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For the Promotion of Scientific Knowledge and Study of the Natives and Natural History of the Island of Borneo.

ISSUED BY THE SARAWAK MUSEUM
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I. — Die Tenebrionidenfauna Borneos. —

Erster Teil. Von Hans Gebien, Hamburg.

Obgleich eine ziemlich grosse Zahl der auf Borneo einheimischen Tenebrioniden bekannt ist (besonders Fairmaire hat in den "Notes from Leyden Mus." zahlreiche Arten beschrieben), muss diese doch im Verhältnis zu den noch unbekannten als nicht bedeutend bezeichnet werden. Es ist daher von Wert, anstatt aus verschieden Gruppen an verschiedenen Stellen einzelne Neuheiten zu beschreiben, die Fauna Borneos im Zusammenhange zu geben. Das Material zu dieser Arbeit liefert mir ausser meiner eigenen, ziemlich umfangreichen Sammlung, in erster Linie das Museum Sarawak, ferner die Kollektion des Herrn Dr. Veth, Haag; das Naturhistorische Museum, Hamburg.

Die Tenebrioniden meiner Sammlung verdanke ich meist der Freundlichkeit des Herrn Hauschild in Kopenhagen, der sie von Waterstradt käuflich erwarb, ihm bin ich zu besonderem Dank verpflichtet, da er mir sogar Unica seiner Sammlung bereitwilligst überliess. Die Typen aller hier beschriebenen neuen Arten befinden sich in meiner Sammlung.

Subfam. Pedininæ.

Mesomorphus, Seidl.

Naturg. Ins. Deutschl. v. 1893, p. 361 nota. Fairm. Ann. Soc. Ent. Belg. xxxviii. 1894, p. 20.—Reitt. Bestimmungstab. pal. Käfer, liii. 1904, p. 73.

Villiger, Blanch. Voy. Pole Sud. iv. 1853, p. 154, t. 10, f. 15.—Fairm. Ann. Soc. Ent. Belg. xxxviii. 1894, p. 20. (Syn. *asperulus*, Fairm.; *dermestoides*, Reitt.; *dispersus*, Champ.; *mustelinus*, Fairm.; *puberulus*, Fauv.).

Diese von Neu-Guinea bis Afrika verbreitete Art liegt mir in 3 Exempl. meiner Sammlung von Borneo vor: Tandjong und Kinabalu.

Subfam. Opatrinæ.

Gonocephalum, Chevr.

Ich glaube 2 Arten dieser Gattung in meiner Sammlung zu haben, da aber mein gesamtes Material an Gonocephalum zu Studienzwecken an Mr. Blair verliehen ist, kann ich vorläufig keine genügende Auskunft geben.

Subfam. Bolitophaginæ.

Atasthalus, Pasc.

Ann. Mag. Nat. Hist. (4) viii. 1871, p. 348.—Lew. Ann. Mag. Nat. Hist. (6) xiii. 1894, p. 385.

Atasthalus spectrum, Pasc., *l. c.* p. 348, t. 14, f. 3.

Von dieser Art liegen mir 3 Exemplare vor, ein ♂ in meiner Sammlung, N. O., Sumatra, Tebingtinggi 2 i. 1895 (Schultheiss) und ein zweites vom Sarawak Mus., Borneo, Kuching, 14, xii. 1898. Das ♀ ebendaher 9, xi. 98. Pascoe's Beschreibung, die leider dürftig genug ist, passt auf unsere Art, aber erst, wenn Stücke aus Malakka vorliegen (dem Originalfundort), wird es möglich sein, die Frage der Zusammengehörigkeit zu entscheiden.

Das ♀ ist noch unbeschrieben. Ich beziehe es nicht mit voller Sicherheit auf diese Art, überhaupt ist das bei dieser und bei verwandten Gattungen nur dann sicher möglich, wenn beide Geschlechter zusammengefunden werden. Es unterscheidet sich vom ♂ durch den ungehörnten Kopf; auf dem Scheitel stehen 2 feine Tuberkeln eng aneinander, der sehr breite Clypeus ist nicht aufgebogen, nicht gewölbt, die Quersutur ist fein aber scharf. Der Thorax hat statt der 2 subhorizontalen, an der Spitze gegeneinander gekrümmten Hörner zwei kräftig erhabene knollige Höcker, die stark und dicht tuberkuliert sind. Wie beim ♂ sind Stirn und Halsschild im Grunde spiegelglatt und tragen die symmetrisch angeordneten rundlichen Tuberkeln. Pro- und Mesosternum haben je eine spitze Tuberkel.

Atasthalus miles, n. sp. (Taf. I. fig. 1 u. 2.)

Noch etwas schmaler und paralleler als *A. spectrum*, wie fast alle Bolitophaginen so dicht mit einer Schmutzkruste überzogen, dass die Skulptur erst nach gehöriger Reinigung erkennbar wird. Schwarz, ziemlich glänzend, hochgewölbt. *Kopf* sehr breit, der Canthus vor den Augen schmal, davor der Clypeus fast von der Breite des Canthus, von ihm seitlich durch eine sehr kleine Ausbuchtung

getrennt, seine Ecken scharf rechtwinklig. An seinem Vorderrand erhebt sich fast rechtwinklig abstehend in der Mitte ein langes, von vorn nach hinten flachgedrücktes, am Ende erweitertes, und ziemlich stark ausgeschnittenes Horn. Die Oberfläche flach ausgehöhlt, glatt, matt, nur der Nacken dicht und grob punktiert. Beim ♀ fehlt das Clypealhorn, der Clypeus ist breit querüber gewölbt, der Vorderrand gerade abgestutzt, dessen Ecken stumpf (es sind also 4 Ecken vorhanden: die ganz stumpfen Vorderecken und die scharf rechtwinkeligen Seitenecken vor dem Canthus). Die Fühler schlank, ihr erstes Glied stark, länger als 2 und 3, aber zum grössten Teil vom Canthus bedeckt, 3 = 1½ mal so lang als 4, 4 und 5 so lang wie breit, 6 und 7 querkugelig, 8, 9 und 10 immer stärker quer werdend, das 11. sehr klein und mit dem 10. ein Glied bildend, das nur eine feine Naht zeigt. Bei flüchtigem Zusehen scheinen daher die Fühler zehngliedrig. *Halsschild* im vorderen Drittel verflacht und stark verbreitert, und dort mit einigen (ca. 4) groben Zacken, die Vorderecken in eine lange, niedergebogene mässig scharfe Spitze ausgezogen, hinter den grossen Zacken 1 oder 2 kleine Tuberkeln am Seitenrand, dieser unmittelbar vor der Basis nicht eingezogen; da der Halsschild am Hinterrande stielrund ist, fehlen die Hinterecken ganz, es ist dort auch kein Rand vorhanden. Von der Mitte aus sind beim ♂ 2 horizontale, dann abwärts gekrümmte, im grössten Teil ihres Verlaufs zusammengewachsene Hörner ausgebildet, die bei allen 3 mir vorliegenden ♂ sehr verschieden sind; beim bestentwickelten sind die Hörner lang, schlank, stielrund, lassen dicht vor ihrer Basis ein kleines Loch zwischen sich, wachsen dann innen zusammen, und divergieren an ihrer Spitze stark; beim zweiten ♂ ist zwischen den Hörnern an der Basis nur eine tiefe Furche; beim dritten sind die Hörner dick und kurz, an der Spitze nur mit kleinem Ausschnitt. Beim ♀ sind statt der Hörner zwei knollige, eng aneinanderliegende, stark über den Vorderrand des Halsschildes hinausragende Höcker vorhanden, die stark und dicht tuberkuliert sind. In beiden Geschlechtern befindet sich jederseits dicht neben der Mittellinie eine etwas unordentliche Reihe kräftiger Tuberkeln, jederseits am Absturz und vor der Basis einzelne weitere Körner. Der Grund ist ganz glatt, auch der vordere Absturz vor den Hörnern. *Flügeldecken* ganz ähnlich wie bei *spectrum*, der Raum neben der Naht flach, die erste Punktreihe regelmässig aus tief eingestochenen, wenig eng

stehenden Punkten bestehend, jederseits läuft eine Doppelreihe abwechselnd gestellter, ziemlich grosser Tuberkeln, ausserdem noch 4 Reihen sehr weitläufig gestellter (ca. 3–6 Tuberkeln enthaltend) Höckerchen, der äusserste Seitenrand mit enger gestellten, feinen Körnchen; die groben Punkte der Flügeldecken stehen, soweit sie nicht durch die Tuberkeln verdrängt werden, reihig; die Schultern sind kräftig entwickelt, wenn auch verrundet, die Seiten parallel. Die *Unterseite* ist matt, unpunktiert, nur das glänzende Analsegment mit groben Punkten besetzt, Prosternum mit senkrechtem Absturz und spitzer, feiner Tuberkel oben am Rande, diesem gegenüber vorn am Mesosternum ein ebensolches Höckerchen. Beine verhältnismässig robust, Schienen sehr schwach gekrümmt, an der Hinterkante scharf gefurcht, das Klauenglied aller Füsse so lang wie die anderen zusammen.

L. 9–9½ mm. (ohne Hörner, vom Clypeus bis zur Flügeldeckenspitze gemessen), Breite 4⅘ mm.

Diese ausgezeichnete Art ist an der Hornbildung sofort zu erkennen, der Clypeus bildet ein Horn, nicht zwei.

3 ♂, 1 ♀ von Kuching, 10, 18, 19 x. 1898: Matang Rd., 17. Sept., 1910.

Bolitonæus spectabilis, n. sp.

Breit elliptisch, seitlich parallel, schwarz, aber wie bei andern Bolitophaginen ganz mit den Resten des Wirtspilzes besetzt. Körper rundherum mit Sägezähnen. *Kopf* sehr breit, flach ausgehöhlt, Clypeus scharfkantig aufgebogen, der Canthus nach vorn verbreitert, breiter als die Augen, etwas spitzwinklig oder (beim ♀) scharf rechtwinklig, der Clypeus beim ♂ mit 4 stumpfwinkligen Zähnen, beim ♀ scharf krenuliert. Auf der Stirn stehen 4 feine, nicht sehr deutliche Tuberkeln in einem Quadrat. Fühler am Grunde glänzend braun, das 3. Glied 1½ mal so lang wie das 4., die folgenden kräftig nach innen ausgezogen, und zwar immer stärker werdend, das 10. ist das grösste und an der Spitze zur Aufnahme des 11. Gliedes ausgeschnitten, dieses selbst ist auch seitlich durch einen sehr feinen Ausschnitt abgesetzt, nicht nur wie bei *Atasthalus* durch eine feine Naht getrennt. Mentum grob punktiert, stark quer, über doppelt so breit wie lang, vorn flach und mit der noch breiteren, sehr flachen Ligula fast eine Fläche bildend, Palpen weit getrennt, Endglied lang, gekrümmt, Vorderrand der Ligula sanft ausgeschnitten und jederseits mit einigen Borsten, die Vorderecken breit

und ganz verrundet, Endglied der Maxillarpalpen wie bei *Atasthalus* sehr lang, gekrümmt zilindrisch, die sehr zarte innere Lade der Maxillen viel schmaler und kleiner als die äussere. Mandibeln aussen fast rechtwinklig geknickt, Ende mit zwei groben Zähnen, Mahlzahn gross, gewölbt mit sehr feinen und dichten (ca. 100) Querriefen. *Halsschild* ca. $2\frac{1}{2}$ mal so breit wie lang, mit abgeflachtem Seitenrand bis zur Basis, in der Mitte am breitesten, nach hinten schwach, nach vorn stark verengt, Vorderecken rechtwinklig, Seiten mit ca. 8–10 mässig grossen, verrundeten Zähnen, die Hinterecken ebenfalls rechtwinklig, Basis breit doppelbuchtig, da die Mitte breiter vorgezogen ist als die Seiten. Vor der Mitte der Scheibe erheben sich nach vorn zwei dicht aneinander stehende, kurze, kräftige Hörner schräg nach vorne beim ♂, zwei knollige verrundete Höcker beim ♀. Grund der Oberfläche matt, glatt. Verstreute Körner bilden einige Längsgruppen. *Flügeldecken* nur wenig länger als zusammen breit, hochgewölbt, der breit von oben sichtbare Seitenrand ist regelmässig gezähnt, die Zähne abgerundet, zur Spitze immer feiner werdend, grösser als die des Halsschildseitenrandes. Jede Flügeldecke mit 4 Reihen von Tuberkeln, die erste besteht aus 3 grossen Höckern, der erste beim Schildchen hat vor sich einige Körnchen, der zweite steht schwach schräge und ist seitlich zusammengedrückt, der dritte am Absturz ist schwach 2 oder 3 zackig, die 2. Reihe hat 4–5 ungleichgrosse Höcker, die viel kleiner sind als die der ersten Reihe, die beiden äusseren Reihen sind noch kleiner, tuberkelartig, sehr weitläufig, die übrigen Zwischenräume, besonders Nahtstreifen und Absturz mit zerstreuten Körnern. Der Raum zwischen den beiden ersten Höckerreihen, die Naht einschliessend, flach. Der Grund trägt Reihen ziemlich dicht stehender regelmässiger grober Punkte, die nur durch die groben Tuberkeln aus der Reihe gedrängt werden. *Prosternum* wagerecht, mit steilem aber nicht senkrechtem Absturz, das Ende scharfwinklig, aber nicht spitz ausgezogen, Mesosternum mit nach vorn gerichteter spitzer Tuberkel, Hinterbrust und Abdomen glänzend, mässig grob und wenig dicht punktiert. Beine kurz, die Schenkel ragen mit ihrer Spitze kaum über den Seitenrand der Flügeldecken hinaus. Epipleuren sehr breit, neben der Hinterbrust noch doppelt so breit wie die Epimeren. Schienen scharf gekielt, sehr zart linear, die vorderen und hinteren gegen die Spitze merklich verengt.

L. $8\frac{1}{2}$, Br. $5\frac{1}{4}$ mm.

1 ♂, 1 ♀ von Kuching, 19. Okt. 1898, aus dem Sarawak-Museum.

Die Skulptur der Flügeldecken, der gezähnte Körperrand sind ganz so, wie Motschulsky von *Bolitoxenus gibber* schreibt, aber wegen des verlängerten dritten Fühlergliedes kann die Art nicht in diese Gattung gestellt werden. Von den anderen Arten von *Bolitonæus* scheidet sich unsere sofort durch den grob gezähnten Rand des Körpers.

Atasthalus serratus Geb. von den Philippen muss auch in diese Gattung gestellt werden. *Atasthalus* sollte auf die Arten beschränkt werden, bei denen der Thorax hinten rund, ohne abgeflachten Seitenrand ist. Dann haben wir ein gutes Gattungskriterium, denn die Tasterbildung haben auch andere Gattungen. Es gehören also auch *A. dentifrons* und *bellicosus* Lewis nicht hinein.

Bolitonæus capricornis, n. sp. (Taf. I. fig. 4.)

Robust, parallel, hochgewölbt, schwarz, ganz bedeckt mit pilziger Kruste. *Kopf* sehr breit, der Canthus so lang wie die Augen hinter ihm, aber viel breiter, Oberfläche dicht punktiert, am Innenrande der Augen ein kurzer, scharfer Augenkiel, die Clypealfurche schwach gebogen, scharf, aber fein, der Clypeus in beiden Geschlechtern einfach, ohne Zähne und Hörner, auf der Stirn ein paar undeutliche Erhabenheiten. Fühler mässig schlank, Glied drei $1\frac{1}{2}$ mal so lang als vier, die folgenden immer stärker quer, aber nicht sehr deutlich nach innen ausgezogen, das letzte in das zehnte eingelassen und viel kleiner als dieses. Mentum grob punktiert, nur $1\frac{1}{2}$ mal so breit wie lang, Ligula vorn sehr deutlich ausgeschnitten. *Halsschild* reichlich doppelt so lang wie breit, die Seiten nach vorn schwach, nach hinten noch weniger verengt, breit verflacht, die Vorderwinkel etwas niedergebogen, ca. 80° gross, spitz, der Seitenrand mit ca. 7 ziemlich grossen Zähnen, die Hinterecken scharf recht- oder stumpfwinklig, die Basis fast gerade. Auf der Scheibe befinden sich beim ♂ zwei ziemlich lange, und ziemlich dünne Hörner, am Grunde weit von einander entfernt, nach aussen gekrümmt, mit ihren Spitzen etwas gegeneinander gerichtet, an der äussersten Spitze befindet sich ein Büschel goldgelber Haare, die nur bei Ansicht von vorn deutlich sind, diese Hörner sind fast horizontal. Beim ♀ stehen an Stelle der Hörner zwei kräftige, runde Tuberkeln. Die Scheibe mit zahlreichen, teils in Gruppen stehenden Körnern, es befinden sich zwischen den Hörnern zur Basis laufend, zwei gekrümmte

Längsreihen, einige Körnchen an der Basis, andere seitlich am Absturz, auch die Hörner resp. Tuberkeln sind ziemlich dicht gekörnt. Der Grund ist deutlich, aber nicht gedrängt punktiert, der verflachte Seitenrand sehr fein und flach quer gefältelt. *Flügeldecken* sehr hoch und kurz, der von oben kaum sichtbare Seitenrand gezähnt, die Zähne ziemlich gleichmässig, nach hinten allmählich feiner werdend. In jedem Zwischenraum befindet sich eine sehr weitläufige Reihe von 4–5 Höckerchen oder Körnern, der Nahtstreifen enthält ca. 12 sehr feine Körnchen, der 2. wesentlich grössere, der 3. ca. 6 meist paarweise genäherte Höcker, die aber viel kleiner sind als etwa bei den Byrsaxarten, der folgende wieder feinere, der nächste etwas grössere Höcker; die Punktreihen ziemlich grob, aber nicht sehr ordentlich, der übrige Grund der Flügeldecken glatt. Die Epipleuren ziemlich fein, tief eingestochen punktiert. *Unterseite*, besonders das Abdomen glänzend. Prosternum wagerecht, mit steilem, aber nicht senkrechtem Abfall, ohne Spitze, Mesosternum mit feiner Spitze, Abdomen ziemlich grob punktiert. Die Schienen, besonders die vorderen und mittleren in der Mitte erweitert, oder richtiger, in der Endhälfte aussen verschmälert.

