G. Forst.) Hoffm., Comm. Soc. Reg. Gott. 12: 29. t. 5. 1796; Beddome, Handb.: 460. f. 285. 1883; Holttum, Rev. Fl. Malaya 2: 44. f. 3. 1960; Tagawa & K. Iwats., Fl Thailand 3(1): 41. 1979.—*Polypodium evectum* G. Forst., Fl. Ins. Austr. Prod.: 81. 1786.—*Angiopteris crassipes* Wall. ex Presl, Suppl. Tent. Pterid.: 23. 1845; E. Smith, J. Siam Soc. Nat. Hist. Suppl. 8: 9. 1929.—*Angiopteris helferiana* Presl, Suppl. Tent. Pterid.: 22. 1845.—*Angiopteris* sp.; C. Chr., Contr. U.S. Natn. Herb. 26: 329. 1931.

Rhizome short, massive fleshy stocks, bearing several large fronds in a tuft. **Stipe** fleshy, green, swollen at base, with scattered whitish streaks at both sides, more or less covered with appressed soft small brown scales and hairs when young, usually up to 120 cm long. **Lamina** oblong, large, bipinnate, up to 2.5 m long, 1.3 m wide; rachis green, sparsely scaly and hairy like the stipes, especially on the lower surface, sides narrowly winged towards apex of smaller rachis; pinnae oblong, up to 7 pairs, about 100 cm lobe, alternate, swollen at base; pinnules oblong, long acuminate at apex, commonly 20 cm by 3 cm, each with a short swollen fleshy stalk, about 2-3 mm long, base unequal, the basiscopic side usually rounded and approaching the rachis a little nearer than the more cuneate acroscopic side, edges parallel, with a small blunt tooth to each vein-ending, apex strongly toothed; veins all free, forked, nearly at right angles to the midrib, raised on both

surfaces. **Sori** about 1-2 mm from the edges, with two closed rows of sporangia, usually about 7-14 sporangia; sporangia dehiscing along slits on the side facing the veins.

Thailand.- This species is common throughout Thailand.

Distribution.- Malaysia and Pohnesia.

Ecology.- Terrestrial on damp places or near streams in shady places at 650-800 m. altitudes.

Vernacular.- Wan kip ma (ว่านกีบม้า), wan kip raet (ว่านกีบแรด) (Central); kip ma lom (กีบม้าลม), kip raet (กีบแรด) (Northern); duku (ดูกู) (Malay/peninsular).

Uses.- Rhizome used in local medicine.

Specimens examined.- P. Ratchata 31; T. Boonkerd 190, 194, 199, 447, 508, 614, 1252; S. Arkakraisri 10; C. Apasutaya 66A, 66B; K Lukchant 12; T. Seelanan 13 (BCU).

ORDER OPHIOGLOSSALES

OPHIOGLOSSACEAE

Epiphyte or terrestrial; rhizome fleshy; fronds simple, fertile segments branching from sterile fronds; eusporangiate, sporangia borne in a simple spike.

OPHIOGLOSSUM

L., Sp. Pl.: 1062. 1753.

Small terrestrial plants, rhizome cylindrical, roots unbranched; sterile blades simple; veins reticulate; fertile spike simple, stalked, linear or oblong, fleshy, with 2 rows of immersed sporangia, each opening by a transverse slit.

Ophioglossum petiolatum Hook., Exot. Fl. 1: t. 56. 1823; Tagawa & K. Iwats., Fl Thailand 3(1): 37. 1979.—*Ophioglossum reticulatum* auct. non L.:

Beddome, Handb.: 465. f. 290. 1883; DeVol, Fl. Taiwan vol. 1. 2nd ed: 70. pl. 19. 1980.

Rhizome cylindrical, up to 7 mm long, fleshy, bearing a few fronds, phyllomophore up to 6 cm long, not distinct from trophophyll; trophophyll deltoid-ovate, round to moderately acute at apex, round or cordate at base, about 5 cm long, 3 cm broad, entire at margin, sometime more or less undulate; costae not differentiated; veins reticulate, forming narrow areoles, many, free included veinlets often present, simple or branched; texture softly herbaceous, rather fleshy; fertile spike simple, with stalk about 10-17 cm long; spikes about 2.5 cm long. **Sporangia** up to 2 mm diam. **Photo 93.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep), Mae Hong Son, Lampang (Ngao), Kamphaeng Phet; NORTH-EASTERN: Loei (Phu Kradang); CENTRAL: Bangkok; SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Pong Namron); SOUTH-WESTERN: Kanchanuburi (Hin Dat); PENINSULAR: Surat Thani (Ban Don).

Distribution.- Pantropic (type: cult. at Liverpool, originated from W. Indies).

Ecology.- Terrestrial on mountain slopes in light shade at 670-750 m altitudes.

Specimens examined.- P. Ratchata 23, 198, 206, 229; T. Boonkerd 1017, 1212 (BCU).

ORDER FILICALES

ASPLENIACEAE

Terrestrial or epiphytes, scales clathrate; stipes not articulated to rhizome; fronds monomorphic, simple to pinnate; veins free; sori borne on

veins, along and on one side at the veins, protected by narrow indusia attached along veins and opening normally towards the midrib of the leaflets.

ASPLENIUM

L., Sp. Pl.: 1078. 1753.

Terrestrial or epiphytes, rhizome erect or creeping, cover with clathrate scales; fronds simple to pinnate; veins forked, all free or uniting at apex to form submarginal veins; sori elongate along veins, superficial; indusia linear, narrow, continuous along veinlets.

Key to the species

1. Frond pinnate
 2. Rhizome long-creeping or suberect
 3. Rhizome long-creeping; scales linear-lanceolate, dark brown to nigrescent, entire. Stipe polished **5. *A. unilaterale***
 3. Rhizome suberect or ascending; scales subtriangular, dark brown, entire. Stipe not polish, groove above..... **3. *A. obscurum***
 2. Rhizome erect
 4. Pinnae more than 10 pairs
 5. Pinnae up to 4 cm long; lobed with dentate margin.....
..... **6. *A. yoshinagae***
 5. Lobes near to costa, middle ones largest..... **4. *A. perakense***
 4. Pinnae less than 10 pairs, up to 4.5 cm wide **1. *A. macrophyllum***
1. Frond simple. Sori elongate along veins; indusia thin, about 0.5 mm broad **2. *A. nidus***

1. Asplenium macrophyllum Sw., Schrad. J. Bot. 1800(2): 52. 1801; Beddome, Handb.: 150. 1883; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 86.

1958; Holttum, Rev. Fl. Malaya 2: 431. f. 249. 1960; Tagawa & K. Iwats., Fl. Thailand 3(2): 283. 1985.

Rhizome short or ascending, up to 1 cm in diam., scaly throughout, densely at apex, bearing a tuft of fronds; scales oblong-lanceolate, about 5 mm long, 0.8 mm broad, gradually narrowing from cordate base towards long attenuate apex, dark brown to nearly black, entire. **Stipe** deep green, purplish at base, grooved above, up to 15 cm long, densely scaly at base; scales like those rhizome scales but smaller. **Lamina** oblong to narrowly oblong-subdeltoid, usually broadest just above the base, round at base, acute at apex, about 25 cm long, 15 cm wide, imparipinnate; rachis deep green, grooved, scaly on under surface; pinnae 3-5 pairs, alternate, ascending, the lower ones with stalks to 5 mm long, the upper sessile, cuneate at basiscopic and roundly auricled at acroscopic base, gradually narrowing towards caudately long acuminate apex, up to 10 by 2.5 cm, distinctly irregularly toothed at margin, the basal second pair usually the largest; terminal pinnae larger, broadly rounded to broadly cuneate at base, sometime deeply lobed, up to 12 by 4.5 cm; veins distinctly on under surface, hardly visible on upper surface, forked, all free, forming narrow angles with costa; texture decidedly fleshy when young and chartaceous when dry. **Sori** long, usually occupying the whole length of veinlets from near costa to near margin, up to 2.5 cm long; indusia herbaceous, open to posterior side. **Photo 8.**

Thailand.- EASTERN: Nakhon Ratchasima (Pak Thong Chai); SOUTH-EASTERN: Chon Buri (Si Racha); PENINSULAR: Chumphon (Khao Kiong), Surat Thani (Ko Tao, Khao Hua Khwai, Ban Don), Phangnga (Takua Thung), Nakhon Si Thammarat (Khao Luang, Chawang), Satun, Pattani, Yala (Khao Kalakhiri).

Distribution.- Old World tropics, E. Africa (type) to Polynesia, north to Tonkin and Taiwan.

Ecology.- Lithophytic fern, occurs near the streams in light shaded area at 800 m. altitudes.

Specimens examined.- P. Ratchata 267 (BCU).

2. **Asplenium nidus** L., Sp. Pl.: 1079. 1753; Holttum, Rev. Fl. Malaya 2: 419. 1960; DeVol & Kuo, Fl. Taiwan vol. 1. 2nd ed.: 485. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 267. 1985.—*Thamnopteris nidus* (L.) Presl, Epim.: 68. 1849; Beddome, Handb.: 137. 1883.

Rhizome short, erect, stout, bearing a rosette of fronds, usually with a mass of root on which are growing various epiphytes, densely scaly; scales ovate-oblong, about 2 cm long, 3 mm broad, clathrate, brown to black-brown. **Stipe** short, indistinct, about 3 cm long, winged on upper part, scaly at base, with like those rhizome-scales. **Fronds** simple, linear, broadest at middle portion, gradually narrowing towards both ends, about 70 cm long, 9 cm broad, attenuate at base, moderately acuminate at apex, edge entire or cleft; midrib stramineous, raised on upper surface, flat below; veins distinct, once or rarely twice forked; the first forking near midrib and then running parallel, uniting at apex to form submarginal veins about 0.5 mm inside of margin; texture subcoriaceous, glabrous, green, paler beneath. **Sori** elongate along veins, usually on every veins, extending from near midrib half-way to the margin; indusia thin, about 0.5 mm broad, with a space of 0.5 mm or wider between.

Thailand.- NORTHERN: Chiang Rai (Doi Pacho), Chiang Mai (Doi Chiang Dao, Ban Du, Doi Suthep), Lampang; NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng), Nong Khai (Nong Kai Ploi); CENTRAL: Saraburi (Muak Lek); SOUTH-EASTERN: Chon Buri (Si Racha), Chanthaburi (khao Soi Dao), Trat (Huai Raeng); SOUTH-WESTERN: Kanchanaburi (Sai Yok, Wangka, Khao Nam Tok); PENINSULAR: Surat Thani (Ko Tao, Ko Phu), Nakhon Si Thammarat (Khao Luang).

Distribution.- Throughout the Old World tropics (type from Java).

Ecology.- On mossy tree-trunks or on rocks in dense forests or in light shade at 750-1,200 m altitudes.

Vernacular.- Katae tai hin (กระแตไต่หิน) (North-eastern); kaprok hua long (กระปรอกหัวLONG), kaprok hang sing (กระปรอกหางสิงห์) (South-eastern).

Specimens examined.- P. Ratchata 287; T. Boonkerd 1, 168, 513, 1094 ; K Suwatabandhu 263 (BCU).

3. Asplenium obscurum Blume, En. Pl. Jav.: 181. 1828; DeVol & Kuo, Fl. Taiwan vol. 1. 2nd ed.: 486. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 279. f. 22.1. 1985.—*Hymenasplenium obscurum* (Blume) Tagawa, Acta Phytotax. Geobot. 7: 83. 1934.

Rhizome suberect, ascending or creeping, up to 5 mm in diam., bearing rather closed of fronds, scaly at apex; scales subtriangular, gradually narrowing towards acuminate apex, edges entire, about 3-3.5 mm long, 1 mm broad, dark brown. **Stipe** dull grey-green, not polish, grooved above, scaly near the base, up to 15 cm long; scales like rhizome scales, about 3 mm long, 0.7 mm broad. **Lamina** pinnate, oblong in outline, broadest at base, gradually narrowing towards at apex, rather suddenly narrowing to caudate apex, about 25 cm long, 7 cm wide; rachis like the upper part of stipe; pinnae up to 20 pairs, rhomboid, posterior half of lower portion dimidiate, truncate and slightly auricled at acroscopic base, the lower base with the margin close to the midrib for 1/2 of the length of pinnae, acute at apex, irregular lobed at margin; lobes rounded or forked at apex, usually a lobes placed on each apical portion of lower margin, shortly stalked, more or less falcate, patent, largest pinnae about 3.5 by 1.5 cm; basal pinnae equal to the next above or slightly smaller; upper pinnae gradually smaller upwards; veins once or twice forked, all free, distinct on both surfaces; texture herbaceous to softly herbaceous, pale green. **Sori** usually up to 2.5 mm long, on middle or basal

part of veins; indusia herbaceous, opening towards midrib of pinnae, persistent. **Photo 9.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Phacho), Chiang Mai (Doi Suthep, Doi Inthanon), Lamphun (Doi Khun Tan).

Distribution.- Madagascar, Ceylon, S. India and E. Himalaya, Myanmar, Indochina, S. China, Taiwan, and throughout Malesia (type from Java).

Ecology.- Lithophyte, along streams in half-shade forest trail or rheophyte on rocks in the streams at 680-800 m altitudes.

Specimens examined.- P. Ratchata 28, 56, 139 (BCU).

4. Asplenium perakense C.G. Matthew & H. Christ., J. Linn. Soc. Bot. 39: 214. 1909; Holttum, Rev. Fl. Malaya 2: 429. f. 248. 1960; Tagawa & K. Iwats., Fl Thailand 3(2): 286. 1985.

Rhizome short, suberect, bearing a tuft of fronds, the apex clothed with dark brown scales; scales linear-lanceolate, gradually narrowing towards attenuate-acuminate apex, auriculate at base, entire, about 4 cm long, 0.5 mm broad, brown to dark brown. **Stipe** deep green, dark at base, scaly at lower portion, grooved on upper surface, about 4 cm long; scales small, gradually narrowing from peltate base towards long attenuate-acuminate apex, edges entire, brown, about 1.5 mm long, 0.2 mm broad. **Lamina** oblong-lanceolate, simply pinnate, about 9 cm long, 2.5 cm wide, acuminate at apex; rachis scaly throughout, like the upper part of stipe; pinnae 10-14 pairs, stalked, middle ones largest, spreading or slightly ascending, narrowly long-rhombic, caudately acute to acuminate at apex, auricled at acroscopic and cuneate at basiscopic base, lobed more than 1/3 way to costa, about 2.5 by 1 cm, the lower ones not or slightly reduced, the upper ones smaller upwards, sessile and merging into the narrow deeply lobed apex; their edges slightly involved when dry; lobes oblong, oblique,

dentate at apex; veins indistinct on upper surface, distinct below, usually once or twice forked, free; texture coriaceous, green olivaceous when dry, paler beneath, sparsely scaly on under surface, scales on rachis like those on stipe but smaller. **Sori** long, on those parts of the veins, almost paralleled to the midrib, 1-3 in each lobe; indusia herbaceous, pale. **Photo 12.**

Thailand.- PENINSULAR: Nakhon Si Thammarat (Khao Luang).

Distribution.- Malaya (type).

Ecology.- On mossy tree trunk in rather dry forest at 1,500 m altitudes.

Specimens examined.- P. Ratchata 180; T. Boonkerd 39 (BCU.)

5. **Asplenium** **unilaterale** Lamk., Enc. 3: 305. 1786; Beddome, Handb.: 152. 1883; Holttum, Rev. Fl. Malaya 2: 438. 1954; DeVol & Kuo, Fl. Taiwan vol. 1. 2nd ed.: 490. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 277. 1985.—*Asplenium resectum* Sm., Pl. Ic. 3: pl. 72. 1791.

Rhizome long-creeping, up to 2 mm in diam.. bearing two rows of fronds on dorsal surface, scaly throughout, densely at apex: scales linear-lanceolate, gradually narrowing towards hair-pointed apex, about 2.5 mm long, 0.5 mm broad, entire, dark brown to black.. **Stipe** dark purplish, polished, 0.5-1.5 cm apart, up to 17 cm long, scaly near the base: scales like rhizome scales except in size larger, about 3 mm long, 7 mm broad, dark brown. **Lamina** pinnate, oblong in outline, about 15 cm long, 4.5 cm wide, broadly at basal 1/5 portion, almost paralleled and gradually narrowing upwards and then rather suddenly narrowing to caudate apex; rachis like those stipe, grooved above with a narrow wing on each side of the grooves; pinnae usually 15-17 pairs, shortly stalked, spreading, more or less falcate, closed but not imbricating, the upper base broadly cuneate or subtruncate, hardly auricled, the lower base with the margin closed to the midrib for 1/2-1/3 of the length of pinna, the apex tapering to a blunt or acute tip,

irregularly teeth at margin of pinnae, the lowest pinnae equal to the next above or slightly smaller, usually reflexed; largest pinnae about 2.5 cm long; veins once or twice forked, all free, distinct on both surfaces; texture thin, papyraceous, green, paler when dry. **Sori** occupying the middle part of the veins, up to 4 mm long; indusia herbaceous, pale, opening towards midrib of pinnae. **Photo 10 and 13.**

Thailand.- NORTHERN: Chiang Rai (Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon), Lampang, Tak (Doi Musoe); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Pong Nam Ron, Khao Soi Dao); SOUTH-WESTERN: Kanchanaburi (Wangka); PENINSULAR: Chumphon (Tha San), Ranong (Khao Phota Luang Kaeo, Tua Um), Trang (Khao Chong), Pattani (Bacho), Yala (Bannang Sata).

Distribution.- Widely distributed throughout the Old World tropics (type from Comoros), north to central Japan.

Ecology.- On wet sandy or moist muddy rocks in light shaded along the streams at 800 m altitudes.

Specimens examined.- P. Ratchata 58; T. Boonkerd 507, 555, 556 (BCU).

6. **Asplenium voshinagae** Makino, Phaner. Pterid. Jap. Ic. III. 1: 21. pl. 64. 1900; Tagawa & K. Iwats., Fl Thailand 3(2): 285. f.23.1. 1985.—*Asplenium planicaule* Wall. ex Mett., Abhandl. Senckenb. Naturf. Ges. 3: 201. 1859, non Lowe 1858: C. Chr., Contr. U.S. Nat. Herb. 26: 332. 1931.—*Asplenium indicum* Sledge, Bul. Brit. Mus. (Nat. Hist.) Bot; 3: 264. 1965.

Rhizome short, erect, densely scaly at apex, bearing a tuft of fronds; scales linear-lanceolate, auriculate at base, gradually narrowing towards acute to acuminate apex, about 7 mm long, 1-1.2 mm broad, entire, brown to dark brown. **Stipe** deep green to brownish, sometime purple beneath, not

polish, scaly at base, glabrous, grooved above, up to 16 cm long; scales like rhizome scales. **Lamina** pinnate, oblong-lanceolate, acuminate at apex, usually 20 cm long, 10 cm wide; rachis like the upper part of stipe; scales ovate or lanceolate, round at base, acuminate at apex, about 1 mm long, 0.4 mm broad, the margin bearing irregular and sparse projections, densely at base; pinnae about 10 pairs, rhomboid, broadly cuneate and auricled at acroscopic base, narrowly cuneate and entire at basisopic base, gradually narrowing towards long-acuminate apex, margin irregularly lobed with dentate margin, spreading or slightly ascending, the lowest not or slightly reduced, the middle ones largest; larger pinnae up to 6 cm long, 1.5 cm wide; lobes oblong or obovate, oblique, usually 5-6 mm wide; veins dichotomously forking, indistinct on upper surface; costa inconspicuous or lacking; texture chartaceous, deep green, paler or brownish in dried specimens. **Sori** elongate along veinlets, 1-3 for each lobe; indusia herbaceous. **Photo 11 and 14.**

Thailand.- NORTHERN: Chiang Rai (Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon); Lamphun (Doi Khun Tan), Tak (Ban Musoe); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang, Wang Saphung), Khon Kaen (Phu Wiang); CENTRAL: Saraburi (Hin Lap); PENINSULAR: Surat Thani (Ban Don).

Distribution.- Ceylon, N. & S. India, Myanmar, S. China, Indochina, Taiwan, Philippines, north to Japan(type).

Ecology.- On mossy tree-trunk in rather dry forest at 1,350-1,500 m altitudes.

Specimens examined.- P. Ratchata 103, 175, 188, 280, 306; T. Boonkerd 1063 (BCU).

ATHYRIACEAE

Generally terrestrial; rhizome erect, sometime creeping, bearing a tuft of fronds; scales brown, entire or toothed; fronds monomorphic, pinnate to tripinnate; veins free, simple or forked or reticulate; sori round to elongate; indusia round, horse-shoe-shaped or oblong.

Key to the genera

1. Scales dark brown, toothed at margin. Sori oblong, close to midrib;
indusia crescentic..... **2. *DIPLAZIUM***
2. Sori oblong; indusia horse-shoe-shaped or hooked **1. *ATHYRIUM***
1. Scales concolorous, entire.
2. Sori round; indusia round-reniform. Stipe thickened near base with
constriction just above the rhizome **3. *KUNIWATSUKIA***

ATHYRIUM

Roth, Röm. Mag. 2(1): 105. 1799.

Rhizome short, ascending; scales concolorous, glabrous; fronds pinnate, lanceolate in outline; rachis grooved, glabrous; veins pinnate, all free; sori oblong, dorsal on veinlets; indusia horse-shoe-shaped or hooked.

Athyrium dissitifolium (Baker) C. Chr., Contr. U.S. Nat. Herb. 26: 296, 332. pl. 18. 1931; Tagawa & K. Iwats., Fl Thailand 3(3): 446. f.48.1. 1988.—*Polypodium dissitifolium* Baker. Kew Bull. 1895: 54.

Rhizome short, ascending, bearing fronds together, densely scaly throughout; scales linear, gradually narrowing towards long attenuate apex, about 1.2 by 0.6 mm, brown, dark at base, entire. **Stipe** stramineous, grooved, up to 25 cm long, dark brown at broadened base, scaly at lower part; scales like rhizome scales. **Lamina** linear-lanceolate, widest at base, bipinnatifid, acuminate to attenuate at apex, up to 40 by 12 cm; rachis grooved like those stipe; pinnae linear-lanceolate, shortly stalked, broadest at base, acuminate at apex, deeply lobed nearly to costa; lateral pinnae up to 20 pairs, lower one stalked, up to 8 by 1.5 cm; upper pinnae gradually reducing in size towards apex; lobes oblique, oblong-subdeltoid, round to moderately acute at apex, up to 5 by 3 mm, toothed at margin; veins pinnate, veinlets simple or forked, ending in sharp teeth at margin, rather distinct beneath,

indistinct on upper surface; texture papyraceous to subcoriaceous, light green, paler beneath. **Sori** oblong or slightly round, sometime uniting with the next ones at maturity; indusia thin. **Photo 19-20.**

Thailand.- NORTHERN: Chiang Rai (Mae Talop, Mae Suai, Doi Phacho, Phu Langka), Chiang Mai (Ban Mae Kong, Mae Ho, Pong Pho, Doi Chiang Dao, Doi Suthep, Doi Hua Mot, Sop Aep, Doi Kiu Lom, Doi Inthanon), Mae Hong Son (Bo Luang), Lamphun (Doi Khun Tan).

Distribution.- E. Himalaya and Yunnan (type).

Ecology.- On humus-rich moist ground in half-shade areas in mixed forests at 1,250-1,450 m altitudes.

Specimens examined.- P. Ratchata 167, 249, 298; T. Boonkerd 830, 1075 (BCU).

DIPLAZIUM

Sw., Schrad. J. Bot. 1800(2): 61. 1801.—*Callipteris* Bory in Belanger. Voy. 1: 282. 1804.—*Athyrium* Roth. Röm. Meg. 2(1): 105. 1799, p.p.

Rhizome erect to creeping; scales dark brown, toothed at margin; stipes sometime bearing spines near the base or throughout; fronds bipinnate to tripinnate; veins pinnate, usually forked, or reticulate to form rather regular quadrangular areoles at each side of veinlets; sori oblong, on basal veinlets, close to midrib; indusia thin, crescentic.

Key to the species

1. Veins all free
 2. Stipe spinose. Rhizome-scales black-margined **5. *D. polypodioides***
 2. Stipe not spinose
 3. Frond bipinnate. Rhizome-scales brown, black-margined and minutely tooth throughout.....**6. *D. simplicivenium***

- 3. Frond tripinnate to quadripinnatifid
 - 4. Rhizome-scales entire
 - 5. Sori elongate, more than 3 mm long **2. *D. leptophyllum***
 - 5. Sori oblong, usually closed to midrib **3. *D. muricatum***
 - 4. Rhizome-scales toothed. Stipe grooved above, dark on basal portion **4. *D. petri***
- 1. Veins anastomosing. Frond bipinnate to tripinnate **1. *D. esculentum***

1. Diplazium esculentum (Retz) Sw., Schrad. J. Bot. 1801(2): 312. 1803; Smith, Fl. North Amer. North Mexico, vol. 2.: 253. 1993; Tagawa & K. Iwats., Fl Thailand 3(3): 466. 1988.—*Hemionitis esculenta* Retz., Obs. Bot.: 38. 1791.—*Anisogonium esculentum* (Retz.) Presl, Tent. Pterid.: 116. 1836; Beddome, Handb.: 192. f. 94. 1883; DeVol & Kuo, Fl. Taiwan vol. 1. 2nd ed.: 442. pl. 157. 1980.—*Athyrium esculentum* (Retz.) Copel., Phil. J. Sci. Bot. 3: 295. 1908; Holttum, Rev. Fl. Malaya 2: 562. f. 333. 1960.

Rhizome erect or ascending, densely scaly at apex, bearing a tuft of fronds; scales up to 10 by 1.2 mm dark brown, black-margined, toothed. **Stipe** stramineous, dark brown to nearly black at base, grooved above, up to 1.20 m long, sparsely scaly; scales at base lanceolate, brown, attenuate at apex, about 5 mm long, 1 mm broad, toothed along margin. **Lamina** very variable in size, up to 2.50 m long, bipinnate to tripinnatifid; rachis grooved, like the upper part of stipe; lateral pinnae alternate, oblong-lanceolate, patent, ascending, acuminate at apex, up to 16 pairs; lower pinnae one or two pairs often reduced, shortly stalked; lateral pinnae up to 55 cm long, 20 cm wide, with 2-3 cm stalked; larger pinnules oblong-lanceolate, sessile or shortly stalked, subcordate or auricled at base, narrowing towards acuminate apex, up to 12 by 2.5 cm; costa and costules grooved with ridges; lobes 1/4 way to costules, round at apex, falcate, serrate at margin; veins pinnate, veinlets up to 10 pairs, uniting with the opposite ones forming excurrent

veinlets, raised and distinct below, indistinct on upper surface; texture papyraceous, green, paler beneath, brown or darker when dry, glabrous on both surfaces. **Sori** elongate, on nearly the whole length of veinlets, often uniting with opposite ones; indusia thin, brown when dry. **Photo 17.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok), Chiang Mai (Fang, Ban Mae Kon, Mae Klang, Kang Kat, Sop Aep), Mae Hong Son (Mae La Noi, Mae Su Rin), Lampang, Tak; EASTERN: Chaiyaphum (Nam Phrom); CENTRAL: Nakhon Nayok (Khao Yai), Saraburi (Muak Lek), Bangkok; SOUTH-EASTERN: Chon Buri (Si Racha); SOUTH-WESTERN: Kanchanaburi (Kroeng Kawia, Phomphi, Sai Yok); PENINSULAR: Surat Thani (Khao Pok, Ban Don), Satun, Narathiwat (Waeng).

Distribution.- Tropics of Asia, north to Central China and S. Japan, east to S. Pacific Islands.

Ecology.- On moist ground or wet sand along the streams or in expose areas near the rivers at 640-750 m altitudes.

Vernacular.- Hatsadam (หัตถ์ดำ) (Peninsular); kut kin (กูดกิน)(Northern).

Uses.- Young fronds locally consumed as vegetable.

Specimens examined.- P. Ratchata 202, 208; T. Boonkerd 17 (BCU).

2. Diplazium leptophyllum H. Christ. in C. Chr., Ind. Fil. Suppl.: 103. 1913, based on *Asplenium leptophyllum* Baker, Kew Bull. 1906: 10, non Sw. 1791; Tagawa & K. Iwats., Fl Thailand 3(3): 463. 1988.

Rhizome erect, bearing fronds rather remotely, scaly at apex; scales nearly black, up to 13 by 1.5 mm, entire. **Stipe** stramineous to brown, dark at base, about 45 cm long, grooved above. **Lamina** large, subdeltoid, up to 1 m long and wide, tripinnatifid, acute at apex; rachis grooved above, stramineous to greenish, glabrous; lateral pinnae sword-shaped, acuminate at apex, truncate at base, patent, ascending, alternate, up to 15 pairs; lower pinnae one or two smaller, shortly stalked, middle pinnae the largest, up to 55 cm long, 20 cm wide, about 2 cm stalked; upper pinnae gradually

becoming smaller upwards; larger pinnules shortly stalked, oblong-lanceolate, caudate-acuminate at apex, subtruncate at base, up to 10 by 3 cm, lobed more than half-way to costa; lobes oblong, oblique, round at apex, serrate at margin, up to 10 by 7 mm; costa and costules grooved, distinctly ridges; veins pinnate, veinlets usually forked; texture herbaceous to papyraceous, deep green, paler on under surface. **Sori** elongate along veinlets, usually about 6 mm long, sometime up to 9 mm in basal veinlets; indusia thin, long, brown when dry. **Photo 26 and 30.**

Thailand.- NORTHERN: Chiang Rai (Mae Lao), Chiang Mai (Doi Chiang Dao, Doi Suthep), Lamphun (Doi Khun Tan).

Distribution.- Yunnan (type) and Myanmar.

Ecology.- Terrestrial on moist ground or moist mountain slopes in Mixed Deciduous forests along the streams at 720 m altitudes.

Specimens examined.- P. Ratchata 32 (BCU).

3. **Diplazium muricatum** (Mett.) Alderw., Mal. Ferns: 829. 1909; Tagawa & K. Iwats., Fl Thailand 3(3): 461. f. 48.5-6. 1988.—*Asplenium muricatum* Mett., Ann. Lugd. Bat. 2: 239. 1866.

Rhizome short. erect, bearing a tuft of fronds, densely scaly throughout; scales sword-shaped, dark brown, attenuate-acuminate at apex, about 1.7 cm long, 2.5 mm broad, sparsely minutely toothed along margin. **Stipe** brown to dark brown at base, up to 70 cm long, grooved, scaly at base; scales like rhizome scales, sometime smaller. **Lamina** oblong or subdeltoid, up to 120 cm long, 80 cm wide, tripinnate to quadripinnatifid; rachis shallowly grooved above; lateral pinnae up to 14 pairs, pinnate, alternate, basal one or two sometimes shorter than the next ones, stalked, gradually narrowing towards acute apex, upper ones shortly stalked, gradually narrowing in size to apex, adnate at base to form indistinct apical portion, middle pinnae broadest, patent to ascending, oblong with acuminate apex

and subtruncate at base, up to 40 cm long, 20 cm wide, with 10 or more lateral pinnules; costa and costules grooved with distinct ridges near base, pinnules sessile in larger pinnae, oblong with acuminate apex and subtruncate base, broadest at middle portion, pinnatisect, up to 9 by 3.5 cm; ultimate lobes oblong, oblique, round at apex, serrate at margin; veins pinnate with 5-8 forked veinlets, distinct beneath, reaching to the margin; texture papyraceous, deep green, pale beneath, glabrous on both surfaces. **Sori** oblong, usually closed to midrib, on dorsal veinlets; indusia thin, fragile. **Photo 21-22.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Inthanon).

Distribution.- Sri Lanka, India, Myanmar, Indonesia.

Ecology.- Terrestrial on moist mountain slopes in evergreen forest at 685-800 m altitudes.

Specimens examined.- P. Ratchata 19, 49, 137, 142, 216 (BCU).

4. Diplazium petri Tardieu, *Aspl. Tonkin*: 67. pl. 9, 1-2. 1932; DeVol & Kuo, *Fl. Taiwan* vol. 1. 2nd ed.: 467. 1980; Tagawa & K. Iwats., *Fl. Thailand* 3(3): 461. 1988.—*Diplazium triangulare* Tagawa, *Acta Phytotax. Geobot.* 7: 79. 1938.—*Athyrium petri* (Tardieu) Ohwi, *Fl. Jap.* 88. 1965.

Rhizome short, ascending, bearing a rather close fronds, densely scaly at apex; scales large, oblong-lanceolate, dark brown, about 1.5 cm long, 1.2 mm broad, with minutely toothed at margin. **Stipe** green to stramineous, grooved above, dark on basal portion, up to 35 cm long, scaly at base. **Lamina** subtriangular, up to 45 cm long, 60 cm wide, tripinnatifid, aristulate at apex; rachis like those stipe; lateral pinnae about 8 pairs, with distinctly stalked more than 2 cm long, oblong-lanceolate, moderately caudate at apex, broadest at middle portion; lower pinnae the largest, patent, up to 30 cm long, 15 cm wide; upper pinnae gradually narrowing towards apex, with indistinct terminal portion of fronds; larger pinnules oblong-

lanceolate, sessile, broadest at base, gradually becoming smaller upwards, long aristulate at apex, patent, deeply lobed nearly to costules; lobes oblong, oblique, slightly falcate, serrate at margin, round to subacute at apex, up to 10 by 4 mm; veins pinnate, usually forked, rather raise and distinct beneath; texture papyraceous, deep green, paler beneath. **Sori** oblong, usually on basal veinlets, crescent; indusia thin, pale brown. **Photo 18.**

Thailand.- SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Pong Nam Ron); PENINSULAR: Nakhon Si Thammarat (Khao Luang).

Distribution.- Indochina (type), Ryukyu and Taiwan.

Ecology.- Terrestrial on moist ground in half-shade places at 700-750 m altitudes.

Specimens examined.- P. Ratchata 136, 199 (BCU).

5. Diplazium polypodioides Blume, En. Pl. Jav.: 194. 1828; Beddome, Handb.: 184. 1883; Tagawa & K. Iwats., Fl Thailand 3(3): 465. 1988.—*Diplazium asperum* Blume, En. Pl. Jav.: 195. 1828; Beddome, Handb.: 184. f. 88. 1883.—*Athyrium asperum* (Blume) Milde, Bot. Zeit.: 353. 1870; Holttum, Rev. Fl. Malaya 2: 571. f. 320. 1960.

Rhizome erect, scaly throughout; scales linear, gradually narrowing towards long attenuate apex, about 2.5 cm long, 1 mm broad, dark brown, nearly black-margined, toothed. **Stipe** stramineous, dark brown to nearly black at base, about 1.5 cm in diam. near base, up to 1 m long, scaly near base, surface prickly due to scars of fallen scales. **Lamina** lanceolate to oblong-subdeltoid, up to 1.5 m long, 1 m wide, tripinnatisect; rachis grooved above, distinct; lateral pinnae linear-lanceolate or oblong-lanceolate, acuminate at apex, subtruncate at base, up to 12 pairs; basal one or two pairs sometime smaller, stalked; middle pinnae largest, patent to slightly ascending, up to 50 cm long, 15 cm wide, with up to 20 lateral pinnules; upper pinnae gradually narrowing towards apex, to form indistinct apical

portion; larger pinnules oblong-lanceolate, caudate-acuminate apex, subtruncate at base, deeply lobed nearly to costa, sessile or shortly stalked in larger pinnae, up to 9 by 2 cm; lobes oblong, oblique, round to obtuse at apex, sharply serrate at margin, about 4 mm broad, up to 1 cm long; costa and costules grooved with distinct ridges; veins pinnate, veinlets 5-9 pairs, mostly forked, slightly raised and distinct below; texture papyraceous, deep green, paler beneath, glabrous. **Sori** oblong, usually close to midrib; indusia thin. **Photo 29.**

Thailand.- NORTHERN: Chiang Rai (Mae Lao), Chiang Mai (Doi Suthep, Mae Klang, Doi Inthanon), Phrae (Mae Sai), Tak, Phitsanulok (Phu Miang); SOUTH-EASTERN: Chanthaburi (Khao Soidao); PENINSULAR: Surat Thani (Ban Don), Ranong (Phato), Nakhon Si Thammarat (Khao Luang).

Distribution.- Sri Lanka, S. India, Himalaya, Indochina. Malesia throughout (type from Indonesia), north to Taiwan.

Ecology.- Terrestrial on humus-rich mountain slopes with high moisture in light shade areas at 685 m altitudes.

Specimens examined.- P. Ratchata 12, 346 (BCU).

7. **Diplazium simplicivenium** Holttum, Gard. Bull. S.S. 11: 100. 1940 Tagawa & K. Iwats., Fl Thailand 3(3): 464. 1988.—*Athyrium simplicivenium* (Holttum) Holttum, Rev. Fl. Malaya 2: 573. f. 340. 1954.

Rhizome erect, thick, bearing a tuft of fronds, densely scaly at apex; scales linear-lanceolate, about 15 mm long, 1 mm broad, gradually narrowing from rounded base towards long hair-point apex, brown, black-margined and minutely toothed throughout. **Stipe** about 35 cm long, stramineous, about 2 cm diam. near base, scaly at base. **Lamina** bipinnate, subdeltoid, about 85 cm long, 60 cm wide; lateral pinnae about 10-15 pairs, oblong-lanceolate, long acuminate at apex, up to 30 by 20 cm, ascending, lower pinnae broadest; larger pinnules shortly stalked or sessile, oblong-

subtriangular, gradually narrowing towards long acuminate apex, broadly cuneate to subtruncate or subcordate at base, shallowly lobed, up to 10 by 2 cm, falcate; lobes subquadrangular, 1/4 way to costules, obtuse to subtruncate at apex, subentire; veins pinnate, all free, with 4-6 pairs of simple veinlets; veinlets hardly reaching the margin of lobes, basal anterior ones stopping far below the sinus; texture softly papyraceous, green to yellowish. **Sori** elongate, about 6 mm long; indusia rather thick, pale. **Photo 23-25.**

Thailand.- SOUTH-WESTERN: Kanchanaburi (Khao Ngi Yai), Uthai Thani (Ban Rai); PENINSULAR: Surat Thani (Klong Ton), Nakhon Si Thammarat (Khao Luang), Phangnga (Khao Pok), Trang (Khao Chong), Satun, Yala (Muang Wing).

Distribution.- Malaysia (type).

Ecology.- Terrestrial on moist mountain slopes in open areas near the streams at 1,200-1250 m altitudes.

Specimens examined.- P.Ratchata 288, 345, 355; T. Boonkerd 534, 535; C. Apasutaya 122 (BCU).

KUNIWATSUKIA

Pic.-Serm., *Webbia* 28: 455. 1973.—*Microchlaena* Ching, Bull. Fan Mem. Inst. Biol. 8: 322. 1938, non Wight et Arn., 1834: K. Iwats., Acta Phytotax. Geobot. 24: 188. 1970.—*Athyrium* Roth, Röm. Mag. 2(1): 105. 1799, pp.

Rhizome short, ascending, bearing fronds in a tuft near apex; scales concolorous brown, entire; stipes thickened near base with constriction just above the rhizome; fronds imparipinnate; veins pinnate, all free; sori round, dorsal on veins; indusia round-reniform.

Kuniwatsukia cuspidata (Beddome) Pic.-Serm., *Webbia* 28: 455. 1973; Tagawa & K. Iwats., Fl Thailand 3(3): 442. f. 47.1-4. 1988.—*Lastrea cuspidata* Beddome, Ferns Br. Ind. corr. ad pl. 118. 1870; Handb.: 232. f.

119. 1883, based on *Aspidium cuspidatum* Mett., Abhandl. Senckenb. Naturf. Ges. 2: 376. 1858, non Desv., 1827.—*Aspidium yunnanense* H. Christ, Bull. Herb. Boiss. 6: 965. 1898.—*Microchlaena cuspidata* (Beddome) Ching, Acta Phytotax. Sin. 9: 99. 1964; Tagawa & K. Iwats., Acta Phytotax. Geobot. 22: 103. 1967—*Microchlaena yunnanensis* (H. Christ) Ching, Bull. Fan Mem. Inst. Biol. 8: 325. 1938.

Rhizome short, ascending or erect, bearing a tuft of fronds, densely scaly throughout; scales linear-lanceolate, gradually narrowing from truncate base towards long attenuate acuminate apex, about 1.7 cm long, 1.2 mm broad, brown, entire. **Stipe** dark purplish to redish-brown when young, stramineous to pale purplish-brown when dry, up to 55 cm long, grooved above, densely scaly at base, upper part scattered scaly on the grooves; scales like rhizome scales. **Lamina** oblong to oblong-lanceolate in outline, pinnate, up to 55 cm long, 40 cm wide, acuminate at apex; rachis grooved, like the upper part of stipe but paler; pinnae linear, acuminate at apex, truncate to auricled at acroscopic and cuneate at basiscopic base, shallowly lobed at margin: lateral pinnae up to 20 pairs, patent to ascending; the basal ones largest, up to 20 by 1.5 cm, with 0.5 cm stalked; the upper pinnae shortly stalked and gradually narrowing towards apex; terminal pinnae indistinct, deeply lobed at base; lobes triangular, with sharp teeth at apex; veins pinnate, veinlets simple, all except the basal pairs reaching the margin of lobes, slightly raised beneath, visible on both surfaces; texture papyraceous, green, paler beneath, glabrous on both surfaces. **Sori** dorsal on veinlets, costular, with small round-reniform; indusia lacerate at margin, caducous. **Photo 15-16.**

Thailand.- NORTHERN: Chiang Rai (Mae Suai, Doi Tung), Chiang Mai (Doi Chiang Dao, Doi Suthep, Doi Inthanon), Lamphun (Doi Khun Tan).

Distribution.- Nepal (type), Assam, Upper Myanmar and SW. China.

Ecology.- Terrestrial on rather dry mountain slopes in light shade area in mixed forests at 1,280-1,350 m altitudes.

Specimens examined.- P. Ratchata 79, 80, 95, 117, 149, 155; T. Boonkerd 629 (BCU).

BLECHNACEAE

Terrestrial ferns; rhizome erect, scales narrow, entire; fronds pinnate, dimorphic or subdimorphic; veins free; sori costal, coenosori, without indusia.

Key to the genera

1. Veins fork, forming series of narrow areoles costal **2. BRAINEA**
 1. Veins fork, all free **1. BLECHNUM**

BLECHNUM

L., Sp. Pl.: 1077. 1753.

Rhizome erect, bearing a rosette of pinnate fronds, bases of stipes covered with scales; scales narrow, entire, with pale cartilaginous edges. Lamina pinnate, glabrous, lateral pinnae entire; veins free, usually once or a few fine forked. Sori linear, paralleled to the midrib and closed to it; indusia attached on the side away from costa, opening inwards.

Blechnum oreintale L., Sp. Pl.: 1077. 1753; Beddome, Hand.: 132. f. 66. 1883; Houttum, Rev. Fl. Malaya 2: 446. f. 262. 1960; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 87. 1958; Tagawa & K. Iwats., Fl Thailand 3(3): 298. 1988.

Rhizome thick, erect, densely scaly throughout; scales linear, gradually narrowing towards apex, about 1.5 by 0.2 cm, attenuate acuminate at apex, shining brown with pale cartilaginous edge. **Stipe** stout,

stramineous, up to 30 cm long, bearing small auricled about 2 cm apart, densely scaly at base. **Lamina** about 30 by 15 cm; lateral pinnae numerous, closed, oblique, about 15 by 2 cm, 2-3 cm apart from each other, ascending, linear, gradually narrowing towards long-tailed apex, round or subtruncate at base or decurrent at posterior base and adnate in the upper ones, entire; veins free, forked, spreading at a broad angle to the midrib, distinct on both surfaces, very closed; texture subcoriaceous, green, glabrous. **Photo 28.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Kong Kat, Doi Suthep, Mae Rim), Tak (Ban Musoe, Raheng); NORTH-EASTERN: Loei (Phu Ruea, Phu Luang, Phu Kradueng), Nong Khai, Udon Thani (Phon Phisai); EASTERN: Chiyaphum (Khao Kong); central: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Laem Sing, Phriu waterfall, Makham, Khao Sabap), Trat (Ko Kut, Ko Chang); PENINSULAR: Chumphon (Lang Suan, Ban Pak Chan), Ranong (Nok Nang), Surat Thani (Ban Don), NaKhon Si Thammarat (Khsu Luang, Thap Chang), Phangnga (Between Thanun and Phangnga), Trang (Khao Chong), Satun, Naratiwat (Waeng, Sungai Padi), Yala (Betong, Bannang Sata).

Distribution.- Tropic of Asia, Australia and the Pacific. India to Polynesia, north to southern edge of Japan (Yakushima).

Ecology.- On rather dry slopes along the roads at 650 m altitudes.

Vernacular.- Kut khang fan (กูดข้างฟาน) (northern; kut doi (กูดคอย) (Central); mahasadam (มหาสะด้า) (South-eastern).

Specimens examined.- P. Ratchata 357 (BCU).

Note.- Fertile frond not found on specimens.

BRAINEA

J. Sm., Cat. Kew Ferns: 5. 1856.

Rhizome erect, stout, forming erect trunk; scales abundant, concolorous, shining; stipes stramineous, densely scaly at base, grooved; fronds pinnate, subdimorphic or dimorphic, pinnae 40 or more pairs; veins

fork, free, forming a series of narrow areoles along costa; sori elongate along veins or covering the whole undersurface of narrow fertile pinnae, without indusia.

Brainea insignis (Hook.) J. Sm., Cat. Kew Ferns: 5. 1856; Beddome, Handb.: 395. f. 230. 1883; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 152. pl. 51. 1980; Holttum, Rev. Fl. Malaya 2: 450. 1960; Tagawa & K. Iwats., Fl Thailand 3(3): 302. f. 24.5-6. 1988.—*Bowringia insignis* Hook., J. Bot. 5: 237. t. 2. 1853.—*Brainea formosana* Hayata, Bot. Mag. Tokyo 42: 237. 1928.—*Brainea insignis* (Hook.) J. Sm. var. *formosana* (Hayata) Tagawa, Journ. Jap. Bot. 12: 542. 1936.

Rhizome erect, arborescent, forming a trunk of more than 50 cm in height, the apex covered with scales, bearing a rosette of many fronds. **Stipe** stramineous, about 20-25 cm long, densely scaly at the base only, glabrous above. **Lamina** pinnate, monomorphic or dimorphic; sterile lamina 50-70 cm long, 25-30 cm wide, oblong-lanceolate, acute at apex; pinnae numerous, subopposite, straight, ascending, the lowest sometime reduced, more distant and deflexed, linear, gradually narrowing towards acute apex, sessile, broadly cuneate to deeply cordate towards base, up to 50 pairs; largest pinnae about 15 by 1 cm, the edges finely toothed, tapering gradually from the base to the finely acuminate apex; veins straight, forking once or twice near the midrib and uniting in a single series of slightly triangular costal areoles, for the rest usually free, grooved on upper surface, raised beneath; texture softy coriaceous to papyraceous, green, pale green to brown when dry; fertile lamina narrower in subdimorphic or dimorphic frond, Sori elongate along veins in monomorphic fronds or almost entirely covered beneath with sporangia in dimorphic fronds, without indusia. **Photo 27.**

Thailand.- NORTHERN: Chiang Rai (Doi Pacho), Chiang Mai (Doi Chong, Doi Chiang Dao, Dao Phahom Pok, Doi Suthep, Doi Inthanon, Ban

Yang, Pang Bo, Doi Hua Mot), Lamphun (Doi Khun Tan), Lampang (Doi Luang), Phrae (Mae Sai), Tak (Doi Musoe); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); SOUTH-EASTERN: Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Song Tho).

Distribution.- Himalayas, S. China (type from Hongkong), Myanmar, Indochina, Malaya and N. Sumatra.

Ecology.- Terrestrial on rather dry slopes in open areas or in not so dense forests at 890-1,000 m altitudes.

Vernacular.- Kut doi (กูดอย) (Northern).

Specimens examined.- P. Ratchata 62; T. Boonkerd 438, 493, 1030, 1103 (BCU).

CYATHEACEAE

Tree ferns, tall, stock erect, forming a massive trunk, bearing rosetts of fronds at apex, leaf scar pattern usually with 3-series of small vascular bundle; areophores borne along side of stipe, occurring as streaks arranged in its 3 lines; scales setiferous; fronds large, usually bipinnate, monomorphic; veins usually free, pinnate; sori round, borne on back of veins, with or without indusia.

CYATHEA

Sm., Mem. Acad. Turin. 5: 416. 1793. —*Sphaeropteris* Bernh., Schrad. J. Bot. 1800(2): 122. 1801.—*Hemitelia* R. Br., Prod.: 158. 1810.—*Alsophila* R.Br., Prod.: 158. 1810; *Chnoophora* Kaulf. En. Fil. Chamisso: 250. 1824.—*Gymnosbhaera* Blume, En. Pl. Jav.: 242. 1828.—*Disphenia* Presl, Tent. Pterid.: 55. 1836.—*Schizocaena* J. Sm. in Hook. Gen. Fil. t. 2. 1838.—*Amphicosmia* Gardner, Lond. J. Bot. 1: 441. 1842.—*Dichorexia* Presl, Abh. K. Böhm. Ges. Wiss. V., 5: 55. 1848.—*Fourniera* J. Bommer, Bull. Soc. Bot. France 20. xix. 1873.—*Thysanobotrya* Alderw., Bull. Jard. Bot. Btzg II, n. 28: 66. 1918.

Rhizome erect, forming trunk; scales dark, shining; stipes long, densely scaly, bases of stipe closely arranged around the apex of the trunk; fronds large, bipinnate, bearing both scales and hairs; veins simple, all free; sori round, distinct receptacle, on basal veins, with or without indusia.

Cyathea gigantea (Wall.ex Hook.) Holttum, Gard. Bull. S.S. 8: 318. 1935; Holttum, Fl. Mal. II 1: 124. 1963; Beddome, Handb.: 14. 1883; Tagawa & K. Iwats., Fl Thailand 3(1): 105. 1979.

Trunks 1-1.5 m tall. **Stipe** nearly black or very dark, polished, 40 cm or more long, densely covered with spreading scales. **Lamina** bipinnate, oblong-lanceolate, gradually towards acuminate apex, about 2.5 m long, 1.5 m wide or more; rachis dark brown to nearly black, minutely scaly, shining, smooth; pinnae up to 80 cm long, 25 cm wide, acuminate at apex, about 8-10 pairs; pinna-rachis densely hairy on upper surface, sparsely warty or scaly beneath, dark at base, paler towards apex; pinnules of middle pinnae about 12 cm long, 1.5 cm wide, 2.5 cm apart, straight or slightly falcate, sessile or nearly so, oblong-lanceolate, the base slightly unequal, cordate, narrowed gradually from the broadest part at base to the apex, long acuminate at apex, edges lobed, the apex toothed; lobes to more than 1/3 way towards costae, round-subdeltoid, round at apex, oblique, falcate, serrate at margin, up to 5 mm broad, with minutely narrowed sinus; veins 5-6 pairs in each lobe, simple, all free, the basal one on the side towards the costa usually reaching to the sinus of lobes; texture thin, papyraceous, green. **Sori** on basal veins, forming one row along costule, close to costule or medial, without indusia.

Photo 31 and 35.

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Kang Kaet, Doi Suthep, Doi Inthanon, Fang), Tak (Doi Musoe); NORTH-EASTERN: Loei (Phu Luang); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Khao Sabap), Trat (Ko Chang, Ko Kut); SOUTH-WESTERN: Kanchanaburi

(Wangka); PENINSULAR: Ranong (Muang Laen, Khao Nom Sao), Surat Thani (Ban Don, Khao Nong, Klong Ton), Phangnga (Takua Pa), Nakhon Si Thammarat (Khao Luang, Chawang Nok Nang), Satun, Yala (Ban Chana).

Distribution.- E. Himalaya (type), S. India, Ceylon, Myanmar, S. China, Indochina, Malaya, Sumatra and W. Java.

Ecology.- Terrestrial on mountain slopes in dense evergreen forests along streams at 670-750 m. altitudes.

Vernacular.- Maha sadam (มหาสะดำ) (South-eastern); maha sadaeng (มหาสะแดง) (Peninsular); kut ngong (กูดโง่ง), kut yong (กูดโย่ง), kut hang nok yung (กูดหางนกกยุง) (Northern); khasudo (คาซูด) (Korean/Northern).

Uses.- Adventitious root from trunk used for orchid media.

Specimens examined.- P. Ratchata 71, 338; C. Apasutaya 88; T. Boonkerd 201, 202, 203, 205, 1274 (BCU).

DAVALLIACEAE

Epiphytic ferns, some time growth on the rock, rhizome long creeping, bearing two rows of fronds; stipes jointed to rhizome; rachis narrowly winged on either sides of raised upper surface; fronds pinnatifid to decompose, broadly deltoid; veins free; sori nearly round to subdeltoid, terminal on the veins; indusia tubular, nearly round or subdeltoid.

Key to the genera

1. Rhizome scaly, bearing no hairs
 2. Indusia pale, nearly round, fixed by base only
 3. Sori nearly round, terminal on veinlets..... **1. ARAIOSTEGIA**
 3. Sori round, along the margin of lobes. Frond coriaceous **3. HUMATA**
 2. Indusia cup-shaped, attached by base and side. Sori terminal on veinlets..... **2. DAVALLIA**

1. Rhizome covered with abundant long brown hairs and thin lanceolate brown scales, with hairy roots all over the surface.....4. *LEUCOSTEGIA*

ARAIOSTEGIA

Copel., Phil. J. Sci. 34: 240. 1927.

