CHAPTER 9
TAXONOMIC STUDY OF THE FERN GENUS DIPLAZIUM
IN WEST MALESIA

9.1. Introduction

The genus *Diplazium* was established by Swartz (1801) and typified by *Asplenium plantaginifolium* L (*Diplazium plantaginifolium* Sw.). Since then, a total of 1401 of binomials have been published by various authors for *Diplazium* in the world (IPNI, 2006). Hassler & Swale (2002) listed 474 species and 8 hybrids of *Diplazium* in the world.

Malesian region is the center of *Diplazium* diversity as it was predicted that 75% of species in world (ca.300 species) are existing in this region (Roos, 1995). However, since van Alderwereld van Rosenburgh (1908), there has not been a comprehenship study, including a revision, on Malesian *Diplazium*, yet. Previous workers only studied *Diplazium* based local area. Holttum (1940, 1966) in his revision on ferns of Malaya reported 27 species of Malay Peninsula. Tagawa (1972) listed 15 species of *Diplazium* from Borneo. Iwatsuki & Kato (1984) reported 15 species of diplazioid ferns of East Kalimantan. Tagawa (1972) listed 15 species of *Diplazium* from Borneo. Iwatsuki & Kato (1984) reported 15 species of diplazioid ferns of East Kalimantan. Parris *et al* (1992) listed 31 species from Mt. Kinabalu. Mitsuta (1985) listed 11 species from West Sumatra. In Java, Backer and Posthumus (1939) decribed 17 species. Sixty years after that Praptosuwiryo (1999) recognized 22 species and 4 varieties of Java. Kato (1994) reported 32 species of *Diplazium* from Ambon and Seram (Moluccas).

This chapter presented the account of West Malesian *Diplazium*. The aims of this study are: (1) to revise the genus *Diplazium* in West Malesia; (2) to provide the delimitation of the genus and species, and (3) to provide an identification keys to the species and infra species.

9.2. Materials and Methods

Morphological study on *Diplazium* covered West Malesian species have been conducted. This study is based mainly on available specimens housed at the BO and SING and new collection specimens obtained from field work study in
Java, Sumatra and Kalimantan from 1992 to 2006. The supplemented with images of type specimens from the data bases/websites of the National Herbarium of the Netherlands, University of Leiden Branch (L), the United States National Herbarium in the National Museum of Natural History at the Smithsonian Institution (US), and Herbarium Universitatis Mosquensis (MW) were also used.

The total number of 1051 collections have been examined. Living plants in the field were studied in Java, Sumatra and Borneo. In addition, the living plants grown in botanical gardens and cultivated plants in the green-houses of Bogor Botanic Gardens were also studied. Three species growing naturally in Bogor Botanic Gardens, viz. *D. esculentum*, *D. silvaticum*, and *D. subpolypodioides*, were also examined. The process of undertaking this study follow the steps those described by Davis & Heywood (1963), Rifai (1976), Vogel (1987) and Maxted (1992).

9.3. Taxonomic Treatment

*Diplazium*


Rhizome creeping to erect, scaly. Stipe well-developed, often stout, occasionally muricate or spiny, rarely persistently scaly, adaxially sulcate; scales orbicular to linear, margin entire or toothed; teeth composing two adjacent cells. Lamina simple to pinnately compound; rachis distinctly grooved, occasionally bearing adventitious buds; adaxial groove of rachis usually with flat bottom, glabrous; no spine-like appendages at bases of bases of costae or costules; costa and costules adaxially grooved. Ultimate divisions costate, costae anadromously pinnate, veins simple or forked, free or anastomosing, without free included veinlets. Sori elongate along one or both sides of veins; indusium lateral; double
sori with two quite separate indusia. Spores monolete, bilaterally symmetrical, plano-convex or concave-convex, usually prominent, wing-like folds, often with echinate border, sometimes cristate or echinate, occasionally rugulate.

CHROMOSOME NUMBERS. X=41.

TYPE SPECIES. Diplazium plantaginifolium (L.) Urban.

DISTRIBUTION. Tropical of both hemispheres. Throughout Malesia.

ECOLOGY. Terrestrially, usually on moist humus-rich soil of mountain slopes of primary and secondary forest of shadowed places. Only a few species found in the opened areas and grow on the riparian and rheophytic habitats. Elevation: 20-3400 m.

NOTES. (1) Doubtful Species. Seven species of Diplazium published in some literatures that I doubt and could not found its specimens as follows: Diplazium allantoideum M.G. Price, D. curtisii Holttum, D. heterophlebium (Mett.) Diels, D. mesocarpum Alderw., D. falcinellum C.Chr. in C. Chr. & Holttum, D. megistophyllum (Copel.) Tagawa, D. tabacinum Copel.

(2) Excluded Species. There some species of West Malesian Diplazium that excluded from Diplazium and then have been included in the other genera, namely D. chrysocarpum Alderw., D. grammoides Presl, D. japonicum Bedd., D. subsinuatum (Wall. ex Hook ) et Grev.) Tagawa and D. amplissimum. D. chrysocarpum Alderw was included as Athyrium stramineum (Copel.). D. grammoides Presl, D. japonicum Bedd., D. subsinuatum (Wall. ex Hook ) et Grev.) Tagawa were included in Deparia and treated as Deparia confluens (Kunze) M. Kato, De japonica (Thunb.) M. Kato (Kato 1984), and De lancea (Thunb.) Fraser-Jenk (1997), respectively. While was D. amplissimum included in Cornopteris as C. atroviridis (v.A.v.R.) M. Kato (Kato 1979).

(3) Now, West Malesian Diplazium is reported comprising 69 species with 15 varities. Thirteen new species and two new varieties are described. The thirteen new species described in this chapter are: D. asymmetricum, D. batuayauense, D. crameri, D. densisquamatum, D. halimunense, D. loerzingii, D. megasegmentum, D. megasimplicifolium, D. meijerii, D. parallelivenium, D. profluens, D. subalternisegmentum, and D. subvirescens. While the two new varieties described are: D. accedens var. spinosum and D. silvaticum var. pinnae-
ellipticum. Two new status of Diplazium are proposed: D. pallidum var. montanum and D. accedens var. ridleyi.

Key to Species of Diplazium in Western Malesia

1. Veins free
2. Lamina simple
   3. Rhizome creeping; scales lanceolate, margin entire ………………… D. subsinuatum
   3. Rhizome erect or suberect; scales oblong subtriangular, margin shortly toothed. ……………………………………… D. subserratum

2. Lamina simply or compoundly pinnate
3. Lamina simply pinnate to bipinnatifid
   4. Terminal pinnae conform to lateral pinnae or deltoid with deeply lobed
      5. Scales margin toothed
         6. Rhizome short, erect; lateral pinnae commonly 3-18 pairs; terminal pinna larger or deltoid with deeply lobe at base
            7. Lateral pinnae commonly 3-5 pairs, 4 cm or more wide; texture chartaceous or thinly papyraceous
               8. Rachise non gemmiferae; base of lateral pinnae cuneate ………………… D. halimunense
               8. Rachise gemmiferae; base of lateral pinnae rounded ……………………… D. bantamense
            7. Lateral pinnae commonly 7-18 pairs, 3 cm or less wide; texture thinly coriaceous ………………… D. lobbianum
               6. Rhizome medium, creeping; lateral pinnae commonly to 3 pairs; terminal pinna conform to lateral ones … D. donianum
      5. Scales margin entire
         6. Rheophytic or riparian; scales on stipe black; lateral pinnae to 4 pairs
            7. Rheophytic; Stipe more than 20 cm long; lateral pinnae shortly stalked 4.5 mm long, lanceolate, more than 12 cm long, 2 cm broad ……… D. aequibasale
            7. Riparian; Stipe less than 20 cm long; lateral pinnae adnate, lineary oblong, usually less than 8 cm long, 1.5 cm broad … D. wahauense
6. Terrestrial; scales on stipe pale to dark brown; lateral pinnae 5 or more pairs

7. Scales pale or light brown to brown;
   8. Lateral pinnae ovate-lanceolate, larger ones to 3 wide
   9. Scales brown; pinnae to 5 pairs; veins group forming angle 50-60° to costa ……………. \( D. \) crameri
   9. Scales light brown; pinnae to 20 more pairs; veins group forming angle ca. 45° to costa …………\( D. \) hottae

6. Lower lamina fully pinnate to 2/3 part; free pinnae to 32 or more pairs; veins forked to 3 times …………………………\( D. \) fuliginosum

6. Lower lamina deeply pinnatifid to 5/6; sometimes with one pair of reduced free basal pinnae; veins mostly once forked

7. Lamina elliptic; lobes to 10 mm broad, oblong-lanceolate, narrowing towards apex, subentire ………. \( D. \) lomariaceum

7. Lamina lanceolate; lobes to 15 mm broad, liniery oblong, slightly crenate, or toothed and not seldom the sides entire only the apex serrate ……………. \( D. \) porphyrorachis
5. Scales usually abundant on lower stipe only; lamina oblong subtriangular – oblong lanceolate, to 30 cm broad

6. Scales entire

7. Lamina to about 15 cm wide, subtriangular, costae hairy beneath .......................... \textit{D. tomentosum}

7. Lamina usually wider, oblong-lanceolate, costae not hairy beneath

8. Margin of pinnae shortly toothed or almost entire; veins forked once to twice, usually soriferous on basal acroscopic side .......................... \textit{D. pallidum}

8. Margin of pinnae deeply lobed; veins pinnate in the lobes; usually soriferous on all veinlets

9. Rachise fibrillose; margin of pinnae lobed \(\frac{3}{4} - \frac{11}{12}\) way to costa .......................... \textit{D. sorzogonense}

9. Rachise glabrous; margin of pinnae lobed 1/3-2/3 way to costa

10. Scales light brown without thickening blackish strand margin; lower base of lower pinnae not cut away; sori cover veinlets to 2/3 of their length ........ \textit{D. christii}

10. Scales dark brown with thickening blackish strands margin; lower base of lower pinnae often much cut away; sori cover veinlets to 3/4 of their length or almost reaching margin

11. Rachise not gemmiferous; lobus rounded; texture papyraceous; sori elongate from near base of veins to near margin of lobus; indusia medium brown, concolour .......................... \textit{D. malaccense}

11. Rachise gemmiferous; lobus truncate; texture subcoriaceous; sori medial or close to margin; indusia dark brown, attachment side darker ........ \textit{D. loerzingii}

6. Scales toothed

7. Stipe, rachis and costa tomentose .......................... \textit{D. tomentosum}
7. Stipe, rachis and costa not tomentose

8. Lateral pinnae to 4 cm or more broad, margin lobed to 5/6 way to costa  
   ...........................................  D. speciosum

8. Lateral pinnae less than 4 cm broad, margin lobed to ¾ way to costa

9. Pinnae lobed ¼ - ½ towards costa

10. Scales dark brown or nearly black, without thickening black strand; sori subcostular, touching midveins or nearly so at proximal end

11. Pinnae chartaceous, often auriculate below; scales irregularly and shortly toothed  
    ...........  D. crenatoserratum

11. Pinnae thin in texture, not auriculate below; scales strongly toothed  
    ...........  D. silvaticum

10. Scales brown, with thickening dark brown strand; sori medial or supramedial (not touching midveins)  
    ...........  D. batuayauense

9. Pinnae lobed ¾ way towards costa

10. Pinnae lanceolate, texture herbaceous; Veins forming an angle about 60º to costa  
    ...........  D. petiolare

10. Pinnae lineary subtriangular, texture thicker; Veins forming an angle 50-55º to costa  
    ....  D. acuminatum

3. Lamina bipinnate to tripinnate

4. Rhizome erect

5. Lamina bipinnate

6. Scales rounded

7. Pinnulae lobed more than ¾ way to costa

8. Costae bearing scattered small ovate-rounded scales; pinnulae subtriangular, lower stalked to 1 mm long, apex of lobus truncate; sori usually diplazioid on basal acroscopic veinlets only  
   ............  D. latisquamatum

8. Costae glabrous; pinnulae lanceolate, lower stalked to 2.5 mm long, apex of lobus rounded-acute; sori diplazioid both on basal and median acroscopic veinlets  
   ...............  D. profluens
7. Pinnulae lobed ⅔ way or less to costa

8. Stipes prickly
   9. Stipe muricate, dark brown when dry; lower pinnulae shortly stalked to 1.5 mm long, margin lobed to 1/2 way to costa  …………………  D. betimusense
   9. Stipe spiny, rather stramineous when dry; lower pinnulae adnate, margin lobed less than ⅔ way to costa or almost entire  ………………….  D. spiniferum

8. Stipes not prickly
   9. Lower pinnulae stalked to 2 mm long; Sori on medial on veins  …………………………… D. kunstleri
   9. Lower pinnulae stalked less than 1 mm long or almost adnate; Sori on basal veins  …………………  D. laevipes

6. Scales ovate-liniery lanceolate

7. Scales toothed

8. Pinnulae lobed 1/3 way or less to costa or almost entire

9. Stipes scales throughout
   10. Pinnulae lobed less than 1/4 way to costa (crenulate); veinlets to 9 pairs  ………………….  D. barbatum
   10. Pinnulae lobed to 1/3 way to costa; veinlets to 6 pairs

   11. Pinnulae to 20 pairs, less than 12 mm broad; veins forked 1-3 time  ………………….  D. melanolepis
   11. Pinnulae to 12 pairs, 15 mm or more broad; veins pinnate to 6 pairs of veinlets

   12. Pinnulae elliptical, less than 5 cm long, 2 cm broad; apex of vein whitish-limy (dot like)  ………………….  D. albido-squamatum
   12. Pinnulae oblong, to 6 cm long, 1.5 cm broad, base broadly cuneate; apex of vein not whitish-limy  ………………….  D. crinitum

9. Stipes scales at base only

10. Stipe spiny; pinnulae to 12 pairs, lower stalked to 3 mm long; veins to 8 pairs, once forked on lower lobes  ………………….  D. vestitum

10. Stipe not spiny; pinnulae to 16 pairs, lower stalked to 1.5 mm long; veins to 5 pairs, commonly 4 pairs, all simple  ……  D. simplicivenium
8. Pinnulae lobed ½ or more to costa

9. Lamina less than 100 cm long; scales light brown, without thickening black strand; texture herbaceous … D. umbrosum

9. Lamina more than 150 cm long; scales dark brown, teeth mostly forked, with thickening black strand; texture papyraceous

10. Stipe prickly; lobes oblong to subquadangular; sori less than 2.5 mm long ………. D. polypodioides

10. Stipe not prickly; lobes subdeltoid to semiobicular; sori more than 3 mm long ………. D. dilatatum

7. Scales entire

8. Stipes not nor muricate at base

9. Stipe and rachise not clothed with scattered multicellular brown hairs;
   Sori on medial veins, impressed ……………. D. poience

9. Stipe and rachise clothed with scattered muslicellular hairs;
   Sori on basal veins, not impressed …………. D. velutinum

8. Stipes muricate at base

9. Stipes densely scales throughout; free pinnulae to 18 pairs …………. …………. D. densisquamatum

9. Stipes densely scales only at base; free pinnulae to 13 pairs

10. Lower pinnulae shortly stalked to 1.5 mm long, lanceolate, more than 6 cm long, lobed to 4/5 way to costa …………. …………. D. atrosquamosum

10. Lower pinnulae adnate – sessile, nearly hastate, less than 5 cm long, crenate ….. …………. D. hewittii

5. Lamina tripinnatifid – tripinnate

6. Pinnulae lobed less than ¾ way to costa

7. Pinnulae to 16 pairs; larger pinnule stalked to 5 mm long, oblong subtriangular, to 18 cm long, 4 cm broad, apex attenuate, margin lobed ½ way to costa ………. D. dilatatum

7. Pinnulae to 20 pairs; larger pinnule adnate, oblong-lanceolate, to 5.5 cm long, 1 cm broad, commonly less than 4 cm long, 8 mm broad, apex rounded-acute, margin lobed to 1/3 way to costa ………. D. melanolepis
6. Pinnulae lobed ¾ way or more to costa

7. Pinnulae lobed to within one mm or less of costule, forming segments

8. Lower costule of larger pinnulae winged; free segment not present

9. Scales lineary triangular-lanceolate; Indusia opening when sori mature .......................... *D. subpolypodioides*

9. Scales rounded; Indusia opening before sori mature .......................... *D. megasegmentum*

8. Lower costule of larger pinnulae not winged; free segments present

9. Pinnulae 17 pairs or more; larger pinnulae oblong-subtriangular; sori brown when dry

10. Segments crenate or lobed 1/3 way to costule; sori bearing near basal or on middle veinlets cover ½ of their length; indusia pale brown, attachments side more dark, margin entire  .................. *D. umbrosum*

10. Segments crenulate, apex rounded; sori bearing on basal costule cover veinlets 1/3 of their length; indusia brown, concolour, margin fringed  .................. *D. moultionii*

9. Pinnulae less than 16 pairs; larger pinnulae subtriangular lanceolate; sori nearly golden yellow when dry  .................. *D. chrysocarpum*

7. Pinnulae lobed to within more than 2 mm of costa, not forming segments

8. Scales narrowly linier, margin toothed with thickening black strands; Stipes densely scaly near base, surface prickly; Sori occupying from the base half-way or more to the edge  .................. *D. polypodioides*

8. Scales rounded, margin entire; Stipes scales throughout, surface not prickly; Sori occupying only the lower half or less of the veins  .................. *D. latisquamatum*

4. Rhizome creeping

5. Margin of pinnae lobed to ⅔ towards costa; Sori elongated from basal veinlets .......................... *D. procumbens*

5. Margin of pinnae lobed to 2/3 towards costa; Sori elongated on medial or submedial veinlets .......................... *D. subvirescens*
1. Veins occasionally uniting at margin or copiously anastomosing

2. Veins rarely anastomosing, occasionally uniting at margin

3. Lateral pinnae 6-9 pairs, elliptical; veins occasionally anastomosing; gemmae present at the junction between rachise and costa ….. D. xiphophyllum

3. Lateral pinnae 2-4 pairs, oblong; veins free or very rarely anastomosing; gemmae absent ........................................ D. riparium

2. Veins copiously anastomosing

3. Lamina simply or simply pinnate

4. Lamina simply

5. Lamina subdeltoid, base cordate, veins anastomosing 1/3-1/2 ………………… D. cordifolium

5. Lamina elliptical, base subequally cuneate, veins anastomosing 2/3-4/5 way of margin …... D. megalocarpum

4. Lamina simply pinnate

5. Scales dense on stipe, rachise & costa; lower surface of lamina bearing stelate trichome scatterly ………………… D. squarrasum

5. Scales dense on base of stipes only; lower surface occasionally bearing uniseriat trichome with glandular cells

6. Terminal pinnae differ to lateral ones, deltoid ……. D. accedens

6. Terminal pinnae conform to lateral ones

7. Scales on stipes dark brown nearly black, lateral pinnae oblong, base cuneate; veins anastomosing 1/3 way of margin ………… D. angustipinna

7. Scales on stipes light brown, lateral pinnae lanceolate, lower base rounded to auricled; veins anastomosing 1/4 way of margin ………………… D. cumingii

3. Lamina bipinnate

4. Scales dull brown; stipe spiny toward the base; Pinnuleae fully adnate, texture firmly herbaceous; vein anastomosing like D. accedens ……… D. insigne

4. Scales dark brown; stipe smooth; Pinnuleae shortly stalked, texture papyraceous; Vein in pinnate group in the lobes, 8-10 pairs of side veins, the lower 2-3 pairs of adjacent group anastomosing, forming irregular intermediate excurrent vein leading towards a sinus between adjacent lobes ……………………………… D. esculentum
1. Diplazium accedens Blume


*Asplenium proliferum* Lam. in Lam. & Poir, Encycl. 2: 307. 1786


**Key to the Variety**

Rhizome bearing buds. Stipe protuberances, vascular bundles of its transversal sections near blade continuously U shaped. Rachise not spiny, always gemmiferous.

Stipe sparsely protuberances; protuberance light green. Veinlets pale green when living; extra areola between adjacent normal group of veins few, the line of series extra areola up to 1/3 way to costa ................................................................. var. *accedens*.

Stipe densely protuberances; protuberance deep green. Veinlets light green when living; extra areola between adjacent normal group of veins copious, the line of series extra areola up to 5/6 way to costa ........................................................................ var. *ridleyi*.

Rhizome not bearing buds. Stipe sharply spinuous, vascular bundles of its tranversal sections near blade interrupted U shaped. Rachise bluntly spiny, not gemmiferous .......... var. *spinosum*.

**a. var. accedens**

Rhizome stout, short, erect, bearing buds. Stipe stout, green, clothed with green protuberances toward base, up to 80 cm long, 1-1.2 cm thick, scales at base; scales linier, 10-13 mm long, 1.2-1.5 mm wide, dull brown, thick in texture with narrow black strand toothed at margin. Lamina simply pinnate, oblong with
acuminate apex in outline, to 110 cm long or more, 40 cm wide, pinnae to 18 pairs; lower pinnae stalked to 7 mm long, sessile in upper ones, basal pinnae or subbasal pinnae the largest, about 30 cm long, 7 cm wide, oblong with acuminate apex, base broadly cuneate to subtruncate, margin entire or undulate, or double crenate; terminal deltoid with 1 or 2 deeply lobed at base; papyraceous, glabrous above; rachis grooved above, gemmiferous; costa prominent below, grooved above with distinct ridge; veins pinnate, veinlets 8-10 pairs, veinlets adjacent groups anastomosing producing a series of parallelogram-shape areolus. Sori elongate along veinlets, often throughout their length forming areoles; indusia very thin, fragile, margin entire.

SPORES. Monolete, bilaterally symmetrical, heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view concave-convex to plano-convex; equatorial transverse view, proximal face planar to concave, distal face hemispherical; perinate. E: 25.34(31.47)36.02±2.54; P: 15.32(19.51)23.59±2.82. Laesure: concealed by perine ridge. Perine: costate-ate, reticulation often incomplete; lacunae shallow, project 10-17 μm; wing-like muri or costae project c.0.5-6 μm, terminating margins entire. Exine: often visible through perine, smooth under LM, smooth under SEM.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped with an angle about 90°, the outward of the lower base, angle, and end ridge. Stomata: polycytic and copolyctic.

CHROMOSOMES. 2n = 82 (Cytotype: TNgP1447, BOHB).

DISTRIBUTION. Peninsular Thailand, Malesia, Pacific.

ECOLOGY. Terrestrial, spread throughout Western Part Malesia Region at 400 – 1550 m sea level in moist soil, by preferences more or less shadowed localities, in primary forest, secondary forest in ravine, forest borders, and meadows.

VERNACULAR NAMES. Paku buwah, paku careham (Sundanese), pakis angkrik (Javanese).

USE. The young fronds and bulbis in the axils of leaflets are eaten after cooking.
SPECIMENS EXAMINED. --- JAVA: Arsin s.n.; Backer s.n., 6307, 10891, 16200, 23754; Backer & Posthumus 201; Bakhuizen v/d Brink 2393; Beguin 83; Brinkman 445; Burk s.n.; Coert 910; Danser 6783; Hallier 201; Heurn 201, 202, 203; Kooders 373*, 8778, 10891, 21179B, 23356B, 23725B, 41459B, 41508B; Lörzing 933, 1745; Meijer 31, 172; Pleyte 162; Raciborski 109; Sciffner s.n.; Winckel 1279B, 1419B; Zippelius s.n. --- MALAY PENINSULA: Md Nur 32894, s.n. (28-8-1923); M.R. Henderson s.n. (28-8-1923); Br. G. Allan 3477, s.n. (30-6-1957); Wale 9111. --- SUMATRA: J.A. Lörzing 5577, 12808, 5562; Bünnemeyer 4316; D. Darnaedi 107; J.A. Lörzing 5562; C.G.G.J. van Steenis 4370; J.A. Lörzing 12809, 7001; Dr. Cramer no. 25; J.A. Lörzing 4226; Karta 21; Jacobson 1451, 2498; K. Iwatsuki, Gen Murata, J. Dransfield & D. Saerudin S- 1542; Bünnemeyer 4314a; M. Hotta 26131; W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes 12583; H. Surbeck 81; Dr. O. Posthumus 1105. --- BALI: O. Posthumus 3722; C.G.G.J. van Steenis 8017; W. Meijer 10546; W. Meijer 10453.

b. var. spinosum Praptosuwiryo, var. nov.

TYPE: Tahrodin TR53 (holotype, BOHB), East Kalimantan

Stipe sharply spiny, pale green on upper surface when living, black on lower surface. Pinnae up to 7 pairs; lower pinnae stalked to 3 mm long, basal pinnae reduce to 6 cm long, 2.3 cm broad, margin undulate; rachise not gemmiferous.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form interrupted U-shaped with an angle about 90°, angle and end bluntly ridge.

CHROMOSOMES. 2n = 82 (Cytotype: TR 53, BOHB)

c. var. ridleyi (Copel.) Praptosuwiryo, stat. nov.


Stipe deep green when living, bearing densely deep green protuberances, minutely pilosa. Lateral pinnae up to 7 pairs; larger ones up to 10.8 cm broad, apex caudate, margin entire or crenate. Veinlets very distinct, light green. Extra areola between adjacent normal group of veins copious, the line of series extra areola up to 5/6 way to costa.