L. 6–6½ mm. (ohne Hörner), Breite 4 mm.

2 ♂, 2 ♀, von Kuching, 4., 13., 18., 19. Okt. 1898 (1 ♂ mit der Notiz: from *Boletus* fungus).

Diese Art hat als Verwandten *B. serratus* Geb. von den Philippinen, der grösser und schlanker ist, einen gezähnten Clypeus, viel gröbere und weniger Seitenrandzähne und eine andere Skulptur der Elytren hat, auch sind die Schienen dort einfach linear. Sehr nahe steht ihr auch *B. bifurcus* Pasc., der grösser ist (8 mm.), auf den Hörnern einen Haarschopf trägt (von dem bei unserer Art nur eine Andeutung vorhanden ist), auch sind die Hörner nicht "sublyratis" sondern einfach nach innen gekrümmt und der Halsschild ist nicht "antice gradatim angustato."

Byrsax gibbifer, Wesm. Bull. Ac. Brux. iii. 1836, p. 112, t. 4 f. a-c; Guér. Rev. Zool. 1838, p. 117; Preudh. Bull. Ac. Roy. Belg. (2) xxix. 1870, p. 379.

Von Java beschrieben, liegt mir in meiner Sammlung auch von Sumatra vor. ♂, ♀ von Kuching 29. Dez. 1898.

Byrsax quadrinodosus, n. sp. (Taf. I. fig. 5.)

Von fast kreisförmigem Umriss, wenig länger als breit, die Flügeldecken nur auf sehr kurze Strecke parallel. Braun, mässig glänzend, aber ganz mit einer Schmutz-

kruste überzogen. *Kopf* auf der Stirn mit feiner Längsfurche zwischen den Augen, und ebenso feiner, aber scharf eingeschnittener Clypealsutur, vorn am Clypeus fast glatt zwischen den Hörnern, die Stirn fein punktiert, die Seiten gröber und dichter, vor den Augen bis zum Clypeusrande befinden sich zwei verhältnismässig kurze, wenig mehr als kopflange, fast horizontale, sehr schwach gekrümmte, am Ende aussen schräg abgestutzte Hörner beim ♂ (vermutlich ist aber das einzige mir vorliegende ♂ nicht sehr gut entwickelt), und eine sehr kurze, schmale aufrechte Augenfalte oder Tuberkel zwischen Auge und Horn. Beim ♀ fehlen die Hörner und die Augenfalte ist flach und engt von der Stirn her die Augen etwas ein, in diesem Geschlecht ist die Stirn mit einigen feinen Körnchen besetzt. Fühler kurz, gesägt, das 3. Glied nur wenig länger als das 4., konisch, das 5. so lang wie breit, die folgenden immer stärker quer nach innen und vorn ausgezogen, also schräg, so dass die Ruhelage der Fühlerkeule ein kräftiger Bogen ist, das letzte Glied mit schräger Basis, so lang wie breit. *Halsschild* stark quer, an der Basis am breitesten, die Hinterecken kurz, ganz verrundet, die Seiten nach vorn in sehr schwachem Bogen nach vorn stark verengt, die Vorderecken scharf rechtwinklig, die Seitenränder regelmässig und scharf, wenn auch flach gesägt, die Zähne (ca. 15) stumpfwinklig, jedes ein feines Körnchen oben tragend; die hochgehöckerte Scheibe trägt in der Mitte einen kräftigen Doppelbuckel in beiden Geschlechtern, ist davor schwach quer eingedrückt und beim ♂ mit vorgezogenem einfachen Vorderrand, beim ♀ dort mit zwei horizontalen, schwachen Hörnern, ähnlich wie bei den ♀ der meisten anderen Arten (ausgenommen z. B. *Satanas* Geb.), doch sind die Hörnchen kurz und am Ende stumpf. In einiger Entfernung wird der Rand des Halsschildes von einer unregelmässigen Reihe von Körnchen begleitet, der verflachte Seitenrand ist im übrigen ohne Körner, aber der Absturz des Buckels und dieser selbst sind mit kräftigen Körnchen bedeckt. Die Basis hat jederseits des Buckels einen flachen aber scharf stumpfwinkligen Einschnitt und nach innen davon eine schwach vorspringende stumpfwinklige Erweiterung, dem schwachen Einschnitt entspricht an der Basis der Elytren eine kleine Vorragung. *Flügeldecken* mit scharf rechteckigen Schultern, der Rand viel feiner und stumpfwinkliger gesägt als der des Thorax, fast nur gewellt, jedes Zähnchen am Ende mit sehr feinem, queren Körnchen und viel weiter nach innen mit einem

runden Körnchen, der verflachte Seitenrand sehr schwach quer gerunzelt und nicht granuliert oder punktiert, nur etwas entfernt von der Basis ein einzelnes kräftiges Korn vorhanden; die hochgebuckelte Scheibe trägt 4 grosse Knoten, welche die Ecken eines gedachten Quadrates bilden, dahinter ist am Absturz keine Spur einer Tuberkel vorhanden. Der Nahtstreifen und der äusserste (neben der Verflachung) mit einer regelmässigen Körnerreihe, sonst sind auf dem Buckel einzelne zerstreute Körner vorhanden, die Punkte der Reihen ziemlich grob und weitläufig, nicht sehr regelmässig, der Buckel wird von dem Seitenrand durch eine Reihe sehr grober Punkte abgesetzt, die Spitze der Flügeldecken ganz kurz verrundet; die Pleuren der Elytren und des Halsschildes sind besonders seitlich ziemlich grob punktiert. *Unterseite* glänzend, Prosternum vorn schwach gekielt, hinten niedergedrückt, Mesosternum mit spitz schräg nach vorn ragender Tuberkel, die Vorderschienen haben aussen an der Vorderseite einen etwas stärkeren, flachen Ausschnitt als die Hinterkante.

L. $7\frac{1}{3}$–$8\frac{2}{3}$ mm. (ohne Hörner) Br. 6–$6\frac{1}{2}$ mm.

1 ♂, 1 ♀, von Kuching, 12. 19. Okt. 1898.

Diese ziemlich kleine Art ist durch den kräftigen Buckel des Halsschildes und die 4 Knoten der Elytren gekennzeichnet. Bei den übrigen Gattungsgenossen sind 6 oder 8 Knoten vorhanden. Die schwache Bewaffnung des Kopfes beim ♂ ist vielleicht individuell.

Byrsax excisicollis, n. sp. (Taf. I. fig. 6.)

Von der Form der *B. cornutus*, F., also viel schmaler und gestreckter als gibbifer und die vorige Art, glänzend schwarz-braun (wenn sorgfältig gereinigt), meist mit weisslicher Pilzkruste bedeckt.

Kopf flach, auf der Stirn befindet sich die charakteristische Längsfurche, die ebenso tief eingeschnitten ist, wie die Clypealfurche, Clypeus gerade abgeschnitten, jederseits neben den Seitenecken mit kleinerem, ganz stumpfwinkligen Ausschnitt, am Innenrand der Augen eine kleine, seitlich depresse Tuberkel, einige weitläufige Körnchen machen die Oberfläche uneben, der ganze Kopf ziemlich dicht und mässig grob punktiert. An den Fühlern ist Glied 3 nur wenig länger als 4, 5 und die folgenden immer stärker werdend nach innen erweitert, die 3 vorletzten Glieder fast dreimal so breit wie lang, das letzte so lang wie breit, schief. Mentum schwach gewölbt, quer, die sehr breite Ligula breit ausgeschnitten. Die linke

Mandibel mit zwei sehr langen, scharfen Spitzen, der Maxillarrand (der Seitenrand des Kopfes unten neben den Augen) sehr hoch kielförmig. *Halsschild* mit sehr stark gekrümmtem Seitenrand, ohne Hinterwinkel, grösste Breite hinter der Mitte, es sind 8–9 sehr starke, ziemlich spitze Zähne vorhanden, von denen der erste die nach vorn gerichteten Vorderwinkel bildet, die letzten nach hinten gerichtet, Vorderrand innen, neben dem letzten Hauptzahn mit einigen winzigen Zähnchen, jederseits neben dem letzten Zahn an der Basis befindet sich ein sehr tiefer, über halbkreisförmiger Ausschnitt, etwas schräg nach innen, hinten nach innen von einem ziemlich spitzen Winkel begrenzt. Am Vorderrand befinden sich 2 horizontale, durch einen halbkreisförmigen oder tieferen Ausschnitt gebildete, ziemlich kurze und spitze Hörner, in der Mitte der Scheibe ein scharfer, am Ende oben und vorn sanft ausgeschnittener Höcker, auf dessen abgeschnittener Spitze 4–6 feine Körnchen stehen; hinter diesem Höcker ein senkrecht stehender, kleinerer. Der Grund der Scheibe mit einigen zerstreuten, meist in Querreihen stehenden Körnchen, jedes Seitenrandzähnchen mit sehr feinen Körnchen an der äussersten Spitze oben, und ein paar weiteren Graneln entfernt vom Rand. *Flügeldecken* mit scharf rechteckigen Schultern (richtiger: der Winkel zwischen Basis und Seitenrand ist ein rechter), ihre Basis jederseits in breitem, flachem Bogen ausgeschnitten, neben den Schildchen etwas winklig vorgezogen, der Seitenrand stark gezähnt, er bildet in der ersten Hälfte regelmässige Halbkreiswellen, die Zähne nach hinten immer feiner und schwächer, jeder Zahn oben auf der äussersten Spitze mit sehr kleinem, wenig auffälligem und innen am Grunde mit viel grösserem Körnchen. Oben jederseits neben der Naht steht eine Reihe von 3 sehr hohen, scharfen, seitlich depressen Höckern mit etwas gezackter Spitze, der ganze übrige Raum der Flügeldeckenscheibe mit weitläufigen Reihen kleiner, spitzer Tuberkeln, fast Stacheln bedeckt, von denen vorne zwischen Schulter und Schildchen eine grössere Beule gebildet wird. Die Punktreihen sehr grob und durch die Tuberkeln oft gestört, bei den Haupthöckern laufen sie sogar etwas am Höcker hinauf. *Unterseite* glänzend, Prosternum seitlich zusammengedrückt, hinten ganz niedergebogen, Mesosternum mit spitzer nach vorn gerichteter Tuberkel. Hinterbrust in der Mitte durch schwache Beulen uneben, Abdomen dicht und ziemlich grob punktiert. Die Vorderschienen innen im Ende schmaler als die Hinterseite und gelb befilzt.

L. 8–8½ mm. (ohne Hörner) Br. 5⅓–5½ mm.

Diese Art bildet mit *B. cornutus* F. von Ceylon und *horridus* Ol. wegen des tiefen Ausschnittes an der Basis des Halsschildes eine besondere Gruppe, von diesen beiden Arten ist sie durch bedeutende Grösse, den beim ♂ hornlosen Kopf und die Halsschildskulptur sofort kenntlich.

2 Ex. von Kuching, 4. Okt. 1898; 31. Mai 1900, zwei weitere von Sumatra (Morton) in meiner Sammlung.

Alle Exemplare übereinstimmend, so dass es scheint, als ob die Geschlechter nicht wesentlich verschieden sind.

Die 3 Byrsaxarten von Borneo lassen sich folgendermassen unterscheiden:—

1. Halsschild an der Basis jederseits mit sehr tiefem Ausschnitt, Kopf ohne Hörner, Halsschild mit horizontalen, Hörnern . *excisicollis*, Geb.
   Halsschild fast ohne Ausbuchtung, Kopf beim ♂ stark gehörnt, Flügeldeckenrand schwach gezähnt 2
2. Flügeldecken mit 4 grossen Höckern *quadrinodosus*, Geb.
   Flügeldecken mit 6 grossen Höckern . *gibbifer*, Wesm.

Bradymerus, Perroud.

Ann. Soc. Linn. Lyon, 1864, p. 110.

Bradymerus æquecostatus, Fairm. Notes Leyd. Mus. xv. 1893, p. 20. Liegt mir in Anzahl in meiner Sammlung von Nordborneo, vom Kinabalu und auch von mehreren Fundorten aus Sumatra vor.

Bradymerus granulipennis, Fairm. Notes Leyd. Mus. xv. 1893, p. 20. Diese Art ist mir nicht vorgekommen.

Bradymerus denticeps, n. sp.

Klein, ziemlich robust, glänzend braun-schwarz oder braun. Wurzel der Fühler, Taster, Beine und Unterseite gelbrot oder bräunlich. *Kopf* flach, Clypeus gerade abgestutzt, seitlich vor dem Canthus scharf winklig ausgeschnitten, der Canthus spitzwinklig, fast zahnförmig seitwärts ausgezogen, so breit wie das Auge hinter ihm, die Seiten des Kopfes von der Canthusspitze bis zum Ausschnitt des Clypeus schwach **S**-förmig geschwungen, hinten am Innenrande der Augen befindet sich eine schwache Tuberkel, die Oberfläche sehr dicht und grob punktiert, die Zwischenräume der Punkte stellenweise körnig. Fühler schmal, mit 6 gliedriger Keule, Glied drei 1½ mal so lang wie 4, dieses etwas länger als das 5. die

folgenden nach innen erweitert, die vorletzten fast doppelt so breit wie lang, das letzte etwa kreisförmig. Mentum trapezisch, so lang wie breit, Ligula vorn scharf und deutlich ausgeschnitten. *Halsschild* fast doppelt so breit wie lang, Seiten kräftig gekrümmt, nach vorn nur wenig stärker als nach hinten verengt, die Vorderwinkel spitz vorgezogen, die äusserste Spitze schwach abgerundet, die Seiten scharf gezähnt (es sind 8–11 Zähne vorhanden), Hinterwinkel stumpf. Scheibe sehr hoch gewölbt, sehr grob und dicht punktiert, die Punkte flach, ihre Zwischenräume bilden ein ziemlich regelmässiges Netz, und stellenweise scharfe Körnchen, in jedem Punkte bei reinen Exemplaren ein Schuppenbürstchen. (Die ganze Skulptur tritt erst nach gehöriger Reinigung der stets mit einer Schmutzkruste bedeckten Art hervor.) Basis kräftig zweibuchtig, Mittellappen gross, Seitenrand der *Flügeldecken* von oben kaum sichtbar, Schulterecken sehr stumpf aber deutlich, die Oberfläche mit kurzen, gelben, aufrechten, sparsamen Börstchen, die nicht aus den Punkten, sondern zwischen ihnen entspringen; die alternierenden Zwischenräume scharf gekielt, der Nahtstreif nur in der hinteren Hälfte, der 3., 5., 7., 9. von der Basis an, der erste Streif in der vorderen Hälfte mit Tuberkelreihe, der Kiel auf der Schneide nicht glatt, sondern fein krenuliert, die Punkte der Streifen dicht und ziemlich grob, von den Kielen ist der des 9. Interstitiums der längste, da er sich am Spitzenrand bis in die Spitze fortsetzt. *Prosternum* zwischen den Hüften ziemlich tief gefurcht, das Ende niedergedrückt und in eine verrundete Spitze ausgezogen, Mesosternum hochkantig breit V-förmig ausgeschnitten, die ganze Unterseite ziemlich grob punktiert. Beine ohne Auszeichnung.

