

## On Some Pteridophytes of Sayap-Kinabalu Park, Sabah

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### ABSTRACT

*A total of 142 specimens of fern and fern-allies were collected during the Sayap-Kinabalu expedition. They were identified to 24 families, 59 genera, 106 species and 6 varieties including ten species whose real identity is still uncertain. Four species, viz. Lygodium merrillii (Schizaeaceae), Bolbitis appendiculata (Lomariopsidaceae), Christella sub-dentata (Thelypteridaceae) and Ctenitis vilis (Dryopteridaceae) were identified as new records to Mt. Kinabalu Fern Flora. There were ten other species apparently need further observations and investigation to determine their correct status, either as new species to science or new records for Mt. Kinabalu. These include a species each of the genera, Cyathea, Marattia, Antrophyum, Monogramma, Pteris, Asplenium, Crypsinus, Ctenitis, Tectaria and Cyclopeltis.*

### INTRODUCTION

Sayap-Kinabalu expedition area is situated in the north-western part of Kinabalu Parks. The base camp was erected about 2km from Kampung Sayap. One of the objectives of the expedition was to survey and observe the general flora and the ferns and fern-allies in particular. Apparently the Sayap-Kinabalu area is one of the unexplored part of the Kinabalu Park (Lamri, per. comm.).

The geological morphology of the Sayap-Kinabalu area is dominated by sedimentary rocks belonging to the Crocker Formation which consists of mainly bedded sandstones and interbedded shales and sandstones (Mohd. Shafeea Leman, 1993). The area surveyed is from 850m to 1550m altitude hence the vegetation consists of lower montane forests whose main floristic composition is dominated by highland dipterocarps, melastomes, lauraceous and fagaceous elements.

This preliminary survey is to collect and identify the ferns and fern allies in the study area. The specimens collection were made on the main trails such as Kemantis trail, Wariu trail, Tepisung trail and Minodtuhan trail.

While most taxa were collected in the form of herbarium and life specimens some were only Observed and Noted. Voucher specimens were kept in the Herbarium, Universiti Kebangsaan Malaysia (UKMB), with duplicates sent to the Herbarium of Sabah Park at Mt. Kinabalu and to the National Herbarium (KEP).

## A SURVEY OF THE FERNS

Previous report of Mt. Kinabalu's fern and fern-allies was made by Parrish et al. (1992) which furnished useful data on the species list and geographical distribution of ferns and fern-allies. The report accounted some 30 families, 138 genera and 608 species from 620 numbers of taxa. In the Sayap-Kinabalu area, a total of 142 specimens were collected during the five-day expedition comprising of 24 families (80%), 59 genera (43%) and 106 species(17%).

With regard to the distribution of the ferns, the huge terrestrial fern, *Pleocnemia olivacea*, *Colysis acuminata* and *Pteris excelsa* are more dominant. whereas on the boulders, *Loxogramme avenia*, a riparian fern *Microsorium pteropus* and *Monogramma* sp. which has pinnate segment of frond with single costa, almost cover the surfaces of boulders on river-banks of the sheltered area. Climbing fern, *Davallodes burbidgei*, *Antrophyum semicostatum* and *Microsorium sarawakense* are abundant on stems and branches of the trees especially in semi-sheltered area. On the fringe-disturbed forest along the trails, tree fern *Cyathea contaminans* predominate, and the common lowland fern *Blechnum orientale* are found abundantly. Along the trails juvenile *Cibotium arachnoideum* were commonly found which could be easily recognized by the presence of reddish hairs on stipe. Stands of *Lygodium merrillii* were found under the canopy of *Tremma orientale*. On the bank of the steep trails, one of the commonest lycopods *Lycopodiella cernua* was found together with *Pityrogramma calomelanos*.

Comparatively the Kemantis trail are rocky where *Pleocnemia olivacea* grows well and in this condition fronds of 1.5m were frequently Observed. A tiny fern, *Monogramma* sp. which has single main veins and pinnate segments frond grows abundantly on the boulders near the Kimantis river. *Chistensenia aesculifolia* grows near the trail as well. One of the interesting findings during the expedition was a small epiphytic fern, *Antrophyum* sp. attached onto the bark of the tree. This species is closely related to *Antrophyum parvulum* in having small size and red club-shaped paraphyses but differs in having complete costa, costa 1-2 forked and paraphyses branched.

Sheltered areas along the Wariu trail are covered by small herbs. Many epiphytic fern such as *Antrophyum semicostatum*, *Ctenopteris khasyana*, *Aglaomorpha heraclea* and *Davallodes burbidgei* predominate together with a terrestrial fern, *Colysis acuminata*. Among them, one of the authors (RJ) encountered two interesting species. *Marattia* sp. which has tuberculate stipe and rachis. The author had never seen those characters in the Bornean specimens; *M. sylvatica* has light-brown glabrous stipe and taller than the former. Unfortunately this species has sterile frond and need further information and observation of the fertile one. The other interesting finding is *Asplenium* sp., which also needs further observation. It has simple pinnate frond, sessile to subsessile and bearing bud on the terminal pinnae.

Tepisung trail displays a fern rock garden. This trail has plenty of ferns such as *Marattia sylvatica*, beautiful rock-loving fern *Araiostegia hymenophylloides* with more than 1m frond and massive prostrate rhizome. *Coniogramme macrophyllum* and *Polystichum obtusum*. *Tectaria* cf. *stalactica* also grows on rock crevices and *Pteris* spp. are among them.

Minodtuhan trail is a ridge which gave us *Cheiropleuria bicuspis*. *Huperzia serrata* and *Diplazium porpyrorachis*. *Oleandra pistillaris* growing along the trail. A small tree fern *Cyathea* sp. grows on the ridge slope and is possibly a new species.

## CHECKLIST OF TAXA

### LYCOPODIACEAE

#### ***Lycopodiella* Holub.**

Only one species found in Sayap-Kinabalu area.

*Lycopodiella cernua* (L.) Pichi-Serm.

Plants free standing, erect or arching and rooting at nodes or tips: up to 100cm high at maturity; branched often in whorls; lamina *ca.* 1mm wide at apex with a fine hairpoint; strobilus pendent.

Hill dipterocarp forest. Terrestrial usually along exposed trail.

MATERIAL: Main trail To campsite, Elev *ca.* 950m. *Razali Jaman*, RJ 3966.

#### ***Huperzia* Bernh.**

Three species occur in Sayap-Kinabalu area.

*Huperzia phlegmaria* (L.) Rothm.

Pendulous; leaves broadly lanceolate, less than 4 times longer than broad; base more or less cordate; sporophyll shorter than sporangia.

Lower montane forest. Epiphyte in shade.

MATERIAL: Minodtuhan trail: Elev. *ca.* 1500m. *Razali Jaman*, *Patrick Sungkit & Benedict Gangku*, RJ 4068.

*Huperzia serrata* (Thunb. ex Murray) Trevis

Stem erect or ascending; leaves margin serrate; sporophylls lanceolate, small, usually on apical part of the plants; axillary on leaves.

Lower montane forest. Terrestrial on slope in shade.

MATERIAL: Tepisung trail: Elev. *ca.* 1080m. *Razali Jaman*, RJ 3977b.

*Huperzia squarrosa* (G. Forster) Trevis

Stem pendulous, *ca.* 0.9m long, dichotomously branched; Leaves patent, squarrose, dense, entire, yellowish green in colour; sporophylls hardly smaller than the sterile leaves.

Hill dipterocarp forest. Epiphyte in shade.

MATERIAL: Wariu trail: Elev. *ca.* 910m. *Razali Jaman*, RJ 4031.

## SELAGINELLACEAE

*Selaginella* Beauv.

Stem elongate, bearing leaves and rhizophore, branching pinnately or dichotomously; leaves microphyllous, monomorphic and spirally arranged; sporangia of two kinds in the axils of sporophylls arranged terminally on branchlets; spores tetrahedral.

Four species are known from Sayap-Kinabalu area; but three are presently unidentified.

*Selaginella willdenowii* (Desv.) Baker

Stem scandent, up to 2m height, forming low bushes. Branches up to more than 70cm long; tripinnate, glabrous. Ventral leaves sessile, patent, oblong, more or less falcate, acuminate at apex, rounded and sub-truncate at basal basiscopic of ventral leaves with small auricles at basal acroscopic, up to 4mm long; dorsal leaves adpressed, falcate, acuminate apex, up to 2.3mm long Spikes at apex of lateral branchlets. uniform; sporophylls ovate, acute at apex, ca. 1mm long

Hill dipterocarp forest. Terrestrial in semi-shaded habitat. Abundant on clearings or exposed fringed forest.

MATERIAL: Wariu trail: Elev. ca. 860m *Razali Jaman*. RJ 4011.

*Selaginella* sp. 1

Stem erect or sub-erect, with root horne at interval. Branches dichotomous, up to 40cm Ventral leaves ca. 6mm long and 2mm wide. ohlong. falcate, glaucous below; serrate on acroscopic side of leaves only; basal acroscopic subcordate and truncated on basal basiscopic; dorsal leaves acute and long acuminate at apex. ca. 3mm long. Spike 1-3 pairs on the terminal of lateral branchlets, 1-4mm long, sporophylls 2mm long. concave, basal cordate.

Hill dipterocarp forest. Terrestrial in shade

MATERIAL: Sg. Lumutuk Besar: Elev. 970m. *Razali Jaman*, RJ 3971.

*Selaginella* sp. 2

Stem erect, up to 30cm height with stolon and forming new plants Branches pinnate, leaves closed together, dark green Ventral leaves up to 5mm long, senate on acroscopic side only, oblong, falcate. basal basiscopic subcordate and truncate on basal acroscopic side; dorsal leaves acute and long acuminate at apex, serrate at apex. Spike solitary, up to 5cm long. sporophyllis uniform, ovate, serrate throughout, ca. 1mm long.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Wariu trail: Elev. ca. 850m. *Razali Jaman*, RJ 4010.