Rhizome fleshy, long creeping, scaly throughout; scales attached basally, concolorous brown; stipes articulated to rhizome, scaly throughout; rachis subdeltoid, quadripinnatifid, thin, glabrous; veins forked, all free; sori nearly round, terminal on veinlets, usually at base of the forked lobes; indusia pale, nearly round, fixed by base.

Key to the species

1. Scales entire, somewhat crisped, frond quadripinnatifid; indusia pale, thin, acuminate. 1. *A. pseudocystopteris*
1. Scales minutely irregularly tooth at margin. Frond tri-to quadripinnate; indusia small, round at apex, usually broader than long, entire, sometime completely hidden under sori at maturity. 2. *A. pulchra*

1. *Araiostegia pseudocystopteris* (Kunze) Copel., Phil. J. Sci. 37: 241. 1927; Tagawa & K. Iwats., Fl Thailand 3(2): 155. f. 11.4. 1985.—*Davallia pseudocystopteris* Kunze, Bot. Zeit. 68: 1850.—*Leucostegia pseudocystopteris*(Kunze) Beddome, Ferns Br. Ind. Suppl.: 4. 1876; Handb.: 54. 1883.

Rhizome long-creeping, about 4 mm in diam., sparsely bearing fronds, densely scaly throughout; scales broad, ovate to oblong-subdeltoid, round to moderately acute at apex, round at base, entire, appressed on the surface of rhizome, about 3-3.5 mm long, 1.3 mm broad, membranous, somewhat crisped. **Stipe** stramineous to pale castaneous, about 5 cm long,

scaly at base and upper portion nearly pinna-rachis; scales deltoid, acute at apex, membranous, entire, about 1 mm long, 0.8 mm broad. **Lamina** subdeltoid to lanceolate in outline, gradually acuminate at apex, about 12 by 8 cm, quadripinnatifid; rachis stramineous with narrowly winged throughout, sparsely scaly; pinnae ovate, acute at apex, broadly cuneate and oblique at base, patent, about 11 pairs, alternate, imparipinnate, ultimate pinna deeply lobed; basal pinnae the largest, asymmetrically oblong-subtriangular, moderately acute at apex, truncate at anterior and dimidiate at posterior base, shortly stalked or sessile; upper pinnae gradually smaller upwards; pinnules quadrangular, round to moderately acute at apex broadly cuneate at base, sessile; secondary pinnules pinnatifid, with sessile rhomboid segments, ultimate segments with a few acuminate entire lobes; veins free, forked; texture herbaceous to papyraceous, with yellow glands. **Sori** terminal on veinlets, usually at sinus between the ones of ultimate segments; indusia pale, thin, acuminate.

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao).

Distribution.- Himalayas (type), Upper Myanmar and SW. China.

Ecology.- Epiphyte, on tree-trunks in Hill Evergreen forests at 1,300 m. altitudes.

Specimens examined.- P. Ratchata 189 (BCU).

2. **Araiostegia pulchra** (D. Don) Copel., Phil. J. Sci. 34: 241. 1927; Tagawa & K. Iwats., Acta Phytotax. Geobot. 24: 180. 1970; Tagawa & K. Iwats., Fl Thailand 3(2): 154. 1985.—*Davallia pulchra* D. Don, Prod. Fl. Nepal.: 11. 1825.—*Leucostegia pulchra* (D. Don) J. Sm., J. Bot. 1: 426. 1842; Beddome, Handb.: 52. f. 25. 1883.

Rhizome long creeping, about 5 mm in diam., bearing fronds remote, densely scaly throughout; scales dense, ovate or oblong-subdeltoid, round at both ends or round at base, acute at apex undulate or minutely irregularly

tooth at margin, pale brown or a little darker in central attached portion. **Stipe** jointed to rhizome, phyllopode 0.5 cm high, stramineous, scaly, densely at apex, up to 10 cm long; scales like those rhizome scales but acute at apex and darker. **Lamina** oblong-subtriangular, acute at apex, tri-to quadripinnate, about 20 by 14 cm; rachis like the upper part of stipe, scaly; lateral pinnae about 10 pairs, alternate, lower ones the largest, oblong-lanceolate, patent, falcate on lower part, moderately acute at apex, stalked, basal ones asymmetrically oblong-subtriangular, up to 7 by 4.5 mm; pinnules patent, ascending, stalked, ovate or oblong-ovate, moderately acute at apex, broadly cuneate anteriorly and dimidiate posteriorly at base, about 8 pairs, alternate; secondary pinnules ovate, sessile, cuneate at base, round at apex; ultimate segments with a few lobes, sessile, round to moderately acute at apex, cuneate at base; lobes entire, acute at apex, about 0.5 mm broad; veins free; texture herbaceous to softly papyraceous, glabrous, yellow green to pale green. **Sori** terminal on veinlets, one for each lobe, up to 1 mm broad; indusia small, thin, membranous, round at apex, usually broader than long, entire, attached at base only, sometime completely hidden under sori at maturity. **Photo 36.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao, Doi Phahom Pok, Doi Suthep, Doi Hua Mot), Mae Hong Son (Bo Luang), Lamphun (Doi Khun Tan), Tak (Ban Musoe, Rahaeng); NORTH-EASTERN: Loei (Phu Luang); SOUTH-WESTERN: Kanchanaburi (Bo Rae).

Distribution.- Himalayas (type from Nepal) to Yunnan and Indochina.

Ecology.- Epiphyte, on mossy tree-trunks in rather dry forests at 1,200-1,400 m altitudes.

Vernacular.- Kut long (กูดลอง), kut yung (กูดยุง) (Northern).

Specimens examined. P. Ratchata 305, 309; T. Boonkerd 34 (BCU).

DAVALLIA

Sm., Mem. Acad. Turin. 5: 414. 1793.

Rhizome long-creeping, densely scaly throughout; stipes glabrous, scaly at base, articulated to rhizome; fronds deltoid, slightly dimorphic, pinnately decomposed; veins free; sori terminal on veinlets; indusia cup-shaped, attached by base and side.

Davallia trichomanoides Blume, En. Pl. Jav.: 238. 1828; Holttum, Rev. Fl. Malaya 2: 361. 1960.

Key to the varieties

1. Scales with long paler hairs at margin; hairs longer than the breadth of scales; ultimate segments very shallowly lobed..... **1. var. *lorrainii***
1. Scales bright brown, entire or minutely short-hairy at margin; ultimate segments lobed more than half-way towards midribs
..... **2. var. *trichomanoides***

1. Davallia trichomanoides Blume var. lorrainii (Hance) Holttum, Rev. Fl. Malaya 2: 361. 1960; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 86. 1958 Tagawa & K. Iwats., Fl Thailand 3(2): 163. 1985.—*Davallia lorrainii* Hance, Ann. Sci. Nat. 5: 254. 1866; Beddome., Handb.: 61. 1883.

Rhizome long-creeping, 3-4 mm in diam., densely scaly throughout; scales abruptly narrowing above the base forming long tails, peltate at base, long attenuate-acuminate at apex, dark except for those on young rhizome, with long paler hairs at margin, about 7 mm long, 1-1.2 mm broad; hairs longer than the breadth of scales. **Stipe** stramineous, or castaneous on basal portion, about 8-10 cm long, glabrous, scaly at base. **Lamina** slightly dimorphic, deltoid, about as wide as long, gradually narrowed from base to

apex, about 15 cm long and wide, tripinnate to quadripinnatifid; rachis stramineous, with narrowly winged throughout; pinnae 12-13 pairs, subopposite, lanceolate, gradually narrowly towards acuminate apex; basal pinnae the largest, normally 8 by 5 cm, short stalked; upper pinnae gradually smaller upwards; pinna-rachis green or paler, winged throughout; pinnules sessile, subacute at apex, cuneate at base; secondary pinnules sessile, round to moderately acute at apex, broadly cuneate at base, lobed at margin; lobes acute at apex, ultimate segments very shallowly lobed; veins once or twice forked, all free, slightly raised on upper surface, hardly distinct beneath; texture thin, subcoriaceous, green when living, yellow to brownish when dry, glabrescent; fertile lamina slender. **Sori** terminal on veinlets; indusia cup-shaped, about twice as long as wide, up to 2 by 0.5 mm. **Photo 38 and 42.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Suthep, Ban Chue Kai, Doi Pha Dam, Mae Rim), Lampang, Lamphun (Doi Khun Tan), Phitsanulok (Phu Miang), Tak (Ban Musoe); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); EASTERN: Nakhon Ratchasima (Khao Lotueng); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chon Buri (Si Racha), Rayong (Khao Chamao), Chanthaburi (Khao Sabap), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Khao Ngi Yai); PENINSULAR: Surat Thani (Ban Don), Nakhon Si Thammarat (Khao Luang, Ron Phibun).

Distribution.- Central Myanmar, Indochina and throughout Malesia (type from Malaysia).

Ecology.- Epiphyte, on mossy tree-trunks in light shade forests at 1,500 m. altitudes.

Specimens examined.- P. Ratchata 252, 332; K. Sridith 72 (BCU).

2. Davallia trichomanoides Blume var. **trichomamoides** Blume, En. Pl. Jav.: 238. 1828; Tagawa & K. Iwats., Fl Thailand 3(2): 163. 1985—*Davallia bullata* Wall. ex Hook., Sp. Fil. 1: 169. t. 50 B. 1846; Beddome., Handb.: 61.

f. 31. 1883.—*Davallia stenolepis* Hayata, Icon. Pl. Form. 4: 204. f. 138. 1914.

Rhizome long-creeping, up to 3 mm in diam., densely scaly throughout, bearing remoted of fronds; scales linear-lanceolate, gradually narrowing from peltate base to acuminate apex, bright brown, entire or minutely short-hairy at margin, about 5-6 mm long, 1 mm broad. **Stipe** about 4 cm long, stramineous, glabrous, scaly at base; scales like rhizome scales, sometime paler. **Lamina** deltoid, gradually narrowing towards acuminate apex, slightly dimorphic, about as wide as long, normally 12-15 cm long, quadripinnatifid; rachis green or paler, with narrowly winged throughout; pinnae oblong-lanceolate, 10-12 pairs, subopposite, closed and sometime overlapping, broadly cuneate and oblique at base, acroscopic pinnules larger, gradually narrowing towards acute at apex; basal pinnae the largest, about 6 by 4 cm, shortly stalked; upper pinnae gradually smaller upwards, ultimate pinna lobed to more than half-way towards rachis; pinnules subsessile or larger ones very shortly stalked, ovate-oblong, cuneate at base, moderately acute to acute at apex, patent; secondary pinnules sessile, round to moderately acute at apex, cuneate at base, lobed at margin, ultimate segments lobed more than half-way towards midribs, acute at apex; veins once or twice forked, distinct on lower surface, hardly distinct on upper surface; texture thin, papyraceous to subcoriaceous, glabrescent, green, paler beneath; fertile lamina slender, stipe longer, up to 9 cm long. **Sori** terminal on veinlets, commonly longer than wide; indusia cup-shaped, about 1.5 by 0.5 cm. **Photo 43-44.**

Thailand.- NORTHERN: Chiang Mai (Doi Phahom Pok); PENINSULAR: Surat Thani (Ban Don).

Distribution.- Ceylon, Himalayas, Indochina (Tonkin) and Malesia (type from Indonesia).

Ecology.- Epiphytic on mossy tree-trunks in light shade forests at 1,250-1,350 m altitudes.

Specimens examined.- P. Ratchata 110, 156, 276, 312, 321, 324; T. Boonkerd 580 (BCU).

HUMATA

Cav., Descr. Pl.: 272. 1802.

Rhizome long-creeping, densely covered with scales, bearing stipes remotely; stipes articulate to rhizome, grooved, scaly; fronds simple, slightly dimorphic, oval or deltoid; fertile frond usually more dissected than sterile; veins free; sori round, along the margin of lobes; indusia nearly round, attached only by base.

Humata repens (L.f.) Diels in Pflanzenfam. 1(4): 209. 1899; DeVol & Yang, Fl. Taiwan vol. 1. 2nd ed.: 276. 1980; Holttum, Rev. Fl. Malaya 2: 371. f. 216. 1960; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 86. 1958; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 54. 1968; Tagawa & K. Iwats., Fl Thailand 3(2): 166. 1985.—*Adiantum repens* L.f., Suppl.: 446. 1781.—*Humata pedata* J. Sm., in Hook. Journ. Bot. 3: 416. 1841.—*Davallia pedata* Sw., in Hook., Sp. Fil. 1: 155. pl. 45a. 1846.—*Davallia repens* (L.f.) Kuhn, Fil. Deck.: 27. 1867. non Desv.: H. Christ. Bot. Tidsskr. 24: 111. 1901.—*Humata pinnatifida* Beddome, Handb. Suppl.: 12. 1892.

Rhizome long-creeping, 1-1.5 mm in diam., sparsely bearing fronds, densely scaly throughout; scales lanceolate, long-acuminate at apex, acuminate at base edges, light brown, about 5-6 mm long, 1-1.2 mm broad, edges entire or ferruginous at apical portion,. **Stipe** slender, stramineous, grooved, up to 3 cm long, sparsely scaly; scales subtriangular or deltoid, brown to pale brown, with ferruginous at margin, about 3 mm long, 1 mm broad. **Lamina** slightly dimorphic, ovate or deltoid, about 4 by 3 cm; rachis

winged throughout; pinnae oblong to oblong-subdeltoid, 3-5 pairs, subopposite; basal pinna the largest, oblong-subdeltoid, pinnatifid to pinnate; upper pinnae shallowly lobed or entire, gradually smaller upwards, sessile or adnate; basal pinnules of basal pinnae lobed in larger ones, lobed almost to the midrib; lobes slightly falcate, round to moderately acute, entire or crenulate, each basal lobes bearing a few secondary lobes; secondary lobes entire and rounded in sterile fronds, in fertile ones with minutely tooth each sorus; veins distinct on lower surface, simple, all free, the lateral veins branching from the soral veins just below the sorus and passing to the marginal tooth which flanks the sorus; texture coriaceous, surfaces more or less scaly when young, scattered minutely hairy throughout. **Sori** along the margin of lobes, a little inside the margin; indusia usually nearly round, or slightly widened above the base, the whole edges above the base free, up to 0.5 mm. **Photo 32-33.**

Thailand.- NORTHERN: Mae Hong Son (Doi Pha Dam), Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao, Doi Suthep, Doi Inthanon), Lampang, Lamphun (Doi Khun Tan), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Sabap), Trat (Ko Chang, Khao Kuap); SOUTH-WESTERN: Prachuap Khiri Khan (Khao Luang); PENINSULAR: Surat Thani (Khao Non Sao), Nakhon Si Thammarat (Khao Luang, Khiriwong), Phangnga (Takua Pa, Khao Phra Mi), Trang (Khao Chong), Yala (Gunong Ina, Khao Kala Khiri).

Distribution.- Widely distributed in the tropics of the Old World: Madagascar and Seychelles, Mascarene Islands, Himalayas to S. Japan (type), SE. Asia generally, through Malesia to Polynesia and Australia.

Ecology.- Epiphyte, on mossy tree-trunks in rather dry and open places at 980-1,550 m altitudes.

Vernacular.- Kut hom bai yoi (กุดหอมใบช้อย) (Northern); kut thong (กุดทอง) (North-eastern); nakkharat tua mia (นาคราชตัวเมีย) (South-eastern).

Specimens examined.- P. Ratchata 125, 184; T. Boonkerd 131, 467, 558, 582, 613, 1081, 1407; K. Sridith 106; K. Suwatabandhu 264 (BCU).

LEUCOSTEGIA

Presl, Tent. Pterid.: 94. 1836.

Rhizome creeping, covered with abundant long brown hairs and thin lanceolate brown scales, with hairy roots all over the surfaces; stipes articulated to rhizome; fronds tripinnate to decompose, glabrous, deltoid; ultimate segments not narrow; rachis and costa grooved on upper surface, borne on end of veinlets; indusia semi-circular, and attached by base and on lower 1/3 of side, reaching or surpassing the margin of segments.

Leucostegia immersa (Wall. ex Hook.) Presl, Tent. Pterid.: 95. t. 4. f. 11. 1836; Beddome, Handb.: 51. 1883; DeVol & Yang, Fl. Taiwan vol. 1. 2nd ed.: 279. pl. 98. 1980; Holttum, Rev. Fl. Malaya 2: 325. 1960; Tagawa & K. Iwats., Fl Thailand 3(2): 169. f. 12.5. 1985.—*Davallia immersa* Wall. ex Hook., Sp. Fil. 1: 156. 1846; Holttum, Rev. Fl. Malaya 2: 352. 1960.—*Davallia immersa* Wall. ex Hook., Sp. Fil. 1: 156. 1846.—*Humata dryopteridifrons* Hayata, Icon. Pl. Form. 6: 159. 1916.

Rhizome creeping, bearing fronds remotely, covered with hairs and scales; hairs rather dense, brown or golden-yellow, multicellular, woolly; scales lanceolate, broadest at base, gradually narrowing towards attenuate apex, about 3 by 1 mm, light brown, entire at margin. **Stipe** articulated to rhizome, stramineous or brownish on lower surface, scaly at base, glabrous upwards, up to 30 cm long. **Lamina** deltoid, acuminate at apex, quadripinnatifid, anadromous, up to 35 cm long; pinnae about 10 pairs, oblong-lanceolate or oblong-subdeltoid, the lowest the largest, with distinct petioles, lower ones asymmetrically oblong-subdeltoid, acuminate at apex, broadly cuneate at base, up to 15 cm long and wide; pinnules oblong-

subdeltoid, shortly stalked in larger ones, about 6 pairs, secondary pinnules oblong or narrower, about 3-4 segments; ultimate segments blunt or terminal ones spatulate, coarsely dentate at margin; veins free; texture thin, papyraceous or subherbaceous, light green, glabrous. **Sori** terminal on acroscopic veinlets, one to each segment; indusia circular or more or less oval, wider than broad, attached only by base, entire, white to pale brown, glabrous, about 2.5 mm broad. **Photo 34 and 37.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Pong Pa Po, Doi Suthep, Doi Inthanon, Sop Aep), Lamphun (Doi Khun Tan), Tak (Doi Musoe), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); SOUTH-WESTERN: Kanchanaburi (Bo Rae); PENINSULAR: Surat Thani (Ban Don).

Distribution.- S. India, E. Himalayas (type), SW. China. Myanmar, Indochina, W. Malesia to the Philipines, north to Taiwan.

Ecology.- Epiphytic on mossy tree-trunks in shaded areas in Hill Evergreen forest at 1,500-1,600 m altitudes.

Vernacular.- Kut Mak (กูดหมัก) (Northern).

Specimens examined.- P. Ratchata 310, 311; T. Boonkerd 497, 611, 612, 1039, 1235, 1266; K. Sridith 40 (BCU).

DENNSTAEDTIACEAE

Terrestrial ferns, rhizome slender, solenostelic, clothed with hairs; fronds monomorphic, pinnate to pinnately decompose, not articulated to rhizome, often branching by means of buds on proximal parts of petioles; veins free; sori terminal on the veins, with a cup-shaped or the other continuous along the margin and on the connecting-vein; indusia attach below and the side of the receptacles, or protected by the reflexed margin or naked.

Key to the genera

1. Sori round, terminal on veinlets
 2. Fronds pinnately compound, densely hairy on under surface, without indusia **1. HYPOLEPIS**
 2. Indusia cup-shaped, hairy, attached by base and sides; surfaces often hairy.....**2. MICROLEPIA**
1. Sori linear, thin, brown or paler, elongate along margin; indusia protected by the reflexed margin, continuous along the margin
.....**3. PTERIDIUM**

HYPOLEPIS

Bernh., Schrad. Neues J. 1: 34. 1806.

Rhizome long-creeping, solenostelic, hairy; stipe pubescent, grooved on upper surface; fronds pinnately compound, densely hairy on under surface; veins forked. all free; sori terminal on veinlets, near the margin of lobes, without indusia.

Hypolepis punctata (Thunb.) Mett. ex Kuhn, Fil. Afr.: 120. 1868; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 245. pl. 87. 1980; Holttum, Rev. Fl. Malaya 2: 318. 1960; Tagawa & K. Iwats., Fl Thailand 3(1): 124. f. 9:1-3. 1979.—
Polypodium punctatum Thunb., Fl. Jap.: 337. 1784.

Rhizome long-creeping, bearing a tuft of fronds, up to 3 mm in diam., densely covered with dark brown hairs throughout. **Stipe** stramineous, dark brown at base, paler on upper portion, puberulos, grooved on upper surface, 10-15 cm long. **Lamina** oblong-lanceolate, widest at base, acuminate at apex, bipinnate to tripinnate, 20 cm long, 15 cm wide; rachis like the upper part of stipe; lateral pinnae opposite, up to 8 pairs, lanceolate or subtriangular, acute at apex; larger pinnae up to 10 by 4 cm, round at base,

gradually narrowing towards apex; lower pinnae largest, upper pinnae gradually reducing in size; pinnules oblong-subtriangular, acuminate at apex, subtruncate at base, deeply lobed, lobed to more than 2/3 way towards costae; veins pinnate, distinct on both surfaces, densely hairy on under surface, upper surface with scattered hairs; texture herbaceous to papyraceous, green, paler beneath. **Sori** terminal on veinlets, near to the margin of lobes, exindusiate. **Photo 47.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Mae Lui); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Lung, Phu Kradung).

Distribution.- Tropics of the Old World generally, northwards to Japan (type) and Korea and southwards to New Zealand.

Ecology.- Terrestrial on marshy ground slopes in open areas at 980-1,100 m altitudes.

Specimens examined.- P. Ratchata 126; T. Boonkerd 48 (BCU).

MICROLEPIA

Presl, Tent. Pterid.: 124. 1836.

Rhizome creeping, solenostelic. covered with hairs; stipes hairy, rather closed, rachis shallowly grooved, margins of leaflets decurrent to a vary narrow wing on the rachis; fronds pinnate to pinnately compound, the acroscopic basal pinnules longer than the basisopic and at a broader angle to the pinna-rachis; veins forked, all free; sori terminal on veinlets, usually closed to margin of lobes; indusia cup-shaped. hairy, attached by base and sides, surface often hairy.

Key to the species

1. Rhizome long-creeping. Frond pinnatifid; veins pinnate, main veins usually zig-zag, all free. Sori nearly at margin.....1. *M. calvescens*

1. Rhizome creeping. Frond bipinnate to quadripinnatifid; lateral pinnae up to 10-12 pairs
2. Frond bipinnate to tripinatifid in larger fronds; rachis grooved on upper surface, densely pubescent below; lateral pinnae 10-12 pairs, densely hairy on both surfaces **3. *M. strigosa***
2. Frond tripinnate to quadripinnatifid; costules densely hairy on both surfaces, hairy on under surface of lamina..... **2. *M. speluncae***

1. *Microlepia calvescens* (Wall. ex Hook.) Presl, Epim.: 95. 1849; Tagawa & K. Iwats., Fl Thailand 3(1): 114. f. 7:3. 1979.—*Davallia calvescens* Wall. ex Hook., Sp. Fil. 1: 172. t. 48. B. 1846.—*Microlepia marginalis* var. *calvescens* (Wall. ex. Hook.) Beddome, Handb.: 64. 1883.—*Microlepia marginata* var. *calvescens* (Wall. ex. Hook.) C. Chr., Ind. Fil.: 208. 1905.—*Microlepia marginata* auct. non (Houtt.) C. Chr.: Houttum, Dansk Bot. Ark 23: 233. 1965.—*Microlepia calvescens* var. *calvescens* Presl, Shieh Fl. Taiwan vol. 1. 2nd ed.: 248. 1980.

Rhizome long-creeping, about 4-5 mm in diam., bearing fronds 1.5-2 cm apart, densely covered with bright blackish-brown hairs. **Stipe** stramineous, about 20 cm long, grooved on upper surface, densely hairs at base like those on rhizome, hairs on upper part not so dense. **Lamina** oblong-lanceolate, pinnate to pinnatifid, aristulate or long acuminate at apex, broadly at base. 30-35 cm long, 15-20 cm wide; rachis stramineous, grooved above, scaly throughout, densely beneath, pinnae linear-lanceolate, gradually narrowing towards long acuminate apex, distinct stalked, broadly cuneate at acroscopic base and very narrowly cuneate at basisopic base; lateral pinnae about 15 pairs, the largest pinnae at base, larger pinnae straight, more or less ascending, about 13 cm long, 2 cm wide, lobed about half-way or almost completely to costa and to forms serrate at apical pinnae; costa densely pubescent, distinct on both surfaces; lobes obovate or orbicular, oblique,

slightly falcate, round to acute at apex, dentate at margin, up to 1 cm long, 0.5 cm broad; veins pinnate, main veins usually zig-zag, all free, distinct on both surfaces, minutely hairy; texture papyraceous, green, glabrous above, minutely hairy beneath. **Sori** terminal on veinlets, nearly at margin; indusia cup-shaped, hairy. **Photo 39.**

Thailand.- NORTHERN: Chiang Rai, Chiang Mai (Doi Suthep, Mae Raem), Lampang, Phisanulok (Thung Salaeng Luang, Salaeng Haeng); NORTH-EASTERN: Phetchabun (Phu Maing, Lom Kao), Loei (Phu Luang, Phu Kradung); SOUTH-WESTERN: Kanchanaburi (Klang Dong); PENINSULAR: Phangnga (Khao Bangto).

Distribution.- E. Himalaya (type), Upper Myanmar, China (Yunnan & Kwangsi), Taiwan and Vietnam, Indonesia.

Ecology.- Terrestrial on dry mountain slopes in open areas at 1,160 m. altitudes.

Specimens examined.- P. Ratchata 247; T. Boonkerd 1116. 1308; S. Arkakraisri 990, 100, 101 (BCU).

2. Microlepia spelunca (L.) Moore, Ind. Fil. 93. 1857; Beddome, Handb.: 67. 1883; E. Smith, J. Siam Soc. Nat. Hist. Suppl. 8: 3. 1929; Houttum, Rev. Fl. Malaya 2: 314. 1960; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 54. 1968; Tagawa & K. Iwats., Fl Thailand 3(1): 118. f. 7:7.8. 1979; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 250. 1980.—*Polypodium spelunca* L., Sp. Pl. 2: 1093. 1753.—*Microlepia hancei* Prantl, Arb, Bot. Gart. Breslau 1: 35. 1892.—*Microlepia spelunca* var. *hancei* (Prantl) C. Chr. & Tardieu, Not. Syst. 6: 9. 1937; Houttum, Rev. Fl. Malaya 2: 315. f. 182. 1960.—*Microlepia pilosula* Presl ex Prantl, Arb. Bot. Gart. Breslau 1: 36. 1892.—*Microlepia spelunca* var. *pubescens* (Hook.) Sledge, Kew Bull. 11: 525. 1956.—*Microlepia spelunca* var. *villosissima* C. Chr., Gard. Bull. S.S. 4: 399. 1929; Houttum, Rev. Fl. Malaya 2: 315. 1960.

Rhizome creeping, thick, bearing rather closed fronds, densely hairy at apex, glabrescent in the older part. **Stipe** slightly castaneous, grooved on adaxial, up to 85 cm long, almost glabrous throughout, with two yellow ridge line paralleled the grooves. **Lamina** oblong-subtriangular or oblong with moderately acute apex, tripinnate to quadripinnatifid, up to 2.50 m long, 1.20 m wide; rachis like those stipes but paler on upper portion; pinnae linear-lanceolate, broadly at base, narrowing towards acuminate apex; lateral pinnae up to 10 pairs, the lower ones more than 15 cm apart, upper ones gradually reduced in size to form an indistinct apical pinna, the basal ones largest, distinctly stalked at base, up to 50 cm long, 17 cm broad, patent; costae like the upper part of rachis, densely hairy throughout; pinnules lanceolate to subtriangular; larger pinnules moderately caudate at apex, unequally cuneate at base, basal acroscopic lobed large, basispic ones smaller than the next anterior ones, pinnatisect to pinnate, with shortly stalked at base; costules densely hairy on both surfaces; ultimate lobes oblong, oblique, entire or obscurely undulate at margin, round at apex; veins pinnate, rather distinct and hairy below; texture papyraceous, green, hairy on the under surface of lamina. **Sori** terminal on veinlets or a little within the margin of lobes; indusia cup-shaped, hairy. **Photo 40.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Mae Nam Kok, Doi Phacho), Chiang Mai (Doi Chiang Dao, Doi Suthep, Mae Suai, Doi Inthanon, Wang Tao), Mae Hong Son (Mae Sariang), Lampang, Tak (Huai Krasa, Ban Musoe, Lan Sang); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chon Buri (Si Racha), Chanthaburi (Khao Soi Sao); PENINSULAR: Chumphon (Lam Lieng, Khao Thalu), Surat Thani (Ko Tao), Phuket (Khao Thong Lang), Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong), Satun, Narathiwat (Waeng, Bacho Falls), Yala (Bannang Sata).

Distribution.- Pantropic according to the current delimitation of the species

Ecology.- On rather dry slopes in open areas at 650-1,200 m altitudes.

Vernacular.- Kut Phi (กุดผี), kut Yi (กุดยี่), hora phak kut (โหรผักกุด) (Central); Chon(โชน) (South-wastern); neraphusi (เนระพูสี) (Peninsular).

Specimens examined.- P. Ratchata 10, 114, 143, 200, 217, 245; T. Boonkerd 452, 628, 711, 1246; S. Arkakraisri 16, 106, 107 (BCU).

3. **Microlepia strigosa** (Thunb.) Presl, Epim.: 95. 1849; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 251. 1980; Beddome, Handb.: 67. 1883; Holttum, Rev. Fl. Malaya 2: 310. f. 177. 1954; Tagawa & K. Iwats., Fl Thailand 3(1): 116. f. 8:2. 1979.—*Trichomanes strigosum* Thunb., Fl. Jap.: 339. 1784.

Rhizome creeping, about 7 mm in diam., bearing rather closed fronds, the apex densely covered with yellow brown hairs. **Stipe** slightly castaneous or brownish, rather roughly hairy towards the base, with shorter hairs near the apex. densely especially in the groove on upper surface. about 20 cm long. **Lamina** ovate-oblong to oblong-lanceolate in outline bipinnate to tripinatifid in larger fronds. about 45 cm long, 25 cm wide; rachis like the upper part of stipe, grooved on upper surface, densely pubescent below; pinnae linear-lanceolate, broadly at base, gradually narrowing towards long acuminate apex; lateral pinnae 10-12 pairs, alternate or subopposite at base, a few lower ones a little reduced or not, the upper ones gradually reducing in size, to form indistinct apical, the largest ones straight, ascending, distinctly stalked, up to 20 cm long, 5 cm wide, with numerous pinnules, up to 20 pairs; pinnules oblong-lanceolate or oblong-subdeltoid; larger pinnules acute to acuminate at apex, oblique, sessile, base unequally cuneate, lobed near the base about 4/5 way towards costa, less deeply towards the crenate apex; lobes round, undulate or crenate at margin; veins pinnate, veinlets forked, rather strongly raised below, pale, bearing stiff curved hairs, scattered above; texture softly chartaceous, deep green above, paler beneath, rather brown

when dry, densely hairy on both surfaces. **Sori** between the crenate of lobes, submarginal; indusia rather broadly cup-shaped, hairy. **Photo 41 and 45.**

Thailand.- NORTHERN: Chiang Mai (Doi Khun Huai Pong, Doi Suthep, Doi Inthanon, Doi Hua Mot), Lampang; EASTERN: Nakhon Ratchasima (Bu Phram); PENINSULAR: Chumphon (Khao Tong), Yala (Khao Kalakhiri).

Distribution.- Himalayas to Ceylon and Polynesia, northwards to Japan (type), Mainland China, Taiwan.

Ecology.- Terrestrial on humus-rich slopes in light shaded forests at 1,280-1,300 m altitudes.

Specimens examined.- P. Ratchata 150,168; T. Boonkerd 693, 710 (BCU).

PTERIDIUM

Gled. ex Scop., Fl. Carn. ed. 1.: 169. 1760, nom. cons; Tryon, Rhodora 43:1. 1941.

Rhizome long-creeping, solenostelic; stipes densely hairy: fronds bi-tripinnate; veins forked, all free; sori linear, thin, brown or paler, elongate long margin; indusia protected by the reflexed margin, continuous along the margin.

Pteridium aquilinum (L.) Kuhn, in Deck., Reis. Ost.-Afr. 3(3): 11. 1879; Holttum, Rev. Fl. Malaya 2: 389. f. 225. 1960.—*Pteris aquilina* L., Sp. Pl.: 1075. 1753; Beddome, Handb.: 115. 1883.—*Pteris esculenta* G. Forst., Pl. Escul.: 74. 1786.—*Pteridium esculentum* (G. Forst.) Nakai, Bot. Mag. Tokyo 39: 108. 1825; Holttum, Rev. Fl. Malaya 2: 390. f. 226. 1960; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 86. 1958.

Rhizome long-creeping, densely covered with brown hairs at apex, bearing rather remoted of fronds. **Stipe** stramineous to dark brown or nearly

black at base, up to 2 m long, densely hairy at base, the upper part not so dense. **Lamina** bipinnate to tripinnatisect in larger pinnae, quadripinnatifid at base, ovate in outline, round at base, gradually narrowing towards acuminate apex, up to up to 2 m long, 40 cm wide; rachis grooved above, glabrous or hairy in the grooves above; lateral pinnae linear-lanceolate, up to 30 pairs, subopposite, truncate at base, up to 30 cm long, 15 cm wide, oblique, gradually narrowing towards acuminate apex, the basal ones largest, with 3-3.5 cm stalked, straight, ascending, upper pinnae gradually reducing in size; pinnules 5 or more than 10 pairs, shortly stalked or sessile, deeply lobed closed to costa, with a narrowly winged; costae and costules grooved above, hairy in the grooves; lobes oblong, round to acute at apex, slightly falcate; terminal lobes indistinct; edges entire; veins free, forked, raised beneath, hardly visible on upper surface, hairy; texture subcoriaceous or herbaceous, pale green. **Sori** linear, elongate along margin; indusia thin brown or paler.

Key to varieties

1. Frond large; lateral pinnae more than 15 pairs
 2. Lateral pinnae up to 10 pairs; pinnules shortly stalked; terminal lobes indistinct.....**3. var. yarrabense**
 2. Lateral pinnae 20-30 pairs; pinnules sessile; terminal lobes more or less distinct **2. var. wightianum**
1. Frond smaller; lateral pinnae up to 7 pairs; pinnules shortly stalked, densely hairy on under surface. **1. var. latiusculum**

1. Pteridium aquilinum (L.) Kuhn **var. latiusculum** (Desv.) Shieh in Quart., Journ. Chi. For. 6(4): 98. 1973; Shieh in Fl. Taiwan vol. 1. 2nd ed: 255. pl. 91. 1980.—*Pteris latiusculum* Desv., Mém. Soc. L. 6(2): 303. 1827.

Photo 51.

Thailand.- NORTHERN: Chiang Mai (Doi Inthanon, Om koi); NORTH-EASTERN: Loei (Phu Kradung).

Distribution.- S. China, Japan, the Ryukyus, Taiwan, North America, and Europe.

Ecology.- Terrestrial on hill slopes in exposed areas at 1,280-1,350 m altitudes.

Specimens examined.- P. Ratchata 151; T. Boonkerd 1099 (BCU).

2. **Pteridium aquilinum** (L.) Kuhn var. **wightianum** (Agardh) Tryon, Rhodora 43: 22. pl. 650. f. & pl. 615. 1f. 3. map 2. 1914; Tagawa & K. Iwats., Fl Thailand 3(1): 126. f. 9:4,6. 1979.—*Pteridium aquilinum* (L.) Kuhn subsp. *wightianum* (Wall.) Shieh, in Quart., Journ. Chin. For. 6(4): 98. 1973; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 258. 1980.

Photo 46 and 50.

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Phacho), Chiang Mai (Doi Chiang Dao, Pang Ton, Doi Suthep, Doi Phahom Pok, Huai San, Chom Thong), Lampang (Doi Khun Tan), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Phetchburi (Phu Miang), Loei (Phu Kradung).

Distribution.- Himalayas to Malesia and Taiwan.

Ecology.- Terrestrial on hill slopes in exposed areas at 680-1,600 m altitudes.

Vernacular.- Kut kia (กุดเกี้ยะ) (Northern); chon (โชน), chon yai (โชนใหญ่) (Peninsular); lue-sun (ลือซัน) (Malay/Peninsular).

Specimens examined.- P. Ratchata 68, 91, 96, 115, 119, 263; T. Boonkerd 462, 463, 464, 1115, 1362; K. Sridith 108 (BCU).

3. *Pteridium aquilinum* (L.) Kuhn var. *varrabense* Domin, *Bibl. Bot.* 85 (1): 161. f. 32. 1914; Tagawa & K. Iwats., *Fl Thailand* 3(1): 126. f. 9:5,7. 1979.

Photo 48.

Thailand.- NORTHERN: Chiang Mai (Bo Luang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradung); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Trat (Ko Chang); PENINSULAR: Chumphon (Bang Son), Surat Thani (Ban Don).

Distribution.- Himalayas through Malesia to Australia.

Ecology.- Terrestrial on hill slopes in exposed areas at 670-1,280 m altitudes.

Vernacular.- Kut kin (กูดกิน) (Northern).

Uses.- Young fronds are locally cooked to substitute vegetable.

Specimens examined.- P. Ratchata 108, 153, 213; S. Akakraisri 146, 147, 148; T. Boonkerd 1096 (BCU).

DICKSONIACEAE

Terrestrial ferns, with stout trunks or prostrate rhizome, covered with a mass of hairs; stipes not articulate to rhizome; fronds large, pinnately decomposed; veins free; sori terminal on veins; indusia 2 lobed, outer lobes a continuation of the leaf margin and bent at about right angles to leaf surfaces.

CIBOTIUM

Kaulf., *Enum.*: 229. 1824.

Rhizome massive, large, cover with shining hairs; stipes thick, densely hairy, not jointed to rhizome; fronds large, pinnately decomposed; veins free; sori terminal on veins, submarginal; indusia of two nearly equal concave flaps, both of similar texture and both distinctly different in appearance from the green lamina of the frond.

Cibotium barometz (L.) J. Sm., Lond. J. Bot. 1: 437.1842; Beddome, Handb.: 24. f. 8. 1883; Holttum, Fl. Mal. 2: 114. f. 45. 1954; Rev. Fl. Malaya 2: 114. 1960; in Fl. Malesiana II. 1(2): 165. f. 33. a-c. 1963; Tagawa & K. Iwats., Acta Phytotax. Geobot 23: 52. 1968; in Fl Thailand 3(1): 109. f. 6:8-10. 1979; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 131. 1980.—*Polypodium barometz* L., Sp. Pl. 2: 1092. 1753.

Rhizome massive, prostrate, very large, bearing a tuft of fronds, very densely covered with golden hairs. **Stipe** thick, 1.20 m or more long, base densely covered with golden hairs like those on rhizome, the rest smooth and brownish when old, hairs on upper parts not so dense, gradually becoming shorter upwards. **Lamina** about 1.20 m long, 1 m wide, deeply tripinnatifid; rachis stramineous, appressed-hairy beneath, slightly grooved; pinnae many, largest pinnae up to 70 cm long, 25 cm wide, with numerous pinnules, lateral pinnae oblong-lanceolate, subtruncate at base, gradually narrowing towards acuminate apex, patent, subopposite; pinnules deeply pinnatifid throughout, very shortly stalked or sessile at posterior parts of pinnae, linear-lanceolate, gradually narrowing towards acuminate apex, broadly cuneate to subtruncate at base, about 13 cm long, 2 cm wide, all lobed almost to the costa; lobes oblong, oblique to subfalcate, acute at apex, shallowly but distinct dentate at margin, up to 3 cm long, 4 mm broad; costae and costules covered with pale, entangled, flaccid, appressed hairs below; veins distinct, forked, oblique, all free, sparsely hairy below; texture rather thick, subcoriaceous to papyraceous, glaucous in lower surface. **Sori** terminal on usually unbranched lower veins, paralleled to edge of lobes, 2-5 pairs on each fertile pinnules by two indusia; outer indusia round, paler, inner ones elongate at maturity, oblong. **Photo 49, 52-53.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Mae Nam Kok, Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Hua Mot), Lampang, Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN:

Phetchabun (Phu Miang), Loei (Phu Luang, Phu Kradung); EASTERN: Nakhon Ratchasima (Khao Laem); CENTRAL: NaKhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao), Trat (Ko Chang); PENINSULAR: Yala (Gunong Ina).

Distribution.- Himalayas to S. China and Taiwan, south to W. Malesia, north to the Ryukyus.

Ecology.- Terrestrial on hill slopes in rather dry ground or in light shaded areas, at 900-1,200 m altitudes.

Vernacular.- Kut phipa (กูดผีป่า), kut phan (กูดพาน) (NORTHERN); khon kai noi (ขนไก่น้อย) (North-eastern); hatsadaeng (หัตสแดง) (Eastern); la-ong faifa (ละอองไฟฟ้า), wan kai noi (ว่านไก่น้อย) (Central); kut sua (กูดเสือ), pho si (โพสี). ninla phosi (นิลโพสี) (Peninsular).

Uses.- Locally used for medicine, especially golden hairs used as a styptic for dressing wound.

Specimens examined.- P. Ratchata 69, 122; T. Boonkerd 53, 67, 369, 569, 575, 1300, 1405 (BCU).

DRYOPTERIDACEAE

Terrestrial ferns, covered with persistent leaf bases; rachis deeply grooved on upper side and usually open to receive rachillae groove, upper surface of rachis and costae, and also often other parts of the frond, covered more or less densely with multicellular hairs which are pale when living, rusty on dried or old fronds; fronds pinnate or more compound; veins free or variously anastomosing; sori round, dorsal or terminal on veins; indusia round or reniform.

Key to the genera

1. Frond dimorphic, pinnate, typically glabrous; veins free; sori round, dorsal on veinlets; indusia reniform **2. DRYOPTERIS**

1. Frond monomorphic or subdimorphic
 2. Frond monomorphic, without basiscopic lobes in lowest pinna
 3. Fronds tripinnate or more compound.....**1. ARACHNIODES**
 3. Fronds pinnate, hairy below with septate multicellular hairs
.....**3. PTERIDRYS**
 2. Frond pinnately decompound, basal pinna with large basiscopic pinnules of lowest pinna; veins free to variously anastomosing with or without included free veinlets.....**4. TECTARIA**

ARACHNIODES

Blume, En. Pl. Jav.: 241. 1828.—*Rumohra* Raddi, Opusc. Sci. Bologn. 3: 290. 1819.—*Polystichopsis* (J. Sm.) C. Chr. in Verdoorn, Man. Pterid.: 543. 1938.—*Bryopteris* Mort., Amer. Fern J. 50: 149. 1960.

Rhizome creeping; scales concolorous brown, entire; fronds tripinnatifid or more compound, anadromic in sequence of frond architecture or basal posterior pinnules interior to basal anterior ones; the ultimate pinnules usually rhomboid and aristate; veins free; sori round, terminal on the veins; indusia round-reniform.

Arachniodes henryi (H. Christ.) Ching, Acta Bot. Sin. 10: 258. 1962; Tagawa & K. Iwats., Fl Thailand 3(3): 342. f. 30.7-8. 1988.—*Polystichum henryi* H. Christ. in Lec., Notul. Syst. 1: 36. 1909.—*Rumohra henryi* (H. Christ.) Ching, Sinensia 5: 57. t. 10. 1934.—*Rumohra simulans* Ching, Sinensia 5: 54. pl. 8. 1934.—*Arachniodes simulans* (Ching) Ching, Acta Bot. Sin. 10: 259. 1962.

Rhizome short-creeping, up to 1 cm in diam., densely scaly throughout, bearing rather closed fronds; scales subtriangular, gradually narrowing from truncate base towards acuminate apex, entire, brown, about 5 mm long, 2 mm broad. **Stipe** stramineous, densely scaly at base, sparsely

scaly upwards, up to 55 cm long, grooved above; scales linear-lanceolate, gradually narrowing towards long attenuate-acuminate apex, entire, brown, about 8 mm long, 1 mm broad. **Lamina** oblong-ovate, caudate-acuminate at apex, broadest at base, 4-5 pinnate, up to 40 cm long, 90 cm wide at base; rachis glabrescent, grooved; lateral pinnae alternate, up to 9 pairs, oblong-lanceolate, broadest at base, gradually acuminate towards apex, up to 20 cm long, 10 cm wide, the lowest the largest, with stalked, up to 3 cm long, upper pinnae rather suddenly reduced to form apical part of frond, shortly stalked towards apex; pinnules lanceolate or oblong-subdeltoid, widest at base, unequally cuneate at base, distinctly stalked, gradually towards acuminate apex, the basal pinnules slightly smaller than the next one, up to 6 by 3.5 cm; secondary pinnules oblong-subdeltoid, moderately acute at apex, unequally cuneate at base, pinnatisect to pinnate at base, segments oblong, oblique, sessile, serrate at margin, lobed in larger ones; veins rather distinctly on both surfaces, all free, sparsely hairy on under surfaces; texture papyraceous, green, paler when dry, glabrous on both surface except on veins underneath. **Sori** round, terminal on veinlets, medial or close to margin, raised on upper surface; indusia round-reniform, glabrous. **Photo 54.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Hua Mot, Doi Suthep), Lampang (Mae Tia), Lamphun (Doi Khun Tan).

Distribution.- SW. China [Szechuwan (type), Hupeh], Upper Myanmar and N. Vietnam.

Ecology.- Terrestrial on rather dry mountain slopes or in light shaded areas at 900-1,500 m altitudes.

Specimens examined.- P. Ratchata 83, 87, 88, 111, 152, 179, 308 (BCU).

DRYOPTERIS

Adans., Fam. Pl. 2: 20, 551. 1763.

Rhizome short-creeping, covered with scales; fronds dimorphic, pinnate, typically glabrous; veins free; sori round, dorsal on veinlets; indusia reniform, attached at the inner end of sinus, usually persistent.

Dryopteris cochleata (D. Don) C. Chr., Ind. Fil.: 258. 1905; Tagawa & K. Iwats., Fl Thailand 3(3): 347. f. 31.3-7. 1988.—*Nephrodium cochleatum* D. Don, Prodr. Fl. Nepal.: 6. 1825.—*Lastrea filix-mas* var. *cochleata* (D. Don) Beddome, Handb.: 250. f. 130. 1883.

Rhizome short-creeping, ascending, bearing a tuft of fronds, scaly throughout; scales rather various in size and shape, mostly subtriangular to linear-lanceolate. light brown. with long pale brown hairy in apical portion, sometime divided into three or five at apex, about 1 cm long, 0.1 mm broad., **Stipe** stramineous, up to 20 cm sterile and 45 cm in fertile fronds, densely scaly at base, sparsely scales on upper portion, grooved above; scales like rhizome scales but larger in size, about 2 mm broad. darker. **Lamina** slightly dimorphic; sterile lamina bipinnatisect, oblong-lanceolate, acuminate at apex, up to 30 cm long, 18 cm wide; rachis glabrescent or minutely scaly. grooved above; lateral pinnae oblong-lanceolate, subtruncate at base, moderately caudately acuminate at apex, slightly falcate. up to 10 pairs, subopposite, deeply lobed nearly to costa; basal pinnae largest or slightly smaller than the next above, up to 10 by 3 cm, stalked; lobes oblong, oblique, tooth at margin, round at apex; veins pinnate, all free, indistinct on both surfaces; fertile lamina contracted, linear-lanceolate, up to 25 cm long; stipe taller, up to 40 cm long; pinnae deeply lobed near to costa, sometime pinnate at lower pinnae or narrowly winged throughout; veins indistinct on both surfaces. **Sori** in one row between midrib and margin, sometime

covered throughout on under surface; indusia large, reniform, up to 1 mm in diam., glabrous. **Photo 55 and 58.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Mae Lao, Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Ban Mae Kon, Bo Luang, Doi Kiu Lom, Wang Tao, Mae Klang, Doi Inthanon), Mae Hong Son (Khun Yuam, Pang Mapha, Pa Pae), Lamphun (Doi Khun Tan), Tak (Lan Sang); NORTH-EASTERN: Loei (Phu Kradueng).

Distribution.- Himalayas (type), Myanmar, S. China, Philippines and E. Java.

Ecology.- Terrestrial on humus-rich mountain slopes in rather dense forest at 900-1,280 m altitudes.

Specimens examined.- P. Ratchata 90, 240, 322; T. Boonkerd 1033, 1295 (BCU).

PTERIDRYS

(C. Chr.) C. Chr. & Ching, Bull. Fan Mem. Inst. Biol. 5: 125. 1935.—
Lastrea § *Pteridrys* C. Chr., Gard. Bull. S.S. 7: 243. 1934.

Rhizome erect to ascending; scales concolorous brown; fronds pinnately decompose; rachis grooved, hairy below with septate multicellular hairs; veins campteroide, basicopic branch of anterior basal vein meeting at sinus with that of posterior basal vein of next segments but never actually uniting, a prominent deltoid tooth at each sinus between adjacent pinnules; sori round, on short acroscopic branch of veins; indusia reniform, glabrous.

Pteridrys cnemidaria (H. Christ) C. Chr. & Ching, Bull. Fan Mem. Inst. Biol. 5: 136. pl. 12, 18(8-9), 20(19). 1934; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 116. 1968; Acta Phytotax. Geobot. 25: 78. 1972; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 338. 1980; Tagawa & K. Iwats., Fl

Thailand 3(3): 389. f. 37.1-3. 1988.—*Dryopteris cnemidaria* H. Christ, Bull. Acad. Geogr. Bot. 20: 140. 1910.

Rhizome short, ascending or erect, thick, densely scaly throughout; scales linear-lanceolate, gradually narrowing towards acuminate apex, about 1-1.3 cm long, 2 mm broad, edges entire, dark brown. **Stipe** pale green, stramineous when dry, grooved above, glabrescent, up to 1 m long, scaly at base; scales like rhizome scales. **Lamina** ovate-oblong or lanceolate-oblong, tripinnatifid, up to 1.30 m long, 70 cm wide, round at base, acute at apex; rachis like those stipe, grooved above, sparsely hairy; lateral pinnae linear-lanceolate, up to 26 pairs, upper and lower pinnae reduced, broadest at middle part of fronds, subtruncate at base, long caudate-acuminate at apex, with basal acroscopic in larger ones, deeply lobed towards costa, stalked up to 1.5 cm at basal pinnae; lobes oblong, acute to acuminate at apex, serrate at margin, with prominent sinus-teeth between lobed, up to 4 cm long in larger pinnae, patent, ascending, up to 35 cm long, 7 cm wide; basal pinnae shorter than the next above; upper pinnae shortly stalked and gradually reducing in size towards apex; terminal pinnae ovate-subdeltoid, acuminate and tailed at apex, round or broadly cuneate at base, up to 15 by 4 cm; costa raised on both surfaces, sparsely hairy or glabrescent; veins once or twice forked, all free, basal veins directly from costa, the anterior ones running to the sharp teeth at sinus; texture papyraceous, deep green, greenish-brown when dry, paler beneath, hairy on upper surface. **Sori** in one row on each side of costule; indusia pale, thin, glabrous, persistent.

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao).

Distribution.- Himalayas, SW. China (type from Kweichow), Taiwan, Upper Myanmar, and S. Vietnam.

Ecology.- Terrestrial on moist slopes in light shaded areas in rather dense forests at 680-740 m. altitudes.

Specimens examined.- P. Ratchata 29, 38, 47, 147 (BCU).

TECTARIA

Cav., Ann. Hist. Nat. 1: 115. 1799.—*Ctenitopsis* Ching, Bull. Fan Mem. Inst. Biol. 8: 304. 1938, p.p.

Rhizome erect or creeping, some always growing in crevices of rocks; scales basal, narrowly lanceolate, usually entire; fronds monomorphic to subdimorphic, pinnately decompose, basal pinna largest basisopic pinnules of lowest pinna often enlarged; veins free to variously anastomosing with or without included free veinlets; sori terminal on free included veinlets or on anastomosing veins, usually round; indusia round to reniform, attached by its sinus, fugaceous, persistent.

Key to the species

1. Vein free or anastomosing to form costal and costular areoles only
 2. Scales entire to subentire; veins anastomosing to form costal and costular areoles, other vein free..... **1. *T. devexa***
 2. Scales with pale ferruginous at margin; a row of costal areoles present in fertile and sterile frond **3. *T. fuscipes***
1. Vein copiously anastomosing to form areoles outside the costal and costular ones
 3. Frond deeply lobed; rachis winged throughout..... **2. *T. fauriei***
 3. Frond pinnate or tripinnatifid
 4. Frond pinnate; rhizome short-creeping
 5. Scales with pale ferruginous membrane at margin. Lateral pinnae 3-5 pairs **5. *T. polymorpha***
 5. Scales entire. Lateral pinnae up to 3 pairs **6. *T. angulata***
 4. Frond tripinnatifid. Sori terminal on free included veinlets, more or less raised on upper surface..... **4. *T. impressa***

1. **Tectaria angulata** (Willd.) C. Chr., Ind. Fil. Suppl. 3: 177. 1934; Holttum, Rev. Fl. Malaya 2: 511. f. 301. 1960; Tagawa & K. Iwats., Fl. Thailand 3(3): 373. f. 34.3. 1988.—*Polypodium angulatum* Willd., Sp. Pl. 5: 185. 1810.—*Aspidium angulatum* (Willd.) J. Sm. Ex Mett., Ann. Lugd. Bat. 1: 239. 1864.