L. $5\frac{1}{2}$ mm.

4 Exemplare dieser kleinen, charakteristisch skulptierten Art in meiner Sammlung, die mit der folgenden, mit *granulipennis* und einigen neuen Arten wegen des zahnförmig ausgezogenen Canthus eine besondere Gruppe bildet (Borneo, Kinabalu).

Bradymerus interruptus, n. sp.

Ziemlich flach und sehr schmal, schwarz, matt, Fühler, Taster und Tarsen braun. *Kopf*, durch grobe Punkte sehr rauh, deren Zwischenräume hier und da zu scharfen Körnern werden. Clypeus gerade abgeschnitten, seine Aussenecken kurz verrundet, darüber ein scharfer winkliger

Einschnitt, der Canthus viel breiter als die Augen, seitlich stark winklig vorragend, so lang wie die Augen hinter ihm, am Innenrande der Augen, etwas nach hinten, wie bei voriger Art, eine stumpfe Tuberkel. Fühler dünn, mit sechsgliedriger Keule, Glied drei $1\frac{1}{2}$ mal so lang wie 4, dieses dem 5. fast gleich, die vorletzten Glieder doppelt so breit wie lang, das letzte kugelig. Mentum so lang wie breit, trapezisch, in der Mitte mit Längskiel. *Halsschild* etwa $1\frac{1}{2}$ mal so lang wie in der Mitte breit, Seiten schwach gerundet, die Basis so breit wie die Spitze, der Vorderrand in der Mitte vorgezogen, der Hinterrand kräftig doppelbuchtig, der basale Mittellappen schmaler und kürzer als der Vorderrandlappen, der Seitenrand grob gezähnt (6–7 Zähne), die Scheibe mässig stark gewölbt, sehr grob und dicht punktiert und unregelmässig, ziemlich weitläufig gekörnt. *Flügeldecken* schmal und parallel, an der Basis viel breiter als die Basis des Halsschildes; Schultern kräftig entwickelt, der Seitenrand gerade noch überdeckt, und von oben nicht sichtbar, Oberfläche mit Reihen mässig starker Punkte, deren Zwischenraum grösser als ihre Durchmesser sind, sie sind schwach gewölbt, der erste mit einer Reihe etwas länglicher Körnchen, 2., 4., 6. mit kleineren, rundlichen, scharfen Körnchen, der 3. mit scharfer, stellenweise unterbrochener Rippe, der 5., 7. und 9. Zwischenraum mit je einer Reihe länglicher, scharfer Körnchen, ähnlich dem ersten, aber stärker, der 8. wie der 6. aber etwas gröber gekörnt, der 9. Zwischenraum hinten scharf gerippt und bis zur Spitze ausgebildet, diese Rippe und der Epipleuralrand schwach krenuliert. *Unterseite* glänzend, die Epipleuren fast glatt, die Propleuren grob punktiert, das Prosternum fast wagerecht, mit senkrechtem Absturz, die Spitze etwas aufgebogen, nicht deutlich gefurcht, Mesosternum breit und scharf-erhaben, **V**-förmig ausgeschnitten, Hinterbrust und Abdomen dicht und deutlich punktiert. Beine zart und schlank, Mitteltibien gegen das Ende etwas verschmälert.

L. $5\frac{2}{3}$ mm.

Ein Exemplar von Herrn F. Schneider, Berlin, erhalten, in meiner Sammlung, Njabang, Borneo.

Die Art ist durch schmalen Halsschild, winkligen Canthus, grob gesägten Seitenrand des Thorax und durch die eigenartige Flügeldeckenskulptur ausgezeichnet.

Die *Bradymerusarten* von Borneo lassen sich folgendermassen unterscheiden :—

1. Kopf vor den Augen so breit wie diese, Halsschildseitenrand nicht gesägt, Flügeldecken mit gleichmässigen feinen Kielen . *æquecostatus*, Fairm.
   Kopf vor den Augen stark winklig erweitert, Halsschildseitenrand gesägt (auch *granulipennis* ?) Flügeldecken gekörnt 2
2. Fühlerkeule dreigliedrig, Vorderwinkel des Halsschildes rechteckig, Flügeldeckenintervalle fein granuliert (ex Fairmaire) . . *granulipennis*, Fairm.
   Fühlerkeule sechsgliedrig, Vorderecken des Halsschildes vorgezogen, Flügeldeckenintervalle abwechselnd scharf gerippt, Rippen teilweise unterbrochen 3
3. Prosternum hinten niedergebogen, die alternierenden Interstitien scharf, vollständig gekielt, die übrigen glatt, Halsschildbasis kaum schmaler als die der Flügeldecken . . *denticeps*, Geb.
   Prosternum hinten nicht niedergebogen, die alternierenden Interstitien unterbrochen gerippt, resp. tuberkuliert, die übrigen mit feiner Körnchenreihe, Halsschildbasis viel schmaler als die der Elytren . . . . *interruptus*, Geb.

Subfam. Rhipidandrinæ.

Cherostus, Waterh.

Ann. Mag. Nat. Hist. (6) xiv. 1894, p. 68.

Cherostus nudus, n. sp.

Klein, zilindrisch, kurz, braun, schwarz glänzend. *Kopf* ohne Haare auf dem Scheitel, ohne glatten Fleck, ohne Spur von Canthus, von den Augen nach vorn verengt, die ganze Oberfläche sehr dicht und grob, aber ganz flach punktiert, die Exemplare von Banguey mit glänzendem, schwach punktiertem Clypeus, das von Kuching mit gleichmässig punktiertem Kopf, am Vorderrand keine Leiste. Fühler schlank, Glied 3 ist das kleinste, 4 etwas grösser, so lang wie breit, die folgenden immer stärker nach innen erweitert, fast gekämmt, und zwar bei dem einen Exemplar von Kuching viel weniger als bei den anderen, das letzte Glied so lang wie breit, schief. *Halsschild* an der Basis am breitesten, aber in der Hinterhälfte fast parallel, ringsherum sehr fein gerandet, der Vorderrand breit und stark vorgezogen, alle Winkel verrundet, Seitenrand von oben gerade noch sichtbar, die Oberfläche grob, flach und sehr dicht, aber nicht verworren punktiert, die Zwischenräume bilden vielmehr ein sehr feines, regel-

mässiges Netz. *Flügeldecken* mit sehr feinen, scharfen, vollständigen Kielchen, von diesen geht der erste neben der Naht bis zur Spitze durch, der zweite ist am Absturz verkürzt, die folgenden wieder länger. Diese Leisten sind durch feine Querrippchen verbunden, die an der Basis etwas dichter stehen, auf der Mitte aber bilden sie mit den Längsleisten regelmässige Quadrate. Der Seitenrand ist von oben nicht sichtbar. *Vorderhüften* quer, Prosternum schmal, hinten niedergebogen. Metasternal-und Abdominalfortsatz schmal, zugespitzt, Abdomen und Brust fein und dicht punktiert, Analsegment sehr fein gerandet. Alle Schienen gegen das Ende verbreitet und an der hinteren Aussenkante fein gesägt.

L. 3 mm.

36 Exemplare von Banguey bei Borneo. 1 Exemplar von Kuching, Jan. 1906. In meiner Sammlung und bei Dr. O. Staudinger & Bang-Haas, Dresden, welcher Firma ich sie verdanke.

Es ist möglich, dass die Tiere von beiden Fundorten verschiedenen Arten angehören, da Kopf- und Fühlerbildung Unterschiede zeigen, darüber muss weiteres Material Aufschlüsse geben.

Die nackte Stirn, ohne glatten Fleck und die sehr charakteristische Flügeldeckenskulptur unterscheiden diese Art von ihren Verwandten.

Subfam. Diaperinæ.

Platydema, Cast & Brll.

Ann. Sc. Nat. xxiii. 1831, p. 350 (Separ. p. 26); Lacord. Gen. Col. v. 1859, p. 304; Horn. Revis. Tenebr. North of Mex. 1870, p. 380; Seidl. Naturg. Ins. Deutschl. v. 1894, pp. 508, 518; Champ. Biol. Centr. Ann. Col. iv. 1. 1886, p. 181.

Platydema laticorne, Fairm.—Notes Leyd. Mus. iv. 1882, p. 222. Von Sumatra beschrieben, liegt mir in meiner Sammlung von Java und Borneo: Kinabalu vor. Ich zweifle nicht, diese Art richtig bestimmt zu haben. Die dürftige Beschreibung Fairmaires, der nur ein Geschlecht kennt, bedarf der Ergänzung, die ich nach meinen Exemplaren gebe.

Furche des Clypeus beim ♂ ♀ bogig, scharf und schmal, beim ♂ quer, undeutlich, die gröbere Punktierung des Halsschildes auf die basalen Eindrücke und deren Nähe beschränkt. Vordertarsen des ♂ auch nicht im ersten

Glied erweitert, Kopf bei beiden Geschlechtern ohne Hörner, die Mittel- und Hinterschienen des ♂ gegen das Ende erweitert und stark einwärts gekrümmt, Unterseite glänzend, Prosternum am Ende schmal, fast meisselförmig, senkrecht abstürzend, Mesosternum scharf **V**-förmig ausgeschnitten, Abdomen dicht und deutlich punktiert, fein längsstrigas.

L. 8–9½ mm.

Platydema subfacia, Walk.—Ann. Mag. Nat. Hist. (3) ii. 1858, p. 284 (= *celebum*, Chevr. Pet. Nouv. Ent. ii. 1877, p. 178 = *diversidens*, Fairm. Ann. Soc. Ent. Fr. lxii. 1893, p. 24 = *japanum*, Mars. Ann. Soc. Ent. Fr. (5) vi. 1876, p. 109). Von Japan, Südchina, Hinter- und Vorderindien, Madagascar, und den Sundainseln bekannt, liegt mir in einem Exemplar (♀) in meiner Sammlung von Banguey bei Borneo, vor.

Platydema plagiatum, Waterh.—Ann. Mag. Nat. Hist. (6) xiv. 1894, p. 70. Von der Insel Damma beschrieben, liegt mir in meiner Sammlung vor von der Insel Mentawei: Si Oban iv.–viii. 1894 (Modigliani) und von Banguey bei Borneo.

Platydema sericeum, n. sp.

Kurz oval, gewölbt, rotbraun, matt, auf dem Halsschild und den Flügeldecken mit Seidenglanz. Kopf, die Basis des Halsschildes sehr breit, ein Längswisch seitlich auf jeder Flügeldecke schwärzlich, Fühler und Beine gelb. *Kopf* ohne Canthus, von den Augen an in regelmässigem Drittelkreisbogen nach vorn verengt, die Mitte des Clypeusrandes mit kleiner Tuberkel in beiden Geschlechtern, die Clypealsutur sehr deutlich, schwach eingedrückt, jederseits vor den Augen mit kleinem Grübchen. Stirn beim ♀ schwächer, beim ♂ stärker ausgehöhlt, die Grube nicht scharfkantig, am Innenrande der Augen in beiden Geschlechtern mit kräftiger Tuberkel, beim ♂ ist die linke stärker, kurz hornartig, und an der äussersten Spitze mit feinem Haarschopf versehen; Fühler schlank, Glieder vom 4. an erweitert, querkugelig, 1½ mal so breit wie lang, das letzte so lang wie breit, gegen die Spitze verrundet zugespitzt. *Halsschild* 2½ mal so breit wie lang, seitlich mässig stark gerundet, Vorderwinkel sehr breit, Hinterecken kurz verrundet, Scheibe glatt, die Seiten nur bei starker Vergrösserung sichtbar punktiert, Basalgrübchen gross und sehr flach, Basis stark doppelbuchtig.

Flügeldecken mit scharf stumpfwinkligen Schultern, ihre Oberfläche bei nicht sehr starker Vergrösserung nackt erscheinend, in Wirklichkeit aber mit weitläufigen, staubartigen Härchen. Die Punktlinien sehr fein, auch seitlich nicht vertieft, die vollkommen ebenen Zwischenräume ganz glatt. *Prosternum* wagerecht, Fortsatz nicht sehr spitz. Mesosternum **V**-förmig ausgeschnitten, die Kanten des Ausschnittes gekielt, der Ausschnitt von der Seite gesehen im Bogen nach unten abfallend, durchaus nicht steil, Abdomen glänzend, fast glatt, Schenkel breit und kräftig, Schienen an der Aussenkante fein gesägt und äusserst fein gestachelt, am Ende der Aussenkante der Vorderschienen zwei deutliche Stachelchen. An den Hintertarsen ist Glied, 1 länger als 2 + 3, diese beiden zusammen so lang wie 4.

L. 3–3½ mm.

Ca. 50 Exemplare von Banguey bei Borneo in meiner Sammlung und bei Staudinger & Bang-Haas.

Diese Art ist an der Färbung, dem matt seidigen Glanz, dem in beiden Geschlechtern tuberkulierten Kopf, den sehr feinen Punktreihen, &c., leicht zu erkennen. Sie steht meines Wissens isoliert da.

Platydema planum, n.sp. (*Ischnodactylus breviceps*, Fairm. *i.l.*).

Sehr flach, ziemlich parallel, glänzend schwarz, Tarsen und Palpen rötlich, zwei grosse Flecken auf jeder Flügeldecke gelbrot. *Kopf* mit tiefer, etwas geschwungener Querfurche, der Clypeus bis zu dieser Furche sehr gewölbt, die Stirn zwischen den Augen flach grubig vertieft, in beiden Geschlechtern ohne Hörner, am Innenrand der Augen, vorn bis zu ihrer Mitte reichend eine schmal-dreieckige, hinten offene Augenfurche, die Augen stark genähert, ihr Zwischenraum kleiner als der Durchmesser eines Auges; der Vorderrand des Kopfes bildet keinen regelmässigen Kreisbogen, sondern die Mitte ist deutlich gerade, der Clypeus ist sehr fein, die Stirn, namentlich in der mittleren Längslinie etwas deutlicher punktiert. Mentum länger als breit, auf ihm ein scharfkantiger Eindruck, der die hinteren zwei Drittel der Fläche einnimmt. *Halsschild* 2½ mal so breit wie lang, querüber bis zum Seitenrand, aber auch in der Längsrichtung, besonders vorn kräftig gewölbt, jederseits der stark doppelbuchtigen Basis ein schmales, feines Längsgrübchen, die sehr feine Randlinie an der Spitze vollständig, die vorderen Winkel sehr stark verrundet, die Hinterecken ziemlich scharf stumpfwinklig.

Oberfläche mässig dicht, fein punktiert. *Flügeldecken* mit Linien ziemlich kräftiger Punkte, Schultern stumpfwinklig, Zwischenräume, auch die seitlichen, ganz flach, sehr fein punktiert. Die beiden gelbroten Flecken auf jeder Decke gross, der vordere lässt an der Basis einen schwarzen Saum frei, etwa halb so breit wie der Fleck, der Raum zwischen den Flecken etwa von der Breite des Vorderfleckes. Die Makeln sind isoliert, dass heisst, sie berühren weder Seitenrand noch Naht, die hinteren auch nicht die Spitze. *Unterseite* glänzend, die Seiten glatt, das Abdomen äusserst fein punktiert, seitlich fein längsstrigos. Prosternum wagerecht, schmal, zugespitzt, mit senkrechtem Absturz, Mesosternum scharf **V**-förmig ausgeschnitten, sehr scharfkantig, mit senkrechtem Absturz. Beine zart, ohne Auszeichnung, die Schienen ungefurcht, nicht krenuliert, aber fein rauh und sehr kurz behaart. An den Hintertarsen ist das 4. Glied gleich 2 + 3, das erste etwas länger.

L. $4\frac{1}{3}$–$5\frac{1}{3}$ mm.

Zahlreiche Exemplare von Banguey bei Borneo in meiner Sammlung und bei Dr. Staudinger & Bang-Haas.

Die Art hat mit *Ischnodactylus* wegen des kurzen Kopfes nichts zu tun, auch den Fairmaireschen Artnamen konnte ich nicht beibehalten, da es schon ein *Pl. breviceps* gibt.

Von den anderen Arten mit roten Flecken zeichnet sich unsere durch flache Gestalt, den vorn stark gewölbten Halsschild, einfachen Kopf in beiden Geschlechtern, ungefurchte Tibien, &c., aus.

Platydema nigroæneum, Motsch.—Études Ent. ix. 1860, p. 18.—Fairm. Ann. Soc. Ent. Fr. (6) viii. 1888, p. 355.—Lew. Ann. Mag. Nat. Hist. (6) xiii. 1894, p. 393 (= *musiva*, Har., Deutsche Ent. Zeitschr. xxii. 1878, p. 78). Diese Art ist von Japan zuerst beschrieben, dort häufig, von Fairmaire aus Tonkin nachgewiesen. Mir liegt ein Stück in meiner Sammlung vom Kinabalu vor.