*Selaginella* sp. 3

Plants. small, with wiry rhizome, sub-prostrate. Branches up to 4cm long. Ventral leaves ciliate on margin and upper surfaces. ca. 3mm long; dorsal leaves ovate with

long acuminate at apex Sporophylls spike uniform, short *ca.* 3mm long, sporophylls ovate, acute at apex; about less than 1mm in wide and 2mm in length. Lower montane forest Terrestrial in shade.

MATERIAL: Tepisung trail: Elev. *ca.* 1080m *Razali Jaman*, RJ 3977a.

#### OPHIOGLOSSACEAE

##### *Ophioglossum Tourn. ex Linn.*

Trophophyll, if present, simple or furcate; venation closed, reticulate; spike erect; sporangia embedded in two lateral rows, opening transversely.

Only one species occurs in Sayap-Kinabalu area.

##### *Ophioglossum reticulatum Linn. forma dilatatum (Miq) Wief.*

Plants *ca.* 6-12cm tall; rhizome subglobose. common stalk 1-6cm long; trophophyll in dried material rather thin, ovate with truncate base; venation lax with rather few big areoles and few free ending veinlets; fertile stalk 2.5-5.5cm long, strobilus 1.5-2.5cm long.

Hill dipterocarp forest Terrestrial in exposed alluvial area or sandy riverbank.

MATERIAL: Sg Wariu: Elev *ca.* 830m. *M.Mansor & M. Ganesan*, RJ 4070

#### MARATTIACEAE

There are 7 genera in the family, of which 3 genera are found in the Sayap Kinabalu.

##### *Angiopteris Hoffm.*

Huge ferns with globose adult stems, base of stipe swollen, fleshy, green; frond are bipinnate; veins free; synangia dorsal on veins, composed of a two close rows of contiguous sporangia, but not fused.

##### *Angiopteris angustifolia C.Presl*

Massive stock. Stipule basal stipe, tough Frond *ca.* 2cm Tall, bipinnate. Sori close to serrate margin.

Hill dipterocarp forest. Terrestrial on slope,

MATERIAL: Wariu trail: Elev. *ca.* 860m *Razali Jaman*, RJ 4033, Sayap Park Quarters: Elev. 850m *Razali Jaman*, RJ 4069.

##### *Marattia Swartz*

Rhizome erect, stipe with stipule at base, fleshy; frond bipinnate to tripinnal frond up to 2m long; pinnule are linear-lanceolate, dentate, coriaceous, paler ( lower surface, dark green on upper surface; veins free; sori dorsal on veins, frond, each composed of a short double row of sporangia tightly fused into synangium.

About 60 species known in this genus of which 2 species are found in Sayap Kinabalu area.

*Marattia sylvatica* Blume

Frond up to 2m long; pinnule are linear-lanceolate, coarsely serrate with cartilaginous teeth, coriaceous. paler on lower surface. dark green on upper surface; veins free; sori elongate along veins near pinnule margin. consisting of a double row of fused sporangia.

Hill dipterocarp forest. On rock crevices in light shade.

MATERIAL: Minodtuhan valley: Tepisung trail; Elev ca 1040m. *Razali Jaman*, RJ 3979

*Marattia* sp. 1

Rhizome erect with stipuled-stipe at base; stipe dark green, fleshy, ca. 27cm long, tuberculate; frond tripinnate; pinnae elliptical in shape, basal pinnae much reduced than middle pinnae, slightly asymmetrical at base, cuneate at base, basiscopic pinnule broader than acroscopic side, sessile, glaucous on lower surface, margin coarsely serrate, terminal leaflet broad and longer than the rest; rachis tuberculate and winged at apex; pinnae rachis winged, wings segregated at pinnule stalks; sori not seen.

Hill dipterocarp forest. Terrestrial on slope in deep shade.

MATERIAL: Wariu trail: Elev. 870m. *Razali Jaman*, RJ 4017.

*Note:* The Sayap-Kinabalu specimen differs from the well-known and more widespread *M. sylvatica* in having tuberculate stipe; rachis dark green (tuberculations on stipe and rachises could not be observed easily on the dried herbarium specimen; tuberculate tissue wrinkle and turned into dark scars). Three plants of this interesting species with sterile frond are found; up to 60cm tall. One had been planted in Taman Paku Pakis (Ferns Garden), Universiti Kebangsaan Malaysia in order to observe the fertile frond. It is growing well under cultivation. We suspect the specimen may be a new species, hence more information and observation on this species are needed.

*Christensenia Maxon*

This is a monotypic genus.

*Christensenia aesculifolia* (Blume) Maxon

Caudex creeping, fleshy; frond herbaceous, palmate with 3-5 leaflets, obovate, usually the middle one larger, lower surface paler; veins reticulate; sporangia fused into circular synangia, scattered over under surface. Sori at the junction of veins in two more irregular rows between the main veins

Hill dipterocarp forest. Terrestrial in deep shade.

MATERIAL: Wariu trail: On trail. Elev. ca. 850m. *Razali Jaman*, RJ 4008. Kimantis trail: On trail bank; Elev. ca. 900m. *Razali Jaman & Dolois Sumbin*, RJ 4057.

## SCHIZAEACEAE

***Lygodium* Swartz**

Rhizome creeping. Stipe at least hairy at the base; rachis long, twining; primary rachis-branches short, with a pair of secondary branches bearing palmate lobe or pinnate leaflets; fertile fronds smaller, bearing cylinder sorophores along the edges of the lamina.

This genus contains ca. 40 species, only one is found in Sayap-Kinabalu area

*Lygodium merrillii* Copel

Rhizome creeping. Stipe and rachis hairy throughout Sterile basal frond palmate; medial and apex frond pinnate. 2-3 pinnules dichotomous, lobed at apex. Sporangia borne on edges of frond, ca. 10cm long.

Hill dipterocarp forest. Terrestrial / twinning on disturbed forest in light shade.

MATERIAL: Sayap Parks's Quarters: Elev. ca. 860m. *Razali Jaman*, RJ 4005. Kimantis trail: Elev ca. 880m. *Razali Jaman & Dolois Sumbin*, RJ 4053.

*Note.* This species represents a new record to Kinabatu Park area. It is the fourth collection made in Sabah after those from Danum Valley, Crocker Range and Tawau Hills. All the specimens found were sterile; the sterile specimen collected from Danum Valley were planted in Taman Paku Pakis (Ferns Garden), Universiti Kebangsaan Malaysia had produced some fertile fronds. Hence, we are able to confirm the species.

## ADIANTACEAE

***Pityrogramma* Link**

Two species are known in the genus. Parrish *et al.* (1984) reported the species growing as weed.

*Pityrogramma calomelanos* (L.) Link

Rhizome erect with dark stipe; fronds clustered, bipinnate; pinnule covered with a white waxy powder; sporangia covering the lower surface when mature.

Hill dipterocarp forest. Terrestrial in exposed area.

MATERIAL: Sayap Park Quarters: Along Main trail; Elev. ca. 840m.

Observed.

***Syngramma* J. Smith**

Rhizome creeping which apex covered with very dark purplish brown, shining bristles; frond rather closed together, frond simple or simple pinnate or trifoliate; pinnae more or less coriaceous, the edges cartilaginous, entire or toothed; veins anastomosing near or at the margin; sori exindusiate, extending along the veins, parallel.

Two species found in Sayap-Kinabalu area, out of some 25 species known in the genus.

*Syngamma alismifolia* (C Presl) J. Smith

Stipe dark purplish, polished; frond simple, entire, subcoriaceous; sori borne on the whole length or the veins between midrib and the beginning of anastomosis; paraphyses short, bearing enlarged bright red apical cells.

Hill dipterocarp forest. Terrestrial in light shade.

MATERIAL: Junction of Tepisung Minodtuhan trail: Elev. Ca. 1110m. *Razali Jaman*, RJ 3958.

*Syngamma borneense* (Hook.) J. Smith

Rhizome erect. Frond dimorphous, simple; fertile frond much longer and smaller than sterile frond. Sori forming a network of anastomosing veins; indusiate.

Lower montane forest. Terrestrial in shade on slope.

MATERIAL: Tepisung trail: Elev. ca. 1100m. *Razali Jaman*, RJ 3960. Minodtuhan trail: Elev. ca. 1500m. *Razali Jaman, Benedict Gangkut & Partick Sungkit*, RJ 4065.

*Coniogramme Fee*

Rhizome creeping, rather stout with entire, narrow, thin, dull brown scale; stipe pale green, glabrous, U-shaped vascular strand; frond fairly large, simply pinnate to tripinnate, entire or serrate pinnae, herbaceous; veins free, rarely anastomosing, once forked, ending in elongate hydathodes; sori elongate along the veins except near margin; exindusiate.

A genus of some 20 species, one occurs in Sayap-Kinabalu area.

*Coniogramme macrophylla* (Bl.) Hieron.

Frond large, pinnate, texture firm, basiscopis frond undivided; stipe light green.

Hill dipterocarp forest. On rock surface sometimes on rock crevices usually wet and moist condition.

MATERIAL: Sg. Lumutuk Besar: Elev. ca. 970m. *Razali Jaman*, RJ 3943. Minodtuhan valley: Near Sg. Minodtuhan; Elev. ca. 1050m. *Razali Jaman*, RJ 3989.

## VITTARIACEAE

*Antrophyum* Kaulf.

Rhizome short; frond simple, broader linear, usually broader above the middle; costa partial or absent; veins repeatedly dichotomous, anastomosing with elongate areoles; sori elongate, sunken in grooves along the veins; paraphyses thread-like or club-shaped.

*Antrophyum latifolium* Blume

Stipe distinct, ca. 16cm long, fleshy; lamina orbicular; club-shaped paraphyses present

Hill dipterocarp forest. On rock in shade.

MATERIAL: Minodtuhan valley: Tepisung trail. Elev. *ca.* 1050m. *Razali Jaman*, RJ 3990.

*Antrophyum semicostatum* Blume

Stipe broadly winged extending almost to the base, sessile, lamina apex acuminate to acute, widest above the middle; club-shaped paraphyses present.

Hill dipterocarp forest. Epiphyte or lithophyte in shade.