Rhizome short, ascending, scaly at base; scales linear-subtriangular, about 15 by 1.6 mm, dark brown, entire. **Stipe** scabrous or nearly black, scaly at base. **Lamina** pinnate, oblong-ovate to oblong, about 45 by 40 cm; lateral pinnae 3 pairs, ascending, oblong, more or less falcate, rounded at base, caudately acuminate at apex, entire, shortly stalked or sessile, about 20 by 10 cm; basal pinnae bearing a single basiscopic lobe; terminal pinna larger, oblong-subdeltoid, caudately acuminate at apex, up to 25 by 12 cm, deeply lobed at base; veins distinct on lower surface, anastomosing with main areoles and smaller ones, included free veinlets numerous; texture papery, glabrous

Thailand.- NORTHERN: Lampang; PENINSULAR: Phuket (Khao Pok), Trang (Khao Chong), Satun, Yala (Bannang Sata, Betong).

Distribution.- Malesia (type from Java.).

Ecology.- On moist slopes in half-shaded areas at 650-850 m. altitudes.

Vernacular.- Kut Kaeo (กูดแก้ว), kut taem (กูดเต๋ม) (Northern).

Specimens examined.- P. Ratchata 120 (BCU).

Note.- Fertile frond not found on specimens.

2. **Tectaria devexa** (Kunze) Copel., Phil. J. Sci. 2C: 415. 1907; Holttum, Rev. Fl. Malaya 2: 505. f. 297. 1960; Tagawa & K. Iwats., Fl. Thailand 3(3): 366. 1988.—*Aspidium devexum* Kunze, Bot. Zeit. 6: 259. 1848.—*Polypodium membranaceum* Hook. in Blakist., Yang-tsze: 365. 1862, non

D. Don 1825.—*Pleocnemia membranacea* Beddome, Ferns Br. Ind. Suppl.: 15. 1876; Handb.: 225. 1883.

Rhizome short, erect, bearing a tuft of fronds, densely scaly at apex; scales linear-lanceolate, rather stiff, round at base, long attenuate at apex, about 6 mm long, 0.7 mm broad, dark brown to nearly black, entire to subentire. **Stipe** castaneous, 30-45 cm long, scaly at base, densely pubescent throughout; scales like rhizome scales. **Lamina** subdimorphic, oblong-subdeltoid, bipinnatifid, about 35 cm long, 22 cm wide; rachis winged at upper part, densely hairy throughout; lateral pinnae about 8-10 pairs, basal pinnae largest, asymmetrically oblong-subdeltoid, slightly falcate, acuminate at apex, unequally broadly cuneate at base, up to 15 by 8 cm, shortly stalked, with larger basispic pinnules; middle pinnae ascending, shortly stalked, oblong-lanceolate with caudate apex and broadly cuneate base, lobes 3/4 way towards costa; upper pinnae sessile to adnate at base; basal pinnules of larger pinnae free, shortly stalked, oblong-subtriangular to oblong-lanceolate; ultimate segments indistinct, caudate-acuminate at apex; costa and costules castaneous or paler, densely hairy throughout; segments oblique, oblong, acuminate at apex, crenate at margin, hairy throughout; texture thin, herbaceous, light green; veins anastomosing to form costal and costular areoles, other veins free. **Sori** terminal on free veinlets, medial or submarginal; indusia small, fugaceous.

Thailand.- EASTERN: Chaiyaphum (Nam Phrom, Phu Khieo); CENTRAL: Saraburi (Muak Lek); SOUTH-EASTERN: Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Sai Yok); PENINSULAR: Chumphon (Thap Li, Ko Wiang).

Distribution.- Ceylon, S. China, Indochina. Malesia (type), north to Taiwan and the Ryukyus.

Ecology.- Terrestrial on humus rich slopes near streams in shaded areas at 650-700 m altitudes.

Specimens examined.- P. Ratchata 2, 3 (BCU).

3. ***Tectaria fauriei*** Tagawa, J. Jap. Bot. 14: 102. 1938; DeVol & Kuo, Fl. Taiwan vol. 1. 2nd ed: 342. 1980; Tagawa & K. Iwats., Fl Thailand 3(3): 381. f. 35.6-7. 1988.—*Anapausia bonii* Nakai, Bot. Mag. Tokyo 47: 175. 1933.

Rhizome suberect, ascending, densely covered with scales at apex; scales linear-subtriangular, gradually narrowing towards attenuate-acuminate apex, about 1.2-1.5 cm long, 1.5 mm broad, entire, dark brown. **Stipe** brown, up to 60 cm below the basal lobes, winged in upper half or very narrowly nearly to the base, densely scaly at base, glabrescent upwards; scales like rhizome scales. **Lamina** pinnatisect with lateral lobes, up to 55 cm long, 25 cm wide; rachis winged throughout, wings up to 1 cm at each side, proliferous beneath; lateral lobes oblong; basal lateral lobes with basiscopic lobe, up to 30 cm long, 7 cm wide, subentire, falcate, with caudate apex, narrowly towards base; the terminal pinna oblong or obovate, subentire, gradually narrowing towards both ends, forming trifoliate at base decurrent into apical pinna, up to 25 by 9 cm; veins anastomosing to form main and small areoles with simple or branched included veinlets, main veins raised on both surface, veinlets distinct; texture herbaceous, green to deep green, glabrous. **Sori** terminal on included free veinlets or on anastomosing veins, in two rows between cross-veins, round; indusia small, glabrous. **Photo 56.**

Thailand.- NORTHERN: Chiang Rai (Mae Len), Chiang Mai (Tin Tok), Lampang, Phitsanulok (Thung Salaeng Luang).

Distribution.- N. India and Myanmar, Taiwan (type), Vietnam and the Ryukyus.

Ecology.- Terrestrial in wet sand along streams in evergreen forests at 680 m altitudes.

Specimens examined.- P. Ratchata 255 (BCU).

4. ***Tectaria fuscipes*** (Wall. ex Beddome) C. Chr., Contr. U.S. Nat. Herb. 26: 290. 1931; Tagawa & K. Iwats., Fl Thailand 3(3): 365. 1988.—*Aspidium fuscipes* Wall. ex Beddome, Ferns Br. Ind. Suppl.: 15. t. 366. 1876.—*Lastrea fuscipes* (Wall. ex Beddome) Moore ex Beddome, Handb.: 243. 1883.—*Ctenitopsis fuscipes* (Wall. ex Beddome) C. Chr. ex Tardieu & C. Chr., Not. Syst. 7: 87. 1938; DeVol & Kuo, Fl. Taiwan. vol. 1. 2nd ed.: 330. 1980.—*Pleocnemia membranifolia* auct. non Presl: Beddome, Handb.: 225. f. 115. 1883.—*Sagenia membranifolia* auct. non (Presl) H. Christ: Hosseus, Beih. Bot. Centr. 28(2): 366. 1911.

Rhizome suberect to ascending, densely scaly throughout; scales linear-lanceolate, stiff, about 6 mm long, 1 mm broad, long attenuate at apex, dark brown to nearly black, with pale ferruginous at margin. **Fron**d subdimorphic. Sterile frond: stipes about 15 cm long, stramineous, scaly on lower part, pubescent throughout; lamina bipinnatifid, oblong to oblong-lanceolate, acuminate at apex, broadest at base, up to 45 by 30 cm; lateral pinnae lanceolate, broadest at base, caudately acuminate at apex, up to 17 by 4.5 cm, lobed to 3/4 way to costa, about 8-10 pairs; upper pinnae adnate at base, and decurrent to the next to form indistinct apical portion; basal pinnae asymmetrically oblong-subdeltoid, about 17 by 7 cm, caudate-acuminate at apex, lobed to 4/5 way towards costa, bearing large basal basiscopic pinnules; segments oblong-subdeltoid, oblique, round to acute at apex, entire, up to 1 cm broad; texture herbaceous, deep green, hairy on upper surface; costa pubescent, a row of costal areoles present. Fertile frond taller; laminas narrower; veins all free. **Sori** dorsal on veinlets, round, rather irregularly dispersed on lower surface of pinna, about 1 mm diam.; indusia small, persistent. **Photo 63.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok), Chiang Mai (Doi Chiang Dao, Doi Suthep), Lampang (Mae Ngao), Phitsanulok (Thung Salaeng Luang), Tak (Ban Musoe); NORTH-EASTERN: Loei (Phu Luang, Phu

Kradueng), Nakhon Sawan; SOUTH-EASTERN: Chon Buri (Ang Chang Nam), Chanthaburi (Khao Soi Dao); SOUTH-WESTERN: Kanchanaburi (Wangka).

Distribution.- Sikkim (type) to S. China, east to Taiwan.

Ecology.- Terrestrial on rather dry slopes in humus rich ground in half shaded at 650-700 m altitudes.

Specimens examined.- P. Ratchata 64, 65, 141, 145, 192 (BCU).

5. ***Tectaria impressa*** (Fée) Holttum, Kew Bull. 43: 483. 1988; Tagawa & K. Iwats., Fl Thailand 3(4): 621. 1988.—*Phlebigoonium impressum* Fée, Gen. Fil.: 314. 1852.—*Aspidium variolosum* Wall.ex Hook., Sp. Fil. 4: 51. 1862; Beddome, Handb.: 216. f. 111. 1883.—*Aspidium subtriphyllum* forma *cuspidatopinnatum* Hayata, Icon. Pl. Form. 4: 189. f. 127. 1914.—*Tectaria variolosa* (Wall. ex Hook.) C. Chr.; Holttum, Fl. Mal. 2: 506. f. 298. 1954; Tagawa & K. Iwats., Acta Phytotax. Geobot. 21: 172. 1965; DeVol & Kuo Fl. Taiwan vol. 1. 2nd ed.: 346. 1980; Tagawa & K. Iwats, Fl. Thailand 3(3). 368. 1988.

Rhizome short, suberect or erect, ascending, up to 5 mm in diam., bearing fronds 0.8-1 cm apart, hairy throughout, densely at apex; scales linear, about 7 mm long, 0.7-0.8 mm broad, hairy at margin, rather stiff. bicoloured by nearly black central portion with brown ferruginous edges or concoloured brown. **Stipe** stramineous or pale castaneous, up to 15 cm long in sterile and up to 40 cm long in fertile fronds, densely scaly at base, pubescent on adaxial surface, glabrous on abaxial; scales like rhizome scales. **Lamina** slightly dimorphic, ovate-subdeltoid, pinnate, tripinnatifid at base, widely at base, gradually narrowing towards acuminate apex, up to 35 by 20 cm; rachis and pinna-rachis with dense articulated hairs above, sparsely so below; lateral pinnae usually 4 pairs, opposite; the basal pinnae much the largest, stalked. asymmetrically subtriangular, lobes aristulate at apex with one or two basal basiscopic pinnules; upper pinnae shortly stalked, deeply

lobed or with sessile basal baciscope pinnules, gradually reducing in size; terminal pinna ovate or subdeltoid, deeply lobed, cuneate at base; veins forming a fairly regular series of narrow costal and costular areoles, with included free veinlets; texture herbaceous to papyraceous, green, greenish-brown when dry, glabrous on lamina surfaces; fertile fronds all parts of lamina much contracted, the lobes almost all rounded, venation much simple than sterile fronds, consisting usually of a single and series of costal and costular areoles, the stipes longer. **Sori** terminal on free included veinlets, impressed, round, usually a single row at each side of midrib, more or less raised on upper surface; indusia reniform, persistent. **Photo 57, 59 and 60.**

Thailand.- All over the country.

Distribution.- N. India (type), SW. China, Indochina, Taiwan, W. Malesia to Java.

Ecology.- Terrestrial on dry mountain slopes in half-shaded areas at 650-850 m altitudes.

Vernacular.- Kut kwang(กูดควาง), kut kieo(กูดเกี้ยว), kut sang(กูดซาง), kut hok(กูดหอก), kut hom kha (กูดฮ่อมคำ) (Northern); chon pa (โชนป่า) (Penninsular).

Specimens examined.- P. Ratchata 112, 205, 290; T. Boonkerd 1037 (BCU).

6. Tectaria polymorpha (Wall. ex Hook.) Copel., Phil. J. Sci. 2C: 413. 1907; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 56. 1968; Tagawa & K. Iwats., Fl Thailand 3(3): 378. 1988.—*Aspladium polymorphum* Wall. ex Hook., Sp. Fil. 4: 54. 1862; Beddome, Handb.: 218. 1883.

Rhizome short-creeping, bearing rather closed of fronds, about 2 cm apart, up to 0.5 cm in diam., scaly throughout, densely at apex; scales in old rhizome ovate or elliptic, acuminate at apex, about 2 mm long, 1-1.2 mm broad, with pale ferruginous membrane margin, brown to dark brown, scales in apical rhizome lanceolate, acuminate at apex, about 5 mm long, 1

mm broad, margined with pale thinner edge about 0.3 mm broad, brown to dark brown. **Stipe** stramineous to dark brown, hairy on adaxial surface, glabrescent beneath, scaly at base and scattered on upper portion, up to 60 cm long; scales like rhizome scales except in size, about 6-7 mm long. **Lamina** ovate-oblong, imparipinnate, up to 50 cm long, 30 cm wide; rachis like the upper part of stipe; lateral pinnae elliptic-oblong, caudate at apex, broadly cuneate to rounded at base, patent, falcate, shortly stalked, broadest at 1/3 way from apex, edges entire or subentire, usually 3-5 pairs, about 25 by 6 cm, basal ones like lateral ones or more or less little; terminal pinna a little larger, broadest at 2/3 way from apex, up to 25 by 8 cm; veins copiously anastomosing, main areoles distinct including two rows of smaller areoles with free included veinlets, all veinlets raised beneath; texture papyraceous or chartaceous, deep green, paler when dry, glabrous. **Sori** on anastomosing veins or sometime on included free veins, irregularly scattered on lower surface of pinnae, round; indusia small, fugaceous, pubescent. **Photo 61, 62 and 65.**

Thailand.- NORTHERN: Chiang Rai (Mae Suai, Mae Kok, Doi Phacho), Chiang Mai (Doi Chong, Tha Ton, Khun Khong Sang, Doi Chiang Dao, Mae Son to Huai Sai), Tak (Ban Na, Ban Musoe), Phitsanulok (Thung Salaeng Luang), Nakhon Sawan (Pa Ma Kham Pom); NORTH-EASTERN: Loei (Phu Luang, Sam Phai, Phu Kradueng); CENTRAL: Nakhon Nayok (Khao Yai), Saraburi (Mauk Lek); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Khao Sabap, Takha Mao Falls); SOUTH-WESTERN: Kanchanaburi (Song Tho); PENINSULAR: Chumphon (Khao Tong), Surat Thani (Ban Don), Nakhon Sri Thammarat (Chawang), Trang (Khao Chong), Yala (Bannang Sata).

Distribution.- E. Himalaya (type) to S. China and Taiwan, south to Sri Lanka and W. Malaysia.

Ecology.- Terrestrial on rather dry mountain slopes or in half-shade areas along the streams at 700-1,100 m altitudes.

Vernacular.- Kut Kaeo (กูดแก้ว), kut taem (กูดแต้ม), kut kai (กูดไถ่), kut hua lek (กูดหัวเหล็ก) (Northern); kut hok (กูดหมก) (Shan/Northern); seng-khia-du (เซ็งเขียด) (Karen/Northern).

Specimens examined.- P. Ratchata 15, 78, 131, 295 (BCU).

GLEICHENIACEAE

Terrestrial ferns, usually growing on exposed hillsides, rhizome slender, usually growing near surface of soil, covered with branched hairs or fringed scales; stipes usually distant, slender, terete; fronds pseudo-dichotomously branched, with a dormant apical bud between branches; apical buds covered with hairs, ultimate branches pinnatifid, cut nearly to costa; veins free; sori on back of veins, exindusiate.

DICRANOPTERIS

Bernh.. Schrad. Neues J. Bot. 1(2): 26. 88. 1806.—*Gleichenia* subg. *Mertensia*, § III and § IV, Hook., Sp. Fil. 1. 11, 12. 1844.—*Hicriopteris* Presl, Epim. Bot. 26. 1851, non Ching, nec Copel.—*Gleichenia* subg. *Mertensia* sect. *Heteropterygium* Diels in E. & P., Pfl. Fam. 1, 4. 355. 1900.—*Gleichenia* subg. *Mertensia* sect. *Dicranopteris* Alderw., Handb. 56. 1908.—*Mesosorus* Hassk., Fil. Jav. 1.: 2. 1856.

Rhizome creeping, covered with hairs; frond pinnate or pseudo dichotomous, ultimate branches deeply pinnatifid, reflexed accessory leafly branches usually borne at base of fork; hairs on young parts of plants multicellular, various branched, scales lacking; veins free, more than one forked; sori on veins, without indusia.

Key to the species

1. Rachis-branches at any node equal; costules more than 5 mm apart **1. *D. curranii***

1. Rachis-branches at fork equal or unequal; costules less than 7 mm apart, a pair of accessory branches present at each fork, except in ultimate ones **2. *D. linearis***

1. *Dicranopteris curranii* Copel., Phil. J. Sci. 81:4. 1952; Holttum, Fl. Mal. II. 1: 31.1959; Tagawa & K. Iwats., Fl Thailand 3(1): 54. 1979.

Rhizome long-creeping, slender, bearing fronds usually more than 10 cm apart, covered with red-brown hairs, densely hairy at apex. **Stipe** stramineous to pale brown, shining, up to 50 cm long below the first fork; main rachis sometime very long, commonly short stalked, apical buds protected by a pair of deeply cordate bluntly lobed stipules, with lobes short or long, the dormant apex of rachis densely hairy; rachis-branches usually ceasing growth after the first internode, the opposite branches at any nodes equal; pinnae 2 or 3 cm long, 5-6 cm wide, deeply lobed, almost to the costa; lobes narrowly oblong to linear, round or retuse at apex, entire and sometime reflexed at margin, up to 3.5 cm long, 0.5 cm wide, the costules 6-8 mm apart; veins commonly 3 times forked, veinlets simple, more or less raised; texture chartaceous, green, lower surface slightly glaucous, glabrous. **Sori** medial or costular, dorsal at basal acroscopic veinlets. **Photo 69 and 73.**

Thailand.- CENTRAL: Nakhon Nayok (Khao Yai); PENINSULAR: Ranong (Muang Laen), Trang (Khao Chong), Yala (Bannag Sta).

Distribution.- Malesia (type from Luzon).

Ecology.- Terrestrial on dry slopes in open areas at edges of forests at 650 m altitudes.

Specimens examined.- P. Ratchata 234; T. Boonkerd 49, 1412 (BCU).

2. *Dicranopteris linearis* (Burm.f.) Underw., Bull. Tor. Bot. Club 34: 249. 1907; Beddome, Handb.: 4. f. 1. 1883; Holttum, Fl. Mal. II. 1: 33. f. 12, 14 f-

i: 1959; Tagawa, Acta Phytotax. Geobot. 22: 82. 1966; in Fl Thailand 3(1): 55. 1979.—*Polypodium linearis* Burm.f., Fl. Ind.: 235. t. 67. f. 2. 1768.—*Gleichenia linearis* (Burm.f.) Clarke, Tr. L. Soc. II. Bot. 1.: 428. 1880; Beddome, Handb.: 4. f. 1. 1883; Houttum, Rev. Fl. Malaya 2: 68. f. 16. 1995.

Rhizome long-creeping, up to 3.5 mm in diam., sparsely hairy, densely at apex. **Stipe** 15-65 cm long, terete, dark stramineous to brown, shining, glabrous. Primary rachis-branches usually twice or thrice forked, the two branches at all forks equal or nearly so; stipular leaflets at base of primary branches up to 1 cm long, lobes near the base only; ultimate segments linear, entire, round at apex, sometime retuse, about 4-4.5 mm wide, separated by rather wide sinuses; veins with very short hairs; texture firm, chartaceous or coriaceous, lower surface slightly glaucous, some persistent much-branched rusty hairs on costules. **Sori** medial or costular, dorsal at basal veinlets.

Key to the varieties

1. Veins slightly prominent on lower surface and bearing very short hairs, not prominent on upper surface **1. var. *linearis***
1. Veins rather strongly prominent on both surface; accessory branches always present at the bases of ultimate branches, opposite the fork or distinctly above it..... **2. var. *montana***

2.1. Dicranopteris linearis (Burm.f.) Underw. **var. linearis** (Burm.f.) Underw., Bull. Tor. Bot. Club 34: 249. 1907; Tagawa & K. Iwats., Fl Thailand 3(1): 56. 1979; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 90. 1980.—*Polypodium lineare* Burm.f. Fl. Ind. 235. t. 67. f. 2. 1768.—*Gleichenia hermannii* R. Br. Prod. 161. 1810.—*Gleichenia dichotoma* var. *normalis*

Mett. in Miq. Ann. Mus. Bot. Lugd. Bat.1: 50. 1863.—*Mertensia pteridifolia* Presl, Abh. (K.) Böhm. Ges. Wiss. M.- N. Cl. V, 5: 339. 1848.—*Gleichenia linearis* C.B. Clarke, Trans. L. Soc. Bot, 1: 428. 1880

Photo 67-68.

Thailand.- NORTHERN: Chiang Rai (Mae Ton, Doi Chang, Doi Tung, Doi Phacho), Chiang Mai (Doi Chiang Dao, Doi Hua Mot, Doi Suthep), Lampang (Thoen), Lamphun (Doi Khun Tan); NORTH-EASTERN: Loei (Phu Luang, Phu Krabung); SOUTH-EASTERN: Prachinburi (Khao Yai), Chanthaburi (Makham, Khao Sabap), Trat (Ko Chang); PENINSULAR: Ranong (Muang Laen), Chumpon (Ban Thung Maha), Surat Thani (Ban Don), Nakhon Si Thammarat (Khao Luang, Thung Song), Phuket (Ko Mak), Trang (Khao Chong), Yala (Bannang Sta, Padang Besar).

Distribution.- Tropical and subtropical regions of the Old World (type from Ceylon), north to Central Japan.

Ecology.- Terrestrial on dry slopes in open areas, at edges of foresta at 1,000-1,200 m altitudes.

Vernacular.- Kiku kachoei (กึ๊กกะเจ๊ย) (Karen/Northern); kut pid (กูดปัด), Kut muk (กูดหมึก) (Northern); kut taem (กูดแต่ม), chon lek (จ๋อ้นเหล็ก), chon (จ๋อ้น) (Peninsular); kuekae (กือแก), ruesaе (รือแซ) (Malay/Peninsular).

Specimens examined.- P. Ratchata 55; T. Boonkerd 1180, 1468, 1469 ; K. Suwatabandhu 257 (BCU).

2.2. Dicranopteris linearis (Burm.f.) Underw. **var. montana** Holttum, Reinwardtia 4.: 276. 1957; Tagawa, Acta Phytotax. Geobot. 22: 83. 1966; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 90. 1980.—*Gleichenia linearis* var. *montana* Holttum, Rev. Fl. Malaya 2: 69. 1960.

Photo 64.

Distribution.- Tropical Africa, Asia, Australia.

Ecology.- On rather dry mountain ridges at 975 m. altitudes.

Specimens examined.- P. Ratchata 127 (BCU).

HYMENOPHYLLACEAE

Epiphytic or Lithophytic ferns, rhizome creeping, with distant fronds; fronds simple to decompose, lamina usually 1 cell thick; veins free occasionally present as unattached false veins; sori marginal on vein ends enclosed by 2-valved or conic involucre, sporangia borne on an elongate or capitate receptacle.

Key to the genera

1. Rhizome creeping. Stipe hairy, not winged. Fronds pinnate; soral involucre 2 valvate; receptacles usually of limited growth and much shorter than the lip of the involucre **1. *HYMENOPHYLLUM***
1. Rhizome long-creeping. Fronds simple; soral with tubular, the mouth dilated; receptacle usually elongate considerably and protruding from old sori as a slender curved bristle **2. *TRICHOMANES***

HYMENOPHYLLUM

Sm., Mem. Acad. Turin. 5: 418. 1793.

Rhizome creeping, slender, epiphytic, root at intervals; stipe slender, hairy. short, not winged; fronds pinnate, with 1-veined ultimate segments; sori terminal on the segments, most commonly on basal acroscopic segments of upper pinnae, soral involucre 2 valvate, the halves roundish to ovate; receptacles usually of limited growth and much shorter than the lip of the involucre.

Key to the species

1. Receptacle included, involucre bivalvate, deeply cleft
 2. Stipe glabrous, polish; rachis glabrous; lip subdeltoid or ovate, deeply divided, sometime longer than the breadth.....**3. *H. polyanthos***
 2. Stipe densely on abaxial side; rachis hairy throughout; lip subtriangular acute to subacute at apex; receptacle as long as the lips **2. *H. exsertum***
1. Receptacle extruded; involucre tubular with bilabiate; lips subdeltoid, round to moderately acute at apex, entire **1. *H. acanthoides***

1. *Hymenophyllum acanthoides* (Bosch) Rosenst., Bull. Jard. Bot. Btzg. II. 2: 25, 1911; Houttum, Rev. Fl. Malaya 2: 20. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 612. 1989.—*Meringium acanthoides* (Alderw.) Copel.; Tagawa & K. Iwats., Fl Thailand 3(1): 78. f. 5:5. 1979.

Rhizome creeping or long creeping, covered with brownish hairs. **Stipe** terete, 1.3 cm apart. 0.5-1.2 cm long, narrowing winged almost to the base. **Fron**d variable in size and form, oblong-lanceolate to oblong subdeltoid, bipinnate to tripinnatifid, round to moderately acute at apex, cuneate to broadly cuneate at base, 2.5 by 1.5 cm; rachis winged throughout, with strongly crisped and deeply lobed to several segments, about 5-7 pairs; segments forked or trilobed; ultimate segments oblong or ovate, acute at apex, about 1 mm wide, conspicuously crisped at margin, decurrent at base to form wings of axes. **Sori** at apical part of fronds; involucre tubular with bilabiate lips, with accessory wings, cleft to half-way, about 1 by 1 mm; lips subdeltoid, round to moderately acute at apex, entire. **Photo 74.**

Thailand.- PENINSULAR: Nakhon Si Thammarat (Khao Luang), Yala (Betong).

Distribution.- Tropics of Asia, Indonesia (type), to New Guinea, north to Taiwan.

Ecology.- On moist mossy rocks near streams in dense forests at 800-820 m. altitudes.

Specimens examined.- P. Ratchata 344 (BCU).

2. **Hymenophyllum exsertum** Wall. ex Hook., Sp. Fil. 1: 109, pl. 38A. 1844. Beddome, Handb.: 30, f. 16. 1883; Holttum Rev. fl. Malaya 2: 86. f. 28. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 611. 1989.—*Mecodium exsertum* Copel., Phil. J. Sci. 67: 23. 1938; Tagawa & K. Iwats., Fl Thailand 3(1): 73. f. 5:13. 1979.

Rhizome long-creeping, slender, black when dry, hairy throughout, densely at apex, with distant fronds; scales small, filiform, brown, about 1 mm long. **Stipe** slender, about 1 cm long, sparsely hairy, densely on abaxial sides, sometime winged on the upper part. **Lamina** very variable in shape and size, usually oblong-lanceolate to oval or elliptic, round to acute at apex, about 25 cm long, 1.5 cm wide; rachis like the upper part of stipes, hairy throughout, more densely on abaxial sides, winged throughout, wings of upper part broader, to 1 mm on both side; pinnae pinnatifid, up to 8 pairs, spreading, closed and sometime overlapping, pinnate at basal pinnae, oblong to oblong-lanceolate, with broadly winged sinuous rachis, hairy beneath, slightly falcate, round to moderately acute at apex, commonly 2 cm long, 0.5 cm wide; pinnules about 5 pairs, in larger ones pinnatifid, close, rather shallowly lobed with short close, lobed to 0.8 by 0.5 mm, entire, flat, hairy on every axis, rather sparsely on upper axis, brown; lower pinnae sometime reduced and more widely spaced; main veins distinct, raised on both surfaces; texture thin, papyraceous, green, yellowish or pale brown when dry; glabrous. **Sori** many, usually on upper side of pinnae, very shortly lobes, dispersing near rachis outwards, sometime constricted below the sorus; involucre bilabiate; lips subtriangular, acute to subacute at apex, edges

entire, about 1.5 mm long, 1 mm wide; receptacle as long as the lips. **Photo 70-71.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Phacho), Mae Hong Son (Doi Khun Huai Pong), Chiang Mai (Doi Phahom Pok, Doi Suthep, Doi Inthanon, Doi Chang), Lamphun (Doi Khun Tan), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradung); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao), Trat (Khao Kuap); SOUTH-WESTERN: Kanchanaburi (Khao Ri Yai); PENINSULAR: Krabi (Phanom Bencha), Ranong (Khao Photo Chongdong), Nakhon Si Thammarat (Khao Luang), Trang (Khao Sung, Khao Chong).

Distribution.- N. India (type from Nepal), S. China, Upper Myanmar, Indochina, south to Malaysia.

Ecology.- On mossy tree trunks in open areas at 1,500-1600 m. altitudes.

Specimens examined.- P. Ratchata 186; T. Boonkerd 93 (BCU).

3. **Hymenophyllum polyanthos** (Sw.) Sw., Schard. J. Bot. 1800(2): 1801; Beddome, Handb.: 30. 1883; Holttum, Rev. Fl. Malaya 2: 81. f. 23. 1960; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 85. 1958; Tagawa & K. Iwats., Fl Thailand 3(4): 611. 1989.—*Trichomanes polyanthos* Sw., Prod. Fl. Ind. Occ.: 137. 1788.—*Mecodium polyanthos* (Sw.) Copel., Phil. J. Sci. 67: 19. 1938; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 127. 1980; Tagawa & K. Iwats., Fl Thailand 3(1): 70. 1979.

Rhizome creeping, slender, terete, less than 0.2 mm in diam., with hairy rootlets. **Stipe** 1-2.5 cm long, wingless or except the uppermost part, glabrous, polish. **Lamina** oblong-subdeltoid, tripinnatifid, variable in side and shape, about 1.5-2 by 1.5 cm long; rachis winged throughout, wings narrow, entire, flat; pinnae about 5 pairs, broadest at middle part of fronds, reducing in size both upwards and downwards, the larger ones oblong-

subdeltoid or oblong-lanceolate; ultimate segments linear or narrowly lanceolate, round to obtuse at apex, the margin entire and flat, about 1 mm broad; texture herbaceous, green, glabrous. **Sori** scattered on the upper part of fronds; involucre subdeltoid or ovate, bilabiate, deeply divided, about 1.5 by 1.5 mm, sometime longer than the breadth; lips subtriangular, acute at apex, entire; receptacle clavate, included. **Photo 75.**

Thailand.- NORTHERN: Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon); NORTH-EASTERN: Loei (Phu Luang, Phu Kradung, Phu Tong); CENTRAL: Nakhon Nayok (Khao Khieo); SOUTH-EASTERN: Chanthaburi (Khao Sabap), Trat (Khao Kuap); SOUTH-WESTERN: Kanchanaburi (Khao Ri Yi); PENINSULAR: Chumphon (Langsuan, Pang Wa), Surat Thani (Khao Nong, Ban Don), Nakhon Si Thammarat (Khao Luang).

Distribution.- Tropics or subtropics throughout the world (type from Jamaica), north to central Japan.

Ecology.- On mossy tree-trunks in light shade areas at 1,000-1,200 m altitudes.

Specimens examined.- P. Ratchata 302, 328; T. Boonkerd 47 (BCU).

TRICHOMANES

L., Sp. Pl.: 1907. 1753.—*Vandenboschia* Copel., Phil. J. Sci. 67: 51. 1938.

Lithophyte, rhizome long-creeping; fronds minute, simple, lobed, false veins present; soral with tubular, the mouth dilated; receptacle usually elongate considerably and protuding from old sori as a slender curved bristle.

Trichomanes bimarginatum Bosch, Ned. Kruid. Arch. 5: 143. 1861; Holttum, Rev. Fl. Malaya 2: 92. 1960; Tagawa & K. Iwats., Fl Thailand 3 (4): 614. 1989.—*Microgonium bimarginatum* Bosch, Hymen. Jav.: 7. 1861; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23. 51. 1968., in Fl. Thailand. 3 (1): 95. 1979; DeVol, Fl. Taiwan vol. 1. 2nd ed.: 109. 1980.

Rhizome long-creeping, slender, densely covered with short brownish hairs, bearing fronds 3-5 mm apart. **Stipe** slender, about 2-4 mm long, sparsely hairy throughout, narrowly winged in the upper part. **Fron**d small, up to 1 cm long including stipes, simple, almost circular to oblong-subdeltoid in outline, round to broadly cuneate at base, with few lobes, more or less fan-shaped to pinnate in branching; lobes with submarginal more or less interrupter false veins and a few other very short ones, lobed to 1/3 way to costae, 3-6 segments, oblong, round to moderately acute at apex, entire; false veinlets present, many, the marginal one continuous with a single row of marginal cell outside the stand, joining the ends of oblique ones; texture thin, translucent. **Sori** terminal on the lobes, sometime solitary at the apex of a frond, one on each apical part; involucre tubular, about 1 mm long, less than 0.8 mm in diam., with dilated mouth, immersed in fronds, which does not projected beyond the margin of the fronds, the mouth up to 1.2 mm in diam.; receptacle long extruded, dark brown, up to 1 mm long from dilated mouth. **Photo 72 and 76.**

Thailand.- PENINSULAR: Surat Thani (Khao Nong), Phangnga (Khao Bangto), Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong), Yala (Khao Kalakhiri).

Distribution.- Widely distributed in SE. Asia and Australia, Ceylon (type) to Samoa and Queensland.

Ecology.- Lithophyte, on the rocks near streams in dense forests at 820 m. altitudes.

Specimens examined.- P. Ratchata 224 (BCU).

LINDSAEACEAE

Terrestrial ferns; fronds pinnately decompose, the pinnae not articulated, pinnae always more or less symmetrical; veins free or anastomosing without included veinlets; sori marginal, terminal on the veins

or continuous round all or part of the margins of the fertile pinnae; indusia attached on the basal side of the sorus and opening towards the margin.

Key to the genera

1. Frond simply pinnate; sori along the margin of lobes; indusia narrow flap, opening outwardly, attached at base and side **1. LINDSAEA**
1. Fronds bipinnate; sori terminal on veinlets; indusia fixed by the base and more or less by the sides **2. SPHENOMERIS**

LINDSAEA

Dryand., Trans. Li. Soc. 3: 39. 1799; Sm., Mém. Ac. Turin 5: 401. 1793.—*Schizoloma* Gaudich., Ann. Sc. Nat. 3: 507. 1824.—*Isoloma* J. Sm., Hook. J. Bot. 3: 414. 1841.—*Odontoloma* J. Sm., Hook. J. Bot. 3: 415. 1841, nom subnud.—*Synaphlebium* J. Sm., in Hook. & Bauer. Gen. Fil.: pl. 101. 1842.—*Davallia* Sm. sensu Hook. Sp. Fil. 1: 151. 1845.—*Lindsaenium* (or *Lindsaynium*) Fée, Mém. Soc. Mus. Hist. Nat. Strasb. 4: 201. 1850.

Rhizome creeping, covered with scales; fronds pinnate, glabrous; veins anastomosing; sori marginal, terminal on single veins or on an intramarginal connecting-vein and then linear or even continuous along the margin; indusia narrow flap, opening outwardly, attached at base and side.

Lindsaea ensifolia Sw., Schrad. J. Bot. 1800(2): 77. 1801; Beddome, Handb.: 80. f. 41. 1883; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 260. 1980; Tagawa & K. Iwats., Fl. Thailand 3(2): 131. 1985.—*Adiantum cultratum* Willd., Phytogr. 14. pl. 10. f. 2. 1794.—*Adiantum ensifolium* (Sw.) Poir., Encycl. Suppl. 1: 139. 1810.—*Schizoloma ensifolium* (Sw.) J. Sm., Hook. J. Bot. 3: 414. 1841.—*Lindsaea griffithianum* Hook., Sp. Fil. 1: 219. t. 68B. 1846.—*Schizoloma griffithianum* (Hook.) Fée, Gen. Fil.: 108. 1852.—*Diplazium*

bantamense auct. non Blume: H. Christ, Bot. Tidsskr. 24: 108. 1901.—
Schizoloma ensifolia (Sw.) Alston, Bol. Soc. Brot. II, 30: 24. 1956.

Rhizome creeping or short-creeping, about 3 mm in diam., bearing fronds closed together, densely scaly throughout; scales linear-lanceolate, attenuate-acuminate at apex, rounded at base, about 2-2.5 mm long, 0.2 mm broad, entire, slightly shining. **Stipe** stramineous or castaneous at least at base, scaly at base, hairy throughout, grooved, slightly quadrangular, terete at base, up to 15 cm long; scales like rhizome scales. **Lamina** ovate to oblong-lanceolate in outline, pinnate; rachis stramineous, scattered small hairy throughout, grooved; pinnae linear-lanceolate, acute to caudately acuminate at apex, cuneate or rounded at base, oblique, sessile or with a short winged stalk, entire at margin, basal pinnae largest, up to 20 cm long, 2.0 cm wide; lateral pinnae 2-3 pairs, imparipinnate; terminal pinnae like lateral ones, rather variable, sometime larger or separate to bifid; costa stramineous, strongly raised beneath, with scattered small hairs; veins copiously anastomosing forming 2-4 rows of areoles at each side of costa, slightly prominent on both surfaces when dry, hardly visible in living fronds; texture subcoriaceous, pale green brown when dry. **Sori** continuous along the edges of pinnae; indusia firm, entire, almost reaching the edges of the lamina. **Photo 77.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Suthep, Buak Ha), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng), Nong Khai (Phon Phisai); EASTERN: Ubon Ratchathani, Chanthaburi (Khao Sabap, Makham, Phriu), Trat (Ko Chang, Ko Kut, Tha San falls, Ban Saphan Hin); SOUTH-WESTERN: Kanchanaburi (Khao Ngi Yai); PENINSULAR: Krabi, Ranong (Ko Chong Lat), Surat Thani (Ko Tao, Ban Don), Phuket (Ko Boi Noi), Nakhon Si Thammarat (Tha Samet), Trang (Tahbum), Satun, Yala (Ban Malao, Ban Chana).

Distribution.- Old World tropics from W. Africa (type from Mauritius) to Australia and Polynesia, north to the Ryukyus.

Ecology.- Terrestrial on rather dry slopes in open areas or in light shade at 800-1,050 m altitudes.

Vernacular.- Hang nok kaling (หางนกขี้ลิง) (Central).

Specimens examined.- P. Ratchata 60, 128; T. Boonkerd 40, 116, 117, 520, 736, 1014, 1243, 1261, 1304, 1389 (BCU).

SPHENOMERIS

Maxon, J. Wash. Acad. Sci. 3: 144. 1913. nom cons.; Copel., Gen. Fil.: 54. 1947.—*Davallia* Sm., Mém. Ac. Turin 5: 414. 1793.—*Stenoloma* Fée, Gen. Fil. 330. 1852.—*Odontosoria* Fée, Gen. Fil. 325. 1852.

Rhizome short, clothed with very narrow stiff shining dark brown scales; fronds pinnately decomposed, finally dissected; the ultimate pinnules or segments usually cuneate, glabrous; veins free; sori submarginal, terminal on a vein, or uniting the apices of 2-3 veins closed to the apex of base; indusia fixed by the base and more or less by the sides, opening towards the margin. usually about as long as the lamina of the lobes.

Sphenomeris chinensis (L.) Maxon, J. Wash. Acad. Sci. 3: 144. 1913; Kramer in Fl. Mal. II. 1. 182. f. 1-3. 1971.—*Trichomanes chinense* L., Sp. Pl.: 1099. 1753.—*Adiantum tenuifolium* (L.) J. Smith, Bot. Voy. Herald: 430. 1875.—*Stenoloma tenuifolium* (Lamk.) Fée, Gen. Fil.: 330. 1852.—*Adiantum chusanum* L., Sp. Pl.: 1095. 1853.—*Odontosoria chinensis* (L.) J. Smith, Bot. Voy. Herald: 430. 1857.—*Sphenomeris chusana* (L.) Copel., Bishop Mus. Bull. 59: 69. 1929; Holttum, Rev. Fl. Malaya 2: 341. 1955.—*Stenoloma chusanum* (L.) Ching, Sinensia 3: 337. 1933.—Tagawa & K. Iwats. Fl. Thailand, vol. 3.(2):147. 1985. f. 10.1

Rhizome short, clothed with very narrow stiff shining dark brown scales. **Fron**d subdeltoid in outline, the basal pinnae not conspicuously enlarged or much widened on the basiscopic side; pinnules deltoid, the basal acroscopic segments of leaflet larger than the basiscopic ones and at a wider angle to the pinnule-axis; ultimate lobes containing a single vein, or a vein once or twice forked; midrib of pinnules grooved, basiscopic edges of pinnules thickened towards the base and decurrent on the edges of the grooved rachis. **Photo 81.**

Ecology.- On humus rich slopes along the roads at 650 m. altitudes.

Specimens examined.- P. Ratchata 321 (BCU).

Note .- Fertile frond not found on specimens.

LOMARIOPSIDACEAE

Terrestrial or lithophytic or epiphytic ferns; rhizome erect or creeping or high-climbing, with 2 or more rows of leaves on the dorsal surface, the leaf-bases more or less decurrent as ridges on upper surface of the rhizome, or jointed to it; fronds pinnate, pinnae entire or more or less deeply lobed, in some cases jointed to the rachis; basiscopic edges of pinnae decurrent on a wing or ridge on either sides of the rachis; veins free or anastomosing. the areoles with or without free veins, young plants or new branches of old plant on or near the ground, bearing small fronds of different shape from those of adult plants; fertile fronds usually with longer stipes and narrower lamina; sporangia acrostichoid.

Key to the genera

1. Frond pinnate
 2. Rhizome short creeping; usually on rock. Fronds simple to bipinnatifid; often viviparous near apex **1. BOLBITIS**
 2. Rhizome climbing on trees **3. LOMAGRAMMA**

1. Frond simple; stipe jointed to rhizome; sporangia covering the whole lower surface of fertile fronds, mixed with short hairs.....
 **2. ELAPHOGLOSSUM**

BOLBITIS

Schott, Gen. Fil.: ad. t. 14. 1834.—*Egenolfia* Schott, Gen. Fil.: ad. t. 16. 1834.—*Campium* Presl, Tent. Pterid.: 238. pl. X. 22-23. 1836.

Rhizome short erect to creeping, covered with scales, bearing two rows of usually closed fronds on dorsal surface and numerous roots on ventral surface; scales usually concolorous, glabrous; stipes stramineous, scaly, not articulated to rhizome, with 2 grooves on upper side of stipes; fronds dimorphic; rachis with viviparous near apex; fertile fronds much contracted, with usually longer stipe than those of the sterile fronds; veins free, all forked, or anastomosing with or without included free veinlets; sporangia acrostichoid.

Key to the species and varieties

1. Vein all free
2. Scales entire; lateral pinnae truncate and auricled on the acroscopic side of base **1. *B. appendiculata***
2. Scales ferrugineous at margin; lateral pinnae rounded to subtruncate at base, deeply lobed to half-way towards costule
 **3. *B. sinensis* var. *costulata***
1. Vein anastomosing
3. Pinnae consisting of 5-6 pairs; apical pinna like lateral ones, with sometime bearing viviparous; veins reticulate with one to three included veinlets in each areole **4. *B. virens* var. *virens***

3. Frond with one or two pairs of lateral pinnae; apical pinna usually extended at the tip into a long narrowly prolonged, commonly viviparous **2. *B. heteroclita***

1. *Bolbitis appendiculata* (Willd.) K. Iwats., Acta Phytotax. Geobot. 18: 48. 1959; Hennipm., in Fl. Mal. II. 1: 322. f. 26b, 27d-f. 1978; Tagawa & K. Iwats., Fl Thailand 3(3): 316. 1988.—*Acrostichum appendiculatum* Willd., Sp. Pl. Ed. 4, 5: 114. 1810.—*Polybotrya appendiculata* (Willd.) J. Sm., J. Bot. 4: 150. 1841; Beddome, Handb.: 434. F. 255. 1883.—*Egenolfia appendiculata* (Willd.) J. Sm., Ferns Br. For.: 111. 1866; Holttum, Rev. Fl. Malaya 2: 459. f. 270. 1960; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 87. 1958.; DeVol & Kuo Fl. Tai. vol. 1. 2nd ed.: 350. Pl. 123. 1980.—*Polybotrya helferiana* Kunze, Farnkr. 2: 35. 1849.—*Polybotrya appendiculata* var. *helferiana* (Kunze) H. Christ, Bot. Tidsskr. 24: 109. 1901.—*Egenolfia helferiana* (Kunze) C. Chr., Contr. U.S. Nat. Herb. 26: 292. 1931.—*Polybotrya appendiculata* var. *marginata* (Blume) C. Chr., Bot. Tidsskr. 32: 343. 1916.—*Polybotrya marginata* Blume, En. Pl. Jav.: 100. 1828, nom. superf.—*Egenolfia appendiculata* var. *moniliformis* Tardieu & C. Chr. in Fl. Gen. I. -C. 7(2): 427. 1941.—*Acrostichum* sp. Hosseus, Beih. Bot. Centr. 28 (2): 363. 1911.

Rhizome erect or creeping, bearing a tuft of fronds, densely scaly throughout; scales linear-lanceolate, broadest at base, gradually narrowing attenuate acuminate apex, about 3-5 mm long, 0.5 mm broad, edges entire, light brown or grayish. **Frond** dimorphic; sterile fronds; stipes slender, green when living, stramineous when dry, bearing throughout scattered spreading scales, about 10 cm long; scales like rhizome scales; lamina oblong-lanceolate or gladiate, pinnate, long aristulate at apex, up to 35 cm long, 8 cm wide; rachis bearing scattered scaly throughout, winged at least on upper part, commonly viviparous near apex; pinnae spreading at right

angles to the rachis, alternate, sessile, up to 30 pairs, usually 4 cm long, 1.5 cm wide, basal ones slightly shorter than the next above, truncate and auricled on the acroscopic side at the base, very narrow or cuneate on basispic side, oblong to longer, or gradually narrowing from base to apex, the apex round or acute, margin crenate or gradually narrowing from base to apex, the crenations or lobes entire or with short teeth at the vein ending, slender tooth about 1.5 mm long, always present in each sinus; lobes shallow, round or acute at apex; the apical pinna variable in shape and size, usually narrowly subtriangular, sometime deeply lobed; veins forked, all free, passing to the sinus tooth, raised on both surfaces; texture thin, softly papyraceous, deep green when living, dark olivaceous when dry, glabrous; fertile fronds; stipes like sterile, taller, up to 15 cm long; lamina taller, up to 35 cm long, 4 cm wide, ensiform; rachis sparsely scattered scaly throughout, wingless, rarely viviparous; pinnae 27-30 pairs, indistinct, reduced to globose-shaped, adnate scattered along costa, about 1-3 mm broad, edges shallowly lobed; lobes sharply toothed, the apices of lobes acute to acuminate; veins hardly visible; texture rather thick, glabrous, dark brown. **Sporangia** at maturity dispersed on lower surface of pinnae or lobes, including midrib. **Photo 84.**

Thailand.- NORTHERN: Chiang Mai (Doi Suthep, Doi Intahnon), Lampang; NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang), Sakhon Nakhon (Pha Kham Hom); EASTERN: Nakhon Ratchasima (Pak Thong Chai), Chaiyaphum; SOUTH-EASTERN: Chanthaburi (Khao Sabap), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Sai Yok, Mae Nam Noi); PENINSULAR: Chumphon (Khao Nom Sao, Ban Krayae), Phangnga (Takua Pa, Ko Talibong, Khao Phra Mi), Phuket (Thalang), Nakhon Si Thammarat (Khao Luang, Khao Khi No, Khiriwong, Chawang), Trang (Khao Chong), Songkhla, Satun.

Distribution.- S. China, India to SE. Asia generally, throughout Malesia, northwards to Taiwan and the Ryukyus (type from India).

Ecology.- Lithophyte, on muddy rocks in the streams, in shady places in Moist Mixed Deciduous forests at 685 m. altitudes.

Specimens examined.- P. Ratchata 66 (BCU).

Note.- Fertile fronds narrow, 2-5 mm wide. these fertile pinnae are covered entirely with the sporangia except for the costa and very narrow margins.

2. **Bolbitis heteroclita** (Presl) Ching ex C. Chr., Ind. Fil. Suppl. III.: 48. 1934; Holttum, Rev. Fl. Malaya 2: 462. f. 271. 1954; Hennisman, Fl. Mal. II. 1: 325. f. 25d, 31a-g. 1978; DeVol & Kuo Fl. Taiwan vol. 1. 2nd ed.: 348. pl. 122. 1980; Tagawa & K. Iwats., Fl Thailand 3(3): 320. 1988.—*Acrostichum heteroclitum* Presl, Rel. Haenk. I.: 15. pl. 2. f. 2. 1825.—*Leptochilus heteroclitus* (Presl) C. Chr., Ind. Fil.: 385. 1906.—*Bolbitis koidzumii* Tagawa, Acta Phytotax. Geobot. 6: 93. 1954.

Rhizome long-creeping, up to 5 mm in diam., bearing a few remote fronds, or rather closely on some portions, densely scaly throughout; scales subtriangular, acuminate at apex, dark brown with narrow pale brown ferruginous near margin, about 4 mm long, 0.8 mm broad. **Fron**d dimorphic; sterile fronds: stipes stramineous, pale when dry, about 15-20 cm long, sparsely scaly on lower portion, densely at base; lamina lanceolate in outline, imparipinnate, with one or two pairs of lateral pinnae, apical pinna usually extended at the tip into a long narrowly prolonged, commonly viviparous; rachis and costa distinct on both surfaces, bearing scattered small appressed scales; pinnae gladiate-oblong, broadly cuneate to cuneate and shortly stalked at base, caudate or aristulate at apex, up to 20 cm long, 6 cm wide, almost entire or undulate, sometime with a few short teeth near usually often very long tailed with narrow linear tails 50-60 cm long, 1 cm broad, basal pinnae largest, terminal pinnae oblong; veins distinct on both surfaces, anastomosing forming costal and costule areoles, without included free

veinlets in areoles; texture herbaceous to papyraceous, glabrous, deep green, dark brown to blackish when dry; fertile frond: stipes stramineous, 20-25 cm long, sparsely scaly throughout, densely at base; scales large, about 5 mm long, 1 mm broad, with broad pale brown ferruginous margin; lamina taller, ovate-lanceolate in outline, imparipinnate; pinnae oblong to oblanceolate, with one or two pairs of lateral pinnae, apical pinna usually extended at the tip into a long narrowly prolonged, without viviparous, lateral pinnae up to 6 cm long, 1.5 cm wide; veins anastomosing, hardly visible, rather closely than sterile venation, edges entire or minutely sinuate; texture rather thick, dark brown to blackish. **Sporangia** spread over the whole undersurface of pinnae, except on costa, on apical pinnae the sporangia dispersed on lower portion, up to 1/2 way towards apex. **Photo 78 and 82.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok), Chiang Mai (Doi Chiang Dao), Lampang, Phitsanulok (Nakhon Thai, Thung Salaeng Luang); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chon Buri (Si Racha), Chanthaburi (Nam Tok Takhamao, Pong Nam Ron), Trat (Phriu Waterfall, Huai Raeng); SOUTH-WESTERN: Kanchanaburi (Khao Yai), Prachuap Khiri Khan (Khao Luang); PENINSULAR: Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong).

Distribution.- N. India, Upper Myanmar, S. and SW. China, Taiwan, Ryukyu, Indochina, throughout Malesia (type from Luzon) to New Guinea.

Ecology.- On muddy moist rocks in rather dense forests or near the streams in half-shade at 680-700 m altitudes.

Vernacular.- Kut pao (กูดป่า), kut hang nok kaling (กูดหางนกกะลิง) (Northern).

Specimens examined.- P. Ratchata 144, 219; T. Boonkerd 64, 444, 1324 (BCU).

3. Bolbitis sinensis (Baker) K. Iwats. var. **costulata** (Hook.) Tagawa & K. Iwats., Acta Phytotax. Geobot. 22: 102. 1967; Tagawa & K. Iwats., Fl

Thailand 3(3): 318. f. 26.5. 1988.—*Acrostichum appendiculatum* var. *costulatum* Hook., Sp. Fil. 5: 252. 1864.—*Polybotrya appendiculata* var. *costulata* (Hook.) Beddome, Ferns Br. Ind.: pl. 110. 1865; Handb.: 426. f. 257. 1883.

Rhizome creeping, up to 1 cm in diam., bearing remote fronds, densely scaly throughout; scales subtriangular, peltate at base, acuminate at apex, dark brown with narrowly brown ferruginous margin, about 4 mm long, 1 mm broad. **Fron**d dimorphic; sterile frond: stipes stramineous to castaneous, about 15 cm long, scaly throughout, densely at base; scales triangular with ferruginous margin, brown, about 3 mm long; lamina lanceolate, long aristulate towards apex, usually often viviparous at apex, up to 50 cm long, 25 cm wide, pinnate; rachis sparsely scaly, winged in upper portion; pinnae pinnatifid, about 11-15 pairs, subopposite, basal pinnae the longest, oblong, gradually narrowing towards apex, stalked, patent, slightly ascending, moderately acute to acuminate at apex, rounded to subtruncate at base, oblique, with a few basal anterior pinnae large, up to 18 by 4 cm in basal pairs, distinctly crenate in apical part, lobed in basal part; lobes oblique, round at apex, deeply lobed to half-way towards costule. lobes more or less serrate at margin, about 1 by 0.5 cm, closed to each other, with sinus teeth about 2 mm in ending-lobed; main veins raised beneath, sparsely minutely scaly, veinlets simple or forked, all free; texture deep green when living, dark brown when dried, herbaceous to papyraceous, glabrous; terminal pinna indistinct, deeply lobed, shallowly serrate at apical portion; fertile frond: stipes as sterile, but taller, up to 30 cm long; lamina taller, up to 15 by 7 cm; pinnae oblong to elliptic, rounded at apex, broadly cuneate at base, basal pinnae lobed, up to 4 cm lobe, 1 cm wide, subentire or very slightly waved at margin, terminal pinna narrowly subtriangular with lobed at base, about 4 cm long, lateral pinnae up to 10 pairs; veins simple, all free, not reaching to the edges of margin, visible; texture rather thick, with

distinctly cartilaginous margin, dark brown. **Sporangia** dispersed over the whole undersurface of pinnae. **Photo 79.**

Thailand.- NORTHERN: Chiang Mai (Doi Suthep), Phitsanulok (Thung Salaeng Luang).