Uebersicht über die 6 Platydema-Arten von Borneo.

1. Oben ganz mattschwarz, gross, Kopf beim ♂ ohne Hörner, Mittel- und Hinterschienen beim ♂ stark gekrümmt . . . . . *laticorne*, Fairm.
   Oben nicht schwarz, sondern metallisch oder gefleckt, Kopf beim ♂ meist gehörnt, Schienen gerade 2
2. Stark metallische Art, ♂ gehörnt, Flügeldecken mit Punktstreifen . . . *nigroæneum*, Motsch.
   Körper nicht metallisch, Flügeldecken meist mit feinen Punktlinien 3

3. Oberseite glänzend, Flügeldecken mit grossen, gelbroten Flecken 4
   Oberseite matt, mit Seidenglanz, Flügeldecken rot mit schwarzem Längswisch, Kopf in beiden Geschlechtern tuberkuliert . . . *sericeum*, Geb.
4. Körper sehr flach, Beine schwarz, der Spitzenfleck jeder Flügeldecke isoliert, Kopf in beiden Geschlechtern unbewaffnet . . . *planum*, Geb.
   Körper gewölbt, Beine gelb oder gelbrot, hinterer Fleck der Flügeldecken nimmt die ganze Spitze ein 5
5. ♂ mit ungleichen Hörnern, schmale Art, Streifen an der Spitze stark vertieft, vorderer Fleck schräg . . . . . *subfascia*, Walk.
   ♂ ungehörnt, ovale Art, Flügeldecken nicht gestreift, vorderer Fleck gerade . *plagiatum*, Waterh.

Ceropria, Cast. & Brll.

Ann. Soc. Nat. xxiii. 1831, p. 396 (Separ. p. 72).—Lacord. Gen. Col. v. 1859, p. 307.—Har. Stett. Ent. Zeit. xxxix. 1878, p. 345.

Ceropria induta, Wied.—Zool. Mag. i. 3, 1819, p. 164.—Har. Stett. Ent. Zeit. 1879, p. 345.—Diese im Indo-Malay. Gebiet gemeine Art liegt mir auch von Borneo vor, Kinabalu, in meiner Sammlung, und aus dem Sarawak Museum R. Limbang, 4. April, 1910.

Ceropria speciosissima, n. sp.

Breit oval, die ganze Oberseite metallisch, der Kopf etwas messingfarben, Pronotum purpurn, die Seiten mehr blaugrün, die Flügeldecken herrlich metallisch irisierend gefleckt, die Naht grünlich, daneben goldig, ein schwärzlich kupfriger Humeralfleck, der kupferrot, dann schmal goldig umrandet ist, eine goldige mittlere, etwas gezackte Querbinde, die an der Naht nach vorn ausläuft, und schmal rotkupfrig gesäumt ist, ein kleiner dunkelkupfriger Apikalfleck, der wie der Humeralfleck rotkupfrig und goldig umrandet ist; die Grenzen der Flecke und Binde etwas verwaschen. *Kopf* sehr fein und dicht punktiert, ohne Stirneindruck, die Quersutur sehr stark, der Zwischenraum bei den Vorderecken der Augen sehr klein, kleiner als der halbe Querdurchmesser der Augen. Die Fühler erreichen die Basis des Halsschildes, sie sind stark gesägt vom 4. Glied an, jedes Glied breiter als lang, an der Spitze mit einigen feinen Härchen, Unterseite des Kopfes mit flacher, breiter Längsfurche. *Halsschild* an der Basis reichlich

doppelt so breit wie lang, Basis ganz ungerandet, ihr Mittellappen in der Mitte gerade abgestutzt, die Seitenstücke neben dem Mittellappen bis zu den Ecken ganz geradlinig, die Hinterecken scharf rechtwinklig, die Spitze sehr fein vollständig gerandet, Vorderecken kurz verrundet stumpfwinklig, die Basaleindrücke schmal, deutlich, die Oberfläche sehr fein, mässig dicht, gleichmässig punktiert. Basis der *Flügeldecken* so breit wie die Halsschildbasis, Schulterbeulen kräftig, der Rand dort etwas abgesetzt. Die Oberfläche auf vollkommen flachem Grunde mit Linien ziemlich grober Punkte (viel gröberer als bei *induta*), diese Punkte nicht gedrängt, der Zwischenraum zwischen je zwei Punkten grösser als der Durchmesser eines Punktes die Reihen hinten feiner, seitlich gröber. Die Flügeldeckenspitzen sind (seitlich gesehen) nicht abwärts gezogen, sondern vollkommen wagerecht, von oben gesehen ist der Spitzenrand unmittelbar vor den Ecken sehr kurz und sehr schwach ausgeschnitten, jede Spitze deutlich, nicht abgerundet und sehr fein verdickt. *Unterseite* glänzend schwarz. Prosternum wagerecht, flach, jederseits fein, scharf gerandet, von den Hüften wenig scharf dachförmig. Mesosternum scharfkantig **U**-förmig augeschnitten, Ausschnitt mit senkrechten Absturz, im Grunde mit scharfem Längskiel, Mitte der Unterseite, Pleuren glatt, das Abdomen seitlich fein längsrunzlig und weitläufig und fein, aber deutlich punktiert.

L. 11 mm. Br. 6 mm.

1 Exemplar ♀. Limbang, April 1910.

Von dieser Art liegt mir nur 1 ♀ vor, sodass ich über die Geschlechtsunterschiede keine Angaben machen kann. Sie ist der *C. opulenta*, Har., in der Färbung ausserordentlich ähnlich, aber durch die vollkommenen flachen Flügeldecken und deren ziemlich grobe und weitläufige Reihenpunktur geschieden.

Ceropria superba, Wied.—Zool. Mag. ii. 1. 1823, p. 43.—Har. Stett. Ent. Zeit. xxxix. 1878, p. 350 (=*festiva*, Cast. & Brll. =*Paykulli*, Dalm.).

2 Exemplare aus Borneo; ein ♂ von Kuching, 1. Nov., 1899, ein ♀ Njabang, Borneo occ. in meiner Sammlung.

Harold hat bei seiner Arbeit auf die Geschlechtsunterschiede leider sehr wenig Gewicht gelegt, und dadurch die schwierigen Arten nicht scharf geschieden. Die vorliegende Art hat im männlichen Geschlecht nicht gebogene Schienen (weder Vorder- noch Mittel-) und am Ende der Epipleuren vor der Spitze keinen Ausschnitt, das ♀ hat nicht abwärts

gezogene Spitzen, diese sind einzeln ausgebildet, nicht verrundet. Durch diese Merkmale unterscheidet sie sich von *versicolor*, ausserdem durch die vollkommenen flachen Intervalle und dadurch, dass vor der Spitze eine Querlinie ausgebildet ist. Fairmaire hat eine Art: *impressifrons* beschrieben, die er von *versicolor* unterscheidet. Ich glaube, er verwechselt *versicolor* und *superba*, und beschreibt darum die *versicolor* noch einmal als eine neue Art. Fairmaire's Art ist synonym mit *versicolor*, Cast & Brll.

Ceropria bifoveata, Fairm.—Notes Leyd. Mus. xv. 1893, p. 21, ist mir unbekannt geblieben. Ebenso die folgende Art.

Ceropria rufofasciata, Fairm., *l. c.* p. 22.

*Uebersicht über die Ceropria-Arten von Borneo.**

1. Flügeldecken mit 2 roten Querbinden (ex Fairm.) *rufofasciata*, Fairm.
   Flügeldecken ohne rote Binden, oft aber mit goldiger oder anders metallischer Querfärbung 2
2. Flügeldecken auf bräunlichem Grunde mit 2 mattgoldigen Querbinden, und einem Basalfleck, Schulterbeule selbst nicht von einem Fleck eingenommen. Schienen der ♂ gerade *superba*, Wied.
   Flügeldecken mit irisirenden Flecken und Binden, ein metallischer Humeralfleck vorhanden. Die Vordertibien der ♂ gekrümmt 3
3. Die Zwischenräume vollkommen flach, die Punktreihen mit weitläufigen, ziemlich groben Punkten . . . . . *speciosissima*, Geb.
   Zwischenräume, namentlich an der Spitze gewölbt, die Punkte der Streifen sehr gedrängt . . 4
4. Flügeldecken mit metallischem Humeral- und Apicalfleck, die sehr breit purpurn und goldig, gerandet sind, Halsschild in der Mitte schwarz *induta*, Wied.
   Flügeldecken etwas schachbrettartig metallisch gefärbt, Halsschild mit Purpurflecken (*ex* Fairmaire) . . . . . *bifoveata*, Fairm.

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* *Ceropria violacea*, Blanch. Voy. Pole Sud. iv. 1853, p. 170, t. 12 f. 3, hat mit dieser Gattung nichts zu tun, wie die Figur und die Beschreibung zeigen, sie ist offenbar eine Cnodalonide.

Pentaphyllus, Latr.

Règne anim. éd. ii. vol. v. 1829, p. 30.—Muls. Col. Fr. Latigènes, 1854, p. 196.—Horn. Revis. Tenebr. 1870, p. 378. —Seidl. Naturg. Ins. Deutschl. v. 1894, pp. 509, 536.

Pentaphyllus striatus, n. sp.

Stark glänzend, dunkelbraun, kurz und gedrungen, fast zilindrisch, Fühler und Beine gelbrot. *Kopf* beim ♂ mit 4 ziemlich langen senkrechten Hörnern, die hinteren, am Innenrande der Augen, grösser, am Grunde weit von einander entfernt, zilindrisch, die vorderen am Clypeus, etwas näher aneinander stehend, ihre Aussenkante etwas S-förmig geschwungen in den Seitenrand laufend, ihre Innenkante senkrecht auf dem Clypeus stehend, der Kopf zwischen den Hörnern flach ausgehöhlt, spiegelglatt. Bei schwach entwickelten ♂ sind die vorderen Hörner mehr tuberkelartig. Beim ♀ finden sich statt der hinteren Hörner zwei flache Beulen, die Stirn ist nicht vertieft, aber zwischen Stirn und Clypeus ist die Furche kräftig entwickelt, und der Kopf ist fein aber sehr deutlich punktiert. An den Fühlern ist Glied drei $1\frac{1}{2}$ mal so lang wie 4, das 5. ist so lang wie breit, das 6. deutlich quer, die letzten 5 bilden ein gut abgesetzte Keule, deren Glieder über doppelt so breit wie lang sind, das letzte, schwach quere Glied ist durch eine Querfurche geteilt, so dass fast 12 Glieder angenommen werden können. Mentum kräftig gewölbt, das letzte Glied der Maxillarpalpen zilindrisch. *Halsschild* stark quer, fast doppelt so breit wie lang, stark gewölbt, bis an den Seitenrand, auch vorn stark der Länge nach gewölbt, die Basis ziemlich schmal und flach doppelbuchtig, alle Ecken stark verrundet, die Oberfläche mässig dicht, deutlich, aber fein punktiert, die Spitze sehr fein vollständig gerandet, Basis ungerandet, vor der ganzen Basis befindet sich ein ganz leichter, schmaler Quereindruck, Schildchen sehr gross und breit, gerundet dreieckig mit scharfer Spitze. *Flügeldecken* mit scharf stumpfwinkligen Schulterecken, stark quergewölbt, Seitenrand von oben nicht sichtbar. Oberfläche stark gefurcht, Grund der Furchen mit einer unordentlichen Reihe von feinen Punkten, die inneren Furchen beginnen weit entfernt von der Basis, 3 und 4 vereinigen sich vor der Spitze, die äusseren sind vorn länger und beginnen nahe der Schulterbeule. *Unterseite* glänzend, dicht und deutlich punktiert. Prosternum wagerecht über die Hüften verlängert, mit senkrechtem Absturz, Mesosternum zwischen

die Hüften gedrückt. Metasternum vorn scharf gerandet. Tarsen schlank, die Glieder unten am Ende mit je einem kurzen Dorn jederseits in der Behaarung. Klauen lang, an der Unterkante am Grunde kräftig stumpf gewinkelt, der Stachelkranz am Ende der Schienen ist sehr fein, Hinterkante der Schienen aber nicht bedornt.

L. $2\frac{1}{2}$–3 mm.

23 Exemplare von Banguey bei Borneo (von Dr. O. Staudinger & Bang-Hass, Dresden, erhalten).

Diese Art erinnert in der Form an *chrysomelinus*, ist aber mehr zilindrisch, nach vorn nicht abschüssig. Die 4 Hörner auf dem Kopfe des ♂ finden sich bei keiner bekannten Art, nur bei der folgenden, von der sie sich sofort durch die gefurchten Flügeldecken unterscheidet.

Wahrscheinlich ist *Hoplocephala testacea* Motsch. sehr nahe verwandt und gehört in diese Gattung, doch gibt die unzureichende Beschreibung keinen sicheren Aufschluss.

Pentaphyllus quadricornis, n. sp.

Die ausführliche Beschreibung der vorigen Art passt in allen Einzelheiten auch auf diese, so dass auf sie verwiesen werden kann, doch ist die Oberseite matter und die Flügeldecken sind ohne Spur von Streifung, ganz verworren fein punktiert, beim ♀ ist auch die Stelle der vorderen Hörner durch eine kleine Erhebung angedeutet.

11 Exemplare von Banguey, Borneo, in meiner Sammlung.

Pentaphyllus biconiger, n. sp.

Sehr kurz oval, Vorderkörper abschüssig, Flügeldecken zilindrisch, mattglänzend braun, mit feinen, wenig dichten, goldgelben Härchen bekleidet. Der *Kopf* ist schwach vertieft, äusserst fein und sehr dicht punktiert, beim ♂ stehen vorn neben dem Innenwinkel der Augen, einander genähert, vom Clypeus entfernt, zwei kurze konische Tuberkeln, Kopf beim ♀ ohne Auszeichnung, aber die Querfurche sehr scharf. Fühler sehr kurz, mit stark abgesetzter 5-gliedriger Keule, Glied 4–6 dicht aneinandergedrängt, sehr klein, die vorletzten Glieder fast schalenförmig, mindestens drei mal so breit wie lang, das letzte ist viel schmaler als das vorletzte und mit der Basis diesem aufsitzend. Der *Halsschild* stark quer, mit halbkreisförmigem Querschnitt, alle Ecken in sehr breitem Bogen ganz verrundet, die Seiten stark gebogen, viel kürzer als die mittlere Längslinie, Oberfläche sehr dicht, deutlich punktiert, Spitze ungerandet,

der sehr kurze basale Mittellappen gerade abgestutzt, jederseits ein sehr kleiner, ganz stumpfwinkliger Ausschnitt. Schildchen mässig gross. *Flügeldecken* mit ganz verrundeten Schultern, der Seitenrand von oben nur vorn zu sehen, die Oberfläche ganz verworren, fein, aber dicht und deutlich wie der Halsschild punktiert, ohne Spur von Streifenbildung. *Unterseite* dicht und deutlich punktiert und sehr fein, staubartig behaart. Prosternum ganz niedergedrückt, Schienen aussen fein stachelig, rauh.

L. $2\frac{1}{3}$–$2\frac{1}{2}$ mm.

5 Exemplare von Banguey bei Borneo, in meiner Sammlung (von Dr. O. Staudinger & S. Bang.-Haas erhalten).

Diese Art ist in Körper- und Fühlerform, wegen der feinen Behaarung und des niedergebogenen Prosternums unserm *P. chrysomelinus* viel ähnlicher als den vorhergehenden Arten.

Die 3 Pentaphyllusarten lassen sich leicht so auseinander halten.*

1. Körper unbehaart, Prosternum wagerecht, Halsschild vorn fein gerandet, ♂ auf dem Kopf mit 4 Hörnern, letztes Fühlerglied frei . . . 2
   Körper fein behaart, Prosternum niedergebogen, Halsschild vorn ungerandet, ♂ mit 2 konischen Tuberkeln, letztes Fühlerglied dem 10. aufsitzend . . . . . *biconiger*, Geb.
2. Flügeldecken tiefgefurcht . . . . *striatus*, Geb.
   Flügeldecken ungefurcht, verworren punktiert *quadricornis*, Geb.

Subfam. Leiochrinæ.

Leiochrinus, Westw.

Tijdschr. voor Entom. xxvi. 1883, p. 68.—Lewis, Ann. Mag. Nat. Hist. (6) xiii. 1894, p. 390.

Leiochrinus fulvicollis, Westw. *l. c.* p. 70.—Wird von diesem Autor für Borneo-Sarawak angegeben. Liegt mir von Mysol und Dorey aus dem Deutschen Entomologischen Museum vor.