MATERIAL: Sg. Lumutuk Besar: Near the river; Elev. *ca.* 970m. *Razali Jaman*, RJ 3937. Wariu trail: Elev. *ca.* 850-870m. *Razali Jaman*, RJ 4007 & RJ 4009 & RJ 4018.

*Antrophyum* sp.

Small epiphytic fern. Frond *ca.* 2cm long, fleshy; apex rounded; sori linear, sunken on vein grooved. short; red club shaped paraphyses present.

Hill dipterocarp forest. Epiphyte in semi exposed area.

MATERIAL: Kimantis trail: Near Sg. Kimantis; Elev. *ca.* 870m. *Razali Jaman* & *Dolois Sumbin*, RJ 4048.

*Note:* The Sayap-Kinabalu specimen shows close affinity to *A. parvulum* in size and form as well as having red club-shaped paraphyses but differs in having complete, 1 to 2-forked costa and branched paraphyses.

Probably a new record to Kinabalu Park.

***Vaginularia*** Fee

Minute, grass-like fern with slender rhizome, clothed with clathrate scales; frond forming turf, filiform, thin herbaceous, sessile; costa bearing a few short lateral veins which run parallel to it; sori protected by inner indusium arising along the midrib and by an outer narrower flap arising near the margin.

*Vaginularia trichodea* (J.Smith) Fee

Rhizome very slender, bearing small iridescent, clathrate scale; frond filiform, sessile.

Hill dipterocarp forest On rock in shade.

MATERIAL: Wariu trail: Elev. *ca.* 910m *Razali Jaman*, RJ 4006.

***Monogramma*** Schk.

Similar to *Vaginularia* in other respects, but differs from it in lateral veins lacking; the sorus elongate, borne the upper part of costa, subimmersed in a deep groove on one or both sides of the lamina.

*Monogramma* sp.

Small rock-loving fern. Rhizome erect Stipe green, up to 4cm long, sparsely covered with *ca.* 1 mm long clathrate scales, grooved on upper surface; 'bird shaped' of vascular strand. Frond to tripinnate, segment linear, *ca.* 1-2mm wide,

segment of pinnae pinnate. Costa strongly raised without lateral vein. Sori on the acroscopic side of the lamina segment covered by broad and elongate indusium.

Hill dipterocarp forest. Apparently abundant on mossy rock.

MATERIAL: Kimantis trail: Elev. 860m. *Razali Jaman*, RJ 4039. Sg. Lumutuk Besar: Elev. ca. 970m *Razali Jaman*, RJ 3940 Sg. Wariu: Elev. 870m. Observed.

*Note:* Copeland (1960) listed *M. dareicarpa* Hook as being the only species of the genus in Borneo. However, the presence of the genus was not even noted by Parris *et al.* (1992). The species herein described may be new to science, differing from *M. dareicarpa* in having erect rhizome, scales *ca.* 1 mm long, clathrate, the height *ca.* 14cm long, frond bi- to tripinnate, segment pinnate, sori on acroscopic side of the segment.

## PTERIDACEAE

### *Pteris* Linn.

Rhizome erect or short creeping; frond simple pinnate to bipinnate sometimes tripartite; basal pinnae of the frond often branched, the branch similar in shape to the lateral pinnae but smaller; veins free or anastomosing; sori linear, sub-marginal; protected when young by deflexed membranous margin.

Five species found in Sayap-Kinabalu area.

#### *Pteris excelsa* Gaud.

Rhizome sub erect; basicopic pinnae forked, slightly shorter than basicopic pinnae. Terrestrial in shade.

Hill dipterocarp forest to Lower montane forest. Terrestrial in shade.

MATERIAL: Sg. Lumutuk Besar trail: By main trail; Elev. *ca.* 960m. *Razali Jaman*, RJ 3933. Junction Of Tepisung Minodtuhan trail: Elev. *ca.* 1110m. *Razali Jaman*, RJ 3975. Wariu trail: Elev. *ca.* 910m. *Razali Jaman*, RJ 4027b.

#### *Pteris mertensioides* Willd.

Frond *ca.* 1.2m tall. Frond pectinate, sinuses of lobes near to costa.

Hill dipterocarp forest. Terrestrial in exposed area.

MATERIAL: Tepisung trail: Near Sg. Wariu; Elev. *ca.* 1060m. *Razali Jaman*, RJ 3999.

#### *Pteris* sp. 1

Rhizome erect, covered with brown scales. Stipe atropurpurescens. Frond pinnatifid, coriaceous, under surface paler than the upper surface, light-brown when dried. All pinnae lobes attached by broad base, adnate. Lowest pinnae very small adnate. Sori elongate on lobes edges covered by deflexed edge.

Hill dipterocarp forest. On rock in shade.

MATERIAL: Minodtuhan valley: Tepisung trail: Elev. *ca.* 1060m. *Razali Jaman*, RJ 3991.

*Pteris sp. 2*

Rhizome erect; stipe stramineous; frond rachis dark brown, frond palmate, bipinnatifid; basal of pinnae bearing reduced pinnules at most 1 pair, about twice as long as the middle lateral pinnules, terminal of pinnules leaflet longer, dentate than lateral pinnules, pinnules lobes serrate at apex, paler than the above green pinnules; lobed almost to their costae veins once forked; sori confined to the middle of the lobes, not exceeding to their apices or sinuses.

Hill dipterocarp forest. Terrestrial in light shade area.

MATERIAL: Minodtuhan valley: Sg. Minodtuhan; Elev. ca. 1030m. *Razali Jaman*, RJ 3978.

*Note:* Only one individual plant found near the trail by riverbank. The specimen (RJ 3978) collected was without rhizome.

*Pteris sp. 3*

Plant ca. 1.6m tall; rhizome sub erect; stipe up to 90cm long, dark brown at base, brown on adaxial, glabrous, grooved on abaxial; frond bipinnatifid, stalked, a pair of basal pinnae with branched on basisopic side, lateral pinnae not branched, winged on abaxial of costa; pinnule segment green on upper surface and paler on under surface, serrate distally. deeply lobed almost to costa, broad at base, adnate, terminal as lateral pinnae; veins conspicuous, forked, not reaching margin, hydathode on upper surface; sori sub-marginal, linear.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Wariu trail: Elev. 910m. *Razali Jaman*, RJ 4027a.

## HYMENOPHYLLACEAE

*Trichomanes* Linn.

Indusium tubular or trumpet-shaped, sometimes with two-lipped mouth; receptacles usually elongating considerably and protruding from old sori.

Two species found in Sayap-Kinabalu area.

*Trichomanes auriculata* Blume

Rhizome long creeping, climbing, rather black; frond alternately arranged, bipinnate; sori borne on both sides of pinnules, almost on middle portion,

Hill dipterocarp forest. Climbing on treelet.

MATERIAL: Kimantis trail; Elev. ca. 900m. *Razali Jaman*, RJ 4055.

*Trichomanes maxima* Blume

Rhizome creeping. Stipe up to 22cm long. Frond finely dissected, quadripinnatifid ; all axes with very narrow winged. Involucre up to 3mm long, cylindrical, operculum truncate or slightly dilated.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Kimantis trail: Elev. ca. 870m. *Razali Jaman*, RJ 4047.

***Crepidomanes* Presl**

Rhizome filiform, branched, usually rootless: frond small, pinnately compound or rarely digitate by reduction, glabrous, margin entire; false veins always present on intramarginal or irregular placed; involucre obconic to trumpet shaped, winged, mouth bilabiate or receptacle extruded as in *C. christii*.

Only two species occur in Sayap.

*Crepidomanes christii* Copel.

Rhizome long creeping, very slender, black; frond usually well spaced, frond regularly tripinnatifid; false submarginal and veins band present; sori with expanded margin, confined to frond apex; involucre tubular.

Hill dipterocarp forest to lower montane forest. Lithophyte in shade.

MATERIAL: Sg. Lumutuk Besar: Elev. ca. 970m. *Razali Jaman*, RJ 3973.

Minodtuhan trail: Elev. ca. 1030m. *Razali Jaman*, RJ 3954.

***Cephalomanes* Presl**

Rhizome erect or shortly erect, stout; frond fascicled, setose, scabrous, simply pinnate or rarely pinnatifid; pinnae asymmetric; veins coarse, cells large and with relatively thin, wavy walls; involucre cylindric or rarely obconic, receptacle long and stout.

One species found in Sayap-Kinabalu area.

*Cephalomanes Javanica* (B1.) Bosch

Rhizome erect or short creeping with tufted frond; frond pinnate; sori confined to acroscopic margin, usually projecting beyond pinna margin.

Hill dipterocarp forest. On riverbed rock in exposed stream.

MATERIAL Sg. Lumutuk Besar: Elev. ca. 970m. *Razali Jaman*, RJ 3963.

GLEICHENIACEAE

***Gleichenia* Smith**

*Gleichenia truncata* (Willd) Spr. var. *Truncata*

Ultimate branched simply pinnatifid; stipule-like leaflet (different from ordinary segments of the lamina) present at the branchings of the main rachis (on frond of mature size); segment of the lamina at right angles to the costa, more or less deflexed; forkings of rachic-branches equal or nearly so; veins not strongly raised.

Hill dipterocarp forest. Forming ticket by cleared forest edges.

MATERIAL: Main trail to Sg. Lumutuk Besar: Elev. ca. 850m. Observed.

## CHEIROPLEURACEAE

*Cheiropleuria* Presl

A family with monotypic genus.

*Cheiropleuria bicuspis* (Blume) C.Presl

Rhizome creeping, clothed with soft brown hairs; frond dimorphous with long stipe, sterile frond simple (small plants) to bilobed (on large plants), coriaceous, glabrous, margin entire, fertile frond linear-elliptic with acrostichoid sporangia on lower surface; main vein dichotomous at the base, small veins anastomosing.

Hill dipterocarp forest to Lower montane forest. Terrestrial on slope in shade.

MATERIAL: Junction of Tepisung-Minodtuhan trail: Elev. ca. 1100m. *Razali Jaman*, RJ 3976. Minodtuhan trail: Elev. ca. 1500m. *Razali Jaman, Benedict Gangkut & Patrick Sungkit*. RJ 4062.