Distribution.- Khasia and Lower Myanmar (type).

Ecology.- Terrestrial on humus-rich ground in rather dense forests at 700-720 m. altitudes.

Specimens examined.- P. Ratchata 35, 351 (BCU).

3. **Bolbitis virens** (Hook. & Grev.) Schott var. **virens** Gen. Fil.: ad. t. 14. 1834; Tagawa & K. Iwats., Fl Thailand 3(3): 314. 1988.—*Acrostichum virens* Wall. ex Hook. & Grev., Ic. Fil. II: pl. 231. 1831.—*Campium virens* (Hook. & Grev.) Presl, Tent. Pterid.: 239. 1836.—*Leptochilus virens* C. Chr., Ind. Fil.: 388. 1906.—*Bolbitis costata* auct. non (Presl) Ching: Holtum, Dansk Bot. Ark. 20: 30. 1961.

Rhizome erect or creeping, thick, fleshy, up to 1 cm in diam., bearing closed fronds, green, brown when dry, scaly throughout, densely at apex; scales linear-lanceolate, cordate at base, gradually narrowing towards attenuate apex, about 7 mm long, 1 mm broad, entire or sometime ferruginous. **Fron**d dimorphic; sterile frond: stipes stramineous, up to 55 cm long, bearing scattered appressed scales, scaly throughout, densely at base; scales lanceolate, peltate at base, attenuate-acuminate at apex, ferruginous at margin, irregular in shape, about 6 mm long, 1-1.2 mm broad, light brown; lamina ovate or elliptic, acute at apex, about 25-35 cm long, 20-35 cm wide; rachis stramineous, bearing scattered scaly throughout; pinnae pinnate, alternate, gladiate, gradually narrowly to both ends, aristulate at apex, broadly cuneate to attenuate at base, straight, ascending or patent in lower ones, consisting of 5-6 pairs, the lowest pinnae with stalks to 5 mm, the upper sessile, terminal pinna like lateral ones, with sometime bearing

viviparous, the margins sinuate to crisped or more or less waved, with cartilaginous, toothed only towards the apex; costa strongly raised beneath, minutely scaly throughout; main veins straight, 2-6 mm apart, veins slightly raised on under surface, reticulate with one to three included veinlets in each areole; texture papyraceous, glabrous, green, drying rather light green; fertile fronds: stipes like sterile but taller, usually more than 55 cm long; lamina linear-lanceolate in outline; pinnae linear, acuminate at apex, attenuate at base, 5-6 pairs, about 13 by 0.5 cm, terminal ones longer, the lowest pinnae with stalks to 5 mm, the upper sessile. rarely viviparous at apical pinnae, the margin strongly crisped and commonly reflexed when dry; veins as in sterile but with closed; texture rather thick, softly papyraceous. **Sporangia** completely covered on the whole undersurface of pinnae, except for the costa. **Photo 80 and 83.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Suthep), Lamphun (Doi Khun Tan), Phrae (Mae Sai), Tak (Kuai Krasa); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao); SOUTH-WESTERN: Kanchanaburi (Khao Yai, Sai Yok); PENINSULAR: Surat Thani (Khao Hua Hhwai).

Distribution.- Yunnan, Chittagong, and Myanmar (type).

Ecology.- Terrestrial on humus-rich ground in evergreen forests or on moist rocks near the streams at 680-780 m altitudes.

Vernacular.- Kut ngong (กูดง) (North-eastern).

Specimens examined.- P. Ratchata 5, 6, 14, 36, 67, 221; T. Boonkerd 412, 1537, 1567 (BCU).

ELAPHOGLOSSUM

Schott ex J. Sm., Gen. Fil.: ad. t. 14. 1834; Beddome, Handb. Ferns Br. India: 416. 1883.—*Olfersia* Presl, Tent. Pterid.: 232. 1836. max., non Raddi.—*Aconiopteris* Presl, Tent. Pterid.: 236. 1836.—*Acrostichum* (non L.)

Fée, Hist. Acrost. 8, 27. 1845.—*Dictyoglossum* J. Sm. Bot. Mag. 72. Comp. 18. 1846.

Ephiphytes on tree trunks or lithophytes; rhizome creeping, scaly; stipes closed together, swollen at base, jointed to rhizome, grooved on the upper side; fronds dimorphic, simple; fertile fronds the same shape as sterile ones of the same species but narrower and shorter; veins simple; sporangia covering the whole lower surface of fertile fronds, mixed with short hairs.

Key to the species

1. Frond densely covered on both surface with brown long-armed stellate hairs; margin without distinct cartilaginous membrane . **1. *E. stelligerum***
1. Frond with cartilaginous membrane, sparsely scaly beneath.....
..... **2. *E. yoshinagae***

1. Elaphoglossum stelligerum (Wall. ex Baker) Moore ex Alston & Bonner, Candollea 15: 216. 1956; Tagawa & K. Iwats., Fl Thailand 3(3): 304. 1988.—*Acrostichum stelligerum* Wall. ex Baker in Hook. & Baker, Syn. Fil. ed. 2: 521. 1874. —*Elaphoglossum yunnanense* (Baker) C. Chr., Contr. U.S. Nat. Herb. 26: 327, 335. 1931.—*Elaphoglossum viscosum* auct. non J. Sm.: Beddome, Handb.: 420. f. 250. 1883.

Rhizome short-creeping, about 0.3 cm diam., bearing fronds closed together, densely scaly throughout; scales linear-lanceolate, gradually narrowing from round base towards long attenuate apex, about 6 mm long, 0.6 mm broad, subentire, light brown to reddish-brown. **Fronds** simple, dimorphic: Sterile fronds; stipes stramineous to pale brown, short, about 1-2.5 cm long, with narrowly winged on upper part, densely scaly throughout; scales various, like those on rhizome; lamina linear-lanceolate, broadest at middle portion, gradually narrowing towards both ends, attenuate-acuminate

at apex, narrowly cuneate at base, up to 25 by 1.5 cm; midribs raised on both surfaces, densely covered with long-armed stellate scales; veins slightly visible underneath, simple or a few times forked, parallel; texture papyraceous, deep green, brown in dried specimens, densely covered on both surfaces with brown long-armed stellate scales; Fertile fronds: lower than the sterile ones; stipes like those of the sterile fronds or some time lower; lamina linear, acute at apex, attenuate at base, about 15 cm long, 0.8 mm broad, densely covered with stellate scales on upper surface. **Photo 88-89.**

Thailand.- NORTHERN: Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng).

Distribution.- N. India (type), SW. China and Annam.

Ecology.- Epiphyte, on mossy tree-trunks in Hill Evergreen forests at 1,500 m altitudes.

Specimens examined.- P. Ratchata 279, 314; T. Boonkerd 1100, 257 (BCU).

2. Elaphoglossum yoshinagae (Yatabe) Makino, Phan. Pterid. Jap. Ic. III. 1: pl. 51, 52. 1901; DeVol & Kuo, Fl. Taiwan vol. 3. 2nd ed.: 356. 1980; Tagawa & K. Iwats., Fl. Thailand 3(3): 305. 1988.—*Acrostichum yoshinagae* Yatabe, Bot. Mag. Tokyo 5: 109. t. 23. 1891.—*Elaphoglossum austrosinicum* C.G. Matthew & H. Christ., Not. Syst. 1: 57. 1909.

Rhizome short, with fronds closed together, densely scaly throughout; scales oblong-lanceolate or somewhat irregular in outline, acute or attenuate at apex, round at base, appressed, light brown, membranous, with or without irregular teeth at margin, about 5 by 1.5 mm **Sterile frond**; stipes stramineous, scaly throughout, densely at base, about 3 mm long, narrowly winged throughout except for the basal portion; scales oblong-ovate with acute apex, light brown, membranous, about 5 by 1 mm; lamina

simple, oblong-glabrate to oblong-lanceolate, about 20 cm long, 3 cm broad, broadest at middle portion, moderately acute at apex, gradually narrowing towards base and narrowly decurrent into the wings of stipes, entire or more or less cleft, narrowly cartilaginous at margin; midribs raised on both surfaces; with sparsely scaly beneath; veins free, simple or forked, more or less distinct on lower surface. **Fertile frond** lower than the sterile ones; stipes longer, about 12 cm long, scaly throughout, densely at base; lamina oblong or ensiform, moderately acute at apex, cuneate at base, about 12 by 2 cm; sporangia dispersed on the undersurface. **Photo 87 and 90.**

Thailand.- NORTHERN: Chiang Mai (Doi Suthep), Lampang (Doi Luang); NORTH-EASTERN: Loei (Phu Luang); SOUTH-EASTERN: Prachin Buri (Khao Khieo).

Distribution.- S. China, Laos, Taiwan, Ryukyus and northwards to W. Japan (type).

Ecology.- Epiphyte, on mossy tree-trunks in moist Hill Evergreen forest, on ridges at 1,400-1,600 m altitudes.

Specimens examined.- P. Ratchata 313 (BCU).

LOMAGRAMMA

J. Sm., J. Bot. 3: 402. 1841.—*Leptochilus* Kaulf. In Blume, En. Pl. Jav.: 206. 1828.—*Cheilolepton* Fée, Hist. Acrost.: 19. 1845.—*Neurocallis* Fée, Presl, Epim. Bot: 177. 1851.—*Chorizopteris* Moore, Gard. Chron. Agr. Gaz.: 354. 1855.—*Neurocallis* sect. *Cheilolepton* Moore, Ind. Fil.: xix. 1857.—*Acrostichum* sect. *Chrysodium* (Fée) Hook., Sp. Fl. 5: 268. 1864.—*Polybotrya* Humb. & Bonpl. Sect. *Lomagramma* Kuhn, Ann. Mus. Bot. Lugd.- Bat. 4: 295. 1869.—*Gymnopteris* Bernh. Diels & Netes, Pfl. Fam. 1, 4: 198. 1899.

Rhizome slender, creeping, covered with scales; bathyphyll and acrophyll simply pinnate; pinnae all jointed to rachis; veins anastomosing

without included veinlets; fertile fronds with narrow pinnae; sporangia acrostichoid.

Lomagramma grossoserrata Holttum, Gard. Bull. S. S. 9: 203. pl. 10, 11. 1937; Tagawa & K. Iwats., Fl Thailand 3(3): 325. 1988.

Rhizome long-creeping or climbing, about 5 mm in diam., scaly at apex; scales ovate-lanceolate, dark brown, clathrate, round at base, gradually narrowing towards attenuate apex, entire. **Bathyphyll:** stipes stramineous, about 15 cm long, blackish and sparsely scaly at base, lamina linear or linear-oblong, sessile, 30-35 pairs, unequally cuneate at base, moderately attenuate acuminate at apex, subentire or serrate at apical portion; midribs distinct on both surfaces; veins anastomosing; texture papyraceous, deep green paler beneath, glabrous. **Acrophyll:** stipes stramineous or darker, about 20 cm long, scaly at base; pinnae sessile, asymmetrically cuneate at base, serrate at margin. **Fertile frond** pinnate; pinnae linear; sporangia covering the whole lower surface of pinnae except midribs. **Photo 85-86 and 91.**

Thailand.- NORTHERN: Phrae (Mae Sai, type).

Distribution.- Endemic; Known only by the type collection.

Ecology.- Climbing in dense evergreen forests near the streams at 680-850 m altitudes.

Specimens examined.- P. Ratchata 59, 343; T. Boonkerd 1568 (BCU).

OLEANDRACEAE

Terrestrial or lithrophytes, rhizome slender; fronds tuft or distant, articulated to phyllopodia, stolons slender; Frond simple or pinnate, pinnae articulated to rachis, often caducous; veins free, one or twice forked; sori

round, dorsal or submarginal, borne on the end of a veinlets; indusia reniform.

Key to the genera

1. Rhizome short erect, with slender stolons. Fronds pinnate
.....**1. NEPHROLEPIS**
1. Rhizome long creeping, bearing distant fronds, having phyllopo-
des of various height. Fronds simple**2. OLEANDRA**

NEPHROLEPIS

Schott, Gen. Fil. ad t. 3. 1834.

Lithophyte or epiphytes, rhizome short erect, with slender stolons; scales peltate, appressed, bicolored; fronds pinnate, pinnae sessile, articulated to rachis, usually unequal at base, more or less auricled at acroscopic base; costae adaxially grooved not continuous from rachis to costae; veins free, forked; sori round, terminal on anterior branches of vein-groups; indusia reniform.

Key to the species

1. Scales entire; lateral pinnae up to 50 or more pairs, distinctly auricled and embracing the rachis and anterior base, crenate at margin
.....**1. *N. delicatula***
1. Scales pale ferruginous edges; pinnae up to 40 pairs, falcate, subtruncate at base, auricled acroscopically, round at basisopic base **2. *N. falcata***

1. Nephrolepis delicatula (Dcne.) Pic.-Serm., Webbia 23: 181. 1968; Tagawa & K. Iwats., Fl Thailand 3(2): 174. f. 13.2. 1985.—*Nephrodium*

delicatulum Dcne. in Jacqem., Voy. Ind. Bot. 4: 178. t. 179. 1844.—
Nephrolepis paucifrons J.F.R. Almeida, J. Ind. Bot. Soc. 5: 51. f. 1-5.
 1926.

Rhizome short, erect, about 4 mm in diam., bearing a few fronds, with wiry slender roots, and stolons, scaly; scales oblong-lanceolate, narrowing from base towards long attenuate to form long tail apex, entire, pale brown, membranous, about 2 by 0.3 mm broad. **Stipe** stramineous, about 10 cm long, scaly, dense at base; scales like those rhizome scales or sometime rather irregular scales. **Lamina** linear-lanceolate, pinnate, up to 60 cm long, 7 cm broad, narrowing towards acuminate apex; rachis green, grooved above, minutely scaly throughout, lateral pinnae linear-lanceolate, acuminate at apex, up to 50 or more pairs, patent, falcate near apex, sessile, distinctly auricled and embracing the rachis and anterior base, dimorphic at lower base, gradually narrowing from base to apex, crenate at margin; middle ones larger, up to 4 by 1 cm; veins forked, all free, not distinct; texture papyraceous, glabrous, green or paler. **Sori** round, terminal on veinlets, submarginal, arranged in one row; indusia reniform, pale brown, about 1 mm broad. **Photo 96.**

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Suthep, Sop Aep), Phrae (Mae Ban), Mae Hong Son (Doi Pha Dam), Lamphum (Doi Khun Tan), Tak; NORTH-EASTERN: Loei (Phu Kradueng); SOUTH-WESTERN: Kanchanaburi (Sai Yok).

Distribution.- India (type), Myanmar and also in Yunnan.

Ecology.- On mossy tree-trunks in rather dry forests along road sides at 900 m. altitudes.

Specimens examined.- P. Ratchata 323; T. Boonkerd 1101, 1193, 1227, 1265; O. Thaithong et al. 3n. (BCU).

2. ***Nephrolepis falcata*** (Cav.) C. Chr., Dansk Bot. Ark. 9: 15. 1937; Holttum, Rev. Fl. Malaya 2: 381. f. 221. 1960; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 55. 1968; in Fl Thailand 3(2): 176. 1985.—*Tectaria falcata* Cav., Descr. Pl.: 250. 1802.—*Nephrolepis exaltata* auct. non (L.) Schott: H. Christ, Bot. Tidsskr. 24: 109. 1901.

Rhizome short, suberect, about 3 mm diam., densely scaly throughout, bearing a tuft of fronds, with runner at base; runners slender, long and climbing, few, sparsely scaly, rhizome scales appressed; scales subtriangular, gradually narrowing from round base to acute apex, bicoloured with nearly black central portion and pale ferruginous edges, about 3 mm long, 1 mm broad. **Stipe** stramineous, 8-10 cm long, scaly at lower portion, scales appressed; scales like rhizome scales but smaller, about 2 mm long, 0.5 mm broad. **Lamina** pinnate, linear in outline, about 55 cm long, 8 cm wide, gradually narrowing towards both ends, acute at apex, usually pendulous; rachis sparsely scaly throughout; pinnae up to 40 pairs, triangular, falcate, auricled to rachis; middle ones 1.5-2 cm apart, about 4 cm long, 1.5 cm wide, gradually narrowing from base towards apex, acuminate at apex, subtruncate at base, auricled acroscopically, round at basiscopic base; veins forked, all free, visible on both surfaces, not reaching at margin; costa raised, hairy on upper surfaces; texture thin, glabrous, green or paler. **Sori** round, arranged in one row on each side of costa, with reniform indusia; indusia about 1 mm when dried, brown, persistent. **Photo 94 and 97.**

Thailand.- NORTHERN: Chiang Mai (Chiang Dao), Lampang, Phitsanulok (Salaeng Haeng), Tak (Huai Krasa, Doi Musoe); EASTERN: Nakhon Ratchasima (Kathok), Chaiyaphum (Nam Phrom); CENTRAL: Bangkok; SOUTH-EASTERN: Prachin Buri (Krabin, Thung Pho), Chanthaburi (Khao Soi Dao), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Kroeng Kawia); PENINSULAR: Satun (Boriphat Falls), Narathiwat (Sg. Padi).

Distribution.- Indochina to Malesia (type from Luzon).

Ecology.- On rather dry limestone rocks at 680 m. altitudes.

Vernacular.- Kut hin (กูดหิน) (Peninsular).

Specimens examined.- P. Ratchata 11; T. Boonkerd 3, 59, 323, 329; K. Lukchant 7; T. Seelanan 21 (BCU).

OLEANDRA

Cav., Ann. Hist. Nat. 1: 115. 1799.

Terrestrial, lithophytes or epiphytes; rhizome creeping, bearing distant fronds; scales peltate; stipes articulated to rhizome, leaving phyllopede of various heights; fronds simple, entire, margin undulate; veins free, once or twice forked near midribs; sori round, dorsal on anterior branched of veins, close to midribs; indusia reniform.

Oleandra undulata (Willd.) Ching, Lingn. Sci. J. 12: 565. 1933; Holttum, Rev. Fl. Malaya 2: 384. f. 223. 1960; Tagawa & K. Iwats., Fl Thailand 3(2): 180. 1985.—*Polypodium undulatum* Willd., Sp. Pl. 5: 155. 1810.—*Oleandra cumingii* Hook. & Baker, Syn. Fil.: 303. 1867; Beddome, Handb.: 288. 1883.—*Oleandra pubescens* Copel., Univ. Calif. Publ. Bot. 12: 397. pl. 52-a. 1931.

Rhizome long-creeping, about 3-4 mm diam., bearing distant fronds, or rather closely on some portions, densely scaly throughout; scales appressed, oblong, round or broadly cuneate at base. irregular teeth at basal edge, long acuminate at apex, with minutely irregularly teeth at apical edge, about 5 mm long, 1.8 mm broad, entire, brown, dark near attached points. **Stipe** castaneous, about 10 cm long, with phyllopodia, hairy, slender, scaly at base; scales like rhizome scales but edges with long downy hairy more rhizome scales. **Lamina** ensiform, simple, gradually narrowing towards both ends, up to 35 cm long, 4.5 cm wide, the margin entire, more or less undulate, narrowly cuneate at base and narrow slightly acuminate apex;

veins once or twice forked near midribs, costa and veins underneath as well as under surface of lamina hirsute but glabrous at margin of lamina, upper surface sometime hairy; texture coriaceous to papyraceous. **Sori** in one regular row close to costa or rather irregularly arranged near costa, dorsal on acroscopic veinlets; indusia about 1.5 mm broad, hirsute. **Photo 98.**

Thailand.- NORTHERN: Chiang Rai (Doi Pha Cho), Chiang Mai (Fang, Doi Chiang Dao, Doi Suthep, Doi Hua Mot, Ping Khong, Doi Saket, Mae Klang), Lampang (Ngao), Phrae; NORTH-EASTERN: Loei (Phu Kradueng, Phu Tong, Phu Luang); EASTERN: Chaiyaphum; SOUTH-WESTERN: Kanchanaburi (Hat Phalom, Sai Yok); PENINSULAR: Ranong (Ko Phayam), Phangnga (Khao Phra Mi), Krabi (Ko Pu), Nakhon Si Thammarat (Thung Song).

Distribution.- Myanmar and S. China (type) to Malaysia.

Ecology.- Terrestrial on rather dry places in open areas or in light shade at 680-1,050 m. altitudes.

Specimens examined.- P. Ratchata 52, 123, 326; T. Boonkerd 388, 1098, 1363; R. Chaveerach 19 (BCU).

PARKERIACEAE

Terrestrial ferns; fronds monomorphic, 1-3 pinnate, not articulated to rhizome; veins free; sori oblong, borne on distal ends or on the apical parts of veins, without indusium, but protected by the modified and sharply reflexed leaf-margin and opening introsely; sporangia developing in mixed sequence.

Key to the genera

1. Frond pinnate or tripinnate
2. Frond pinnate, lower surface of frond bearing waxy powder. Sori scattered on under surface **3. *PITYROGRAMMA***

2. Frond pinnatifid to tripinnate, lower surface without waxy powder.
Sori at the end of veinlets, in appearance often continuous along the
margin of lobes **2. CHEILANTHES**
1. Frond simply pinnate; leaflets fan-shaped. Sori on the under surface
of small reflexed marginal flaps; the sporangia attached along the veins,
which are continued into the flaps **1. ADIANTUM**

ADIANTUM

L., Sp. Pl.: 1094. 1753.

Rhizome erect, scaly; stipes dark purple to nearly black, not jointed to rachis; fronds pinnate, leaflets fan-shaped to paralogram-shaped, subentire or more or less deeply lobed; veins free, dichotomously branched from the base; sori on the under surface of small reflexed marginal flaps, the sporangia attached along the veins, which are continued into the flaps.

Key to the species

1. Rachis densely hairy on upper surface; pinnae sessile, hairy on both
surfaces; lower surface with short and long hairs, the upper surface
with stiff hairs **1. *A. caudatum***
1. Rachis glabrous; pinnae large at base, borne on slender black stalks,
glabrous on both surfaces **2. *A. philippense***

1. Adiantum caudatum L., Mant. Alt.: 308. 1771; Beddome, Handb.: 83. f. 44. 1883; Holttum, Rev. Fl. Malaya 2: 599. f. 351. 1960; ed. 2. 2: 638. 1968; Seidenf., Nat. Hist. Bull. Siam Soc. 19: 87. 1958; Shieh in Fl. Taiwan vol. 1. 303. pl. 105. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 207. 1985.—*Adiantum malesianum* J. Ghatak, Bull. Bot. Surv. Ind. 5: 73. f. 1, 4. 6-7. 1963; Holttum, Rev. Fl. Malaya ed. 2. 2: 638. 1968.

Rhizome erect, bearing a tuft of fronds, covered with scales; scales linear, about 5 mm long, bicoloured, dark in central lines, paler at margin, edges entire, truncate at base, attenuate at apex. **Stipe** dark purple to nearly black, polished, densely hairy with long multicellular brown hairs, scaly at base; scales like rhizome scales. **Lamina** gladiate, pinnate, about 30 cm long, 2 cm wide; rachis densely hairy on upper surface with paler stiff hairs, prolonged, leafless on apical part, rooting at tip; pinnae sessile, almost parallelogram-shaped, round at apex, about 1.3 cm long, 0.5 cm wide, up to 28-30 pairs, inner edge straight, at a small angle to the rachis, to form narrowly cuneate base with lower margin; upper edge nearly parallel to the lower edge, curved somewhat to join the short outer edge, upper and outer edges rather deeply lobed, the sinuses between the lobes narrow; lower edge nearly straight, at right angles to the rachis or somewhat ascending; lobes 4-5, often shortly lobed again, subtruncate and slightly toothed at apex, entire at margin; veins prominent on the upper surface but not below, radiating from the thickened end of the very short pinna-stalk; upper pinnae gradually smaller in size; lateral pinnae gradually becoming smaller upwards, the lower ones smaller and deflexed; texture thin, papyraceous, green, hairy on both surfaces, lower surface with short and long hairs, the upper surface with stiff hairs. **Sori** on apices of lobes, the reflexed flaps elongate, narrow, hairy.

Photo 105 - 106.

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao, Doi Suthep, Mae Klang), Lampang (Khao Tham Pha Thai), Phrae (Mae Ban), Phitsanulok (Thung Salaeng Luang), Tak (Lan Sang, Ban Na); NORTH-EASTERN: Loei (Phu Luang, Pha Nok Khao), Nong Khai; EASTERN: Nakhon Ratchasima (Pak Thong Chai); CENTRAL: Saraburi (Muak Lek), Phra Nakhon Si Ayutthaya; SOUTH-EASTERN: Prachuap Khiri Khan (Ban Bueng Hills), Chon Buri (Si Racha), Chanthaburi (Pong Nam Ron); SOUTH-WESTERN: Kanchanaburi (Erawan Falls, Wangka, Khao Tahlu, Ban Kao), Prachuap Khiri Khan (Bang Saphan); PENINSULAR: Surat Thani (Khao

Hua Khwai, Ko Tao, Ko Samui, Ko Paloei), Nakhon Si Thammarat (Thung Song), Phatthalung, Phangnga (Kasum), Satun, Pattani, Yala (Bannang Sata, Ban Sai Khao).

Distribution.- Tropics of the Old World in general, from Africa to Polynesia (type from India).

Ecology.- Terrestrial on mountain slopes in dry areas at 680 m altitudes.

Vernacular.- Kut namkhao (กูดน้ำข้าว) (Northern); tin tukkae (ตีนตุ๊กแก), hang nak bok (หางนาคบก) (Central).

Specimens examined.- P. Ratchata 241; T. Boonkerd 25, 28, 30, 53, 322, 338, 527, 1255, 1378; T. Seelanan 17 (BCU).

2. **Adiantum philippense** L., Sp. Pl. 2: 1094. 1753; Holttum, Rev. Fl. Malaya 2: 598. f. 350. 1960; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 306. pl. 106. 1980; Tagawa & K. Iwats., Fl. Thailand 3(2): 211. 1985.—*Adiantum lunulatum* Burm.f., Fl. Ind.: 235. 1768; Beddome, Handb.: 82. f. 43. 1883.

Rhizome short, erect or suberect, bearing a tuft of fronds, the apex covered with scales; scales linear, broadest at base, gradually narrowing towards attenuate-acuminate apex, edges entire, about 3 mm long, 0.3 mm broad, bicoloured, central black, paler near margin. **Stipe** nearly black, polished, grooved, glabrous or sparsely scaly at basal portion. variable in size, usually about 5-20 cm long; scales on stipe at basal like those on rhizome except in bearing concolorous brown and smaller in size. **Lamina** linear-lanceolate to oblong, pinnate, commonly 15 cm long but the larger more than 30 by 10 cm; rachis glabrous, occasionally prolonged, leaflets on upperpart, and rooting at tip, more commonly bearing an apical pinna like lateral ones, black in color, polished and more or less grooved; pinnae large at base, borne on slender black stalks, alternate, usually bearing about 8-15 pairs, crescent-shaped, the two edges which meet at the stalk lying almost in

the same straight line, the lower edges often recurved distally from this line, the upper and outer edges forming a continuous and almost even curve, usually 1 by 0.5 cm, sometime up to 4 cm by 2 cm; stalks black, slender, the lowest stalks longest, up to 1.5 cm long; veins fine and slightly raised; outer edges of leaflets subentire, crisped or lobed to about 1/4 of breadth of leaflets, the sinus narrow, lobes round to subquadrangular, round to truncate at subentire or slightly toothed apex; texture thin, papyraceous to softly herbaceous, green, glabrous on both surfaces. **Sori** at margin of leaflets, reflexed soral flaps elongate, usually 5-7 mm long, sometime continuous along margin of leaflets. **Photo 101 and 104.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Fang, Doi Chiang Dao, Mae Klang, Doi Inthanon, Wang Tao, Doi Saket), Mae Hong Son (Mae La Noi, Bo Luang), Lampang (Huai Thak), Lamphun (Doi Khun Tan), Phitsanulok (Thung Salaeng Luang, Kaeng So Pha), Tak (Lan Sang, Ban Musoe, Wang Chao); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang, Phu Kradueng); CENTRAL: Nakhon Nayok, Bangkok; SOUTH-EASTERN: Prachin Buri, Chon Buri (Si Racha), Chanthaburi (Khao Sabap); SOUTH-WESTERN: Kanchanaburi (Sai Yok, Wangka, Bang Kasi, Thung Kang Yang Hills, Tha Po); PENINSULAR: Nakhon Si Thammarat (Thung Song).

Distribution.- Throughout the tropics of the Old World (type from the Philippines).

Ecology.- Terrestrial on mountain slopes in light shade on humus-rich or along streams 680-1,300 m. altitudes.

Vernacular.- Kut hu Khwak (กุดหูกวาง), hua khuwak (หูกวาง), Ya khwak (หญ้าขวก), phak kachot (ผักกะถอดหนู) (South-eastern); hang chingcha (หางชิงช้า) (Peninsular).

Specimens examined.- P. Ratchata 7, 33, 61, 82, 195, 196, 233; T. Boonkerd 441, 442, 1020, 1216, 1267, 1414 (BCU).

CHEILANTHES

Sw., Syn. Fil.: 5, 126. 1806.—*Aleuritopteris* Fée, Gen. Fil.: 153. pl. 12 B. f. 1-2. 1852.

Rhizome erect, scaly, bearing a tuft of fronds; stipe grooved, polished, dark purple; fronds pinnately compound, broadly deltoid, the basal pinnae often enlarged on the basiscopic side; veins free; sori at end of veinlets, in appearance often continuous along the margin of lobes, protected by reflexed margin of lobes.

Key to the species

1. Scales linear-lanceolate. Frond bipinnatifid; pinnae up to 10 pairs;
texture glabrous on lamina surface **1. *C. belangeri***
1. Scales ensiform. Frond tripinnatifid to tripinnate, all parts of frond
bearing scattered stiff pale spreading hairs..... **2. *C. tenuifolia***

1. Cheilanthes belangeri (Bory) C. Chr., Ind. Fil.: 172. 1905; Holttum, Rev. Fl. Malaya 2: 591. 1960; Tagawa & K. Iwats., Fl Thailand 3(2): 202. 1985.—*Pteris belangeri* Bory in Belanger, Voy. Bot. 2: 44. 1833.—*Cheilanthes varians* Hook., Sp. Fil. 2: 89. t. 103 A. 1852; Beddome, Handb.: 91. f. 47. 1883.

Rhizome short, erect, bearing a tuft of fronds, covered with scales; scales linear-lanceolate, gradually narrowing towards long attenuate apex, shining brown, various in size, about 2-3.5 by 0.1-0.2 mm, entire. **Stipe** purple to dark brown, polished, up to 10 cm long, grooved on adaxial surface, scaly at base; scales like rhizome scales more or less hairy. **Lamina** linear-lanceolate, bipinnatifid, up to 12 cm long, 4 cm wide; rachis like stipe; pinnae up to 10 pairs, 1.5 cm apart in lower fronds, closed in upper portion, gradually increasing from the apex downwards; upper pinnae sessile, narrowly deltoid, more or less deeply lobed, the basal basiscopic lobes largest, shortly stalked, pinnatifid to pinnate, oblong-subdeltoid, acuminate

at apex, broadly cuneate and stalked at base; the basal pinnules free, the other adnate and merging into the lobed, deltoid apex of the pinna; pinnules oblong, oblique, subtruncate or broadly cuneate at base, round at apex, irregularly lobed in larger ones, apical pinnules of larger pinnae like upper ones, moderately acute or round at apex, entire at apical part; veins all free, hardly visible; texture papyraceous, green, glabrous on lamina surface. **Sori** occupying the side of lobes, more or less interrupted, protected by reflexed margin of lobes. **Photo 107-108.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Suthep, Mae Klang), Lampang, Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Nong Khai; SOUTH-EASTERN: Chon Buri (Si Racha), Chanthaburi (Makham); PENINSULAR: Surat Thani (Ban Na), Satun, Yala (Bannang Sata).

Distribution.- N. India, S. China, Indochina and Malaya to the Philippines.

Ecology.- Terrestrial on mountain slopes in open areas at 650 m altitudes.

Vernacular.- Kachot khai (กะจอตไข่) (South-eastern); kut ngot (กูดหงอต) (Northern).

Specimens examined.- P. Ratchata 228 (BCU).

2. **Cheilanthes tenuifolia** (Burm.f.) Sw., Syn. Fil.: 129, 332. 1806; Beddome, Handb.: 92. 1883; Holttum, Rev. Fl. Malaya 2: 590. f. 347. 1960; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 284. 1980; Tagawa & K. Iwats., Fl. Thailand 3(2): 201. 1985.—*Trichomanes tenuifolium* Burm.f., Fl. Id.: 237. 1768.

Rhizome short, ascending, bearing a tuft of fronds, densely scaly throughout; scales ensiform, gradually narrowing towards attenuate apex, light brown, edges entire, about 4 mm long, 0.3 mm broad. **Stipe** purple to

black, polished, densely scaly at base, up to 25 cm long, sparsely scaly upwards, grooved on adaxial surface; scales like rhizome scales but shorter and paler, about 3 mm long. **Lamina** dimorphic; sterile lamina with stipe up to 25 cm long, deltoid in outline; fertile lamina with stipe up to 30 cm long, tripinnate to tripinnatifid, subdeltoid in outline; rachis and pinna-rachis scaly, grooved on upper surface; smaller rachis with narrowing green wing on the edges of the grooves; pinnae lanceolate or subtriangular, acute at apex, up to 10-12 pairs, basal ones largest; middle pinnae oblong-subdeltoid; larger pinnules pinnatisect with a few pairs of lobes and large terminal ones, terminal lobes of pinnules like terminal pinnae and pinnules, oblong, round at apex, 5-7 by 3 mm, entire; ultimate lobes round or oval, 5-7 mm long, 3-4 mm broad; veins all free, obtuse; hardly visibly above, distinct below, 1-2 forked in the larger leaflets; texture thin, all parts of frond bearing scattered stiff pale spreading hairs, green. **Sori** confined to the end of veins but appearing continuous at margin of lobes, protected only when young by the reflexed margin of the lamina, uneven pellucid edge very narrow. **Photo 102-103.**

Thailand.- NORTHERN: Chiang Mai (Chiang Dao, Doi Suthep, Mae Klang), Mae Hong Son (Mae Sariang, Doi Pha Dam), Lampang (Doi Phalat), Lamphun (Doi Khun Tan), Phrae (Mae Ban), Phitsanulok (Thung Salaeng Luang), Tak (Doi Musoe); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Sabap), Trat (Ko Chang); PENINSULAR: Chumphon (Tha Ko), Surat Thani (Bang Bao, Ban Don), Songkhla, Phangnga, Satun, Trang (Khao Chong), Yala (Bannang Sata).

Distribution.- Tropics of Asia and Oceania, from India and S. China through Malesia (type from India) to Polynesia, Australia and New Zealand.

Ecology.- Terrestrial on mountain slopes in open areas at 650 m altitudes.

Vernacular.- Chon phi (จันทน์) (Peninsular).

Specimens examined.- P. Ratchata 227; T. Boonkerd 63, 340, 1015, 1217 (BCU).

PITYROGRAMMA

Link, Handb. Gew. 3: 19. 1833.

Rhizome erect, bearing a close tuft of fronds; stipe dark, polished; fronds pinnately compound, not basiscopically enlarged, rachis grooved; veins free, lower surface of leaflets covered with a waxy powder; sori along the whole length of the vein on the under surface of fertile leaflets, without indusia.

Pityrogramma calomelanos (L.) Link, Handb. Gew. 3: 20. 1833; Holttum, Rev. Fl. Malaya 2: 593. f. 348. 1960; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 56. 1968; Shieh, Fl. Taiwan vol. 1. 2nd ed.: 315. pl. 111. 1980; Tagawa & K. Iwats., Fl. Thailand 3(2): 193. 1985.—*Acrostichum calomelanos* L., Sp. Pl.: 1072. 1753.—*Pellaea calomelanos* (L.) Link, Fil. Sp.: 61. 1841; Beddome, Handb.: 104. 1883.

Rhizome short, erect, or ascending, bearing a tuft of fronds, covered with scales; scales ensiform, broadest at base, gradually narrowing towards attenuate apex, about 4 mm long, 0.5 mm broad, entire at margin, light brown. **Stipe** dark castaneous to dark purple, polished, up to 30 cm long, scaly on lower part, towards the apex slightly grooved on upper surfaces, covered with white powder when young; scales longer than rhizome scales, about 5 mm long. **Lamina** lanceolate, acuminate at apex, bipinnate to tripinnatifid, about 35 cm long, 24 cm wide, the pinnae in the lower half of frond all about equal, gradually shortened towards apex in the upper half; rachis grooved on upper surfaces, purple, polished; pinnae linear-lanceolate, up to 16 pairs, lower pinnae largest, up to 12 cm by 3 cm, widened at base, gradually long acuminate towards apex, shortly stalked, pinnatifid to pinnate

at the base, deeply lobed almost to the acuminate apex, costa grooved, with narrowly green wing on each side of the groove formed by the decurrent base of pinnules; pinnules oblong to oblong-lanceolate, cuneate at base, acuminate at apex, the basiscopic side usually longer than acroscopic side of the pinna-rachis, deeply lobed at the base and progressing less so to the acute apex; lobed oblanceolate to obovate, oblique, slightly toothed or dentate at apical portion; veins free, pinnate in the larger lobes of the pinnules, ending close to the margin; texture herbaceous, green to light green, glabrous, coated with white waxy powder (farina). **Sori** placed along veins throughout the lower surfaces, when mature often covering it completely, without any protection. **Photo 99-100.**

Thailand.- NORTHERN: Chiang Mai (Wang Tao); Mae Hong Son (Mae Sariang); Tak (Ban Musoe); SOUTH-EASTERN: Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Wangka, Bang Kasi); PENINSULAR: Nakhon Si Thammarat (Khao Luang, Wat Khiriwong) Narathiwat (Bacho Falls), Yala (Bukit, Betong, Bannang Sata), Phangnga (Khao Katha Khwan), Trang (Khao Chong), Satun (Khaum Kalong).

Distribution.- Pantropics (type from America); this may have been spread to the palaeotropics by man

Ecology.- On mountain slopes in open areas at 670 m. altitudes.

Vernacular.- Foen ngoen (เฟินเงิน), foen thong (เฟินทอง) (General).

Specimens examined.- P. Ratchata 209; T. Boonkerd 376, 1024, 1214 (BCU).

POLYPODIACEAE

Usually epiphytic, some terrestrial or rheophytes, rhizome thick, usually creeping, scales often clathrate; fronds simple and entire or lobed, or pinnate, dimorphic or monomorphic; stipes usually articulate to rhizome; veins anastomosing with included veinlets; sori round, oblong or linear,

some genera acrostichoid, sometime sunk in cavities under surface of the fronds; exindusiate; paraphyses present or absent.

Key to the genera

1. Nest leaves present
 2. Rhizome creeping; foliage-leaves pinnatifid, all lobes or pinnae articulated to rachis. Sori round, borned on veins junction, arranged in one row on each side of costa **6. DRYNARIA**
 2. Rhizome short; all part of frond densely covered with stellate hairs, fertile-fronds pendulous, sporangia spreading on specialized areas, mixed with stellate hairs..... **12. PLATYCERIUM**
1. Nest leaves lacking
 3. Frond simple
 4. Frond covered with stellate hairs. Sori in a single row or sometime having appearance of the acrostichoid condition, covered to the apical half of the laminae **14. PYRROSIA**
 4. Frond not having stellate hairs
 5. Frond bearing peltate scales on surfaces or in sori
 6. Frond dimorphic; fertile fronds narrow throughout or narrowed at base and fertile in apical part; sori continuous along margin..... **7. LEMMAPHYLLUM**
 6. Frond monomorphic
 7. Fertile portion at apical portion of frond, linear, covered by sporangia on the lower surfaces, sometime separated from the rest of the frond by a constriction **3. BELVISIA**
 7. Sori usually at junction of veins, round or nearly oblong, superficial or sunk in cavities **8. LEPISORUS**
 5. Frond without peltate scales

8. Frond dimorphic. Sori covering the whole under surface of linear fertile laminae except on midrib and at margin
 **9. LEPTOCHILUS**
8. Frond monomorphic
9. Sori elongate usually oblique to midrib
10. Terrestrial; fronds lobed, articulated to rhizome. Sori linear, one between the adjacent lateral main veins, oblique to costae **4. COLYSIS**
10. Epiphytic, stipes tuft, not articulated to rhizome; fronds usually oblanceolate in outline. Sori immersed
 **10. LOXOGRAMME**
9. Sori round
11. Scales not clathrate. Sori arranged in one row at each side of costa between adjacent main veins
 **5. CRYPSINUS**
11. Scales clathrate. Sori scattered, or arranged in one row at each side of costa **11. MICROSORUM**
3. Frond pinnate or pinnately lobed
12. Scales clathrate
14. Frond deeply pinnatifid to pinnate, when pinnate pinnae jointed to rachis. Sori round, terminal on the included free veinlets, usually in one row along costa **13. POLYPODIUM**
14. Frond simple or pinnate. Sori on reticulate veins, scattered, or arranged in one row at each side of costa **11. MICROSORUM**
12. Scales not clathrate
15. Frond pinnatifid or pinnately lobed
16. Upper part of fronds like foliage leaves, lower part like nest-leaves. Sori round in one row between each pair of lateral veins, or variously spreading **1. AGLAOMORPHA**

16. Foliage-leaves pinnatifid; all lobes or pinnae articulated to rachis. Sori round, borne on junction on veins, arranged in one row on each side of costa **6. DRYNARIA**

15. Frond pinnate; lateral pinnae articulated to rachis, sessile. Sori without paraphyses, borne singly or in rows between the lateral main veins, superficial **2. ARTHROMERIS**

AGLAOMORPHA

Schott, Gen. Fil.: ad pl. 20. 1834.

Epiphytic ferns, rhizome creeping, thick, densely scaly; fronds sessile, upper part like foliage leaves, pinnatifid, lower part like nest-leaves very broad at base, coriaceous; veins reticulate, forming large prominent raised areoles with included free veinlets; sori round in one row between each pair of lateral veins, or variously spreading.

Aglaomorpha coronans (Wall. ex Mett.) Copel., Univ. Calif. Publ. Bot. 16: 117. 1929; Tagawa & K. Iwats., Fl Thailand 3(4): 551. f. 55.4-5. 1989.—*Polypodium coronans* Wall. ex Mett., Abh. Senck. Naturf. Ges. 2: 121. t. 3. f. 40-41. 1857.—*Drynaria coronans* (Wall. ex Mett.) J. Sm., J. Bot. 4: 61. 1841; Beddome, Handb.: 338. 1883.—*Polypodium conjugatum* Baker, Syn. Fil.: 366. 1868.—*Drynaria conjugata* (Baker) Beddome, Ferns Brits. India correct. 1870.—*Pseudodrynaria coronans* (Wall. ex Mett.) Ching, Sunyatsenia 5: 262. 1940; DeVol & Kuo Fl. Taiwan vol. 1. 2nd ed.: 214. pl. 75. 1980.—*Aglaomorpha heraclea* (Kunze) Copel. sensu Holttum, Dansk Bot. Ark. 20: 21. 1961.

Rhizome short-creeping, thick, more than 1.5 cm diam, densely scaly throughout. **Frond** large, sessile, more than 50 cm long, about 40 cm wide, lobed almost to rachis, upper part of fronds deeply pinnatifid, sinuses nearly as wide as lobed, the base of fronds dilated, broadly rounded to cordate, up

to 5 cm broad, subentire or shallowly lobed, brown; lobes continuing with wings, less than 1 cm broad, lobes of the upper part of fronds ascending, up to 10 pairs, linear-subtriangular, acute to attenuate acuminate at apex, entire at margin, every lobes falling at the abscission along rachis; costules and main veins conspicuously raised on both surfaces; venation drynarioid, or with complicatedly reticulate, forming large prominently raised areole; main areoles quadrangular, lateral vein parallel, smaller areoles with free included veinlets; texture coriaceous, green, glabrous, polished. **Sori** short elongate, in one row between main veins, sometime uniting longitudinally, but rarely continuous beyond cross veins.

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Hua Mot, Doi Suthep, Huai Tong, Doi Inthanon), Lampang (Mae Tia), Phrae (Mae Sai), Tak (Huai Krasa, Doi Musoe), Phitsanulok (Thung Salaeng Luang); EASTERN: Chaiyaphum (Thung Kamang, Nam Phrom); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng), Prachin Buri (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao); SOUTH-WESTERN: Kanchanaburi (Song Tho); PENINSULAR: Surat Tahni (Ban Don), Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong), Phangnga (Khao Phota Luang Kaeo).

Distribution.- Himalayas to S. China, Indochina, Taiwan and northwards to the Ryukyus.

Ecology.- Epiphyte. on mossy tree-trunks or on mossy rocks in rather dry forest at 650-1,350 m. altitudes.

Vernacular.- Bai kut om (ใบกุต้อม) (Northern).

Specimens examined.- P. Ratchata 89; T. Boonkerd 587; T. Seelanan 22. (BCU).

ARTHROMERIS

(Moore) J. Sm., Hist. Fil.: 110. 1875;

Rhizome creeping, densely scaly; scales concolorous, not clathrate; stipes jointed to the rhizome; fronds pinnate with a few pairs of lateral pinnae; lateral pinnae articulated to rachis, sessile, usually oblong-lanceolate, entire, margined by more or less broad cartilaginous membrane; terminal pinnae similar to lateral ones; main lateral veins distinct, other veins obscure, forming copiously anastomosing at the drynarioid venation; texture papyraceous, glabrous; sori round, without paraphyses, borne singly or in rows between the lateral main veins, naked, superficial.

Arthromeris amplexifolia (H. Christ) Ching, Contr. Inst. Biol. Nat. Acad. Peiping 2: 94. 1933; Tagawa & K. Iwats., Fl Thailand 3(4): 565. f. 57.1-2. 1989.—*Polypodium amplexifolium* H. Christ, J. Bot. II. 1: 269. 1908.

Rhizome long-creeping, about 5 mm diam., bearing fronds more than 2.5 cm apart, densely cover with scales throughout; scales narrowly subtriangular, broadest at base, gradually narrowing towards long attenuate acuminate apex, about 4 mm long, 1 mm broad, white with pale brown base, minutely toothed at margin. **Stipe** stramineous, polish, densely scaly at base, glabrous upwards, about 15 cm long; scales like those rhizome scales. **Lamina** oblong in outline, imparipinnate, up to 35 by 30 cm; rachis pale castaneous, glabrous; lateral pinnae supopposite, 3-4 pairs, oblong-lanceolate, straight, ascending, sessile, caudately acuminate at apex, deeply cordate and amplexicaulous at base, up to 15 by 3 cm, subentire, margined with cartilaginous membrane; terminal pinnae like the lateral ones, up to 15 by 3 cm, rounded to cordate at base, narrowing from base towards caudately acuminate apex; main veins about 6 mm remote. veins copiously anastomosing with many included veinlets; texture papyraceous, light green,

glabrous, glaucous beneath. **Sori** round, about 2 mm diam., at junction of several veinlets, in a single row at each side of costa, superficial. **Photo 130.**

Thailand.- NORTHERN: Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Mae Ho, Doi Suthep); PENINSULAR: Nakhon Si Thammarat (Khao Luang).

Distribution.- Vietnam (Tonkin, type), Laos.

Ecology.- Epiphyte, on mossy tree-trunks in rather dry forests at 1,200 m altitudes.

Specimens examined.- P. Ratchata 301; T. Boonkerd 1076.

BELVISIA

Mirb., Hist. Nat. Gen. 4: 65. 1803; Holttum. Rev. Fl. Malaya: 153. 1960.—
Hymenolepis Kaulf., Enum.: 146. 1824, non Cassini 1817.

Rhizome creeping; scales clathrate; stipes short winged almost to the base; fronds simple, entire, jointed to rhizome; fertile portion on narrow apical part of fronds, usually wholly covered by sporangia on the lower surfaces, sometime separated from the rest of the fronds by a constriction; veins copiously anastomosing, hardly visible; sporangia mixed with stalked peltate paraphyses and protected also by the narrow reflexed edge of laminae.

Key to the species

1. Base of apical fertile portion constricted; frond up to 20 cm long,
3 cm wide..... **1. *B. henryi***
1. Not constricted at base of the apical fertile portion; frond up to 16 cm
long, 3.5 cm wide..... **2. *B. mucronata***

1. Belvisia henryi (C. Chr.) Raymond, Mém. Jard. Bot. Montréal 55: 32. 1962; Tagawa & K. Iwats., Fl Thailand 3(4): 520. 1989.—*Hymenolepis*

henryi C. Chr., Dansk Bot. Ark. 6: 67, f. 1d. 1929.—*Macroplethus henryi* Tagawa, Acta Phytotax. Geobot. 11: 234. 1942.

Rhizome short-creeping, bearing fronds closely, scaly throughout; scales ovate-oblong, attenuate-acuminate at apex, about 2 by 0.8 mm. dark brown or reddish-brown, clathrate, dentate. **Stipe** short, green to stramineous, winged almost to the base, scaly at base; scales about 2 by 0.8 mm. **Lamina** linear-oblong to narrowly oblong, up to 20 cm long, 3 cm wide, gradually narrowing towards base. apex abruptly truncate sometime asymmetrically or narrowed more gradually, bearing linear fertile portion, the margin of fronds entire; fertile portion narrowly cuneate at base, up to 9 cm long, 2 mm wide; veins indistinct; texture subcoriaceous, green, paler beneath. **Sori** covering the whole under surfaces except the margin, paraphyses peltate, with circular blade, toothed at margin. cell walls strongly thickened in mature paraphyses.

Thailand.- NORTHERN: Chiang rai (Mae Talop), Chiang Mai (Doi Suthep, Doi Inthanon), Mae Hong Son (Kun Kong San), Phitsanulok (Phu Miang), Tak (Huai Krasa, Ban Musoe); NORTH-EASTERN: Loei (Phu Luang, Phu Kradang, Phu Tong); EASTERN: Nakhon Ratchasima (Khao Yai).

Distribution.- China (Yunnan), Bhutan, Sikkim, India (Assam), Myanmar, Thailand, Vietnam.

Ecology.- Epiphyte. on tree branches along the streams at 700 m altitudes.

Specimens examined.- P. Ratchata 329 (BCU).

2. **Belvisia mucronata** (Fée) Copel., Gen. Fil.: 192. 1947; DeVol & Kuo, Fl. Taiwan 168. pl. 57. 1980; Tagawa & K. Iwats., Fl Thailand 3(4): 520. f. 52.4-6. 1989.—*Hymenolepis mucronata* Fée. Mém. Fougères 5: 81. pl. 6, f.1. 1852.—*Macrolethus mucronatus* (Fée) Tagawa, Acta Phytotax. Geobot. 11:234. 1942.

Rhizome short-creeping, bearing a tufted of fronds, densely scaly at apex; scales ovate-oblong or subtriangular, about 2 mm long, 1 mm broad, long attenuate at apex, broadest at basal portion, concolorously reddish-brown to black, clathrate, all cells thickened walls, toothed at margin. **Stipe** short, not distinct from lower part of midribs of fronds, narrowly winged, 1-2 mm thick, scaly at base. **Lamina** linear-lanceolate, up to 16 cm long, 35 cm wide, broadest at middle portion, gradually narrowing towards both ends, attenuate at both apex and base, edges entire or slightly revolute, sometime fronds deeply lobed nearly to midribs; midribs raised on both surfaces, green, glabrous; veins hardly visible, copiously anastomosing; texture coriaceous, fertile portion of fronds at apex, linear, up to 4.5 cm long, 1 mm wide. **Sori** close to midrib, completely covering the lower surfaces when ripe, except the very margin; paraphyses peltate blades, brownish to black, margin entire, cell with thick walls.

Thailand.-SOUTH-EASTERN: Chanthaburi (Takhamao Falls); PENINSULAR: Nakhon Si Thammarat (Khiriwong, Khao Luang). Yala (Betong).

Distribution.-Ceylon, Indochina, Taiwan, throughout Malesia, Australia, Pacific islands: Palau Is., Marianas, Figi, Tonga, Samoa, Cook Is., Tahiti, Tubuai, Raivavae. Marquesas

Ecology.- On tree branches in light shade forests near the streams at 650-1,200 m. altitudes.

Specimens examined.- P. Ratchata 13, 248, 273, 331; T. Boonkerd & R. Polwath 70 (BCU).

COLYSIS

Presl, Epim. Bot.: 146. 1849.

Terrestrial ferns, rhizome creeping, scaly; scales clathrate; fronds simple, lobed, monomorphic, articulated to rhizome; veins anastomosing to

form irregularly arranged areoles with included veinlets; sori linear, usually continuous, one between the adjacent lateral main veins, oblique to costae.