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* Von einer vierten, starkglänzenden, weitläufig punktierten Art, liegt mir nur ein einzelnes ♀ vor, das ich nicht zu beschreiben wage. Ferner gibt es noch eine ungehörnte Art in Java.

Leiochrinus lutescens, Westw. *l. c.* p. 71.—Von Mount Ophir (Malakka) beschrieben. 2 Exemplare meiner Sammlung stammen von Banguey bei Borneo.

Leiochrodes, Westw.

Leiochrodes tenebrosus, Thoms. Mus. scient. 1860, p. 13 (= *rufolimbatus*, Fairm. Notes Leyd. Mus. iv. 1882, p. 257).—Sechs Exemplare meiner Sammlung stammen aus Sumatra. Ein Exemplar des Hamburger Museums von Borneo: Tandjong (F. Suck). Thomson's gute Beschreibung und Abbildung lässt keinen Zweifel, dass Fairmaire's Art synonym ist.

Leiochrodes varicolor, West. Tijdschr. voor Entom. xxvi. 1883, p. 76.—Der Autor gibt Sarawak als Patria an. Mein Stück stammt aus Sumatra: Si Rambé (Modigliani). Die Art ist durch die dornförmig ausgezogenen Hinterecken des Halsschildes, der fast geradlinig nach vorn verengt ist, ausgezeichnet.

Leiochrodes nigripennis, Westw. *l. c.* p. 72.—Nach Westwood von Ceram, Dorei und Gilolo. In meiner Sammlung in Anzahl von Banguey bei Borneo (von Staudinger & Bang-Haas erhalten).

Leiochrodes discoidalis, Westw. *l. c.* p. 71, taf. 3, f. 15, t. 4, f. 8–13.—Von Sumatra in ziemlicher Zahl in der Sammlung des Deutschen Entomol. Museums und in meiner eigenen, ca. 40 Exemplare auch von Banguey bei Borneo in meiner Sammlung und bei Dr. Staudinger & Bang-Haas, Dresden.

Leiochrodes castaneus, Westw. *l. c.* p. 74.—Von Sarawak nach dem Autor. Meine Exemplare von Sumatra, d. h. wenn ich sie richtig deute. Die nur zwei Zeilen lange Beschreibung ist ungenügend.

Leiochrodes bispilotus, Westw. *l. c.* p. 74.—Von Sarawak.

Leiochrodes octomaculatus, Westw. *l. c.* p. 74. — Von Sarawak.

Beide Arten sind mir unbekannt geblieben.

Die nachfolgende Bestimmungstabelle musste leider mit Rücksicht auf die beiden letzten Arten die Bedeutung der Farbe mehr betonen als mir lieb ist.

1. Flügeldecken mit starken Punktreihen, Hinterwinkel des Halsschildes verrundet. Oberseite schwarz mit dunkelrotem Rand . *tenebrosus*, Thoms.
   Flügeldecken glatt oder mikroskopisch fein punktiert, Hinterecken des Halsschildes spitz . . 2
2. Hinterecken des Halsschildes kurz dornförmig ausgezogen, Kopf und Halsschild rot, Flügeldecken blassgelb und schwarzer Naht schwarzem Rand und schwarzem Humeralfleck . *varicolor*, Westw.
   Hinterecken des Halsschildes nicht mit ausgezogener Spitze. Körper anders gefärbt . . . 3
3. Flügeldecken einfarbig, höchstens die Naht ganz schmal rot 4
   Flügeldecken gefleckt 5
4. Oberseite einfarbig, kastanienbraun, Körper etwas länger als breit, Seiten des Halsschildes etwas gelblich, Flügeldecken weitläufig punktiert *castaneus*, Westw.
   Flügeldecken schwärzlich mit schwachem Metallschimmer, Körper so breit wie lang, Flügeldecken mit ganz vereinzelten Punkten *nigripennis*, Westw.
5. Jede Flügeldecke mit 4 hellen Flechen *octomaculatus*, Westw.
   Jede Flügeldecke mit einem Fleck 6
6. Flügeldecken rot mit je einem sehr grossen, schwarzen Discoidalfleck . . *discoidalis*, Westw.
   Flügeldecken schwarz mit grossem, rotem Fleck *bispilotus*, Westw.

Stethotrypes, n. gen.

Halbkugelig, Coccinellenförmig. Kopf frei, mit winzigem Canthus, ausgehöhlt, im vorderen Teil mit 2 Hörnern, die auf den ersten Blick die beiden riesig vergrösserten Mandibeln zu sein scheinen. Fühler vom vierten Glied an erweitert. Augen gross, nicht ausgerandet, grob facettiert. Mentum klein, trapezisch, flach, Ligula viel grösser, flach ausgehöhlt, Mandibeln am Ende gefurcht und scharf zweispitzig. Letztes Glied der Maxillarpalpen kurz zilindrisch. Halsschild stark quer, die Kreislinie der Flügeldecken fortsetzend, mit basalem Mittellappen. Schildchen gross, dreieckig. Flügel vorhanden. Flügeldecken mit feinen Punktreihen. Epipleuren sehr breit, vorn ausgehöhlt, weit vor der Spitze verkürzt. Vorderhüften etwas vorstehend, sehr stark quer, zilindrisch, Prosternum zwischen ihnen flach, gesenkt, Mittel- und Hinterhüften sehr weit auseinanderstehend, der Hinterbrust- und Abdominalfortsatz vorn abgestutzt, gerade, Mittelbrust

flach. Beine sehr kurz, die Schenkel ragen nicht über den Seitenrand des Körpers hinaus, dick, unten scharfkantig. Schienen sehr kurz, innen gerade, Enddornen fehlen. Alle Tarsen erweitert und ziemlich lang, das Klauenglied ist das längste, die Klauen bilden unten einen scharfen Zahn, die Glieder unten nicht lappenartig ausgezogen.

Ich stelle diese Gattung in die Subfamilie Leiochrinae nur mit Vorbehalt. Die ganz queren, zilindrischen Vorderhüften sind ein Charakter, der sie von allen Tenebrioniden entfernt und eigentlich die Aufstellung einer eigenen Coleopterenfamilie verlangt. Dazu kann ich mich aber um so weniger entschliessen, als auch die Gattung *Leiochrodes* quere, d. h. seitlich offene Gelenkhöhlen der Vorderhüften hat. Aeusserlich ist die neue Gattung sofort an dem 2-hörnigen Vorderkopf kenntlich.

Stethotrypes bicornutus, n. sp.

Fast halbkugelig, nur wenig länger als breit, stark glänzend, hell rotgelb, die Flügeldecken blasser, die Naht und eine Querbinde in der Mitte, die meist auf einen seitlichen Fleck reduciert ist, dunkler. Der *Kopf* ist zwischen den Augen mit einem halbkreisförmigen, tiefen, nicht sehr scharfen Eindruck versehen, der Canthus winzig klein, unmittelbar vor dem Clypeus stehen zwei breite, innen und vorn messerartig scharfe, nach vorn gerichtete divergierende Hörner, der Winkel zwischen ihnen ist klein, am Grunde verrundet, die Innenkante gerade, die Aussenkante gewinkelt, und am Grunde bis zu diesem Winkel doppelt gekantet. Die Fühler sind vom 4. Glied an erweitert, diese Glieder gleich gross, quer. *Halsschild* stark quer, der Vorderrand nicht gerade abgestutzt, sondern mit breit vorgezogener Mitte, ähnlich wie die Basis, nur stärker, die grösste Breite liegt an der Basis, alle Winkel breit verrundet, die Seiten schmal aufgebogen, die Oberfläche glatt. *Flügeldecken* mit deutlichen Punktreihen, die Zwischenräume glatt, die Reihen nur schwach vertieft, besonders der erste, am Absturz befindet sich in den Zwischenräumen eine Reihe ebenso grosser Punkte wie die der Reihen.

L. $1\frac{2}{3}$–$1\frac{3}{4}$ mm.

Ca. 50 Exemplare von Banguey bei Borneo, in meiner Sammlung und bei Dr. O. Staudinger & A. Bang-Haas.

Stethotrypes glaber, n. sp.

Von der vorigen Art durch einfarbig braunrote Oberseite, glatte, unpunktierte Flügeldecken, bedeutendere Grösse,

spitze, mit der oberen Aussenkante an die Augen tretende, nicht messerscharfe Hörner, verschieden.

L. $2\frac{2}{3}$ mm.

2 Exemplare vom Kinabalu aus dem Deutschen Entomol. Museum.

Uloma, Latr.

Cuv. Règne Anim. ed. 2 vol. v. 1829, p. 29.—Cast. Hist. Nat. ii. 1840, p. 219.—Lacord. Gen. Col. v. 1859, p. 332.—Seidl. Naturg. Ins. Deutschl. v. 1894, pp. 591, 593.

Uloma orientalis, Cast. Hist. Nat. ii. 1840, p. 220 (= *retusa* F. Syst. El. i. 1801, p. 150 [nicht *retusa* F. *l. c.* p. 149] = *denticornis* Fairm. Notes Leyd. Mus. iv. 1882, p. 225.—Diese grosse Art ist im männlichen Geschlecht an den Fühlern (Glied 5 und 7 stark zahnförmig ausgezogen) leicht zu erkennen. Es gibt aber auf Borneo auch eine Form (var. *minor* nov.) die viel kleiner, schmaler ist, bei dieser ist nur das 7. Glied mässig stark gezähnt, oder fast ungezähnt, nur scharf gewinkelt. Die Kinnform ist aber gleich, flach, mit scharfem Borstenrand, der genau Herzform hat, also vorn eingeschnitten ist.

Uloma simillima, n. sp.

Der var. *minor* der vorigen Art ganz ausserordentlich ähnlich. Der Pronotumeindruck klein, quer, Fühler ungezähnt, aber die Glieder 7–10 sind an ihrer Oberkante schneidig scharf und nach vorn schwach heruntergebogen. Das Kinn beim ♂ herzförmig, d. h. vorn sanft eingeschnitten, und hinter dem Einschnitt eingedrückt, jederseits der Basis befindet sich ein tiefer Eindruck, ganz wie beim ♀ von orientalis, ein Borstenkranz fehlt, statt dessen geht eine Reihe Borstenpunkte von der Basis schräg nach den Vorderecken, meist sind aber Borsten nur als Büschel vorn vorhanden. Aehnlich ist auch das Kinn des ♀, nur sind die seitlichen Eindrücke schwächer als bei orientalis. Forceps wie bei voriger Art. Im übrigen ist die Art in Skulptur, feinerer Formausbildung der Vorderschienen, in der Stärke des aufgebogenen und zwei zähnigen Clypeus variabel, genau wie orientalis.

L. 9–$10\frac{1}{2}$ mm.

Eine Anzahl Exemplare in meiner Sammlung von Borneo, Kinabalu, Banguey bei Borneo und Sumatra. 1 Exemplar von Kuching, 12. Feb., 1899, aus dem Sarawak Museum.

Uloma planimentum, n. sp.

Schmal, parallel, stark quer gewölbt, glänzend rotbraun. *Kopf* breit und flach, zwischen den Augen ausgehöhlt, der Clypeus einfach gewölbt, ohne aufgebogenen Rand und ohne Zähnchen, der Canthus ist breiter als die Augen und ebenso lang wie diese hinter ihnen, der Clypeus ist gerade abgeschnitten. Fühler kurz und dick, Glieder beim ♂ ungezähnt, die vorletzen ausserordentlich stark quer, 3 mal so breit wie lang, ihre obere Vorderkante nicht nach unten abgeschrägt. Mentum beim ♂ vollkommen kreisförmig, spiegelblank, mit einzelnen Pünktchen ohne Borsten, ganz flach; beim ♀ mit einigen groben Punkten, vorn sanft ausgeschnitten, hinter dem Ausschnitt eingedrückt und mit 2 starken, länglichen, seitlichen basalen Gruben, der Oberkopf ziemlich dicht und deutlich punktiert. *Halsschild* $1\frac{1}{2}$ mal so breit wie lang, seitlich mässig stark gerundet, die Ecken ganz kurz verrundet stumpfwinklig, der Eindruck des ♂ hinten nicht bis zur Mitte gehend, querüber etwas mehr als die Hälfte einnehmend, an seiner Basis mit 2 sehr kleinen Beulen, die Punktierung im Eindruck und seitlich stärker, auf der Scheibe hinten sehr fein, beim ♂ auf der ganzen Fläche ziemlich grob, aber nicht dicht punktiert. *Flügeldecken* beim ♂ subzilindrisch, beim ♀ flacher und breiter, die Schultern deutlich, kurz verrundet rechtwinklig, schwach aufgebogen, kräftig punktiert gestreift, die Streifen hinten nicht schwächer, die Zwischenräume auf der Scheibe ganz flach, seitlich immer stärker konvex, äusserst fein und ziemlich dicht punktiert. *Unterseite* in der Mitte sehr fein, seitlich gröber punktiert, die Abdominalsegmente seitlich längsstrigos. Prosternum jederseits mit feiner Furche, hinten niedergedrückt, aber beim ♂ mit Fortsatz, beim ♀ ohne diesen. Die Vorderschienen des ♂ innen mit starkem, fast halbkreisförmigem basalen Ausschnitt, der nach unten stark winklig begrenzt ist, die untere Innenseite tritt hakig nach innen, dieser Haken etwas nach hinten gedrückt, Aussenkante scharf und stark gezähnt, die Hinterseite nicht gekielt aber mit einigen kleinen Zähnchen. Hinterschienen deutlich dreieckig, ungezähnt. An den Hintertarsen ist Glied 1 = 4. Forceps mit sehr dünner, ausgezogener, fein abgestutzter Spitze.

L. 10–$11\frac{1}{2}$ mm.

3 ♂ und 4 ♀ in meiner Sammlung von Kinabalu.

Ich bin nicht ganz sicher ob ♂ und ♀ zusammengehören. Das ♂ ist durch das Mentum und die Bildung der Vorder-

schienen sehr ausgezeichnet, das ♀ ist den beiden vorigen Arten ausserordentlich ähnlich, hat aber einen einfach gewölbten Clypeus.

Uloma picicornis, Fairm. Notes Leyd. Mus. iv. 1882, p. 224.—Ca. 50 Exemplare in meiner Sammlung von Java, Sumatra und Borneo (Kinabalu).

Uloma truncata, Fairm. Notes Leyd. Mus. xv. 1893, p. 24. Ist mir unbekannt geblieben. Sie muss an der Bildung des Halsschildes und vor allem an derjenigen der Schienen, die sämtlich gezähnt sind, leicht zu erkennen sein.

Uloma bidens, n. sp.

Kurz und gedrungen, stark glänzend schwarzbraun. *Kopf* querüber stark und breit ausgehöhlt, der Canthus etwas breiter als die Augen, der Clypeus beim ♂ stark und scharf aufgeworfen und mit 2 kräftigen Zähnen versehen, diese Zähne weit von einander getrennt, zwischen den Zähnen und dem Canthus eine kräftige Tuberkel seitlich am Vorderrand. Beim ♀ ist der Quereindruck nur vorn, nicht auch zwischen den Augen, der Clypeus sanft gewölbt, ungezähnt. Fühler kurz und dick, das 3. kaum länger als das 4., die folgenden immer stärker quer, in beiden Geschlechtern nicht ausgezeichnet, das vorletzte etwa 3 mal so breit wie lang, das letzte quer, verrundet. Mentum in den beiden Geschlechtern sehr ähnlich, nach vorn stark erhaben, zweibuckelig, von der Basis schräg nach vorn jederseits ein starker Längseindruck. Oberfläche unbeborstet, vereinzelt ziemlich grob punktiert. *Halsschild* beim ♂ wie beim ♀ vorn ohne Eindruck, ca. $1\frac{3}{4}$ mal so breit wie lang, seitlich stark gerundet, Winkel verrundet. Der Eindruck nimmt querüber nur etwa die Hälfte der Breite ein, und reicht nach hinten wenig über das erste Drittel hinaus, er ist nach hinten mehr vertieft, aber ohne kleine Beulen am Rande, Oberfläche sehr deutlich, wenig dicht punktiert. *Schildchen* glatt, ogival. *Flügeldecken* stark quer gewölbt, kurz mit starken Punktstreifen, deren Zwischenräume auf der Scheibe schwach, seitlich und hinten stark gewölbt sind, die Streifen sind an der Spitze nicht schwächer; die Punkte der Streifen grob, ihre Entfernung von einander auf der Scheibe so gross, seitlich kleiner als der Durchmesser eines Punktes; die Interstitien sind äussert fein und weitläufig punktiert. *Prosternum* hinter den Hüften ganz niedergedrückt, jederseits sehr fein gerandet,

Mesosternalausschnitt sehr scharfkantig, aber von der Seite gesehen ganz verrundet, Abdomen in der Mitte sehr fein, seitlich gröber punktiert, fein längsstrigos, Vorderschienen der Männchen breit, ihre Innenkante S-förmig geschwungen, oberhalb der Mitte nicht gewinkelt, das Ende nicht zahnförmig ausgezogen, sondern mit dem normalen Winkel, die innere Hinterkante besteht aus einigen kleinen Dornen, Hinterschienen glatt. An den Hintertarsen ist Glied 1 = 4. Der ungemein feine Forceps einfach verjüngt.