**DISTRIBUTION.** Malay Peninsula, Sumatra.

**SPECIMENS EXAMINED:** --- MALAY PENINSULA: Ridley 13970. --- SUMATRA: T.Ng. Praptosuwiryo 2525a.

2. _Diplazium acuminatum_ Blume


Rhizome short, erect-suberect. Stipe 34-36 cm long, 2 mm thick when dry, brown, black and scales at base, glabrous upward; scales lineary triangular, 5-10 mm long, 0.5-mm broad, dark brown, margin sharply toothed. Lamina pinnate, subtriangular- lanceolate in outline, 45-50 cm long, 15-23 cm broad, free pinnae 15-21 pairs below deeply lobed acuminate apex of lamina; lower pinnae shortly stalked to 6 mm long, upper ones adnate–sessile, linear subtriangular, larger pinnae 12-12.5 cm long, 2-2.2 cm broad, base unequal, lower base cuneate, upper truncate, apex acuminate, margin lobed ½-3/4 way to costa; lobe oblong, basal acrosopic the largest, 3.5-5.5 mm wide, ends truncate, entire or slightly toothed; texture firm; rachis gemmiferous on upper part; veins free, forming angle about 50-55° to costa, pinnae in the lobes, veinlets 5-7 pairs, all simple, forming angle about 15-20° to main veins. Sori elongate from near costule covers 1/3-2/3 way of their length or almost reaching the margin, basal acrosopic diplazioid; indusia brown, rolled back, margin entire, firm.

**DISTRIBUTION.** Sumatra.

**ECOLOGY.** In the mountain forest at 400-1000 m dpl.

NOTES. Kato (1994) states that this species is similar and perhaps related to *D. megaphyllum* (Baker) Chist from E. Myamma, SW China, Taiwan, Vietnam and Thailand, in general habit and leaf morphology, but from it in the regularly anastomosing veins. *D. megaphyllum* generally has free veins.

3. **Diplazium aequibasale** (Baker) C.Chr.


Rhizome short, erect. Stipe 21-28 cm long, pale brown when dry, black and scales at base; scales ovate-lanceolate, 3-5 mm long, 1-1.5 mm broad, fragile, margin entire. Lamina simply pinnate, lateral pinnae 3-4 pairs, terminal pinnae like the laterals, the largest; lower pinnae shortly stalked to 3-4.5 mm long, upper adnate, lanceolate, to 14 cm long, 2.5 cm broad, base cuneate, margin entire or crenate near apex, suddenly narrowed near apex, acuminate; texture rather thin, surface naked; costa rounded beneath, grooved on upper surface; veins group forming angle about $65-70^\circ$ to costa, each group of 3 veins, middle vein forked 1-3 times, occasionally the outer of vein group uniting with the inner close to the margin. Sori bearing at 1-3 veins in each vein group, those on the outer vein of the group extending from the costa to margin, rest shorter, acroscopic outer veins usually diplazioid; indusia brown, narrow, margin entire, persistent, fragile, opening when mature.

CHROMOSOMES. $2n = 164$ (Cytotype: T.Ng. Praptosuwiryo 2026, BO)

DISTRIBUTION. Java, Sumatra, Malay Peninsula, Borneo.

ECOLOGY. It is rheophytic species and usually grown at lowland clay stream-bank. 20-400 m.

4. Diplazium albido-squamatum Alderw.

_Diplazium albido-squamatum_ Alderw., Bull. Buiten. II no. 23. 9. 1916. --

_TYPE_: C.J. Brook 272/S. (holotype, BO!), Soelit, Lebong, Bengkulu, Sumatra; C.J. Brook s.n. (isotype, L!), Lebong Tandai, Bengkulu, Sumatra.

Stipes 38 cm long, 6 mm thick, grooved above, dark brown-blackish, scales throughout; scales linearly lanceolate or subulate, to 1 cm long, 1 mm wide, dark brown, margin toothed with thickening black strand. Lamina bipinnate, ca. 70 cm long, (?) cm broad, lanceolate in outline, pinnated pinnae 5 pairs below ca. 5 pairs of pinnatifid pinnae, apical lamina (?); lower pinnae stalked, stalked to 17 mm long, 8-10 cm apart, ovate-lanceolate, 15-24.5 cm long, 8.5-9 cm broad, pinnulae 5-8 pairs; lower pinnulae shortly stalked to 1 mm long or adnate, 2.5-3 apart, upper pinnulae sessile with subequally broadly cuneate; larger pinnulae oblong-elliptical, 4.8 cm long, 1.9 cm broad, base subequally subtruncates, apex acute, margin lobed ¼-1/3 way to costule; lobus 4-6.5 mm wide, ends rounded-subtruncate; texture subherbaceous, upper surface glabrous, to apex vein whitish-limy, dot-like; rachise obscurely dark brown, minutely scales, at length base persistent scales fallen away rugged; veins free, pinnate, mid-veins forming angle ca. 60° to costule; veinlets 4-6 pairs, length base persistent scales fallen away rugged all simple, forming angle about 20-25° to costule. Sori elongate along veinlets, cover ½-2/3 of its length, acroscopic basal diplazioid, others asplenoid; adusia dark brown, stiff, margin entire, opening when mature.

DISTRIBUTION. Sumatra.

ECOLOGY. Grown in limestone.

SPECIMENS EXAMINED. --- SUMATRA: C.J. Brooks 272/S.

NOTES. young plants simply pinnate, with the fronds similars to the largest pinnae of the adult ones but less copiously soriferous.
5. Diplazium angustipinna (Holttum) Holttum


Rhizome short, erect. Stipe to 36 cm long, 3 mm thick, scales at base; scales narrow, to 8 mm long, 1 mm broad, medium margin entire, some larger ones with black firm edges. Lamina simply pinnate, fertile ones to 41 cm long, lateral pinnae 4-6 pairs below a terminal leaflet of similar shape; largest fertile pinnae on different fronds 10-18 cm long, 1.6-2.8 cm broad, widest 1/3 from the base, tapered evenly to the narrow apex and to the base which is truncate on a stalk 1 mm. long, margin slightly and irregularly sinuous; frond and rachis glabrous except for very short hairs in groove of upper surface of rachis and small scales on bases of costae; rachis not proliferous; veins anastomosing freely in outer 1/3 of each half of the lamina, forking 2 or 3 times before anastomosing. Sori long, diplazioid on acroscopic branch of each first forking, reaching from costa 2/3 towards the margin, also 1-3 short sori on distal anastomosing vein-branches; indusia narrow, firm, persistent, margin entire.

**ANATOMY.** Transverse section of stipe near lamina: Vascular bundle form uninterrupted V-shaped, with an angle 70°, ends simple, not forming a ridge.

**CHROMOSOMES.** 2n = 123 (Cytotype: T.Ng. Praptosuwiryo 1904, BO), 164 (T.Ng. Praptosuwiryo 1905b, BO).

**DISTRIBUTION** --- Malay Peninsula, Borneo.

**ECOLOGY** --- Terrestrially on humus rich soil or rock soil in dense jungle. 400-900 m.

**SPECIMENS EXAMINED** --- BORNEO: T.Ng. Praptosuwiryo 1904, 1905b. --- MALAY PENINSULA: R.E. Holttum SFN 3946; King’s 8026.
6. Diplazium asymmetricum Praptosuwiryo, sp. nov. Plate 1.


Rhizoma breve erectum. Stipites ad 40 cm longi, basi squamis subulatis vel oblongis ovatis ad 4.5 mm longis 1.5 mm latis margine dentatis vestitae. Lamina deltoideus, 46-50 longae, 46-50 latae, bipinnata-tripinnatifida, pinnate pinnae 3-4 jugatae infra pinnatifis pinnae, apice deltodeus peniti-lobus. Pinnae infimus maximeae, stipitatae ad 4 cm longae, ubtriangulare, libere pinnulae 6-10-jugatae infra apice deltoideus pinnatifidus; pinnulae infimus basiscopicus maximeae, stipitae ad 1.5 mm longae, subtrianglare, asymmetricus, base subcordatus vel truncates, apice acuminate, cetera margine lobatae ad 4/5 costam versus; lobi angulum plus minusve 90° cm costa formantes, ad 8 mm latis supra basi, margine leviter denticulatus, apice subtruncatus vel obliquely subrotundatus. Vennae in uno lobo ad 6-jugatae, plerumque furcatae. Sori basaliter, aliquando medianus, in 1/3-1/2 longitudine venularum sedentes, in basi venulae acroscopicus diplazioides. Indusia badius, fragilis, maturis aperiens.

Rhizome short, erect. Stipe pale green when living, scales at black base, glabrous upwards, 30-101 cm long, 5-8 mm diam. near base; scales dark brown, subulate-oblong ovate, to 4.5 mm long, 1.5 mm wide, margin toothed. Lamina bipinnate-tripinnate, deltoid in outline, 46-50 cm long, 46-50 cm broad, pinnate pinnae 3-4 pairs below pinnatifid pinnae, apex deltoid with deeply lobed. Basal pinnae the largest, stalked to 7 cm long, subtriangular in outline, pinnule 6-10 pairs below acuminate deeply lobed deltoid apex of pinnae, basiscopic pinnules the larger than acroscopic ones; pinnulae shortly stalked to 4 mm long, subtriangular, asymetrical, base subcordate-truncate, apex sharply toothed attenuate or caudate, margin lobed 4/5-7/8 way to costule (on bipinnate lamina), or forming segments (on tripinnate lamina); basiscopic segments larger than acroscopic ones, to 4 cm long, 1.8 cm broad, base truncate or broadly cuneate, apex acute, margin lobed to 1/3 way to costulet; lobus almost at right angle, to 4 mm broad (on tripinnate lamina) or to 8 mm broad above base (on bipinnate leaves), margin slightly toothed, ends subtruncate-obliquely subrounded. Veins pinnate in the lobes, veinlets to 6 pairs, usually once forked. Sori from near
costule, sometimes medial, cover 1/3-1/2 of veinlets, diplaziod on basal acroscopic veinlets. Indusia pale brown, fragile, margin entire, opening when maturity, rolled back.

PARATYPE. JAVA. West Java: Mt.Gede, Cibodas Forest, behind Cibodas Botanic Gardens, ca. 1450 m, 19 August 2002, T.Ng. Praptosuwiryo 1334 (BO); Mt. Salak, Southern Slope, Cangkuang Forest, 18 December 2002, T.Ng. Praptosuwiryo1365 (BOHB ); Mt. Halimun, Track Cikaniki-Cikuda Paeh, ca. 1250 m, 29 September 2003 T.Ng. Praptosuwiryo 1780 (BO).

CHROMOSOMES. 2n = 123.

DISTRIBUTION. Only found from Java, from Mt. Gede, Mt. Salak and Mt. Halimun.

ECOLOGY. Growing on moist humus-rich soil, shadowed places of mountain forest at altitude 1000-1500 above sea level.

ETYMOLOGY. This species is named in relation to the specific characters of its pinnae and pinnulae. Pinnae and pinnulae are usually asymmetric, the acroscopic pinnulae and segments or lobes are larger than the basiscopic.

SPECIMENS EXAMINED. --- JAVA: T.Ng. Praptosuwiryo 1728, 1334, 1365, 1780.

NOTES. Diplazium asymmetricum is similar to D. procumbens. The two species share in scales on stipes fallen when mature, ovate-lanceolate dark brown scales with blunt teeth, deltoid lamina, oblong lobes with blunt or truncate apex, and forked veinlets. Diplazium assymetricum differs from D. procumbens in the following characters combination: rhizome short, erect; lamina more incised (to tripinnate) basiscopic pinnulae or segments and lobes are larger than the acroscopic ones; indusia thicker, margin entire.
7. **Diplazium atrosquamosum (Copel.) C.Chr. & Holtt.**


--- TYPE: Clemens 11051 (holotype PNH?†; isotype MICH, s.n.; photo of isotype at UC, K, s.n.).

Rhizome short, erect. Stipe light brown, 65 cm long, 7 mm thick, muricate and scales fallen. Lamina bipinnate, subdeltoid, 56 cm long, 40 cm broad, pinnated pinnae to 4 pairs; pinnae stalked to 5.5 cm long, lanceolate, 32 cm long, 14 cm broad, free pinnulae 12 pairs below pinnaatifid apex of pinnae, basal acrosopic slightly reduced; lower pinnulae shortly stalked to 2 mm long, upper andate or sessile, lanceolate, to 9.2 cm long, 2 cm broad, apex sharply acuminate, margin lobed ¾- 4/5 way to the costule; lobes oblong, 2-5-3.5 mm wide above base, ends truncate, slightly toothed; rachis gemmiferous at the adjacent to the costae at the apex of lamina, glabrous; costae and costule sometimes scales, mainly at the adjacent costae and costule or costule and costulet; veins black, mainvein forming angle about 70° to costa, free, pinnate in the lobes; veinlets 5-6 pairs, simple, forming an angle about 35° to the costulet. Sori on basal veinlets, elongate from near costulet cover 1/3-1/2 way to margin, indusia pale brown, thin, broad, persistent, margin lacerate when opening.

**DISTRIBUTION.** Borneo.

**ECOLOGY.** Terrestrial in mountain forest. Elevation: 1500-2700 m.

**SPECIMENS EXAMINED.** --- BORNEO: R.E. Holttum SFN 25429; J. M.S. Clemens 29716, 28103, 32558.

8. **Diplazium bantamense Blume**


Rhizome short, erect, suberect. Stipe up to 90 cm long, 4-6 mm thick near base, glabrescent, clothed with scales at base; scales narrow, to 15 mm long, 2
mm wide at base, dark brown, margin toothed. Lamina simple pinnate, oblong in outline, up to 50 cm long, 26 cm wide; lateral pinnae 2-5 pairs, ascending, shortly stalked, upper ones sessile, oblong, rounded at base, widest at a little above the base, gradually narrowing towards acuminate apex, margin subentire or serrate near apex, up to 25 by 5.5 cm; terminal pinnae similar to lateral ones or occasionnally with large lobe at base; texture chartaceous, glabrescent; rachis grooved above, often gemmiferous at the junction with costa of upper pinnae; costa raised below, grooved above; veins free, 2-3 times forked. Sori elongate along veinlets, usually diplazioid. Indusia brown, fragile, margin entire.

SPORES. Monolete, bilaterally symmetrical, heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view concave-convex; equatorial transverse view, proximal face concave, distal face hemispherical; perinate. E: $42.81(53.88)66.05\pm5.69$; P: $22.64(31.48)37.47\pm3.38$. Laesure: concealed by perine ridge. Perine: costate-aleate, loosely reticulate irregular envelope, costae form a large reticulation; separated from the spores; reticulation often incomplete; lacunae large irregular polygons 11-25 µm across; costae or alate project 3-13 µm, terminating margins entire; surface of perine smooth. Exine: often visible through perine, smooth under LM.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form uninterrupted U-shaped with an angle about 120º, base almost flat, end ridges on both direction, outward and inward, bend outward to form an angle 150º. Stomata: polycytic and copolycytic.

CHROMOSOMES. 2n = 164 (Cytotype: T.Ng. Praptosuwiryo 1454, BOHB), 328 (Cytotype: Tin 1-3, BOHB).

DISTRIBUTION. Malesia throughout.

ECOLOGY. Terrestrial in lowland and lower montane forest. Occurs in shady places in hills and occasionally by streams in the lowlands, but not common. 20-1600 m.


9. Diplazium barbatum Christensen


Rhizome short, erect. Stipe ca. to 30 cm long, light brown throughout, densely scales toward base; scales light brown, linear lanceolate, 3-1.4 mm long, 0.25-1 mm broad, concolours, without thickening black strands, margin toothed, teeth distinctly forked. Lamina broad lanceolate, ca. to 65 cm long, 19 cm broad, pinnae 10 pairs; lower shortly stalked to 3 mm long, pinnae pinnate, ovate lanceolate, to about 12 cm long, 5.3 cm broad, free pinnulae 2-4 pairs below pinnatifid apex of pinnae; pinnulae sessile, almost at right angle to costa, oblong, margin entire, ends acute-rounded, slightly toothed; texture papyraceous, rachis and costa densely minute scales; veins free, pinnate in the pinnulae; veinlets to 9 pairs, once forked. Sori elongate from near costule continuing to acroscopic branch of veinlets covers 2/3-3/4 of their length, indusia pale brown, margin entire, persistent.

**DISTRIBUTION.** Borneo.

**ECOLOGY.** Terrestrial in mountain forest. Elevation 1400-2100 m.


**NOTES.** As notified by Christensen & Holttum (1934), *D. barbatum* is somewhat resembling *D. speciosum* in general habit, colour and texture, but very distinct by its densely squamose stipe, rachis and costae.
10. *Diplazium batuayauense* Praptosuwiryo, sp. nov.

**TYPE:** Borneo, Central Kalimantan, Mts. Muller, Batau Ayau, Above S. Talikot Puhung Kucan, ca. 450 m, 14 June 2004, T.Ng. Praptosuwiryo 1927 (holotype, BO).

Rhizoma breve erectum. Stipites gracilis, 19.5-23 cm longae, 3 mm crassa, squamis caducus brunneus, linear-lanceolatus, 4-10 mm longae, 0.5 mm latis, margine irregularis dentibus furcatis cum filum niger spissescens. Lamina pinnata, lanceolatis, 41 cm longis, 20 cm latis, pinnae 15-jugatae infra apice pinnatifidus; pinnae inferiora stipitae ad 3.5 mm longis, superiora adnatus, lanceolatae, 11.2 cm longis, 2 cm latis, basi inaequaliter truncatae ad cuneatae, e margine 1/3-1/2 costam lobatae; lobi 4-5.5 mm latae supra basim, truncatae, leviter crenati. Rachides non gemmiferae, glabrae. Venulae distinctus in superficiebus ambabus, liberis, pinnatae in uno lobo, venae principalis angulum 55° cum costa formantes, venulae 4-5-jugatae, simpliciter. Sori medial or close to margin of lobes, cover 1/3-1/2 of veinlets length (3 mm length). Indusiis brunneis, concolour, persistens, inegleri.

Rhizome short, erect. Stipe slender, 19.5-23 cm long, 3 mm thick, fallen scales; scales brown, lineary lanceolate, 4-10 mm long, 0.5 mm broad, margin toothed, teeth apart, with thickening dark brown strand irregularly, glandular cells present. Lamina pinnata, lanceolatis in outline, 41 cm longis, 20 cm latissimae, pinnae 15 pairs below pinnatifid apex of lamina; lower pinnae stalked 3.5 mm long, upper pinnae adnate, one pair basal pinnae bending downward with cut away base; pinnae lanceolates, widest at 1/3 part from basal, 11.2 cm longis, 2 cm latis, base unequally truncate on lower pinnae, cuneate at upper ones, apex acuminate, margin lobed to within 4 mm of costa (or 1/3-1/2 way to costa); lobi 4-5.5 mm latae supra basim, truncatae, leviter crenati. Rachis non gemmiferus, glabrous. Texture thin. Veins distinct on both surface, free, pinnate in the lobus, main vein forming angle 55° to costa, veinlets 4-5 pairs, all simple, reaching margin. Sori medial or close to margin of lobes, cover 1/3-1/2 of veinlets length (3 mm length). Indusia brown, persistent, margin entire.
PARATYPE. BORNEO: Central Kalimantan, Mts. Muller, Above S. Talikot Puhung Kucan, track to Batu Ayau, 450 m, 14 June 2004, T.Ng. Praptosuwiryo 1927a, 1927b, 1927c, 1927d, 1927e.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form interrupted U-shaped, with an angle 115º, angle slightly ridges, end almost simple.

CHROMOSOMES. 2n = 164 (Cytotype: T.Ng. Praptosuwiryo 1927c, BOHB), 205 (Cytotype: T.Ng. Praptosuwiryo 1909, BOHB).

DISTRIBUTION. Borneo

ECOLOGY. Terrestrial in lower montane forest. It is Grows on humus rich soil in shady places.

NOTES. This species closely related to D. sorzogonense. Diplazium batuayauense differs from D. sorzogonense in the following characters: Scales sharply toothed with thickening dark brown stand irregularly, fronds are much smaller, never reaching 1 m, lacks the fibrillose scales on stipe and rachis, pinnae lobed only to ½ way to costa, sori not impressed. D. batuayauense is also similar to D. malaccense.

ETYMOLOGY. The specific epithet is from the locality where this species found, Batu Ayau, the mountain forest of Mts. Muller in Central Kalimantan, Borneo.

11. Diplazium beamanii M.G. Price


Rhizome erect. Stipe stramineus, 66 cm long, 7 mm thick, densely scales at base; scales pale brown, ovate, 10 mm long, 4.5 mm broad, margin entire. Lamina ovate, 60 cm long, bipinnate to deeply tripinnatifid at base, pinnae (?) pairs; pinnae stalked to 2.5 cm long, subbasal the largest, to 37 cm long, ca. 17 cm broad, pinnulae to 13 pairs, basal acrosopic slightly reduced; pinnulae stalked to ca. 1 mm long, 2 cm distance, subtriangular-lanceolate, to 8 cm long, 2 cm broad, base truncate, apex acuminate, margin lobed to 5/6 way to costa (within 2 mm of
costa); segments to ca. 5 mm wide, ends subtruncate, margin slightly denticulate-crenulate; veins free, pinnate, veinlets to 5 pairs, usually simple. Sori from near costule cover 1/3 way of veinlets (1.0-2.5 mm long), basal acroscopic often diplazioid; indusia broad, margin irregularly fringed, persistent.

**DISTRIBUTION.** Borneo.

**ECOLOGY.** Terrestrial. Lower montane forest by stream. Elevation: 1400 m. Endemic to Mount Kinabalu.

**SPECIMEN EXAMINED.** --- BORNEO: Beaman 10724.

12. Diplazium betimusense Alderw.


Rhizome short, erect, 17 mm thick. Stipe dark brown, 48 cm long, sparingly muricate, scales towards the base, scales on stipes dark brown, rounded-ovate, margin entire, deciduous, leaving the stipes roughish by their persistent bases, 3.5 mm long, 3 mm broad. Lamina bipinnate, (?) cm long, (?) cm broad, pinnae (?) pairs; lower pinnae stalked to 5.3 cm long, oblong subtringular, 40 cm long, 18 cm broad, pinnulae 6-9 pairs below pinnatifid deltoid apex of pinnae; lower pinnulae shortly stalked to 1.5 mm long, upper ones adnate-sessile, lanceolate, 8-10.5 cm long, 2-3 cm broad, base subequally truncate-cuneate, apex acuminate-caudate, sharply toothed, margin lobed to within 7 mm of costa (or 1/3-1/2 to cosule; lobus more or less widest at base, 5-6.5 mm broad, ends truncate, slightly toothed; rachis dark brow, glabrous; texture firm; veins free, pinnate in the lobus, main veins forming angle 50-55° to costule, veinlets 4-5 pairs, forming angle about 10-15 ° to main veins, distinct on both surface, simple, all reaching the margin. Sori subbasal or medial, covers to 1/3 of their length, sometimes diplazioid on basal acroscopic veinlets; indusia narrow.

**DISTRIBUTION.** Sumatra.

**ECOLOGY.** Growing on shade part of forest, near river at ca. 400 m sea level.
SPECIMENS EXAMINED. --- SUMATRA: J.A. Lörzing 5718

13. Diplazium christii C.Chr.

*Diplazium christii* C.Chr., Index Fil.: 229. 1905; C.Chr. & Holttum, Gard. Bull. S.S. 7: 270. 1934.

Rhizome (?). Stipe 35 cm long, 4 mm diam., scales at base, dark brown; scales on stipes light brown, concolours, shining, 3-7 mm long, 0.5-1.5 mm diam. near base, margin entire, without thickening black strands. Lamina pinnate, lanceolate, 65 cm long, 18 cm broad, pinnae 19 pairs below deeply deltoid apex of lamina (?); pinnae shortly stalked to 3 mm long, lanceolate 15 cm long, 1.8 cm broad, base cuneate, apex acuminated, margin lobed \( \frac{1}{2} \) way to costa; lobus oblique, widest at base, to 6 mm above base, ends subtruncate, slightly toothed; veins free, pinnate in the lobes; veinlets usually 5-6 pairs, simple. Sori elongate at middle veinlets covers 2/3 of their length; indusia light brown, broad, margin entire, opening when mature.

DISTRIBUTION. Malay peninsula.

ECOLOGY. In dense forest, near summit 600 m.

SPECIMENS EXAMINED. --- MALAY PENINSULA: R.E. Holttum SFN 19912.

14. Diplazium cordifolium Blume


*Callipteris cordifolia* (Blume) J. Sm., Copel., Polypod. Philipp.: 70. 1905.