## POLYPODIACEAE

*Aglaomorpha* Schott

Rhizome large, to ca. 2cm diameter, creeping, fleshy, covered with a mass densely brown-hairy root; scale base 2cm, length 3cm, dark red-brown with pale short-hairy edges; frond pinnatifid, large, sessile, basal frond cordate, texture leathery, humus-collecting; costa strongly raised on both surfaces; main veins raised; sori small in 2 fairly regular rows, usually on terminal a free veins.

*Aglaomorpha heraclea* (Kze) Copeland

Rhizome large, stout, fleshy, covered with castaneous scales. toothed scale; and immersed in a mass of fibrous roots; frond pinnatifid, sessile 80 x 270cm, basal frond cordate, texture leathery, humus-collecting; costa strongly raised on both surfaces; main veins raised; sori round, small in 2 fairly regular rows on each side of each main vein, one in each areola, usually on terminal of free veins

Hill dipterocarp forest. Epiphyte in semi shade

MATERIAL Wariu trail: Elev. ca. 900m. *Razali Jaman*, RJ 4024.

*Pyrrhosia* Mirbel

Rhizome long creeping, covered with peltate scale (not peltate on some species) at base, entire or fringed with hairs; frond articulate to rhizome, uniform or moderately dimorphic, usually simple, shortly stalk, entire. fleshy; surfaces more or less clothed with stellate hairs (various kind of stellate hairs); hydathodes present and conspicuous on the upper surface (in some species); sori confined to apical half of fertile frond, on the included veinlet, round, sori protected when young with stellate paraphyses.

A genus of about 100 species, only one present in Sayap-Kinabalu area.

*Pyrrhosia floccigera* (Bl.) Ching

Rhizome scaly, peltate, long acuminate. Frond oblanceolate; lower surface of frond covered with interlocking light brown stelate hairs. Sori round, scattered, not touching each other.

Hill dipterocarp forest. On twig in exposed area

MATERIAL: Wariu trail: Elev. ca. 900m. *Razali Jaman*, RJ 4025.

*Note:* Compared with Peninsular Malaysian specimens, the Sayap-Kinabalu one is smaller in size.

*Microsorium* Link

Epiphyte or lithopyte, Rhizome long creeping (or climbing) covered with clathrate scales more or less rounded, peltate; stipe jointed to rhizome; frond simple to pinnatifid, segment not jointed to rachis; veins more copiously anastomosing; sori round, various in size, either in rows beside main lateral veins or scattered; not at the end of free veins.

Five species out of some 40 species in the genus are found in the Sayap- Kinabalu area.

*Microsorium heterocarpum* (Blume) Ching

Rhizome short creeping; frond simple, narrowly decurrent almost to the base, ovate-lanceolate; main veins prominent; sori numerous, scattered, round. small. on reticulate veins between each pair of main veins.

Hill dipterocarp forest. Terrestrial and sometimes epiphyte on tree in shade or light exposed area. One of the commonest fern on the forest floor.

MATERIAL: Kimantis trail: Elev. ca. 870m. *Razali Jaman & Dolois Sumbin*, RJ. Elev. ca. 960m. *Razali Jaman*, RJ 3930. Sg. Lumutuk Besar: Elev. ca. 890m. (Observed). Wariu trail: Elev. ca. 850m. Observed.

*Microsorium alternifolium* (Willd.) Copel.

Rhizome creeping. Frond coriaceous. Sori in one row, closed to costules, immersed.

Hill dipterocarp forest. On rock in various sheltered places.

MATERIAL: Kimantis trail: Elev. ca. 860m. *Razali Jaman & Dolois Sumbin*, RJ 4041. Sg Wariu: On boulder by river; Elev. ca. 850m. Observed.

*Note:* Copeland (1960) and Holttum (1968) called it *Microsorium longissimum* (J. Smith) Fee and *Phymatodes longissima* (Bl.) J. Smith, respectively. Some other authors such as Pichi-Sermoli placed it in *Phymatosorus*.

*Microsorium musifolium* (Blume) Ching

Rhizome climbing, stout; frond simple, close together, alternately arranged. humus collecting, cordate or broadly truncate at base, apex acuminate, texture thin and translucent but firm; sori numerous, very small, scattered closely all over the frond, on veins.

Hill dipterocarp forest. Climbing on tree in light shade area.

MATERIAL: Kimantis trail: Elev. ca. 850m. *Razali Jaman & Dolois Sumbin*, RJ 4036.

*Microsorium pteropus* (Blume) Ching

Rhizome creeping, green; frond pinnatifid, 2 pairs of lateral lobes; sori small, scattered.

Hill dipterocarp forest. Common on boulders in river bed, exposed area

MATERIAL: Sg Lumutuk Besar: Elev. 970m. *Razali Jaman*, RJ 3941 Kimantis trail: Elev. ca. 870m. *Razali Jaman & Dolois Sumbin*, RJ 4050.

*Microsorium sarawakense* (Baker) Holttum

Rhizome long creeping; frond well spaced. simple; sori large, round, few.

Hill dipterocarp forest. Epiphyte or lithophyte in river bed. Exposed area. Fairly abundant.

MATERIAL: Sg. Lumutuk Besar trail: by main trail, Elev. 970m. *Razali Jaman*, RJ 3930. Sg. Wariu: Elev. 870m. *Razali Jaman*, RJ 3964. Minodtuhan valley Tepisung trail: Elev. ca. 1060m. *Razali Jaman*, RJ 3997.

*Colysis* C. Presl

Rhizome covered with clathrate scales; frond simple, thin, segment not jointed to rachis; veins visible; sori elongate, oblique, parallel to main lateral veins. Two species present in Sayap-Kinabalu area.

*Colysis acuminata* (Baker) Holttum

Rhizome creeping; frond simple; stipe winged almost (sometimes not) to the base; main veins less prominent; sori in single row (broken line) between adjacent main veins.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Kimantis trail: Elev. ca. 900m. *Razali Jaman & Dolois Sumbin*, RJ 4058.

*Colysis macrophylla* (Blume) C.Presl

Rhizome creeping; frond usually more than 5cm wide; at least main veins raised; sori in slightly broken or continuous lines between main veins.

Hill dipterocarp forest. On boulders in riverbed, exposed.

MATERIAL: Sg. Lumutuk Besar: Elev. ca. 970m. *Razali Jaman*, RJ 3945. Kimantis trail: Elev. ca. 890m. Observed.

*Crypsinus* C.Presl

Rhizome creeping covered with peltate scales; frond simple. deeply lobed or pinnate; margin usually notched; fertile frond or lobed are often narrower than sterile fronds; sori round or linear, often sunk in cavities, in one or more rows between midrib and margin or between pairs of main veins; umbrella paraphyses absent.

Four species present in Sayap-Kinabalu area.

*Crypsinus taeniatus* (Sw.) Copel.

Rhizome creeping, densely covered with dull pale brown peltate scales, broad at base, edges somewhat toothed; frond imparipinnate with 2 pairs of lateral pinnae; sori superficial. slightly immersed.

Hill dipterocarp forest to Lower montane forest. On tree in light shade.

MATERIAL: Minodtuhan Valley-Tepisung trail: Elev. ca. 1060m *Razali Jaman*, RJ 3996 Minodtuhan trail: Elev. ca. 1500m. *Razali Jaman*, Benedict Gangku & Patricit Sungkit, RJ 4063

*Crypsinus trilobus* (Houtt) Copel.

A specimen collected from fallen tree comprising of dried fertile fronds. Fertile frond pinnate (or pinnatifid): sori sunken in the pit.

Hill dipterocarp forest. Epiphyte on tall tree.

MATERIAL: Wariu trail: Elev. ca. 860m. *Razali Jaman*, RJ 4032.

*Crypsinus* sp. 1

Rhizome creeping, densely covered with dull pale brown scales; frond simply-pinnate, imparipinnate, 4-6 pairs of lateral pinnae, rather coriaceous, petiole to 6mm long, slightly asymmetrical at base, basal basisopic pinnae much broader than acroscopic side with cuneate on acroscopic pinnae, mucronate at apex with long narrowed tips; veins slightly prominent on both surfaces, sori inframedial, one each side of midrib, sunken in cavities.

Hill dipterocarp forest. On rock in light shade area.

MATERIAL: Wariu trail: Elev. ca. 910m. *Razali Jaman*, RJ 4028.

*Crypsinus* sp. 2

Rhizome creeping, densely with red-brown rounded-peltate scales, broad at base, long narrowed to apex, with pale toothed edges; white- chalky present when scales removed; frond imparipinnate, 2-3 pairs of lateral pinnae, white-chalky dots present on vein ending of upper surface; sori inframedial in shallowly cavities.

Hill dipterocarp forest. On tree in light shade area of the forest.

MATERIAL: Wariu trail: Elev. ca. 910m. *Razali Jaman*, RJ 4029.

*Lemmaphyllum* C.Presl

Rhizome long creeping and very slender; with densely matted roots clothed with dark brown hairs, clathrate, small; widely spaced frond, frond shortly stalked, usually dimorphous; Sterile frond short and broad, fertile frond narrow, throughout and fertile on apical part; veins not or hardly visible; sori separated or continuous, sori protected when young by umbrella-shaped paraphyses.

Eight species in the genus and one occurs in Sayap-Kinabalu area.

*Lemmaphyllum accedens* (Blume) Donk

Rhizome long creeping; frond dimorphous, sori round, on narrow apical part of the fertile frond.

Hill dipterocarp forest. A riparian fern, on twigs in exposed streams.

MATERIAL: Sg. Wariu: Elev *ca.* 830m *M.Mashhor & M.Ganesan*, RJ4061.

*Belvisia* Mirble

Rhizome short creeping, covered with dark peltate scale; frond closed together, jointed to the rhizome, shortly-stalked, simple and entire, linear-lanceolate, coriaceous; veins copiously anastomosing; fertile portion on apical part of the lamina, sometimes separated by a constriction; sori protected when young by umbrella-shaped scales, edges deflexed.

Two species occur in Sayap-Kinabalu area.