L. 7–8 mm.

3 ♂ und 4 ♀ von Kinabalu (von Staudinger & Bang-Haas erhalten) in meiner Sammlung.

Die Art ist der *compacta* und *contracta* Fairm. ähnlich, gehört aber in die erste Abteilung der Gattung, bei der das ♂ vor dem ♀ durch einen eingedrückten Halsschild ausgezeichnet ist. Von den Arten dieser Abteilung unterscheidet sie sich ausser durch die geringe Grösse durch den stark 2-zähnigen Clypeus, der ausserdem noch 2 Beulen hat und durch die innen ungewinkelten Vordertibien.

Uloma compacta, Fairm. Notes Leyd. Mus. xv. 1893, p. 23.—13 Exemplare vom Kinabalu in meiner Sammlung. Vom Autor von Borneo occ. Sambas beschrieben.

Uloma contracta, Fairm. Notes Leyd. Mus. iv. 1882, p. 226.—Von Sumatra beschrieben. In Anzahl vom Kinabalu in meiner Sammlung.

*Dichotomische Tabelle der borneensischen Ulomaarten.**

1. Das ♂ mit Eindruck vorn auf dem Halsschild . . . 2
   ♂ und ♀ gleichgestaltet 7
2. Alle Schienen gezähnt (ex Fairm.) . . *truncata*, Fairm.
   Die Hinterschienen glatt 3
3. 5. und 7. Fühlerglied des ♂ in einen Zahn ausgezogen oder mindestens scharf gewinkelt (v. *minor*, Geb.) Mentum mit feinem Borstenkranz *orientalis*, Cast.
   Fühler in beiden Geschlechtern einfach, Mentum glatt oder höchstens mit 2 Borstenstrichen . . 4
4. Clypeus des ♂ aufgeworfen und scharf zweizähnig, daneben stumpf gebeult, Vorderschienen desselben Geschlechts mit basalem Ausschnitt. Sehr kurze und robuste Art . *bidens*, Geb.
   Clypeus höchstens schwach doppelt gewinkelt, Vorderschienen des ♂ mit undeutlichem Ausschnitt. Sehr gestreckte Arten 5

* *Uloma hæmorrhoa*, Fairm. gehört zur folgenden Gattung.

5. Der Eindruck auf dem Halsschilde des ♂ ist gross und vertieft. Arten von 10 mm. . . 6
   Der Eindruck auf dem Halsschilde ist flach, ganz quer, der Halsschild fast wie abgestutzt. Art bis zu 8 mm. . . . . *picicornis*, Fairm.
6. Fühlerglieder 5–10 mit scharfer nach unten gezogener Kante beim ♂, Mentum mit Gruben und vorderem Eindruck, Clypeus gewinkelt . *simillima*, Geb.
   Fühlerglieder normal, Mentum vollkommen flach, kreisförmig beim ♂, Clypeus in beiden Geschlechtern einfach verrundet . *planimentum*, Geb.
7. Art von 7–7⅓ mm. Punkte der Streifen grob, seitlich sehr deutlich . . . . *contracta*, Fairm.
   Art von 9–9⅓ mm. Punkte der Streifen sehr fein, seitlich fast geschwunden . . *compacta*, Fairm.

Cneocnemis, n. gen. *Ulomidarum.*

Schmal, parallel, ziemlich flach, nackt. *Kopf* breit, Stirn zwischen den Augen über doppelt so breit wie der Querdurchmesser eines Auges oben, Clypeus gerade abgestutz, schwach gewölbt, ohne Auszeichnung, Augen kaum eingeschnürt, der Canthus schwach, viel schwächer als die Augen, Fühler sehr schlank und lose gegliedert, Glieder vom 5. an allmählich grösser werdend, das letzte ist wenigstens doppelt so gross wie das vorletzte, Mentum etwa kreisförmig, mit erhabenem, oben abgeflachtem Diskus, in beiden Geschlechtern verschieden. Ligula sehr klein, viel kleiner als das Mentum, vorn sanft ausgeschnitten, zwischen den Palpen gehöckert, aber ohne Kiele. Maxillarpalpen gross und schlank, das erste Glied winzig klein, das zweite viel grösser als das dritte, die Innenlade ist viel kleiner als die Aussenlade, am Ende ohne Hornhaken, aber hornig und meisselförmig scharf. Mandibeln am Grunde sehr dick, mit dünner, doppelter Spitze, grossem Mandibelsack; der grosse Mahlzahn mit 2 Querfalten, die Kiele auf den Mandibeln sind hoch erhaben; die Seiten des Unterkopfes zwischen Maxillen und Augen sind einfach scharf gekantet und daneben nach aussen etwas abgeflacht. *Halsschild* in beiden Geschlechtern gleich, etwas breiter als lang, nur seitlich gerandet. *Flügeldecken* mit kräftigen Schultern, stark punktiert gestreift, mit deutlichem Skutellarstreif, Epipleuren verkürzt. *Prosternum* niedergebogen wie das Mesosternum, dieses scharfkantig ausgeschnitten, Abdominal- und Metasternalfortsatz kurz verrundet. Schenkel gekeult, dick, die vorderen unten nicht gekielt, nur bei dem länglichen

Endausschnitt. Vorderschienen aussen gesägt, vorn ohne Tarsalfurche, an der Hinterseite beim ♂ mit starker Beule, die Mittelschienen fein bestachelt, die Hinterschienen glatt. Tarsen schlank, die vorderen deutlich, wenn auch nicht sehr stark erweitert beim ♂.

Diese neue Gattung steht *Uloma* wenig nahe, sie entfernt sich von ihr durch die schlanken Fühler, deren letztes Glied stark vergrössert ist, besonders aber durch die erweiterten Vordertarsen des ♂. Diesen Charakter hat auch *Ulomimus* Bates aus Indien, von der sich unsere Gattung durch unbehaartes Mentum, nicht dreieckige Vorderschienen, denen die Tarsalfurche fehlt, ungerandete Basis des Thorax, ungezähnte Vordertibien, &c., stark unterscheidet.

Ausser dem Typus der Gattung (*Uloma hæmorrhoa*, Fairm.) besitze ich noch eine kleinere, gelbe Art aus Indien, bei der die Tarsen stark erweitert sind.

Cneocnemis hæmorrhoa, Fairm. Notes Leyd. Mus. xv. 1893, p. 24.—Die typischen Exemplare des Museums Leyden aus Borneo: Sintang beschrieben. Mir liegt die Art in Anzahl in meiner Sammlung vom Kinabalu vor (von Dr. O. Staudinger und A. Bang-Haas erhalten).

Achthosus, Pascoe.

Journ. of Entom. ii. 1863, p. 42.

Achthosus bihamatus, Fairm. Ann. Soc. Ent. Fr. lxvii. 1898, p. 392.—Von dieser Art liegt mir ein Pärchen von Kuching: Nov. 1898 und 16. Febr. 1899, vor. Ich besitze in meiner Sammlung ein ♀ einer nahe verwandten Art, das ohne Kenntnis des ♂ nicht zu beschreiben ist.

Auf diese beiden Arten muss eine neue Gattung begründet werden. Leider sind mir die beiden andern indo-malay. Arten der Gattung: *antimachoides*, Fairm., und *furcicollis*, Fairm., nur in der Beschreibung bekannt.

Martianus, Fairm.

Ann. Soc. Entom. Belg. xxxvii. 1893, p. 540.

Martianus dermestoides, Fairm. Ann. Soc. Ent. Fr. lxii. 1893, p. 28 (nicht *dermestoides* Chevr. Pet. Nouv. Ent. ii. 1878, p. 242). Liegt mir in meiner Sammlung in 33 Exemplaren von Südchina (Prov. Fokien: Fu-tschou-fu), Java und Borneo: Kinabalu, vor.

Ich zweifle nicht, dass ich Fairmaire's Art richtig bestimmt habe. Mit Chevrolat's Art von den Viti-Inseln hat aber unsere nichts zu tun, die beiden Beschreibungen widersprechen einander so sehr, dass es klar ist, dass Fairmaire die Beschreibung seines Landsmannes überhaupt nicht gelesen hat. Chevrolat beschreibt die Art als $10\frac{1}{2}$ mm. gross, gehörnt, auf dem Scheitel kanalikuliert, unten granuliert. Fairmaire seine als 6 mm. gross, ungehörnt und vorn *quer* eingedrückt, unten punktiert.

Palorus, Muls.

Col. Fr. Latigènes, 1854, p. 250.—Jacq. du Val, Gen. Col. iii. 1861, p. 308.—Seidl. Naturg. Ins., Deutschl., v. 1. 1894, pp. 570, 573.—Champ. Ent. Mo. Mag. (2) vii. 1896, p. 26.—Fleisch., Wien, Ent. Z. xix. 1900, p. 236.

Palorus humeralis, n. sp.

Ziemlich dunkel braun, die Flügeldecken etwas heller, Körper sehr schmal, depress. *Kopf* sehr lang; die Augen treten aus dem Kopf fast halbkugelig heraus, der Wulst des Kopfes stark abgesetzt, aber vor den Augen aufhaltend, nicht wie bei *subdepressus* die Vorderecken verdeckend, der Canthus ist vom Clypeus nicht durch einen Eindruck getrennt, der Randwulst also nicht unterbrochen, die ganze Oberfläche ist sehr grob und dicht punktiert, der Clypeus nur wenig feiner, die Ecke zwischen Vorderrand des Auges und Canthus ist fast rechtwinklig, Fühler kurz und sehr dick, das erste Glied so klein, dass es leicht übersehen werden kann, das zweite am längsten und dicksten, die folgenden alle gleich. Der Unterkopf punktiert wie die Oberseite, das Submentum mit sehr tiefer, rundlicher Grube. *Halsschild* kaum breiter als lang, der Seitenrand deutlich verflacht, die Seiten nach hinten etwas mehr als nach vorn verengt, nur sehr schwach gerundet, vor den Hinterecken schwach ausgeschweift, die Hinterecken sehr fein zahnförmig, die Vorderecken deutlich lappenförmig vorgezogen, die Oberfläche sehr grob punktiert, seitlich gedrängter als auf der Scheibe. *Flügeldecken* fast parallel, Schulterwinkel mit sehr feinen, spitzen Zähnchen, die Punktstreifen grob, so breit wie die Interstitien, diese mit einer einzelnen, sehr feinen Punktreihe. Unterseite glänzend, grob punktiert, Analsegment stark und vollständig gerandet, das vorletzte seitlich etwas lappenförmig verbreitert.

L. 2.8–3 mm.

3 Exemplare von Brit. N. Borneo; Kudat in meiner Sammlung.

Diese Art steht wegen der Kopfbildung und der groben Punktierung neben *depressus* F. Von diesem entfernt sie sich stark durch den langen Kopf die lappenartig vorragenden Vorderdecken des Halsschildes, dessen Seitenrand verflacht ist, durch die deutlichen feinen Zähnchen der Schultern, die bei *depressus* nur angedeutet sind. Die übrigen asiatischen Arten sind: *australinus* Champ. von Australien und der Ins. Damma; diese ist kleiner, fein punktiert, breiter und hat nicht vorragende Vorderwinkel des Halsschildes; *exilis* Mars. von Japan und Java, nur 1, 8 mm. gross, viel feiner punktiert, Halsschild gerade abgestutzt, Prosternum gefurcht, Abdomen in der Mitte kaum punktuliert; *minor* Waterh. ebenfalls kleiner ($1\frac{1}{4}$ lines) hell gefärbt, sehr fein punktiert, mit deutlich herausgehobenem 5. Streifen.

Doliema, Pasc.

Journ. Entom. i. 1860, p. 50.—Champ. Biol. Centr. Amer. Col. iv. 1, 1886, p. 157.—Seidl. Naturg. Ins. Deutschl. v. 1894, p. 549.

Doliema platisoides, Pasc. *l. c.*, p. 50, t. 3, f. 8.—Von Ceylon, Java und Manila. 2 Exemplare meiner Sammlung von Banguey bei Borneo (durch Dr. Staudinger & Bang-Haas erhalten).

Subfam. Tenebrioninæ.

Setenis, Motsch.

Bull. Mosc. xlv. 1872, ii. p. 24.

Setenis coracina, Knoch. Neue Beiträge, i. 1801, p. 172.—Kolbe, Entom. Nachr. xxvi. 1900, p. 72 (= *æreipennis*, Fairm. Notes Leyd. Mus. iv. 1882, p. 228 = *cupripennis*, Boh. Resa Eugen. 1858, p. 96). An der metallischen Oberseite leicht kenntlich. Auf Borneo häufig: Kuching, März 1895, R. Limbang, Apr. 1910; Kinabalu; Banguey; Kudat.

Setenis valga, Wiedem. Zool. Mag. ii. 1823, p. 42.—Von dieser auf Java häufigen Art liegt mir nur ein ♀ in meiner Sammlung vom Kinabalu vor.

Setenis dentipes, n. sp. (Taf. I. fig. 9.)

Breit und flach, schwarz glänzend, seitlich etwas matter. *Kopf* ziemlich gleichmässig fein und dicht punktiert, die

Augenfalten schwach, die Clypealsutur nur schwach angedeutet, durchaus nicht eingeschnitten, der Clypeus gerade abgestutzt. Die Fühler erreichen die Mitte des Halsschildes, Glied 3 kaum länger als 4, die folgenden allmählich an Länge ab-, an Breite zunehmend. Kinn in beiden Geschlechtern mit Bart, der beim ♀ dünn und sparsam ist, so dass der dicht punktierte Grund durchscheint, beim ♂ sehr dicht und stark, Ligula am Vorderrand vor den Palpen mit doppelter Tuberkel. Innenlade der Maxillen mit langem Hornhaken, der weit vor der Spitze gezähnt ist. Mandibeln schwach zweispitzig, Mahlzahn gewölbt, mit einigen stark gebogenen Querrunzeln. *Halsschild* stark quer, beim ♀ fast so breit wie die Flügeldecken, beim ♂ etwas schmaler, bis zum schmal abgesetzten Seitenrand flach gewölbt, die Seiten stark gerundet, viel stärker als bei *coracina* Kn., an der breitesten Stelle in der Mitte fast doppelt so breit wie lang, zur Spitze viel stärker als zur Basis verengt, die Vorderecken verrundet stumpfwinklig, die Hinterecken nach hinten kurz zahnförmig ausgezogen, sehr spitz, die Oberfläche ziemlich fein und dicht, seitlich etwas undeutlicher punktiert, der Grund fein lederrunzlig, die Mittellinie ist sehr fein aber deutlich, die basale Randung vollständig, in der Mitte etwas verbreitert. Schildchen breiter als lang, seitlich parallel, die Spitze sehr stumpf, Oberfläche einzeln punktiert. *Flügeldecken* flach, stumpf zugespitzt, der Rand ist von oben der ganzen Länge nach übersehbar, die doppelbuchtige Basis ist im vorragenden Teil sehr scharfkantig, die Kante fast etwas überhängend, die Punktstreifen sehr fein, kurz hinter der Basis je 2 und 2 verbunden, die Interstitien flach gewölbt, unpunktiert, sehr dicht und fein ledernarbig. *Unterseite* bis auf die matten, fast glatten Propleuren glänzend. Prosternum sehr breit und ganz flach, das Ende verrundet, zwischen den Hüften zwei tiefe Furchen, Mesosternum zwar flach, aber doch vorn mit senkrechtem Ausschnitt, oben mit undeutlicher Doppelfurche. Hinterbrust in der Mitte in beiden Geschlechtern behaart, die Seiten aber nackt. Abdominalsegmente hinten sehr fein punktiert, im übrigen ziemlich grob und dicht punktiert, und etwas längsrunzlig; das Analsegment mit sehr scharfer und tiefer Randlinie. Die Beine beim ♂ stark von denen des ♀ verschieden. Vorderschenkel nicht verdickt, an der Unterkante mit vollständigem feinen Haarsaum, Vorderschienen stark gekrümmt, innen von der Mitte bis zur Spitze mit sehr starkem Haarbesatz,

Schenkel und Schiene ohne Zahn oder winklige Erweiterung. Mittelschenkel unbehaart, die Schienen fast gerade, am Ende nach innen etwas erweitert, Hinterschenkel vor der Spitze an der Unterkante mit nicht sehr starkem, rechtwinkligen Zahn, von dort bis zur Spitze mit feinem Haarbesatz, die Hinterschienen fast gerade, in der Mitte innen mit schwachem Winkel, der dadurch entsteht, dass die äussere Vorderkante nach innen gezogen ist, wodurch die ganze Vorderfläche in der Oberhälfte um einen halben rechten Winkel um die Achse gedreht erscheint. Der Forceps ist klein und sehr spitz, die ganze Spitze tief, scharfkantig eingedrückt. Beim ♀ sind alle Beine einfach, doch ist der Zahn an den Hinterschenkeln auch hier vorhanden, wenn auch kleiner, die Vorderschienen sind schwach gekrümmt, die Behaarung fehlt.