Key to the varieties

1. Lamina simple, oblong subdeltoid, base cordate, apex acuminate; veins forked to 5 times .......................................................... var. cordifolium

1. Lamina simply pinnate

2. Terminal pinnae usually the largest, oblong subdeltoid; lateral pinnae oblong, base cordate, apex acuminate; texture coriaceous .................... var. integrifolium

2. Terminal pinnae usually similar shape to lateral ones, lanceolate; lateral pinnae lanceolate, base rounded to moderately auricled at basiscopic and truncate to cunetae at acroscopic, apex attenuate; texture subcoriaceous ....... var. pariens

Rhizome erect, suberect, scales on younger part. Stipe pale brown, 3-4 mm diam., 30-55 cm long, grooved above, brown, nearly black and scales toward base; scales oblong ovate with acuminate apex, 6-9 mm long, 1-2 mm wide near base, shining dark brown, margin entire with black thickening above base to tip when old, occasionally with glandular cells. Lamina of two kinds, simple and imparipinnate; simple ones oblong subdeltoid, 23-30 cm long, 8-13 cm wide above base, widest 1/3 from base, base cordate, apex acuminate, margin entire; imparipinnate ones nearly oblong deltoid in outline, 28-45 cm long, 24 cm wide; lateral pinnae 1-6 pairs, upper smaller, usually terminal ones largest, oblong subdeltoid, to 13-18 by 4-8 cm; upper pinnae sessile, broadly cuneate at base, lower pinnae shortly stalked, the largest 16 by 5.5 cm, cordate at base, apex acuminate, margin entire, rachis distincty beneath, gemmiferous at the junction with costa; texture coriaceous; veins at about 45-70° to costa on pinnate ones, 50-80° to midrib on simple ones, forked close to midrib, lower branch forked again 2-5 times, anastomosing irregularly about 1/3-1/2 from margin. Sori elongate along veinlets on both side or on acroscopic ones; indusia thin, persistent, margin entire.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) plano-convex; equatorial transverse view, proximal face planar, distal face convex; perinate. E: 37.02(42.15)51.62 ± 5.09 P: 20.23(26.56)31.21±2.97. Laesura: concealed by perine wing. Perine: alat to costate-alate, loose reticulate; irregular envelope separated from exine surrounds the spore in continuous anastomosing wings,
forming a loose reticulation; lacunae large irregular polygons 15-20 µm across; thin wing-like muri project 2-8 µm, terminating margins are often echinate; surface of perine sparsely echinate or ciliate; echinae project 0.5-0.8 µm. Exine: visible through perine, smooth under SEM.


DISTRIBUTION. Malesia throughout, eastward to Solomon Islands.

a. var cordifolium


Lamina simple, about 27 cm long, 13 cm broad; veins branching to 8 times, anastomosing 1/3 from margin to the costa; veins group forming an angle about 70º to costa (at the middle), soriferous on outer veins, inner also, diplazioid on basal acroscopic.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted V-shaped, with an angle 65º, end simple, not forming a ridge.

CHROMOSOMES. 2n = 164 (Cytotype: T.Ng. Praptosuwiryo 1203, BO), 205 (Cytotype: T.Ng. Praptosuwiryo 1204, BO), 246 (T.Ng. Praptosuwiryo 1201, BO), 328 (Cytotype: T.Ng. Praptosuwiryo 1926b, BO).

DISTRIBUTION. Sumatra, Malay Peninsula, Java, Borneo.

ECOLOGY. Occurs on moist sandy soil or humus rich soil of mountain slopes in dense forest at low or medium altitudes. 400 – 2000 m.

SPECIMENS EXAMINED. --- JAVA. West Java: A. Hidayat & H. Wiriadinata AH 501; T.Ng.Praptosuwiryo 1201, 1202, 1203, 1204, 1206, 1207, 1208, 1456, 1460, 1461, 1737, 1768, 1807, 1813, 1710, 1768, 1807, 1808. --- BORNEO: T.Ng. Praptosuwiryo 1910, 1926a, 1926b, 2128a, 2128c, 2128e, 2194a, 2194c, 2128b, 2194d, 2194e; Amdjah 271; J. & M.S. Clemens 26898; Amdjah 273; J. & M.S. Clemens 33810; Amdjah 718; Kunio Iwatsuki, M. Kato, Gen Murata & Y.P Mogea B-779; K. Iwatsuki, M. Kato, G. Murata & Y.P. Mogea B-1935; A.Kostermans 8130; Amdjah 718; Kostermans 9051; Teysman s.n.; M.Kato, M. Okamoto & E.B. Walujo B-10079; M. Kato & H. Wiriadinata B-

Lamina imparipinnate. Terminal pinnae usually the largest, oblong subdeltoid; lateral pinnae 1-6 pairs, the largest 16 by 5.5 cm, oblong, base cordate, apex acuminate; texture coriaceous; veins 1-3 forked, anastomosing in the marginal 1/3-1/2.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) plano-convex; equatorial transverse view, proximal face planar, distal face convex; perinate. E: 37.02(42.15)51.62 ±5.09 P: 20.23(26.56)31.21±2.97. Laesura: concealed by perine wing. Perine: alat to costate-alate, loose reticulate; irregular envelope separated from exine surrounds the spore in continuous anastomosing wings, forming a loose reticulation; lacunae large irregular polygons 15-20 µm across; thin wing-like muri project 2-8 µm, terminating margins are often echinate; surface of perine sparsely echinate or ciliate; echinae project 0.5-0.8 µm. Exine: visible through perine, smooth under SEM.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped with an angle about 110º, base flat on inward and outward direction, end ridges equally on both directions.

CHROMOSOMES. 2n = 164 (T.Ng. Praptosuwiryo 2128, BO).

DISTRIBUTION. Sumatra, Java, Malay Peninsula, Borneo.


Lamina pinnate, pinnae 4-8 pairs; lower lateral pinnae shortly stalked to 3 mm, upper ones sessile, lanceolate, gradually reduce in size upwards, larger ones 12 cm long, 2.8 cm wide, attenuate at apex, rounded to moderately auricled at basiscopic and truncate to cuneate at acroscopic bases, margin entire, terminal pinnae similar to the lateral ones; texture subcoriaceous, rachis gemmiferous at the adjacent to costa; veins 1-3 forked, anastomosing in the marginal 1/3-1/2.

SPECIMENS EXAMINED. --- JAVA: TNgPraptosuwiryo 1192, 1205, 1305, 1367, 1368, 1369, 1374, 1375, 1457, 1708.

NOTE: Mitsuta (1985) also recognized two varieties of *D. cordifolium* of Sumatra, var. *integrifolium* (Blume) Mitsuta and *D. pariens*. The two varieties are differentiated with characters as follow: Var. *integrifolium* has 2-3 pairs of lateral pinnae and base of terminal pinna sessile, while var. *pariens* with 4-6 pairs of lateral pinnae and base of terminal pinna usually wide cuneate.

15. *Diplazium crameri* Praptosuwiryo, sp. nov.

TYPE: Sumatra, Sukaraja, Kenali, 27 August 1915, DR. Cramer 41 (Holotype, BO).

Rhizoma erect (?). Stipites dilutus brunneus nitidus, 38 cm longis, 4 mm crassis, basi piceus squamis caducus lanceolatus, c.7 mm longis, 2 mm latis, integris, brunneus. Lamina simpliciter imparipinnatae, oblongae, 25.5 cm longae,
21 cm latae; pinnae 5-jugatae, stipitae ad 1.5 cm longis, 3.5-4 cm seorsum, ovate-lanceolate, gradatim decrescente in statura, pinnae infernus ad 12.5 cm longis, 3 cm latis, basi cuneatae, marginae subintegrae, versus apice leviter serratus, apice acuminatae, glabrae, in sicco superne atrobrunneae, inferne brunneae, pinnae terminalis ad lateralis conformes; rhachides non gemmiferae, glabrae, costae inferne prominens; vennae distinguibilis, libere, angulum 50-60° cum costa formantes, propinquus costae furcated, ramus superis simpliciter et soriferus, ramus infernis simpliciter vel furcatis, plerumque furcatis. Soris e propinquus costae elongati ad 7/9 venulae occupants, soris infimus acroscopicus diplazioides. Indusiis latis, brunneis, margin leviter crispatus, persistens.

Rhizome erect (?). Stipe pale brown, glossy, 38 cm long, 4 mm thick, black at base, fallen scales; scales lanceolate, ca. 7 mm long, 2 mm broad, margin entire, dark brown. Lamina simply pinnate, oblong, 25.5 cm long, 21 cm broad, pinnae 5 pairs, terminal pinnae conform the lateral ones; lateral pinnae stalked to 1.5 cm long, 3.5-4 cm apart, below apical pinnae adnate, ovate-lanceolate, gradually decrising in size, lower pinnae to 12.5 cm long, 3 cm broad, margin entire, slightly serrate towards apex, base equally cuneate; rachise not gemmiferous, costa raised below, glabrous; texture very firm. Veins free, distinct on both surface, forming angle 50-60 to costa, forked near costa, upper branch simple and soriferous, lower branch simple-once forked, commonly once forked. Sori elongate from near basal veinlets (0.5-3.5 mm distance from costa) cover to 7/9 of lengt veinlets (irregularly), acroscopic basal diplazioid, other asplenoid. Indusia broad, brown, margin slightly crisped, persistent.

DISTRIBUTION. Sumatra.

ECOLOGY. This is a dry land terrestrial fern that grows in shady places of primary forest.

NOTES. Diplazium crameri may closely related to D. xiphophyllum. The two species share stramineous stipe, lanceolate entire concolour scales, simply pinnate oblong lamina, base of pinnae cuneate and texture subcoriaceous. Diplazium crameri differs from D. xiphophyllum in its scales dark brown, pinnae stalked to 1.5 cm long, ovate-lanceolate, all veins free and forked to 2 times. Meanwhile D. xiphophyllum has pinnae elliptical, lower pinnae shortly stalked,
veins often anastomosing near margin and forked to 5 times. There is one specimen only found among assemblage of specimens at BO that collected from Sumatra. (22 Sept. 2007).

ETYMOLOGY. This species is named after DR. Cramer, the first collector of this species.

SPECIMENS EXAMINED. --- SUMATRA: DR. Cramer 41.

16. Diplazium crenatoserratum (Blume) Moore


Rhizome short, erect. Stipe 30-50 cm long, glabrescent, pale brown, black and scales at base, distinctly grooved above; scales narrowly oblong subtriangular, about 5 by 1 mm, concolour, dark brown, margin toothed irregularly, teeth not forked. Lamina pinnate without distinct terminal pinnae of the fornd, oblong triangular in outline with attenuate apex, widest at base, 33-70 cm long, 14-20 cm or more wide; rachis grooved above; pinnae 9-22 pairs, stalked 3.5-5 mm long, liniery oblong, 7-11 cm long, 1.4-2.7 cm wide, upper ones sessile with cuneate lower base, lower ones stalked, upper base strongly auricled, less lower base or slightly rounded; margin lobed ¼- ½ to costa or almost entire, lobes irregularly in size; texture softly chartaceous; veins pinnate in lobes to 3 pairs or once-twice forked in subentire pinnae. Sori alongate from nearly costa almost reach margin of pinna, single or occasionally diplazioid on acroscopic veinlets of forked veins, usually diplazioid on acroscopic of basal pinnate veins; indusia thin brown, fragile, persistent, margin entire.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) concave-convex; equatorial tranverse view, proximal face concave, distal face convex; perinate. E: 29.86(38.19)45.74±4.95, P: 17.92(23.48)27.36±2.94. Laesura: concealed by thin
wing-like muri. Perine: aleate, loosely reticulate; irregular envelope, separated from exine, surrounds the spore in anastomosing wings, forming loose reticulation, reticulation irregular and often incomplete; lacunae irregular polygons, 8-16 µm across, irregular holes and small papillae within; holes caused by the fallen papillae; muri thin, wing-like, projected c. 1-8 µm, terminating margin ciliate; surface of perine fibrous-like and holed, holes irregular and formed by fallen ciliae.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an interrupted V-shaped formed from two long oval leaf traces, end simple without ridges at both inward and outward directions.

CHROMOSOMES. 2n = 123 (Cytotype: T.Ng. Praptosuwiryo 2075, BO), 164 (Cytotype: T.Ng. Praptosuwiryo 2067, BO).

DISTRIBUTION. Peninsular, Malaysia, Sumatra, Java, Borneo, Moluccas, Thailand.

ECOLOGY. Terrestrial in primary and secondary forest, dry land, shaded in slope and rigde of lowlands and montane forest. It can grow on various soil from yellow-red loamy, red clay, and on humus rich soil. 20 – 1000 m.

17. Diplazium crinitum (Baker) C.Chr.


Rhizome (?). Stipe 25-45 cm long, 2.5-7 mm diam. near base, light brown, densely scales throughout; scales on stipes yellowish, shining, lanceolate, 4-7 mm long, 0.5-1 mm broad, margin toothed with thickening black strands irregularly, fragile; teeth forked irregularly. Lamina bipinnate, ovate in outline, (?) cm long, 24 cm broad, pinnae (?) pairs. Pinnae shortly stalked to 6 mm long, oblong in outline, 25 cm long, 10 cm broad, pinnulae to 11 pairs; lower pinnulae adnate, upper sessile below deeply deltoid apex of pinnae; pinnulae oblong, larger ones to 6 cm long, 1.5 cm broad, base broadly cuneate, apex acuminate, margin lobed 1/3 way to costule; lobes oblique, widest at base, ends truncate or slightly rounded, subentire; rachise dark brown, grooved on upper surface, densely minute toothed scales; costa and costule also densely scales as like as rachise; texture herbaceous-membranaceous; veins free, pinnate in lobes, veinlets 4-6 pairs, simple, soriferous 1-4 pairs from basal. Sori elongate from near cosulet covers 1/4-2/3 of their length, diplazioid on basal acroscopic; indusia light brown, attachment side darker, margin entire, fragile.

**DISTRIBUTION.** Borneo.

**ECOLOGY.** Limestone areas. Terrestrial on mountain slope in deep shade. 50-100 m.

**SPECIMENS EXAMINED.** --- BORNEO: M. Kato & H. Wiriadinata B-5953; B-5955; B-5956; M. Kato, H. Wiriadinata B-5414; M. Kato & H. Wiriadinata B-5953; B-5935.

18. Diplazium cumingii (Presl) C. Chr.

*Diplazium cumingii* (Presl.) C. Chr. *Ind. Fil.* 230. 1905. --- *Athyrium cumingii* (Presl) Milde. --- *Ochlogramma cumingii* Presl. --- *Calliptiteris alismifolia* J. Smith (nomina nudum). --- **TYPE:** Cuming 116 (Isotype, MW!).

Rhizome short, erect. Stipe dark brown or nearly black, 25.5-39 cm long, 3-4 mm diam. near base, blackish, fallen scales at base. Scales on stipe dark
brown, blackish, concolour, subulate, 4-7 mm long, 0.5-1.0 mm broad, margin entire. Lamina imparipinate, oblong, 37-45 cm long, 19-32 cm broad, lateral pinnae 2-3 pairs, terminal pinnae like the rest, the largest. Pinnae subopposite, shortly stalked 2.5-3 mm long, oblong, base cuneate, apexcaudate, margin entire, to 19 cm long, 4.7 cm broad; terminal pinnae 21.5-26 cm long, 6.8-7.0 cm broad. Coatae distinctly raised below, dark brown when dry, minutely scales on lower surface. Veins in small group of 2-4 veins, forming an angle about \( \theta \) to costa, veilets forked 2-3 times again, outer and inner veins uniting with the nearest veins forming areoles 1 mm wide, or nastomousing 1/7-1/4 way from margin to costa. Sori elongate from costa continuously to near margin, forming areoles near margin, outer acroscopic diplazioid, inner also. Indusia black, margin entire, firm, persistent, opening when old, margin of indusia leaving line scar between veins like false veins.

**DISTRIBUTION.** Borneo

**ECOLOGY.** Terrestrial on stream bank in deep shade, lowlands evergreen rain forest, on humus rich slope. 270 – 1500 m.


**NOTE:** The sori and the indusia of this species are very distinctive. Indusia are rolled back when old, always leaving a distinct ridge indicating the original position of their outer edges.

**DISTRIBUTION.** Borneo, Philippines.

19. **Diplazium densisquamatum** Praptosuwiryo, sp. nov. Plate 4.

**Type:** SUMATRA. Jambi, Kerinci Seblat National Park, Sungai Penuh, Bukit Tapan, secondary forest, 1290-1300 m, 5 September 2006, T.Ng. Praptosuwiryo 2491 (holotype, BO).

Rhizoma breve erecta. Stipites ad 47.5 cm longae, 0.6 cm cassi fere basi, squamis brunneis nitidus integris ovatis-lanceolatis 7-17 mm longae 0.5-2.5 mm latae densus penitus vestitae. Lamina ad 95 cm longae, 65 latae, bipinnata
deltoideus; pinnate pinnae ad 6 jugatae, pinnatida pinnae ad 7 jugatae infra apice pinnatifidus. Infimus pinnae stipes ad 1 cm longae, 38-41 cm longae 10.5-13.0 cm latae, lanceolate, libere pinnulae 13-18-jugatae; pinnulae infimus acroscopicus leviter dimidia ad 2.8 cm longis, 1 cm latis; pinnulae maximae stipitae ad 1 mm longis, superiorea adnatus-sessilis, oblong subtriangularis, ad 6.8 cm longiae, 1.9 cm latae, basi truncatae, apice acuminatae, e margine ¾ costam versus lobatae; lobi oblongis, basi basiscopics maximae, ad 4 mm latae, plerumque 3 mm latae, truncati, leviter dentatis. Venulae libere, pinnatae in lobo, 5-6-jugatae, plerumque 5-jugatae, simplices vel in lobo infimus basiscopics furcatis. Rachise et costae, minute squamis, non gemmiferae. Sori e basi venarum ½, ad 1.5 mm longae, soris infimus acroscopicus diplazioideus. Indusii latis, brunneus, concolorus, marginem lacerum, persistens.

Rhzome short, stout, erect, scales densely on younger part. Stipes dark brown, black toward base, 47.5 cm long, 0.6 cm thick, scales densely throughout; scales dark brown, ovate-lanceolate, 7-17 mm long, 0.5-2.5 mm broad, margin entire, without thickening black strands, glandular cell present. Lamina bipinnate, deltoid, to 95 cm long, 65 cm broad; pinnate pinnae 6 pairs, pinnatifid pinnae 7 pairs below pinnatifid apex of lamina; lower pinnae stalked to 1 cm long, lanceolate, 38-41 cm long, 10.5-13.0 cm broad, free pinnulae 13-18 pairs; basal acroscopic pinnulae a little reduced to 2.8 long, 1 cm broad; larger pinnae short stalked to 0.5-1 mm long, upper adnate-sessile, oblong subtriangular, 5.6-6.8 cm long, 1.7-1.9 cm broad, base truncate, apex acuminata, margin lobed ¾ way to costa; lobes oblong, basal basiscopics the widest, 2-4 mm wide, commonly 3 mm wide, ends truncate, slight toothed. Veins free, pinnate in the lobes, veinlets 5-6 pairs, commonly 5 pairs, commonly simple, once forked on basal basiscopics lobes. Rachise and costa minutely scales, not gemmiferous. Texture subpapyraceous. Sori elongate from basal covers ½ of its length, 1.5 mm long, basal acroscopic diplazoid. Indusia broad, dark brown, concolour, margin lacerate, persistent.

DISTRIBUTION. This species has hitherto only been found in shady forest of Bukit Tapan, Kerinci Seblat National Park, Sumatra.

ECOLOGY. In shady place of dry land in secondary forest. 1000-1200 m.
SPECIMENS EXAMINED. SUMATRA: T.Ng. Praptosuwiryo 2491.

NOTES. Diplazium desisquamatum is in a glance similar to the small plants of D. polypodioides. However the dense scales throughout the stipes with ovate–lanceolate and entire margin will differentiate from D. polypodioides fastly. The stipes of D. polypodioides are densely covered by linear lanceolate sharply toothed scales at base only. Moreover D. desisquamatum is differ from D. polypodioides in characters combination as follow: larger pinnulae lobed to ¾ way to costa and veinlets 6 pair or less, while D. polypodioides has larger pinnulae lobed more deep close to costules and veinlets to 11 pairs.

ETYMOLOGY. The species epithet is from the Latin densus and squamatus meaning scales are dense in illustrating the densely scales throughout the stipes and rachis.

20. Diplazium dilatatum Blume


Rhizome stout, short, erect. Stipe to 80 cm or larger, 8 mm or more thick near base, dark green when living, black and very densely scales at base; scales narrowly linier, to 15 mm long, 1 mm wide, yellowish brown at middle, blackish brown and sharply toothed at margin. Lamina bipinnate-tripinnatifid, about 90 cm long, 70 cm wide, variable in size; pinnae oblong, narrowing toward acuminate apex, to 58 cm long, 70 cm wide, pinnules to about 16 pairs below deltoid lobed apex of pinna; basal pinnules usually a little reduce; larger pinnules stalked to 5 mm long, to 18 long, 4 cm broad, oblong subtriangular with attenuate apex, basal lobes a little reduce, base truncate-cordate on stalked ones, lobed ½ way to costa or a little more; lobes slightly subdeltoid-semiobicular, apex rounded, margin subentire or serrate, 15 by 9 mm, commonly less; rachis glabrescent, costa with scattered narrow brown scales to 20 by 3 mm; veins in lobes pinnate with 5-7 pairs of simple or forked veinlets. Sori elongate along veinlets from near base to 2/3 length.
SPORE. Monolete, bilaterally symmetrical (made asymmetric by prine), heteropolar, polar outline (excluding perine) elliptical, sides convex; equatorial longitudinal view (excluding perine) concave-convex; equatorial transverse view, proximal face concave, distal face convex; perinate. E: 31.85(45.69)49.56±4.78; P: 19.84(28.55)34.62±3.89. Laesura: concealed by perine. Perine: alate-to costate-alate, irregular envelope separated from exine surrounds the spore; wing-like muri projected c.6 -15 µm µm, terminating margin are often ciliate; surface of perine smooth. Exine: visible through perine, smooth under SEM.

ANATOMY. Stomata: Polocytic, copolocytic and seppolocytic.

CHROMOSOMES. 2n= 123 (Cytotype: T.Ng. Praptosuwiryo 1073)

DISTRIBUTION. India, Burma, S. China, Taiwan, Ryuku, S. Japan, Indochina, Malesia throughout to N. Australia.

ECOLOGY. Terrestrial. On humus rich soil of mountain slopes primary forest or mixed forest at 100-1800 m sea level.

VERNACULAR NAMES. Pakis layung (Javanese), paku beunyeur (Sundanese).

USE. The young fronds can be eaten as vegetable after cooking.

SPECIMENS EXAMINED. --- JAVA: Adelbert 142; Alston 12771; Dillewgn 706; Donk s.n., 603; Lefebu 113; Matthew 610; Moga 2344, 2345; Mousset 50, 760; Popta 225; Posthumus 3584, 3768, 3939; Sapiin 2660, 2713, 2717; Zippelius 239. --- BORNEO: M. Kato, G. Murata & Y.P. Moga B-3873; R.E. Holfatum SFN 25555; M.Kato, G.Murata & Y.P. Moga B-3738; M. Kato, M. Okamoto, & E.B. Walujo B-10036.

NOTES. Kato (1995) recognized two varieties *D.dilatatum* in Japan, viz. var. *dilatatum* and var. *heterolepis*. The first variety has scales on stipe base lanceolate, to 20 mm long, black at margin, while the second variety has scales on stipe broadly lanceolate, 10-15 mm long, 1-3 mm broad, hardly black at margin.


Rhizome stout; scales lineary, 1 cm long, black-dark brown. Stipe crowded, ca. 35 cm long, 8 mm thick, base densely scales, muricate, upper; subglabrous; scales dark, lineary, 4-8 mm long; lamina ovate, 1-1.5 mm long, bipinnate, apex pinnatifid; larger pinnae 45 cm long, 20 cm broad, lower smaller; pinnulae shortly stalked, subfalcate, to ca. 10 cm long, 2 cm broad, base truncate, apex serrate, margin lobed to 1/3 way to costa; lobus truncate, toothed; rhachis glabrescent, grooved on upper surface; texture papyraceous, glabrous, upper surface shiny, lower surface pale; veins free, pinnate in the lobus, veinlet to 6 pairs, simple, lower curved. Sori lineary, to 8 mm long; indusia broad, brown.

**DISTRIBUTION.** Borneo, Philippines

**ECOLOGY.** Terrestrial. Hill dipterocarp forest. Elevation: 1000 m.

**SPECIMEN EXAMINED:** Borneo: Beaman 10641 (K).

**NOTES.** This species is described based on photograph of specimen deposited at Rijks Herbarium, Kew.

22. Diplazium donianum (Mett.) Tardieu


Rhizome creeping, 4-5 mm thick, blackish, with leaves 1-2 cm apart, scales on younger part; scales brown shining, ovate-narrowly lanceolate, 2.5-9 mm long, 1-3 mm broad, apex acuminate, brown, margin tooched irregularly with thickening black strand. Stipe longer than lamina, 28-57 cm long, 3-4.5 mm thick, dark brown and scales at base, upper pale green when living. Lamina simply pinnate, oblong in outline, 30-42 cm long, 15-19 cm broad, lateral pinnae subalternate, to 4 pairs, terminal pinnae conform to lateral ones; pinnae stalked 3-
6 mm long, ovate-lanceolate to narrowly oblong, to 16.2 cm long, 3-4.5 cm broad, base cuneate, apex acuminate, margin entire, slightly toothed; rachise glabrous; texture firm-papyraceous, upper surface rather light green, glossy, lower pale green; slightly serrate near apex; veins group forming angle 55-60° to costa, free, forked near costa, upper branch simple or one forked and soriferous, lower forked 1-4 times again, outer usually also soriferous but shorter. Sori bearing on outer veins, sometimes also on inner ones, basal acroscopic usually the longest, diplazoid, elongate from near costa almost reaching the margin; indusia concolour, brown, rolled back, margin subentire, persistent, opening when mature.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped, with an angle 110, flat base both inward and outward, angles not forming ridges, ends slightly ridges outward.