Colysis pothifolia (D. Don) Presl, Epim. Bot.: 148. 1849; Tagawa & K. Iwats., Fl Thailand 3(4): 540. 1989.—*Hemionitis pothifolia* D. Don, Prodr. Fl. Nepal.: 13. 1825.—*Colysis elliptica* var. *pothifolia* (D. Don) Ching, Bull. Fan Mem. Inst. Biol. 4: 334. 1933.—*Selliguea elliptica* (Thunb.) Beddome Sensu Beddome, Handb.: 392. 1883.

Rhizome creeping, thick, about 0.5 cm diam., bearing fronds remote, densely scaly at apex; scales oblong-subtriangular, about 3.5 mm long, 1 mm broad at base, gradually narrowing towards long-attenuate apex, concolorous, dark brown, clathrate, edges with irregularly minutely toothed. **Stipe** stramineous, about 30-35 cm long, scaly at base, terete; scales like rhizome scales. **Lamina** simple, ovate in outline, about 35 by 30 cm, acute at apex, deeply lobed nearly to the midribs, remaining wings of rachis about 0.5 cm in breadth; rachis and costa stramineous, glabrous, raised on both surfaces; lobes about 7-8 pairs, ensiform, broadest at middle portion, gradually narrowing towards attenuate-acuminate apex, narrowly cuneate towards base, straight, slightly ascending, up to 22 cm long, 3 cm wide, slightly crenate at margin; veins visible, anastomosing to forming two rows of areoles between the adjacent main veins; texture thin, papyraceous, dark green in living condition, brownish in dried specimens, glabrous. **Sori** linear, continuous along the line between two rows of areoles.

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Inthanon), Lampang, Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang).

Distribution.- Himalaya (type) to S. China and Taiwan, extending north to SW. Japan and the Ryukyus, south to Indochina and the Philippines.

Ecology.- On humus-rich moist grounds in half-shade places near the streams in not so dense forests at 700 m. altitudes.

Specimens examined.- P. Ratchata 85, 135, 270, 342; T. Boonkerd 1347 (BCU).

CRYP SINUS

Presl, Epim. Bot.: 123. 1849.

Epiphytic ferns, rhizome creeping, cover with peltate scales; stipes jointed to rhizome; fronds simple, lobe, monomorphic, edges of lobes cartilagineous; veins anastomosing with included free veinlets in areolae; sori round, arranged in one row at each side of costa between adjacent main veins, superficial or sunken.

Key to the species

1. Scales entire. Frond simple or tri-lobed; costa and. Sori shallowly cavities, raised on upper surface.....**1. *C. cruciformis***
1. Scales tooth at margin. Frond deeply lobed, with 1-4 pairs of lateral lobed and a terminal one. Sori hardly raised on upper surface.....
.....**2. *C. oxylobus***

1. Crypsinus cruciformis (Ching) Tagawa, Acta Phytotax. Geobot. 14: 193. 1952; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 48. 1968; in Fl Thailand 3(4): 559. f. 56.4-5. 1989.—*Polypodium cruciforme* Ching, Sinensia 1: 47. 1930.—*Phymatodes cruciformis* (Ching) Ching, Contr. Inst. Bot. Nat. Acad. Peiping 2: 77. 1933.—*Polypodium hastatum* Thunb. Sensu C. Chr., Contr. U.S. Nat. Herb. 26: 334. 1931.

Rhizome creeping, about 3 mm diam., densely scaly throughout, sparsely bearing fronds; scales narrowly subtriangular, gradually narrowing from peltate base to long attenuately acuminate apex, light grey to pale brown base, entire. **Stipe** various, about 0.5-4.5 cm long, stramineous,

densely scaly at low phyllopoles with those like rhizome-scales, upper portion glabrous. **Lamina** simple or tri-lobed, up to 12 cm long, 10 cm broad; lateral lobes patent or slightly ascending, oblong or oblong-subdeltoid, round at apex, up to 4 cm long, entire; terminal lobes large, gradually narrowing from base to moderately acute to acuminate apex, up to 8 cm long, entire; rachis raised on both surfaces, stramineous; costa and main veins distinct on both surfaces, ascending, more or less zigzag, the other veins hardly visible, anastomosing to form regularly areoles; texture papyraceous, green, paler beneath, glabrous. **Sori** round, large, about 2.5-3.5 mm diam., arranging in one row between adjacent main veins, in a single row of at half-way between midribs and margin of lobes, shallowly cavities, raised on upper surface. **Photo 134-135.**

Thailand.- NORTHERN: Chiang Rai (Doi Nang Ka), Chiang Mai (Doi Suthep, Doi Hua Mot).

Distribution.- China (Kwangtung, type) and N. Vietnam.

Ecology.- Epiphyte, on mossy tree-trunks in rather dry forests on ridges at 1,120-1,600 m altitudes.

Specimens examined.- P. Ratchata 244, 320; T. Boonkerd 52, 1077 (BCU).

2. Crypsinus oxvlobus (Wall. ex Hunze) Sledge, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 145. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 559. f. 56.6. 1989.—*Polypodium oxvlobum* Wall. ex Kunze, Linnaea 24: 255. 1851.—*Phymatodes oxvloba* (Wall. ex Kunze) Presl ex Ching, Contr. Inst. Bot. Nat. Acad. Peiping 2: 67. 1933.—*Pleopeltis hastata* (Thunb.) Beddome, Handb.: 362. f. 205. 1883.—*Pleopeltis trifida* (D. Don) Beddome, Handb. Suppl.: 96. 1892.—*Crypsinus taeniatus* var. *palmatus* (Blume) C. Chr. sensu Holttum, Dansk Bot. Ark. 23: 231. 1965.

Rhizome creeping to long-creeping, about 4 mm diam., bearing sparsely fronds, densely scaly throughout; scales subdeltoid, round to cordate at base, gradually narrowing from round peltate base to attenuately acuminate apex, brown in broader basal portion, pale in narrow tails, toothed at margin, about 2.5 by 1 mm. **Stipe** brown, polish, jointed to rhizome at low scaly phyllopoles, glabrous, about 5-15 cm long, grooved above; sclaes like those rhizome-scales. **Lamina** deeply lobed, with 1-4 pairs of lateral lobed and a terminal one, up to 35 cm long, 25 cm broad; rachis raised beneath, flat above, dark brown, paler on upper surface, winged with lobes 5-13 mm in breadth; lateral lobes usually longest at base, becoming smaller upwards, ascending, sometime bending downwards, gladiate to oblong, like the lateral lobed; midribs raised on both surfaces, main veins distinct, ascending, more or less zigzag, the other veins obscure, reticulate. forming irregular areoles with including veinlets; texture papyraceous, deep green, paler beneath, glabrous, narrowly margined with cartilaginous membrane. **Sori** round, about 2 mm diam., one between adjacent main veins, in a single row along both side of midrib, subcostular or medial, hardly raised on upper surface. **Photo 133.**

Thailand.- NORTHERN: Chiang Rai (Phu Langka, Doi Tung), Chiang Mai (Pong Pho, Doi Chiang Dao, Doi Suthep, Huai Kaeo, Doi Pha hom Pok, Doi Hua Mot, Doi Inthanon), Lamphun (Doi Khun Tan), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng), Prachin Buri (Khao Yai); SOUTH-WESTERN: Ratchaburi (Khao Luang).

Distribution.- N. India (type), Upper Myanmar, SW. China (Yunnan & Szechuwan) and Indochina.

Ecology.- On mossy tree-trunks in rather dry forests on mountain ridges at 1,600 m altitudes.

Vernacular.- Kut hom (กุ่มหอม) (Northern).

Specimens examined.- P. Ratchata 259, 261, 300, 319; T. Boonkerd 74 (BCU).

DRYNARIA

(Bory) J. Sm., J. Bot. 4: 60. 1841.

Epiphytic ferns, rhizome creeping, fleshy, thick; leaves in two kinds; nest-leaves sessile, sterile, usually placed to cover the rhizome persistent, usually humus-collecting, foliage-leaves pinnatifid; sipes not or distinctly jointed to rhizome, all lobes or pinnae articulated to rachis, some species without nest-leaves; sori round, borned on veins junction, arranged in one row on each side of costa.

Key to the species

1. Nest-leaves present
 2. Foliage-leaves pinnatifid or pinnatisect
 3. Nest-leaves sessile, ovate, lobes round at apex. Foliage-leaves lobed about 6-8 pairs **1. *D. sp.***
 3. Nest-leaves ovate-oblong; lobes acute at apex. Foliage-leaves lobed; lobes up to 12 pairs. Sori round, arranging in one row on each side of costa, rather closed to costa **3. *D. propinqua***
 2. Foliage-leaves pinnate; scales with very sparsely pale long downy hairs **4. *D. rigidula***
1. Nest-leaves wanting. Foliage-leaves lobed, up to 10 pairs; sori round, arranging in ones row on each side of costa, rather close to costa, one between main vein, slightly raised on upper surface **2. *D. parishii***

1. Drynaria sp.

Rhizome creeping, about 0.6 cm diameter, densely scaly throughout; scales narrowing from rounded peltate base to long-tailed apex, about 1.5 mm broad, 0.8-1 cm long, pale brown with dark center, sparsely hairy at margin with pale long downy hairs. **Nest-leaves** sessile, adnate, ovate-

subdeltoid, cordate at base, acute at apex, about 8-10 cm in both length and width, cleft or minutely lobed at margin; lobes round at apex, entire, subtriangular, up to 1 by 1 cm. **Foliage-leaves:** stipes stramineous, about 10 cm long, narrowly winged at least on the upper part, scaly at base with those like rhizome-scales; lamina oblong, up to 55 by 26 cm, deeply lobes almost to rachis, remaining wings of rachis about 1 mm in breadth; lobes about 6-8 pairs, oblong-lanceolate, acuminate at apex, narrowing towards base, entire and more or less crisped at margin, up to 15 by 3.8 cm, the basal lobes reduced; costas grooved above, glabrous; veins distinct on both surfaces, with a row of main areoles along both sides of midribs, anastomosing with or without free included veinlets, 5-7 rows of areoles between adjacent main veins, chartaceous, green to paler, glabrous. **Sori** not found on specimens. **Photo 109 and 112.**

Ecology.- On moist rock or on mossy tree trunks in shade areas at 600-620 m. altitudes.

Specimens examined.- P. Ratchata 291 (BCU).

2. **Drvnaria parishii** (Beddome) Beddome, Ferns S. India Suppl.: 24. 1876; Tagawa & K. Iwats., Acta Phytotax. Geobot. 24: 175. 1970; in Fl Thailand 3 (4): 548. f. 55.2-3. 1989.—*Pleopeltis parishii* Beddome, Ferns Brit. India t. 125. 1866.

Rhizome long-creeping, bearing fronds more than 3 cm apart, densely scaly throughout, about 0.5 cm diam; scales persistent, narrowing from peltate base towards long attenuate apex, about 5 mm long, 1 mm broad at base, pale brown with still paler margin and dark central point, edges with long downy white hairs. **Nest-leaves** wanting. **Foliage-leaves:** stipes stramineous, grooved above, up to 5 cm long, winged almost to the base, glabrous, scaly at base with those like rhizome-scales; lamina ovate to oblong, up to 20 by 15 cm, deeply lobed almost to rachis remaining very

narrow wings of rachis less than 2 mm in breadth; rachis raised on both surfaces, stramineous; lobes up to 10 pairs, oblanceolate, broadest at 1/3 part from apex, slightly narrowing to base, moderately acute to acuminate at apex, subentire at margin, up to 7.5 by 1.5 cm patent, ascending, costa raised on both surfaces; veins anastomosing, 3-5 row of areoles between adjacent main veins, with included free veinlets, raised on both surfaces; texture chartaceous, green or pale, paler beneath, glabrous. **Sori** round, up to 2 mm diam., arranging in ones row on each side of costa, rather close to costa, one between main veins, slightly raised on upper surface. **Photo 113.**

Thailand.- NORTHERN Chiang Mai (Huai Tong, Doi Chiang Dao, Doi Suthep, Tin Tok, Bo Luang), Lamphun (Doi Khun Tan), Tak (Rahaeng, Khao Pha Wo, Doi Musoe); SOUTH-WESTERN: Kanchanaburi (Si Sawat, Khao Ri Yai).

Distribution.- Myanmar (Moulmein, type) and Vietnam.

Ecology.- On mossy tree-trunks in Hill Evergreen forests at 890-1,270 m altitudes.

Specimens examined.- P. Ratchata 54, 92, 148; T. Boonkerd 621, 1229, 1282 (BCU); G. Murata, K. Iwatsuki & Chamlong Pengklai T. 14955 (BKF.).

3. Drynaria propinqua (Wall. ex Mett.) J. Sm. ex Beddome, Ferns Brit. India: t. 160. 1866; Handb.: 339, f. 189. 1883; Tagawa & K. Iwats.. Fl Thailand 3(4): 547. 1989.—*Polypodium propinquum* Wall. ex Mett., Abh. Senck. Naturf. Ges. 2: 120. t. 3. f. 50. 1857.

Rhizome long-creeping, about 0.5 cm diam., bearing fronds about 3 cm apart, usually very densely scaly throughout; scales persistent, narrowing from rounded peltate base to long-tailed apex, about 1 cm long, 1.5 mm broad at base, pale brown with dark central, the margin bearing long white downy hairs. **Nest-leaves** sessile, ovate, about 10 cm in both length and

width, lobed more than half-way between midrib and margin; lobes narrowly subtriangular, acute at apex, entire, up to 3 by 1 cm, small scales with downy hairs, more or less dense on main axes. **Foliage-leaves:** Stipes stramineous to brown, up to 16 cm long, narrowly winged at least on the upper part; scales like rhizome scales; rachis grooved above, with sparsely scaly throughout; lamina ovate to oblong-lanceolate, slightly narrowing towards base, up to 35 by 30 cm, pinnatifid, deeply lobed almost to rachis, remaining wings of rachis less than 2 mm in breadth; lobes up to 12 pairs, ensiform, acute to acuminate at apex, slightly narrowing towards base, patent, more or less ascending, up to 15 by 1.5 cm, edges entire or minutely serrate; costa raised on both surfaces, with sparsely hairy throughout; veins raised on both surfaces, anastomosing to form 2-4 rows of anastomosis between main veins, with included free veinlets; texture papyraceous to subchrateous. **Sori** round, about 1.5 mm diam., arranging in one row on each side of costa, rather closed to costa, a little raised on upper surface. **Photo 110.**

Thailand.- NORTHERN: Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Doi Hua Mot, Doi Suthep, Bo Luang).

Distribution.- Himalayas (type), S. China, Myanmar, Laos, N. Vietnam and Java.

Ecology.- On mossy tree-trunks in rather dry forests at 1,350 m. altitudes.

Specimens examined.- P. Ratchata 100, 105, 159, 161; T. Boonkerd 1206 (BCU); K. Iwatsuki, H. Koyama, N. Fukuoka & A. Nalampoon T. 9401 (BKF.).

4. Drynaria rigidula (Sw.) Beddome, Ferns Brit. India: t. 314. 1869; Hanb.: 344. f. 192. 1883; Holttum, Rev. Fl. Malaya 2: 183. f. 90. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 550. 1989.—*Polypodium rigidulum* Sw., Schrad. J. Bot. 1800(2): 26. 1801. pl. IV: 5.

Rhizome creeping, about 6 mm in diameter, densely scaly throughout; scales linear, broadest at base, gradually narrowing from peltate base to long-attenuate apex, up to 10 by 1 mm, pale brown with dark basal point, marginal with very sparsely pale long downy hairs. **Nest-leaves** sessile, oblong-subdeltoid, cordate at base, acute at apex, about 4 by 3 cm, shallowly lobed to 1/3 way towards midrib; lobes subtriangular, round to moderately acute at apex, entire. **Foliage-leaves**: stipes about 5 cm long, pale castaneous, very narrowly winged throughout, densely scaly at base with those like rhizome-scales; lamina oblong-lanceolate, pinnate, about 12 by 8 cm; rachis pale castaneous, downy-hairy throughout; lateral pinnae linear, about 3 pairs, sessile, about 8 cm long, 8 mm broad, unequally cuneate at base, caudately acuminate at apex, subentire or serrate at margin; costa raised on both surfaces, pale, jointed to rachis; veins distinct, copiously anastomosing 1-3 areole between main veins, with a row of main areoles along both sides of midribs. Sori round, one row along each side of costa, one between main veins, close to costa, raised on upper surface.

Thailand.- NORTHERN: Chiang Rai (Mae Kok), Chiang Mai (Mae Ho, Kong Kat, Ping Khong, Doi Suthep, Sop Aep, Doi Inthanon, Bo Luang), Phitsanulok (Thung Salaeng Luang), Tak; NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Sabap); SOUTH-WESTERN: Kanchanaburi (Wangka, Thung Kang Yang); PENINSULAR: Krabi (Ao Luek), Surat Thani (Ban Don), Yala (Betong).

Distribution.- Myanmar, Indochina, Malesia, Polynesia and tropical Australia.

Ecology.- On tree-trunks in rather dry forests at 1,300 m altitudes.

Vernacular.- Kra prok lek (กระปรอกเล็ก), kra prok hua hin (กระปรอกหัวหิน), kut thang (กูดถั่ง), kut fuei (กูดเฟื้อย), kut mai (กูดไม้), kut om (กูดอ้อม), kut hang ma (กูดหางม้า) (Northern).

Specimens examined.- P. Ratchata 334; T. Boonkerd 19, 20, 36, 37, 515; K. Sridith 18 (BCU).

LEMMAPHYLLUM

Presl, Epim. Bot.: 157. 1849.—*Weatherbya* Copel., Gen. Fil.: 191. 1947.

Epiphytic ferns, rhizome creeping, bearing fronds remotely; scales concolorous brown, clathrate; fronds simple, entire, usually dimorphic; fertile fronds narrow throughout or narrowed and fertile in apical part; veins anastomosing, hardly visible, with included free veinlets in areoles; sori continuous along margin, often covering the whole under surface when mature, covered with peltate toothed paraphyses.

Lemmaphyllum carnosum (Hook.) Presl, Epim. Bot.: 158. 1849; Tagawa & K. Iwats., Fl Thailand 3(4): 518. f. 52.2-3. 1989.—*Drymoglossum carnosum* J. Sm. ex Hook., Gen. Fil.: pl. 78A. 1841; Beddome, Handb.: 411. f. 243. 1883.—*Microsorium* sp.; Holttum, Dansk Bot. Ark. 20: 20. 1961.

Rhizome long-creeping, about 1 mm diam., brown, bearing fronds more than 2 cm apart, scaly throughout; scales narrowly lanceolate, gradually narrowing from ovate base towards long attenuate apex, about 3 mm long, 0.6 mm broad at base, brown, entire, all cells thickened walls. **Frond** simple, dimorphic. Sterile fronds; stipes very short, up to 1.5 cm long, stramineous, scaly at base; scales like rhizome-scales; lamina ovate or oblong-lanceolate, broadest at 1/3 part from apex, gradually narrowing towards apex, acuminate or attenuate-acuminate at apex, cuneate or cuneately attenuate at base, up to 11 cm long, 2.3 cm wide; midrib raised on both surface; veins hardly visible, copiously anastomosing, the margin cartilaginous; texture subcoriaceous, green or paler, black when dry. Fertile frond narrower and longer; stipes up to 3 cm long. **Sori** covering whole the under surface of lamina except midrib and margin.

Thailand.- NORTHERN: Chiang Rai, Chiang Mai (Doi Chiang Dao, Doi Suthep); NORTH-EASTERN: Loei (Phu Luang).

Distribution.- Himalayas (type from Nepal), to SW. China (Yunnan & Kwangsi) and N. Vietnam.

Ecology.- On branches of tree in Moist Mixed Deciduous forests at 730 m altitudes.

Specimens examined.- P. Ratchata 45, 293 (BCU).

LEPISORUS

(J. Sm.) Ching, Bull. Fan Mem. Inst. Biol. 4: 47. 1933.—*Drynaria* & *Lepisorus* J. Sm., Bot. Mag. 72. Comp. 13. 1846.—*Pleopeltis* Humb. & Bompl. ex Willd., Sp. Pl. 5: 211. 1810.

Epiphytic ferns; rhizome creeping, bearing frond closely; stipes articulated to rhizome; fronds simple, entire, monomorphic; veins anastomosing with included free veinlets in areoles; sori usually at junction of veins, round or nearly oblong, superficial or sunk in cavities, covered with umbrella-shape peltate paraphyses.

Key to the species

1. Scales brown to dark brown, or dark in central portion and pale margin, with or without irregular teeth at margin
2. Scales dark brown to black, with irregular teeth at margin
3. Sori about 2-3 mm broad
 4. Scales black, toothed at margin. Stipe indistinct, about 1 cm long. Sori round or elliptic, about 2 mm broad, only on the upper half of frond..... **2. *L. heterolepis***
 4. Scales brown to dark brown, rather irregular at paler margin or minutely toothed. Stipe about 1 cm long. Sori round to oblong, about 2.5 by 3 mm, nearly to the base..... **1. *L. contortus***

3. Sori more than 3 mm broad; scales dark brown to nearly black, sharply toothed at margin. Sori round to elliptic, sometime fusing to the next ones **5. *L. subconfluens***
2. Scales concolourous or dark brown in central portion
5. Scales concolourous, light brown. Stipe short, up to 2 cm long. Fronds up to 25 by 2.5 cm; texture papyraceous to subherbaceous; sori round to oblong, about 3.5 mm diameter, sometime obliquely elongate **6. *L. scolopendrium***
5. Scales dark brown in central portion. Stipe long, up to 5 cm long. Frond up to 30 by 2 cm, texture subcoriaceous; sori round, about 2.5 mm broad **4. *L. suboligolepidus***
1. Scales brown, entire. Stipe 3-5 cm long. Sori round or oblong, about 3 mm broad, distinct from the next ones **3. *L. nudus***

1. *Lepisorus contortus* (A. Christ) Ching, Bull. Fan Mem. Inst. Biol. 4: 90. 1933; Tagawa & K. Iwats., Fl Thailand 3(4): 513. f. 51.3. 1989.

Rhizome long-creeping, about 2.5 mm in diameter, bearing fronds with intervals more than 0.5 cm, densely scaly throughout; scales oblong-subdeltoid, broadest at base, gradually narrowing towards apex, rounded at base, attenuate at apex, brown to dark brown, slightly clathrate, rather irregular at paler margin or minutely toothed. **Stipe** about 1 cm long, stramineous, narrowly winged nearly to the base, scaly at base. **Frond** linear, up to 17 by 1 cm, attenuate towards both ends; midrib raised on both surfaces; veins invisible; texture coriaceous, green, paler beneath, the margin more or less recurved. **Sori** round to oblong, about 2.5 by 3 mm, nearly to the base, distinct from the next ones, hollowing on upper surface. **Photo 116.**

Thailand.- NORTHERN: Chiang Mai (Doi Inthanon).

Distribution.- Himalayas, Tibet and China (type).

Ecology.- On mossy tree trunks in Hill Evergreen Forests at ridges at 1350-1450 m altitudes.

Specimens examined.- P. Ratchata 160, 164, 307 (BCU).

2. **Lepisorus heterolepis** (Rosenst.) Ching, Bull. Fan. Mem. Inst. Biol. 4: 86. 1933; Tagawa & K. Iwats., Fl Thailand 3(4): 514. f. 51.1. 1989.

Rhizome creeping, bearing fronds with intervals of less than 1 cm, about 2.5 mm in diameter, densely scaly throughout; scales black, linear-subtriangular, clathrate, rounded at base, long attenuate at apex, toothed at margin, about 2 by 0.8 mm. **Stipe** stramineous, indistinct, about 1 cm long, variously winged on upper part, scaly at base. **Fron**d linear, about 15 by 1 cm long, broadest at 1/3 way from base, long attenuate at both ends; midrib raised on both surfaces; vein invisible, copiously anastomosing; texture coriaceous, the margin more or less recurved, green, paler beneath. bearing sparsely small peltate scales on under surface. **Sori** round or elliptic, about 2 mm broad, only on the upper half of frond. **Photo 111.**

Thailand.- NORTHERN: Chiang Mai (Doi Suthep), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang).

Distribution.- Sikkim (type) and SW. China (Yunnan).

Ecology.- On mossy tree trunks in Hill Evergreen forests at 1350-1450 m altitudes

Specimens examined.- P. Ratchata 94, 170, 172 (BCU).

3. **Lepisorus nudus** (Hook.) Ching, Bull. Fan. Mem. Inst. Biol. 4: 83. 1933; Tagawa & K. Iwats., Fl Thailand 3(4): 512. f. 51.4. 1989.

Rhizome long-creeping, about 2.5 mm in diameter, green on surfaces, bearing sparsely fronds, scaly throughout; scales clathrate, concolorously

light brown, ovate-oblong, rounded at base, gradually narrowing towards attenuate apex, about 3 by 1 mm. **Stipe** stramineous, usually 1 cm apart, 3-5 cm long, scaly at base, winged on upper part. **Fron**d linear, up to 30 by 15 cm, broadest at middle portion, gradually narrowing towards both long attenuate ends, entire, with a little revolute at margin; midrib raised on both surfaces; vein invisible, copiously anastomosing; texture subcoriaceous, deep green, paler beneath, sparsely minutely scaly on lower surface. **Sori** round or oblong, about 3 mm broad, distinct from the next ones, more or less raised, hollowing on upper surface. **Photo 117-118.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Phacho), Chiang Mai (Doi Nang, Doi Luang, Doi Hua Mot, Doi Chiang Dao, Doi Suthep, Doi Inthanon), Tak (Khao Phra Wo, Ban Musoe); NORTH-EASTERN: Loei (Phu Kradueng); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao).

Distribution.- Sri Lanka, S. India, Himalayas (type), Upper Myanmar to SW. China (Yunnan); also recorded from Sumatra.

Ecology.- On mossy tree trunks in Hill Evergreen Forests at 1450-1500 m altitudes.

Specimens examined.- P. Ratchata 104, 166, 177, 181, 251; T. Boonkerd 31, 77, 1018 (BCU).

4. Lepisorus scolopendrium (Ham. ex D. Don) Tagawa in Hara, Fl. East. Himal. 494. 1966; Tagawa & K. Iwats., Fl Thailand 3(4): 511. f. 51.6. 1989.

Rhizome creeping to long-creeping, bearing fronds sparsely, about 2.5 mm in diameter, dark brown, densely scaly throughout; scales ovate-subtriangular, broadest at base, gradually narrowing towards acuminate apex, concolorously light brown, clathrate, rather irregularly paler margin, about 3 by 1 mm. **Stipe** short, up to 2 cm long, stramineous, winged on the upper part, scaly at base. **Fron**d linear, often broadest at 1/3 part from base, gradually narrowing towards both ends, up to 25 by 2.5 cm, moderately

acute at apex, attenuate toward base, entire or a little revolute at margin; midrib raised on both surfaces; vein invisible, copiously anastomosing with branches included veinlets; texture papyraceous to subherbaceous, green, paler beneath, with sparsely minutely scaly on lower surface. **Sori** round to oblong, one between adjacent main veins, about 3.5 mm diam., distinct from the next ones, sometime obliquely elongate, superficial, the receptacles raised with hollows on upper surface. **Photo 120.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Pong Pho, Doi Pha Hom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon, Doi Hua Mot, Huai Mae Pan), Lamphun (Doi Khun Tan), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao); PENINSULAR: Surat Thani (Ban Don).

Distribution.- Himalayas (type) and Tibet, SW. China, Upper Myanmar and Indochina.

Ecology.- On mossy tree trunks in Hill Evergreen forests at 1,250-1,350 m. altitudes.

Specimens examined.- P. Ratchata 254, 350; T. Boonkerd 1038, 1071 (BCU).

5. **Lepisorus subconfluens** Ching, Bull. Fan Mem. Inst. Biol. 4: 85. 1933; Tagawa & K. Iwats., Fl Thailand 3(4): 514. f. 51.2. 1989.—*Pleopeltis subconfluens* (Ching) Tagawa & K. Iwats., Acta Phytotax. Geobot. 22: 100. 1967.

Rhizome creeping, about 2 mm in diam., bearing fronds rather closely near apex, densely scaly; scales oblong-subtriangular with round base and long attenuate apex, dark brown to nearly black, clathrate. the basal marginal portion brown and more or less clathrate, sharply toothed at margin, about 2.5 by 1 mm. **Stipe** stramineous, short, about 0.5 mm, wing on upper part decurrent near to the base, scaly at base; scales like those rhizome

scales. **Fron**d linear, about 15 by 1 cm. broadest at 1/3 way from base, gradually narrowing towards both ends, round to moderately acute apex; midrib raised on both surfaces; texture leatherly, green, paler beneath, bearing sparsely small peltate scale on lower surface; vein invisible. **Sori** round to elliptic, only the upper half of frond, often twice as long as broad, sometime fusing to the next ones, about 4 by 2.5 mm: the sterile portion of fronds usually revolted, in contrast to the remaining soriferous portion.

Photo 121.

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon).

Distribution.- Bhutan and SW. China (Yunnan, type).

Ecology.- On mossy tree trunks in Hill Evergreen forests at 1,200-1,350 m altitudes.

Specimens examined.- P. Ratchata 165, 169, 173, 348; T. Boonkerd 32, 1541 (BCU).

6. **Lepisorus suboligolepidus** Ching, Bull. Fan Mem. Inst. Biol. 4: 77. 1933; Tagawa & K. Iwats., Fl Thailand 3(4): 513. 1989.—*Pleopeltis suboligolepida* (Ching) Tagawa & K. Iwats., Acta Phytotax. Geobot. 26: 172. 1975.

Rhizome long-creeping, bearing fronds rather remotely, 2-2.5 mm in diam., scaly throughout; scales oblong-subtriangular, cordate at base, gradually narrowing towards attenuate-acuminate apex, dark brown in central portion, rather irregular at paler margin. **Stipe** stramineous, long, up to 5 cm long, scaly at base, winged on upper part. **Fron**d linear, broadest at middle portion, gradually narrowing towards both ends, cuneate at base, attenuate at apex, up to 30 by 2 cm, entire or a little revolted at margin; midrib raised on both surfaces, veins invisible, copiously anastomosing; texture subcoriaceous, deep green, paler beneath, with sparsely minutely

scaly on lower surface. **Sori** round, only on the upper half of frond, about 2.5 mm broad, distinct from the next ones, superficial. **Photo 123.**

Thailand.- NORTH-EASTERN: Loei (Phu Kradueng).

Distribution.- SW. China (Yunnan, type) and Taiwan.

Ecology.- On mossy tree trunks in Hill Evergreen Forests at 1,400-1,550 m altitudes.

Specimens examined.- P. Ratchata 185 (BCU).

LEPTOCHILUS

Kaulf., Enum.: 147. pl. 1. f. 10. 1824.—*Paraleptochilus* Copel., Gen. Fil.: 198. 1947.

Lithophytic or terrestrial; rhizome creeping; scales clathrate; fronds simple, articulated to rhizome, distinctly dimorphic; steriles broad; fertiles narrow, entirely by sporangia or rarely with vary oblique linear, more or less confluent sori; veins anastomosing with included free veinlets; sori covering the whole under surface of linear fertile laminae except on midrib and at margin.

Leptochilus decurrens Blume, En. Pl. Jav.: 206. 1828; Holtum, Rev. Fl. Malaya 2: 164. f. 74. 1960; DeVol & Kuo, fl. Taiwan vol. 1. 2nd ed.: 189. pl. 65. 1980; Tagawa & K. Iwats., Fl Thailand 3(4): 542. f. 54.7. 1989.—*Anapausia decurrens* (Blume) Presl. Epim. Bot. 186. 1849.—*Acrostichum variabile* Hook., Sp. Fil. 5: 277. 1864.—*Gymnopteris variabilis* (Hook.) Beddome, Ferns Br. Ind.: t. 272. 1868; Handb.: 429. f. 258. 1883.

Rhizome long-creeping, bearing fronds more than 1 cm apart, up to 0.5 cm in diam., scaly throughout; scales narrowly-subtriangular, gradually narrowing from base towards long attenuate apex, about 4 by 1 mm, clathrate, concolorous brown. **Frond** dimorphic: sterile fronds; stipes stramineous, short, up to 1.5 cm long, more or less winged at least on the

upper part, sparsely scaly at lower portion. Fronds oblong-lanceolate, broadest near base, cuneate at base and decurrent downwards to form wings of stipe, gradually narrowing upwards moderately acuminate at apex, edges entire or irregularly undulate. up to 30 by 7 cm; midrib raised on both surfaces, scaly throughout; main lateral veins distinct, the other veins visible, forming copiously areoles with forked or branched included free veinlets; texture papyraceous, dark green, paler beneath, dark in dried specimens: fertile fronds; stipes longer, up to 30 cm long, stramineous, wingless, scaly at base; fronds linear, up to 40 by 0.3 cm. **Sori** wholly covered by sporangia except on the midrib.

Thailand.- NORTHERN: Chiang Rai (Doi Phacho), Chiang Mai (Doi Chiang Dao, Tintok, Doi Suthep, Doi Inthanon), Lamphun (Doi Khun Tan), Mae Hong Son (Doi Loi Bian, Ban Pasui), Phrae (Huai Hom Noi), Lampang (Mae Tha); NORTH-EASTERN: Phetchabun (Phu Miang); SOUTH-EASTERN: Chanthaburi (Khao Ram, Khao Soi Dao Tai); SOUTH-WESTERN: Uthai Thani (Noen Pardu), Kanchanaburi (Kha Thalai); PENINSULAR: Nakhon Si Thammarat (Khao Luang).

Distribution.- S. India, Himalayas to S. China and Taiwan, Indochina, Malesia (type from Java), and Polynesia throughout.

Ecology.- Lithophytic or terrestrial on mossy rocks in dense evergreen forests near the streams at 680-800 m altitudes.

Specimens examined.- P. Ratchata 1, 16, 27, 40, 265; T. Boonkerd 509, 618, 632, 1275 (BCU)

LOXOGRAMME

(Blume) Presl, Tent. Pterid.: 214. pl. 9. f. 8. 1836.

Epiphytic ferns; rhizome short; scales clathrate; stipes tuft. not articulated to rhizome; fronds simple, monomorphic, usually oblanceolate in outline, fleshy, gradually narrowing to short stipe at base; veins reticulate to

form areoles with included free veinlets; sori elongate, usually oblique to midrib, immersed.

Key to the species

1. Rhizome creeping. Frond about 9 cm long, 0.5 cm broad; midrib raised on both surface, dark. Sori nearly parallel to midrib or a little oblique**1. *L. chinensis***
1. Rhizome short or ascending, frond up to 35 cm long, 3 cm broad; midrib raised on upper surface. Sori to form angles of about 30° to midrib, continuous from near margin to near midrib**2. *L. involuta***

1. *Loxogramme chinensis* Ching, Sinensia 1: 13. 1929; Tagawa & K. Iwats., Fl Thailand 3(4): 578. 1989.—*Loxogramme lanceolata* (Sw.) Presl sensu Beddome, Handb.: 392. 1883.

Rhizome creeping, about 1.5 mm diam., bearing fronds rather close, 2-3 cm apart, densely scaly throughout; scales oblong-lanceolate or ovate with rather broad tails, clathrate, dark brown to nearly black, cordate at base, gradually narrowing towards attenuate-acuminate apex. entire, about 2 by 1 mm. **Stipe** indistinct, stramineous, scaly at base, narrowly winged decurrent downwards near base. **Lamina** simple, linear-lanceolate, broadest at 1/3 way from apex, attenuate-acuminate at apex, gradually narrowing downwards to the wings of indistinct stipe, about 9 cm long, 0.5 cm broad; midrib raised on both surfaces, dark; veins indistinct; texture thick, coriaceous, fleshy, green, paler beneath, glabrous, more or less involute. **Sori** elongate, usually in a single row, nearly parallel to midrib or a little oblique, about 5 by 2 mm, naked, superficial.

Thailand.- NORTHERN: Chiang Rai (Phu Langka), Chiang Mai (Doi Chiang Dao, Doi Suthep, Doi Inthanon).

Distribution.- Assam, Bhutan, Upper Myanmar, S. & SW. China (Type) and N. Vietnam.

Ecology.- On mossy tree-trunks in Hill Evergreen forests at 1,400 m altitudes.

Specimens examined.- P. Ratchata 187; T. Boonkerd 499 (BCU).

2. **Loxogramme involuta** (D. Don) Presl, Tent. Pterid.: 215. 1836; Beddome, Handb.: 393. f. 228. 1883; Tagawa & K. Iwats., Fl Thailand 3(4): 577. 1989.—*Grammitis involuta* D. Don, Prodr. Fl. Nepal.: 14. 1825.

Rhizome short or ascending, bearing a tuft of fronds, about 0.5 cm in diam., scaly throughout, densely at apex; scales oblong-lanceolate, about 5 mm long, 1 mm broad, attached at base, gradually narrowing towards long-attenuate apex, clathrate, brown to grayish-brown, entire. **Stipe** short, indistinct, winged almost to the base, scaly at base; scales like rhizome-scales except in size, about 7 by 2 mm. **Lamina** simple, linear-lanceolate, acuminate to attenuately acuminate at apex, attenuate at base and decurrent to narrow wings of stipe nearly to the base, up to 35 cm long, 3 cm wide, entire at margin or sometime involute; midrib raised on upper surface, slightly raised on lower surface, stramineous or pale green; veins indistinct; texture thick, coriaceous, glabrous on both surfaces, deep green on upper surface, paler beneath. **Sori** linear, to form angles of about 30° to midrib, continuous from near margin to near midrib, up to 4 cm long, about 1.5 cm broad, superficial. **Photo 114 –115.**

Thailand.- NORTHERN: Chiang Mai (Doi Inthanon, Doi Chiang Dao, Khun Kong San, Doi Hua Mot), Tak (Khao Phra Wo, Mae Sot); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); EASTERN: Nakhon Ratchasima (Khao Yai).

Distribution.- India (type from Nepal), Upper Myanmar and Indochina.

Ecology.- On mossy tree-trunks in rather dry mountain ridges at 1,450-1,500 m altitudes.

Specimens examined.- P. Ratchata 178, 303; T. Boonkerd R. Polwath 12; T. Boonkerd 624, 1311 (BCU).

MICROSORUM

Link, Hort. Berol. 2: 110. 1833.

Epiphytic or lithophytic; rhizome creeping, covered with clathrate scales; stipes articulated to rhizome, sometime indistinct from the attenuate base of laminae; fronds simple and entire, or pinnate, monomorphic; veins anastomosing with free included veinlets; sori round to oblong, scattered, or arranged in one row at each side of costa.

Key to the species

1. Frond simple or deeply lobed
 2. Frond simple, entire or undulate
 3. Sori irregularly scattered, abundant
 4. Scales dark brown to nearly black, the margin brown and more or less fringed, shining; lateral main vein distinctly raised at least in lower surface..... **2. *M. membranaceum***
 4. Scales dark brown, toothed at margin, lateral main vein hardly visible **4. *M. punctatum***
 3. Sori arranging in two regular rows between adjacent main veins; scales, brown, toothed at margin. Frond up to 45 cm long including winged at base..... **6. *M. zippelii***
 2. Frond deeply lobed
 5. Scales entire. Sori irregularly scattered on the under surface of fronds **3. *M. pteropus***

5. Scales irregularly toothed at margin. Sori in one row arranging at each side of costa, distinctly raised on upper surface
 **5. *M. rubidum***
1. Frond pinnate, up to 1.50 m long, 80 cm wide; lateral pinnae up to 15 pairs, sori round, arranging in one row at each side of costa, nearly superficial..... **1. *M. cuspidatum***

1. Microsorium cuspidatum (D. Don) Tagawa in Hara, Fl. East. Himal.: 495. 1966; Tagawa & K. Iwats., Fl Thailand 3(4): 531. f. 53.3-4. 1989.—*Polypodium cuspidatum* D. Don, Prodr. Fl. Nepal.: 2. 1825.—*Phymatodes lucida* (Roxb.) Ching, Contr. Inst. Bot. Nat. Acad. Peiping 2: 61. 1933.

Rhizome fleshy, creeping, about 2 cm in diam., bearing a few fronds remotely, densely scaly throughout; scales peltate or circular, attached to rhizome a little basal than central point, 5-10 mm in both directions, the central portion with large cells, the cells becoming smaller towards margin, dark brown but paler towards margin, entire, more or less clathrate. **Stipe** stramineous to pale brown, grooved above, up to 40 cm long, scaly at base; scales like rhizome scales, dark brown to nearly black throughout. **Lamina** oblong to ovate-oblong, imparipinnate, acute to moderately acute at apex, truncate to broadly cuneate at base, up to 1.50 m long, 80 cm wide; rachis like the upper part of stipe; lateral pinnae up to 15 pairs, linear-lanceolate, round to cuneate at base, slightly oblique, stalked, gradually becoming smaller from base towards long attenuate apex, patent, more or less ascending, entire at margin, slightly undulate, basal pinnae the largest, up to 40 by 3.5 cm; the upper pinnae gradually smaller upwards; costa raised, stramineous; veins hardly visible, copiously anastomosing with included veinlets; texture herbaceous to softly papyraceous, green, pale below, dark brown to nearly black when dry. **Sori** round, about 2 mm, sometime up to

3.5 mm, arranging in one row at each side of costa, medial or a little costal, nearly superficial. **Photo 132.**

Thailand.- NORTHERN: Chiang Rai (Doi Tham Yup), Chiang Mai; EASTERN: Chaiyaphum (Nam Phrom); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng).

Distribution.- Himalayas (type), SW. China, Upper Myanmar, Laos and N. Vietnam.

Ecology.- On mossy rocks near the streams in Moist Mixed Deciduous forests at 800 m altitudes.

Vernacular.- Kut cham (กูดจ๋ำ) (Northern).

Specimens examined.- P. Ratchata 266; T. Boonkerd 1276 (BCU).

2. **Microsorium membranaceum** (D. Don) Ching, Bull. Fan Mem. Inst. Biol. 4: 309. 1933; DeVol & Kuo Fl. Taiwan vol. 1. 2nd ed.: 196. 1980; Tagawa & K. Iwats., Fl Thailand 3(4): 526. f. 53.2. 1989.—*Polypodium membranaceum* D. Don, Prodr. Fl. Nepal.: 2. 1825.—*Pleopeltis membranacea* (D. Don) Moore, Ind.: 191. 1860; Beddome, Handb.: 355. 1883.

Rhizome short-creeping, bearing closed fronds, usually near apical portion, scaly throughout, densely at apex; scales subtriangular, attached at base, about 3.5 mm long, 1.2 mm broad at base, clathrate with small cells, bicoloured, the central portion dark brown to nearly black, the margin brown and more or less fringed, shining, gradually narrowing from base towards acuminate apex. **Stipe** short, about 2 cm long, stramineous to dark brown, winged almost to the base, scaly at base; scales like rhizome scales. **Lamina** simple, oblong, broadest at middle portion, attenuate at base, acuminate at apex, margin entire to more or less crisped, up to 25 cm long, 7 cm wide; rachis raised on both surfaces, main lateral veins prominent; veins copiously anastomosing with free included veinlets in areoles, main areoles visible,

smaller areoles hardly visible, many in number and irregularly arranged; texture membranous to thinly herbaceous, glabrous, dark brown in dry specimens. **Sori** round, small, at join of veins, irregularly scattered usually in 2-5 rows between main lateral veins. **Photo 127.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon), Mae Hong Son (Mae Sariang), Lamphun (Doi Khun Tan), Lampang (Mae Ngao), Tak (Khao Phra Wo).

Distribution.- Sri Lanka, Himalayas (type from Nepal) to S. China, Taiwan, N. Vietnam and the Philippines.

Ecology.- On mossy tree-trunks in Hill Evergreen forests near the streams at 1,600 m. altitudes.

Specimens examined.- P. Ratchata 258, 318; T. Boonkerd 57, 84 (BCU).

3. **Microsorium pteropus** (Blume) Copel., Univ. Calif. Publ. Bot. 16: 112. 1929; Holttum, Rev. Fl. Malaya 2: 172. f. 80. 1954; DeVol & Kuo, Fl. Taiwan vol. 1. 2nd ed.: 196. 1980; Tagawa & K. Iwats., Fl Thailand 3(4): 529. 1989.—*Polypodium pteropus* Blume, En. Pl. Jav. 2: add. 3 . 1828.—*Pleopeltis pteropus* (Blume)., Handb.: 359. f. 203. 1883.

Rhizome long-creeping, 1-2 mm diam., green, bearing fronds rather closed, densely scaly; scales oblong-lanceolate, broadest at base, gradually narrowing towards acute apex, about 2.5 mm long, 1 mm broad, brown, clathrate, with rather irregularly cell arranged longitudinally, entire. **Stipe** indistinct or up to 10 cm long, about 0.5 or so apart from the next ones, stramineous, with the scales like those on rhizome but smaller in size, winged on upper portion. **Lamina** simple to trifoliate, simple lamina broadest at lower 1/3 portion, narrowing towards attenuately long-acuminate apex, narrowing towards attenuate base, decurrent downwards as wings of

stipes, entire, up to 20 cm long, 2.7 cm wide, the lateral lobes of trifoliate lamina various in shape and size, rarely almost the same as the terminal lobes, usually narrower, terminal lobes like simple lamina; midrib raised on both surfaces, sparsely scaly; veins distinct beneath, anastomosing with a row of main areoles along both sides of midrib and many smaller areoles in irregular arrangement; texture papraceous to subherbaceous, dark green to blackish in colour. **Sori** round to more or less elongate, many, irregularly scattered on the under surface of fronds. **Photo 125-126.**

Thailand.- NORTHERN: Chiang Rai (Mae Lao), Chiang Mai (Doi Chiang Dao, Doi Saket), Lampang (Mae Long), Tak, Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang); EASTERN: Buri Ram (Bu Khanun), Chaiyaphum; CENTRAL: Nakhon nayok (Khao Yai), Saraburi (Muak Lek); SOUTH-EASTERN: Chanthaburi (Pong Nam Ron); SOUTH-WESTERN: Ratchaburi, Kanchanaburi (Khao Ri Yai), Prachuap Khiri Khan (Huai Yang); PENINSULAR: Chumphon (Ban Tha Ngo), Ranong (Mueang Laen), Surat Thani (Ko Samui, Ban Don), Nakhon Si Thammarat (Khao Luang, Thap Chang, Khiriwong), Trang (Khao Chong), Satun (Bukit Racha Wang), Yala (Bannang Sata).

Distribution.- India to Malesia (type from Java), north to S. China and The Ryukyus.

Ecology.- On wet rocks near stream-beds in Mixed Deciduous forests or on humus-rich rocks near the streams at 670 m. altitudes.

Vernacular.- Kut hang nok kaling (กุดหางนกกะลิง) (Peninsular).

Specimens examined.- P. Ratchata 289; T. Boonkerd 538, 1185 (BCU).

4. **Microsorium punctatum** (L.) Copel., Univ. Calif. Publ. Bot. 16: 111. 1929; Holttum, Re. Fl. Mal. 2: 179. 1954. DeVol & Kuo Fl. Taiwan vol. 1. 2nd ed.: 196. 1980; Tagawa & K. Iwats., Fl Thailand 3(4): 528. 1989.—*Acrostichum punctatum* L. Sp. Pl. 2nd ed.: 1542. 1763.—*Pleoltis punctata*

(L.) Beddome, Ferns Brit. Ind. Suppl.: 22. 1876; Handb.: 357. f. 201. 1883.—
Polypodium punctatum (L.) Sw., Schrad. J. Bot. 1800 (2): 21. 1801.

Rhizome creeping, about 3-5 mm diam., bearing closed of fronds, scaly at apex; scales clathrate, oblong-subtriangular, gradually narrowing from ovate basal portion towards attenuate apex, greyish-brown, toothed at margin, about 7 by 1.5 mm. **stipe** indistinct, scaly at base, stramineous to palebrown. **Fron**d narrowly oblong to lanceolate, about 35-45 cm long, gradually narrowing towards both ends, moderately acute at apex, attenuate at base and decurrent downwards to form wings of stipe; midrib raised on both surfaces; vein anastomosing to form copiously areoles, indistinct; texture subcoriaceous, glabrous, the margin sometime revolute. **Sori** round, many, scattered on the whole under surface of fronds. **Photo 122.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok), Chiang Mai (Fang, Doi Chiang Dao, Tin Tok, Mae Rim, Doi Inthanon), Lampang (Mae Ngao), Tak (Lan Sang, Doi Musoe), Phitsanulok (Salaeng Luang, Thung Saleang Luang); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang, Phu Kradueng); EASTERN: Chaiyaphum (Phu Khieo); SOUTH-EASTERN: Prachin Buri (Khao Yai), Chon Buri (Si Racha, Hup Bon), Nakhon Ratchasima (Pak Thong Chai, Pak Chong), Chanthaburi (Takhamao Falls, Makham, Khao Kluea), Trat (Ban Saphan Hin, Ko Chang, Ko Kut); SOUTH-WESTERN: Kanchanaburi (Khao Ri Yai, Wangka, Sai Yok), Prachuap Khiri Khan (Bang Saphan); PENINSULAR: Ranong (Kra Buri, Khlong Nakha), Surat Thani (Ban Don), Phangnga (Khlong Nang Yon), Phuket, Nakhon Sri Thammarat (Khao Luang, Thung Song), Trang (Khao Chong), Yala (Khao Khalakhiri, Bannang Sata).

Distribution.- Throughout the Tropics of The Old World, W. Africa to Tahiti.

Ecology.- On mossy tree-trunks or on mossy rocks in open places along the streams at 650-700 m. altitudes.

Vernacular.- Kraprok hang sing (กระปรอกหางสิงห์) (South-eastern); prue mai (ปรีอไม้) (South-western); lin phi mai (ลินผีไม้), hang nok wa (หางนกหัว) (Peninsular); ai-ka bu kong ka-waeng (ไถกานุกงกะแวง) (Malay/Peninsular); Crested Fern.

Specimens examined.- P. Ratchata; T. Boonkerd 123, 157, 169, 172, 277, 1525 (BCU).

5. Microsorium rubidum (Kunze) Copel., Gen. Fil.: 197. 1947; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 53. 1968; Tagawa & K. Iwats., Fl Thailand 3(4): 532. f. 53.5. 1989.—*Polypodium rubidum* Kunze, Bot. Zeit. 1848: 117.—*Pleopeltis longissima* (Blume) Moore, Ind.: Ixviii. 1857; Holttum Rev. Fl. Malaya 2: 191. 1960.

Rhizome creeping or long-creeping, thick, about 1 cm in diameter, bearing fronds remotely, scaly; scales oblong-subdeltoid, clathrate, brown to dark brown, round or subcordate at base, gradually narrowing towards acute apex, about 4 by 1.5 mm, irregularly toothed at margin. **Stipe** stramineous, terete, about 10 cm long, winged on upper portion. **Lamina** linear-oblong, pinnatifid, with broadly winged throughout, moderately acute at apex, about 100 by 25 cm; lateral pinnae linear-lanceolate, about 30 pairs, acute to acuminate at apex, with a narrowly winged at base and decurrent to rachis, more or less ascending near base; costa raised on both surfaces; veins anastomosing; lateral main veins distinct, the other veins visible; texture papyraceous or herbaceous, deep green, brownish in dried specimens. **Sori** round; in one row arranging at each side of costa, distinctly immersed in surface depression which are prominently raised on upper surface, about 2-3 mm diam.. **Photo 119.**

Thailand.- NORTHERN: Lampang (Mae Tha); PENINSULAR: Nakhon Si Thammarat (Khao Luang), Yala (Bannang Sata).

Distribution.- India, Sri Lanka, Throughout Malesia and Polynesia, north to Vietnam.

Ecology.- On rather wet rocks near the streams in light shade areas at 650 m altitudes.

Vernacular.- Kraprok Bai Chaek (กระปรอกใบแดง) (South-eastern).

Specimens examined.- P. Ratchata 341; T. Boonkerd 1120/1, 1580 (BCU).

6. ***Microsorium zippelii*** (Blume) Ching, Bull. Fan Mem. Inst. Biol. 4: 308. 1933; Holttum, Rev. Fl. Malaya 2: 176. f. 85. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 525. 1989.—*Polypodium zippelii* Blume, Fl. Jav. Fil.: 172. t. 80. 1829.—*Pleopeltis zippelii* (Blume) Moore, Ind.: 348. 1862; Beddome, Handb.: 357. 1883.

Rhizome creeping, about 3 mm diam., bearing fronds more than 1 cm apart, scaly throughout; scales lanceolate to oblong-lanceolate, gradually narrowing towards long attenuate apex, about 5 mm long, 1 mm broad at base, clathrate, brown, toothed at margin. **Stipe** stramineous, join to the rhizome, up to 5 cm long, indistinct, winged almost on the upper portion, scaly at base; scales like rhizome-scales, sometime 6 mm in length. **Lamina** simple, gladiate or oblong-lanceolate, caudately acuminate at apex, broadest at middle portion, gradually narrowing towards long-attenuate base, up to 45 cm long including winged at base, 6.5 cm wide, entire at margin; midrib and main lateral veins raised on both surfaces, main veins not reaching at margin, veins more or less distinct, anastomosing to form areoles, smaller areoles in 3 rows between adjacent main veins with branched included veinlets; texture rather thin, green when dry, the older fronds brown to castaneous, midrib darker. **Sori** round, usually at junction of veinlets, arranging in two rows and rather closed between main veins, 1-2 mm diam.. **Photo 124.**

Thailand.- northern: Chiang Rai (Mae Len), Chiang Mai (Doi Chiang Dao); north-eastern: Loei (Phu Luang).