*Belvisia mucronata* (Fee) Copel.

Rhizome-scales clathrate, consisting entirely of large thick-walled cells, edges toothed; stipe short; sterile lamina narrowed evenly to base and apex, veins; constriction at junction with fertile portion.

Hill dipterocarp forest. Epiphyte in exposed areas.

MATERIAL: Main trail to camp-site: Elev. *ca.* 960m. *Razali Jaman*, RJ 3967.

*Belvisia revoluta* (Blume) Copel.

Rhizome scales with dark centre of large thick-walled cells and thin pale edges of small cells, margin entire, ovate; stipe usually distinct; sterile lamina narrowed gradually to both ends.

Lower montane forest. Epiphyte in shade.

MATERIAL: Minodtuhan valley: Elev *ca.* 1060m. *Razali Jaman*. RJ 3995.

*Thylacopteris* Kunze*Thylacopteris papillosa* (Blume) Kunze ex J.Smith

Rhizome long creeping. Frond pendulous. Sori immersed.

Hill dipterocarp forest. On boulder in exposed streams.

MATERIAL: Sg. Lumutuk Besar: Elev. *ca.* 970m. *Razali Jaman*, RJ 3939. Sg. Wariu: Elev. *ca.* 840m. Observed.

## GRAMMITIDACEAE

*Grammitis* Swartz

Frond undivided, entire or very slightly crenate, usually linear-lanceolate to linear-oblancheolate.

Only one species found in Sayap area.

*Grammitis impressa* Copel.

Erect. Frond subcoriaceous; sori sunk in cavities in the frond.

Hill dipterocarp forest. Epiphyte on twig in shade.

MATERIAL: Sg. Wariu: Elev. ca. 830m. *M.Mansor & M.Ganesan*, RJ 4071. Sg.

Wariu: Elev. ca. 870m. *Razali Jaman*, RJ 4060.

*Ctenopteris* B1. ex Kunze

Only one species occurs in Sayap-Kinabalu area.

*Ctenopteris khasyana* (Hook.) Holttum

Frond subcoriaceous; pendulous

Hill dipterocarp forest. Epiphyte in shade area.

MATERIAL: Wariu trail: Elev. ca. 910m. *Razali Jaman*, RJ 4030. Minodtuhan valley-Tepising trail: Elev. ca. 1060m. *Razali Jaman*, RJ 3994.

## LOXOGRAMMACEAE

*Loxogramme* (B1.) C. Presl

Short-creeping rhizome; frond simple, linear-lanceolate to elliptic; veins anastomosing freely; sori elongate on veins, oblique to midrib.

Only one species found in the Sayap-Kinabalu area.

*Loxogramme forbesii* Copel.

Rhizome creeping. Frond sessile, up to 40cm long; lamina widest on apical part.

Sori on apical part of frond, elongate, oblongate, oblique to costa.

Hill dipterocarp forest. On boulders in shade.

MATERIAL: Sg. Lumutuk Besar: Elev. ca. 970m. *Razali Jaman*, RJ 3942.

## CYATHEACEAE

*Cyathea* Smith

Stock erect, forming a massive trunk (in most species); apex of trunk and bases of stipes covered with more or less dense scales; frond medium to large in sizes, pinnate to more or less deeply tripinnatifid; veins pinnate, simple or forked; sori on the veins, medial or marginal (never terminal); indusia absent or present.

A large cosmopolitan family. three species occur in Sayap-Kinabalu area.

*Cyathea contaminans* (Hook.) Cope].

Stipe stout, strongly thorny. purplish glaucous.

Hill dipterocarp forest. Terrestrial on roadbank in exposed area. Abundant.

MATERIAL: Sayap Park's quarters: Elev. ca. 870m. Observed.

*Cyathea latebrosa* (Wall. ex Hook.) Copel.

Trunk *ca.* 1.2m tall; shortly thorny; sori with minute scale on inner side.

Hill dipterocarp forest. Terrestrial in shade

MATERIAL: Minodtuhan trail: Elev. *ca.* 1020m. *Razali Jaman*, RJ 3952.

*Cyathea* sp. I

Stock sub-erect. short. *ca.* 6cm tall. Stipe up to 8cm long, base of stipe covered with pale brown setiferous scales, concolor with red hairs on its marginal, one cell thick throughout; and the rest covered with septate hairs, *ca.* 3mm long. Frond simply pinnate, pinnae well spaced *ca.* 12- 13mm apart, subopposite to alternate, pinnae serrate-crenate, the crenature less than 2/3 to the costa; lower pinnae gradually reduced, bending downward; apex of pinnae rather blunt or almost rounded; frond rachis dark to medium brown with long septate hairs, to about 3mm long. Veins free, forked to pinnate(11/2 - 3 pairs); basal basicopic veins springly from costa (midrib), simple or once forked. Sori closed to costa on veins, covered with thin and translucent indusium, lost when maturity.

Lower montane forest. Terrestrial on ridge slope in shade.

MATERIAL: Minodtuhan trail. Elev. *ca.* 1550m *Razali Jaman*, *Patrick Sungkit & Benedict Gangku*, RJ 4067.

*Note:* This species belongs to Subgenus *Sphaeropteris* of Section *Schizocaena* and Subsection *Schizocaena* in having stipe-scale setiferous, one cell thick throughout; the position of the basal basicopic vein of each group springs from costa (or in *C. moluccana* from the midrib of the pinna). the indusia thin and translucent (not hemiteloid type) fully covered the sorus when young. breaking and lose at maturity.

It is similar to *C. capitata* Copel. in having simply pinnate frond, and apex of frond a deltoid deeply lobed lamina; but differs in having very short trunk up to 6cm long and short stipe, up to 8cm long, entire margin, and smooth rachis. This is possibly a new species.

## DICKSONIACEAE

*Cibotium* Kaulf.

*Cibotium arachnoideum* (C.Chr.) Holttum

Rhizome massive, prostrate. Stipe covered with appressed antrose hairs, reddish.

Hill dipterocarp forest. Exposed on secondary forest by main road.

MATERIAL: Park Quarters: Elev. *ca.* 870m. Observed.

## DENNSTAEDTIACEAE

***Microlepia*** C.Presl

Rhizome creeping, covered with short hairs; frond pinnate to tripinnatifid or more divided with free veins; sori close to margin of lobes, on terminal veins: indusia attached by side and base, half cup shaped, often hairy.

A genus of *ca.* 50 species, only one occurs in Sayap-Kinabalu area.

*Microlepia hookeriana* (Wall. ex Hook) C.Presl

Rhizome long creeping. Frond simply pinnate, subsessile; acroscopic basal pinnae auricled.

Hill dipterocarp forest. Terrestrial in light shade or shade areas.

MATERIAL: Minodtuhau Trail: Elev. 1040m., near trail *Razali Jaman*, RJ 3957.

Tepisung trail: Elev. 1100m. *Razali Jaman*, RJ 3962.

***Orthiopteris*** Copeland

Rhizome stout, erect; rhizome and base of stipes bear rather stiff dark scales when young; frond bipinnate to decompose, broad at the base, glabrous, pinnae and pinnules oblique; sori marginal, on the veins, indusium obconic.

Eleven recognized species with only one in the Sayap-Kinabalu area.

*Orthiopteris kingii* (Bedd.) Holttum

Rhizome erect covered with dark brown peltate scales, rather thick; frond tripinnate, distinctly stalked; sori on terminal veins, on margin crenature.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Minodtuhau valley Tepisung trail: Elev. *ca.* 1050m. *Razali Jaman*, RJ 3987.

***Lindsaea*** Dryand

Rhizome short to long creeping covered with scales; frond small to medium sized, simply pinnate to bipinnate with crescent or parallelogram-shaped pinnae or pinnules: veins free or anastomosing; sori submarginal with elongate or roundish indusium and open toward margin.

About 150 species in the genus with only in the Sayap-Kinabalu area.

*Lindsaea cultrata* (Willd.) Sw.

Rhizome creeping. Pinnule longer than wide. Petiole stramineous. Veins anastomosing. Sori marginal, continuous.

Hill dipterocarp forest. Terrestrial near trail.

MATERIAL: Tepisung trail: Elev. *ca.* 1100m., *Razali Jaman*, RJ 3962.

## THELYPTERIDACEAE

***Pronephrium* C.Presl**

Caudex creeping or sub-erect; frond simple to simply to simply-pinnate, crenate to entire; veins several pairs, almost all anastomosing with the excurrent veinlet arising from their union, often forming zig-zag composite veins alternating with the costules; hooked hairs sometimes present; sessile spherical yellow glands present on lower surface; sori indusiate or lacking. sporangia often bearing short hair, less often spherical glands or both hair and gland.

***Pronephrium cf. cuspidatum* (Bl) Holttum**

Rhizome creeping, quite long; stipe widely spaced, 3cm apart, bearing hooked hairs and brown scale *ca.* 7x1mm with a few hooked hairs present on margins; sterile pinnae measuring up 15cm X 4.5cm, cuneate at base and long caudate-acuminate apex, blunt, stalked up to 3mm long, alternate, terminal pinnae-like, slightly broader than lateral one; fertile pinnae smaller measuring up to 11cm x 3.5cm, slightly asymmetric at base; hooked hairs present on lower surface of costa; veins 10-12 pairs, anastomosing, excurrent veinlets free with hydathodes on the end of free veinlet; sori exindusiate, medial, elongate on veins, hooked hairs lacking on sporangia.

Hill dipterocarp forest. Terrestrial in shade

MATERIAL: Tepisung traai: On slope: Elev. *ca.* 1080m *Razali Jaman*, RJ 4003.

*Note:* Differs from the typical *P.cuspidatum* as follows; rhizome quite long, creeping bearing widely spaced of frond, basal pinnae of frond alternate and sori on medial of veins.

***Pronephrium firmulum* (Bak.) Holttum**

Rhizome creeping; frond not or little dimorphous; sori inframedial, indusia none or very small.

Hill dipterocarp forest. On rock in light shade.