L. 24½–28 mm. Breite des Halssch. 8½, der Flügeld. 11 mm.

1 ♂ von Borneo: Kinabalu, 1 ♂, 2 ♀ von Singapur in meiner Sammlung: ferner von Sumatra: Medan und Deli-Dolok: Baros, 1000 m.

Diese durch zahlreiche Merkmale sehr ausgezeichnete Art hat in der artenreichen Gattung keinen nahen Verwandten. Die in beiden Geschlechtern gezähnten Hinterschenkel sind sehr auffallend.

Setenis impressa, F. Syst. Eleuth. i. 1801, p. 146.—Motsch. Bull. Mosc. xlv. 1872, ii. p. 30.—Geb. Deutsche Ent. Z. 1906, p. 231 (= *sulcator*, Knoch., Neue Beytr. i. 1801, p. 174.—Einige Exemplare von Borneo und Brunei: Borneo in meiner Sammlung. 1 Exempl. von Baram Point, Okt. 1910, aus dem Sarawak Museum.

Setenis excisa, n. sp. (Taf. I. fig. 12.)

Schwarz, matt, mässig breit, ziemlich gewölbt. *Kopf* zwischen den Augen flach gedrückt, mit kurzen, hohen Augenfalten, die Clypealsutur scharf und tief eingeschnitten, in der Mitte gerade, nach vorn viel feiner, die Stirn ziemlich grob und dicht punktiert, der schwach gewölbte Clypeus fast unpunktiert, gerade abgestutzt, der Canthuswinkel so weit wie die Augen vorspringend. Die Fühler erreichen die Mitte des Halsschildes, Glied drei ist 1½ mal so lang wie 4, 4 = 5, die folgenden quer, während 4 und 5 etwas länger als breit sind, das letzte länger als breit, parallel, kurz verrundet; die Scheibe des Mentums ist vorn erhaben und von den Seiten gut abgesetzt, die Fläche schwach

behaart. *Halsschild* reichlich $1\frac{1}{2}$ mal so lang wie breit, seitlich ziemlich stark gerundet, die Basis scharf und vollständig gerandet, in der Randlinie einige gröbere Punkte. Der Seitenrand ist breit abgesetzt und etwas aufgebogen, an den Vorderecken hört diese Aufbiegung plötzlich auf und macht einer feinen Randung Platz, so dass dort ein flacher Ausschnitt entsteht, im übrigen ist die Seitenrandkante etwas gewellt, die Oberfläche hat etwas Seidenglanz und ist gleichmässig äusserst fein und ziemlich dicht punktiert. Die Hinterecken sind scharf rechtwinklig, die Randlinie dort tief eingeschnitten, die Seiten vor den Ecken sehr schwach ausgeschweift. Schildchen dreieckig, mit verrundeten, stark nach der Spitze verengten Seiten. *Flügeldecken* tief punktiert gestreift und zwar bei dem Exemplar von Singapur mehr als bei dem von Borneo, die Streifen an der Basis schärfer eingeschnitten als an der Spitze, die gewölbten Zwischenräume nicht gerunzelt, nicht punktiert, der Seitenrand der Elytren ist von oben der ganzen Länge nach sichtbar. *Unterseite* bis auf die Propleuren glänzend, vor den Hüften gerunzelt. Prosternum flach, zwischen den Hüften mit starker, doppelter Furche, Mesosternum flach ausgeschnitten, der Ausschnitt senkrecht abfallend, wenn auch niedrig, Metasternum unbehaart. Abdomen längsrunzlig und sehr fein punktiert das 1.–4. Segment seitlich, das Analsegment an der Spitze mit scharfer, tiefer Randfurche. Beine (♀ !) ungezähnt, unbehaart, die Vordertibien gegen die Spitze stärker gekrümmt, die hinteren schwächer.

L. $20\frac{1}{2}$–$22\frac{1}{2}$ mm.; Br. Halssch. 6–$6\frac{1}{2}$ mm.; Flügeld. $8\frac{1}{3}$–9 mm.

2 ♀ in meiner Sammlung, eins von Borneo, eins von Singapur. Obgleich ich nur das eine Geschlecht kenne, habe ich doch gewagt, die Art als neu zu beschreiben, da sie an der eigentümlichen Bildung der Vorderecken des Halsschildes sofort zu erkennen ist.

Setenis Fairmairei. Kolbe nom. nov. Entom. Nachr. xxii. 1900, p. 74 (= *coracina*, Fairm.—Notes Leyd. Mus. iv. 1882, p. 230, nec. Knoch.) in meiner Sammlung von Banguey und Brunei, aus dem Sarawak Museum von Kuching 28. Okt. 1898, 5. Juli 1899; Matang Rd. 27. iii. 1909.

Setenis penicilligera. Geb. Col. Cat. pars. 28 p., 445 nom. nov. (= *brevicornis*, Schauf. Horæ Soc. Ent. Ross. xxi. 1887, p. 134.— ♂ und ♀ vom Kinabalu in meiner

Sammlung, 1 ♂ vom R. Limbang, 4. April 1910, aus dem Museum Sarawak.

Setenis æquatorialis, Blanch. Voy. Pol. Sud. iv. 1853, p. 161, t. 11. f. 11. (=*podagra*, Fairm. Notes Leyd. Mus. iv. 1882, p. 299).—In Anzahl aus Borneo und Brunei in meiner Sammlung. 3 Exemplare des Sarawak Museums Kuching, 15. Dez. 1898; 27. Sept. 1899; 6. März 1900.

Var. *sanguinicrus*, Fairm. Notes Leyd. Mus. xv. 1893, p. 25.—Einige Stücke von Borneo in meiner Sammlung.

Die für Borneo aufgezählten Setenis-Arten lassen sich folgendermassen auseinanderhalten.

1. Analsegment mit scharfer, tiefer Randfurche, Kopf meist mit scharfer Querfurche 2
   Analsegment ungerandet, höchstens die Spitze fein gewulstet Kopf ohne Querfurche 6
2. Vorder-, Mittel- und Hinterbrust in einer Ebene liegend, Vordertibien des ♂ in der Mitte innen gezähnt 3
   Mittelbrust mit erhabenem Vorderrand, Vordertibien innen ungezähnt 4
3. Flügeldecken stark metallisch, Vordertibien des ♂ mit starkem medianen und schwächerm basalen Zahn innen, Hintertibien ♂ gewinkelt, Zwischenräume ganz flach oder kaum gewölbt *coracina*, Knoch.
   Flügeldecken schwarz, tief gestreift, Vordertibien des ♂ nur mit medianem Zahn, Hintertibien ungewinkelt . . . . . *valga*, Wied.
4. Hinterschenkel gezähnt, Körper sehr breit und flach, Vorderschenkel und -schienen des ♂ mit starkem Haarsaum, Kopf mit feiner Clypealsutur . . . . . *dentipes*, Geb.
   Hinterschenkel ungezähnt, Körper schmaler, gewölbt, Vorderschenkel und -schienen beim ♂ unbehaart (auch bei *excisa* ?) Kopf quer tief eingeschnitten 5
5. Vorderwinkel des Halsschildes ausgerandet, Seitenrand gewellt, Mittellinie des Halsschildes schwach angedeutet . . . *excisa*, Geb.
   Vorderwinkel des Halsschildes normal, Seitenrand glatt, die Mittellinie tief eingedrückt . *impressa*, F.
6. Halsschild vorn mit dreickig verbreitertem Rand, Vorderschienen des ♂ innen stark behaart, grosse Art von mindestens 24 mm. . *penicilligera*, Geb.

Halsschild vorn in der Mitte ungerandet, Vordertibien des ♂ innen nur gekrümmt, kleine Arten von höchstens 20 mm. 7

7. Halsschild glänzend, ohne Mittellinie, stark gewölbt, Vorderschenkel gezähnt, Vordertibien des ♂ einfach, mässig stark gekrümmt *Fairmairei*, Kolbe.

Halsschild matt, flach, mit Mittelfurche, Vorderschenkel ungezähnt, Vordertibien des ♂ stark gekrümmt und auf der Unterkante stark ausgeschnitten . . . . *æquatorialis*, Blanch.

Schenkel schwarz . . . . . *Stammform.*

Schenkel rot . . . . . var. *sanguinicrus*, Frm.

Rhophobas, Motsch.

Bull. Soc. Mosc. xlv. 1872, ii. p. 26.

Rhophobas asperatus, Motsch. *l. c.* p. 36 (= *granifer*, Fairm. Notes Leyd. Mus. iv. 1882, p. 230.—In meiner Sammlung vom Kinabalu, aus dem Museum Sarawak von Kuching, 28. Aug. 1897, Dez. 1898.

Encyalesthus, Motsch.

Schrenk's Reise ii. 1860, p. 139.—Mars. Abeille xvi. 1878, p. 103.

Encyalesthus æruginosus, F. Mant. Ins. i. 1787, p. 213; Syst. El. i. 1801, p. 158.—Mäkl. Act. Soc. Fenn. 1863, p. 552.—Einige Exemplare vom Kinabalu in meiner Sammlung.

Encyalesthus Hauschildi, n. sp.

Kurz und gedrungen, glänzend schwarz, Flügeldecken etwas messingerzfarben mit grünem Schulter- und Apikalfleck. *Kopf* ohne Augenfalten, aber mit starken Augenfurchen, die vorn gerade sind, hinten aber mit dem Hinterrand der Augen stark divergieren, aber nicht untereinander parallel sind. Stirn viel breiter als der Durchmesser eines Auges. Stirn und Clypeus separat gewölbt, daher die Clypealsutur gerade und tief, aber nicht furchig eingeschnitten. Canthus nicht so weit vortretend wie die Augen, parallel, Clypeus sehr schwach ausgeschnitten, die Fühler überragen die Mitte des Halsschildes kaum, die ersten Glieder dünn, $3 = 1\frac{1}{2}$ mal 4, die letzten 6 quer, eine gut abgesetzte Keule bildend, das letzte so lang wie breit, an der Spitze verrundet. Mentum flach,

durch einige Furchen uneben. *Halsschild* schwach quer, querüber sehr stark gewölbt, in der Mitte am breitesten, die Seiten stark gerundet, vor den Hinterecken nicht ausgeschweift, die sehr feine, vollständige Seitenrandkante von oben nicht übersehbar, die Oberfläche gleichmässig dicht, auf der Scheibe sehr deutlich, seitlich feiner punktiert; die Mittellinie schwach angedeutet. Schildchen dreieckig. *Flügeldecken* im letzten Drittel am breitesten, erzfarben, die Basis grün oder grünblau, diese Binde an den Schultern breiter, und seitlich mit dem Spitzenfleck verbunden, dieser vorn, die Basalbinde hinten mit kupfrigem Rande, der Apikelfleck auch auf den dort etwas erhabenen Insterstitien kupfrig, im übrigen sind die Zwischenräume ganz flach, deutlich aber feiner als der Halsschild punktiert, die Streifen sehr schmal und wenig deutlich purpurn, die Punkte ziemlich grob, ihre Zwischenräume so lang wie der Durchmesser eines Punktes. *Unterseite* glänzend schwarz. Prosternum hinten ganz niedergedrückt und plattenförmig kurz überragend, zwischen den Hüften eingedrückt, ungefurcht, das Ende mit deutlicher Randlinie, Mesosternum kräftig eingedrückt, der Eindruck seitlich nicht beulig. Alle Schenkel stark gekeult, Vordertibien schwach gekrümmt, am Ende innen mit kleinem Tomentfleck, Hintertibien ohne Spur eines Zahns oder einer winkligen Erweiterung. Abdomen beim ♂ mit kräftigem Längseindruck, wie die Hinterbrust dicht und deutlich punktiert. Mittel- und Hintertarsen kurz.

L. 11–11½ mm. Br. der Flügeldecken 4¾ mm. 3 ♂ ♀ von Kinabalu in meiner Sammlung.

Diese Art ist ausser mit der folgenden mit *brevicornis* Mäkl. und *metallescens* Fairm. verwandt. Von beiden unterscheidet sie sich durch geringere Grösse, purpurne Flügeldeckenstreifen, ungefurchtes Prosternum, einfache Hintertibien, &c.

Encyalesthus viriditinctus, Fairm. Notes Leyd. Mus. iv. 1882, p. 234. Diese Art ist der vorigen ausserordentlich ähnlich, so dass auf die Beschreibung verwiesen werden kann. Sie unterscheidet sich scharf durch die schmale Stirn, die den Querdurchmesser eines Auges nicht erreicht und zwischen den Augen einen Eindruck hat, durch die langen Beine (besonders sind die Mittel- und Hintertarsen sehr gestreckt und durch den beim ♀ deutlichen Analeindruck, der den Spitzenrand des Analsegmentes fein aufbiegt).

L. 12 mm.

Ausser der bedeutenderen Grösse (9½ mm. bei Fairm.) kann ich keinen Unterschied zwischen meinem Exemplar und der Fairemair'schen Beschreibung finden. 1 ♀ von Borneo in meiner Sammlung (von Staudinger & Bang-Haas erhalten).

Encyalesthus transversicollis, Fairm. Notes Leyd. Mus. xv. 1893, p. 27.—Von Borneo beschrieben. In meiner Sammlung ein Exemplar ohne Fundort, bei dem die Basaleindrücke des Halsschildes nur schwach entwickelt sind.

Encyalesthus morio, n. sp.

Gross, ziemlich schlank, fast zilindrisch, glänzend schwarz. *Kopf* ohne Augenfalten, mit scharfen, kurzen, hinten sich von den Augen nicht entfernenden Augenfurchen, die Stirn so breit wie der Querdurchmesser eines Auges, die Clypealsutur querüber tief eingeschnitten, dieser Einschnitt jederseits stärker vertieft, d. h. ihr Oberrand sehr fein doppelbuchtig, der Canthus viel schmaler als die Augen, parallel, der Clypeus und die Oberlippe schwach ausgerandet. Die Fühler überragen die Mitte des Halsschildes, Glied 3 nur wenig länger als 4, 4–6 länger als breit, 7–10 immer stärker quer, das letzte Glied so lang wie breit, mit rechtwinkliger Aussenecke, es ist nur eine 5-gliedrige Keule vorhanden. Mentum vorn kegelförmig erhaben, jederseits etwas gefurcht, Vorderecken wenig spitz. Ligula häutig, nicht breiter als das Mentum. Innenlade der Maxillen schmal und parallel, mit langem und spitzem Hornhaken, der Mahlzahn der Mandibeln ungefurcht. *Halsschild* kaum breiter als lang (5½ : 5) sehr stark quer gewölbt, mit stark gerundeten Seiten, die vorn ohne Winkel in den Vorderrand übergehen, der ganze Halsschild rings gerandet, die Spitzenrandung nur in der Mitte schwach unterbrochen, auf der Scheibe einige sehr schwache Eindrücke, die Punktierung fein und wenig eng, seitlich fast erloschen. *Flügeldecken* mit kräftig punktiertem, langem Skutellarstreif und fein und scharf eingeschnittenen Linien, in denen die Punkte kaum wahrnehmbar sind, der Suturalstreif ist besonders hinten eingedrückt, die Interstitien vollkommen flach und kaum sichtbar punktiert. *Unterseite* stark glänzend, Prosternum zwischen den Hüften nicht eingedrückt, kaum gefurcht, das Ende ganz niedergedrückt. Mittelbrust mässig eingedrückt, Abdomen fein punktiert, schwach gerunzelt, Analsegment nicht ausgezeichnet. Schenkel stark gekeult, Schienen innen am Ende mit goldgelbem Haartoment,

die vorderen schwach gekrümmt, die hinteren ohne Zahn oder winklige Erweiterung. Tarsen kurz, an den hinteren ist das Klauenglied kürzer als die andern zusammen.