CHROMOSOMES. 2n = 164 (Cytotype: XIX.C.III.65, BOHB, living plant is cultivated at Bogor Botanic Gardens).

DISTRIBUTION. Japan, Taiwan, S. China, Indochina, Thailand, India, Sumatra, Java, New Guinea.

ECOLOGY. On mountain slopes in light shade or in dense primary forest, at low elevations lower than 1300 m.


NOTES. This species is new record for Java and Sumatra. Kato (1995) also reported chromosomes number 'n' = 164 (apogamous).

23. Diplazium esculentum (Retz.) Sw.


Rhizome erect. Stipe 5-10 mm diam., 14-80 cm long, brown, glabrescent, black and scales toward base; scales narrowly linier, 7-13 mm long, 1-1.5 mm wide, concolour, dark brown, margin toothed with thickening black strand. Lamina pinnate-bipinnate, large, various in size; lower one-two pairs of pinnae usually reduced; larger pinnae 27-47 cm long, 12-25 cm wide, bearing numerous
of pinnules; pinnules oblong, narrowing towards acuminate or attenuate apex, varying much in size, larger ones 8-13 cm long, 1.5-2.8 cm wide, lower shortly stalked about 1 mm long, the rest sessile truncate-subcordate or broadly cuneate, auricled one or both side at base, margin crenate or lobed about 2 mm or less from margin to ¼ way to costa; lobes or crenation truncate or rounded, and serrate at apex; texture papyraceous, sometimes fibrillose hairy beneath; rachis glabrescent or occasionally bearing fibrillose hairs beneath; costa or costae grooved with distinct ridge above, bearing scattered minutely scales; vein in pinnate group in the lobes, 8-10 pairs of side veins, the lower 2-3 pairs of adjacent group anastomosing, forming irregular intermediate ecurrent vein leading towards a sinus between adjacent lobes. Sori occupying almost the whole length of the veins, often also on part of the joint ecurrent vein, 1-4 pairs from basal sometimes diplazioid; indusia not so thin, dark brown, persistent, margin toothed when opening.

**SPORES.** Monolete, bilaterally symmetrical, heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view concave-convex to plano-convex; equatorial transverse view, proximal face planar to concave, distal face hemispherical; perinate. E: 31.72(38.39)43.09±3.35; P: 22.74(26.37)29.12±1.39. Laesure: not visible, concealed by perine. Perine: smooth under LM, micro rugulate under SEM. Exine: Exine: often visible through perine, granulate under SEM.

**ANATOMY.** Transverse section of stipe near lamina: Vascular bundle form an interrupted U-shaped with angle about 100°, base flat, end ridges outward to form an angle about 140°. Stomata: polycytic and seppolycytic.

**CHROMOSOMES.** 2n= 82 (Cytotype: T.Ng. Prapotuwiryo 1784, BO)

**DISTRIBUTION.** India to Fiji, throughout Malesia, north to Japan.

**ECOLOGY.** On moist soil in light shade, ravine, swampy ground, grassland (not no dry), hedges, dith banks, roadside, riverside in the forest at elevation 5-1600 m sea level.

**USE.** Young fronds of this species is sold in the local marked as vegetables. It is eaten after cooking.
SPECIMENS EXAMINED. SPECIMENS EXAMINED --- JAVA:
Adelbert 435; Arsin 19455; Backer 4479, 7855, 12004, 12574, 17745, 18638; Backer & Posthumus 4, 108, 162, 308, 400, 419, 601; Bakhuiizen v/d Brink 1440, 2401, 3715, 5508; Beguin 76; Dorgello 1938; Hallier 678b; v. Heurn s.n. (Pujon); Kooders 22754B; Lörzing 698, 699; Oosten a.17; Polak s.n. (Rawa Lakbok); Posthumus 1455a; T.Ng. Praptosuwiryo 630, 635, 637, 638, 1784, 1785; Raciborski s.n. (Kota Batu); Rumka 3; Rutten 323; Zippelius 178. --- MALAY PENINSULA: Newton, Z. Teruya 2343. --- BORNEO: K. Iwatsuki M. Kato, Gen Murata & Y.P.Mogeia B-194; M. Kato & Y.P.Mogeia B-224; K.Iwatsuki, M. Kato, M. Okamoto, K. Ueda & E.B. Walujo B-7190; M. Kato & H. Wiradinata B-6868; O. Posthumus 2065. ---SUMATRA: CH Lamourex 5652. --- BORNEO: T.Ng. Praptosuwiryo 2017, 2080, 2094b, 2094c, 2161b, 2161c, 2248a, 2248b.

24. Diplazium fraxinifolium Presl

*Diplazium fraxinifolium* Presl, Rel. Haenk 1: 49. 1825.


Rhizome erect, 12 mm thick. Stipe 44.5-67 cm long, 4-7 mm thick, fallen or sparsely scales at base; scales on stipe 2.5-8 mm long, 1-1.5 mm broad, margin entire, brown, concolour. Lamina simply pinnate, 37.5-46 cm long 22-44 cm broad, lateral pinnae 4-5 pairs, terminal pinnae conform to the rest; pinnae 4-8 cm distance, lower stalked 6-7 mm long, upper adnate, elliptical, 21.5-26 cm long, 4.5-6 cm broad, base cuneate, margin waved- crenate entirely or only toward apex, or lobed to 1/6 way to costa, apex acuminate or caudate; veins group forming angle 50-65°, each crenation for one vein group; vein forked 5-7 times, outer veinlets in each veinlets group uniting with outer adjacent veinlets group at 1/5-1/4 way from margin or less. Sori almost on each veinlet, cover ½-5/6 of veinlet length (2.5-17 mm long), diplazioid on basal acroscopic, others asplenoid and opening toward acroscopic, except subbasal acroscopic ones opening towards basiscopic; indusia pale brown, margin entire and darker, persistent, opening when mature.

DISTRIBUTION. Malaya, Borneo, New Guinea, Philippines.
ECOLOGY. Terrestrial on slope in light-deep shade, lowland rain forest at 20-750 m s.l.

SPECIMEN EXAMINED. --- Borneo: C. Boden Kloss 19028 (BO, SING); M. Kato & H. Wiriadinata B-5568; B-4728; M.Kato, M. Okamoto & K. Ueda B-11615, B-11659.

25. Diplazium fuliginosum (Hook.) M.G. Price


Rhizome short, erect. Scales on stipes blackish, shining, margin entire, 6 mm cm long, 1.5 mm broad. Stipe 2.5-7 cm long, 3-3.5 mm diam, blackish when dry, densely scales. Lamina very narrowly elliptic, 31-79 cm long, 9-13 cm broad at about 1/3 of upper part, lower 2/3 part fully pinnate, upper 1/3 part pinnatifid, free pinnae 15-32 pairs, lower pinnae 17 pairs gradually reduced downward; pinnae subfacate, sessile, lanceolate, to 4.8 -6.7 cm long, 1.2-1.7 cm broad, base truncate, apex sharply acute, margin subentire; texture very thin; rachis densely scales beneath; veins free, 1-3 forked, soriferous on acroscopic branch. Sori elongate along veinlets from basal almost reaching the margin; indusia dark brown, margin entire, opening when mature.

DISTRIBUTION. Bismarck Arch. (New Ireland), New Guinea (widespread), North Borneo (Mt. Kinabalu, common), Philippines (Leyte, one collection).

ECOLOGY. Occurring in shaded moist ravines in montane forests, c. 1000-3000 m.
SPECIMENS EXAMINED --- BORNEO: R.E. Holtum SFN 25529; J.M.S. Clemens 33723; J. & M.S. Clemens 31797.


TYPE: Java: G. Halimun, Cikuda Pah-Cikaniki, ca. 1300 m, 25 February 2006, T.Ng. Praptosuwiryo 2341 (holotype, BO).

Rhizoma breve erectum. Stipites 31-43 cm longae, in sicco stramineus, basi brunneus squamatus deciduus; squama linearis lanceolatissimum, ad 7 mm longae, 1 mm latae, margine irregulare dentatus cum filum niger spissescens. Lamina pinnata, oblonga, pinnae laterales ad 3-6-jugatae, pinna terminalis ceteris similis, rachis non prolifera; pinnae stipitatae ad 6 mm longae vel adnatus, ovate-lanceolata, 15-21 cm longae, 3.5-5.5 cm latae, basi subequaliter cuneate, margine fere integrae, apicem acuminatum leviter serratus. Venae libere, angulum 60-70° cum costa formantes, furcatis Sori basalis vel medius, 1/8-4/5 venulae occupantes. Indusia brunneus, marginem subintegris, persistens.


ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an interrupted U-shaped with angle about 110°, flat base on both inward and outward directions, end bluntly ridges to form an angle 140°.
CHROMOSOMES. 2n = 123 (Cytotype: T.Ng. Praptosuwiryo 2341, BO)

DISTRIBUTION. Java.

ECOLOGY. This species is growing on moist humus-rich soil of shady places in mountain forest. In the Mt. Halimun, *D. halimunense* was found growing among *D. donianum* and *D. bantamense*. Ca. 1300 m.

SPECIMEN EXAMINED. --- JAVA: T.Ng. Praptosuwiryo 749, 2341.

NOTES. *D. halimunense* may be closely related to *D. bantamense*, but the last two species appears to differ from the first species. *Diplazium halimunense* has irregularly sharp toothed scales with thickening black strands, while the margin scales of *D. bantamense* are minutely and regularly toothed; Pinnae of *D. halimunense* are cuneate at base with margin entire, while pinnae of *D. bantamense* are round at base with subentire or serrate at posterior portion. It also resembles *D. donianum*, but *D. halimunense* has erect rhizome, while *D. donianum* with creeping rhizome. The two species have similarities in irregular sharp toothed scales and ovate-lanceolate pinnae.

Cytological observation of one individual of *D. halimunense* (TNgP 2341b) showed 2n = 123 (triploid). Whereas most indivual of *D. bantamense* from Java are tetraploid and only some individual oktoploid. One collection number of *D. donianum* planted in Bogor Botanic Gardens (from Sumatra) is tetraploid (See Chapter 5).

ETYMOLOGY. The specific epithet is formed from name of the locality where this species is found, Mt. Halimun, Halimun National Park, West Java.

27. *Diplazium hewittii* (Copel.) C.Chr


*Diplazium paripinnatum* Alderw., Handb. Suppl. 1 : 266. 1916.

Rhizome short, erect. Scales on stipes concolour, dark brown-blackish, shiny, ovate, to 2.5 mm long, 2 mm broad, margin entire, glandular cell on tip when young. Stipe 25-67 cm long, 2.5-3.5 mm diam. near base, light brown, slightly muricate, black at base. Lamina pinnate – bipinnate, subtrangular in
outline, 30 – 70 cm long, 20-27 cm broad. Pinnae opposite-subopposite; lower pinnae stalked to 1.5 cm long, lanceolate, 22 cm long, 5.7 cm broad, pinnate, apex acuminate; lower pinnulae adnate – subsessile, upper pinnule sessile below deeply lobed apex of pinnae; larger pinnulae nearly hastate, 1.8-3.3 cm long, 0.4 – 1.0 cm broad, base broadly cuneate, upper base distinctly auricle, lower base less, apex acute-acuminate, margin crenate; middle pinnae with pinnulae sessile; upper pinnae gradually less pinnate-pinnatifid; texture subcoriaceous; surface naked, lower pale, upper dark green when living; rhacise naked; veins free, forked in each crenatiron, oblique. Sori elongated along veinlet from near costule covers 5/6 way to margin, acroscopic branch diplazioid; indusia brown, fragile, persistent, margin entire.

CHROMOSOMES.  2n = 123 (Cytotype: T.Ng. Praptosuwiryo 1913b, BO).

DISTRIBUTION.  Borneo

ECOLOGY.  Growing on humus rich soil, low sandy ridges, on shaded places in the forest at 400-450 m.

SPECIMENS EXAMINED.  --- BORNEO: M. Kato, M. Okamoto, K. Ueda & E.B. Walujo B-7383; M. Kato, M. Okamoto, K. Ueda & E.B. Walujo B-7902; B-7903.  K. Ueda & D. Darnaedi B-8835; T. Ng. Praptosuwiryo 1913a; 1913b; 1913c; 1908a; 1908b; 1908c; 1942; 2171; 2172a; 2172b, 2174; 2177; 2178; 2179; 2180.

NOTES.  Christensen & Holttum (1935) stated that a series of specimens collected by Mjoberd in Sarawak has shown that *Athyrium Hewittii*, *A. sarawakense*, and *A. paripinnatum* of Copeland probably all forms of the same species, different in size but otherwise scarcely distinguishable.

My collections from Muller Range, Borneo, showed that this species has variation in morphology from a young to adult. Young plants in which spores have not been produced are showing pinnate fronds while adult plants having fronds with pinnate-bipinnate.
28. *Diplazium hottae* Tagawa


TYPE: Hotta 15185 (Holotype, KYO, n.v.), Gunung Mulu, Sarawak.; Kokawa & Hotta 2364, 2415 (Paratype, KYO, n.v.).

Rhizome shorth, stout, erect. Scales on stipes light brown, shining, concolours, 9-15 mm long, 1-2 mm broad. margin entire. Stipe 56-67.5 cm long, 3-6 mm diam. at base stramineous, deeply grooved upper surface, base dark brown, scales, upward glabrous. Lamina oblong, lanceolate, ca. 85 cm long, 36 cm broad, pinnae 11-21 pairs; lower pinnae stalked to 5 mm long, lanceolate, larger pinnae 28 cm long, 2.5 cm broad, base narrowly cuneate, apex acuminate and slightly crenate, margin entire; rachis glabrous, gemmiferous at the adjacent between rachis and costa near terminal pinna; veins group forming an angle about 45° to costa; veins forked near costa, upper branch simple, lower branch forked again once-twice; Sori elongate along acroscopic branch, mostly not so close to costa, almost reaching the margin; indusia light brown, shining, margin entire, rolling back, not so broad.

DISTRIBUTION. Sumatra, Borneo.

ECOLOGY. Terrestrial on rather dry mountain in light shade. 300 – 1350 m.

VERNACULAR NAMES. Paku rahang (Dayak).

USE. Dayak use this plant for medicine. The very young fronds are crushed for sore poultice.


NOTES. Tagawa (1972) stated that *D. hottae* is allied to *D. subintegrum* Holtt. Occurring on Malay Peninsula and in Northern Sumatra. This species differs with *D. subintegrum* constantly in: (1) terminal not lobed at base and similar to upper laterals ones in shape and size, (2) uppermost 1 or 2 lateral pinnae gemmiferous at the base on the rachis, (3) pinnae apparently entire, but in reality
provided with minute and remote incision on margin, (4) venation obscure, acroscopic veinlet of group simple and soriferous, basiscopic one once forked and sterile, (5) sori all asplenioid, narrower, very unequal in length, their anterior ends arranged in an intramarginal uneven line, (6) scales at the base of stipe much longer.

29. Diplazium insigne Holttum


Rhizome stout, short, erect. Stipe stout, c.1 m long, spiny toward the base, the spines 2 mm long, each at first bearing a scale; scales dull brown 1.5 cm long by 1.5 cm wide at base, with a narrow black toothed edge, deciduous. Lamina to 1.5 m long, bipinnate; lowest pinnae about 28 cm long and 6.5 cm wide, narrowed and stalked at the base, the margins lobed half-way to the costa, the apex acuminate; middle pinnae largest, to 60 cm long and 16 cm wide, pinnate; pinnules slightly oblique, adnate to the rachis (the lowest ones narrowly, the upper fully adnate and grading into the lobed apical lamina of the pinna), to 9 cm long and 2.3 cm wide, cuneate at the base at an angle of about 45° on each side, narrowed gradually from the base and then suddenly at 1.5 – 2 cm, from the apex, margins slightly serrate; texture firmly herbaceous; veins anastomosing as in *D. accedens*. Sori few or copious, the lowest acroscopic sorus in each vein-group usually diplazioid, and occasionally a few others also.

ECOLOGY. In moist shady valley forest. 600-1200 m

DISTRIBUTION. Malay Peninsula.

SPECIMENS EXAMINED. --- MALAY PENINSULA: R.E. Holttum SFN 21635.

NOTES. As stated by Holttum (1940) this species is evidently closely allied to *D. accedens* and the apex of afrond might pass for that species, but its copious bipinnate form marks it as a quite distinct species. Holttum (1940) added that this species is also similar to *D. Smithianum* from Ceylon, but appears to be
much larger; probably both *D. Smithianum* and *D. insigne* are local derivatives of *D. accedens* (or *D. proliferum*).

### 30. Diplazium kunstleri Holttum


**TYPE:** R.E. Holttum SFN 31194 (holotype, US!).

Rhizome suberect, about 2 cm diam., scales on younger part. Stipe 7 mm diam at base, 70 cm long, glabrescent, dark brown, nearly black and scales at base; scales rounded. Lamina bipinnate, about 107 cm long, 60 cm wide; pinnae about 11 pairs; larger pinnae 52 cm long, about 16 cm wide, on stalk to 11 cm long, upper pinnae with shorter stalk; lowest pinnules to about 5 cm apart, largest ones 9.2 cm long, 2.7 cm broad, on stalk to 2 mm long, base broadly cuneate to truncate, margin lobed to 2/3 way toward costa; lobes slightly oblique, 5-7 mm wide, base dilated, margin slightly toothed, apex rounded; texture thicker than in allied species; rachis gemmiferous at upper portion; veins in each lobe 6-9 pairs, oblique, mostly simple, distinct but hardly prominent on both surface. Sori at middle part of the veins or nearly close the costules, basal acroscopic veinlets usually diplazioid; indusia narrow, hardly evident in mature sori, very dark brown.

**DISTRIBUTION.** Malaya, Java.

**ECOLOGY.** Locally abundant near streams in shady forest in the foothills. Ca. 900-1000 m.

**SPECIMENS EXAMINED** --- MALAY PENINSULA: R.E. Holttum SFN 31194. --- JAVA: Winckel 1556B.

### 31. Diplazium laevipes C.Chr. in C.Chr. & Holttum

*Diplazium laevipes* C.Chr. in C.Chr. & Holttum, Gard. Bull. S.S. 7: 271. Pl. 58. 1934. **TYPE:** Borneo, Mt. Kinabalu, H. 25259 (Holotype, SING!).

Stipe 55-75 cm long, ca. 3-8 cm diam near base, glabrescent, dark brown and scales towards base. Scales on stipes rounded, to 3.5 mm diam., dark brown, margin entire, more thick toward central. Lamina subdeltoid, bipinnatifid-
bipinnate, pinnae numerous; pinnae shortly stalked 5-15 mm long, oblong subtriangular-ovate outline, basal pinnae smallest, oblong lanceolate, base subcordate-subtruncate, subbasal pinnae 32-37 cm long, 8-19 cm wide, pinnulae to 10 pairs below pinnatifid or deltoid lobed apex of pinnae, acroscopic basal basal pinnulae a little reduced; pinnulae almost at right angle to costa, lower shortly stalked less than 1 mm long, oblong subtriangular, 10 cm long, 3.5 cm broad, base subtruncate, apex acuminate with slightly toothed, margin lobed 1/3-2/3 way to costa; lobus oblong, slightly oblique, to 4 mm above base, acroscopic basal a little reduce, ends truncate, entire-slightly toothed; texture stiff, blackish on upper surface and dark brown beneath when dry; rachis and costa deeply grooved and rather tomentose above, gemmiferous, gemmae bearing at adjacent between upper part of rachis and costa; veins pinnate in each lobe, free, not so distinct on both surface, forming an angle about 65-80° to costa; veinlets simple, to 9 pairs, occasionally once forked on one-two pair basal lobus, forming an angle about 25-35° to costalet. Sori elongate from basal veinlet cover ¼-2/3 their length, diplazioid on basal acroscopic; indusia dark brown, fragile.

DISTRIBUTION. Borneo.

ECOLOGY. Occurring on forest floor in deep shade near river or ravine at 900-1300 m.


NOTES. As pointed out by Christensen & Holttum (1934), *D. laevipes* is closely related to *D. spiniferum*. The two species are quite similar in size, colour and division, but the step of *D. spiniferum* is prickly, the segments all entire, the sori far from the costule, and the frond coriaceous.
32. Diplazium latisquamatum Holttum


Rhizome short, erect. Stipe 52-100 cm long, 5-9 mm thick, dark brown, nearly black at base, scales throughout, more dense at base; scales rounded-ovate, dark brown, center thicker, margin entire, 4-8 mm long, 2.5-4 mm broad, thickening black strand irregularly near apex. Lamina bipinnate-tripinnatifid, 50-125 cm long, about 40-80 cm wide; pinnae stalked 2.5-5.5 cm long, lanceolate, larger pinnae 26-54 cm long, 15-18 cm wide, pinnulae 10-13 pairs below pinnatifid apex of pinnae, basal pinnules a little reduce, smaller on acroscopic than on basiscopic side; pinnulae sessile on upper ones, shortly staked on lower ones, the larger 6.5-11 cm long, 1.8-3 cm wide, base broadly cuneate to subtruncate, gradually narrowed to acuminate apex, margin lobed to within 1.5-2 mm of the costa (3/4 way to costa), lobes slightly oblique, 2.5-6 mm wide, commonly 5 mm wide, apex truncate, margin entire or toothed near apex; texture thin, firm; rachis occasionally gemmiferous at the adjacent to the costae at the apex of lamina, glabrous; costae bearing scattered small rounded-ovate scales beneath; veins pinnate in lobes, veinlets 5-7 pairs, simple or forked. Sori covering 1/4-1/2 way of veinlet, acroscopic basal veinlets usually diplazioid. Indusia thin, brown, broad, torn from margin to the base when opening, persistent.

**DISTRIBUTION.** Malay Peninsula, Java, Borneo.

ECOLOGY. In moist shady valley of montane forest. These plants often grow in very wet ground. Elevation: 1200-2700 m.

**SPECIMENS EXAMINED --- JAVA:** Matthew 609; Meijer 1453, 1818; Popta 203; Raciborski 108. --- MALAY PENINSULA: R.E. Holttum SFN 31311 (holotype, SING!). --- BORNEO: J. & M.S. Clemens 27122, 27951, 28391, 29716, 32516, 32952.
33. Diplazium lobbianum Moore

*Diplazium lobbianum* Moore, Ind. Fil.: 331. 1861; Alderw., Malay. Ferns
Hand.: 408. *Asplenium lobbianum* Hook., 2nd Cent. of Ferns, t. 17. 1861.

Rhizome short, erect. Stipes up to 70 cm or larger. 7 mm diam. when dry, glabrescent, dark brown, black and scales toward base, distinctly grooved on upper surface; scales subulate, to 15 mm long, 5 mm wide at base, brown, toothed with thickening black strand at margin. Lamina simple pinnate, oblong-ovate in outline, up to 53 cm long, 27 cm wide near subbasal, pinnae to 18 pairs below deltoid acuminate with deeply lobed of terminal frond; pinnae subhorizontal, ascending, oblong lanceolate to linier-oblong, lower ones on stalk to 3 mm long, basal pinnae up to about 10-14 cm long, 2-2.8 cm wide or larger, subbasal pinnae 14-15.5 cm long, 2.3 cm wide, upper base subtruncate, lower base slightly rounded, upper pinnae sessile with obliquely rounded-cuneate at base; margin entire on lower part, toothed near apex, apex acuminate, subfalcate; texture thinly coriaceous, vein-group at an angle 50° to costa, forked near costa, upper branch simple, soriferous, lower branch forked 1-2 times again, scarcely 3 times, basiscopic and also one pair subbasal soriferous. Sori on acroscopic veinlets elongate nearly from the costa almost reaching the margin or more far (covers ½-3/4 way to wargin), usually diplazioid, basiscopic veinlets soriferous also, shorter, mostly simple; ndusia frim, fragile, brown, margin entire, persistent.

**SPORES.** Monolete, bilaterally symmetrical (made asymmetrical by perine), heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view concave-convex to plano-convex; equatorial transverse view, proximal face planar to concave, distal face hemispherical; perinate. E: 38.20(46.10) 51.87±3.22; P: 20.47(26.28)32.81±3.73. Laesure: concealed by perine ridge or wing-like muri. Perine: costate-alate; wing-like muri surrounds the spore without forming reticulation or with forming loose reticulations, terminating margins ciliate; surface of perine smooth to scatterly ciliate or pappilate. Exine: often visible through perine under LM, smooth under SEM.

**ANATOMY.** Tranverse section of stipe near lamina: vascular bundle form an anterrupted U-shaped with angle about 115°, base flat on inward and
outward directions, angle and end not forming ridges. Stomata: polycytic and seppolycytic.

**CHROMOSOMES.** $2n=164$ (Cytotype: T.Ng. Praptosuwiryo 720, BO).

**DISTRIBUTION.** Java, Philippines, New Guinea.

**ECOLOGY.** On moist ground or humus-rich soil in mountain slopes secondary and primary forest in altitude between 1500-1800 m sea level.