MATERIAL: Sg. Lumutuk Besar: Elev. *ca.* 970m. *Razali Jaman*, RJ 3944. Wariu trail: Elev. *ca.* 860m *Razali Jaman*, RJ 4012 Kimantis trail: Elev. *ca.* 860m. *Razali Jaman & Dolois Sumbin*, RJ 4043.

***Mesophlebion* Holttum**

Caudex creeping, sometimes elongate, covered with narrow scales, rather rigid but not spine-like, bearing short acicular hairs; frond simply pinnate to bipinnate, sometimes dimorphic, basal pinnae not reduced but more or less narrowed toward their asymmetric bases; basal basisopic vein arising from costa, basal veins from adjacent costules usually both passing to base of sinus between their lobes, costules and veins bearing many narrow scales and acicular unicellular hairs; only hairy on costa of upper surface; sori indusiate, stalk of sporangia always bearing spherical orange-red glands.

17 species recognized in Malesia, only one occurs in the Sayap area.

*Mesophlebion crassifolium* (B1.) Holttum

Rhizome long creeping; frond dimorphous, texture very firm, subopposite, widely-space; basal pinnae stalked, basal pinnae *ca.* 1-3 lobes reduced; sori indusiate, inframedial, indusia rather large but thin, bearing short hairs.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Sg. Lumutuk Besar trail: By main trail; Elev. *ca.* 960m *Razali Jaman*, RJ 3932. Sg. Lumutuk Besar: Elev. *ca.* 970m *Razali Jaman*, RJ 3972.

*Sphaerostephanos* J. Smith

*Caudex erect or short creeping; scales narrow, thin, bearing superficial acicular hairs; large pinnae abruptly change to much reduced pinnae, present at base of frond; pinnae lobed, crenate or a few subentire; sinus membrane distinct; veins anastomosing; sessile spherical yellow glands present on pinnae, indusia or sporangia; acicular hairs present on both surfaces of costae and costules; sori round, more or less elongate, indusia usually present.*

About 180 species in the genus, mostly Malesian, *ca.* 152 species, only one was found in the Sayap-Kinabalu area.

*Sphaerostephanos polycarpus* (B1.) Copel.

Rhizome erect; sori medial, elongate; indusia and sporangia bearing spherical yellow glands.

Hill dipterocarp forest. Terrestrial in shade

MATERIAL: Minodtuhan valley-Tepisung trail: Elev. *ca.* 1060m. *Razali Jaman*, RJ 3933 Tepisung trail: Near Sg. Wariu; Elev. *ca.* 1060m *Razali Jaman*, RJ 3987

*Pneumatopteris* Nakai

Rhizome short-creeping or erect; base of frond abruptly much reduced: aerophores always somewhat swollen sometimes elongate; lower surface of lamina between veins more or less pustular when dried, small capitate hairs present on lower surface of frond and / or sporangia.

About 80 species in the genus; only two species are found in the Sayap- Kinabalu area.

*Pneumatopteris truncata* (Poir.) Holttum

Reduced pinnae at base of frond all distinctly leafy, *ca.* 6- 10 pairs, normal pinnae thin, usually with some short hairs on lower surface of costae; pinnae-lobes truncate, always with distinct teeth at ends of veins. Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Sg. Lumutuk Besar Elev. *ca.* 970m. *Razali Jaman*, RJ 3968.

*Pneumatopteris* sp.

Rhizome creeping. Stipe green, abrupt reduced pinnae present on stipe, *ca.* 5 pairs. Frond simply pinnate. Pinnae *ca.* 24x3.5cm, truncate at base, acuminate at apex. Lobes truncate at apices, *ca.* 5mm incised; Sori inframedial on veins, indusium persistent.

Hill dipterocarp forest. Terrestrial in light shade.

MATERIAL: Kimantis trail: Elev *ca.* 860m. *Razali Jaman*, RJ 4038.

*Note:* Stipe produces young plantlets.

***Christella*** Leveille

*Caudex erect or short creeping; a few pairs of lower pinnae gradually decrescent, auricled on acroscopic, lowest small; pinnae always bearing acicular hairs and some elongate glandular or short capitate hairs; at least the basal pair of veins anastomosing; sori indusiate, sporangia lacking glands or hairs but elongate yellow or reddish unicellular glands present on stalk of sporangia; spores with thick tubercles or ridges.*

A genus of some 50 species; two species occur in the Sayap-Kinabalu area.

*Christella papilio* (Hope) Holttum

Rhizome erect; frond tufted; lower pinnae reduced *ca.* 8 pairs, broad, deeply lobed, distinctly auricled; hairs on lower surface of costa and costules all minute; sori medial, large and thin, with short hairs.

Hill dipterocarp forest. Terrestrial in light shade.

MATERIAL: Kimantis trail: Elev *ca.* 880m. *Razali Jaman & Dolois Sumbin*. RJ 4051.

*Christella subdentata* Holttum

Rhizome erect. Stipe brown, shiny.

Hill dipterocarp forest. Terrestrial in shade

MATERIAL: Minodtuhan trail: Elev. *ca.* 1030m. *Razali Jaman*. RJ 3956.

*Note:* This is another new record to Sabah. The specimen collected from the Sayap-Ktnabalu area was the second collection after the type specimen collected from Mindoro island, Philippines (Holttum. 198 1).

## ASPLENIACEAE

***Asplenium*** L.

Rhizome creeping or erect; bearing clathrate scales, small and dark; frond simple to tripinnate; stipe containing 2 vascular strands at base then uniting upward into X-shaped; veins usually free but in a few cases united forming a submarginal veins; sori elongate, along and on one sides of the veins, protected by linear indusium and attached along the veins and opening normally towards their midrib.

One of the largest fern genera consisting of some 650 species, 8 species occur in the Sayap-Kinabalu area.

*Asplenium affine* Swartz

Frond tripinnate, stipe dark brown, minutely scale: veins distinct prominent on both surfaces, mostly once forked; sori rather long, indusium brown, deflexed at maturity.

Hill dipterocarp forest. Epiphyte in light shade.

MATERIAL: Kimantis trail: Elev. ca. 860m *Razali Jaman*, RJ 4037.

*Asplenium caudatum* G. Forster

Rhizome short, creeping, bearing close group of stipe, apex clothed with long narrow dark brown scales; rachis deeply sulcate above, pinnae up to 30 pairs, narrower ca. 2cm, broad, the lowest slightly reduced; sori almost closed to midrib and parallel with it.

Hill dipterocarp forest. Epiphyte or lithophyte

MATERIAL: Minodtuhan trail: Elev. ca. 970m. *Razali Jaman*, RJ 3947.

Kimantis trail: Elev. ca. 860m. *Razali Jaman*, RJ 4040.

*Asplenium cheilosorum* Kze. in Mett.

Rhizome creeping; frond closed together; sori confined to the lobes; indusia coenosori, short; spore with broad, thin anastomosing wing, irregularly toothed, light brown

Hill dipterocarp forest. On rock in shade

MATERIAL: Minodtuhan valley: Sg. Minodtuhan: Elev. ca. 1040m. *Razali Jaman*, RJ 3980. Tepisung trail: Elev ca. 1040m. *Razali Jaman*, Observed

*Asplenium phyllitidis* DDDon subsp. *malesicum* Holttum

Frond up to 8cm wide; midrib prominent below; sori usually on one branch of each vein; broad indusia; spore bearing slender spines.

Hill dipterocarp forest. Epiphyte in shade.

MATERIAL: Minodtuhan trail: Elev ca. 1020m. *Razali Jaman*, RJ 3951.

*Asplenium tenerum* Forst

Rhizome erect, having a rosette of fronds and a large spongy mass of roots beneath; pinnae pinnate, toothed, acroscopic truncate and slightly auricled, basisopic narrowly cuneate; rachis winged throughout; spores pale, with thickened wing of width and anastomosing.

Lower montane forest. Epiphyte in shade.

MATERIAL: Minodtuhan valley-Tepisung trail: Elev. ca. 1080m. *Razali Jaman*, RJ 4004.

*Asplenium vittaeforme* Cav.

Rhizome creeping frond simple, linear lanceolate, entire, marginal cartilaginous, Coriaceous; veins immersed and distinguishable on upper surface.

Hill dipterocarp forest. On rock sometimes climbing on tree.

MATERIAL: Wariu trail: Elevatin ca. 860m *Razali Jaman*, RJ 40 15. Minodtuhan valley: Sg. Minodtuhan; Elev. ca. 1040m. *Razali Jaman*, RJ 3984.

*Asplenium* sp. 1.

Rhizome erect; scale dull brown, toothed; stipe dark brown, not polished; frond simply pinnate, pinnae up to 20cm long and 4.5cm wide, unequal at base with cuneate on acroscopic side and broad on basispic side, 5 pairs of pinnae, only 2 pairs stalked and the others adnate on basispic side, the terminal leaflet pinnae-like having bud on its apex, margin of pinnae serrate and undulated; most of veins are simple, a few with forking on the middle of the vein or near costa; sori elongate on acroscopic side of veins, indusium linear.

Hill dipterocarp forest. On rock in deep shade

MATERIAL: Wariu trail: Elev. ca. 870m. *Razali Jaman*, RJ 4022.

*Note:* Attempts to compare with the taxa as accounted by Copeland (1960), Holttum (1966) and Parrish et al. (1984) failed to identify to the species level

## WOODSIACEAE

*Diplazium* Swartz

Rhizome erect or short creeping, clothed with dark scales, partially clathrate; frond simple or pinnate to tripinnate-tripinnatifid, up to 100cm or more long stipe containing 2 vascular strands; veins free or rarely anastomosing; sori elongate along the acroscopic side of the veins; indusium linear.

About 400 species in the genus with 4 species and 2 varieties found in the Sayap area.

*Diplazium cordifolium* Blume

Two varieties of the species are found in Sayap-Kinabalu area.

*Diplazium cordifolium* var. *cordifolium*

Rhizome erect; frond simple, entire, broadly lanceolate to ovate - lanceolate with a cordate base, basal basispic lobed; veins forked, and anastomosing on medial of the frond to margin of lamina; sori elongate, indusiate linear on veins

Hill dipterocarp forest. Terrestrial in light shade.