Distribution.- Himalayas to Malesia throughout (type from Java), northeast to S. China (Hainan) and Indochina.

Ecology.- On tree-trunks in evergreen forests near the streams at 730 m. altitudes.

Specimens examined.- P. Ratchata 44; T. Boonkerd 142, 143, 144, 646, 1159 (BCU).

PLATYCERIUM

Desv., Mem. L. Soc. 6: 213. 1827.

Large epiphytic ferns; rhizome short, covered by a mass of fronds and roots; fronds in two kinds, all part of fronds densely covered when young with stellate hairs, more or less glabrous when old; sterile frond or nest-leaves erect, sessile, persistent broad and cordate at base imbricate, basal portion thick and fleshy, protecting a mass of stems; roots and other decaying substances, shallowly lobed; fertile leaves or fertile fronds pendulous, articulated at base, entire, repeatedly forked dichotomously; veins anastomosing with free included veinlets; sporangia spreading on specialized areas. mixed with stellate hairs.

Key to the species

1. Nest-leaves about 50 cm in length. Fertile leaves about 80 cm or more long , with 1 or 2 main lobes, each with one soral patch.... **1. *P. holttumii***
1. Nest-leaves about 30-35 cm in length. Fertile leaves about 45 cm long; with 3 main lobes, 2 of which with one soral patch; mature nest-leaves brown **2. *P. wallichii***

1. **Platynerium holttumii** de Jonch. & Hannipman, Brit. Fern Gaz. 10: 116. pl. 12, f. 1-3. 1970; Tagawa & K. Iwats., Fl Thailand 3(4): 489. 1989.—
Platynerium grade J. Sm. ex Hook. sensu Beddome, Handb.: 445. f. 271. 1883.

Rhizome short-creeping. **Nest-leaves** about 50 cm in length, as wide as long, dichotomously lobed, the deepest sinus about 20 cm deep, lobes round or moderately acute at apex, about 5 cm in both length and width, thick, fleshy, green. **Fertile leaves** about 80 cm long or more length, pendulous, dichotomously branching, the base broadly cuneate, equal; ultimate lobes narrow, about 30 by 8 cm, thick. **Sporangia** on lower surface of a single broad fertile area in the basal sinus. **Photo 136.**

Thailand.- NORTHERN: Chiang Mai (Fang, Ban Huai Bong), Tak; NORTH-EASTERN: Nong Khai (Pak Cheng), Loei (Ban Na Luang); EASTERN: Chiyaphum (Nam Phrom), Nakhon Ratchasima (Khao Yai, type); SOUTH-EASTERN: Chanthaburi (Khao Phra Bat); SOUTH-WESTERN: Kanchanaburi (Erawan Falls).

Distribution.- Indochina and Malaya.

Ecology.- On tree-trunks in monsoon forests at 640-850 m altitudes.

Vernacular.- Chai pha sida (ชาบ้ำสี่ด้า) (Central); Holttum's Staghorn Fern.

Specimens examined.- T. Boonkerd 120, 180, 563 (BCU).

2. **Platynerium wallichii** Hook., Gard. Chron. 1858: 765; Beddome, Handb.: 445. f. 272. 1883; Holttum, Rev. Fl. Malaya 2: 141. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 488. f. 49.7-11. 1989.

Rhizome short-creeping, bearing fronds densely covered with scales. **Scales leaves** about 30-35 cm in length, as wide as long, dichotomously lobed, the deepest sinus about 15-20 cm deep; lobes round or moderately

acute at apex, longer than wide; main veins and secondary veins raised on both surfaces, smaller ones hardly visible; main veins dichotomous, secondary ones forming network, smaller ones more copiously anastomosing; texture thick and fleshy, green. **Fertile leaves** about 45 cm long, pendulous, repeatedly dichotomously branching, the base broadly cuneate; ultimate lobes narrow, about 15-20 cm, entire; main veins distinct, dichotomous, smaller ones hardly visible, copiously anastomosing with included free veinlets; texture thick, densely scattate hairy, green. **Sporangia** spreading a large area of the lower surface at base of the two first sinus of the fertile leaves.

Thailand.- NORTHERN: Chiang Rai (Mae Suai), Chiang Mai (Fang, Ping Khong, Doi Suthep), Mae Hong Son (Ban Mae Pang), Lampang (Huai Thak), Nakhon Sawan (Pang Ma Kham Pom, Takhli); NORTH-EASTERN: Loei (Phu Luang, Pha Nok Khao), Nong Khai (Pak Cheng); CENTRAL: Saraburi (Phrieo); SOUTH-EASTERN: Chon Buri (Si Racha); SOUTH-WESTERN: Kanchanaburi (Erawan Falls, Wangka); PENINSULAR: Ranong (Kapoe), Satun.

Distribution.- E. India, Myanmar (Tenasserim) and Yunnan to Malaya (Langkawi; Kedah, type).

Ecology.- On tree-trunks or lithrophytic in rather Mixed Deciduous forests at 880-900 m altitudes.

Vernacular.- Ka-cho-pho-na (กะฉอโพน่า) (Karen/Northern); Krapok hua mu (กระปรอกหัวหมู), Krapok yai (กระปรอกใหญ่) (South-eastern); chai pha sida (ชายผ้าสีดา) (Central); tong ho khao ya ba (ตองห่อข้าวข่าบา) (Northern); hua thao i ba (หัวเต่าอีบา) (North-eastern); Staghorn Fern.

Specimens examined.- P. Ratchata 74; T. Boonkerd 278, 1237, 1547 (BCU).

POLYPODIUM

L., Sp. Pl. 2: 1082. 1753.—*Goniophlebium* (Blume) Presl, Tent. Pterid.: 185. 1836.

Epiphytic ferns; rhizome creeping, scales clathrate; stipes articulated to rhizome at phyllopoles; fronds monomorphic, deeply pinnatifid to pinnate, when pinnate pinnae jointed to rachis; veins anastomosing, each areoles including a simple free veinlets running outwards towards margin; sori round, terminal on the included free veins, usually in one row along costa.

Key to the species

1. Rhizome dark brown. Frond deeply pinnatifid; rachis densely pilose on upper surface throughout; lobes up to 15 pairs. Sori round, more or less immersed.....**1. *P. amoenum***
1. Rhizome glaucous. Frond pinnate with distinctly terminal pinnae; rachis scaly; lateral pinnae about 8 pairs. Sori round, superficial..**2. *P. argutum***

1. Polypodium amoenum (J. Sm. ex Hook. et Grev.) Mett., Abhandl. Senckenb. Naturf. Ges. 2: 80 1857; DeVol. & Kuo, Fl. Taiwan vol. 1. 2nd ed.: 202. 1980; Tagawa & K. Iwats., Fl Thailand 3(4): 569. 1989.—*Goniophlebium amoenum* J. Sm. ex Hook. et Grev., Gen. Fil.: t. 50. 1840; Beddome, Handb.: 317. f. 170. 1883.—*Polypodium arisanense* Hayata, Icon. Pl. form. 4: 243. f. 170. 1914.

Rhizome wide-creeping, dark brown, about 5 mm diam., densely covered with scales throughout; scales linear-lanceolate, gradually narrowing from base towards long attenuate apex, about 7 mm long, 1 mm broad at base, light brown to grayish, more or less clathrate, toothed at margin. **Stipe** stramineous, grooved, up to 23 cm long, glabrous, scaly at base; scales

subtriangular, about 4 mm long, 1.5-1.8 mm broad at base, gradually narrowing from base towards attenuate apex, clathrate, brown to grayish, toothed at margin. **Lamina** oblong-subdeltoid to oblong-lanceolate, deeply pinnatifid with more or less distinct apical lobes, smaller ones subdeltoid, caudate at apex, caudate at base, up to 35 cm long, 26 cm wide; rachis stramineous, grooved above, usually sparsely minutely scaly beneath or sometime hairy, densely pilose on upper surface throughout; lobes up to 15 pairs, middle lobes the largest, the upper ones gradually becoming smaller, a few basal pairs a little shorter than the next above, slightly deflexed, the middle and lower ones patent, straight or slightly falcate, linear-lanceolate, long attenuate-acuminate at apex up to 12 by 2 cm, continuous to the next ones by wings of rachis more than 5 mm in breadth, slightly serrate or toothed at margin; costa raised on both surfaces, densely hairy on upper surface, sparsely scaly beneath; paraphyses on rachis minute, various in size and shape, brown; veins reticulate to forming a row of large costal areoles along each side of costa, each containing a simple included veinlet, the other veins free, visible on both surfaces; texture thin papyraceous to herbaceous, green, brown when dry. **Sori** round, at terminal on free included veinlets in costal areoles, thus in a single row at each side of costa, more or less immersed. with toothed scale like paraphyses. **Photo 128 and 131.**

Thailand.- NORTHERN: Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Doi Suthep, Doi Inthanon), Phitsanulok (Phu Miang); NORTH-EASTERN: Loei (Phu Luang); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao).

Distribution.- Himalayas (type) to Myanmar, S. China, Indochina and Taiwan.

Ecology.- On mossy tree-trunks on mountain ridges in rather dry Hill Evergreen forests at 1,500 m altitudes.

Specimens examined.- P. Ratchata 250, 257, 316, 325, 349; T. Boonkerd, HB. No. 00916 (BCU).

2. **Polypodium argutum** (J. Sm. ex Hook. et. Grev.) Hook., Sp. Fil. 5: 32. 1863; Tagawa & K. Iwats., Fl Thailand 3(4): 572. 1989.—*Goniophibium argutum* J. Sm. ex Hook. et Grev., Gen. Fil.: t. 51. 1840; Beddome, Handb.: 323. f. 174. 1883; DeVol & Kuo Fl. Taiwan vol. 1. 2nd ed.: 178. pl. 61. 1980.—*Polypodium taiwanianum* Hayata, Bot. Mag. Tokyo 23: 80. 1909.

Rhizome long-creeping, glaucous, 3-4 mm diam., densely scaly at apex; scales clathrate, narrowly subtriangular, with irregularly toothed at margin, brown, about 2.5 by 0.5 mm. **Stipe** stramineous or faintly castaneous, up to 10 cm long, scaly at base, glabrous upwards. **Lamina** pinnate with distinct terminal pinnae, oblong-lanceolate, 20 by 10 cm; rachis like the upper part of stipes, minutely scaly; lateral pinnae about 8 pairs, oblong-lanceolate, the basal one either reduced or the longest, the upper ones gradually becoming smaller upwards, slightly ascending, straight or more or less falcate, sessile, lower one patent, deeply cordate and more or less roundly auricled at base, attenuately acuminate at apex, serrate at margin; the lobes toothed; the larger pinnae up to 6 cm long, 1 cm broad; terminal pinnae usually longer, sometime deeply lobed at basal portion, up to 6 by 1 cm; veins anastomosing to form 2-3 rows of areoles at each side of costa. each areoles including a simple included free veinlets, the other veins free, ending inside the margin of lobes, visible on both surfaces; texture herbaceous, glabrous or minutely scaly beneath. **Sori** round, terminal on included veinlets of costal areoles, in a single row along each side of costa, medial, about 1 mm diam., superficial. **Photo 129.**

Thailand.- NORTHERN: Chiang Mai (Doi Pha Hom Pok, Doi Suthep, Doi Hua Mot, Pha Mon , Doi Inthanon), Lampang; NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng), Phetchabun (Phu Miang); SOUTH-WESTERN: Kanchanaburi (Si Sawat, Khao Ri Yi).

Distribution.- Himalayas (type) to China, Indochina, Taiwan and the Philippines.

Ecology.- On mossy tree-trunks on mountain ridges in rather dry Hill Evergreen forests at 1,600 m altitudes.

Specimens examined.- P. Ratchata 260, 317; T. Boonkerd 1253 (BCU).

PYRROSIA

Mirb., Hist. Nat. Veg. 5: 91. 1803.—*Niphobolus* Kaulf., Enum. Fil.: 124. 1824.

Epiphytes; rhizome creeping; scales usually peltate at the base; fronds simple, entire freshy, monomorphic to subdimorphic, covered with stellate hairs, generally caducous on upper surface; veins anastomosing; areoles with included veinlets pitted, hydathodes borne on upper surface in some species; sori round in a single row or more commonly in several close rows at each side of midrib, sometime appearance of the acrostichoid condition, covered to the apical half of the laminae, and protected by a dense mat of stellate hairs.

Key to the species and varieties

1. Indument dimorphic
 2. Lamina linear or linear-lanceolate, about 2 cm broad, bearing fronds close together
 3. Scales entire. Frond linear-lanceolate, broadest at middle or upper 1/3 way, up to 12 cm long, 0.7 cm wide **4. *P. manni***
 3. Scales hairy
 4. Frond linear, about 15-20 cm long, 0.5-0.7 mm broad, gradually narrowing towards both ends..... **8. *P. tonkinensis***
 4. Frond oblanceolate, widest above the middle, acuminate at apex, gradually narrowing towards attenuate base, up to 13 cm long, 1-1.3 cm wide **5. *P. mollis***

2. Lamina oblong or oblong-oblong, more than 3 cm broad
5. Rhizome short-creeping. Frond lanceolate, cuneate at base, decurrent downwards; stipe up to 7 cm long, the base of lamina long decurrent and winged on upper part of stipe**7. *P. stigmosa***
5. Rhizome long creeping; scales reddish-brown. Frond subdimorphic, cuneate at base, acute to acuminate or sometime caudately acuminate at apex; stipe brown to nearly black, up to 17 cm long.....**2. *P. lingua* var. *heteractis***
1. Indument monomorphic
6. Upper surface of frond with distinctly hydathode
7. Rhizome long creeping. Frond ovate-oblong to elliptic, round to broadly cuneate at base, caudately-acuminate at apex; stipe 3-7 cm long**3. *P. lingua* var. *lingua***
7. Rhizome short; scales brown. Frond slightly dimorphic, ovate or oblong-lanceolate; fertile fronds twice as long as sterile frond; stipe short **1. *P. adnascens***
6. Hydathode absent
8. Scales dark brown to nearly black, bearing pale downy hair at margin of apical part. Stipe short, up to 2 cm long, densely hairy**6. *P. nuda***
8. Scales light brown, dark at central base, with irregularly toothed at margin. Stipe up to 4 cm long, sparsely stellate hairy or glabrescent up wards**9. *P. varia***

1. *Pyrrosia adnascens* (Sw.) Ching, Bull. Chin. Bot. Soc. 1:45. 1935; Houttum, Rev. Fl. Malaya 2: 144. f.60. 1960; Tagawa & K. Iwats., Fl Thailand 3(4): 496. 1989.—*Polypodium adnascens* Sw., Syn. Fil.: 25, 222. pl. 2. f. 2. 1806.—*Niphobolus adnascens* (Sw.) Kaulf., Enum.: 124. 1824; Beddome, Handb.: 325. f. 176. 1883. *Cyclophorus adnascens* (Sw.) Desv.,

Berl. Mag. 5: 300. 1811.—*Pyrrosia lanceolata* (L.) Farw.; Hovenkamp, Leid. Bot. Ser. 9: 191. 1986.

Rhizome long-creeping, bearing fronds rather remote about 1-2.5 cm apart, 1 mm diam., densely scaly throughout; scales oblong-subdeltoid, about 3.5 mm long, 0.7 mm broad, acuminate at apex, round at base, brown, paler near margin, base entire to dentate, with a shining black spot near the attachment, hairy at margin. **Stipe** short, about 0.5 cm long, brown, densely scaly at base, **Fron**d slightly dimorphic, ovate or oblong-lanceolate, about 2.5-3 cm long, 0.5-0.7 cm wide, cuneate at base, round or acute at apex, gradually narrowing towards base; midrib distinct on upper surface, grooved above, raised beneath; veins hardly visible, anastomosing to forming regular areoles with included forked free veinlets; texture thick, subcoriaceous, green, curved back in dried condition; indument monomorphic, densely beneath, persistent, light grey to brown, with appressed, boat-shaped rays; hydathodes distinct, scattered over the lamina, distinctly pitted; fertile fronds like sterile fronds, but longer twice as long as sterile fronds. **Sori** round, distinct, scattered on all over the lower surface or in middle part of it, covering the whole surfaces with dense stellate hairs when young. **Photo 142.**

Thailand.-NORTHERN: Chiang Rai (Chiang Khong, Mae Suai), Chiang Mai (Fang, Mae Rim, Doi Chiang Dao, Doi Saket, Soi Suthep, Mae Klang, Sop Aep), Lampang (Khao Tham Pha Thai), Phitsanulok (Thung Salaeng Luang), Tak (Ban Musoe, Huai Krasa, Lan Sang); **NORHT-EASTERN:** Loei (Phu Luang, Phu Kradueng, Pha Nam Thop), Khon Kaen (Pha Nok Khao), Chaiyaphum (Tat Ton, Phu Khieo), Buri Ram (Chan Thuek); **CENTRAL:** Saraburi (Muak Lek), Nakhon Nayok (Khao Yai); **SOUTH-EASTERN:** Chon Buri (Si Racha, Ko Sichang), Chanthaburi (Makham, Khlung, Laem Sing, Khao Sabap), Trat (Ban Saphan Hin, Ko Chang, Ko Rang Yai); **SOUTH-WESTERN:** Kanchanaburi (Erawan), Prachuap Khiri Khan

(Huai Yang, Bang Saphan); PENINSULAR: Ranong (Khao Sai Daeng), Surat Thani (Ko Tao, Ko Kut, Ban Don), Phangnga (Takua Thung, Ko Kho Khao, Thung Maphrao, Ko Similan), Phuket (Ko Phu), Nakhon Si Thammarat (Khiriwong, Chawang, Khao Luang), Trang (Khao Chong), Phatthalung, Narathiwat (Bacho Falls), Yala (Bannang Sata).

Distribution.- Very widely known in the tropics of Asia, India to S. China, Indochina, Taiwan and the Ryukyus, Malesia throughout to Polynesia.

Ecology.- On mossy tree-trunks or on the rocks in exposed areas at 650-1,000 m. altitudes.

Vernacular.- Phak pik kai (ผักปิกไค) (Northern).

Specimens examined.- P. Ratchata 158, 246; T. Boonkerd 636, 660, 1127, 1256, 1560 (BCU).

2. ***Pyrrhosia lingua*** (Thunb.) Farw. var. ***heteractis*** Hovenkamp, Blumea 30: 208. 1984; Lied. Bot. Ser. 9: 206. 1986. P.p.—*Cyclophorus eberhardii* Christ, J. Bot. France 21: 237, 270. 1908.—*Pyrrhosia eberhardii* (Christ) Ching, Bull. Chin. Bot. Soc. 1: 59. 1935; Tagawa & K. Iwats., Fl Thailand 3 (4): 505. f. 50.9-10. 1989.—*Pyrrhosia mannii* (Gies.) Ching et *Pyrrhosia stigmosa* (Sw.) Ching sensu Houttum, Dansk Bot. Ark. 20: 19. 1961., p.p.—

Rhizome long creeping, bearing fronds remotely 2-5 cm apart, densely scaly throughout; scales oblong-lanceolate, patent, gradually narrowing from peltate base towards acuminate apex, about 7 mm long, 1 mm broad, light brown, dark at peltate attached point or nearly black central portion, ciliate at margin. **Stipe** 3-7 cm long, densely scaly at base with those like rhizome-scales, about 7 by 2 mm. **Lamina** ovate-oblong to elliptic, round to broadly cuneate at base, caudately-acuminate at apex, about 10 by 5 cm; fertile fronds taller than the sterile one, midrib distinct on both surfaces, raised beneath; veins invisible, copiously anastomosing, texture chrataceous,

the upper surface with stellate hairy or glabrescent, with dispersed hydathodes, the lower surface densely covered with hairs; hydathodes occasionally absent; induments dimorphic, persistent, light to grayish-brown, appressed, lower boat-shaped rays composed of hairs with mainly woolly rays. **Sori** round, distinct, scattered on all the lower surface or in upper part.

Photo 140.

Thailand.- NORTHERN: Chiang Mai (Doi Pha Hom Pok), Tak (Doi Pae Poe), Phitsanulok (Phu Miang).

Distribution.- Himalayas (type from Assam), upper Myanmar and SW. China (Yunnan).

Ecology.- On mossy tree-trunks or on mossy rocks in rather dry areas at 1,300-1,350 m altitudes.

Vernacular.- Thao hin (เถาหิน) (North-eastern).

Specimens examined.- P. Ratchata 98, 102 (BCU).

3. ***Pyrrosia lingua*** (Thunb.) Farw. **var. *lingua*** Amer. Midl. Nat. 12: 302. 1931.—*Polypodium heteractium* Mett. Ex Kuhn, Linnaea 36: 140. 1869.—*Niphobolus heteractus* (Mett. ex Kuhn) J. Sm., Ferns Br. For.: 296. 1877; Beddome, Handb.: 327. 1833.—*Pyrrosia heteractis* (Mett. ex Kuhn) Ching, Bull. Chin. Bot. Soc. 1: 57. 1935; Tagawa & K. Iwats., Fl Thailand 3(4): 506. f. 50.11-12. 1989.

Rhizome long-creeping, slender, about 2 mm diam., bearing fronds sparsely, scaly throughout, densely at apex; scales oblong-subtriangular, patent at least in the upper part especially in young portion, about 5 mm long, 1 mm broad, gradually narrowing from peltate base towards long-acuminate apex, reddish-brown, marginal paler, ciliate at margin. **Stipe** brown to nearly black, up to 17 cm long, scaly at base with those like rhizome scales, densely hairy throughout. **Lamina** subdimorphic, oblong-lanceolate to oblong, widest at below the middle, cuneate at base, acute to

acuminate or sometime caudately acuminate at apex, up to 16 cm long, 5.5 cm wide; midrib distinct on both surfaces, raised beneath; veins hardly visible; lateral main veins forming regular areoles included free veins many; texture subcoriaceous, green, densely stellate hairs beneath, sparsely on upper surface; hydathodes distinct, scattered over the lamina, more or less superficial; indument monomorphic, persistent, light to grayish brown, appressed, boat-shaped rays. **Sori** round, apical to all over the lamina, irregularly shaped patch, superficial. **Photo 137.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Doi Inthanon, Doi Suthep, Pha Mon), Phitsanulok (Phu Miang, Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng, Phu Paek); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao), Trat (Khao Kuap); SOUTH-WESTERN: Kanchanaburi (Si Sawat); PENINSULAR: Nakhon Si Thammarat (Khao Luang, Khao Phra Mi), Phangnga (Khao Phota Luang Kaeo), Trang (Khao Chong).

Distribution.- S. China (Hainan) and Vietnam (Type).

Ecology.- On mossy tree trunks or on the rocks in exposed area, in light shaded at 1,300-1450 m altitudes.

Vernacular.- Lin Kuram (ลันกูรัม) (Eastern).

Specimens examined.- P. Ratchata 99, 106, 163, 171, 190 (BCU).

4. **Pyrrosia mannii** (Giesenh.) Ching, Bull. Chin. Bot. Soc. 1: 55. 1935; Tagawa & K. Iwats., Fl Thailand 3(4): 502. f. 50.7-8. 1989.—*Niphobolus mannii* Giesenh., Niphobolus: 107. 1901.

Rhizome short-creeping, about 2 mm diam., bearing fronds rather close together, densely scaly throughout; scales lanceolate or subtriangular, acuminate at apex, about 2.5 mm long, 1 mm broad at base, brown paler near margin, dark spot near attachment, entire. **Stipe** indistinct with wings

decurrent from lamina. **Fron**d linear-lanceolate, gradually narrowing towards both apex and base, attenuate-acuminate at apex, broadest at middle or upper 1/3 way, up to 12 cm long, 0.7 cm wide; midrib distinct on both surfaces, usually covered with stellate hairs; veins invisible, anastomosing; texture rather thick, fleshy, densely covered with stellate hairs on upper surface; hydathodes distinct, scattered over the lamina; induments dimorphic, persistent, brown. **Sori** apical to all over the lamina, except the lower portion, nearly embedded in thick layer of hairs. **Photo 143.**

Thailand.-NORTHERN: Chiang Mai (Doi Inthanon, Khun Kong San, Mae Suai), Tak (Doi Pae Poe); north-EASTERN: Loei (Phu Paek); SOUTH-WESTERN: Kanchanaburi (Khao Ri Yai, Bo Rae).

Distribution.- Himalayas (type from Assam), SW. China (Yunnan), and Myanmar.

Ecology.- On mossy tree-trunks at 1,280-1,350 m. altitudes.

Specimens examined.- P. Ratchata 77, 327; T. Boonkerd 1120, 1294 (BCU).

5. **Pyrrosia mollis** (Kunze) Ching, Bull. Chin. Bot. Soc. 1: 53. 1935; Tagawa & K. Iwats., Fl Thailand 3(4): 501. 1989.—*Niphobolus mollis* Kunze, Bot. Zeit. 6: 121. 1884.—*Niphobolus fissus* (Blume) Beddome, Ferns Br. Ind. Corr.: ii, 1870; Handb.: 330. f. 179. 1883, nom. sol., non. Blume—*Pyrrosia penangiana* (Hook.) Houttum; Hovenkamp, Leid. Bot. 9: 218. 1986. p.p.

Rhizome short-creeping, bearing closed of fronds, about 3-5 mm diam., densely scaly throughout; scales oblong-lanceolate, gradually narrowing towards tails at apex, about 4 by 1.2 mm, base entire to ciliate, long ciliate at margin, bicoloured, dull brown to blackish with a distinct lighter margin. **Stipe** up to 10 cm long, indistinct, winged decurrent to the base, densely hairy, scaly at base. **Fron**d monomorphic, widest above the

middle, acuminate at apex, gradually narrowing towards attenuate base, up to 13 cm long, 1-1.3 cm wide; midrib distinct on both surfaces, not raised on upper part of upper surface, veins invisible, anastomosing; texture fleshy, rather leatherly; hydathodes distinct, all over the lamina; induments dimorphic, persistent, with appressed boat-shaped rays, lower layer composed of woolly rays. **Sori** round, covered on the whole lower surface of upper half of fronds, covered with stellate hairs. **Photo 139.**

Thailand.- NORTHERN: Chiang Rai (Phu Langka), Chiang Mai (Doi Pha Hom Pok, Doi Chiang Dao, Khun Kong San, Doi Hua Mot, Doi Suthep, Doi Inthanon, Pang Bo), Lampang (Mae Mo, Mae Ta); NORTH-EASTERN: Loei (Phu Kradueng); SOUTH-EASTERN: Trat (Ko Chang).

Distribution.- Sri Lanka, Himalayas to SW. China, Upper Myanmar and Indochina.

Ecology.- On various situation in exposed areas at 1200-1250 m altitudes.

Vernacular.- Kut mak (กุดหมาก) (Northern).

Specimens examined.- P. Ratchata 101, 157, 174, 304; T. Boonkerd 2, 470, 561 (BCU).

6. **Pyrrosia nuda** (Gies.) Ching, Bull. Chin. Bot. Soc. 1: 70. 1935; Tagawa & K. Iwats., Acta Phytotax, Geobot. 23: 110. 1968; Tagawa & K. Iwats., Fl Thailand 3(4): 499. f. 50.3. 1989.—*Niphobolus nudus* Gie., Nipn.: 149. 1901.—*Pyrrosia lanceolata* (L.) Farw.; Hovenkamp, Leid. Bot. Ser. 9: 191. f. 25. 1986. p.p.

Rhizome long-creeping, bearing fronds 2.5-3 cm apart, about 2 mm in diameter, densely scaly throughout; scales oblong-lanceolate, distinctly bi-coloured, dark brown to nearly black in central portion, paler at margin, appressed, bearing pale downy hairy at margin of apical part, round or subcordate at base, gradually narrowing towards attenuate apex, about 5 by

1.5 mm. **Stipe** short, about 1-2 cm long, dark brown, densely hairy. **Fron**d linear or linear-lanceolate, round to acute at apex, cuneate-attenuate at base, about 10-15 cm long, 5-8 mm broad; midrib raised beneath, grooved or flat on upper surface, stramineous to pale green, veins invisible; texture subcoriaceous, upper surface hairy or glabrescent; fertile fronds narrower and longer. **Sori** round, covering the whole lower surface of upper part of fronds. **Photo 138.**

Thailand.- NORTHERN: Tak (Ban Musoe, Khao Phra Wo).

Distribution.- Himalayas (type from Assam), Myanmar, SW. China (Yunnan), Vietnam and Laos.

Ecology.- On mossy tree trunks in rather dry forests at 900-1,200 m. altitudes.

Specimens examined.- P. Ratchata 46 (BCU).

7. ***Pyrrosia* *stigmosa*** (Sw.) Ching, Bull. Chin. Bot. Soc. 1: 67. 1935; Holttum, Fl. Malaya 2: 148. 1954; Tagawa & K. Iwats., Fl Thailand 3(4): 504. 1989.—*Polypodium stigosum* Sw., Schrad. J. Bot. 1800(2): 21. 1801.—*Cyclophrus stigmatasus* Desv., Mag. Ges. Naturf. Freunde Berlin (Berl. Mag.) 5: 301. 1811.—*Niphobolus stigosus* (Sw.) T. Moore, Ind. Fil.: 276. 1861; Beddome, Handb. Ferns Brit. Ind.: 329. pl. 178. 1883.

Rhizome short-creeping, bearing fronds closely, about 3 mm diam., brown to dark brown, densely scaly at apical portion; scales lanceolate, attached at base, gradually narrowing from base towards long attenuate apex, about 7 mm long, 1 mm broad, bi-coloured with nearly black central portion at base, dark brown margin of base and long tail, rather stiff and downy at apical portion. **Stipe** brown, up to 7 cm long, densely hairy throughout, scaly at base, the base of lamina long decurrent and winged on upper part of stipe; scales like rhizome scales. **Lamina** lanceolate, attenuate acuminate at apex, cuneate at base, decurrent downwards, broadest at middle to 1/3 way from

apex, up to 40 cm long including the wings of stipes, 5 cm wide, the upper surface with rather sparsely hairy or glabrescent, green with many scattered hydathodes, lower surface densely hairy, margin entire, sometime involute; induments dimorphic, persistent, light grayish-brown; midrib and main veins indistinct, raised beneath; veins hardly visible, anastomosing; texture coriaceous and rigid coriaceous when dry, the sterile and the fertile fronds not different. **Sori** round, closed, covering the whole undersurface of fronds, sometime covered the whole lower surface of apical half, becoming narrow in soriferous portion, usually covered with dense stellate hairs. **Photo 144.**

Thailand.- NORTHERN: Chiang Rai (Phu Langka), Chiang Mai (Fang, Doi Chiang Dao), Mae Hong Son, Lampang (Mae Mo, Mae Long, Ngao, Tham Pha Thai), Tak (Khao Phra Wo, Lan Sang, Huai Krasa, Rahaeng), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang), Nakhon Phanom (Mukdahan); CENTRAL: Saraburi (Muak Lek, Khao Khao), Nakhon Nayok (Nang Rong); SOUTH-EASTERN: Prachin Buri (Ban Hills), Chanthaburi (Takhamao Falls); SOUTH-WESTERN: Kanchanaburi (Huai Ban Kao, Linthin, Sai Yok), Prachuap Khiri Khan (Huai Yang); PENINSULAR: Chumphon (Tha Ko), Surat Thani (Khao Hua Khwai, Khao Na Daeng), Phangnga (Thap Put), Yala (Bannang Sata).

Distribution.- Myanmar, Indochina and southwards to W. & C. Malesia (type form Indonesia).

Ecology.- On mossy tree trunks or moist rocks in Mixed Deciduous forests near the streams at 680-1,300 m altitudes.

Vernacular.- Kha kai (ข่าไค้) (Central).

Specimens examined.- P. Ratchata 48, 63, 75, 93, 162, 191, 340; T. Boonkerd 128, 177, 383, 385, 591, 1221 (BCU); M. Tagawa, K. Iwatsuki & N. Fukuoka No. T 1256, T 2020, T 4079; E. Hennipman No. 3102; T. Smitinand No. 1737, 2729, 6094 (BKF).

8. ***Pyrrrosia tonkinensis*** (Gies.) Ching, Bull. Chin. Bot. Soc. 1: 55. 1935; Tagawa & K. Iwats., Fl Thailand 3(4): 501. f. 50.6. 1989.—*Niphobolus tonkinensis* Gies., Niph.: 144. 1901.—*Pyrrrosia porosa* (Presl) Hannipman var. *tonkinensis* (Gies.) Hovenkamp, Blumea 30: 208 (1984); Leid. Bot. Ser. 9: 229. 1986.

Rhizome short-creeping, about 2.5 mm in diam., bearing fronds rather closely, densely scaly except in older portion; scales oblong-subdeltoid, about 4 by 0.6 mm, light brown, nearly black in central portion, entire or lacerate at apical portion. **Stipe** indistinct, with winged decurrent to base. **Fron**d linear, about 15-20 cm long, 0.5-0.7 mm broad, gradually narrowing towards both ends; midrib slightly grooved on upper surface, raised beneath, sparsely hairy; veins invisible, anastomosing; texture thick, fleshy, rather leatherly; upper surface covered with stellate hairy or glabrescent; lower surface densely with two kinds of hairs; induments dimorphic, persistent, with appressed boat-shaped rays, lower layer composed of woolly rays. **Sori** on the whole lower surface of upper half of fronds, covered with stellate hairs when young.

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao), Lamphun (Doi Khun Tan); EASTERN: Chaiyaphum (Nam Phrom, Chulaphon Dam), Nakhon Ratchasima (Khao Lotueng); NORTH-EASTERN: Loei (Phu Luang); SOUTH-WESTERN: Kanchanaburi (Si Sawat).

Distribution.- S. China (Kweichow, Kwangsi, Hainan), Laos and N. Vietnam (type).

Ecology.- On various situation in open mountain forest at 1,000-1,350 m altitudes.

Specimens examined.- P. Ratchata 97, 107, 154, 297; T. Boonkerd 1226, 1545 (BCU).

9. ***Pyrrrosia varia*** (Kaulf.) Farw., Amer. Midl. Nat. 12: 302. 1931; Houttum, Rev. Fl. Malaya 2: 146. f. 61. 1960; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 52. 1968; Tagawa & K. Iwats., Fl Thailand 3(4): 499. 1989.—*Niphobolus varius* Kaulf., Enum. Fil.: 125. 1824.—*Pyrrrosia lanceolata* (L.) Farw.; Hovenkamp, Leid. Bot. Ser. 9: 191. 1986.

Rhizome long-creeping, bearing fronds more than 2 cm apart, about 1 mm diam., densely scaly throughout; scales oblong-lanceolate, gradually narrowing from round base towards long acuminate apex, about 5 mm long, 1 mm broad, light brown, dark at central base, base ciliate, with irregularly toothed at margin. **Stipe** brown to nearly black, dark at base, grooved above, up to 4 cm long, scaly at base, sparsely stellate hairy or glabrescent upwards; scales like rhizome scales. **Fron**d subdimorphic, gladiate to ensiform, attenuate at base, acuminate to attenuate-acuminate at apex, broadest at 1/3 part from apex, up to 21 by 3 cm, entire at margin or slightly crisped, involute when dry; rachis raised beneath, stramineous to brown, glabrous; veins anastomosing, hardly visible; texture coriaceous, green, upper surface glabrous, densely pale stellate hairs beneath; hydathode absent, induments monomorphic, thin, sparsely, persistent or fugacious, erecto-patent to slightly appressed; fertile fronds narrower and longer, sometime less than half in breadth. **Sori** round, about 1 mm diam., distinct or close to the neighboring, covering the whole lower surface of the upper part of fronds.

Photo 141.

Thailand.- EASTERN: Nakhon Ratchasima (Pak Thong Chai); SOUTH-EASTERN: Chanthaburi (Takhamao Falls); SOUTH-WESTERN: Kanchanaburi (Wangka); PENINSULAR: Nakhon Si Thammarat (Khao Luang), Phangnga (Takua Pa), Trang (Khao Chong), Satun (Thung Wa), Pattani (Bacho).

Distribution.- Throughout Malesia, Sumatra and Malaysia to New Guinea; also recorded from Polynesia.

Ecology.- On mossy rocks near the streams at 650 m altitudes.

Specimens examined.- *P. Ratchata* 113; *T. Boonkerd* 1223, 1486 (BCU).

PTERIDACEAE

Terrestrial ferns; fronds monomorphic; stipes brownish red to purple black or stramineous, grooved, scaly at base; veins free and forked or anastomosing; sori linear, continuous along margin; sporangia protected by the modified and sharply reflexed leaf-margin which are individual and separate or more or less continuous.

PTERIS

L., Sp. Pl.: 1073. 1753.

Rhizome erect, cover with entire or furrugineous scales; fronds pinnate to bipinnate or sometime tripartite, each basal pinna or branch with a pinnatisect or bipinnate branch; the branch similar in shape to the main part of the pinna but smaller; rachis always deeply grooved; veins free or anastomosing, forming costa areoles, without included free veinlets; sori linear, submarginal, continuous along the margin, protected by reflexed margin.

Key to the species

1. Frond tripartite
 2. Each lateral branch bearing with a large secondary branch
 3. Veins anastomosing, copiously forming one or more row of areoles outside costal ones and a row of costular areoles
.....**6. *P. tripartita***
 3. Veins anastomosing to form costal areoles only, the other veins forked, free,**9. *P. wallichiana***
 2. Lateral branch without secondary branches **5. *P. longipes***

1. Frond pinnate or pinnately compound
 4. Pinnae simple, entire
 5. Scales brown near edge, central dark brown to nearly black.
Stipe shining, 20-50 cm long; lateral pinnae simple, 3-7 pairs.....
.....**7. *P. venusta***
 5. Scales light brown. Stipe up to 30 cm long; lateral pinnae simple, about 30-35 pairs, sessile**8. *P. vittata***
 4. Pinnae deeply lobed, each of lower pinnae with a few branches near base
 6. Lateral pinnae about 3 pair, sessile or very short stalked, the spines on costae at base of costules prominent..... **1. *P. aspericaulis***
 6. Lateral pinnae more than 5 pairs
 7. Vein free except those united apically by soral commissure
 8. Stipe purple, about 60 cm long; lateral pinnae 6 pairs, opposite; rachis and costa grooved on upper surface.....
.....**2. *P. asperula***
 8. Stipe stramineous, about 30-35 cm long; lateral pinnae 7-10 pairs.....**4. *P. linearis***
 7. Basal veinlets uniting with those of opposite groups forming arches close to costa, bearing a few branches on posterior side
.....**3. *P. biaurita***

1. ***Pteris aspericaulis*** Wall. ex J. Agardh, Rec. Pterid.: 22. 1839; Tagawa & K. Iwats., Fl Thailand 3(2): 253. f. 1985.—*Pteris quadriaurita* var. *aspericaulis* (Wall. ex J. Agardh) Beddome, Handb.: 111. 1883.

Rhizome short, erect, densely scaly at apex, 0.5-0.7 mm diam., bearing fronds closed to each other or tuft; scales linear, dark brown, with pale ferruginous edge, about 3 by 0.2 mm. **Stipe** castaneous to deep purplish, about 15-45 cm long scaly at base; scales like rhizome scales.

Lamina ovate-subdeltoid, imparipinnate, about 35 by 25 cm; lateral pinnae 3-5 pairs, broadest at middle portion, sessile or very shortly stalked, ascending or subpatent, oblong-lanceolate, gradually narrowing towards caudately acuminate at apex, rounded at base, up to 15 by 3.5 cm, rather remote on purplish rachis, basal ones usually the largest, each bearing basal basisopic branches like upper pinnae; terminal pinnae like lateral ones, more or less longer than lateral pinnae; pinnules oblong, oblique, moderately acute at apex, dilated towards base, slightly falcate, continuous with neighboring one by very narrow wings of costae; the spines on costae at base of costules prominent, about 1 mm long; papyraceous, dully green; veins forked, all free, distinct on both surfaces. **Sori** continuous along margin of segments, except at base and ultimate of apex, indusiate; indusia formed by reflexed margin of lobes. thin but firm, pale brown, glabrous.

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Inthanon).

Distribution.- N. India (type), Upper Myanmar and Yunnan.

Ecology.- On mountain slopes in light shade areas at 1,450-1,500 m altitudes.

Specimens examined.- P. Ratchata 262, 278 (BCU).

2. **Pteris asperula** J. Sm. ex Hieron., *Hedwigia* 55: 362. 1914; Holttum, *Rev. Fl. Malaya* 2: 406. f. 236. 1960; Tagawa & K. Iwats., *Fl Thailand* 3(2): 252. f. 20.3. 1985.

Rhizome short, erect, bearing fronds close to each other, densely scaly at apex; scales linear, about 4 by 0.2 mm, brown to dark brown, with pale ferruginous margin. **Stipe** about 60 cm long, castaneous or stramineous upwards, grooved above and scaly at base, glabrescent; scales like rhizome-scales but paler and longer, about 5 by 0.2 mm. **Lamina** oblong-ovate in outline, about 40 by 25 cm, acute at apex, deeply bipinnatifid; pinnae opposite, about 6 pairs, oblong, ascending or slightly falcate, caudate at

apex, nearly truncate or slightly rounded at base, up to 15 by 4 cm; basal pinnae largest, bearing basal basiscopic pinnules like lateral ones, upper pinnae becoming smaller upwards; terminal pinnae like lateral ones, more or less bigger than another pinnae; pinnae segments continuous with neighboring ones by very narrow wing of costa, narrowly oblong, rounded at apex, about 2.5 by 0.5 cm; the spines on costa and costae up to 2 mm; rachis and costa grooved on upper surface; texture papyraceous, green; veins forked, all free, distinct on both surfaces. **Sori** continuous along margin of pinnae segments, from base towards apex; indusia membranous, pale brown, thin.

Thailand.- NORTHERN: Phitsanulok (Thung Salaeng Luang); SOUTHWESTERN: Kanchanaburi (Kroeng Kawia); PENINSULAR: Satun (Khuan Kalong).

Distribution.- Throughout Malesia (type from the Philippines).

Ecology.- On rather dry mountain slopes or in light shade areas at 700 m altitudes.

Specimens examined.- P. Ratchata 134 (BCU).

3. ***Pteris biaurita*** L., Sp. Pl.: 1076. 1753; Holttum, Rev. Fl. Malaya 2: 407. f. 237. 1960; Shieh Fl. Taiwan vol. 1. 2nd ed.: 293. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 253. 1985.—*Campteria biaurita* (L.) Hook., Gen. Fil.: t. 65 A. 1841; Beddome, Handb.: 116. 1883.—*Pteris repandula* Link, Fil. Sp.: 56. 1841.—*Pteris quadriaurita* var. *grevilleana* C. Chr., Bot. Tidsskr. 24: 106. 1901, p.p. excl. type.—*Pteris flavicaulis* Hayata, Mat. Fl. Form, 443. 1911.

Rhizome short, erect, bearing fronds in a tuft, densely scaly at apex, 1-1.5 cm diam.; scales linear, about 4 by 0.5 mm, dark brown, nearly black at marginal and terminal portion, toothed at margin, with pale ferruginous. **Stipe** about 70 cm long, stramineous, dark brown at base, sparsely scales

throughout and densely at base, grooved above and terete below, glabrous; scales like rhizome scales. **Lamina** ovate in outline, deeply bipinnatifid, acuminate at apex, about 70 cm long, 50 cm wide; lateral pinnae opposite or nearly so, up to 10 pairs, oblong-lanceolate, round or broadly cuneate at base, caudately acuminate at apex, broadly at middle portion, up to 25 by 6 cm, shortly stalk, deeply lobed to 5-6 way towards costa; basal pinnae bearing a long basisopic pinnule just like lateral ones; ultimate segments oblong, falcate, round to moderately acute at apex, with rounded sinus, edges entire; veins fork, all free, basal veinlets uniting with those of opposite groups forming arches close to costa, bearing a few branches on posterior side. **Sori** linear, along margin of segments except a bottom of sinus and at apex; indusia thin, pale. **Photo 148.**

Thailand.- NORTHERN: Chiang Rai (Mae Lao, Doi Tung, Mae Kok, Pang Kia, Doi Pacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Wang Tao, Doi Suthep, Ban Mae Kom, Ban Nong Lu, Ban Yang), Lamphun (Doi Khun Tan), Phetchabun (Phu Miang), Tak (Huai Krasa, Mae Sot, Doi Musoe, Lan Sang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); Chanthaburi (Khao Sabap), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Wangka, Sai Yok, Kroeng Kawia); PENINSULAR: Surat Thani (Khao Luang), Nakhon Si Thammarat (Thung Song), Phangnga (Khao Thong Lang), Trang (Khao Chong).

Distribution.- Pantropic (type from tropical America).

Ecology.- Terrestrial occurs in various parts of expose or shady areas at 650-1,250 m altitudes.

Vernacular.- Kut hang khang (กุดหางค่าง) (Northern); phak kut khon khang phaya nak (ผักกุดขนค่างพญานาค) (South-Western).

Specimens examined.- P. Ratchata 42, 271; T. Boonkerd 592, 626, 641, 714 (BCU).

4. **Pteris linearis** Poir. in Lamk., Enc. 5: 723. pl. 43. 1804; Shieh Fl. Taiwan vol. 1. 2nd ed.: 297. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 238. 1985.—*Pteris arisanensis* Tagawa in Acta Phytotax. Geobot. 5: 102. 1936.

Rhizome erect, ascending, bearing a tuft of fronds, densely scaly throughout; scales linear, gradually narrowing from base towards long attenuate apex, about 1 cm long, 0.5 mm broad, reddish-brown, nearly black margined by pale ferruginous edges with toothed margin. **Stipe** stramineous, slightly castaneous on lower part, scaly at base, about 30-35 cm long; scales like rhizome scales except in size, with pale ferruginous edges with broad. **Lamina** ovate or ovate-oblong, imparipinnate, about 40 by 30 cm, acute at apex; rachis stramineous, grooved above; lateral pinnae oblong-lanceolate, caudately acuminate at apex, broadly cuneate at base, opposite or nearly so, sessile or shortly stalked, straight, slightly falcate, about 7-10 pairs, up to 15 by 3 cm, deeply lobed to 3/4 way towards costa; basal pinnae bearing basiscopic pinnule just like lateral ones; lobes oblong, falcate, round or moderately acute at apex, up to 1.5 by 0.7 cm; basal pairs of veinlets forked, the basiscopic branches meeting those of the opposite groups at bottom of sinus forming triangular loop, the other veins forked, all free; texture papyraceous, deep green. **Sori** linear, along margin of segments except at bottom of sinus and apex; indusia thin, pale, entire.

Thailand.- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Hua Mot, Sop Aep); SOUTH-WESTERN: Kanchanaburi (Wangka).

Distribution.- E. Africa (type from Bourbon) and tropical Asia generally, but accurate area is not certain.

Ecology.- On mountain slopes in rather dry forests or in half-shade areas at 1,350 m altitudes.

Specimens examined.- P. Ratchata 281, 282 (BCU).

5. ***Pteris longipes*** D. Don, Prod. Fl. Nepal.: 15. 1825; Beddome, Handb.: 115. 1883; Shieh Fl. Tai vol.1. 2nd ed.: 297. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 235. 1985.—*Pteris pellucens* J. Agardh, Rec. sp. Gen. Pter.:43. 1839.

Rhizome erect or suberect, about 1 cm diam., bearing a few fronds in a tuft, scaly at apex; scales linear, brown or darker, entire, about 7 by 0.8 mm. **Stipe** up to 80 cm long, stramineous, glabrescent, with sparsely scales, grooved above; scales like rhizome scales or darker. **Lamina** tripartite, deeply bipinnatisect, middle branch up to 70 by 40 cm, lateral branches smaller, up to 40 by 15 cm, bearing no secondary branch; pinnule linear-oblong, broadly cuneate at sessile base, caudately acuminate at apex, deeply pinnatisect nearly to costae up to 12 by 2 cm, falcate; ultimate segments oblong, oblique at base, round to moderately acute at apex, serrate near tip, papyraceous, green, veins forked, all free, distinct on both surfaces; spines on costae 1.5-2.0 mm long, on costule 0.7-1.0 mm long, prominent; costae stramineous, grooved above. **Sori** along margin of segments, from base nearly to apex, indusiate; indusia formed by reflexed margin of lobes, brown, thin but firm, glabrous, up to 1 mm in breadth. **Photo 149.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao, Doi Suthep), Phrae (Mae Sai), Tak (Ban Musoe); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao).

Distribution.- N. India (type), S. China, Tonkin and Taiwan, southwards to the Philippines.

Ecology.- On mountain slopes in light shade or half-shade areas at 740 m altitudes.

Specimens examined.- P. Ratchata 34; T. Boonkerd 724 (BCU).

6. ***Pteris tripartita*** Sw., Schrad. J. Bot. 1800(2): 67. 1801; Holttum, Rev. Fl. Malaya 2: 408. f. 238. 1960; Tagawa & K. Iwats., Fl Thailand 3(2): 237. 1985.—*Pteris wallichiana* auct. non J. Agardh: Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 55. 1968.

Rhizome thick, erect, densely scaly throughout; scales oblong-subtriangular, dark brown, entire. **Stipe** pale castaneous, scaly at base, about 30 cm long. **Lamina** tripartite, middle branches about 25 cm long, bipinnatisect; lateral branches nearly as long as middle one; each branch bearing a large bipinnatifid branches on lower side towards base; lateral pinnae deeply lobe, caudately acuminate at apex; lobes upto 2/3 way toward costa; ultimate segments oblong, falcate, round at apex, serrate at margin; texture herbaceous, yellow-green, glabrous; veins anastomosing, copiously forming one more rows of areoles outside costal ones and a row of costular areoles. **Photo 151.**

Thailand.- NORTH-EASTERN: Nakhon Ratchasima (Kathok); SOUTH-EASTERN: Trat (Kpo Chang); PENINSULAR: Phangnga (Thap Put), Yala (Betong, Kue Long Falls).

Distribution.- Very widely distributed in the tropics of the Old World (Type from Java), southeast to Australia and Polynesia.

Ecology.- Terrestrial in open areas at 1,250 m altitudes.

Specimens examined.- P. Ratchata 356; T. Boonkerd 510 (BCU).

7. ***Pteris venusta*** Kunze, Bot. Zeit. 6: 195. 1848; Shieh Fl. Tai vol. 1. 2nd ed.: 300. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 256. 1985.—*Pteris pellucida* auct. non Presl: Beddome, Handb.: 106. 1883.—*Pteris matsudai* Masam. in Trans. Nat. Hist. Soc. Form. 25: 12. 1935.

Rhizome short, creeping or ascending, up to 1 mm diam., bearing fronds closely, densely scaly at apex; scales linear, brown near edges, central

dark brown to nearly black, about 3-4 by 0.5 mm. **Stipe** dark brown and scaly at base, stramineous or castaneous above, shining, puberulos or glabrescent, 20-50 cm long; scales like rhizome scales. **Lamina** ovate to oblong, imparipinnate; ultimate forked to trifoliolate, up to 60 by 40 cm; rachis castaneous or stramineous beneath, winged in the upperpart, puberula; lateral pinnae simple, 3-7 pairs, sessile or shortly stalked in lower ones, decurrent downwards in upper ones, little falcate, gradually narrowing towards cuneate base, caudate with long tail at apex, margin subentire or undulate in dried specimens, minutely serrate at apical portion, up to 25 cm long, 2-3.5 cm broad; terminal pinnae like the lower lateral pinnae but straight, chartaceous, the lower ones longest or a little shorter than the next above; costa raised, visible on both surfaces, stramineous to yellowish; veins close, forked, all free, directly from costa, visible on both surfaces. **Sori** continuous along the margin of pinnae except at base and towards apex, indusiate; indusia formed by reflexed margin of lobes, thin but firm. **Photo 145.**

Thailand.- NORTHERN: Chiang Rai (Doi Tham Tu Pu), Chiang Mai (Doi Chiang Dao, Doi Saket, Doi Suthep, Doi Inthanon), Lampang, Lamphun (Doi Khun Tan), Tak (Lan Sang, Khao Phra Wo), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng), Khon Kaen (Kranuan); EASTERN: Nakhon Ratchasima (Khao Yai); SOUTH-EASTERN: Chon Buri (Si Racha, Hup Bon), Prachin Buri (Ban Bueng Hills), Chanthaburi (Khao Soi Dao, Pong Nam Ron); SOUTH-WESTERN: Kanchanaburi (Sai Yok, Kroeng Kawia, Song Tho).

Distribution.- N. India to Malesia (type from Indonesia).

Ecology.- On rather dry mountain slopes or in light shade areas at 680-1,000 m altitudes.

Specimens examined.- P. Ratchata 22, 25, 53, 73, 121, 214, 268; T. Boonkerd 114, 115, 593, 1325, 1382; T. Seelanan 15 (BCU).

8. ***Pteris vittata*** L., Sp. Pl. 2: 1074. 1753; Holttum Rev. Fl. Malaya 2: 396. f. 23. 1960; Shieh Fl. Taiwan vol. 1. 2nd ed.: 300. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 233. 1985.—*Pteris longifolia* auct. non Retz.: Beddome, Handb.: 106. f. 55. 1883.