**SPECIMENS EXAMINED.** --- JAVA: Backer 14716, 15910; Donk 612, 632, 771; Popta 204; Posthumus 204; T.Ng. Praptosuwiryo 720, 722, 723, 1190, 1240, 1239, 1245, 1246, 1251, 1346, 1487 (G. Slamet), 1488 (G. Slamet); Raciborski 52.

34. **Diplazium lomariaceum** (Christ) Price


Scales blackish, shiny, entire, to 9 by 1 mm, gradually narrowed to a hair-tip, abundant and persistent on stipe, rachis, costae, and vein beneath. Stipe of fertile fronds to 15 cm long, of sterile tp 9 cm. Lamina narrowly elliptic, to 50 by 9.5 cm, deeply pinnatifid, one pair of reduced basal pinnae sometimes free and sessile; lobes to 4.5 by 1 cm, oblong-lanceolate, narrowing towards apex, subentire, blunt. Colour dark greenish-brown, more or less shiny below when dry, dark bluish-green when living; rachises above with a channel formed by raised cartilaginous sides, either continuous or interrupted at each junction with a middle of a lobe, and paleate at that point whether or not interrupted; indusia brown, margin erose. Spore brown, with irregular short wing.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) elliptical; equatorial longitudinal view (excluding perine) biconvex; equatorial transverse view, proximal face convex, distal view hemispherical; perinate. E: 35.03(39.41)54.55±4.20; P: 19.55(24.57)30.13±3.46. Laesura: concealed by wing-like costae. Perine: alate to costate-alate, alae forming loose reticulation; irregular envelope separated from exine surrounds the spore in wing-like muri reticulation, lacunae large, 13-21µm; wing-like muri thin, project 3-10 µm, terminating margin waved or almost entire. Exine: visible through perine, rough rugulate under SEM.

DISTRIBUTION. Philippines, Borneo, Sumatra, Celebes, Ceram, New Guinea.

ECOLOGY. This species usually grows in moist montane forest, 400-2000 m.

SPECIMENS EXAMINED --- BORNEO: Garry Shea SHEA 23160; Maskuri 845; Veldkamp 7874. -- SUMATRA: CJ Brooks 322S.

NOTE: Price (1983) state that the holotype was destroyed in 1945 at the PNH so he designated the MICH specimen as lectotype. *D. porphyrolepium* and *D. porphyrophyllum* are not except not exceptional in any way. The latter had a syntype purportedly from Sumatra, Brooks 322S. Price (1983) designated the specimen from Ceram at L as lectotype. *Athyrium altum* is a form with narrow fronds not otherwise distinguishable. Three specimens from eastern Kalimantan
(Kortermans 9089, Meijer 577, 872 – all L) differ by having fewer and brownish paleae but agree in distribution of paleae, and in frond form and colour. Diplazium lomariaceum is very closely related to D. porphyrorachis and until now the name seems to have been ignored since Christ himself reduced lomariaceum to porphyrorachis in Ann. Jard. Bot. Buitenz. 15 (1989, p. 119).

35. Diplazium loerzingii Praptosuwiryo, sp. nov.

TYPE: SUMATRA. North Sumatra, E. Mount Sibajak, Upper Petani Valley, primary forest, 1250-1350 m, 5 Feb. 1929, J.A. Lörzing 15124 (holotype, BO).

Rhizoma breve erectum. Stipites ad 45 cm longi, in sicco brunnei, basin versus aquamis brunneis nitidis lanceolatis, ad 13 mm longis 1.5 mm latissimis acuminatis vestiti. Lamina pinnata lanceolatis, ad 75 cm longa et 32 cm supra basin lata, pinnae ad 24-jugatae; rachis supra sulcata, infra acem gemmifera. Pinnae subbasales maximae (1-3 jugatae deflexae), petiolulatae ad 5 mm longae, lanceolatae, ad 17.5 cm longae, 2.8 cm latae, basi truncatae, apice attenuatae, margine ½-2/3 costam lobatae; lobi maximi ad basim, 5-9 mm lati, apice truncati, margine apices leviter dentati. Rachis supra sulcata, glabrae, infra apicem gemmifera. Textura subcoriacea vel plus solid; in vivo colorae supra atrovirides, subtus pallidus. Venae perspicuus in uno lobo 3-5 jugatae, plerumque 5 jugatae, omnes simplices. Sori medius in 1/3-3/4 longitudine venularum. Indusia brunneus, in affixus atro brunneus, marginem integrum, non revolutus, persistens.

Rhizome short, erect, scales densely on younger part; scales lanceolate, 7-13 mm long, 0.5-1.5 cm broad, dark brown-blackish, with thickening black strands, shining, margin entire. Stipe 33-45 cm long, 4-5 mm thick, pale brown when dry, black at base, fallen scales. Lamina lanceolate, pinnate, 61-75 cm long, 24-32 cm broad, pinnae 22-24 pairs below pinnatifid triangular apex of lamina. Lower pinnae stalked to 3-5 mm long, 2.3-3.6 cm apart, oblong-lanceolate, larger ones 10.3-21.3 cm long, 1.8-3.2 cm broad, base of 1-3 pairs basal pinnae cut away lower, base truncate, margin lobed to ½-2/3 way to costa, apex attenuate, toothed; upper ones adnate-sessile; lobe widest at base, larger ones 5-9 mm broad, ends truncate, slightly toothed. Rachise gemmiferous, bearing buds at the adjacent
between rachis and costa, glabrous, costa glabrous. Texture subcoriaceous or firmer, dark green upper surface, pale green lower when living. Veins free, pinnate in the lobus, mid-veins of lower lobus forming angle 70-75° to costa, veinlets 3-5 pairs, commonly 5 pairs, distinct, simple, all reaching margin, forming angle 25-30° to midveins. Sori medial, (leaving sterile part of veinlets 1.5-2.5 mm) or close to margin of lobus, elongate cover 1/3-3/4 of veinlet length, basal acroscopic diplazioid. Indusia broad, brown, attachment side darker, margin entire, opening when mature, not rolled back, persistent.


CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 2339c, 123 (T.Ng. Praptosuwiryo 2339d).

DISTRIBUTION. Java and Sumatra.

ECOLOGY. Secondary and primay forest, light-deep shady places, on moist and humus rich soil. 1250-1400 m.

NOTES. Diplazium loerzingii is closely related to Diplazium malaccense. This species differs from D. malaccense in the following characters: lower base of 1-2 pairs basal pinnae less cut, base of lower pinnae almost equally truncate, texture thicker or subcoriaceous, upper rachis much gemmiferous, lobes truncate, sori medial on veinlets or close to margin, attachments sides of indusia darker.

ETYMOLOGY. This species is named after J.A. Lörzing who collected this plant for the first time. He collected D. loerzingii in 1920 at Mt.Sibajak Sumatra. Nine year after that he collected this plant again in the same place. C.J. Brook also found this species at Mt. Dempo (Sumatra) in 1923. I found this plant at Mt. Halimun (Java) and Bukit Tapan (Kerinci Seblat National Park, Sumatra) respectively in February and September 2006.
36. Diplazium malaccense Presl.,


Rhizome short, ca. 1.5-1.8 cm diam, erect, densely scales on young part. Stipe 39-48.5 cm long, 0.3-0.5 cm diam near base, densely scales at base; scales 10-12 mm long, 1 mm broad, lineary triangular, brown. Lamina pinnate, oblong elliptical –subtriangular in outline, 33-64.5 cm long, 15-30 cm broad, pinnae 16-19 pairs below lobed apex of lamina. Lower pinnae stalked 2-5 mm long, 1-2 pairs basal pinnae bending downward, lineary- subtriangular, 9-19.5 cm long, 1.1-2.8 cm broad, base very unequal, lower base cut away, upper truncate, upper pinnae with base subequally truncate or cuneate. Pinnae thin in texture, drying rather light green, margin lobed 1/3-2/3 way to the costa, apex acuminate; lobes about 4-7 mm wide at base, oblique, apex rounded to subtruncate, slightly toothed. Veins 4-7 pairs in each lobe, all simple. Sori from near base of veins to near margin of lamina, acroscopic basal sorus usually diplazioid. Indusia medium brown, thin but firm, narrow, margin entire.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) elliptical; equatorial longitudinal view planar convex to concave-convex; equatorial transverse view, proximal face concave, distal view convex. Laesura: concealed by wing-like muri. E: 37.73(34.24)27.53±3.03; P: 26.01(20.80)13.33±2.82. Perine: alate to costate-alate, often loosely reticulate; irregular envelope separated from exine surrounds the spore in continuous anastomosing wings, forming a loose reticulation; wing-like muri project 1.5-8 µm, terminating margins sparsely ciliate. Exine: visible though perine, smooth granulate under SEM.

ECOLOGY. In evergreen forest, terrestrial on rather moderate slope, in light shade, on humus-rich soil ground. 20 – 1000 m.

SPECIMENS EXAMINED. --- MALAY PENINSULA. Pahang: M.R. Henderson 11235; Md Nur 10508; R.E. Holttum 20788; A.B. Murdock s.n. (12 June 1913); H.N. Ridley s.n. (1891). Negeri Sembilan: R.E. Holttum 9565; Md
37. Diplazium megasegmentum Praptosuwiryo, sp. nov. Plate 7.

TYPE. JAVA. West Java, Mt. Salak, Southern Slope, Cangkuang Forest, 19 December 2002, T.Ng. Praptosuwiryo 1382 (foto) (holotype, BO).

Rhizoma breve erectum, crassum. Stipites ad 122 cm longis, prope basin 10 mm crassi, in sicco brunneis, basin versus squamis deciduis nigris rotundis vel ovatis peltatis integris imbricates vestitae. Lamina ad 100 cm longae, 80 cm latae, subdeltoideus, tripinnatifidus, pinnae ad 14-jugatae; pinnae inferus bipinnatidus, stipites ad 3.5 cm longae, lanceolatus, 50 cm longae 26 cm latae, libere pinnulae ad 16-jugatae, apice pinnatifidus; pinnulae inferus subalternatus, 2.5-3.5 cm seorsum, stitipatae ad 3 mm longae, oblongus-lanceolatus, ad 13 cm longae 3.5 cm latae, basi truncatae, apice acumitae, margine lobatae segmenta formantes, segmenta inferiors opposes plus minus opposite, 2.5-5.0 cm seorsum, sessilis; segmenta superius subalternatae; segmenta maximae 2.4 cm longae et 8 mm latae, apice rotundatus-acutus, margine 1/3-1/2 versus venae principalis; pinnae medius pinnatus, pinnae superius pinnatifidus. Venae liberis, in segmento pinnatus, venulae ad 6-8-jugatae, in lobo furcatis vel bifurcate. Sori e basi venulae ramis acroscopicus 1/3-1/2 extensi, plerumque in basi venulae acroscopicus diplazioideus. Indusiis brunneus, margine laciniatus, ante sporangiis maturis aperiens, persistens.
Rhizome erect, stout. Stipes dark brown, 122 cm long, 10 mm diam. near base, fallen scales; scales rounded, ca. 6 mm long and broad. Lamina bipinnate-tripinnatifid, subdeltoid in outline, 100 cm long, 80 cm broad, pinnae to 14 pairs, lower pinnae bipinnatifid, middle pinnae pinnate, upper pinnae pinnatifid. Larger pinnae stalked to 3.5 cm long, lanceolate, 50 cm long, 26 cm broad, free pinnulae 16 pairs below pinnatifid apex of pinnae. Lower pinnulae subalternate, 2.5-3.5 cm apart, shortly stalked to 3 mm long, oblong-lanceolate, 13 cm long, 3.5 cm broad, base truncate, apex acuminate, margin lobed deeply to within 1 mm of costa forming segments; lower segments opposite, 2.5-5.0 mm distance, sessile; upper segments subalternate below deeply lobed acuminate apex of pinnulae; larger segments oblong, 2.4 cm long, 8 mm broad, apex rounded-acute, margin lobed 1/3-1/2 way to main vein. Veins free, pinnate in the segments, to 6-8 pairs Veinlets once-twice forked in lobes. Sori bearing on basal acroscopic branch of veinlets, elongate from basal covers 1/3 -1/2 of their length, diplazioid on basal acroscopic veinlets. Indusia brown, persistent, opening when sori young, margin laciniate.


SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) concave-convex; equatorial transverse view, proximal face convex, distal face convex; perinate. E: 39.61(51.42)57.01±4.28; P: 18.51(31.49)35.85±3.59. Laesura: concealed by perine. Perine: alate; alae sometimes loosely reticulate; wing-like muri project 4-13 μm, terminating margins almost entire.

DISTRIBUTION. Java.

ECOLOGY. Diplazium megasegmentum is growing well on moist humus-rich soil in shady places.

NOTES. Diplazium megasegmentum is very distinct among Javanese species Diplazium in the combination of the following characters: pinnules cut to within 1 mm of costa to form a big oblong segments to 8 mm broad that lobed again to 1/2 way to main vein; basalis sori which not more than half away to the
main vein. It grows on moist humus-rich soil in shady forest in southern slope of Mt. Salak West Java.

ECOLOGY. The species epithet is from the Latin *mega* and *segmentum* meaning the large segment in illustrating the large size of its large lobed segments.

38. *Diplazium megalosimplicifolium* Praptosuwiryo, sp. nov. Plate 8.

TYPE: Borneo: Bukit Raya, Tumbang Tubus, Veldkamp 7998, 150 m, 5 May 1983 (holotype, BO).

Rhizome breve erectum, gracilis. Stipites ad 15 cm longae, in sicco brunneus dilutus, glabrous, basi deciduis squamatus; squamis (?). Lamina simpliter, ellipticus, ad 40 cm longae, 7.5 – 10.6 cm latae, angustatus versus apicem acuminatus, gradatim decrescens versus basin qui subito contractus et latitude 1 cm vel minus, basi cuneatus, margine integrae; subcartaceus; rhachides prominens; venae in parvus caterva in angulum 65-70º cum costa formantes, ad 5-7 mm seorsum, ramis basalis acroscopicus et venulae anastomosis diplazioid. Indusiis dilutis brunneis, integris, persistens.

Rhzomae short, erect, slender. Stipe 14-15 cm long, pale brown, glabrous, fallen scales at base. Scales on stipes (?). Lamina simple, elliptical, to about 40 cm long, 7.5 – 10.6 cm wide, narrowed toward acuminate apex, narrowed gradually to the base which is suddenly contracted from a wide of 1 cm or less, base subequally cuneate, margin entire. Texture thin, subcartaceous pale green on upper surface when dry, paler beneath. Rachis distinct on both surface; veins in small group at an angle about 65-70º to the costa, the group about 5-7 mm apart, each vein group forked at the costa, lower branch forked 5-7 times, lateral members of the vein group copiously anastomosing (2/3-4/5 way from margin to costa). Sori elongate along lateral veins, both outer and inner vein group forming areoles about 1.5 mm wide, basal acroscopic branch and also those anastomosing veinlets diplazioid. Indusia thin, pale brown, margin entire, persistent.

DISTRIBUTION. Borneo.
ECOLOGY. This species grows terrestrially on lowland mountain forest at 150 m. Hitherto it has only been found in Bukit Raya.

NOTES. This species is very distinct among Malesian Diplazium in characters combination as follow: Lamina simple elliptical with base subequally cuneate, veins copiously anastomosing to 4/5 way of margin to form areoles about 1.5 mm wide on both outer and inner veins group. This species similar to simple frond of D. cordifolium in its copiously anasomousing veins so that the specimen was formerly identified as D. cordifolium by de Joncheere. Unfortunately, scales that is the important characteristic for identifying Diplazium is fallen, not found on the specimens.

ETYMOLOGY. The species epithet is chosen in illustrating the large simple frond.

39. Diplazium meijerii Praptosuwiryo, sp. nov. Plate 9.

TYPE: Sumatra: Central Sumatra, Payakumbuh, Northern slope of Mt. Sago, 900-1200 m, 21 July 1955, W. Meijer 3772 (Holotype, BO).

Rhizome subprocumbent. Stipites ad 62 cm longis, prope basin 4 mm crassi, in sicco dilutus brunneus, basi nigris squamis; squama nitidus nigris, linearis lanceolatis, ad 9 mm longis 1 mm latis, margine regularis dentatus cum filum niger spissescens, dentatis furcatis. Lamina ad 50 cm longis et latis, bipinnata deltaideus; pinnae inferiora stipitae ad 6.5 mm latis, ad 9 cm seorsum, ascendens, oblongis subtriangularis, ad 28 cm longis 12 cm latis, pinnulae ad 13 jugatae; pinnulae inferiora stipitae at 2 mm longis, superiores adnatae vel sessile, lanceolatis, ad 7.5 cm longis, 2 cm latis, basi truncates, apice acuminatus, marginae 2/3-3/4 costam lobatae; lobus basalis acrosopicus multus deminutus ad 2 latis, lobi magniora ad 6 mm latae, obiquus, basin latissimus, apice truncates vel to roundrotundatus, integer; venae liberae, in lobo pinnatus, venulae ad 6-8-jugatae, simplices vel furcatis. Textura tenuis papyraceous. Sori medius in 1/4-3/4 longitudine venularum. Indusiis tenuis, paleis Brunneis, persis, margine laciniatus.
Rhizome subcreeping (?), densely scales on younger part. Stipe to 62 cm long, 4 mm thick, light brown when dry, black and scales at base; scales linear lanceolate, to ca. 9 mm long, 1 mm broad, black, shiny, margin toothed, with regularly thickening black strands, teeth forked at tip. Lamina bipinate, deltoid, ca. 50 cm long and broad; lower pinnae stalked to 6.5 cm long, to 9 cm apart, ascending, oblong subtringular, to 28 cm long, 12 cm broad, pinnulae to 13 pairs; lower pinnulae stalked to 2 mm long, upper adnate to sessile, lanceolate, to 7.5 cm long, 2 cm broad, base truncate, apex sharply acuminate, margin lobed 2/3-3/4 way to costa; basal acroscopic lobes much reduce to 2 mm broad, larger lobes to 6 mm broad, oblique, broadest at base, apex truncate to rounded, entire; rachise not gemmiferous; veins free, pinnate in the lobes, veinlets 6-7 pairs, commonly 7 pairs, simple or once forked. Texture thinly papyraceous. Sori medial, cover ¼-3/4 of veinlets length; indusia thin, pale brown, persistent, margin laciniate.

**DISTRIBUTION.** Sumatra.

**ECOLOGY.** Terrestrially, in primary forest at 900-1200 m.

**NOTES.** Diplazium meijeri may closely related to *D. latisquamatum*. *D. meijeri* differs from *D. latisquamatum* in its black linearly toothed scales with regular thickening black strands; sori medial. *D. latisquamatum* has dark brown round-ovate entire scales with irregularly thickening black strand; sori basalis.

**ETYMOLOGY.** This species is named after W. Meijer, the collector of this species.

40. **Diplazium melanolepis** Alderw.


Rhizome (?). Scales on stipes dark brown, concolour, lanceolate, 5-12 mm long, 1-2 mm broad, margin toothed, Stipe 56 cm long, 7 mm thick, blackish when dry, scales throughout, dense toward base. Lamina bipinnae-bipinnatifid, pinnae (? pairs; lower pinnae stalked to 13 mm long, 7.5 cm apart, almost at right angle, lanceolate, widest one third from the base, 34.5 cm long, 8 cm broad, pinnulae 20 pairs below pinnatifid apex of pinna; pinnulae adnate-sessile, oblong-lanceolate,
one pair basal reduced to 12 mm long, 3.5 mm broad, larger pinnulae to 5.2 cm long, 0.9 cm broad, commonly less than 4 cm long, 0.8 cm broad, apex rounded-acute, margin lobed to 1/3 way to costule; lobe 2-2.5 mm broad, oblique, ends subtruncate, slightly toothed. Rachis and costae scales. Texture firm. Veins forming angle 40-50° to costule, free, forked at costule, upper branch simplend soriferous, usually diplazioid, lower branch simple or forked once-twice again, basiscopic branch usually also soriferous, asplenoid. Sori from basal cover 2/3-3/4 of their length. Indusia dark brown, usually rolled back, persistent, margin entire.

DISTRIBUTION. Sumatra.

ECOLOGY. Occurs in light shade, on mountain forest at ca. 1900 m above sea level.

SPECIMENS EXAMINED. --- SUMATRA: C.G. Matthew 507.

41. Diplazium moultonii (Copel.) Tagawa


Lamina tripinnatifid, (?) cm long, 25 cm broad; pinnae numerous, (?) pairs. Pinnae alternate, about 3-4 cm apart, costa forming an angle about 70-80° to rachis, stalked to about 8 mm long, oblong subtriangular, to about 28 cm long, 8 cm broad, pinnulae to 24 pairs below pinnatifid apex of pinna, gradually decrease in size towards apex of pinna; pinnulae almost at right angle to costa, shortly stalked to 33 mm long; lower pinnule oblong subtriangular, to about 6 cm long, 1.6 cm wide, base subequally truncate, lower segmented, segments 1-4 pairs, upper deeply lobed to 4/5 – 6/7 way to costule (deeply lobed to within 1 mm of costule), apex acuminate; segments adnate to sessile, forming an angle about 60° to costule, oblong, to about 9 mm by 4 mm, apex rounded, crenulate. Veins pinnate in each segment, free, to 4 pairs, veinlet simple in each crenation, distinct, black when dry. Sori from basal costule cover veinlets 1/3 of their length. Indusia brown, thin, broad, persistent, margin tearing of.

DISTRIBUTION. Borneo.
ECOLOGY. Growing on shade parts of ridge mountain forest at 1100-1850 m sea level.


42. Diplazium pallidum (Blume) Moore


**Key to the varieties**

Terminal pinna deltoid and deeply lobed; upper base of lateral pinnae broadly truncate, lower base narrowly rounded  …………………………………………………………… var. _pallidum_

Terminal pinna conform to lateral or with one or two lobes; upper base of lateral pinnae rounded, lower base cuneate  …………………………………………………………… var. _montanum_

a. var. _pallidum_

Rhizome erect, suberect. Stipe 17-57 cm long, black and scales densely at base; scales dark brown, nearly black, concolours, 7-13 mm long, 1-1.8 mm wide. Lamina nearly oblong, pinnae 11-27 pairs; rachis grooved on upper surface; pinnae 7.8-23.5 cm long, 1.2-2.6 cm wide; lower pinnae on stalk up to 5 mm long, upper pinnae sessile, apical lamina of the frond deltoid and deeply lobed; upper pinnae with cuneate base, lower pinnae with base broadly truncate, lower base narrowly rounded; margin of pinnae toothed, apex toothed acuminate; texture subcoriaceous; veins free, forked near the costa, upper branch simple and soriferous, lower branch forked again 1-3 times. Sori on acroscopic veinlet
simple, sometimes double, reaching from the costa almost to margin of pinnae. Indusia firm, persistent, dark brown, margin entire.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical; equatorial longitudinal view (excluding perine) plano-convex; equatorial view transverse view proximal face convex, distal face hemispherical; perinate. Size: E: 32.65±8.98; P: 17.08±5.12. Laesura: concealed by perine. Perine: alate under LM, costate under SEM, irregular envelope separated from exine surrounds the spore in irregular, wing-like costae, often anastomosing to form loose reticulation, lacunae shallow irregular polygons 15-18 µm wide, muri 0.8 – 5 µm wide, surface of muri smooth and lacunae smoothly granulate. Exine: visible through perine, granulate under LM.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped with an angle 105°, base flat, ends bluntly ridge both inward and outward.

CHROMOSOMES. 2n = 164  (Cytotype: T.Ng. Praptosuwiryo 1151, BO).

DISTRIBUTION. Malay Peninsula, Sumatra, Java.

ECOLOGY. Grows in shady forest in the hills and mountains, 1000 – 1600 m.


b. var. montanum (Alderw.) Praprosuwiryo, com. nov.


Pinnae to 16 pairs, 8.5-21 cm long, 1.3-2.3 cm wide; lower pinnae on stalk 2-4 mm long, upper base rounded, lower base cuneate; upper pinnae sessile with
broadly cuneate base; terminal pinane like others, occasionally with one-two rounded lobes; margin of pinnae shortly toothed or almost entire.

CHROMOSOMES. $2n = 82$ (Cytotype: T.Ng.Praptosuwiryo 1406, BO).

DISTRIBUTION. Sumatra, Java.

ECOLOGY. Terrestrial. Dense jungle, rich soil on rock, wet ground. Elevation: 20 – 400 m.


NOTES. All specimens examined here are treated as *D. montanum* v.A.v.R. by Holttum (1940). He stated that this species differs from *D. pallidum* Bl. In having the apical pinna like others (in *D. pallidum* the apical lamina of the frond is deltoid and deeply lobed), and in having the lower pinnae with much narrower bases (in *D. pallidum* the lower pinnae have s broadly truncate upper base). He added, based his field experience, that *D. pallidum* has fertile fronds from young stage of development, whereas *D. montanum* does not produce fertile fronds untiul the palants are full grown. *D. pallidum* occours in Sumatra on higher parts of the mountains, matching Java specimens exactly; *D. montanum* appears to occur at lower levels in Sumatra, thus falsifying its name. In Peninsula *D. pallidum* does not occur. *D. montanum* occurs in forest at low and medium elevations.
43. Diplazium parallelivenium Praptosuwiryo, sp. nov. Plate 10.