MATERIAL: Sg. Lumutuk Besar trail: near main trail. Elev. ca. 960m. *Razali Jaman*, RJ 3934.

*Diplazium cordifolium* var. *pariens* (Copel.) C.Chr.

Differs from var. *cordifolium* in having rhizome sub-erect and frond simply pinnate.

Hill dipterocarp forest. Terrestrial in light shade.

MATERIAL: Sg Lumutuk Besar trail: Elev. ca. 960m. *Razali Jaman*, RJ 3936.

*Diplazium pallidum* (Bl.) T.Moore.

Rhizome sub-creeping. Frond simply pinnate; broader at base and narrower toward their apices, serrate; shortly stalk. Sori on acroscopic veins, elongate, coenosori.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Minodtuhan trail: Near trail, Elev. *ca.* 970m. *Razali Jaman*, RJ 3949 & RJ 4021.

*Diplazium latisquamulatum* Holttum

Rhizome sub-erect; apex of rhizome and base of stipe covered with rounded peltate scale, dark; frond bipinnate-tripinnatifid, lower surface light brown when dried, basal of pinnae reduced on acroscopic than basiscopic pinnae or pinnae lobed; veins pinnate 6-7 pairs, simple or once fork; sori confined to basal of veins on acroscopic veins, diplazoid sori.

Hill dipterocarp forest. Terrestrial in deep shade of the forest.

MATERIAL: Trail to Minodtuhan trail: Elev *ca.* 870m. *Razali Jaman*, RJ 3955a.

*Note:* Bud present on basal of pinnae.

*Diplazium porphyrachis* (Baker) Diels.

Rhizome suberect or erect stipe 4-8cm long, dark purple, densely covered with rather thick scales, narrow, dark, broad at base; frond simple, pinnatifid, lobes deeply incised *ca.* 6mm to costa, attenuate at both ends, basal frond reduced gradually to small auricle, lower surface brown when dried; veins simple; sori elongate on total length of acroscopic veins.

Lower Montane Forest. Terrestrial on steep ridge in light exposed area.

MATERIAL: Minodtuhan trail: Elev. *ca.* 1500m. *Razali Jaman*, Benedict Gangku & Patric Sungkit, RJ 4066

*Diplazium* sp.

Rhizome creeping. Frond simply pinnate. Pinnae very unequal at base. Basal pinnae cuneate on basiscopic, broad on acroscopic side. Bud present on basal of terminal pinnae. Sori elongate along the veins from costa to almost slightly crenate margin.

Hill dipterocarp forest. On rock crevices in shade.

MATERIAL: Minodtuhan trail: Elev. *ca.* 1030m. *Razali Jaman*, RJ 3955.

*Note:* Closely related to *D. pallidum* but differs in having rhizome creeping, pinnae very unequal at base, broader at the middle, basal acroscopic pinnae much broader than basiscopic pinnae slightly crenate margin and bud present on basal of terminal frond.

## DRYOPTERIDACEAE

*Ctenitis* (C.Chr) C.Chr.

Rhizome erect or shortly creeping covered with very narrow scales; frond bi-to tripinnate with multicellular hairs on upper surface of the rachis; veins free with basal basiscopic vein of each group arising from the costule; sori are medial; round with a thin fugacious indusium.

*Ctenitis aciculata* (Bak.) Ching

Caudex erect; stipe up to 60cm long, copiously covered with brown scales, 20x1mm, scales entire, narrow, with multicellular hairs present; longer at base of stipe than on the pinnae rachises; basiscopic pinnule longer than acroscopic one; sori on veins, having small indusium, probably lost when sori matured

Hill dipterocarp forest. Terrestrial on sheltered places.

MATERIAL: Wariu trail: Elev. ca 870m. *Razali Jaman*, RJ 4020 & RJ 4013.

*Ctenitis vilis* (Kunze) Ching

Caudex erect. up to 10 cm; stipe dark brown covered with brown - scales; frond tripinnatifid (dark brown when dried); multicellular hairs present on upper surface, costa and costule; sori indusiate, indusium having multicellular hairs.

Hill dipterocarp forest. On rock crevices or terrestrial in shade.

MATERIAL: Minodtuhan valley: On rock crevices; Elev ca. 1040m *Razali Jaman*, RJ 3982 Minodtuhan valley-Tepisung trail: Elev ca.1050-1060m. *Razali Jaman*, RJ 3986 & RJ 4001.

*Note:* New record for Ferns Flora of Mt. Kinabalu.

*Pleocnemia* C.Presl

Rhizome erect, densely clothed with thin, narrow dull brown scales, entire or with short teeth; frond bipinnate to bipinnate-tripinnatifid, basal pinnae greatly enlarged on basiscopic side, pinnae and pinnules deeply-lobed with a tooth in the sinuses between the lobes; veins anastomosing; glandular hairs on lower surface of costae and costules; sori round on veins, indusium reniform

A genus of about 20 species with two species found in the Sayap area.

*Pleocnemia leuzeana* (Gaud.) Presl.

Rhizome erect, stout; basal scales ca. 3cm long, 1.7mm wide. shiny dull brown scale; sinus-teeth broadly triangular on basiscopic side of the sinus; spores with many small obtuse protuberances all over them.

Hill dipterocarp forest. Terrestrial in light shade area.

MATERIAL: Sg Lumutuk Besar: Elev. ca. 970m. *Razali Jaman*, RJ 3970

*Pleocnemia olivacea* (Copel. ) Holttum

Rhizome stout. Frond ca. 1.5m height, sinus-teeth short and narrow in bases of sinuses; spores with a continuous-wing and some cross wing.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Kimantis trail: Elev. ca 850m *Razali Jaman*, RJ 4035

*Pteridrys* C.Chr. & Ching

Rhizome short, erect or suberect bearing firm, narrow, entire with cordate scales; multicellular hairs present within the scales; frond bipinnatifid. deeply lobed, lobes crenate or dentate; veins free, 1-2 forked; sinus-teeth present between lobes of pinnae; sori on the

acroscopic branch of each vein; indusia reniform. A genus of eight species; only one is found in the Sayap-Kinabalu area.

*Pteridrys microthecia* (Fee) C.Chr. & Ching

Rhizome suberect, green, basal basispic lobes of basal pinnae elongate, longer than those next to them, pinnae mostly shortly-stalked, pinnae lobes slightly toothed distally; basal acroscopic veins in larger pinnae twice forked; indusium reniform.

Hill dipterocarp forest. Terrestrial in light exposed.

MATERIAL: Wariu trail: Elev. ca. 870m. *Razali Jaman*, RJ 4021.

*Tectaria angulata* (Willd.) C.Chr.

Rhizome erect. Basal frond pinnate. Sori small, scattered and exindusiate.

Hill dipterocarp forest. Terrestrial in light shade.

MATERIAL: Kimantis trail: Elev. ca. 870m. *Razali Jaman & Dolois Sumbin*, RJ 4044.

*Tectaria crenata* Cav.

Rhizome erect Frond dimorphic, brown olivaceous when dried; basal pinnae distinctly stalked, apical lamina deeply lobed. Sori in two regular rows; indusia firm, large, slightly reniform.

Hill dipterocarp forest. Terrestrial in shade.

Material: Wariu trail: Elev. ca. 900m. *Razali Jaman*, RJ 4026.

*Tectaria decurrens* (Presl) Copel.

Rhizome suberect to erect. Frond simple and pinnatifid. Stipe winged to their bases. shortly stalk. Sori in 2 rows between costules; indusiate, large, reniform and persistent.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Sg Kimantis: By riverbank, Elev. ca. 870m. *Razali Jaman & Dolois Sumbin*, RJ 4046. Kimantis trail: Elev. ca. 900m. *Razali Jaman & Dolois Sumbin*, RJ 4054.

*Note:* In Sayap, *T.decurrens* has simple form of sterile and fertile fronds (RJ 4054) differing from the typical form which is the pinnatifid.

*Tectaria cf. stalactica* M.G. Price.

Caudex creeping; frond erect not pendulous; stipe atropureous and polished. Frond deltoid in outline; basispic large and broader than the others, small and broad lobed present on basispic side. Indusia large ca. 1 mm wide with few, short slender hairs.

Hill dipterocarp forest. On rock crevices in shade.

MATERIAL: Minodtuhan valley: Elev. ca. 1040m. *Razali Jaman*, RJ 3981.

*Note:* Differs from the typical *T. stalactica* in having toothed scale which are attached by a broad base; hairs present on the margin of frond only and sori on free veins.

*Tectaria vasta* (Hook.) Copel.

Rhizome erect: veins anastomosing. free veinlet present in coastal areoles; sori in two regular rows between veins, on terminal free veinlet; covered when young with indusium, reniform.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Tepising trail; Minodtuhan valley: Elev. ca. 1060m. *Razali Jaman*, RJ 3998.

*Note:* *T. vasta* in Sayap-Kinabalu area, having wings not continuous throughout the stipe.

### ***Heterogonium* C. Presl**

Rhizome short, erect bearing scales: frond pinnate with deeply-lobed pinnae basal pinnae widest in the middle of the basiscopic side; veins free or forming a series of costal and costular areoles; fertile frond much contracted than sterile frond; sori round with reniform indusium or exindusiate on veins.

The genus contains 22 known species and only two species are found in the Sayap-Kinabalu area.

*Heterogonium giganteum* (Bl.) Holttum.

Rhizome sub-erect; frond slightly dimorphous; fertile frond slightly reduced; sori round to less elongate; exindusiate

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL Wariu trail: Elev. ca. 870m. *Razali Jaman*, RJ 4023.

*Heterogonium aff. profereoides* (Christ) Copel.

Stipe: dark-brown, polished, covered with shiny-brown ovate-peltate scales, rigid and leaving some scars when fallen or removed. Frond dimorphic, sterile frond larger than fertile frond. Sterile pinnae measuring up to 21x6cm, slightly reduced at base, slightly falcate, shortly stalked, adnate from medial to apical lamina; pinnae-lobed more or less 2/3 toward costa, multicellular hairs present on margins and near sinuses. Fertile frond measuring up to 18x6cm, slightly contracted from those sterile. Veins anastomosing in sterile and fertile frond forming a costa areole and costular areoles. Sori elongate on veins exindusiate.