Rhizome short, ascending, bearing rather closed fronds, about 0.5-1 cm diam., scaly throughout; scales linear-lanceolate, gradually narrowing towards long attenuate apex, about 7 mm long, 1 mm broad, light brown, entire. **Stipe** up to 30 cm long, stramineous, scaly throughout, densely at lower part, grooved above. **Lamina** imparipinnate, oblanceolate, widest at upper 1/6 portion; rachis stramineous, grooved above, scaly throughout; pinnae simple, lower ones gradually becoming smaller downwards to mere auricle, middle or upper ones ensiform, straight, subopposite, about 30-35 pairs, sessile, cordate at base, attenuately long acuminate at apex, up to 15 cm long, 1 cm wide, edges entire, serrate at non-seriferous margin; terminal pinnae usually much longer, up to 20 cm or more long; veins forked, all free except when connected by soral commissure; texture papyraceous, deep green, paler beneath. **Sori** linear, along marginal of pinnae, continuous, from base to apex; indusia thin, pale green.

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Chiang Dao, Kaeng Ka, Mae Klang), Mae Hong Son (Mae Sariang), Lampang, Tak (Lan Sang, Mae Sot, Doi Musoe); NORTH-EASTERN: Loei (Ban Nong Noen Thong); CENTRAL: Saraburi (Muak Lek); SOUTH-EASTERN: Chanthaburi, Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Sai Yok, Erawan Falls, Song Tho, Chedi Sam Ong); PENINSULAR: Surat Thani (Ban Don), Phatthalung, Nakhon Si Thammarat (Ron Phibun), Phangnga (Thap Put), Songkhla, Trang, Satun, Yala (Bannang Sata).

Distribution.- Tropics and subtropics of the Old World (type from China), north to S. Japan.

Ecology.- On moist shaded in open areas or along the streams at 750-850 m altitudes.

Vernacular.- Kaching duphae (กะจิงคู่พะ) (Karen/Northern); kut tat (กูดตาด), kut mak (กูดหมาก) (Northern).

Specimens examined.- P. Ratchata 275; T. Boonkerd 594, 642, 715, 1219, 1329; C. Apasutaya 124 (BCU).

9. Pteris wallichiana J. Agardh, Rec. Pterid.: 69. 1839; Shieh Fl. Taiwan vol. 1. 2nd ed.: 301. 1980; Tagawa & K. Iwats., Fl Thailand 3(2): 236. 1985.—*Campteria wallichiana* (J. Agardh) Moore, Ind. Fil.: 221. 1861; Beddome, Handb.: 118. 1883.—*Pteris morrisonicola* Hayata in Bot. Mag. Tokyo 23: 33. 1909.

Rhizome thick, erect, bearing tuft of fronds, densely scaly at apex; scales oblong-subtriangular, about 8 mm long, 3 mm broad, long acuminate at apex, brown to reddish-brown, concolorous, entire. **Stipe** stramineous or castaneous, grooved above, scaly at base, about 1 m long. **Lamina** tripartite, each branch deeply bipinnatisect, middle branch up to 90 cm long, 35 cm wide, lateral branches nearly as long as middle ones, each bearing a large secondary bipinnatifid branch on lower side towards base, secondary branch bipinnatifid; lateral pinnae lanceolate or linear-lanceolate, caudately acuminate at apex, broadly cuneate at base, sessile, about 8 -10 pairs in middle branch and about 7-8 pairs in lateral branch, up to 30 by 10 cm, deeply lobed almost to costa, with narrowly winged about 0.5 - 1 cm broad; lobes ensiform, slightly falcate, apex acute, margin serrate, about 4 by 0.7 cm; veins anastomosing, forming costal areoles only, the other veins forked, free, more or less visible on both surfaces; texture herbaceous to papyraceous, green, glabrous. **Sori** linear along margin of segments from base to midway or sometime to apical part of segments; indusia rather thick, pale green, entire. **Photo 147.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok), Chiang Mai (Doi Chiang Dao, Kaeng Ka, Doi Suthep, Doi Inthanon), Phrae (Mae Sai), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Kradueng); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao).

Distribution.- N. India (type), S. China, Laos, S. Japan to Taiwan, south to Java, Celebes, and a variety in Samoa.

Ecology.- On light shade areas or near streams at 750 m altitudes.

Vernacular.- Sam ngam (สามง่าม) (Eastern).

Specimens examined.- P. Ratchata 272 (BCU).

SCHIZAEACEAE

Usually terrestrial ferns, without scales; stems subterranean, densely hairy; fronds vine like dimorphic; rachis twining, indeterminate growth, bearing short sterile and fertile branches; primary rachis-branches short, the apex dormant and covered with hairs, each bearing a pairs of secondary branches; secondary rachis-braches bearing leaflets in a pinnate arrangement, on dichotomously branching bearing digitately lobed leaflets; sporangia in special lobes terminal on the costae, in two distinct row, partly protected by the indusium-like recurved margin

LYGODIUM

Sw., Schrad. J. Bot. 1800(2): 7, 106. 1801.—*Ramondia* Mirb., Bull. Soc. Philom. Paris 2: 179. 1801.—*Ugena* Cav. Ic. Descr. Pl. 6: 73. 1801.—*Odontopteris* Bernh. Schrad. J. Bot. 1800(2). 127, t. 2. f. 4. 1801.—*Ripidium* Bernh. *I.c.* 127, t. 2. f. 3.—*Gisopteris* Bernh. *I.c.* 129, t. 2. f. 1.—*Hydroglossum* Willd. Abh. Kurfu“rstl. Mainz. Ak. Nu”tzl. Wiss. Erfurt 2(4). 13: 20. 1802.—*Hugona* Cav. ex Roem., Arch. Bot 2: 486. 1801-1802.—*Cteisium* Michx, Fl. Bor. Am. 2: 275. 1803.—*Vallifilix* Thouars, Gen. Nov. Madag. 1. 1808.—*Lygodictyon* J. Sm. in Hook. Gen. Fil. t. 111 B. 1842.

Rhizome creeping, densely covered with hairs; fronds climbing; pinnae reduced to short stalks, each bearing a pair of opposite pinnules, usually with an often dormant apical bud; sterile branches borne lower on rachis, sterile leaflets entire, toothed or lobed; veins usually free, forking; sporangia in 2 rows, 1 on each side of midvein of contracted, oblong, marginal lobed of ultimate segments, covered by hoodlike flab of tissue serving as indusium.

Key to the species

1. Secondary rachis-branches with a few leaflets
 2. Secondary rachis-branches pinnate to bipinnate, each branch bearing a single leaflets which is deeply 3 lobed, the lowest often 2-3 separate leaflets at its base, sometime formed to pinnate at lowest base leaflets **1. *L. flexuosum***
 2. Secondary rachis-branches normally pinnate, sometime the tertiary branches bearing one or more pairs of short spreading lateral leaflets, all leaflets of about equal size **3. *L. salicifolium***
1. Secondary rachis-branches bearing many alternate leaflets; leaflets 10 or more pairs; indusia densely covered with pale velutinous **2. *L. polystachyum***

1. Lygodium flexuosum (L.) Sw., Schrad. J. Bot. 1800(2): 106. 1801; Beddome, Handb.: 457. F. 283. 1883; Holttum, Fl. Mal. II. 1: 53. f. 9 e-f. 1959; Tagawa & K. Iwats., Fl Thailand 3(1): 62. 1979.—*Ophioglossum flexuosum* L. Sp. Pl.: 1063. 1753.—*Ophioglossum scandens* L. Sp. Pl.: 1063. 1753.—*Ramondia flexuosum* (L.) Mirb., Bull. Soc. Philom. Paris 2: 179. t. 12. f. 3. 1800.—*Hydroglossum flexuosum* (L.) Willd. Abh. Kurf. Mainz. Ak. Wiss. Erfurt 2: 23. t. 1. f. 3. 1802.—*Hydroglossum pinnatifidum* Willd. Ibid. 21.—*Lygodium pinnatifidum* Sw. Schrad. J. Bot. 1801(2): 303.

1803.—*Lygodium semipinnatum* R. Br. Prod. Fl. Nov. Holttum: 162.
 1810.—*Lygodium serrulatum* Blume En. Pl. Jav.: 254. 1828.—*Lygodium flexuosum* var. *setulosum* Tardieu & C. Chr. Fl. Gen. I.- C. 7: 39. 1939.

Rhizome short creeping, densely covered with dark brown hairs. **Stipe** close together. **Fronde** climbing, usually more than 3 m long; rachis narrowly winged, flattened and puberulous of the upper surface between the wings, stramineous; primary rachis-branches short, up to 5 mm long, the apex dormant, covered with pale brown hairs; secondary rachis-branches pinnate to bipinnate, oblong to subdeltoid in outline, commonly about 20-25 cm long, 7-8 cm wide, with acute apex, each branch bearing a single leaflets which is deeply 3 lobes, bearing leaflets on each side and an apical one; tertiary leaflets of lower branches palmate, the apical and lower leaflets asymmetric or more or less lobed at the base, the lowest often 2-3 separate leaflets at its base, sometime formed to pinnate at lowest base leaflets; leaflets acute or aristulate, base distinctly cordate, edges serrate, lower leaflets stalked, upper subsessile to sessile; texture papyraceous; costae usually bearing scattered long hairs, often densely short hairs, stalks up to 1 cm long, winged; veins often with scattered short hairs on the lower surface; fertile leaflets more or less smaller than sterile. **Sorophores** 1-4 mm long, protruding at margin of tertiary leaflets; indusia glabrous or with a few hairs like those of the lower surface of the lamina. **Photo 158-159.**

Thailand.- NORTHERN: Chiang Rai (Doi Chang, Chiang Khong, Chiang Kham, Tha Ko), Chiang Mai (Doi Phahom Pok, Mae Chaem, Doi Chiang Dao, Ban Huai Bong, Doi Suthep, Doi Chom Chaeng, Ping Khong, Doi Makena, Mae Klang, Pang Bo), Mae Hong Son (Mae La Noi, Mae Sarieng), Lampang (Doi Pang La, Huai Thak), Lamphun (Doi Khun Tan, Li), Phrae (Mae Ban), Nan (Pha Sing), Tak (Rahaeng, Bhumiphol Dam, Lan Sang), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang, Phu Kraduang), Khon Kaen (Pha Nok Khao, Phu Wiang); EASTERN:

Nakhon Ratchasima (Lat Bua Khac); SOUTH-EASTERN: Prachin Buri (Ban Ban Hills); SOUTH-WESTERN: Kanchanaburi (Ban Kasi, Sai Yok, Ban Kao), Prachuap Khiri Khan (Bang Saphan); PENINSULAR: Chumphon, Nakhon Si Thammarat (Thung Song), Phangnga.

Distribution.- Ceylon (type), N. India, SW. and S. China, Hongkong, Ryukyus and Taiwan, southwards to Queensland through Malesia and Melanesia.

Ecology.- Climbing fern occurs on dry ground in open or light shade places sometime found near streams in Mixed Deciduous forests at 680-1,350 m altitudes.

Vernacular.- Kut kong (กูดก้อง); kut doi (กูดคอย), kut ngot ngaet (กูดงอดแงด), kut phae (กูดแพะ), kut yong (กูดย่อง) (Northern); moi mae mai (หมอยแม่หม้าย) (Eastern); kachot (กะลอค), taphao khuen hon (ตะเภ่าขึ้นหนู) (South-western); tin mangkon (ตีนมังกร), tin takhap (ตีนตะขาบ) (Central); liphao yai (ลิเภ่าใหญ่), saiphan phi (สาขพานผี), (Peninsular); thu kai kho (ทุไก่อโค) (Karen/South-western); ribu basa (ริบูบะซา) (Malay/Peninsular).

Uses.- Stipes used as a material for handicraft, such as handbag.

Specimens examined.- P. Ratchata 109, 256; T. Boonkerd 11, 511, 725, 1242, 1305 (BCU).

2. **Lygodium polystachyum** Wall. ex Moore, Gard. Chron.: 671. 1859; Beddome, Handb.: 458. f. 284. 1883; E Smith, J. Siam Soc. Nat. Hist. Suppl. 8: 8. 1929; Holttum, Rev. Fl. Malaya 2: 56. f. 10. 1960; in Fl. Mal. II. 1: 46. f. 5c, 8 a-c. 1959; Tagawa & K. Iwats., Fl Thailand 3(1): 59. 1979.

Rhizome creeping, densely covered with hairs, bearing stipes close together. **Fron**d climbing, sometime more than 3 m long; stipes 10-30 cm long, brown, densely hairy throughout; rachis like the upper part of stipes, slender, paler, hairy, terete; pinnae numerous, 10-15 cm apart; primary

rachis-branches very short, usually 2-3 mm long, rather thick, the apex densely covered with short unicellular hairs, bearing many alternate leaflets; leaflets 10 or more pairs on secondary branches, with short stalks of 2 mm or so, oblong, acute to moderately so at apex, subtruncate or rounded at base, side lobed about 2/3 of way to the costa, hairy on veins and margin; lobes slightly oblique, with parallel sides and rounded apex, up to 12 mm long 4 mm wide, basal widest, lobes continuous with neighboring ones by very narrow wing of costa, ultimate lobes round at apex, entire; costa and main veins bearing scattered bristles above and below, costa with shorter hairs. **Sorophores** bearing lobes narrow, on the undersurface, up to 1.5 cm by 0.2 cm; indusia densely with pale velutinous. **Photo 152 and 157.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Nam Mae Kok), Chiang Mai (Doi Chiang Dao, Huai San, Doi Suthep, Doi Buak Ha, Tha Ko, Lampang, Phitsanulok (Thung Saleang Luang); NORTH-EASTERN: Phetchabun (Phu Miang); SOUTH-EASTERN: Chon Buri (Si Racha); CENTRAL: Nakhon Nayak; SOUTH-WESTERN: Prachuap Khiri Khan (Bang Saphan); PENINSULAR: Chumphon, Surat Thani (Khao Tha Phet, Huai Mut, Ban Don, Ko Tao), Nakhon Si Thammarat (Ronphibun, Lan Saka), Phuket (Thalang), Songkhla (Khao Pak), Trang (Khao Chong), Narathiwat (Bacho).

Distribution.- Assam, Myanmar, SW. China (Kwangsi & Yunnan), Indochina and Malaya (type).

Ecology.- Climbing on dry slopes in mixed forests at 680-920 m altitudes.

Vernacular.- Kut khua (กูดเหือ), kut kong (กูดก้อง) (Northern); liphao (ลิผา), liphao yong (ลิผาช่อง) (Peninsular).

Uses.- Stipes used as a material for handicraft, such as handbag.

Specimens examined.- P. Ratchata 50, 238; T. Boonkerd 449, 667, 668, 726, 734, 1132, 1269 (BCU).

3. **Lygodium salicifolium** Presl, Suppl. Tent. Pterid.: 102. 1845; Holttum in Fl. Mal. II. 1: 51. f. 6. 10, 13 a-b. 1959; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 51. 1968. *Lygodium kingii* Copel. Philip. J. Sc. 6: 68. 1911; Tagawa & K. Iwats., Fl Thailand 3(1): 64. 1979.—*Lygodium pinnatifidum* sensu Rac. Fl. Buit.: 7. 1898.—*Lygodium flexuosum* sensu Holttum Ferns Mal.: 57. 1955.

Rhizome short creeping, densely covered with blackish or brown hairs, bearing remote fronds. **Fron**d very large, climbing, to several meters; primary rachis-branches always very short, ending in a dormant apex covered with brown hairs, 2-3 mm long; secondary rachis-branches normally pinnate, sometime the tertiary branches bearing one or more pairs of short spreading lateral leaflets, with about 4-5 pairs of leaflets and a terminal usually deeply lobed leaflets, all leaflets of about equal size, and all stalked; stalks 5-10 mm long and thickened at junction with lamina; leaflets oblong-lanceolate, acute at apex, typically 5-10 cm long, 1-2 cm broad, edges of sterile leaflets finely crenate to serrate, base caudate to truncate; stalks of leaflets distinct but wanting in smaller leaflets, up to 1.5 cm long; surface of leaflets herbaceous to papyraceous, fresh green, almost glabrous on both surfaces except the margin hairy, upper surface of costae more or less hairy especially towards the base, lower surface often glabrous; every axis higher than the secondary rachis-branches with narrow but distinct wing, pubescent throughout. **Sorophores** 2-5 mm long, bearing lobes protruding at margin of tertiary leaflets, usually constricted at the base, often with hair on upper surface of midrib; indusia glabrous. **Photo 146 and 150.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Chang, Nam Mae Kok), Chiang Mai (Doi Chiang Dao, Doi Suthep, Tha Ko), Phrae (Huai Ton Yang, Mae Sai); NORTH-EASTERN: Loei (Phu Luang); EASTERN: Nakhon Ratchasima; CENTRAL: Chon Buri (Ban Bung), Trat (Laem Ngop, Ko Chang); SOUTH-WESTERN: Kanchanaburi (Kroeng Kawia, Sai Yok),

Prachuap Khiri Khan (Bang Saphan); PENINSULAR: Surat Thani (Ban Don, Ko Tao), Phangnga (Khao Nang Hong), Nakhon Si Thammarat (Thung Song, Ronphibun, Khiriwong), Trang (Khao Chong), Phatthalung, Satun (Tarutao), Narathiwat (Bacho Falls, Sg. Kolok), Yala (Bannang Sta).

Distribution.- Assam to Yunnan, Indochina, Hainan, Taiwan, throughout Malesia (type from Singapore), southeast to New Guinea and Micronesia.

Ecology.- Climbing in Mixed Deciduous and Hill Evergreen forests at 650-1,100 m altitudes.

Vernacular.- Kut khue (กูดคือ), saiphan phi (สาขพานผี), u taphao (อู่ตะเภา) (Northern); kachot (กะจอต), kachot nu (กะจอตหนู) (South-eastern); yan I-phao (ย่านอีเภา), yan yai phao (ย่านยายเภา) (Peninsular); libu (ลิบู) (Malay/Peninsular).

Uses.- Stipes used as a material for handicraft, such as handbag.

Specimens examined.- P. Ratchata 17, 51, 81, 86; T. Boonkerd 54, 425, 658, 666, 727, 1189, 1272; P. Leethavorn 1 (BCU).

THELYPTERIDACEAE

Terrestrial ferns; rhizome creeping or erect, scaly at apex; stipes not articulated to rhizome, containing two vascular bundles at base and uniting into U-shape in the upper part, with or without aerophore; fronds monomorphic, pinnate to pinnatifid, usually oblong or narrowly elliptic in outline, not enlarged basiscopic basal pinnules of lowest pinnae; surfaces bearing slender unicellular hairs and sometime also short glandular hairs; veins free or anastomosing, running to margin; sori occasionally nearly marginal, round or some time elongate; indusia round or reniform or sometime absent.

THELYPTERIS

Schmidel, Icon. Pl. ed. Keller: 45. t. 11, 13. 1763.

Rhizome creeping or ascending or erect; scales concolorous, hairy; fronds pinnate, proximal pinnae reduced or not, apex commonly gradually reduced in frequently abruptly reduced and pinna like; veins free, or regularly anastomosing to form rather regularly quadrangular areoles; sori round; indusia round or reniform, persistent, hairy, sometime absent; sporangia setiferous or glabrous.

Key to the species

1. Vein anastomosing, goniopteroid or meniscioid
 3. Scales entire
 4. Rhizome erect or ascending; lower pinnae gradually becoming small downwards to butterfly-shaped, pubescent beneath.....
.....**3. *T. crinipes***
 4. Rhizome long-creeping
 5. Pinnae hirsute beneath, with densely yellow-glandular along veinlets throughout as well as hairy**1. *T. arida***
 5. Pinnae hairy throughout, without glandular**6. *T. hirtisora***
 3. Scales hairy
 6. Indusia hairy
 7. Rhizome erect or ascending
 8. Lower pinnae gradually becoming smaller downwards to from butterfly shaped
 9. Lateral pinnae about 18 pairs, densely pubescent on both surfaces, basal veinlets and basal second anterior ones uniting below callous membrane**4. *T. dentata***

9. Lateral pinnae 10-15 pairs; glabrous on both surfaces,
with yellow-glandular sparsely along lateral veins
..... **10. *T. papilio***
8. The basal one to three pairs of lateral pinnae slightly
reduced; basal veinlets uniting to form simple goniopteroid
venation, densely hairy on both surfaces **12. *T. siamensis***
7. Rhizome creeping to long-creeping
10. Lateral pinnae up to 6 pairs
11. Pinnae 4-6 pairs, subentire or irregularly undulate,
with cartilaginous at margin, verrucose, sparsely
pubescent or glabrescent **2. *T. aspera***
11. Pinnae 5-7 pairs; lower surface of lamina glandular,
gland as well as hairy **5. *T. glandulosa***
10. Lateral pinnae more than 10 pairs
12. Verrucose on lower surface or glabrous
13. Pinnae variously lobed, with callous membrane at sinus
between lobes
14. Basal pair of veinlets actually anastomosing; the
second basal pairs running to the callous membrane,
about 9-11 pairs **14. *T. terminans***
14. At least of the second basals veinlets uniting with
excurrent veinlets below callous sinus, about 8-12
pairs **13. *T. subelata***
13. Pinnae subentire, callous membrane absent at sinus
between crenae; veins menisoid about 16 pairs
..... **8. *T. nudata***
12. Under surface with glandular hair, pinnae up to 17 pairs,
glands rod-shaped, orange to red **11. *T. parasitica***

6. Exindusiate or Indusia glabrous, entire

15. Sori exindusiate, lateral pinnae up to 10 pairs

..... **7. *T. lakhimpurensis***

15. Indusia entire, glabrous, lateral pinnate about 30 pairs

..... **16. *T. truncata***

1. Vein all free

2. Sori dorsal on veinlets, one for each lobe, exindusiate **9. *T. ornata***

2. Sori usually close to midrib of ultimate segments; indusia very

small, bearing a few capitate hairs **15. *T. torresiana***

1. *Thelypteris arida* (D. Don) Morton, Amer. Fern J. 49: 113. 1959; Tagawa & K. Iwats., Fl Thailand 3(3): 431. 1988.—*Aspidium aridum* D. Don, Prod. Fl. Nepal: 4. 1825.—*Nephrodium aridum* (D. Don) J. Sm. in Hook., J. Bot. 4: 188. 1841; Beddome, Handb.: 272. f. 139. 1883.—*Cyclosorus aridus* (D. Don) Ching, Bull. Fan Mem. Inst. Biol. 8: 194. 1938; Holttum, Rev. Fl. Malaya 2: 259. f. 146. 1960.—*Christella arida* (D. Don) Holttum Nayar & Kaur, Comp. to Beddome Handb.: 206. 1974; Kuo C., Fl. Taiwan. vol. 1. 2nd ed: 404. 1980; Holttum Fl. Mal. II. 1: 555. f. 1i. 1981.

Rhizome long creeping, dark brown to black, about 5 mm diam., sparsely scaly, with remote fronds; scales subtriangular with long tail, about 5 by 1.2 mm, brown, dark at base, edges entire. **Stipe** brown to castaneous, grooved, about 50 cm long, scaly at base, hirsute on upper surface more than lower surface; scales like rhizome scales, rather small. **Lamina** oblong to linear-oblong in outline, apex aristulate, pinnate up to 80 by 40 cm; rachis grooved, densely hairy throughout; lateral pinnae numerous up to 45 pairs, linear, rounded to truncate at base, gradually narrowing towards apex, long-acuminate at apex, with variously lobed and callous membrane at sinus between lobes; lobes about 1/3 way to costa; segments subdeltoid, oblique, acute at apex; costa grooved above, hirsute throughout; veins goniopteroid,

more than 2 pairs of lower veinlets truly anastomosing below callous-sinus; veinlets hirsute, visible on both surfaces, strongly raised; lower pinnae gradually narrowing downwards to mere auricle; larger pinnae patent to slightly ascending, shortly stalked, up to 20 by 2 cm, 6-7 cm apart; texture softly papyraceous, hirsute beneath, green, paler beneath, with densely yellow-glandular along veinlets throughout as well as hairy. **Sori** medial, round, rather close to margin of lobed, forming one parallel rows; indusia brown, rather small, hairy, persistent but usually under sporangia in matured sori, sporangia setose. **Photo 178.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok, Doi Tung), Chiang Mai (Fang, Pang Bo, Ban Mae Kong, Kang Kat, Doi Suthep, Mae Klang, Ban Yang), Tak; PENINSULAR: Satun, Yala (Bannang Sata).

Distribution.- Himalaya (type) to W. Malesia, north to N. Vietnam, Hong Kong and Taiwan.

Ecology.- Terrestrial on wet sand along the streams in light shade areas at 750-670 m altitudes.

Specimens examined.- P. Ratchata 207, 211, 339; T. Boonkerd 608 (BCU); M. Tagawa No. T 3941; M. Tagawa, K. Iwatsuki, N. Fukuoka No. T 2431; E. Heninpman No. 3466 (BKF).

2. Thelypteris aspera (Presl) K. Iwats., Mem. Coll. Sci. Univ. Kyoto B. 31: 192. 1965; Reed, Phytologia 17: 261. 1968; Tagawa & K. Iwats., Acta Phytotax. Geobot. 25: 17. 1971; Tagawa & K. Iwats., Fl Thailand 3(3): 411. 1988.—*Polypodium asperum* Presl, Rel. Haenk. 24: t. 3. f. 4. 1825, non L.—*Goniopteris aspera* Presl, Tent. Pterid.: 183. 1836, based on *Polypodium asperum* Presl, Rel. Haenk. 1: 24. t. 3. f. 4. 1825, non L. 1753.—*Aspidium asperum* (Presl) Mett. Ann. Mus. Bot. Lugd.- Bat. 1: 225. 1864, excl. syn. *Nephodium latifolium* Presl.—*Abacopteris liukiensis* (A. Christ.) Tagawa, Acta Phytotax. Geobot. 8: 171. 1919.—*Dryopteris gymnopteridifrons* Hayata, Ic. Pl. Formos. 8: 148. f. 75, 76. 1919.—

Dryopteris presliana Ching in C. Chr. Ind. Fil. Suppl. 3: 95. 1934.—*Abacopteris gymnopteridifrons* (Hayata) Ching, Bull. Fan Mem. Inst. Biol. 8: 251. 1938.—*Abacopteris presliana* (Ching) Ching, Bull. Fan Mem. Inst. Biol. 8: 248. 1938.—*Abacopteris aspera* Ching, Acta Phytotax. Sinica 8: 332. 1963.—*Pronephrium asperum* (Presl) Holttum, Fl. Mal. II. 1: 512. f. 14, g-i. 1981.—*Pronephrium gymnopteridifrons* (Hayata) Holttum, Boumea 20: 112. 1972; Kuo C., Fl. Taiwan. vol. 1. 2nded: 429. pl. 150. 1980.—*Thelypteris urophylla* auct. non (Wall. ex Hook.) K. Iwats.: Tagawa & K. Iwats., Southeast As. St. 5: 71. 1967, p.p.

Rhizome long-creeping, dark brown to black, scaly throughout, about 5 mm diam., bearing remoted fronds, with densely scales at apex; scales oblong-subtriangular, pale brown, hairy at margin. **Stipe** stramineous and dark at base, scaly near base, hairy throughout, grooved above, up to 80 cm long, rather thick. **Lamina** ovate-oblong, pinnate, up to 50 cm long, 25 cm wide, acute at apex; rachis stramineous, grooved above, hairy throughout; pinnae ovate-oblong, 4-6 pairs, sessile, caudate at apex, gradually narrowing towards broadly cuneate base, about 25 by 4 cm, subentire or irregularly undulate, cartilaginous at margin; costa densely hairy throughout, grooved above; veins meniscioid, raised beneath; terminal pinnae straight; lateral pinnae ascending; texture chartaceous to papyraceous, green to pale green. verrucose, sparsely pubescent or glabrescent. **Sori** in two rows, medial one close to excurrent veinlets; indusia thin, reniform, usually immersed among sporangia at maturity, hairy; sporangia with a few setose hairs. **Photo 182.**

Thailand.- NORTHERN: Lampang (Mae Ngao); NORTH-EASTERN: Loei (Phu Luang).

Distribution.- S. China, Taiwan, Malesia throughout (type from Luzon) to N. Queensland.

Ecology.- Terrestrial on rather dry mountain slopes in light shaded area at 700-750 m altitudes.

Vernacular.- Kut tong (กุดตอง) (Northern).

Specimens examined.- P. Ratchata 130, 132 (BCU).

3. **Thelypteris crinipes** (Hook.) K. Iwats..J. Jap. Bot. 38: 315. 1963; Tagawa & K. Iwats., Fl Thailand 3(3): 430. 1988.—*Nephrodium crinipes* Hook., Sp. Fil. 4: 71. 1862; Beddome, Handb.: 279. 1883.—*Cyclosorus crinipes* (Hook.) Ching, Bull. Fan Mem. Inst. Biol. 8: 179. 1938.—*Christella crinipes* (Hook.) Holttum in Nayar & Kaur, Comp. Beddome, Handb.: 208. 1974.

Rhizome erect or ascending, bearing a few fronds, tuft, densely scaly throughout; scales linear-lanceolate with long-tailed apex, about 1.5 mm long, 1 mm broad, brown to reddish-brown, entire. **Stipe** up to 45 cm long, stramineous, bearing reduced pinnae on upper part, densely scaly throughout; scales like rhizome scales. **Lamina** pinnate, oblong-lanceolate in outline, acute at apex, broadest at middle portion, gradually narrowing towards base, up to 100 by 40 cm; rachis stramineous, grooved above, scaly throughout; lateral pinnae linear, straight, slightly ascending, sessile, subtruncate at base, gradually narrowing towards long-acuminate apex, subopposite, about 15-20 cm long, 1.5 cm wide, lobed half-way to costa; terminal pinnae larger, deeply lobed to 3/4 way to costa, indistinct; lower pinnae gradually becoming small downwards to butterfly-shaped and immersed among scales; segments oblong, oblique, acute at apex, entire; costa pubescent; veins anastomosing, basal pairs of veinlets uniting with those of the adjacent group to form connivent, the other running to the margin of segments, hairy; texture papyraceous, green or paler, pubescent on under surface. **Sori** closed to margin, round; indusia round-reniform, densely hairy throughout. **Photo 181.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung), Chiang Mai (Doi Phahom Pok, Chiang Dao, Tin Tok, Ban Mae Ho, Doi Suthep, Mae Klang,

Bo Luang, Ban Yang), Mae Hong Son (Ban Mae Pang), Lamphun (Doi Khun Tan), Lampang (Mae Tia), Tak (Huai Krasa, Doi Musoe, Lan Sang); SOUTH-WESTERN: Uthai Thani (Ban Rai).

Distribution.- Himalaya (type) and SW. China.

Ecology.- On sandy ground along the streams in open areas or evergreen forests at 860 m altitudes.

Specimens examined.- P. Ratchata 274 (BCU).

4. *Thelypteris dentata* (Forssk.) H. St. John, Amer. Fern J. 26: 44. 1966; Tagawa & K. Iwats., Fl Thailand 3(3): 426. f. 44:7-9. 1988.—*Polypodium dentatum* Forssk., Fl. Aegypt.- Arab.: 185. 1775.—*Dryopteris oblancifolia* Tagawa, Acta Phytotax. Geobot. 5: 190. 1936.—*Cyclosorus dentatus* (Forssk.) Ching, Bull. Fan Mem. Inst. Biol. 8: 206. 1938.—*Chistella dentata* (Forssk.) Brownsey & Jermy, Brit. Fern Gaz. 10: 338. 1973; Kuo C., Fl. Taiwan vol. 1. 2nd ed: 404. 1980; Holttum Fl. Mal. II: 557. f.1: 557. f. 1p, 20a. 1981.—*Cyclosorus subpubescens* auct. non (Blume) Ching; Holttum, Rev. Fl. Malaya 2: 273. f. 157. 1960.

Rhizome erect or ascending, bearing a tuft of fronds, densely scaly at apex; scales oblong-lanceolate, broadest at base, gradually narrowing towards long, attenuate apex, about 5 mm long, 1 mm broad. brown, hairy at margin. **Stipe** stramineous to pale brown, 15-20 cm long, hairy throughout, scaly at base, bearing reduced pinnae on upper portion; scales like those rhizome scales but smaller. **Lamina** pinnate, narrowly oblong, acute at apex, gradually narrowing to both ends, up to 75 by 18 cm; lateral pinnae about 18 pairs, patent to slightly ascending, linear-lanceolate, more or less auricled at base, sessile, gradually narrowing from base towards long-acuminate apex, up to 9 by 1.5 cm, lobed 1/3 to 2/3 way to costa; lower pinnae gradually becoming smaller downwards to from butterfly shaped; apical pinnae indistinct; segments oblong-subdeltoid, oblique, round to more or less acute

at apex, entire; costa and rachis densely hairy throughout; texture herbaceous to softly papyraceous, yellow-green to green, densely pubescent on both surfaces; basal veinlets and basal second anterior ones uniting below callous membrane. **Sori** medial, round, bearing in one row along main vein; indusia rather large, about 0.5 mm, pale, densely hairy. **Photo 174 and 179.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok, Ban Nong Lu), Chiang Mai (Doi Suthep, Mae Klang), Mae Hong Son (Khun Yuam), Lamphun (Doi Khun Tan), Lampang (Mae Ang), Phrae (Mae Sai), Tak (Ban Musoe, Mae Sot), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang, Dan Sai), Khon Kaen (Phu Nok Khao); CENTRAL: Nakhon Nayok (Khao Yai), Saraburi (Muak Lek), Krung Thep (Bangkok, Khlong San); SOUTH-EASTERN: Prachin Buri (Krabin, Bu Phram), Chanthaburi (Khao Soi Dao, Khao Sabap), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Bang Krasai, Wangka, Phomphi, Thung Kang Yang); PENINSULAR: Surat Thani (Ban Don), Nakhon Si Thammarat (Khao Luang, Thung Song), Phangnga, Trang, Satun.

Distribution.- Pantropic (type from Arabia).

Ecology.- Terrestrial on rather dry ground in open areas near streams at 670-680 m altitudes.

Specimens examined.-P. Ratchata 294; K. Lukchant 17; T. Boonkerd 375 (BCU).

5. **Thelypteris glandulosa** (Blume) Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 54. 1968; Tagawa & K. Iwats., Fl Thailand 3(3): 408. f. 40: 4-5. 1988.—*Aspidium glandulosum* Blume, En. Pl. Jav.: 144. 1828.—*Nephrodium glandulosum* (Blume) Hook., Sp. Fil. 4: 76. 1862; Beddome, Handb.: 273.1883.—*Cyclosorus glandulosus* (Blume) Ching, Bull. Fan Mem. Inst. Biol. 8: 227. 1938; Holttum, Rev. Fl. Malaya 2: 278. f. 160. 1960.—*Pronephrium glandulosum* (Blume) Holttum, Fl. Mal. II. 1: 522. 1981.

Rhizome short creeping or ascending, dark brown to black, up to 5 mm diam., bearing closed fronds, sparsely scales; scales subtriangular with long tail, about 3 mm long, 0.5-0.7 mm broad, brown, with minutely hairy at margin. **Stipe** dark stramineous to castaneous, up to 15 cm long, grooved above, hairy throughout, densely on upper surface and, polish beneath, densely scale at base; scales like rhizome scales. **Lamina** oblong-lanceolate in outline, pinnate, gradually narrowing aristulate apex, up to 30 cm long, 15 cm wide, lateral pinnae 5-7 pairs; rachis grooved above, densely hairy throughout; pinnae oblong, gradually narrowing towards long-acuminate apex, broadly cuneate at basiscopic and truncate at acroscopic base, variously lobed, with callous membrane at sinus between lobes, sessile or subsessile, up to 6.5 by 1.5 cm; lobes to 1/3 way to costa, round or obtuse at apex, oblique, subentire at margin; lobes 3-4 mm broad, 1-2 mm long; costa grooved above, densely hairy but minutely hairy beneath; veins meniscioid, lower two pairs of veinlets anastomosing, with long hair sparsely on both surfaces; lower pinnae little reduced, basal pair more or less reflexed; upper pinnae patent to ascending; terminal pinnae distinct, lobes more than 1/2 way towards costa; texture papyraceous, green, lower surface of lamina glandular; glands as well as hairy, yellow to paler. **Sori** submedial, rather close to lobes, round, usually confluent at maturity; indusia reniform, persistent, brown to pale brown, hairy.

Thailand.- PENINSULAR: Yala (Bannang Sata).

Distribution.- W. Malesia (type from Java).

Ecology.- On wet grounds near the streams in light shade areas at 650-750 m altitudes.

Specimens examined.- P. Ratchata 194, 220 (BCU).

6. **Thelypteris hirtisora** (C. Chr.) K. Iwats., J. Jap. Bot. 38: 314. 1963; Tagawa & K. Iwats., Fl Thailand 3(3): 418. f. 43.1-2. 1988.—*Polypodium acuminatum* Houtt., Nat. Hist. 14: 181. pl. 99. f. 2. 1783.—*Chistella*

acuminata (Houtt.) H. Lév., Fl. Kouy-tcheou: 476. 1915; Kuo C., Fl. Taiwan vol. 1. 2nd: 404. 1980.—*Dryopteris hirtisora* C. Chr., Contr. U.S. Nat. Herb. 26: 277, 330. 1931.—*Cyclosorus hirtisorus* (C. Chr.) Ching, Bull. Fan Mem. Inst. Biol. 8: 221. 1938.—*Cyclosorus validus* auct. non (H. Christ), Tardieu: Tardieu. & C. Chr. in Fl. Gén. I.- C. 7(2): 398. 1941.—*Cyclosorus acuminatus* auct. non (Houtt.) Nakai ex H. Ito; Hott., Dansk Bot. Ark. 20: 22. 1961.

Rhizome long creeping, about 5 mm diam., brown to dark brown, scaly throughout, densely at apical portion; scales large, about 10 by 2.5 mm, brown, entire. **Stipe** stramineous to costaneous at base, 30-70 cm long, scaly at base, hirsute throughout; scales like rhizome scales, sometime darker. **Lamina** oblong in out line; pinnate with a long terminal pinna, acute at apex, up to 70 by 45 cm; rachis stramineous, shallowly grooved above, densely covered with hirsute throughout; pinnae about 10-12 pairs, basal one or two pairs slightly reduce and deflexed; lower pinnae hardly reduced; larger pinna patent to slightly ascending, nearly straight, short stalked, linear, gradually narrowing to long-acuminate apex, round to broadly cuneate at base, up to 30 by 2.5 cm; lobes more than 1/3 way towards costa; segments subdeltoid, oblique, acute at apex; costa grooved with distinct ridges, densely hirsute throughout; texture papyraceous, deep green, paler beneath; veins goniopteroid, more than 2 pairs of lower veinlets truly anastomosing below callous-sinus; veinlets 8-10 pairs, visible on both surfaces, hairy throughout. **Sori** round, up to 1 mm diam., on veinlets, arranged in one row on medial part along costa, indusiate; indusia rather small, thin, round, persistent but usually under sporangia in matured sori, hairy; sporangia setose. **Photo 186.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Doi Phacho, Chiang Kham), Chiang Mai (Doi Suthep, Doi Chang, Doi Hua Mot, Mae Klang, Ban Yang), Tak (Ban Musoe); NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang, Phu Kradueng); SOUTH-WESTERN: Kanchanaburi (Khao Ngua).

Distribution.- SW. China, Upper Myanmar (type) and Indochina.

Ecology.- Terrestrial on rather dry slopes in light shade areas at 800-1,050 m altitudes.

Specimens examined.- P. Ratchata 76, 116, 124, 264 (BCU); M. Tagawa No. T 3950; M. Tagawa, K. Iwatsuki, N. Fukuoka No. T 1105, T 2429; K. Iwatsuki & N. Fuluoka No. T 3432; R. E. Holttum No. 1596. (BKF).

7. ***Thelypteris lakhimpurensis*** (Rosenst.) K. Iwats., Mwm. Coll. Sci. Univ. Kyoto B. 31: 194. 1965; Tagawa & K. Iwats., Fl Thailand 3(3): 412. 1988.—*Dryopteris lakhimpurensis* Rosenst., Med. Rijksherb. 31: 7. 1917.—*Pronephrium lakhimpurensis* (Rosenst.) Holttum, Blumea 20: 110. 1972.—*Dryopteris rubra* Ching, Bull. Fan Mem. Inst. Biol. 2: 198. t. 12. 1931.—*Abacopteris rubra* (Ching) Ching, Bull. Fan Mem. Inst. Biol. 8: 245. 1938.—*Cyclosorus rubra* (Ching) Tardieu ex Tardieu & C. Chr., Notul. Syst. 7: 76. 1938.—*Thelypteris rubra* (Ching) K. Iwats., J. Jap. Bot. 38: 315. 1963.—*Cyclosorus moulmeinensis* auct. non (Beddome) Copel.: Holttum, Dansk Bot. Ark. 23: 233. 1965.

Rhizome creeping, dark brown to black, scaly throughout; scales oblong-ovate, about 4 by 1.2 mm. brown, hairy. **Stipe** stramineous. dark brown at base, about 80-100 cm long, scaly at base. **Lamina** pinnate, oblong, about 120 by 50 cm, with a distinct terminal pinnae; lateral pinnae up to 10 pairs, subsessile, oblong, moderately cuspidate at apex, round to broadly cuneate at base, subentire, up to 35 by 5 cm, broadened at middle lateral pinnae, lower pinnae gradually narrowing downwards; rachis and costa hairy; texture papyraceous to herbaceous, green to dark green, red in dried specimens, glabrous; veins miniscioid. **Sori** in two rows usually closed to excurent veinlets, round to oblong, confluent at maturity, exindusiate.

Thailand.- NORTHERN: Chiang Rai (Mae Lao, Doi Tung), Chiang Mai (Doi Chiang Doa, Doi Suthep, Doi Inthanon, Ban Yang), Mae Hong Son, Tak (Doi Musoe, Phitsanulok (Thung Salaeng Luang, Phu Miang); NORTH-EASTERN: Loei (Phu Luang); SOUTH-WESTERN: Kanchanaburi (Song Tho).

Distribution.- Himalaya (type) to Sw. China and N. Veitnam.

Ecology.- Terrestrial on humus-rich slopes near streams in light shade areas at 1,165 m altitudes.

Vernacular.- Kut sang (กุดซาง) (Northern).

Specimens examined.- P. Ratchata 353 (BCU).

8. **Thelypteris nudata** (Roxb.) Morton, Contr. U.S. Nat. Herb. 38: 352. 1974; Tagawa & K. Iwats., Fl Thailand 3(3): 411. f. 42.2-3. 1988.—*Polypodium nusatum* Roxb., Calc. J. Nat. Hist. 4: 491. 1844.—*Polypodium multilineatum* Wall. ex Hook., Sp. Fil. 5: 11. 1863.—*Nephrodium moulmeinense* Beddome, Ferns Br. Ind. Suppl.: 18. 1876; Handb.: 275. f. 141. 1883.—*Nephrodium multilineatum* (Wall. ex Hook.) Beddome, Handb. Suppl.: 80. 1892.—*Dryopteris moulmeinense* (Beddome) C. Chr., Ind. Fil.: 278. 1905.—*Dryopteris urophyllum* acut. non (Mett.) C. Chr.: Bonap., Not. Pterid. 14: 49. 1923.—*Abacopteris multilineatus* (Wall. ex Hook.) Ching, Bull. Fan Mem. Inst. Biol. 8: 253. 1938; Holttum, Rev. Fl. Malaya 2: 297. 1960.—*Nephrodium urophyllum* auct. non (Mett.) Keys.: E. Smith, J. Siam Soc. Nat Hist. Suppl. 8: 5. 1929.—*Cyclosorus multilineatus* (Wall. ex Hook.) Tardieu & C. Chr. in Fl. Gén. I.- C. 7(2): 358. 1941.—*Thelypteris multilineata* (Wall. ex Hook.) Morton, Amer. Fern J. 49: 113. 1959.—*Pronephrium nudatum* (Roxb.) Holttum, Blumae 20: 111. 1972.

Rhizome long-creeping, about 5 mm diam., dark brown, bearing fronds remoted, scaly throughout; scales dark brown, hairy. **Stipe** stramineous to greenish, dark near base, grooved above, hairy, with scatted

multicellular hairs, scaly at base, up to 80 cm long. **Lamina** oblong, pinnate, up to 45 cm long, 30 cm wide, acuminate at apex, broadly at base; rachis stramineous, grooved above, densely hairy throughout, with scattered multicellular hairs; pinnae oblong, sessile to subsessile, up to 35 cm long, 6.5 cm wide, the side almost parallel, gradually narrowing towards caudate apex, narrowly cuneate at base, margin subentire to crenate, occasionally broadly toothed in the apical pinna; costa hairy above, minutely hairy on costa beneath; veins menisoid about 16 pairs, at about 45° to the costules, slightly curved, the veins of adjacent groups meeting and forming excurrent veins and elongated to meet the next veins above; marginal lobes acute at apex, with cartilaginous membrane; texture chartaceous, green, verrucose on lower surface; terminal pinnae like lateral ones, round to broadly cuneate at base, or oblique; lateral pinnae ascending. **Sori** medial one closed to excurrent veinlets, in two rows between costules; indusia reniform, setose; sporangia glabrous. **Photo 183 and 185.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok, Doi Tung, Doi Phacho), Chiang Mai (Doi Phahom Pok, Ching Dao, Pong Pa Po, Pang Kia, Ban Mae Kon, Doi Suthep, Wang Tao, Pong Khrai, Ban Huai Khrai), Mae Hong Son (Mae La Noi, Pha Mong), Lampang, Tak (Ban Musoe); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Pong Nam Ron), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Wangka); PENINSULAR: Surat Thani (Ko Tao), Nakhon Si Thammarat (Khao Luang, Khiriwong), Phangnga, Yala (Bannang Sata).

Distribution.- Himalaya (type), Myanmar, China and N. Vietnam.

Ecology.- Terrestrial on moist ground along streamlet in exposed or light shade areas at 650-680 m altitudes.

Vernacular.- Kut daeng (กูดแดง) (South-eastern).

Specimens examined.- P. Ratchata 20, 193, 284; R. Chaveerach 22; T. Boonkerd 502 (BCU).

9. ***Thelypteris ornata*** (Wall. ex Beddome) Ching, Bull. Fan Mem. Inst. Biol. 6: 346. 1936; Tagawa & K. Iwats., Fl Thailand 3(3): 39. f. 38: 4-7. 1988.—*Polypodium ornatum* Wall. ex Beddome, Ferns S. India: t. 171. 1864.—*Phegopteris ornata* (Wall. ex Beddome) J. Sm., Hist. Fil. 233. 1875; Beddome, Hand.: 294. f. 152. 1883.—*Macrothelypteris ornata* (Wall. ex Beddome) Ching, Acta Phytotax. Sin. 8: 309. 1963.

Rhizome erect or ascending, brown to dark brown, about 0.5 cm diam., densely scaly throughout, bearing tuft of fronds; scales linear-lanceolate, about 15 by 2 mm, brown, hairy both on dorsal surface and at margin. **Stipe** castaneous, about 80 cm long, thick, scaly throughout and densely at base, scattered black spinos; scales like rhizome scales. **Lamina** oblong-ovate, tripinnate to quadripinatifid, acuminate at apex, about 120 cm long, 70-80 cm wide, basal one or two pinnae often reduced in size, 17-20 pairs; rachis densely hairy throughout, grooved above, with scattered black spinos, stramineous; pinnae oblong-lanceolate, gradually narrowing towards acuminate apex, up to 40 by 9 cm, ascending; pinnules oblong-lanceolate, truncate at base, gradually narrowing towards acuminate apex, up to 7 by 1.5 cm, deeply lobes closed to costae, sessile; segments oblong, round at apex, adnate at base, about 1 cm long, 0.5 cm wide; lobes oblong-subdeltoid, oblique, round at apex, entire, about 1.5 by 1 mm, often revolute in dried specimens; costa and costae densely hairy throughout, strongly raised on both surfaces; veins pinnate, veinlets simple or forked, not reaching the margin of lobes, sparsely hairy on upper surface but densely hairy beneath, hardly visible; texture thin, softly papyraceous, green. **Sori** dorsal on veinlets, one for each lobe, exindusiate. **Photo 190.**

Thailand.- NORTHERN: Lampang (Mae Tia); NORTH-EASTERN: Phetchabun (Phu Miang); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao); SOUTH-WESTERN: Kanchanaburi (Khao Yai).

Distribution.- S. & N. India (type), N. Myanmar and Taiwan.

Ecology.- Terrestrial on clayey grounds in half-shade areas along the streams at 670-800 m altitudes.

Specimens examined.- P. Ratchata 222 (BCU).

10. *Thelypteris papilio* (C. Hope) K. Iwats., Mem. Coll. Sci. Univ. Kyoto B. 31: 175. 1965; Tagawa & K. Iwats., Fl Thailand 3(3): 428. 1988.—*Nephrodium papilio* C. Hope, J. Bomb. Nat. Hist. Soc. 12: 625. t. 12. 1899.—*Cyclosorus papilio* (C. Hope) Ching, Bull. Fan Mam. Inst. Biol. 8: 214. 1938; Holttum, Rev. Fl. Malaya ed.2. 2: 633. 1968.—*Christella papilio* (C. Hope) Holttum in Nayar & Kaur, Comp. Beddome, Handb.: 208. 1974; Kuo C., Fl. Taiwan vol. 1. 2nded: 406. 1980; Holttum Fl. Mal. II. 1: 556. f. 20 d-e. 1981.

Rhizome erect, with a tuft of fronds, densely scaly throughout; scales linear-subtriangular, broadest at base, gradually narrowing towards long acuminate apex, about 4 mm long, 0.7-0.8 mm broad, brown, minutely hairy at margin. **Stipe** stramineous, about 10-15 cm long, bearing reduced pinnae on upper portion, scaly at base, puberulous throughout; scales broad, about 5 mm long, 1-1.3 mm broad, hairy. **Lamina** gladiate or narrowly oblong, acuminate at apex, broadest at middle portion, gradually narrowing downwards, up to 60 by 10 cm; lateral pinnae oblong-lanceolate, attenuately acuminate at apex, subtruncate at base, about 6 by 1.5 cm, opposite, patent, ascending, sessile, shallowly lobed about 1/4 way to costa, about 10-15 pairs; segments oblong-subdeltoid, oblique, rounded at apex, entire; terminal pinnae larger, deeply lobed about 1/2 way to costa, oblique at base, attenuate-acuminate at apex; lower pinnae gradually becoming smaller downwards to butterfly-shaped, usually opposite in pairs; rachis and costa grooved above, puberulous; veins anastomosing, at least one of the second basal veinlets uniting with excurrent veinlets below callous-membrane; texture papyraceous, green, glabrous on both surfaces, with yellow-glandular

sparsely along lateral veins. **Sori** round; indusia reniform, persistent, shortly hairy or sparsely hirsute. **Photo 188-189.**

Thailand.- NORTHERN: Chiang Mai (Doi Inthanon, Doi Suthep); SOUTH-WESTERN: Kanchanaburi (Khao Ngi Yai).

Distribution.- Sri Lanka, Himalaya (type), Taiwan, and Makaya.

Ecology.- Terrestrial on moist ground near the streams in light shade areas at 680 m altitudes.

Specimens examined.- P. Ratchata 269, 286, 292 (BCU).

11. Thelypteris parasitica (L.) Fosb., Occ. Pap. B.P. Bishop Mus. 23: 30. 1962; K. Iwats. Mem. Coll. Sci. Univ. Kyoto B, 31: 172. 1965; Tagawa & K. Iwats., Fl Thailand 3(3): 424. 1988.—*Polypodium parasiticum* L., Sp. Pl. 2: 1090. 1753.—*Aspidium parasiticum* (L.) H. Christ., Bot. Tidsskr. 24: 109. 1901.—*Dryopteris parasitica* (L.) O. Ktze., Rev. Gen. Pl. 2: 811. 1891.—*Cyclosorus parasiticus* (L.) Farw., Amer. Midl. Nat. 12: 259. 1929; Holttum, Rev. Fl. Malaya 2: 281. f. 162. 1960.—*Christella parasitica* (L.) H. Lév., Fl. Kouy-Tchéou: 475. 1915; Kuo C., Flora Taiwan vol. 1. 2nd: 406. 1980; Holttum, Rev. Fl. Mal. II. I: 559. f. 20 f. 1981; in Rev. Fl. Malaya 2: 281. f. 162. 1960.—*Nephrodium amboinense* auct. non Pr.: Hosseus, Beih. Bot. Centr. 28(2): 365. 1911.

Rhizome creeping, about 4 mm diam., dark brown, densely hairy throughout, sparsely bearing fronds; scales ensiform, dark brown, sparsely hairy at margin, about 7 by 1 mm. **Stipe** stramineous, grooved above, about 30-35 cm long, scaly at base, hairy throughout; scales like rhizome scales. **Lamina** oblong-lanceolate in outline, pinnate, gradually acute at apex, up to 40 cm long, 20 cm wide, up to 17 pairs, subopposite but alternate on upper portion; rachis grooved above, densely hairy throughout; pinnae linear-lanceolate, sessile, with acroscopic base, round to truncate at base, gradually long acuminate apex, patent or ascending, up to 9 cm long, 1.2 cm wide,

variously lobed, with callous membrane at sinus between lobes, lobes to half-way towards costa or more than, entire, segments oblong, oblique, rounded at apex, wide at base, separated; veins free, basal pairs of veins meeting the side of lobe, about 7-8 pairs; basal pinnae deflexed and narrowed gradually to a narrowly cuneate base; texture thin, softly papyraceous, yellow-green to green, densely hairy beneath, glandular; glands rod-shaped, orange to red, confined to axes. **Sori** suprasedial, on one or two basal veinlets; indusia rather large, pale brown, persistent, densely covered with hirsute.