TYPE: Java, West Java, G. Halimun, Track Cikuda Paeh – Cikaniki, ca. 1300 m s.l., 25 February 2006, T.Ng. Praptosuwiryo 2338 (holotype, BO).

Rhizoma breve erectum. Stipitus 62 cm longis, 8 mm crassis in sicco niger in basi, squamis sparsim penitus; squama bruneis nitidis linearis lanceolatis ad 6-12 mm latae 0.5-1 latae, margine dentatis cum filum niger spissescens. Lamina ad 94 cm longis et latis, bipinnata sudbeltoideus, pinnae 9-jugatae; pinnae inferiora stipitae ad 3.2 cm longis, oblongis subtrianlaris, ad 48 cm longis 29 latis, pinnulae 9-11-jugatae; pinnae inferiora stipitae ad 3.5 mm longis, pinnulae superiora adnatae latisissimis cuneatis; pinnulae magniore ad 14.7 cm longis 3.2 cm latis, lanceolatis, basin truncatus, margine 1/5-1/3 costam lobatae, plerumque 1/5-1/4 costam lobatae, apice attenuatis; lobi ad 9 mm latis truncates dentatis, lobi basalis basiscopicus magissimathe; venae liberis, in lobo pinnatus, venae principalis angulum fere 60º cum costa formantes, venulae 6-7-jugatae, simplices vel furcatis in lobi basalis acroscopicus, venulae basasimus acroscopicus nondilatatus. Sori costulis, in ½ vel minus longitudine venularum (2.5-7.5 mm latis), basalis acroscopicus diplazioideus. Indusiis tenuis angustatus dilutus brunneus, persistens, revolutus, laceratus.

Rhizome stout, short, erect, scales on younger part. Stipe 62 cm long, 8 mm thick when dry, black at base, sparsely scales throughout; scales dark brown, linearly lanceolate, 6-12 mm long, 0.5-1 mm broad, margin toothed with thickening black strand regularly. Lamina subdeltoid, ca. 94 cm long and broad, bipinnate, pinnae 9 pairs; lower pinnae stalked to 3.2 cm long, oblong subtriangular, to 48 cm long, 29 cm broad, pinnulae 9-11 pairs; lower pinnulae stalked to 3.5 mm long, upper pinnulae adnate with broadly cuneate; larger pinnulae to 14.7 cm long, 3.2 cm broad, lanceolate, base truncate, margin lobed 1/5-1/3 way to costa, commonly 1/5-1/4 way, apex attenuate; lobes to 9 mm wide, basal basiscopic the largest, ends truncate, toothed; veins free, pinnate in the lobes, midveins commonly forming angle about 60º to costa, veinlets 6-7 pairs, simple or once forked on basal acroscopic lobes, basal acroscopic ones not dilated. Sori costular, cover ½ or less of veinlets length (2.5-7.5 mm), basal
acroscopic diplazioid. Indusia very thin, narrow, light brown, persistent, rolled back, margin lacerate.

**DISTRIBUTION.** Java.

**ECOLOGY.** This species is found in moist soil, red clay mixed with humus rich soil, in shady place at about 1300 m.

**NOTES.** *Diplazium parallelivenium* closely related to *D. vestitum*. This species differ from *D. vestitum* on the following characters combinations: Stipe smooth, not muricate or spiny; pinnulae lanceolate; midvein commonly forming angle 60° to costa; sori is not more than ½ of veinlets length; indusia rolled back, lacerate. *D. parallelivenium* is also closely related to *D. dolichosorum*. The two species share linearly black scales, pinnulae with truncate base and shallow incision margin to form truncate lobes, and free simple veinlets. *D. parallelivenium* differ from *D. dolichosorum* on the following character combinations: lamina subdeltoid, pinnulae lanceolate with sharply acumin ate or attenuate apex, basal acroscopic veinlets parallel to the other veinlets; while *D. dolichosorum* have lamina ovate, pinnulae oblong with acute or acuminate apex, basal acroscopic veinlets curved.

**ETYMOLOGY.** The species epithet *parallelifolium* is used because basal acroscopic veinlets are parallel to the others. It is a distinct character that differentiate from other bipinnate West Malesian *Diplazium* species.

### 44. *Diplazium petiolare* C. Presl

*Diplazium petiolare* C. Presl, Epimel. Bot.: 86. 1849.

Rhizome short, erect, densely scales on younger part. Stipe slender, 41.5-51 cm long, 2-2.5 mm diam. near base, light brown, black at scales base, upper glabrescent; scales linearly triangular, concolour, dark brown, margin sharply toothed. Lamina pinnate, subtriangular in outline, 34-45 cm long, 17.5-26 cm broad, pinnae 15-17 pairs below pinnatifid apex of lamina; lower pinnae stalked 2-4 mm long, lanceolate, to 8.2-13 cm long, 2.1-3 cm broad above base, base subequally cuneate, apex sharply acumin ate, margin lobed to ¾ way to costa; lobes about 5 mm wide above base, slightly oblique; rachise glabrescent; texture herbaceous; light green above when dry, paler beneath, surface naked; veins free,
Pinnate, forming an angle about 60° to costa, veinlets 4-7 pairs, simple, forming an angle about 25° to costules. Sori almost on all veinlet, sometimes the last pair no sori, elongate from near base cover their length, basal veinlets acroscopic, sometimes subbasal also; indusia brown, persistent, margin entire, opening when mature.

CHROMOSOMES. 2n = 82 (Cytotype: TT993.3, BOHB).

DISTRIBUTION. Sumatra, Borneo.

ECOLOGY. Occurring on shade places in the forest. Elevation: ca. 450 –1000 m sea level.


45. Diplazium poiense C.Chr. in C.Chr. & Holttum

*Diplazium poiense* C.Chr. in C.Chr. & Holttum, Gard. Bull. S.S. 7: 269. 1934. --- TYPE: R.E. Holltum 25380 (Holotype, SING!), Borneo, Tenompok, Mt. Kinabalu, 1430 m.

Rhizome erect, suberect. Stipe dark brown, 35-40 cm long, ca. 4 mm thick, scales at base; scales brown, shining, linearily lanceolate, 6-8 mm long, 0.25-1 mm broad, concolorous, margin entire, without thickening black strand. Lamina pinnate-bipinnate, oblong lanceolate, 38.5 cm long, 17 cm broad, pinnae 27 pairs below pinnatifid apex of lamina; lower pinnae stalked to 4 mm long, subfalcate, to 8.5 cm long, 1.8 cm broad, lower base narrowly cuneate, upper base truncate, apex acuminate, margin lobed ½-5/6 way to costa; lobe oblong, oblique, basal acroscopic the largest, 3-5 mm wide, subtruncate-acute, slightly toothed; veins free, pinnate in the lobe, rather hardly observed, veinlets to 10 pairs, simple. Sori impressed, elongate ½-2/3 from margin; indusia broad, persistent, brown, concolor, margin entire, opening when mature.

DISTRIBUTION. Borneo.

ECOLOGY. Growing on shade part of mountain forest at ca. 500-1700 m sea level.

46. Diplazium polypodioides Blume


Rhizome stout, erect, to about 10 cm diam., 15 cm cm hight, scales like on stipes. Stipe stout, about 9 mm dian near base, 36=110 cm long, densely scaly near base, surface prickly; scales narrowly linier, 20-50 by 1-2 mm, thick, dark brown, black and toothed at margin. Lamina bipinnate-tripinnatifid, ovate-subdeltoid in outline, 50-156 cm long, to about 70 cm wide; pinnae 21-60 cm long, 11-17 cm wide, narrowed oblong subtriangular, shortly stalked, with 13-26 pairs of pinnules below deltoid lobed apex of pinna; largest pinnuler 6.5-16.5 by 1.2-2.1 cm, oblong with acuminate apex, base subtruncate, sessile or lowest shortly stalked, margin deeply lobed near costules; lobes oblong to subquadangular, oblique, rounded to obtuse at apex, sharply serrate, 6-15 mm long, 2-5 mm wide; texture papyraceous, dark green, paler beneath; veins pinnate in each lobe, veinlets 5-11 pairs, usually simple, sometimes once forked. Sori
usually on almost all veinlets, from base half-way or more close to margin, basal
veinlet sometimes diplazioi; indusia thin, persistent.

SPORES. Monolette, bilaterally symmetrical (made asymmetric by
perine), heteropalar; polar outline (excluding perine) transversely elliptical, sides
convex; equatorial longitudinal view plano-convex to concave-convex; equatorial
transverse view, proximal view planar to concave, distal view convex; perinate.
Size: E: 34.36(39.63)43.17± 3.33, P: 16.31(22.92)27.84±2.97. Laesura: concealed
by wing-like perine. Perine: costate-alate, loosely reticulate; irregular envelope
separated from exine surround the spore with costae forming loose irregular
reticulation or wing-like muri, reticulation often incomplete, lacunae large
irregular polygons, 3-9 µm across; wing-like muri project 1-7µm, terminating
margins entire; surface or perine smooth under SEM.

ANATOMY. Vascular bundle form uninterrupted U-shaped with an angle
105°, base and angle ridges on both inward and outward directions, end
develops large ridges and grooves becomes somewhat W-shape.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 1647, BO).

DISTRIBUTION. Assam, Sri Langka, SW China, Taiwan, throughout
Malesia.

ECOLOGY. On moist ground, humus rich soil in shadowed places in
mountain slopes forest elevation 200-1900 m sea level.

VERNACULAR NAMES. Pakis benik (Bengkulu).

USES. Young fronds of this species are sold in the local marked of
Sumatra as vegetables.

SPECIMENS EXAMINED --- JAVA: Alston 12671; Backer 8898;
9185, 9812 bit, 9847, 10242, 10412, 12024, 12906, 14158, 16043,
16231, 18447, 18621; Backer & Posthumus 44, 91, 122, 207, 258, 541;
Bakhuizen v/d Brink 88, 2011, 2530, 3252, 5677; Beguin 12, s.n. (5-1927);
Clason s.n. (27-5-1931), F101, F97, K173; Blume s.n., Clason-Laarman K142,
K162; Dillerogn 707; Donk 355, 357, 602; Groenhart s.n. (Malang); Hallier s.n.
(23-11-1894), 682, 685; Heurn s.n. (7-1935); Kern 8459; Koorders 15442B,
22881B, 41113B, 41164B, 43738B; Laarman K169; Posthumus 1460a, 1666;
Popta 84, 94; D.R. Pleyte 32; T.Ng. Praptosuwiryo 533, 536, 549, 605, 609, 703,
NOTES. I justify *Athyrium ophiodontum* Copel. as new synonym of *D. polypodioides* Bl. The size of the middle pinnae, 11 x 3 cm, is slightly larger than that recorded for *D. polypodioides* in Holttum (1940). Otherwise there is no differences between the Philippine specimen and the materials from BO and SING.

47. *Diplazium porphyrorachis* (Baker) Diels


Rhizome erect or short-creeping, bearing weary roots, clothed with lanceolate-acuminate, dark-brown scales at the extremity. Stipes ca. tufted, firm, slender, 5-50 cm long, scaly at the base, black-hairy or scaly above, the hairs or scales deciduous; scales 2 mm long, 0.25 mm broad, dark brow, stiff, deciduous. Lamina pinnatifid, 16-25 cm long, 3.5-5.5 cm broad, lanceolate, apex lobed or toothed, the lower 2/3–6/7 deeply pinnatifid into many or numerous, close, spreading, subfalcate, linear oblong, blunt, slightly crenate, serrate or toothed segments 8-15 mm broad, which have not seldom the sides entire and only the apex serrate; lower segments gradually growing smaller, the 1-4 lowest free and deflexed; texture subcoriaceous; rachise and under surface slightly covered with
scattered scales; veins distinct, mostly once forked. Sori oblique, parallel, reaching ca. the edge; indusia dark brown, persistent, margin entire, opening when mature.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) plano-convex, ; equatorial tranverse view, proximal, proximal face planar, distal convex; perinate. E: 39.89(46.39)50.98±3.53, P: 21.74(27.57)30.49±2.87. Laesura: concealed by perine. Perine: alate to costate-alate, alae sometimes anastomosing forming loose reticulation; irregular envelope, separated from exine, surrounds the spore in loose anastomosing wing, forming a very loose reticulation, reticulation often incomplete; lacunae very irregular polygons, 10-16 µm across; muri thin, wing like muri project 1.5-9.0 µm; terminating margin ciliate or papillate; surface of perine holed, holes irregular and formed by fallen papillae

CHROMOSOMES. 2n = 164 (Cytotype: T.Ng. Praptosuwiryo 1885, BO).

DISTRIBUTION. Malay Peninsula, Borneo, Celebes (v.A.v.R., 1908)

ECOLOGY. Terrestrial on on small river banks in the forest shade at 200-1270 m sea level.

VERNACULAR MANES. Paku tuot (Dayak)

SPECIMENS EXAMINED. --- BORNEO. East Kalimantan: Tabang (32 km point), West Kutai, M. Kato & H. Wiriadianata B-6159; G. Kongkat-G. Kongbotak, Alt. 350-200, Masahiro Kato & Harry Wiriadianata B-5176; Masahiro Kato & Harry Wiriadianata B-6348; Masahiro Kato & Harry Wiriadianata B-6879; Masahiro Kato & Harry Wiriadianata B-4733; Masahiro Kato & Harry Wiriadianata B-4733; Masahiro Kato & Harry Wiriadianata B-4733; Masahiro Kato & Harry Wiriadianata B-6214; T.Ng. Praptosuwiryo 1845, 1883, 1884, 1885, 1890, 1925, 1936.

NOTES. As noted by Price (1983), D. porphyrorachis is very closely related with D. lomariaceum and some specimens shown sign of apparent gene interchange. He shows the different of the two species in the key with characters combination as follow. D. lomariaceum has scales blackish that numerously bear on stipe, rachise, costae and vein beneath, and also present above where costae
and meet rachis; frond narrowing gradually towards base, drying dark greenish brown. While *D. porphyrorachis* reveals scales brown that present on stipe, rachis, and costae beneath; frond not or only moderately narrowed downwards, drying dull grayish brown.

48. Diplazium prescottianum (Wall.) Moore


Rhizome short, erect, bearing thick black roots; scales dark brown, about 15 by 1 mm, entire. Stipe about 80 cm long, stramineous with dark brownish base, glabrous. Frond oblong, about 50 by 20 cm, pinnate; lateral pinnae stalked, ascending, falcate, caudateiattenuate at apex, rounded to moderately auricled at acroscopic and cuneate at basiscopic bases, up to 15 by 1.7 cm, shallowly crenate, terminal pinna not distinct with deeply lobed base, the lower ones like the upper lateral pinnae; thin chartaceous, dark green with paler lower surface, glabrous; costa raised below, veins twice or thrice forked, all free, glabrous. Sori elongate along basal anterior veinlets or rarely along basal posterior ones; indusia thin but firm, persistent.

SPORES. Monolete, bilaterraly symmetrical (made asymmetric by perine), heteropolar, polar outline (excluding perine) transversely elliptical; equatorial longitudinal view plano-convex; equatorial transverse view, proximal face planar, distal face concave; perinate. E: 32.72(39.11)51.44±5.16, P: 20.23(24.79)33.56±3.63. Laesura: concealed by perine. Perine: alate, costate-alate, loosely reticulate; irregular envelope separated from exine surrounds the spore in continuous anastomosing wings, forming a loose reticulation; lacunae large, irregular polygons 5-8 µm; thin wing-like muri project 4-9 µm, terminating margins ciliate or echinate. Exine: visible through perine, smooth-granulate under SEM.

DISTRIBUTION. Malaya Peninsula.
ECOLOGY. On humus-rich mountain slopes in dense forest at 1500 –
2000 m sea level.

SPECIMENS EXAMINED. MALAY PENINSULA. Perak: Kinta s.n (January 1885), C. Curtis 3369; Larut, C.G. Mathew s.n. (1905). Singapore: Ridley s.n. (1892); J.Sinclair 9376. Selangor: H.L. Hume 8997; H.L. Hume 9347.

NOTES. No. Coll. J. Sinclair 9376 (12 March 1958) showed a few
differences to the description of Holttum (1940), basal veinlets of some pinnate
vein group area sometimes uniting. But J. Sinclair stated in his notes that this
specimen matches the type specimen of *D. Prescottianum* (*Aspidium
Prescottianum* Wall.). For clarification, therefore, the type specimen should be
seen and compared to the Sinclair’s specimen.

49. Diplazium procumbens Holttum

*Diplazium procumbens* Holttum, Gard. Bull. S.S. 11: 95. 1940. Fig. 4. --

- TYPE: Malay Peninsula, Pahang, Frasser’s, R.E. Holttum SFN 36503 (holotype, SING!).

Rhizome creeping, 8-13 mm diam. Stipe 30-47 cm long, glabrescent, pale
brown, black at base. Lamina deltoid, bipinnate, 41.5 – 73 cm long, (?) wide;
largest pinnae 25-27 cm long, 12-23 wide; pinnules sessile or the shortly stalked
to 2 mm long, larger ones to 7.5 by 2-2.7 cm, base truncate, apex acuminate,
margin lobed ¾ way or more to costae; large lobes 6-7 mm wide, oblong, almost
at right angle to costae, apex rounded, slightly toothed toward apex; veins 6-7
pairs, all forked in larger lobes, usually simple in smaller ones; costae bearing
scattered small narrow brown toothed scales beneath. Sori spreading from cortule
1/3-1/2 of the length of the veins; indusia very thin, pale brown.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by
perine), heteropolar; polar outline (excluding perine) transversely elliptical;
equatorial longitudinal view (excluding perine) plano-convex; equatorial
transverse view, proximal face convex, distal face hemispherical; perinate. Size:
E: 43.03(53.78)63.20±4.72, P: 29.52(33.22)37.31±2.39. Laesura: concealed by
perine. Perine: alate under LM, costate under SEM, irregular envelope separated
from exine surrounds the spore in irregular, wing like costae, often anastomosing to form a loose reticalution, lacunae shallow irregular polygons 8-22 µm, muri 1.6-6.6 µm, surface of muri and lacunae smooth.

CHROMOSOMES. 2n = 123 (Cytotype: T.Ng. Praptosuwiryo 1173, BO).

ANATOMY. Transverse section of stipe near lamina: Vascular strand form an uninterrupted V-shaped or U-shaped with an angle 100º, end ridge in both inward and outward directions do form an angle 120º.

DISTRIBUTION. Malay Peninsula, Sumatra, Java.

ECOLOGY. Terrestrial. Rock soil, on open wet ground by stream.


50. Diplazium profluens Praptosuwiryo, sp. nov. Plate 11.


Rhizoma breve erectum, Stipites 68 cm longae, 7.5 mm crassi fere basi, in sicco nigellus penitus, basi squamus caducus; squamis rotundatis vel ovatis, ad ca. 5 mm longae, 4 mm latis, brunneis nitidis, integris. Lamina bipinnatae; pinnae inferiora stipitae ad 3.7 cm longae, lanceolatae, 51 cm longae, 23 cm latae, pinnulae ad 14-jugatae infra apice pinnatifidus; pinnulae inferiora stipites ad 2.5 mm longae, 2.5-4 cm spatium, superiora adnatus vel sessilis; pinnulae lanceolatae, basiscopicae plerumque maximae, 11-13.5 cm longae, 3.5-3.9 cm latae, basi subaeque truncatae, apice acuminate, e marginie 7/8-8/9 costam lobatae; lobi oblongi, basiscopicae plerumque longiora, oblique, apice rotundatae vel acutae, margine apicem leviter dentate. Venulae libere, pinnatae in lobo, venulae principalis inferiora angulum 70º vel patentissimus cum costa formantes, venulae 7-9 –jugatae, prerumque 7–jugatae, plerumque furcatis, 1-2 –jugatae superiora
simpliciter. Sori e basi profluens versus venulis acroscopicae ramis 1/3-1/2 longitudine venularum sedentes, sorus infimus acroscopicus diplazioideus, sorus medius acroscopicus intermidum diplazioideus. Indusiis brunneus, concolorous, persistens, integer.

Rhizome stout, erect. Stipe 68 cm long, 7.5 mm thick at base, blackish throughout when dry, fallen scales at base; scales on stipes fallen without leaving spines or protuberances on stipes surface, rounded, blackish, margin entire. Lamina bipinate; lower pinnae stalked to 3.7 cm long, lanceolate, widest at 1/3 part from base, 51 cm long, 23 cm broad, pinnulae 14 pairs below deeply pinnatifid apex of pinnae; lower pinnulae stalked to 2.5 mm long, 2.5-4 cm apart, upper adnate to subsessile with broadly cuneate base; pinnulae lanceolate, basiscopic ones usually larger, 11.1-13.5 cm long, 3.6-3.9 cm broad, base subequally truncate, apex acuminate, margin lobed to within 2-3 of costa (or 7/8-8/9 way to costa); lobe oblong, basiscopic ones usually longer, end oblique, rounded-acute, slightly toothed; veins free, pinnate in the lobes, lower main vein forming angle 70° to almost at right angle, veinlet 7-9 pairs, commonly 7 pairs, veinlets usually once forked, except those 1-2 pairs upper part (simple). Sori from basal running to acroscopic branch of veinlets, covers 1/3-1/2 way of veinlets length, diplazoid on basal acroscopic veinlets, sometimes others middle acroscopic veinlets also diplazioid. Indusia dark brown, concolours, persistent, margin entire.

PARATYPES. JAVA. West Java: Mt. Halimun, Cikaniki Forest, Jalan Macan, 1 October 2003, T.Ng. Praptosuwiryo 1818; track Cikaniki-Cikuda Paeh, near Sungai Cikuda Paeh, ca. 950 m, 30 September 2003, T.Ng. Praptosuwiryo 1798.

CHROMOSOMES. 2n = 164 (T.Ng. Praptosuwiryo 1798, BO).

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view concave-convex to plano-convex; equatorial transverse view, proximal face planar to concave, distal face hemispherical; perinate. E: 36.44(44.06)63.70±8.92; P: 23.89(29.04)43.07±5.73. Laesure: concealed by perine ridge. Perine: micro costate, costae broken, reticulate irregularly, densely echinate under SEM, echinae
single elements irregularly apart and projecting 1.1-2.1 µm. Exine: often visible through perine, smooth.

**DISTRIBUTION.** Java.

**ECOLOGY.** *Diplazium profluens* usually grows in moist humus-rich soil at shady places of small river banks.

**NOTES.** *D. profluens* is closely related to *D. latisquamatum* and shared characters as follow, scales on stipes round or ovate, entire, and nearly black; sori basalis and occupying only lower half or less of the veins, margin of pinnulae lobed to within 2-3 of costa. It is different from *D. latisquamatum* on veinlets 7-9 pairs, middle acroscopic veinlets also diplazioid, margin of pinnulae lobed to within 2-3 mm of costae (7/8-8/9 way to costa).

This species is also similar to *D. kunstleri*, but the two species is differentiated on their pinnulae incision. Pinnulae *D. kunstleri* is usually lobed 2/3 way to costa, while pinnulae of *D. profluens* lobed 7/8-8/9 way to costa.

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**51. Diplazium riparium Holttum**


Rhizome short, erect. Stipe 25-52 long, brown when dry, black and scales at base; scales 4-8.5 mm long, 0.5-1 mm wide, dark brown or nearly black, margin entire. Occasionally with glandular cells. Lamina pinnate, pinnae 2-3 pairs, terminal one like the others; argest pinnae oblong, 25-5 cm long, 6 cm wide, shortly stalked to 4 mm long or sessile, base cuneate, margin entire, suddenly narrowed near apex, apex caudate; texture chartaceous; rachis without buds; costa rounded beneath, glabrous, grooved on upper surface; veins at angle about 60º to costa, in small group, each group of 3 veins, middle vein forked 1-3 times, the outer of vein group uniting each other near margin of pinnae or 1/5 or less length from margin. Sori elongate along 2-4 to each vein-group, those on the outer veins of the group extending almost from the costa to margin, rest shorter, acroscopic
outer veins usually diplazioid; indusia not so thin, pale brown, fragile, margin entire.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle continued V-shaped with an angle 65°, ends simple, not forming a ridge.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. PraptoSuswiryo 2147, BO), 123 (Cytotype: T.Ng. PraptoSuswiryo 1847, BO).

DISTRIBUTION. Java, Sumatra, Malay Peninsula, Borneo.

ECOLOGY. Occurring on in jungle, rock soil, usually in wet places and often on stream banks at elevation 60–1250 m sea level.

USE. Dayak people use the young frond as vegetable after cooking.


52. Diplazium silvaticum (Bory) Sw.


**Key to the varieties**

Pinnae up to 13 pairs; lower pinnae lanceolate, 7-15 cm long,
upper base subruncate ................................................................. var. *silvaticum*

Pinnae up to 6 pairs; lower pinnae elliptical, 3-5.5 cm long,
upper base subrounded ............................................................. var. *pinnae-ellipticum*
a. **Var. silvaticum** (Bory) Sw.