Hill dipterocarp forest. Terrestrial on riverbank in light shade.

MATERIAL: Minodtuhan valley: Near Sg Minodtuhan; Elev. Ca. 1040m. *Razali Jaman*, RJ 3985.

*Note:* Differs from the typical *H. profereoides* in having peltate scales, the largest fronds measuring 21x6.5cm and costae and costular areoles present on fertile fronds.

***Cyclopeltis* J.Smith**

Rhizome short, erect covered with narrow, entire scales (or with marginal teeth formed by outgrowths from single cells); frond simply pinnate; rachis rounded on both surfaces; frond sessile, articulate to the rachis, subentire, their bases cordate on basiscopic side, veins free, arising from the costae of pinnae; sori dorsal on lateral veinlet; indusia peltate.

About 7 species in the genus, only one species occurs in the Sayap Kinabalu area

***Cyclopeltis* cf. *mirabilis* Copel.**

Rhizome erect. short to 6cm; basal stipe dark, the rest of stipe light brown up to 20cm long, covered with entire acuminate scales, dark up to pinna-rachis Frond simply-pinnate. Basal of pinnae shortly stalked, sessile to adnate on apical lamina, apical lamina lobed; linear light- brown scales present on lower surface of margin, costa and costules. Costa grooved on upper surface and strongly raised on lower surface. Vein pinnate, 4-5 pairs, free, not reaching margins with a hydathodes on its apical. Sori on veins, each on 1 -3 pairs of veins, exindusiate.

Lower montane forest. Terrestrial in shade

MATERIAL: Minodtuhan valley: Elev. ca. 1060m. *Razali Jaman*, RJ 4000.

*Note:* Differs from the typical *C. Mirabilis* in having margin of scale not toothed, dark.

***Didymochlaena* Desv.*****Didymochlaena truncatula* (Sw.) J.Smith.**

Rhizome erect, massive; apex of rhizome and basal of stipe densely covered with shiny red-brown scales and also bearing with fine red- brown hairs. Frond bipinnate, pinnae articulate to the rachis; young frond purplish; veins free; sori terminal on acroscopic branch of each veinlet; indusium elongate.

Hill dipterocarp forest. Terrestrial in shade.

MATERIAL: Minodtuhan trail: Elev. ca. 1000m. *Razali Jaman*, RJ 3950.

***Polystichum* Roth.**

Rhizome erect with scales clustered along stipe; frond simply-pinnate to bipinnate, ovate-lanceolate (in Sayap) with ultimate margin of pinnae mucronate; veins free, several times alternately forked; sori medial on acroscopic veins; indusium orbicular, peltate base.

A genus with some 175 species; only one found in the Sayap-Kinabalu area.

***Polystichum obtusum* J.Smith**

Rhizome sub-erect; apex of rhizome and stipe densely clothed with broad lanceolate, shining brown scales; frond bipinnate. unequal at base; bud present on apical part of lamina; sori small on acroscopic veins, indusium small peltate base.

Hill dipterocarp forest. On boulders in exposed.

MATERIAL: Sg. Lumutuk Besar: Elev. ca. 970m *Razali Jaman*. RJ 3938.

## LOMARIOPSIDACEAE

***Bolbitis*** Schoot

Rhizome short creeping bearing sub-clathrate scales; frond simple or simply pinnate, dimorphic, margin entire or slightly lobed; main lateral veins distinct smaller veins forming costa areoles, without included free veins; fertile frond much reduced than sterile frond, fleshy, covering all over the lower surfaces.

A genus consisting of forty four species with two species occurring in the Sayap-Kinabalu area.

*Bolbitis appendiculata* (Willd.) Iwatsuki ssp. *appendiculata* Rhizome creeping; frond dimorphous, simply pinnate. with more or less lobed pinnae. sterile frond with asymmetrical bases. a slender tooth present in the sinus; veins free; fertile frond much smaller than sterile ones, acrostichoid; perispore reticulate.

Hill dipterocarp forest. On rock in deep shade.

MATERIAL: Wariu trail: Elev. ca. 870m. *Razali Jaman*. RJ 4016.

*Note:* A new record to Kinabalu Park.

*Bolbitis heteroclita* (C. Presl) Ching in C.Chr.

Rhizome creeping. Frond dimorphous, fertile pinnae acrostichoid.

Hill dipterocarp forest. On rock in exposed area.

MATERIAL: Kimantian trail: Elev. ca. 880m. *Razali Jaman & Dolonis* Sumbin, RJ 4052. Tepisung trail: Near Sg. Wariu; Elev. ca. 1060m. *Razali Jaman*, RJ 4002.

***Teratophyllum*** Mett. ex Kuhn

Rhizome scandent, dorsiventral. high climbing with widely spaced frond: frond pinnate to bipinnate; bathyphylls to pinnate, acrophylls simply pinnate, pinnae jointed to rachis with terminal pinna jointed to its base; veins all free; sori on linear fertile frond with covering the lower surface.

*Teratophyllum clemensiae* Holttum

Young bathyphylls simple to pinnate, broadly cordate at base.

Hill dipterocarp forest. Terrestrial in deeply shaded forest.

MATERIAL: Wariu trail; Elev. ca. 890m *Razali Jaman*, RJ 4073.

***Lomagramma*** J.Sm. ex Hook.

Rhizome high climbing, large, rooting on one side; frond dimorphic, fertile pinnae much contracted than sterile; veins anastomosing to form a few areolae without included veinlet; sori acrostichoid.

*Lomagramma brooksii* Copel.

Rhizome creeping and later climbing. Frond dimorphous. simply pinnate. Pinnae short stalk; basal pinnae slightly cordate.

Hill dipterocarp forest. Climbing on tree.

MATERIAL: Kimantis trail: Elev. ca 860m *Razali Jaman & Dolois Sumbin*, RJ 4042.

*Lomagramma sumatrana* vA.v.R.

Rhizome creeping and later climbing Frond dimorphous, simply pinnate, pinnae reduced gradually. Fertile frond much reduced; basal pinnae of fertile frond slightly cordate.

Hill dipterocarp forest. Climbing on rock.

MATERIAL: Kimantis trail: Elev. ca. 900m. *Razali Jaman*, RJ 4056

## DAVALLIACEAE

### *Davallia* Smith

Rhizome elongate, covered with peltate-based, elongate and squarrose, frond usually finely divided, coriaceous; veins free (false veins present in a few species); sori terminal on veinlet with indusium attached at sides and base.

A genus of about 50 species with one species found in the Sayap-Kinabalu area.

*Davallia trichomanoides* Blume.

Rhizome rather slender densely clothed with spreading bright red- brown scales, very short lateral hairs on the margin of the scales, rounded peltate base; frond quadripinnatifid; veins once or twice forked, without false vein; indusia longer than broad.

Hill dipterocarp forest Epiphyte on high canopy

MATERIAL: Kimantis trail: Elev ca. 850m. *Razali Jamar & Dolois Sumbin*, RJ 4059.

*Note:* Specimen collected from a fallen tree consisting of dried fertile fronds.

### *Davallodes* Copel.

Rhizome long creeping, densely covered with narrow and sharp pointed scales frond thin to coriaceous in texture, bipinnatifid and hairs present at least on veins and axes; sori small; indusia various forms.

Ten species in the genus with one species found in the Sayap-Kinabalu area.

*Davallodes burbidgei* C.Chr.

Lower pinnae much reduced than those in middle of frond; indusium longer than broad, cup-shaped, attached at side and base.

Hill dipterocarp forest. Climbing on tree stem in shade, common near stream.

MATERIAL: Sg. Lumutuk Besar: Elev. ca. 960 ca. *Razali Jaman*, RJ 3946.

Wariu trail: Elev. ca. 880m *Razali Jaman*, RJ 4034. Sg. Kimantis: Elev. ca. 870m. Observed.

***Araiostegia* Copel.**

Rock-loving fern with long creeping rhizome, densely covered with broad red brown peltate scale; stipe elongate, articulate to rhizome; frond finely dissected, thin, glabrous; sori round. terminal on very short branch of veins indusia attached by the base.

Only one species recorded from the Sayap area; the genus has about twelve species.

*Araiostegia hymenophylloides* (Blume) Copel.

Rhizome long creeping, huge Frond *ca.* 1m tall, quadripinnate with deeply incised ultimate pinnule, herbaceous, glabrous; sori terminal on short veinlet, round, small Hill dipterocarp forest. On boulders in exposed area.

MATERIAL: Sg. Lumutuk Besar: Elev, *ca.* 960m *Razali Jaman*, RJ 3969  
Minodtuhan valley: Elev *ca.* 1060m *Razali Jaman*, RJ 3992.

***Oleandra* Cav.**

Rhizome long and branching. creeping or erect with broad peltate scales and attenuate apices; frond simple, entire, coriaceous, frond jointed to phyllopodia. Uniform or rarely dimorphic; veins free and forked; sori dorsal on veins, in one row each side of the costa; indusium reniform to orbicular, attached at its sinus.

A genus *ca.* 40 species with one in the Sayap-Kinabalu area.

*Oleandra pistillaris* (Sw) C.Chr

Rhizome long scandent. Sori closed to costa; indusium reniform.

Lower montane forest Terrestrial in shade on ridge.

MATERIAL: Minodtuhan trail: Elcv *Ca.* 1500m. *Razali Jaman*, Benedict Gangku & *Patrick Sungkit*. RJ 4064.

## BLECHNACEAE

***Blechnum* L.**

Frond simply pinnate to bipinnatifid. sori continuously along. parallel and closed to the costa. indusium attached to the fertile vein and opening along the costa, persistent and firm

Only one species found in the Sayap-Kinabalu area.

*Blechnum orientale* L.

Frond uniform. pinnae up to 1.5cm wide. Lower ones truncate to broadly cuneate at base

Hill dipterocarp forest. Terrestrial on disturbed area in exposed.

MATERIAL: Road to Sayap Park's quarters: Elev *ca.* 860m. Observed.

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