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Mae Kok), Chiang Mai (Mae Hok, Doi Chiang Dao, Wang Tao, Doi Saket, Doi Suthep, Mae Klang, Pha Mon), Lampang (Mae Ngao), Tak (Mae Sot), Phitsanulok (Thung Salaeng Luang); EASTERN: Chiyaphum (Nam Phrom); NORTH-EASTERN: Loei (Phu Kradung); SOUTH-EASTERN: Chon Buri (Si Racha), Trat (Ko Chang); PENINSULAR: Surat Thani (Ban Don, Ban Huai Tha), Nakhon Si Thammarat (Khiriwong), Phangnga, Trang, Satun.

Distribution.- Tropics and subtropics of Asia (type from S. China), north to S. Japan and south to New Zealand.

Ecology.- Terrestrial on rather dry mountain slopes in open areas at 680-700 m altitudes.

Specimens examined.- P. Ratchata 140, 285; T. Boonkerd 290, 291 (BCU).

12. Thelypteris siamensis Tagawa & K. Iwats., Acta Phytotax. Geobot. 22: 101. f. 5. 1967; Tagawa & K. Iwats., Fl Thailand 3(3): 426. f. 44.7-9. 1988.—*Christella siamensis* (Tagawa & K. Iwats.) Holttum, Kew Bull. 31: 332. 1976.

Rhizome erect or slightly ascending, densely scaly throughout, bearing 2-4 fronds in a fascicle; scales linear-lanceolate, gradually narrowing

towards long attenuate apex, about 8 mm long, 1 mm broad, brown to reddish brown, black at central to apical portion upwards, sparsely hairy at margin. **Stipe** stramineous to pale brownish yellow, densely scaly at base, glabrescent upwards, hirsute throughout, 20-40 cm long; scales like rhizome scales except in size, about 1.2 cm long, 1.5 mm broad. **Lamina** oblong-lanceolate, pinnate, about 45 cm long, 20 cm wide, broadest at middle portion, gradually narrowing towards the acute apex; lateral pinnae linear-lanceolate, long-acuminate to caudately acuminate at apex, truncate at base, sessile, up to 15 cm long, 2 cm wide, about 20-23 pairs, ascending, middle larger ones falcate, alternate, lobed to 2/3 way to costa, the basal one to tree pairs slightly reduced, deflexed, auricled at acroscopic base; rachis and costa hirsute throughout; lobes oblong, oblique, round to moderately acute at apex, entire on margin, about 0.7 by 0.5 cm; veins pinnate, lateral veinlets 6-8 pairs, running to the margin of lobes; basal veinlets uniting to form simple goniopteroid venation; texture papyraceous to subherbaceous, green, densely covered with pale setose hairs on both surfaces. **Sori** round, dorsal on veinlets, sometime confused with neighboring when mature; indusia round-reniform, densely hirsute, persistent, brown.

Thailand.- NORTH-EASTERN: Phetchabun (Phu Miang), Loei (Phu Luang, type).

Distribution.- Endemic

Ecology.- On rather dry mountain slopes in not so dense forests at 1,350 m altitudes.

Specimens examined.- P. Ratchata 277 (BCU).

13. *Thelypteris subelata* (Baker) K. Iwats., J. Jap. Bot. 38: 315.1963; Tagawa & K. Iwats., Fl Thailand 3(3): 429. 1988.—*Nephrodium subelatum* Baker, Kew Bull. 1906: 11.—*Cyclosorus subelatus* (Baker) Ching, Bull. Fan Mem. Inst. Biol. 8: 224. 1938.—*Christella subelata* (Baker) Holttum,

Kew Bull. 31: 331. 1976.—*Thelypteris subpubescens* auct. non (Blume) K. Iwats.: Tagawa & K. Iwats., Southeast As. St. 5: 65. 1967.

Rhizome creeping, dark brown to nearly black, about 5-6 cm diam., sparsely bearing fronds, densely scaly at apex; scales subtriangular, about 4 by 1 mm, dark brown, hirsute. **Stipe** dark castaneous, 30-40 cm long, hairy throughout, scaly at base, bearing reduced lower pinnae on upper portion; scales like rhizome scales. **Lamina** oblong in outline, acuminate at apex, pinnate, with long terminal pinna, up to 60 by 30 cm; rachis densely hairy throughout, grooved above; pinnae about 19-24 pairs, linear-lanceolate, round or truncate at base, gradually narrowing towards apex, attenuate at apex, about 20 by 3 cm, lobed more than 1/3 way to costa; segments oblong to subrectangular, oblique, acute at apex; lower lateral pinnae shortened to mere auricle; middle pinnae shortly stalked or sessile; costa grooved, densely hairy throughout; veins goniopteroid, truly anastomosing below callous-sinus, visible on both surfaces, about 8-12 pairs; texture papyraceous, green, pale below, subglabrous to sparsely pubescent, often verrucos. **Sori** submedial, rather close to margin of lobes, forming one parallel rows; indusia round, dark brown, paler at margin, persistent, shortly hairy throughout. **Photo 180.**

Thailand.- NORTHERN: Chiang Rai (Doi Tung, Mae Sai, Mae Kok, Doi Phacho, Ban Doi Hang), Chiang Mai (Doi Phahom Pok, Fang, Doi Chiang Dao, Kang Kat, Doi Suthep, Ban Yang), Mae Hong Son (Ban Mae Pong), Lamphun (Doi Khun Tan), Lampang, Tak (Doi Musoe, Mae Sot), Phrae (Mae Sai), Phitsanulok (Phu Miang); NORTH-EASTERN: Nong Khai, Loei (Phu Kradueng); SOUTH-EASTERN: Chon Buri (Si Racha), Chanthaburi (Khao Soi Dao, Ta Khamao Falls); SOUTH-WESTERN: Kanchanaburi (Sai Yok).

Distribution.- SW. China (type) and Upper Myanmar.

Ecology.- Terrestrial on mountain slopes in open areas at 670-800 m altitudes.

Specimens examined.- P. Ratchata 18 (BCU).

14. *Thelypteris terminans* (Hook.) Tagawa & K. Iwats., Acta Phytotax. Geobot. 26: 169. 1975; Tagawa & K. Iwats., Fl Thailand 3(3): 432. 1988.—*Nephrodium terminans* Hook., Sp. Fil. 4: 73. 1862.—*Amphineuron terminans* (Hook.) Holttum, Amer. Fern J. 63: 82. 1973; in Fl. Mal. II. 1: 545. f. 19a. 1981.—*Nephrodium pteroides* auct. non (Retz.) J. Sm.: Beddome, Handb.: 269. 1883.—*Dryopteris pteroides* auct. non (Retz.) O. Ktze.: C. Chr., Contr. U.S. Nat. Herb. 26: 184. 1931.—*Cyclosorus interruptus* auct. non (Willd.) H. Ito: Ching, Bull. Fan Mem. Inst. Biol. 8: 184. 1938; Holttum, Rev. Fl. Malaya 2: 262. f. 149. 1960.—*Thelypteris interrupta* auct. non (Willd.) K. Iwats.: Tagawa & K. Iwats., Southeast As. St. 3(3): 79. 1965; 5: 68. 1967.—*Cyclosorus extensus* auct. non (Blume) Ching: Holttum, Dansk Bot. Ark. 20: 23. 1961.

Rhizome long-creeping, about 8 mm diam., dark brown, densely scaly throughout, with remoted fronds, up to 8 cm apart; scales oblong-lanceolate, about 7 mm long, 1.5 mm broad, attenuate-acuminate at apex, brown, hairy. **Stipe** stramineous or medium brown when dry, up to 80 cm long, with dark scaly at base and sparsely scales on upper portion; scales like those rhizome scales but smaller. **Lamina** oblong-lanceolate, pinnate, acute at apex, about 90 by 80 cm; pinnae subopposite, up to 32 pairs, the lowest pairs often reduced to small auricle, the apex like lateral ones, pinnae linear, gradually narrowing to both ends, narrowing cuneate base, long acuminate at apex, up to 40 by 3 cm, straight, patent to ascending, sessile or shortly stalked in largest pinnae; lobes to 2/3 way to costa; segments oblong, oblique, acute at apex, entire, hairy at margin; rachis grooved, densely hairy on upper surface, glabrous below; costa and costae glabrous below or

bearing short scattered hairs, grooved above, densely hairy; veins raise beneath, pinnate, free, basal pair of veinlets actually anastomosing, the second basal pair running to the callous membrane, 9-11 pairs, veinlets hairy; texture papyraceous, green, paler beneath. **Sori** confined to the upper part of segment; indusia firm, brown, persistent, with a densely hairy. **Photo 191 and 195.**

Thailand.- Common all over the country.

Distribution.- Tropics of Asia (type from Myanmar) to Australia (Queensland).

Ecology.- Terrestrial on rather dry mountain slopes in not so dense forests at 650-1,350 m altitudes.

Specimens examined.- P. Ratchata 43, 118; T. Boonkerd 7, 71, 72, 605, 729, 1095, 1313; Boonnag 633 (BCU).

15. Thelypteris torresiana (Gaudich.) Alston, Lilloa 30: 111. 1960; K. Iwats. Mem. Coll. Sci Univ. Kyoto B, 31: 151, 153. 1965; Tagawa & K. Iwats., Fl Thailand 3(3): 398. 1988.—*Polystichum torresianum* Gaudich. In Freyc., Voy. Bot.: 333. 1817.—*Lastrea tenericaulis* (Wall.) Moore, Ind. Fil.: 99. 1858; Beddome, Handb.: 266. 1883.—*Thelypteris uliginosa* (Kunze) Ching, Bull. Fan Mem. Inst. Biol. 6: 342. 1936; Holttum Rev. Fl. Malaya 2: 241. 1960.—*Macrothelypteris torresiana* (Gaudich.) Ching, Acta Phytotax. Sin. 8: 310. 1963; Holttum, Fl. Mal. II. 1: 348. f. 2, h-j. 1981; N. Morin, Conv. Ed. Fl. North Amer. north Mexico, vol. 2.: 221. 1993.—*Aspidium setigerum* auct. non (Blume) Kuhn: Christs, Bot. Tidsskr. 24: 108. 1901.—*Thelypteris adscendens* Ching Bull. Fan Mem. Inst. Biol. 6: 332. 1936.—*Metathelypteris adscendens* (Ching) Ching Acta Phytotax. Sin. 8: 306. 1963; Kuo C., Fl. Taiwan vol. 1. 2nded: 417. pl. 144. 1980.

Rhizome suberect or ascending, up to 1 cm diam., densely scaly at apex, bearing tuft of frond; scales large, linear-lanceolate, up to 1.5 cm long,

1.2 mm broad, long attenuate at apex, hairy on dorsal surface as well as margin, base often a few cells thick, dark brown. **Stipe** stramineous, dark near base, about 30 cm long, converged with many scales both spinose in lower part, terete; scales like rhizome scales but smaller, about 1 cm long, 0.7 mm broad. **Lamina** oblong to oblong-ovate, deeply tripinnatifid, 25 by 20 cm, gradually towards acuminate apex; rachis densely hairy throughout; pinnae lanceolate, long acuminate apex, basal ones largest, about 11-14 pairs; largest pinnae deltoid, 11 by 5 cm, pinnate with all pinnules but lowest adnate to a narrowly winged pinna-rachis; pinnules oblong-subdeltoid, sessile to subsessile, oblique, acuminate at apex; larger pinnules up to 3 by 1 cm, cut almost to costa into oblique dentate to deeply lobes; ultimate segments oblong, oblique, round to moderately acute at apex, lobes to 3/4 way towards midrib; lobes oblong to subdeltoid, entire, involute; costa and costae winged throughout, hairy; veins indistinct, hairy throughout; texture herbaceous to softly papyraceous, green but usually brown to dark brown when dried, whole lower surface of lamina bearing short capitate hairs. **Sori** round, usually close to midrib of ultimate segments; indusia very small, bearing a few capitate hairs, often covered by mature sporangia. **Photo 177.**

Thailand.- NORTHERN: Chiang Rai, Chiang Mai (Doi Chiang Dao, Bo Luang, Doi Saket, Mae Klang, Pha Mon), Lampang, Lamphun (Doi Khun Tan), Tak (Ban Musoe); CENTRAL: Nakhon Nayok (Khao Yai); SOUTH-EASTERN: Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Sai Yok); PENINSULAR: Chumphon, Surat Thani (Ban Don), NaKhon Si Thammarat (Khao Luang), Satun, Yala (Betong).

Distribution.- Mascarene Island, throughout tropical Asia (type from Mariana Islands), Polynesia, Hawaii, north to Japan and south to Australia; also naturalized in the new World.

Ecology.- Terrestrial on wet sand along the streams in light shaded or open areas at 680 m altitudes.

Specimens examined.- P. Ratchata 237 (BCU).

16. Thelypteris truncata (Poir.) K. Iwats., Mem. Coll. Sci. Univ. Kyoto B. 31: 33. 1964; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 54. 1968; in Fl Thailand 3(3): 420. 1988.—*Polypodium truncatum* Poir. In Lamk., Enc. 5: 534. 1804.—*Dryopteris truncata* (Poir) C. Chr. Ind. Fil.:299. 1905.—*Cyclosorus truncatus* (Poir.) Farw. Amer. Midl. Nat. 12: 259. 1931.—*Nephrodium truncatum* (Poir) Tardieu ex Tardieu & C. Chr., Natul. Syst. 7: 78. 1938; Holttum, Rev. Fl. Malaya 2: 266. f. 152. 1960.—*Pneumatopteris truncata* (Poir) Holttum, Blumea 21: 314. 1973; in Fl. Mal. II. 1: 429. f. d-f. 1981; Kuo C., Fl. Taiwan vol. 1. 2nded: 427. pl. 149. 1980.

Rhizome erect, covered with scales at apex, bearing tuft of fronds; scales brown, hairy. **Stipe** pale stramineous, dark brown and scaly at base, about 50-70 cm long, pubescent, bearing reduced pinnae in lower part. **Lamina** oblong-lanceolate in outline, up to 120 cm long, 50 cm wide, pinnate, with 30 or more pairs of pinnae. lower them several pairs of pinnae reduced to mere auricles, sometime almost to the base of stipe: pinnae up to 30 cm long, 3 cm wide in largest pinnae; middle pinnae larger, straight, ascending; basal pinnae narrowed to broadly cuneate base; upper pinnae widest at the broadly cuneate or truncate base, pinnae 5-7 cm apart in lowest, upper much closed, edges of pinnae lobed to 1/3 way to costa, with sinus membrane, lobed of pinnae spreading, not falcate, slightly truncate, up to 4 mm wide, often with minutely dentate; costa bearing hairs; veins goniopteroid, in each lobes to about 10 pairs, pale below and strongly raised, the lower pairs anastomosing and forming excurrent veins which running to the sinus membrane: the higher veins passing to the sides of the sinus membrane, free one ending in teeth at margin of segments; texture thin, papyraceous, green, the lower surface showing verrucose, glabrous. **Sori** medial, forming two parallel rows along costa; indusia pale, grabrous, entire, persistent. **Photo 184 and 187.**

Thailand.- NORTHERN: Chiang Rai (Mae Kok, Doi Tung, Mae Lao, Doi Phacho), Chiang Mai (Doi Phahom Pok, Doi Chiang Dao, Doi Suthep, Mae Klang), Mae Hong Son (Mae La Noi), Lamphun (Doi Khun Tan), Tak (Ban Musoe), Phrae (Mae Sai, Huai Hok), Phitsanulok (Thung Salaeng Luang); NORTH-EASTERN: Loei (Phu Luang); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao); PENINSULAR: Krabi (Phanom Bencha), Surat Tahni (Ban Don), Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong), Yala (Khao Kala Khiri).

Distribution.- Sri Lanka, S. India, Himalaya to S. China, Myanmar, Indochina, Ryukyu Is., Taiwan, W. Malesia to Philippines.

Ecology.- Terrestrial on wet ground along the streams in half-shade areas in evergreen forest at 680-750 m altitudes.

Vernacular.- Kut kan daeng (กูดก้านแดง) (Northern).

Specimens examined.- P. Ratchata 8, 133, 138, 146, 218 (BCU); M. Tagawa No. T 3842, T 3854; M Tagawa & I. Yamada T 102; K. Iwatsuki & N. Fukuoka No. T 3445, T 3962, T 5492, T 7323 (BKF).

VITTARIACEAE

Epiphyte or lithophyte: rhizome creeping, short; scales clathrate; fronds tuft, simple entire; veins anastomosing, forming elongate areoles, without included veinlets; sori linear; sporangia borned along the margin, or dichotomously forking veins, superficial or more often in soral grooves, with paraphyses, filiform or club-shape. simple or branched.

Key to the genera

- 1 Sori in one or two rows. Frond linear **2. VITTARIA**
 1. Sori more than two rows, elongated along reticulate veins, usually
 sunken in groove. Frond not linear **1. ANTROPHYUM**

ANTROPHYUM

Kaulf., Enum.: 197. 1824.

Epiphyte; rhizome creeping, covered with clathrate scales; roots covered with mass of brown hairs; fronds simple, entire, oblanceolate or elliptic, sessile or stipitate; veins dichotomously forked, often forming elongate areoles without included veinlets; sporangia elongate along reticulate vein, usually sunken in grooves, paraphyses abundant, clavate or linear, simple or branches.

Antrophyum callifolium Blume, En. Pl. Jav.: 111. 1828; Holttum, Rev. Fl. Malaya 2: 605. f. 356. 1960; Tagawa & K. Iwats., Fl Thailand 3(2): 221. 1985.—*Antrophyum reticulatum* auct. non (G. Forst.) Kaulf.: Beddome; Handb.: 401. f. 235. 1883.—*Antrophyum semicostatum* auct. non Blume: Bonap., Not. Pterid. 14: 63. 1923.—*Antrophyum* sp.: Holttum, Dansk Bot. Ark. 20: 34. 1961.

Rhizome short-creeping, bearing a few to several fronds in a tuft, scaly; scales black, narrowly subtriangular, gradually narrowing from base towards long-tailed apex, up to 7 mm, sharply toothed at margin. **Stipe** short, indistinctly merging with the basal portion of frond, green to darker, scaly; scales like rhizome scales. **Fron**d simple, variable in outline, usually oblong-lanceolate to broadly oblanceolate, gradually narrowing downwards, narrowing towards acute to acuminate apex, 13-15 cm long, 1.6-3.2 cm broad, leathery, green; costa distinct only in the lowest portion of fronds; vein more or less distinct, evenly anastomosing without included veinlets. **Sori** linear, anastomosing along veins, usually immersed; paraphyses filamentous, long, numerous, brown to paler.

Photo 192 and 196.

Thailand.- NORTHERN: Chiang Mai (Doi Suthep, Chiang Mai, Mae Taeng, Lamoo), Tak (Huai Krasa); NORTH-EASTERN: Nong Khai, Loei (Phu

Luang, Phu Kradueng, Khao Huai Khae); CENTRAL: Nakhon Nayok (Khao Yai, Nang Rong falls); SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Khao Sabap), Trat (Ko Chang); SOUTH-WESTERN: Kanchanaburi (Khao Sakan, Song Tho); PENINSULAR: Chumphon (Tha Ngo, Langsuan, Tako, Sapli), Surat Thani (Ko Tao, Ban don, Ko Phangan), Nakhon Si Thammarat (Khiriwong, Khao Luang, Thung Song), Narathiwat (Sg. Padi), Phangnga (Thap Put), Phuket (Khao Chong), Satun, Yala (Bannang Sata).

Distribution.- Throughout the tropics of the Old World (type from Indonesia), although the exact boundary is not clear.

Ecology.- Epiphyte, on mossy tree-trunks or on moist rocks in Mixed Deciduous forests at 720-950 m altitudes.

Specimens examined.- P. Ratchata 84, 223; T. Boonkerd, 318, 709, 1318, 1398, 1532 (BCU).

VITTARIA

Sm., Mem. Acad. Turin 5: 413. pl. 9. f. 5. 1793.

Epiphyte; rhizome creeping, roots abundant, covered with clathrate scales; fronds linear, simple, entire, leathery; vein anastomosing on each side of midrib in row of long areoles without included veinlets; sori linear, continuous, borned in a single row at submarginal; sporangia mixed with branched paraphyses.

Key to the species

1. Frond more than 10 cm long, 2-5 mm broad; costa indistinct or hardly visible on upper surface..... **1. *V. angustifolia***
1. Fronds up to 10 cm long, 2 mm broad; costa flat above **2. *V. sikkimensis***

1. Vittaria angustifolia Blume, En. Pl. Jav.: 199. 1828; Holttum, Rev. Fl. Malaya 2: 610. 1960; Tagawa & K. Iwats., Acta Phytotax. Geobot. 23: 56.

1968; in Fl Thailand 3(2): 225. 1985.—*Vittaria ensiformis* auct. non Sw.: Tagawa & K. Iwats., Southeast As. St. 5: 111. 1967.

Rhizome creeping, about 1-1.5 mm diam, bearing fronds rather sparsely, densely scaly throughout; scales narrow, gradually narrowing from base towards acute apex, up to 1.8 mm, fuscous, clathrate, minutely toothed at margin. **Stipe** short, green or dark at base, indistinct, narrowly winged throughout. **Fron**d linear, about 10-20 cm long, 0.2-0.5 mm broad, leathery, more or less curved, gradually narrowing towards acute apex, the margin sometime involved, green to paler; costa indistinct or hardly visible on upper surface, raised in lower surface. **Sori** immersed in deep groove almost at margins of frond, usually elongate along both margin, except the upper part of fronds. **Photo 193 and 197.**

Thailand.- SOUTH-EASTERN: Chanthaburi (Khao Soi Dao, Khao Sabap); PENINSULAR: Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong), Krabi (Phanom Bencha), Yala (Khao Kalakhiri, Bla Hat).

Distribution.- Throughout Malesia (type from Java), east to New Caledonia.

Ecology.- On mossy tree-trunks in Hill Evergreen forests at 1,500-1,600 m altitudes.

Specimens examined.- P. Ratchata 183, 253, 315 (BCU).

2. **Vittaria sikkimensis** Kuhn, Linnaea 36: 66. 1869; Beddome, Handb.: 406. f. 239. 1883; Tagawa & K. Iwats., Fl Thailand 3(2): 224. f. 17.5. 1988.

Rhizome short-creeping, bearing closed fronds, densely scaly throughout; scales linear-lanceolate, about 1 mm long, 0.2 mm broad, gradually narrowing towards hair-pointed apex, dark brown, clathrate, minutely toothed at margin. **Stipe** indistinct, green to darker, with narrowly winged throughout, scaly at base. **Fron**ds simple, linear, very narrow,

broadest in upper part, acuminate at apex, gradually narrowing downwards into narrowly winged of stipe, up to 10 by 0.2 cm; costa flat above, more or less raised beneath; veins indistinct; texture thin coriaceous, green, the margin more or less revolute. **Sori** immersed in deep grooves near the margin of fronds, except apical and basal portion.

Thailand.- NORTHERN: Chinag Mai (Doi Suthep, Doi Inthanon), Phetchbun (Phu Miang): NORTH-EASTERN: Loei (Phu Luang, Phu Kradueng).

Distribution.- Sikkim (type), Yunnan and Tonkin.

Ecology.- On mossy tree-trunks in Hill Evergreen forests at 1,500 m altitudes.

Specimens examined.- P. Ratchata 283 (BCU).



1. Khun Korn Waterfall, the highest waterfall in Chiang Rai, 800 m a.s.l.



2. One of microhabitats frequently found in the park



3. Deforestation due to shifting cultivation by hill tribes near Ban Pang Khon, 1.350 m a.s.l.



4. Hill Evergreen Forest, the way to Ban Li So Mae Mon



5. Ban Pang Khon, hill tribes village at 1,300 m a.s.l.



6. Hill Evergreen forest at 1,500 m a.s.l. near Doi Kia



7. Nam Mae Kon, the main stream in the forest park during March –April 1998



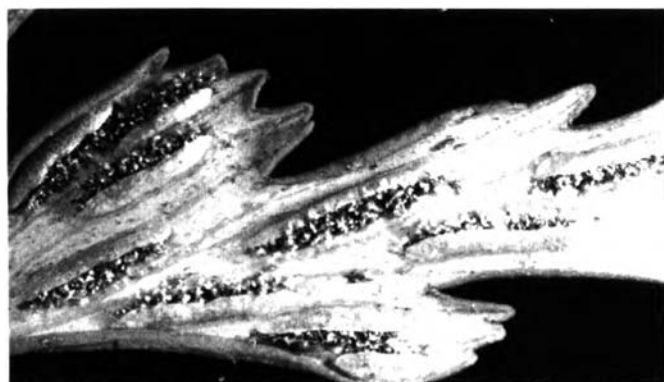
8. *Asplenium macrophyllum* Sw.



9. *Asplenium obscurum* Blume



10. *Asplenium unilaterale* Lamk., sporophylls



11. *Asplenium yoshinagae* Makino, sori



12. *Asplenium perakense* C. G. Matthew & A. Christ.



13. *Asplenium unilaterale* Lamk.



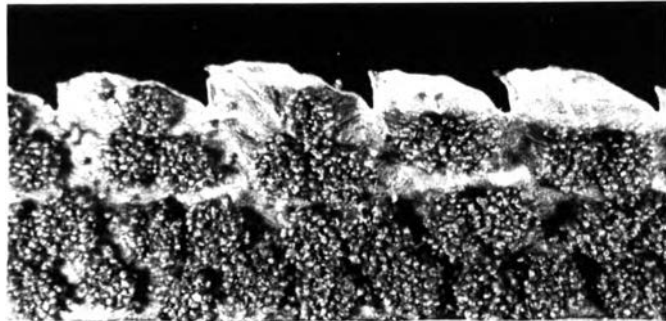
14. *Asplenium yoshinagae* Makino



15. *Kuniwatsukia cuspidatum* (Beddome) Pic. Serm.



19. *Athyrium dissitifolium* (Baker) C. Chr.



16. Fertile lobes of *Kuniwatsukia cuspidatum* (Beddome) Pic. Serm.



20. Fertile of *Athyrium dissitifolium* (Baker) C. Chr.



17. *Diplazium esculentum* (Retz.) Sw., sori



21. *Diplazium muricatum* (Mett) Alderw.



18. Fertile pinnules of *Diplazium petri* Tardieu



22. *Diplazium muricatum* (Mett) Alderw., fertile lobes



23. *Diplazium simplicivenium* Holttum, base of fronds



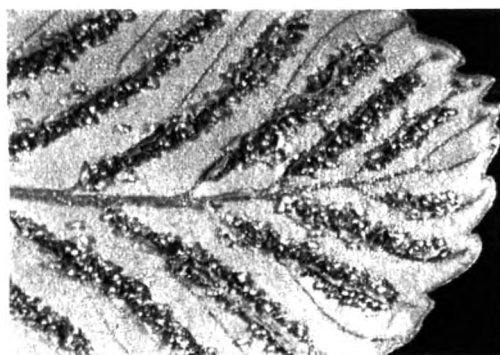
27. *Brainea insignis* (Hook.) J. Sm.



24. *Diplazium simplicivenium* Holttum



28. *Blechnum orientale* L.



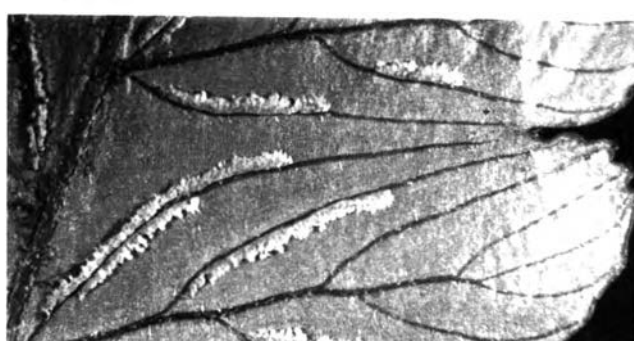
25. *Diplazium simplicivenium* Holttum, sori



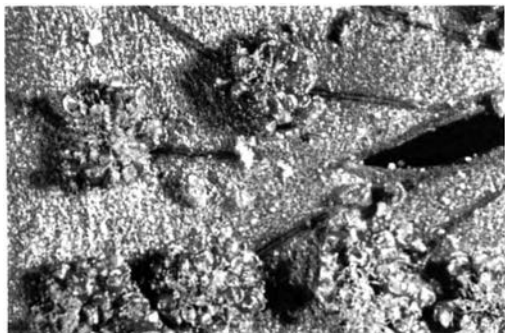
29. Lower surface of fertile lobes of *Diplazium polypodioides* Blume



26. *Diplazium leptophyllum* A. Christ.



30. *Diplazium leptophyllum* A. Christ., venation and sori



31. *Cyathea gigantea* (Wall. ex Hook.)
Holttum, sori



35. *Cyathea gigantea* (Wall. ex Hook.) Holttum,
fertile pinnules



32. *Humata repens* (L. f.) Diels.



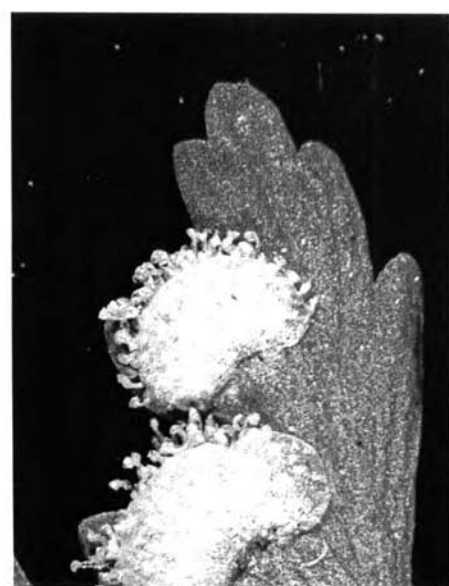
33. Fertile frond of *Humata repens* (L. f.) Diels.



36. *Araiostegia pulchra* (D. Don)
Copel., sori



34. *Leucostegia immersa* (Wall. ex Hook.) Presl



37. *Leucostegia immersa* (Wall. ex
Hook.) Presl, sori



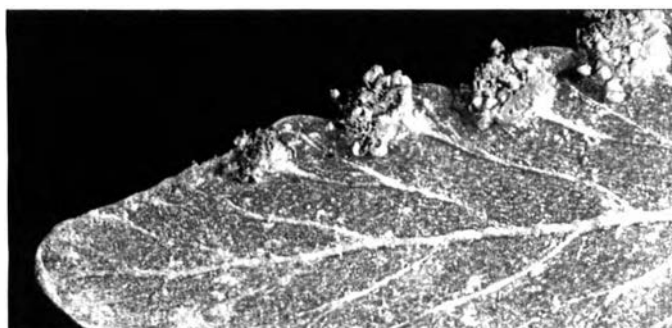
38. *Davallia trichomanoides*
Bl. var. *lorrainii* (Hance)
Holttum



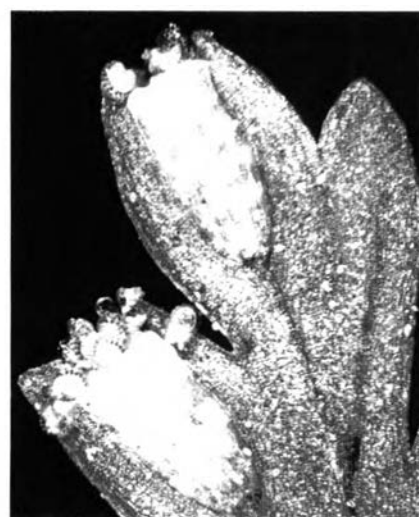
42. *Davallia trichomanoides*
Bl. var. *lorrainii* (Hance)
Holttum, sori



43. *Davallia trichomanoides*
Bl. var. *trichoanoides*



39. *Microlepia calvescens* (Wall. ex. Hook.) Presl,
sori in cup-shaped indusia



44. *Davallia trichomanoides*
Bl. var. *trichoanoides*, sori



40. *Microlepia speluncae* (L.) Moore, sori



41. *Microlepia strigosa* (Thunb.) Presl



45. *Microlepia strigosa* (Thunb.)
Presl, fertile pinnea



46. *Pteridium aquilinum* (L.) Kuhn var. *wightianum* (J. Agardh) Tryon



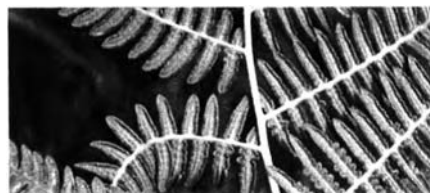
47. *Hypolepis punctata* (Thunb.) Mett. ex Kuhn



48. *Pteridium aquilinum* (L.) Kuhn var. *yarrabense* Domin



49. *Cibotium barometz* (L.) J. Smith



50. *Pteridium aquilinum* (L.) Kuhn var. *wightianum* (J. Agardh) Tryon, sori



51. *Pteridium aquilinum* (L.) Kuhn var. *latiusculum* (Desv.) Shieh



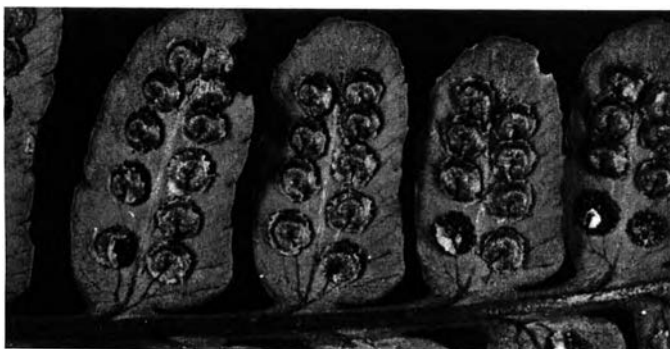
52. Golden hairs on rhizome of *Cibotium barometz* (L.) J. Smith



53. *Cibotium barometz* (L.) J. Smith, with lobes of indusium



54. *Arachniodes henryi* (Christ) Ching



55. *Dryopteris cochleata* (D. Don.) C. Chr., indusia and sori



56. *Tectaria fauriei* Tagawa



58. *Dryopteris cochleata* (D. Don.) C. Chr., fertile frond



59. *Tectaria impressa* (Wall. ex Hook.) C. Chr., part of fertile fronds



57. *Tectaria impressa* (Wall. ex Hook.) C. Chr.



60. *Tectaria impressa* (Wall. ex Hook.) C. Chr., variation of fronds



61. *Tectaria polymorpha* (Wall. ex Hook. & Grev.) Ching



62. *Tectaria polymorpha* (Wall. ex Hook. & Grev.) Ching, variation of fronds



63. *Tectaria fuscipes* (Wall. ex Beddome) C. Chr.



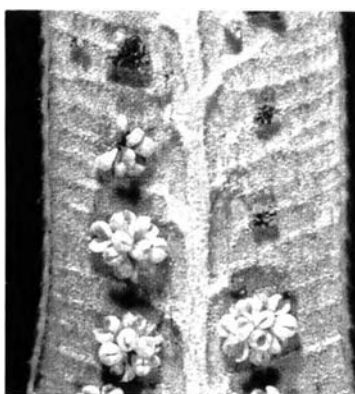
65. *Tectaria polymorpha* (Wall. ex Hook. & Grev.) Ching, fertile pinnae



66. *Tectaria angulata* (Willd.) C. Chr.



67. *Dicranopteris linearis* (Burm.f.) Underw. var. *linearis*



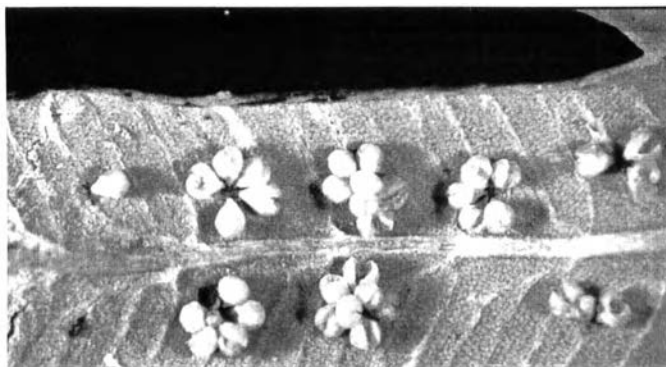
64. lower surface of *Dicranopteris linearis* (Burm.f.) Ungerw. var. *montana* Holttum



68. *Dicranopteris linearis* (Burm.f.) Underw. var. *linearis*, sporangia



69. *Dicranopteris curranii*
Copel.



73. *Dicranopteris curranii* Copel., fertile
segments



70. *Hymenophyllum*
exsertum Wall. ex Hook.



74. *Hymenophyllum acanthoides* (Bosch)
Rocentst, apex of fertile segments



71. *Hymenophyllum*
exsertum Wall. ex Hook.,
receptacle at apex



75. *Hymenophyllum polyanthos* (Sw.) Sw.



72. *Trichomanes bimarginatum* Bosch,
venation and sori



76. *Trichomanes bimarginatum* Bosch



77. *Lindsaea ensifolia* Sw.



78. Apical pinnae of *Bolbitis heteroclita* (Presl) Ching ex C. Chr.



79. *Bolbitis sinensis* (Baker) K. Iwats.
var. *costulata* (Hook.) Tagawa & K. Iwats.



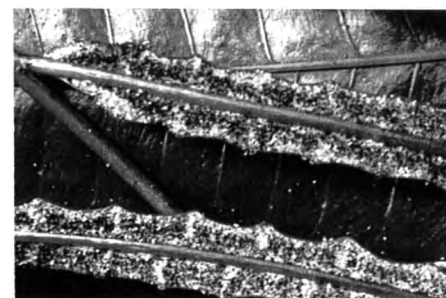
80. Fertile frond of *Bolbitis virens* (Hook. & Grev.) Schott var. *virens*



81. *Sphenomeris chinensis* (L.)
Maxon



82. Fertile fronds of *Bolbitis heteroclita* (Presl) Ching ex C. Chr.



83. *Bolbitis virens* (Hook. & Grev.) Schott var. *virens*,
fertile pinnae



84. *Bolbitis appendiculata* (Willd.)
K. Iwats.



85. Climbing fern, *Lomagramma grossoserrata* Holttum



86. Fertile pinnae of
Lomagramma grossoserrata Holttum



87. *Elaphoglossum yoshinagae* (Yatabe)
Makino



88. *Elaphoglossum stelligerum* (Wall. ex
Baker) Moore ex Alston & Bonner



89. *Elaphoglossum stelligerum* (Wall.
ex Baker) Moore
ex Alston &
Bonner, part of
fertile frond



90. *Elaphoglossum yoshinagae* (Yatabe)
Makino, part of
fertile frond



91. *Lomagramma grossoserrata* Holttum, fertile frond



92. *Lycopodium cernuum* Linn.



95. *Lycopodium hamiltonii*
Spring



93. *Ophioglossum petiolatum* Hook



96. Fertile lobes
of *Nephrolepis delicatula*
(Dcne.) Pic. Serm.



98. *Oleandra undulata*
(Willd.) Ching



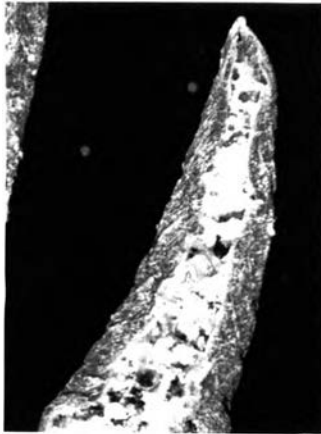
94. *Nephrolepis falcata*
(Cav.) C. Chr.



97. Fertile lobes
of *Nephrolepis falcata* (Cav.)
C. Chr.



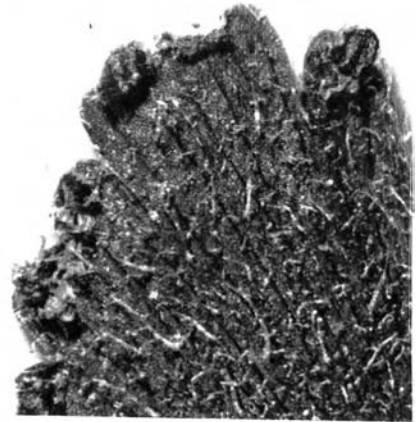
99. Fertile pinnae of
Pityrogramma calomelanos
(L.) Link



100. Sori with farina of *Pityrogramma calomelanos* (L.) Link



104. Fertile pinnae of *Adiantum philippense* L.



105. *Adiantum caudatum* L., fertile pinnae



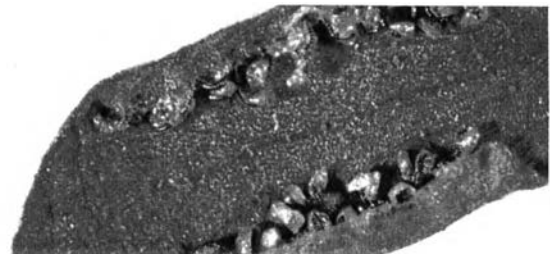
101. *Adiantum philippense* L.



106. *Adiantum caudatum* L.



102. *Cheilanthes tenuifolia* (Burm.f.) Sw., sori



107. *Cheilanthes belangeri* (Bory) C. Chr., fertile pinnae



103. *Cheilanthes tenuifolia* (Burm.f.) Sw.



108. *Cheilanthes belangeri* (Bory) C. Chr.



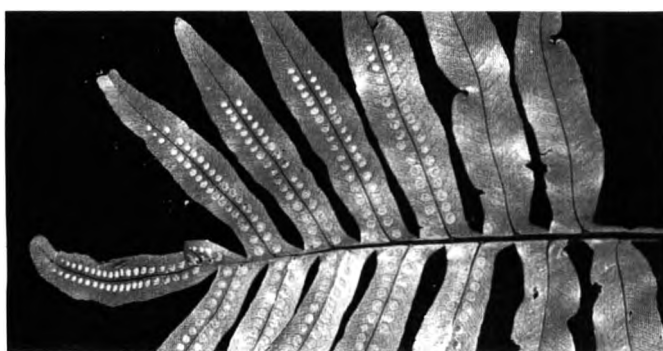
109. *Drynaria* sp.



112. Foliage leaves of *Drynaria* sp.



110. *Drynaria propinqua* (Wall. ex Mett.) J. Sm. ex Beddome



113. *Drynaria parishii* (Beddome) Beddome, lower surface of fertile frond



111. *Lepisorus heterolepis* (Rosenst) Ching



114. *Loxogramme involuta* (D. Don) Presl



115. Fertile lamina of *Loxogramme involuta* (D. Don) Presl



116. *Lepisorus contortus* (A. Christ) Ching



117. *Lepisorus nudus* (Hook.) Ching



120. *Lepisorus scolopendrium* (Ham. ex D. Don) Tagawa



121. *Lepisorus subconfluens* Ching



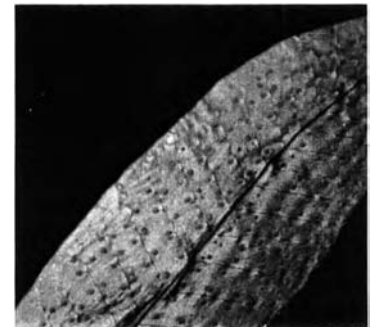
122. *Microsorium punctatum* (L.) Copel.



118. Sori of *Lepisorus nudus* (Hook.) Ching,



123. *Lepisorus subligolepidus* Ching



124. *Microsorium zippelii* (Blume) Ching, part of fertile lamina



119. *Microsorium rubidum* (Kunze) Copel.



125. *Microsorium pteropus* (Blume) Copel. part of fertile lamina



126. *Microsorium pteropus* (Blume) Copel



127. *Microsorium membranaceum*
(D. Don.) Ching



130. *Arthomeris amplexifolia* (A. Christ) Ching



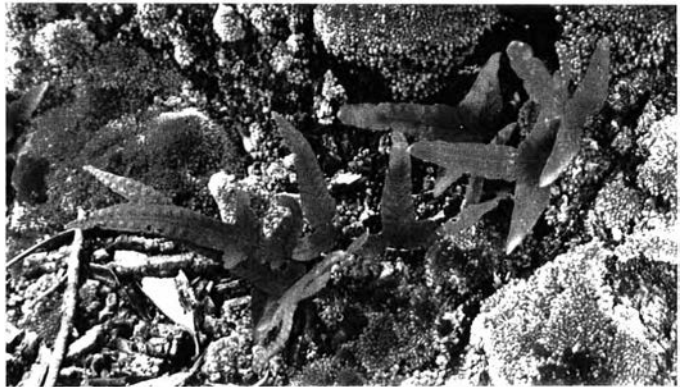
128. *Polypodium amoenum* (J.
Sm. ex Hook. et. Grev.) Mett.



131. *Polypodium*
amoenum (J. Sm.
ex Hook. et. Grev.)
Mett., sori



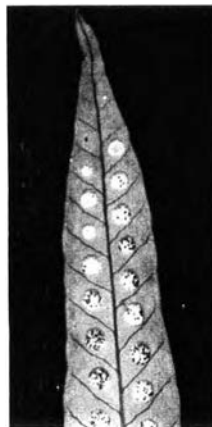
132. *Microsorium*
cuspidatum (D. Don.)
Tagawa



133. *Crypsinus oxylobus* (Wall. ex. Kunze) Sledge



129. *Polypodium argutum* (J.
Sm. ex. Hook. et Grev.)
Hook.



134. *Crypsinus*
cruciformis
(Ching)
Tagawa, sori



135. *Crypsinus cruciformis*
(Ching) Tagawa



136. *Platycerium holttumii*
de Jonch & Hennipman



137. *Pyrrosia lingua* (Thunb.)
Farwell. var. *lingua*



138. Fertile fronds of
Pyrrosia nuda (Gies.) Ching



139. *Pyrrosia mollis* (Kunze) Ching, sori on lower
surface of fronds



140. *Pyrrosia lingua* (Thunb.) Farwell.
var. *heteractis* Hovenkamp.



141. *Pyrrosia varia* (Kaulf.) Farw.



142. *Pyrrosia*
adnescens (Sw.)
Ching, rhizome



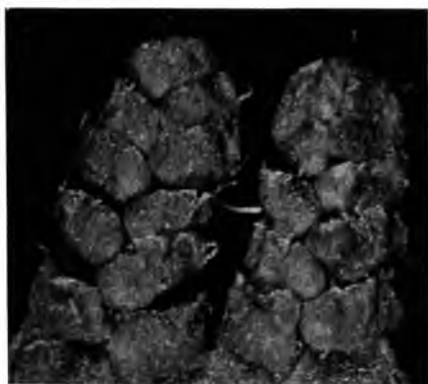
143. *Pyrrosia mannii*
(Gies.) Ching



144. *Pyrrosia stigmosa*
(Sw.) Ching



145. *Pteris venusta* Kunze



146. *Lygodium salicifolium* Presl



147. *Pteris wallichiana*
J. Agardh



148. *Pteris biaurita* L.



149. *Pteris longipes* D. Don



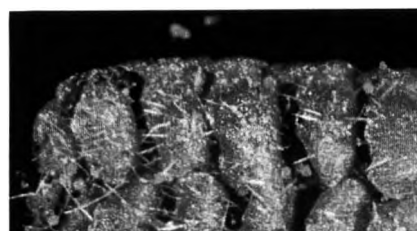
150. *Lygodium salicifolium*
Presl



151. *Pteris tripartita* Sw.



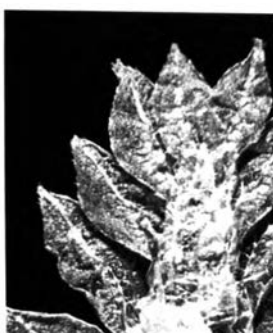
152. *Lygodium polystachyum* Wall. ex Moore



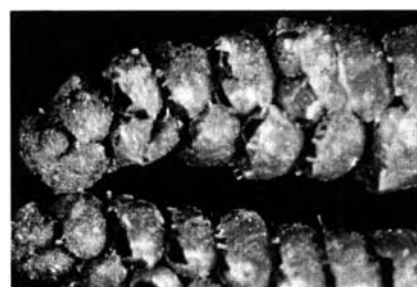
157. *Lygodium polystachyum* Wall. ex Moore, sporangia



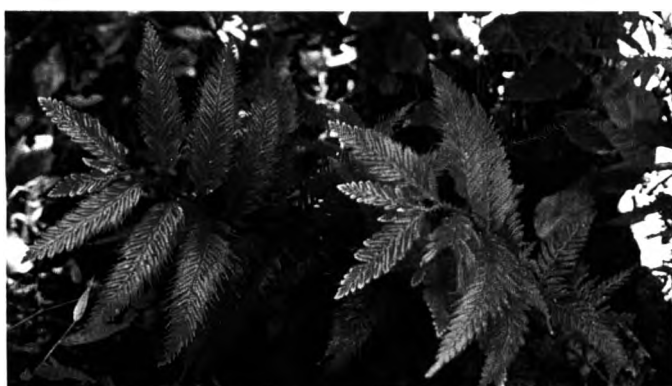
153. *Selaginella pennata* (D.Don) Spring



154. Sporophyll of *Selaginella pennata* (D.Don) Spring



158. *Lygodium flexuosum* (L) Sw., sporangia



155. *Selaginella wallichii* (Hook. & Grev.) Spring



159. *Lygodium flexuosum* (L) Sw.



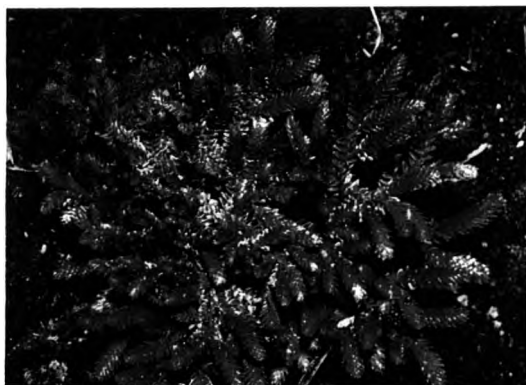
156. *Selaginella wallichii* (Hook. & Grev.) Spring, sporophylls



160. *Selaginella minutifolia* Spring, sporophylls



161. *Selaginella minutifolia* Spring



162. *Selaginella* cf. *ciliaris* (Retz.) Spring



166. *Selaginella* cf. *ciliaris* (Retz.) Spring, ventral and dorsal sporophylls



163. *Selaginella* cf. *ciliaris* (Retz.) Spring, sporophylls



167. *Selaginella helferi* Warb., sporophylls



168. *Selaginella helferi* Warb.



164. *Selaginella kurzii* Baker



170. *Selaginella tenuifolia* Spring



169. *Selaginella lindhardii* Hieron.



165. *Selaginella tenuifolia* Spring, sporophylls



171. *Selaginella lindhardii* Hieron., sporophylls



172. *Selaginella involvens*
(Sw.) Spring



175. Sporophylls of
Selaginella monospora Spring



176. *Selaginella monospora*
Spring



173. *Selaginella involvens*
(Sw.) Spring, sporophylls



177. *Thelypteris torresiana*
(Gaudich) Alston



178. *Thelypteris arida*
(D. Don) Morton



174. *Thelypteris dentata*
(Forssk.) St. John



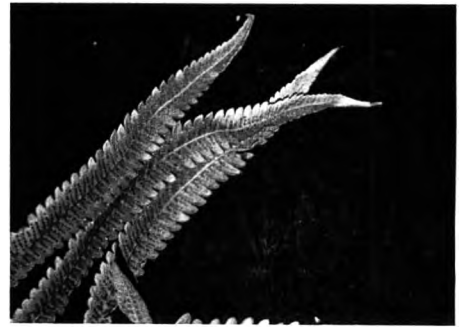
179. *Thelypteris dentata* (Forssk.)
St. John



180. *Thelypteris subelata*
(Baker) K. Iwats.



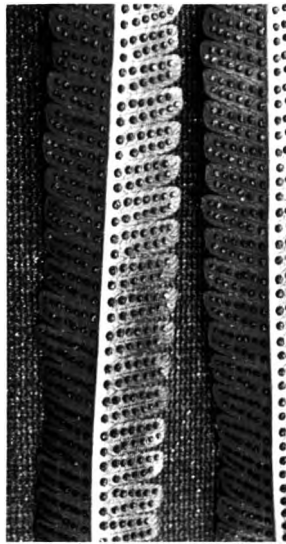
181. *Thelypteris crinipes* (Hook.) K. Iwats.



186. *Thelypteris hirtisora*
(C. Chr.) K. Iwats., sori



182. *Thelypteris aspera*
(Presl) K. Iwats.



184. *Thelypteris truncata* (Poir.)
K. Iwats.



187. *Thelypteris truncata*
(Poir.) K. Iwats.



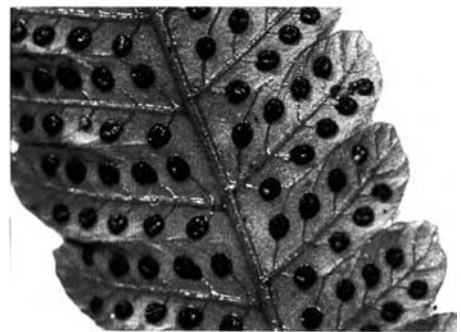
183. *Thelypteris nudata*
(Roxb.) Morton



185. *Thelypteris nudata*
(Roxb.) Morton,
areophores



188. *Thelypteris papilio* (C. Hope)
K. Iwats.



189. *Thelypteris papilio* (C. Hope)
K. Iwats., sori and venation



190. *Thelypteris ornata* (Wall. ex Beddome) Ching



191. *Thelypteris terminans* (Hook.) Tagawa & K. Iwats.



192. *Antrophyum callifolium* Blume



193. *Vittaria angustifolia* Blume, fertile fronds



194. *Thelypteris ornata* (Wall. ex Beddome) Ching, stipe scales



195. *Thelypteris terminans* (Hook.) Tagawa & K. Iwats., fertile segments



196. *Antrophyum callifolium* Blume, elongated of sori



197. *Vittaria angustifolia* Blume