Rhizome erect, sub erect, scales. Stipe to about 40 cm long, scales; scales very dark, nearly black, to about 10 mm long, 1.5 mm wide, margin toothed, teeth mostly forked. Lamina pinnate, 18.5-63 cm long, 14.5-38 cm wide near base; pinnae numerous, 8-13 pairs, upper ones sessile, lower ones shortly stalked to 3 mm long; rachis gernmiferous; pinnae lanceolate, 6.7-15 by 1.6-3 cm, lower ones with upper base subtruncate, lower base cuneate, upper pinnae with broadly cuneate base to truncate, more or less auricle above but not below, apex acuminate, margin lobed to ¼ way to costa, texture thin, lobes oblique, apex truncate; toothed, veins in pinnate group with 3-4 pairs of lateral veinlets. Sori elongate from near base of vein diploazioid, other simple, basiscopic veins of basiscropic basal lobes sometimes also diploazioid; indusia brown, broad, persistent, margin entire, opening when mature.

**SPORES.** Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar, polar outline (excluding perine) transversely elliptical; equatorial longitudinal view (excluding perine) concave-convex; equatorial transverse view, proximal face concave, distal face hemispherical; perinate. E: 31.59(41.31)49.30±3.82, P: 18.64(23.56)26.41±2.46. Laesura: concealed by perine. Perine: alate under LM, costate-alate under SEM, irregular envelope separated from exine; alae form loose reticulation; lacunae irregular polygons c. 6.6-20.0 µm across, interior of lacunae showing micro irregular reticulate/fenestretata under SEM; muri very thin, wing-like, terminating margin irregularly echinate. Exine: smooth-granulate under LM.

**ANATOMY.** Vascular bundle form an uninterrupted U-shaped with and angle about 120°, base flat inward and outward directions, angle not forming ridge, end almost simple or slightly ridges.

**CHROMOSOMES.** 2n=164 (Cytotype: T.Ng. Praptosuwiryo 1300, BOHB).

**DISTRIBUTION.** Africa to Samoa, throughout Malesia.

**ECOLOGY.** Occurs in forest in the lowlands and hills, and to moderate altitudes in the mountains. 15 – 1350 m.
SPECIMEN EXAMINED. --- JAVA: Backer 2241, 18023, 18445; Backer & Posthumus 256, 651; Donk s.n.; Pleyte 29; Posthumus 1736, 1498, 4027, 3542; Raciborski s.n.; V.A.v.R. s.n.; T.Ng. Praptosuwiryo 1300, 1301. --- MALAY PENINSULA: M.R. Henderson 22422; Ridley 5808; R.E. Holttum 24704; H.N. Ridley s.n. (Dec. 1891); Curtis s.n. (September 1890); M.R. Henderson 19498. --- SUMATRA: C.H. Lamoureux 5580.

b. Var. pinnae-ellipticum Praptosuwiryo, var. nov.

Stipe 7.5 – 16.0 cm long, 3 mm diam. at base, pale green, densely shortly hairy throughout, scales toward base; scales subulate to linearly triangular, to 7 mm long, 1 mm wide, brown, margin toothed, teeth mostly forked. Lamina pinnate, ovate-subtriangular in outline, light green, 16.5-25 cm long, 8.5-12.5 cm broad, 2-6 pairs below pinnatifid deltoid apex of lamina; lower pinnae stalked to 2.5 mm long, elliptical, 3.3 -5.4 cm long, 2.0-2.7 cm wide, upper base subrounded, lower base cuneate; upper pinnae upper adnate-sessile, oblong subtriangular, upper base truncate, lower base broadly cuneate; margin lobed 1/6-1/4 way to costa, apex acute; lobeus 5-10 mm wide at base, ends truncate to subemarginate, almost entire; veins free, distinct on both surface, pinnate in each lobe, 3-4 pairs, simple.

CHROMOSOMES. 2n = 123 (Cytotype: T.Ng. Praptosuwiryo 2001a, BOHB).

DISTRIBUTION. Sumatra

ECOLOGY. On secondary forest, rather wet humus rich soil in shadowed places at 15-70 m sea level.

53. Diplazium simplicivenium Holttum


Rhizome short, erect. Stipe 100 cm or more long, 15 mm thick, rough near base, fallen scales at base; scales 2 cm long or more, 1-2 mm wide near base, dark brown, margin toothed, teeth simple (not forked). Lamina bipinnate, 55-150 cm long, 50-100 cm wide, or larger; pinnae c.15 cm apart, oblique; 45-66 cm long, 17-24 cm wide, free pinnules 15-20 pairs below the lobed apex of pinna; largest pinnule stalked to 1.5 mm, 7.4-12 by 1.8-2.1 cm, upper pinnules sessile, base truncate, apex acuminate, margin lobed 1/5-¼ way towards costa; lobes 6-7 mm wide, slightly oblique; texture thin; veins distinct on both surface, upper surface hairy, pinnate, veinlets 4-5 pairs, all simple. Sori covered the basal 1/3-¾ or more of veinlets; indusia thin, firm, persistent.

SPORE. Monolete, bilaterally symmetrical, heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view plano-convex to concave-convex to plano-convex; equatorial transverse view, proximal face planar to concave, distal face hemispherical; perinate. E: 43.99(50.61)54.60±3.36, P: 23.31(29.42) 33.78±2.79. Laesure: concealed by perine ridge. Perine: alate to costae alate, irregular envelope separated from exine surrounds the spore in irregular and in continuous or discontinuous anastomosing wing, forming a loose reticulation; lacunae large irregular polygons, occasionally with granulate deposite within; thin winglike muri projected 3-8µm, terminating margins are almost entire. Exine: smooth regulate under SEM.

ANATOMY. Vascular bundle form an uninterrupted U-shaped with an angle about 90°; base flat inward, slightly ridges outward, angle ridges, end distinctly ridges to form an angle 100°.

CHROMOSOMES. 2n = 123 (Cytotype: T.Ng. Praptosuwiryo 1386, BO).

DISTRIBUTION. Malay Peninsula, Sumatra, Java, Thailand.
ECOLOGY. Found in shady mountain valleys and occasionally in exposed places by roadside drains. 400 – 1600 m.


54. Diplazium sorzogonense C. Presl.


Rhizome erect, suberect. Stipe 20-65 cm long, dark brown, black at base, scales throughout; scales narrowly linear, 20 by 1-3 mm, concolour, dark brown, margin entire with black strand. Lamina pinnate, oblong lanceolate in outline with nacute apex, 40-85 cm long, 20-45 wide; rachis grooved shallowly above, fibrillose; pinnae commonly 20 pairs below pinatified apex of frond, basal ones or more pairs, reflexed, upper ones adnate or decurrent to form distinct apical portion, middle pinnae shortly stalked, patent to ascending, narrowly lanceolate, 13-22 cm long, 2-2.4 cm wide above base, apex acuminata, subtruncate to cordate at base, deeply lobed to ¾-6/7 way to costa; fibrillose beneath, shallowly grooved above; lobes almost at right angle to costa, oblong, oblique, rounded at apex, toothed; texture papyraceous; veins pinnate, black, distinct beneath, veinlets commonly 6-8 pairs, mostly simple. Sori elongate along veinlets, nearly from main veins ½-2/3 length of veinlets, sometimes almost marginal, diplazioid only on acroscopic basal veinlets; indusia thin, brown, persistent, crescentic.

SPORES. Monoolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) plano-convex; equatorial
transverse view, proximal face planar to convex; distal face hemispherical; perinate. E: 27.80(33.03)37.90±3.91, P: 13.95(20.92)26.39±3.82. Laesura: concealed by perine. Perine: alate, costate-alate, irregular envelope separated from exine; lacunae irregular polygons c. 8.3-16.6 µm across; terminating margins of costae or wing-like muri entire. Exine: smooth under SEM.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped, with an angle 110°, base flat both inward and outward, angles without ridge, ends almost simple.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 1803, BO).

DISTRIBUTION. Peninsular Thailand, throughout Malesia.

ECOLOGY. On slopes in lowland and lower montane, hill forest. Locally common on shady ridges between streams in forest in the hills and to moderate altitudes in the mountains. 10-2150 m.

SPECIMENS EXAMINED. --- MALAY PENINSULA: R.E. Holttum s.n. (31-12-1939); R.E. Holttum s.n. (20-3-1929); Md. Nur 11198; B.M. Allen 2036; Ridley 13432; M.R.Henderson 18612; Kiah SFN 35012; R.E. Holttum SFN 20747. --- BORNEO: M. Kato, G. Murata & Y.P. Mogea B-3810. --- SUMATRA: W.J.J.O. de Wilde and B.E.E. de Wilde-Duyfjes 19408; Dransfield 3274; Harry Wiriadinata 1540; H. Surbeck 151; Dr. J. Winkler 2121; C.G.G.J. van Steenis 710; T.Ng. Praptosuwiryo 2092a, 2092c, 2092d, 2092f, 2092h, 2092i. --- JAVA: T.Ng. Praptosuwiryo 1713, 1720, 1725, 1737, 1743, 1744, 1745, 1746, 1805, 1753, 1758, 1760, 1803, 1802. BORNEO: T.Ng. Praptosuwiryo 2092a, 2092b, 2092c, 2092d, 2092h, 2092i.
55. Diplazium speciosum Blume


Key to the varieties

Lobes moderately toothed, end rounded. Veinlets 7-9 pairs, simple ........ var. *speciosum*

Lobes strongly toothed, end mostly acute. Veinlets 10-16 pairs, mostly forked ... var. *major*

a. var. *speciosum*

Rhizome (?). Stipe (?) cm long, distinctly grooved above, scales towards base, dark brown, black at base. Scales on stipe shining brown, narrowly linier, about 17 by 1-1.5 mm, without thickening black strand at margin, margin toothed. Lamina about 85 cm long, 36 cm wide, pinnate, oblong lanceolate, pinnae 15-24 pairs; rachis grooved; pinnae spreading, ascending oblong lanceolate, upper one adnate to decurrent to form indistinct apex of frond, middle pinnae shortly stalked, to 22 cm long, 4 cm wide above base, base truncate, apex acuminate, margin deeply lobed 5/6 way to costa; costa distinctly grooved above with distinct ridge; lobes oblong, to 21 mm long, 6 mm wide, end rounded. Margin toothed; texture herbaceous, but firm; veins in each lobes pinnate, distinct beneath, veinlets 7-9 pairs, simple. Sori not impressed, elongate nearly from the costule cover 2/3 length of veinlets, acrosopic basal ones diplazioid. Indusia not so thin, brown, persistent, margin entire.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex-straight; equatorial longitudinal view (excluding perine) concave-convex; equatorial transverse view, proximal face convex, distal face biconvex; perinate. E: 29.98(39.29)47.25±5.53; P:17.37(21.69)25.83±2.56. Laesura: concealed by perine ridge. Perine: alate, costate-alate, irregular envelope separated from exine; alae occasionally form loose reticulation; lacunae irregular polygons c. 6.6-10.8 µm
across, interior of lacunae smooth under SEM; terminating margins of wing-like
muri entire. Exine: rugulate, rugulae large, shallow, irregular anastomosing
under SEM after separating from perine.

CHROMOSOMES. 2n = 82 (T.Ng. Praptosuwiryo 1359, BO).

ANATOMY. Transverse section of stipe near lamina: Vascular bundle
form an uninterrupted U-shaped with an angle about 90°, base flat both inward
and outward, ends slightly ridge.

DISTRIBUTION. Malay Peninsula, Sumatra, Java.

ECOLOGY. Shady jungle, especially in sheltered, moist depressions,
there typical and covering a good deal of the ground. Found in light or partial
shade on a few high mountain peaks. Elevation: 1500-2600 m.

SPECIMENS EXAMINED --- JAVA: Backer 14723, 15847; Lörzing
2595; Posthumus s.n. (Tangkuban Prau), 109; Raciborski s.n. (G. Salak); v.
Slooten 184. SUMATRA: T.Ng. Praptosuwiryo 2221, 2227, 2228, 2229.

b. var major (Bedd.) Holttum

*Diplazium speciosum* var. *major* (Bedd.) Holttum, Gard. Bull. S.S. 11:
103. 1940. – *D. sorzogenense* var. *major* Bedd., Supl. 40. 1892.

Lamina to 138 cm long, 30 cm wide; middle pinnae to 20-25.5 by 4-5.5
cm, base truncate, apex acuminate, margin deeply lobed to 9/10 way to costa;
costa bearing scattered brown small linier subtriangular scales with margin
toothed benath; lobes various in length, to 7 mm wide above base, end mostly
acute, strongly toothed; veinlets 10-16 pairs, mostly once forked, occasionally
twice.

CHROMOSOMES. 2n = 82.

DISTRIBUTION. Malay Peninsula, Borneo, Sumatra, Java

ECOLOGY.

SPECIMENS EXAMINED. MALAY PENINSULA: A.G. Piggott 1087;
Scortechini s.n. --- BORNEO: M Kato, M Okamoto & E.B. Walujo B-9801; B-
9797; B-9795; R.E. Holttum SFN 25444. SUMATRA: J.A. Lörzing 14901;
15540; J.A. Lörzing 16255; C.J. Brooks 350 S; J.A. Lörzing 15934; J.A. Lörzing
5987; H.A.B. Bünnekeijer 2708; 5426; 5427a.

DISTRIBUTION. Java, Sumatra, Malaya, Borneo, Seram.
NOTES. This species is similar to *D. sorzogonenense*. As stated by Holtum (1940) and Kato (1994), it differs from *D. sorzogonenense* in the toothed scales, non-fibrillose scales on the rachise, and non-impressed sori.

56. *Diplazium spiniferum* Alderw.


Rhizome short, erect. Stipe 65 cm long, 8 m diam, near base, scales, spinuous, pale brown or rather stramineous, shining, black at base; scales rounded, ca. to 4 mm long and broad, entire. Lamina bipinate, 95 cm long, 58 cm broad, pinnated pinnae 5 pairs, pinnatifid pinnae 3 pairs, simple pinnae 8 pairs below pinnatifid apex of lamina; lower pinnae oblong lanceolate, to 32 cm long, 9 cm broad, free pinnulae to 9 pairs, commonly 8 pairs; pinnulae almost at right angle, adnate-sessile, oblong, base broadly cuneate, apex acute-acuminate, margin usually lobed less than 1/4 way to costule or almost entire; basal lobe the largest, to 3 mm wide; rachis veins free, forming an angle about 45° to costule, veinlets to 4 pairs, commonly 3 pairs, simple, forming an angle about 10-15° to main veins. Sori at middle veinlet covers ¼-1/3 of theirs length, basal acroscopic diplazioid; indusia dark brown, narrow, margin torn, persistent.

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, side convex; equatorial longitudinal view concave-convex to plano-convex; equatorial transverse view, proximal face planar to convex, distal face hemispherical; perinate. E: 31.96(39.52)47.77±4.18, P: 14.87(23.92)29.21±4.14. Laesura: concealed by perine. Perine: micro-costate, densely echinate under SEM, costae broken, densely micro reticulate, coralline; irregular envelope, separated from exine, surrounds the spore in densely coralline with enchinae project 1.5-2.3 µm; lacunae are very small, irregular polygons less than 0.5-1.5 µm across; heavily fenestrate throughout under SEM, giving coralline appearance. Exine: visible through perine.
ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped, with an angle 90°, base flat inward and ridges outward, angles distinctly ridges, ends ridges outward and forming an angle 130°.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 1896c, BO).

DISTRIBUTION. Borneo.

ECOLOGY. Growing on humus rich soil or limestones area of mountain forest at altitude 100-1300 m sea level.


NOTES. Kato (1994) stated that in the large leaves the pinnules are lobed more than ½ to costule.

57. Diplazium squarrasum K. Iwats. & M. Kato


Rhizome stout, short, erect, 1.8 c, thick when dry. Stipe 33.5-36.5 cm long, 5 mm thick, deeply grooved above, dark brown, densely scales throughout; scales ovate-lanceolate, 2.5-12 mm long, 0.25 – 2 mm broad, concolour, light brown, margin sharply toothed, without thickening black strands. Lamina simply pinnate, oblong, 72 cm long, 24 cm broad, lateral pinnæ 17 pairs below deltoid deeply lobed apex of lamina; lower pinnae shortly stalked to 1.5 mm long, upper ones adnate-sessile, 4.2-7.2 cm apart, patent (at right angle to rachise), oblong,
one pair basal pinnae reduced to 7.7 cm long, 2.8 cm broad, larger ones 11.3-15.5 cm long, 2.7-3.3 cm broad, suddenly narrowed at 2/3 part of base, base shallowly auricle, lower truncate, upper broadly cuneate, base of upper pinnae broadly cuneate, margin entire, or slightly waved, apex acuminated; texture thin, but firm (subherbaceous), lower surface scatterly bearing stelate trichome; upper surface glabrous; rachise densely scales, scales like those on upper part of stipes; costa raised below, densely minutely scales; veins anastomosing, veins group forming angle 50-60° to costa, each vein group of 3 veins, middle veins forked 4-5 times again, outer veins uniting with the nearest of outer veins of other veins group 1/4-1/3 way of costa (veins anastomosing 2/3-3/4 way to costa), forming areola more or less 1.5 mm wide, inner veins also uniting with nearest veins. Sori elongate along veinlets, cover 1/4-4/5 of their length, opening towards both acroscopic and basiscopic, sometimes diplazioid on basal acroscopic or on uniting veinlets; indusia narrow, light brown, concolour, margin entire, persistent, firm, opening when mature.

DISTRIBUTION. Borneo.

ECOLOGY. On humus-rich slopes near stream in evergreen forest, at ca. 1200 a.s.l.

SPECIMENS EXAMINED. --- BORNEO: M. Kato & H. Wiriadinata B-4822, 5030.

58. Diplazium subalternisegmentum Praptosuwiryo, sp. nov.

TYPE: BORNEO: Mt. Kinabalu, Nr. Camp in mossy low jungle, ca. 1500 m, 19 May 1933, J. & M. S. Clemens 33169 (holotype, BO).

Rhizoma breve erectum crassum. Stipites (?) longae, 7 mm crassi fere basi, nigris, muricatus, basin squamis linearis lanceolatus 5-15 mm longae 0.5-1.5 mm latae denticulatus cum filum niger spissescens densus vestitae. Lamina tripinata; pinnae stipitae ad 3.7 longis, subtriangularis, pinnulae liberis ad 29-jugatae; pinnae stipitae ad 3.7 cm longae, subtriangularis, libere pinnulae ad 29 jugatae; inferiorae pinnulae stipitae ad 5 mm longae, pinnatae (7 jugatae), subtriangularis, 11 cm longis, 2.4 cm latis, apice acuminatus, libere segmentae 4-6 jugatae; segmentae subalternae, ad 6 mm seorsum, adnatus, subhastatus, ad 12
mm longis 5 mm latis ad basim, apice acutus, margine lobatae ad ½ costam versus. Venae pinnata in segmento, venulae ad 7-jugatae, simpliciter vel bifurcates in uno lobo. Sori e basi ½-2/3 venulae occupants, venulae infimus acrosopicus interdum diplazioideus. Indusia bruneus, latae, margine integrae.

Rhizome short, erect, stout. Stipe (?) long, 7 mm diam. near base, dark brow, black, muricate, densely black scales at base; scales on stipe black, lineary lanceolate, 5-15 mm long, 0.5-1.5 mm broad, margin sharply toothed, with thickening black strand. Lamina tripinnate. Pinnae on stalk to 3.7 cm long, subtriangular in outline, free pinnulae to 29 pair; lower pinnulae stalked to 5 mm long, pinnate (7 pairs), subtriangular, 11 cm long, 2.4 cm broad, apex acuminate, free segments 4-6 pairs below pinnatifapex of pinnulae. Segments subalternate, to 6 mm apart, adnate, subhastate, 12 mm long, 5 mm broad at base, apex acute, margin lobed to ½ way to costulet. Veins pinnate in the segments, veinlets to 7 pairs; veinlet simple to 2 forked in lobes. Sori from basal elongate, covers ½-2/3 of their length, sometimes diplazioid on basal acrosopic veins of segments. Indusia brown, broad, margin entire.

**DISTRIBUTION.** Borneo.

**ECOLOGY.** Light shady in primary forest.

**NOTES.** *D. subalternisegmentum* resembles *D. megasegmentum*. These two species are sharing characters combination as follow: (1) lamina tripinnatifid-tripinnate; (2) subalternate segments at middle part of pinnulae; (3) sori often cover ½ of veinlets length. *D. subalternisegmentum* differs from *D. megasegmentum* in characters: scales lineary lanceolate, margin sharply toothed, with thickening black strand; pinnae more deeply lobed to froms 4-6 pairs of free segments; indusia entire. Whereas, *D. megasegementum* has rounded scales with entire margin, pinnae lobed to within 2 mm of costa without forming free segments; indusi lacinate.

**ETYMOLOGY.** The species epithet *subalternisegmentum* is used to depict the pinnulae that having subalternate segments at subbasal part.
59. Diplazium subintegrum Holttum


Rhizome short, erect. Stipe 59 cm long, 4 cm diam. when dry, scales; scales brown, entire, to about 1.5 cm by 2 mm. Lamina simply pinnate, 53,8 by 32 cm; pinnae 10 pairs, the apical lamina narrowly deltoid, lobed at the base; pinnae ca. 22 by 3 cm, lowest stalked to 1.5 cm, upper 2 pinnae only sessile; bases almost equal, of lower pinnae narrower, cuneate, edges toothed, apices acuminate; texture softly chartaceous, glabrous; veins forked near the costa, the upper branch always simple, the lower branch forked 1-4 times. Sori on upper branch from base 1/3-1/2 of way towards margin, diplazioid, usually also on one branch only of lower vein, simple; indusia pale brown, thin, persistent.

**DISTRIBUTION.** Malay Peninsula, Sumatra.

**ECOLOGY.** Terrestrial. In jungle, on humus rich soils, in deep shade in valley at first over 4000- 5000 ft. (1600-1800 m sea level)

**SPECIMENS EXAMINED.** --- SUMATRA: K. Iwatsuki, G. Murata, J. Dransfield, & D. Saerudin S-985. --- MALAY PENINSULA: R.E.Holttum 23338; R.E. Holttum SFN 31350 (20 May 1936) (HOLOTYPE); Ridley 13969; R.E. Holttum s.n. (13 may 1936), A.G. Piggott 2425; T. Shimizu, K. Iwatsuki, F. Fukuda & M. Hutoh 13242; C.F. Symington 36053; H.D Harvey s.n. (1889); B. Scortechini 391; J.H. Burkill s.n. (5 March 1924); I.H. Burkill & R.E.Holttum 8818; R.E. Holttum s.n. (14 September 1923), 4000 FT., R.E. Holttum 21539; Ridley 70144.
60. Diplazium subpolypodioides (Alderw.) Alderw.


Rhizome stout, erect. Stipe (?) long, end glabrescent, nearly glossy. Lamina bipinnate; pinnae oblong lanceolate, shortly stalked to 9 mm long, 40 by 14 cm; rachis glabrous, nearly glossy; pinnules 17 pairs below acuminate deeply pinnatifid apex of pinnae, one basal pinnule a little reduce, acrossopic ones smaller than basiscopic, upper pinnule adnate to sessile with broadly cuneate base, lower pinnules shortly stalked to 2 mm long; larger pinnules to 8.2 by 1.9 cm, oblong subtriangular with sharply acuminate apex, base truncate, margin deeply lobed to within 0.5-1 of the costule; costule distinctly winged above, tomentose beneath, liniery small scales; lobes (segments) almost at right angle to costae, basiscopic lobes the largest, oblong, to 12 mm long, 3.5 mm wide, apex obliquely rounded to acute with crenate tip, margin crenate ¼-2/3 way to costulets; costulets distinctly winged above, tomentose beneath; veins pinnate in each segment 6-7 pairs, veinlets on larger lobes forked 1-2 times in each crenation, one pair end simple, veinlets on smaller mostly simple. Sori elongate along veinlets a half or less length from costulets, on one pair basal ones usually diplazioid; indusia pale brown, thin fragile, margin sharply toothed, crisped when opening.

**SPORES.** Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex-straight; equatorial longitudinal view (excluding perine) concave-convex; equatorial transverse view, proximal face convex, distal face biconvex; perinate. E: 32.49(40.29)47.17±4.08, P: 17.15(21.54)28.28±2.90. Laesura: concealed by perine ridge. Perine: alate, costate-olate, irregular envelope, reparated from exine; costae or alae sometimes form loose reticulation; lacunae irregular polygons c. 3.3—12.5 µm, interior of lacunae smooth under SEM; muri, wing-like, smooth, terminal margin entire. Exine: smooth under SEM.
ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an uninterrupted U-shaped with an angle 100°, angles ridges outward, end ridges outward and shallowly grooved.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 2292, BO).

DISTRIBUTION. Java.

ECOLOGY. Growing on on humus rich soil rather opened places of secondary mountain forest.

SPECIMENS EXAMINED. --- JAVA: van Steenis 10979; T.Ng. Praptosuwiryo 2292.

61. Diplazium subserratum (Blume) Moore


Rhizome slender, erect, suberect. Stipes slender, clustered, up to 22 cm long, dark brown, blackish toward base, glabrescent, minutely scaly at base, more dense when young, slightly grooved above; scales oblong subtriangular, about 1 mm long, less than 1 mm wide at base, apex acuminate, margin shortly toothed. Lamina simple, lanceolate up to 39.5 cm long, 3.7 cm wide at middle, narrowed gradually toward attenuate apex; margin entire or irregularly undulate in lower part, toothed towards apex; herbaceous softly papyraceous; midrib grooved above, prominent beneath, scatteredly dark brown oblong subtriangular scales 1 mm long or less; veins free, in small group at angle about 60 to midrib, up to 6 mm apart; veins group forked at midrib, upper branch simple, usually soriferous, lower brach forked 2-4 times, sometimes soriferous also. Sori on acroscopic veinlets diplazioid in various length, others simple, shorter; indusia very firm, brown when dry, margin entire, rolled back when old, persistent.

SPORES. Monolete, bilaterally symmetrical, heteropolar; polar outline elliptical, sides convex; equatorial longitudinal view concave-convex to plano-
convex; equatorial transverse view, proximal face planar to concave, distal face hemispherical; perinate. Size: E:27.88(41.19)45.49±5.03, P: 16.54(27.13)20±5.03. Laesure: concealed by perine ridge. Perine: costate-olate, irregular envelope, separated from exine; costae form irregular loose reticulation; lacunae irregular polygons c.to 23 µm across; interior of lacunae and costae smooth. Exine: visible through perine, smoothly granulate under LM.

ANATOMY. Transverse section of stipe near lamina: Vascular bundle form an interrupted U-shape that formed by two ovale leaf traces, with an angle about 110°.

CHROMOSOMES. 2n = 82 (T.Ng. Praptosuwiryo 1463, BO), 123 (T.Ng. Praptosuwiryo 1072, BO), 164 (T.Ng. Praptosuwiryo 1380, BO).

DISTRIBUTION. Sumatra, Malaya, Borneo, Java.

ECOLOGY. On moist mountain slopes by stream in evergreen jungle at about 700- m.


NOTE: Alderwerelt (1920) recognized two forms united by intermediates. Forma tytica with fronds bluntly crenulate to toothed at or towards the apex and distributed in Java and Malacca. The second form, viz. Forma lobata, revealed fronds coarsely toothed or even lobed throughout and found in Sumatra (Deli, Sibolangit, W. Docters van Leeuwen No. 161). The intermediates forms is showed J.A. Lörzing No. 5043 from Sumatra (Deli, Bandarbaru) is intermediate between both forms.

TYPE: Java. West Java, Mt. Gede, Cibodas Forest, behind Cibodas Botanic Garden, ca. 1450 m, 28 March 2002, T.Ng. Praptosuwiryo 1178 (holotype, BO).

Rhizoma procumbent, c.1.5 cm. diametro, apice dense squamatus. Stipites 20-36 longi, 3-6 cassi fere basi, in vivo viridis, basi squamis lineari-lanceolatis, 5-17 mm longis, 0.5-1.25 mm latis sparse vestitae. Lamina deltoideus, 49-54 cm longae et latae, bipinnata vel triplinata, pinnae ad 9-jugatae. Pinnae basin maxima, oblongis-subtringularis, c.28-30 cm longae, in stipitibus ad 2.7 cm longis stantes, pinnule ad 10-jugatae. Pinnule subalternatis; pinnule maxime 7-9.2 cm longae, 2.6-3.2 cm latae, oblong subtriangularis, in stipitatae ad 3.5 mm longis, basi subcordatae vel truncate, apice acuminate deeply lobed fronds. Rachis et costae supra sulcata, infra sparse squamulosus; venulae perspicuus in pagina inferiore et superiore, in uno lobo ad 6-jugatae, simpliciter vel furcatae, in venulis infimus basiscopicus potius dilatatior. Textura tenua subcoriacea, colorae supra aeroginosus. Sori submedianus vel medianus venularum occupantes, plerumque submedianus, sori infimus acroscopicus obliquus, diplazioideus; indusia angusta, tenuis, laciniatus, ante sporangiis maturis aperiens.

Rhizome long creeping, blackish, bearing weary black roots, apex densely scales. Stipe 20-36 cm long, green when living, black at base, 3-6 mm diam near scaly base, densely clothed with dark brown scales at base, upward scattered scales, grooved on upper surface, scales liniery lanceolate, 5-17 mm long, 0.5-1.25 mm broad at base, dark brown or blackish, margin toothed almost regular with thickening black strand, teeth simple or sometimes forked near tips. Lamina bipinnate to triplinata, deltoid in outline with acuminate deeply lobed apex frond, to 49-51 cm long, 49-54 cm wide, pinnae 8-9 pairs, basal pinnae the largest; pinnae stalked to 2.7 cm long, oblong subtriangular with acuminate deeply lobed apex, basal pinnae the largest, 28-30 cm long, pinnules subalternates, numerous, to 10 pairs; pinnules on stalk to 3.5 mm long, upper ones sessile, oblong subtriangular, larger pinnules 7-9.2 cm long, 2.6-3.2 cm wide, base truncate-
subcordate, margin deeply lobed to 2/3 way to costule, apex serrate acuminate, lobus numerous, to 12 pairs; lobes oblong with rounded apex, basal or subbasal lobe the largest, to 6 mm wide, margin sharply serrate toward apex. Rachis scattered minutely pale brown scales beneath, grooved on upper surface; costa minutely scales towards base, shallowly grooved on upper surface; costules raised beneath, glabrous, shallowly grooved on upper surface; veins prominent on both surface, raised above, pinnate to 6 pairs, simple or once forked; basal basiscopic vein rather dilated. Texture firm-herbaceous, deep green above when living. Sori linear on medial or sub-medial veinlets, usually on basal-subbasal veins, obliquely diplazioid on basal acroscopic veins. Indusia thin, margin laciniate, irregularly opening at maturity.

PARATYPE. JAVA. West Java: G. Gede, Cibodas Forest, behind Cibodas Botanic Garden, ca. 1450 m, 7 August 2001, T.Ng. Praptosuwiryo 1012, 1013; 28 March 2002, T.Ng. Praptosuwiryo 1177 (BO).

ANATOMY. Vascular bundle form an uninterrupted U-shape with an angle about 90°, end ridges outward to form an angle about 130°.

CHROMOSOMES. 2n=123 (Cytotype: T.Ng. Praptosuwiryo 1177, BO).

SPORES. Monolete, bilaterally symmetrical (made asymmetric by perine), heteropolar; polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) plano convex, equatorial transverse view, proximal face planar, distal view convex; perinate. Laesura: concealed by wing-like alae spinous coralline perine. Perine: alate to costate alate, alae or costae forming irregular reticulation, reticulation often incomplete; lacunae with echinae and coralline within, wing-like muri project 3-11 µm, terminating margins pappilate or echinate; pappilae project c.0.7-1.5 µm; surface of perine echinae – coralline with densely irregular hole, windows-like. Exine: not visible through perine under SEM.

DISTRIBUTION. Java.

ECOLOGY. In shady places in the forest on humus rich soil at about 1500-1600 m a.s.l.

NOTES. *D. subvirescens* has affinity to *D. virescens* in the characters combination as follows: rhizome long creeping, black with densely scales on
younger part; scales on stipes lineary lanceolate, polish dark brown with toothed margin; lamina deltoid, deep green, firm herbaceous with veinlets prominent on both surface; sori oblong to linear, medial to supramedial; indusia thin-membranaceous, laciniate at margin, irregularly broken at maturity.

*D. subvirescens* differs from *D. virescens* in the following characters. Lamina to tripinnate so that giving its pinnulae more divided to form adnate to sessile free segments, while the lamina of *D. virescens* are to bipinnate with pinnulae lobed to; pinnulae of bipinnate fronds subtriangular, much wider (2.6-3.2 cm), margin lobed 2/3-3/4 way to costa; veins sometimes once forked.

This fern is very distinct among the bipinnate-tripinnate fronds of *Diplazium* in West Malesia. The long creeping rhizome and deep green of firm-herbaceous lamina with veinlets very prominent above as well as the position of the sori at the middle or sub-middle are useful features which distinguish this species from the other bipinnate species of *Diplazium*.

**ETYMOLOGY.** The species epithet *virescens* is chosen in illustrating the closely related of *D. subvirescens* to *D. virescens*.

63. *Diplazium tomentosum* Blume


Rhizome short, erect. Stipe 9-43 cm long, 3-4 mm diam, grooved on upper surface, brown when dry, black toward base, scales throughout; scales 2.5-5 mm, 0.5 mm wide, dark brown, margin entire, sometimes with glandulars cell near base or at tip. Lamina pinnate, oblong lanceolate to nearly oblong subtriangular in outline, to 26 cm long, 14 cm wide, pinnae to 20 pairs below indistinct acuminate apex of frond; basal pinnae the largest, deflexed, slightly elliptical, widest about 1/3 from base, base narrowed, apex acuminate; middle and upper pinnae narrower with almost parallel side, nearly at right angle to rachis, base truncate, auricled upper side; pinnae of larger frond deeply lobed a half a way or nearly to costa,
lobes to 3 mm wide above base, at angle about 60º to costa; rachis and costa densely covered with multicellular hairs with pale and dark brown cross-walls; veins pinnate in each lobe, veinlets to 5 pairs. Sori on acroscopic basal veinlets the largest, nearly from the basal veins almost reach margin, diplazioid; indusia firm, dark brown, persistent, margin entire, nearly crescentic.

SPORES. Monolete, bilaterally symmetrical, heteropolar; polar outline elliptical, sides convex, equatorial longitudinal view plano-concave-concave convex, equatorial transverse view, proximal face planar to concave, distal face convex; perinate. E: 34.64(41.06)47.19±3.88, P: 23.14(26.77)28.67±2.13. Laesura: concealed by perine. Perine: alate to costate-alate, loosely reticulate; irregular envelope separated from exine surrounds the spore in continuous anastomosing wings, forming a loose reticulation, occasionally wing-like alae only form 3 reticulation surround the spore; lacunae large irregular polygons, papillae within; thin wing-like muri projected 3-12 µm, terminating margin are often ciliate, ciliae projected to ca. 0.5 µm. Exine: visible through perine, granulate under LM.

ANATOMY. Tranverse section of stipe near lamina: Vascular bundle form uninterrupted V-shaped, with an angle 90º, end simple.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 2336b, BO), 164 (T.Ng. Praptosuwiryo 2066, BO), 205 (Cytotype: T.Ng. Praptosuwiryo 1722, BO).

DISTRIBUTION. Burma (Tenessarian), Malaya, Vietnam, Sumatra, Java (type), Malaya, Borneo, Seram, and Mindanao.

ECOLOGY. On mountain slopes in deep shade of dense forest at altitudes 800 (1000-5000 ft).

SPECIMENS EXAMINED. --- MALAY PENINSULA: H.N. Ridley 9866; A.G. Piggott 1904; R.E. Holttum 9537; Smith E.S. 818, Md. Nur 11038, G.H. Addison (10-8-1939), M. Shah & noor M.S. 734; I.H. Burkhill & R.E. Holttum 1886; R.E. Holttum s.n. (26-12-1939); R.E. Holttum s.n.; G.A. Best SFN 14134; H.N. Ridley s.n. (1891); H.N. Ridley 16213; A.G. Piggott 2430; H.N Ridley s.n (Dec. 1895); B. Allan 1571; H.N. Ridley s.n. (1904); H.D.
Harvey s.n. (1889); 800-1000 ft, King 10767; H.N. Ridley 13438; H.N. Ridley s.n. (21 June 1889); R.E. Holttum s.n.; E.J.H. Corner 30104. --- BORNEO: M. Kato, M. Okamoto, K. ueda, D. Darnaedi & E.B. Walujo B-8316. --- JAVA: Backer 10704; Donk 24; Hodorleg 248; Raciborski s.n. (G. Salak); T.Ng. Praptosuwiryo 1236, 1721, 1722, 1723, 1747, 1762, 1769, 1748, 1804, 1807, 2336. --- SUMATRA: T.Ng. Praptosuwiryo 2030a, 2030b, 2047, 2540a, 2048a, 2048b, 2048c, 2048d, 2050a, 2050b, 2050c, 2050d, 2066, 2087.

NOTES. Holttum (1940) stated that this species is closely related to *D. velutinum* Holtt., a species that has hitherto only been found in the moist shady valleys at Cameron Highlands, Malay Peninsula. *Diplazium tomentosum* seems to be related also *D.crenatoserratum*.

**64. Diplazium tricholepis C. Chr.**


Rhizome short, erect, densely scales on youger part. Stipe 25 cm long, densely scales at base; scales lineary lanceolate, 3-10 mm long, 0.5-1 mm broad, light brown, concolour, without thickening black strands, margin sharply toothed, teeth simple. Lamina broadly lanceolate, 70 cm long, 25 cm wide, bipinnatifid, pinnae 17-18 pairs, one pair basal bending ward; pinnae subfalcate, sessile, oblong subtriangular, base truncate, acuminate, incised to a wing 2 mm broad; segments patent, triangular-oblong, 6-7 mm wide at base, lower side usually somewhat longer than the upper ones (1.4 against 1.2 cm), obtuse, toothed in the outer half or occasionally acute on the lower pinnae; rachise grooved on upper surface, minutely scattered scales, non gemmiferous; veins dark, free, pinate in the lobes or segment, veins group forming angle 45° to midrib, veinlets 6-10 pairs, forked once to twice or simple. Sori narrow, straight, extending from costa nearly to margin, cover to 6-7 of veinlets length (to 4 mm long), acroscopic basal ones diplazioid; indusia brown, concolour, persistent, margin entire.

DISTRIBUTION. Borneo
ECOLOGY. In the forest, near streams or in the gorge at 1000-2100 m above sea level.

SPECIMENS EXAMINED. BORNEO: J & M.S.Clemens 34476; RE Holttum 25522.

NOTES. This species is similar to \textit{D. christii}, but scales are very different. \textit{D.christii} has entire scales while \textit{D. tricholepis} with sharply toothed scales.

65. Diplazium umbrosum (Smith) Bedd.


Rhizome stout, short, erect, scales densely on younger part. Stipe 31-61 cm long, 5 mm thick, pale brown, glabresent, black densely scales at base; scales narrowly triangular, dark brown, margin toothed, teeth mostly simple, without thickening black strand. Lamina bipinate-tripinnatifid, to 60 cm long, about 50 cm wide; pinnules numerous, to 18 pairs, basal ones a little reduce; larger pinnules oblong lanceolate with deeply pinnatified acuminate apex, to 21 by 6.8 cm, shortly stalked to 6 mm long; pinnules numerous, 17 pairs, lower one shortly stalked to 1 mm long, upper ones sessile; costa winged, distinctly grooved above; larger pinnules 7.5 by 1.8 cm, oblong subtriangular, base subtruncate to subcordate, apex toothed acuminate, margin deeply lobed to one mm or less from costules, on lower portion almost reach the costules; costules winged; segments mostly 3.5-5 mm wide, one basal basiscopic lobes the largest, to 10 by 6 mm, apex blunt or truncate, margin crenate or lobed 1/3 way to costulet of segments; texture herbaceous; vein pinnate in each segments 4-6 pairs, mostly forked once in each crenations, on larger crenation pinnate 2-3 pairs of second veinlets. Sori elongated from near costule of segments or on middle veinlets; indusia pale brown, attachment side darker, thin but firm, broad, persistent margin entire.

ANATOMY. Transverse section of stipe near lamina: vascular strand form an uninterrupted U-shaped with an angle 90°, base almost flat, angle thicker
than base, end ridges outward to form an angle about 130°. Stomata: polycytic and copolyctic.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiry 1348, BO).

DISTRIBUTION. Madeira, Canaries, Azores, Guinea Coast, Himalayas to Ceylon, Java, Australia, Tasmania, and New Zealand.

ECOLOGY. On mountain slopes forest at elevation 1400-2000 m sea level.

SPECIMENS EXAMINED. --- JAVA: Backer 14650; Bruggeman 625; Donk 343, 675, 775; Meijer 1632; Paidan 8; Sapiin 2727, 2743; v. Slooten 199, T.Ng. Praptosuwiry 1332, 1352, 1453, 1496. --- SUMATRA: H. Surbeck 146.

66. Diplazium velutinum Holttum


Rhizome short, erect. Stipe to 40 cm long (commonly about 20 cm), clothed throughout with scattered multicellular brown hairs, and towards the base with narrow almost black entire scales; scales to about 1 cm long and barely 1 mm wide at the base. Lamina bipinnate, to about 25 cm long, 15 cm wide, the rachis and costa beneath densely clothed with brown hairs like those on the stipe, with a few small narrow scales; free pinnae 12-15 pairs, the sub-basal largest, the upper ones gradually reduced and grading into the lobed apical lamina; largest pinnae ca. 8 cm long, 3 cm wide (commonly about 6 by 2 cm), sub sessile, narrowed from truncate base to acute or acuminate apex, pinnate towards the base only, for the rest lobed almost to the costa, the pinnules or segments at right angles to the pinna-rachis at the base, gradually more oblique towards the apex; free pinnules few, the rest more or less broadly adnate to the pinna-rachis; largest pinnules about 12 mm. long and 4 mm wide, base unequally cuneate, margin serrate or lobed as much as half-way to the costule, apex rounded, texture very firm; veins in pinnules or pinna-lobes 7-10-jugate, mostly forked. Sori on basal ½-2/3 of
veinlets; in the largest pinnules several diplazioid sori, in smaller pinnules only one such sorus; indusia thin, broad, persistent.

**DISTRIBUTION.** Malaya

**ECOLOGY.** Occurring on moist shady valley at 1460-1520 m sea level.

**SPECIMENS EXAMINED.** --- MALAY PENINSULA: R.E. Holttum SFN 31221 (HOLOTYPE), SFN 23428, s.n..

**NOTES.** This species is very closely related to *D. tomentosum* but much more deeply dissected. Hitherto it has only been found in the moist shady valleys at Cameron Highlands.

**67. Diplazium vestitum C. Presl**


**Key to the Variety**

| Lower pinnulae on stalk to 1.5 mm long, to 11.5 cm long; veinlets 4-5 pairs, all simple. | a. var. vestitum |
| Lower pinnulae on stalk to 3 mm long, to 13 cm long; veinlets 6-8 pairs, simple or once forked. | b. var. borneense |

**a. Var. vestitum C. Presl**

Rhizome stout, short, erect. Stipe 50 cm long, 7 mm thick near base, light brown when dry, black towards base, muricate. Lamina bipinnate, ovate in outline, to about 75 cm long, 60 cm broad, pinnate pinnae to 4 pairs below 7 pairs pinnatifid ones, apex deltoid with deeply lobed; pinnae stalked to 7 cm long, sub basal pinnae the largest, elliptical in outline, to 33 cm long, 13 cm broad, pinnule 6-10 pairs; lower pinnule subssile, oblong subtriangular with suddenly narrowed towards acuminate apex, to 11.5 cm long, base broadly cuneate, margin lobed to 1/5-1/3 way to costule; lobes to 5 mm wide, ends truncate, entire; veins pinnate in the lobe, main vein forming an angle about 50-75° to costule; veinlets 4-5 pairs,
simple, forming an angle about 15-30° to main vein. Sori elongated along veinlets from near main vein, not reaching the margin, cover to about ½ veinlets length, basal acroscopic usually diplazioid; indusia narrow, dark brown, margin entire, opening when mature, persistent.

SPORES. Monolette, bilaterally symmetrical (made asymmetric by perine), heteropolar, polar outline (excluding perine) transversely elliptical, sides convex; equatorial longitudinal view (excluding perine) concave-convex; equatorial transverse view, proximal face convex, distal face concave to hemispherical; perinate. E: 28.21(32.58)±2.26, P: 16.55(19.94)±1.64. Laesura: concealed by perine. Perine: costate-alate, almost no reticulation irregular envelop, separated from exine, surrounds the spore with alae-costae ridge (occasionally) projected 2-5 µm; surface of perine smooth. Exine: visible through perine, smooth under SEM.

DISTRIBUTION. Borneo, Philippines.

ECOLOGY: primary forest, lowland, shadowed place, river bank.


b. Var. borneense C.Chr. in C.Chr. & Holttum, Gard. Bull. S.S. 7: 273. 1934. --- TYPE: Borneo, Koun-Dallas, Mt. Kinabalu, 240 m, R.E. Holttum 25134 (holotype, SING!); Dallas/Tenompok, 1400 m, Clemens 27734 (syntype, BM n.v.; isosyntype US n.v.); Kabayau/Kaung, 300 m, Clemens 27478 (syntype, BM n.v.; isosyntype, K n.v.).

Rhizome (?). Stipe cm long, 8 mm thick pale, spinouse or muricate, black at base, (?). Scales on stipes brown shining, lanceolate, margin toothed with thickening black strands, teeth forked. Lamina bipinnate, (? cm long, (?) cm broad; pinnae stalked to 1.5 cm long, oblong subtriangular, to 52 cm long, 25 cm broad, pinnulae 10-12 pairs below deltoid deeply lobed apex of pinnae; lower pinnulae on stalk to 3 mm long, oblong subtriangular with acuminate apex, to 13 cm long, lower base subcordate, upper base subtruncate; upper pinnae adnate-
subsessile with subtruncate-broadly cuneate base; larger pinnulae to 13 cm long, 3 cm wide, lobed to 1/3 way to costule, basal acroscopic lobes the largest, to 8 mm wide, ends truncate-blunt, slightly toothed to entire; texture thinly herbaceous; rachis caffy like the stipe; veins pinnate in the lobus, veinlets 6-8 pairs, simple or once forked on lower lobes. Sori elongate from basal veinlets covers 1/3-3/4 of their length, one pair basal acroscopic diplazioid; indusia thin, margin entire, persistent.

DISTRIBUTION. Borneo.

ECOLOGY. On wet slope in deep shade.


68. Diplazium wahauense Kato, Darnaedi et K. Iwatsuki


Rhizome short, erect. Stipe black, 4-10 cm long, 1 mm diam. near base. Scales on stipe lanceolate, 4 mm long, 1 mm broad, margin entire. Lamina simple imparipinnate, oblong, 10-13 cm long, 5.5-6.5 cm broad, pinnae 2-4 pairs; pinnae adnate – sessile, linearly oblong, 3.7 – 8 cm long, 0.8 – 1.0 cm broad, glabrous, base cuneate, margin crenulate, apex acuminate; terminal pinnae conform to the lateral ones; rachis glabrous; veins free, 1-3 times forked. Sori elongate along veinlets, basal acroscopic diplazioid; indusia broad, dark brown, margin subentire.

NOTES. As stated by Kato _et al_ (1991), this species is closely related to, and may have been derived from _D riparium_ which occurs in riparian and dryland forest in Borneo. These two species share black, somewhat crisped, entire scales, blackish stipes, dark brown, naked rachises, and imparipinnate leaves with 3-4
69. Diplazium xiphophyllum (Baker) C.Chr.


Rhizome short, erect. Stipe to 73 cm long, 8 mm thick, stramineous when dry, scales toward base; scales subulate, to 6-17 mm long, 2-4 mm wide at base, pale brown, margin entire with glandular cells. Lamina oblong, 55 cm long, 45 cm broad, pinnate, pinnae 6-9 pairs, terminal one like the rest; basal pinnae reduce to 12,5 by 2.5 cm; lower pinnae shortly stalked, upper pinnae slightly adnate to decurrent, smaller, without buds on their axils; larger pinnae to 26-36 cm long, 4.1-6.4 cm wide, elliptical, narrowed gradually to slightly unequal cuneate base, abruptly to acuminate-caudate apex, margin entire to irregularly toothed throughout; texture thin, drying light brownish; rachis pale, glabrous; costa pale, glabrous, prominent beneath; veins in small group, at about 45-55° to costa, scarcely 4 times, sometimes acroscopic basal veins anastomosing with basiscopic basal veins of the nearest vein group or with the nearest branch of central vein near margin. Sori on basal pair of vein in each group elongated from near costa to near margin, or other vein shorter, commonly 2-5 sori on each vein-group, sori on acroscopic basal vein diplazioid, indusi persistent, pale brown, not so thin, margin entire.
SPORES. Monolet, bilaterally symmetrical, heteropolar; polar outline (excluding perine) elliptical, sides convex; equatorial longitudinal view plano-convex to concave-convex; equatorial transverse view, proximal face planar-convex, distal view convex; perinate. Laesura: concealed with wing-like perine. E: 36.49(40.76)47.14±3.92, P: 19.16(24.88)30.65±3.32. Perine: alate to costate-late, free of reticulation or occasionally loosely reticulate; irregular envelope, separated from exine, surround the spore in free wings and anastomosing costae-ridge, reticulation irregular and often incomplete; lacunae shallow, irregular polygons 2.5-8 µm across; wing-like muri thin, project 2.5-10 µm, terminating margins often papillate. Exine: visible through perine, smooth under LM.

CHROMOSOMES. 2n = 82 (Cytotype: T.Ng. Praptosuwiryo 1841, BO), 164 (Cytotype: T.Ng. Praptosuwiryo 2040b, BO), 246 (Cytotype: T.Ng. Praptosuwiryo 1190, BO).

DISTRIBUTION. Java, Sumatra, Borneo, Philippines, Moluccas.

ECOLOGY. In shadowed places of secondary and primary forest, at ca.50-1100 m sea level.


NOTES. Kato (1994) state that this species seems to be related to *D. fraxinifolium* Presl. With anastomosing veins its linear, brown, entire scales, imparipinnate leaves, and gradually narrowed subtruncate pinna-base. Kato (1977) also suggested an affinity of *D. xiphophyllum* to *D. subserratum*, on the basis of similarities in having costae raised on the adaxial side of leaves and notched pinna-margin. He inferred that the simple leaves of *D. subserratum* have been derived from pinnte ones of an ancestral species like *D. xiphophyllum*. 

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