L. 20 mm. Br. $7\frac{1}{3}$ mm.

1 Exemplar von Njabang. Borneo, occ. in meiner Sammlung.

Diese Art ist durch die bedeutende Grösse, reinschwarze Farbe, 5-gliedrige Fühlerkeule vor allen Gattungsgenossen ausgezeichnet.

Die vorstehenden Arten von Encyalesthus lassen sich wie folgt übersehen:

1. Körper ganz schwarz, die letzten 5 Glieder der Fühler bilden eine Keule . . . . . *morio*, Geb.
   Wenigstens die Flügeldecken metallisch, die letzten 6 Glieder bilden eine Keule 2
2. Die ganze Oberseite metallisch, die Flügeldecken einfach 3
   Kopf und Halsschild schwarz, Flügeldecken mit bunter Basis und Spitze 4
3. Körper schlank, Halsschild schwach quer, Flügeldecken mit feinen Punktstreifen, die Interstitien nur vor der Spitze gewölbt . *æruginosus*, F.
   Körper sehr robust, Halsschild über $1\frac{1}{2}$ mal so breit wie lang, Flügeldecken mit Streifen grober Punkte, alle Interstitien kräftig gewölbt *transversicollis*, Fairm.
4. Stirn schmaler als der Querdurchmesser eines Auges, Tarsen sehr schlank, Analsegment des ♀ mit flachem Eindruck, dessen Spitzenrand fein aufgebogen ist . . . *viriditinctus*, Fairm.
   Stirn breiter als der Durchmesser eines Auges, Tarsen kurz, Analsegment des ♀ ohne Eindruck *Hauschildi*, Geb.

Exocolena, n. g. aff. *Encyalesthus*.

Gross, fast cylindrisch. *Kopf* stark entwickelt, mit Augenfurchen, ohne Augenfalten, Stirn schmaler als der Querdurchmesser eines Auges, Canthus sehr gross, Clypeus und die stark quere Oberlippe nicht ausgeschnitten. Fühler lang und dünn, sie erreichen die Basis des Halsschildes, die letzten 6 Glieder matt, nicht quer, eine Fühlerkeule fehlt also. Mentum trapezisch, Vorderrand gerade, Scheibe schwach gehöckert, Ligula so breit wie das Mentum, vorn nicht augeschnitten, die Seitenlappen durchsichtig, fast häutig; die Innenlade der Maxillen mit sehr langem, dünnen

Hornhaken, die Aussenlade schief oval, das letzte Glied der Maxillarpalpen stark dreieckig, mit spitzem Innen- und verrundetem Aussenwinkel; Mandibeln mit winklig gebogener Aussenkante, die Unterrandkante vor dem Gelenkkopf wie bei den verwandten Gattungen mit starkem kurzem Ausschnitt, die Spitze breit, meisselförmig, ungezähnt, ungefurcht, Mandibelsack gross, innen am Mahlzahn entlang laufend, dieser ungefurcht, nach oben in einen schmalen Lappen ausgezogen, die Unterseite der Mandibeln nach dem Winkel mit tief eingestochener Grube. *Halsschild* so lang wie breit, stark gewölbt, rings gerandet. Schildchen dreieckig. *Flügeldecken* mit starken Schulterbeulen, feinen Punktlinien, Epipleuren nur wenig verkürzt, schmal. *Prosternum* zwischen den Hüften eingedrückt, hinten ganz niedergedrückt, in eine breite, lange Zunge ausgezogen, die in einen länglichen tiefen Eindruck des Mesosternums passt, dieser Eindruck nicht scharfkantig, der Abdominalfortsatz bogig dreieckig vorgezogen. Beine ausserordentlich lang, die Hinterschenkel überragen die Spitze des Hinterleibes, die Schenkel kräftig gekeult, d. h. mit sehr dünner Wurzel, die sehr langen Tibien ungefurcht, ohne Enddornen, das Klauenglied aller Füsse sehr lang, das der Vorder- und Mittelfüsse so lang wie die übrigen zusammen, das der Hinterfüsse kürzer, die Sohle mit starker dichter Bürste, auch das Klauenglied mit Haarstreif.

Diese Gattung unterscheidet sich von allen andern der Unterfamilie durch die ausserordentlich langen Beine. Von *Encyalesthus*, der nächstverwandten ist sie u. a. durch den zungenförmig vorgezogenen Prosternalprozess, durch die schlanken Fühler, die keine Keule bilden verschieden.

Exocolena longipes, n. sp. (Taf. I. fig. 8.)

Schwarz, mässig glänzend, Körper fast zilindrisch, in der Längsrichtung ebenfalls stark gewölbt, seine mittlere Längslinie bildet vom Apex der Elytra bis zum Clypeus einen kontinuierlichen Bogen, der kurz hinter der Mitte der Flügeldecken am höchsten ist. *Kopf* mit schmaler Stirn, die den Querdurchmesser eines Auges nicht erreicht, Augenfalten fehlen, Stirn ganz flach, Augenfurchen tief aber schmal, um die Augen innen herumgehend, sich also hinten nicht vom Innenrand der Augen entfernend. Der Canthus ist sehr stark entwickelt, gut aufgebogen, so lang wie das grosse Auge hinter ihm, und ebenfalls ihre Breite

erreichend, der Clypeus ist seitlich kräftig winklig vom Canthus abgesetzt, lang, gerade abgestuzt, seine Aussenwinkel verrundet rechtwinklig; die Clypealsutur ist fein, nicht eingeschnitten, aber deutlich, ihr oberer Rand spiegelglatt, der übrige Kopf fein und mässig dicht, nicht ganz gleichmässig punktiert. Die schlanken Fühler überragen die Basis des Halsschildes, Glied 3 etwas länger als 4, 4–11 ungefähr gleich, vom 6. an etwas nach innen erweitert, graugelb tomentiert, jedes aber noch viel länger als breit, das letzte mit sehr schwach -förmig gekrümmter Innenkante und fast halbkreisförmiger Aussenkante. Mentum nackt, trapezisch, die Vorderkante etwa $1\frac{1}{2}$ mal so breit wie lang, Vorderecken spitz, die Seiten unmittelbar vor den Hinterecken schwach geschweift, die Oberfläche mit gewölbter Mitte, jederseits mit schrägem Eindruck, der nach aussen scharf begrenzt ist. *Halsschild* $1\frac{1}{4}$ mal so breit wie lang, querüber sehr stark bis zum Seitenrand gewölbt, von der Mitte nach hinten gerade, nach vorn stark verengt, die Hinterecken sehr fein nach aussen tretend, die Vorderecken sehr kurz verrundet stumpfwinklig; von der Seite gesehen ist die vollständige Seitenrandkante fast gerade, die Basis ist fein doppelt geschwungen, vollständig gerandet, der Rand in der Mitte etwas breiter, die Vorderrandlinie in der Mitte kurz unterbrochen, die Oberfläche ist ziemlich fein und weitläufig, in der Mitte stärker als an den Seiten punktiert. Schildchen ogival, glatt, glänzend. *Flügeldecken* mit starken Schulterbeulen, die Schultern selbst schräg abgeschnitten, die Wölbung reicht nicht bis zur Basis, sondern diese ist etwas flachgedrückt, die Basalkante sehr scharf, die Oberfläche mit sehr fein und schmal eingeschnittenen Linien, deren Punkte sehr fein sind, und weitläufiger stehen als ihr Durchmesser beträgt, die äusserste Spitze ist verdickt, mit eingedrückter Naht, der Spitzenrand hat dicht vor dem Spitzenwinkel einen feinen Ausschnitt, bis zu dem die Epipleuren reichen. Die vollkommen flachen Interstitien haben eine mikroskopisch feine, regelmässige, lederartige Grundskulptur, äusserst feine geschlängelte, weitläufige Querlinien (neben den Streifen oft längsrissig) und sehr feine und weitläufige Punktur. Das *Prosternum* ist zwischen den Hüften nicht gefurcht, sehr fein und unregelmässig punktiert, der zungenförmige Fortsatz etwas verdickt, Abdomen etwas gröber punktiert, nicht längsgerunzelt, das Analsegment am Ende flachbogig ausgeschnitten, die Ecken des Ausschnittes kurz zipfelig ausge-

zogen, auf der Scheibe ist die Spitze zwischen diesen Ecken flach eingedrückt, schwach behaart und sehr dicht, fast runzlig punktiert. Die Schenkel, besonders die vorderen Paare, sind kräftig aber schlank gekeult, die vorderen überdies etwas gekrümmt, unten ungefurcht und ungekantet, die vorderen Tibien im Enddrittel kräftig gekrümmt, dicht unter der Basis ist eine kleine gerundete Erweiterung, im übrigen ist die Schiene gleichmässig breit, die Mitteltibien sind schwach gekrümmt, die hinteren gerade. An den Vorder- und Mitteltarsen ist das Klauenglied länger als die vorhergehenden zusammen, an den Hintertarsen wesentlich kürzer.

L. 26 mm. Br. thor. $6\frac{1}{2}$, elytr. 10 mm.

1 ♂ vom Kinabalu in meiner Sammlung.

Die Bildung der Vordertibien, des Analsegments und der Flügeldeckenspitze dürften Sexualcharaktere sein.

Necrobioides bicolor, Fairm. Notes Leyd. Mus. xv. 1893, p. 28.—Davon liegen mir 8 Exemplare vom Kinabalu in meiner Sammlung vor (von Staudinger & Bang-Haas und Hauschild erhalten).

Necrobioides sulcaticollis, Fairm. l. c. p. 28.—Diese Art kann ich in meinem Material nicht auffinden.

Necrobioides sternalis, n. sp.

Von der Form des *bicolor*, hinten etwas mehr erweitert, stark glänzend, Kopf, Halsschild, Beine purpurviolett, Flügeldecken dunkelgolden, Unterseite dunkel metallisch, Abdomen seitlich mit violetten Reflexen. *Kopf* dick und kräftig punktiert, Augenfurche breit und sehr tief, nach hinten verbreitert, Clypealsutur sehr deutlich, gerade, nicht eingeschnitten, jederseits vor den Augen ein Grübchen; Stirn breiter als der Querdurchmesser eines Auges. Der Clypeus geht seitlich ohne Einwinkelung in den Canthus über, er ist sanft ausgeschnitten. Fühler schlank, die ersten 5 Glieder braun, die anderen schwarz, Glied 6–11 als sehr schlanke Keule abgesetzt, jedes Glied so lang wie breit, dreieckig, das letzte fast kreisförmig. Mentum gewölbt mit schwachem Mittelkiel. *Halsschild* etwas quer, sehr stark gewölbt, seitlich und vorn ohne Spur einer Randung, die Basis ist vollständig und scharf, in der Mitte etwas breiter gerandet, die Randlinie geht seitlich über die basalen Längsfurchen hinaus, diese sind sehr tief und scharf, ihre Ränder nicht parallel, sondern der untere bildet einen Viertelkreisbogen, die Mittellinie ist der

ganzen Länge nach angedeutet, aber nur in der hinteren Hälfte etwas eingedrückt, die Oberfläche auf der Scheibe dicht und deutlich, seitlich erloschen punktiert. *Flügeldecken* im letzten Drittel am breitesten. Schulterbeule deutlich abgesetzt, die Randlinie beginnt hinter der Schulter, Oberfläche mit sehr feinen Punktlinien, die Punkte so gross wie ihre Entfernung von einander, die Linien sind hinten viel feiner, an der Spitze erloschen, die Naht ist hinten sehr schmal eingedrückt, die Interstitien vollkommen flach und äusserst fein punktiert. *Prosternum* zwischen den Hüften mit starker Doppelfurche, die vorn durch einen schmalen **V**-förmigen Eindruck gegabelt wird, ähnlich wie die Mittelbrust, nur viel schmaler, unmittelbar hinter den Hüften ist das Prosternum steil niedergedrückt und mit kleinem, wagerechtem Fortsatz versehen, der Eindruck des Mesosternum ziemlich scharfkantig, es ist in der Mitte gerunzelt, seitlich ganz glatt. Metasternum vorn, gleich hinter dem Fortsatz mit scharfer Querfurche, die in der Mitte nach vorn kräftig aufgeworfen ist, die Scheibe der Hinterbrust runzlig, Abdomen beim ♂ längsimpress, fein längsrunzlig und punktiert. Alle Tibien in der Endhälfte innen behaart.

L. $10\frac{1}{3}$ mm. Br. $4\frac{1}{3}$ mm.

1 ♂ vom Kinabalu, 1500 m hoch, habe ich von Herrn Hauschild erhalten.

Die 3 Necrobioidesarten von Borneo lassen sich so auseinanderhalten:

1. Oberseite einfarbig, Halsschild mit kräftiger Mittellinie [ex Fairmaire] . . . *sulcaticollis*, Fairm.
   Oberseite zweifarbig, Halsschild höchstens mit feiner Mittellinie 2
2. Vorderkörper und Beine blaugrün, Halsschild ohne Mittellinie, Hinterbrust vorn mit feiner Querfurche . . . . . *bicolor*, Fairm.
   Vorderkörper und Beine purpurviolett, Halsschild mit deutlicher Mittellinie, Hinterbrust mit scharfer Querfurche . . . . *sternalis*, Geb.

Cryptobates, Fairm.

Notes Leyd. Mus. iv. 1882, p. 231.

Cryptobates crassecostatus, Fairm. Ann. Soc. Ent. Fr. lxvi. 1898, p. 394.—Von der Insel Labuan bei Borneo, mir unbekannt.

Menephilus, Muls.

Col. Fr. Latigènes, 1854, p. 291.—Lacord. Genera Col. v. 1859, p. 378.—Jacq. du Val. Gen. Col. Eur. iii. 1861, p. 311.—Seidl. Naturg. Ins. Deutschl. v. 1896, pp. 623, 624.—Geb. Jahrb. Nass. Ver. Naturk. lxv. 1912, p. 238.

Menephilus borneensis, n. sp.

Kurz und gedrungen, glänzend schwarz. *Kopf* zwischen den Augen flach und breit eingedrückt, der Eindruck geht nicht bis an den Hinterkopf, sondern verflacht sich schon in der Höhe des Hinterrandes der Augen, die Augenfurchen schmal und tief, die Augenfalten hoch erhaben, neben diesen innen, etwas nach hinten wieder eine kurze, schwach schräge Furche, die Clypealsutur ist fein aber deutlich, gerade, seitlich neben den Augenfalten vertieft und verbreitert. Der Clypeus ist fast gerade, seine Seitenecken abgerundet, Canthus von Augenbreite und so lang, wie das Auge hinter ihm; die Fühler haben eine rotbraune Wurzel, die letzten 6 Glieder bilden eine deutliche Keule, sie sind quer, das letzte Glied fast kreisförmig, die Punktierung des Kopfes ist zwischen den Augen deutlich und ziemlich grob, am Clypeus und Hinterkopf dagegen sehr fein. Mentum der Länge nach hochgekielt, seitlich grob punktiert, jederseits an der Basis mit Grübchen, es ist so lang wie breit, die Ligula wie bei *orientalis* m. mit scharfem Querkiel hinter dem stark behaarten Vorderrand, dieser Kiel in der Mitte viereckig nach hinten gezogen. *Halsschild* fast $1\frac{2}{3}$ mal so breit wie lang, in oder hinter der Mitte am breitesten, die Seiten unmittelbar vor den Hinterwinkeln etwas geschweift, diese daher etwas spitz nach hinten gezogen, die Vorderecken ziemlich scharf rechtwinklig; der Halsschild ist besonders beim ♂ vorn stark quer und längsgewölbt, diese Wölbung in der Mitte schwach eingedrückt, ohne Spur von Tuberkeln; die Oberfläche ist sehr fein und ziemlich dicht punktiert, beim ♂ seitlich fast erloschen, daher der ganze Halsschild stark glänzend; die Basis ist stark gerandet. Schildchen 5-seitig, fast glatt. *Flügeldecken* mit starken Punktstreifen, deren Punkte grob und dicht, an der Spitze nicht schwächer sind, die stark gewölbten Zwischenräume sind fein und sehr dicht punktiert, die Basis ist schwach aufgeworfen. Das *Prosternum* ist zwischen den Hüften stark gefurcht, das Ende kaum gesenkt, mit etwas aufgeworfener Spitze, das Mesosternum V-förmig ausgeschnitten mit vortretenden Ecken, die Hinterbrust vorn stark

gerandet, die Propleuren stark punktiert und längsrunzlig, Abdomen ziemlich fein punktiert und etwas längsrunzlig, das Analsegment sehr fein gerandet, die Randlinie reicht vorn lange nicht in die Vorderecken. Beine kurz und dick, die Vorderschienen gegen das Ende ziemlich stark verbreitert, besonders beim ♂, ihre Aussenkante ist gerade, ihre Innenkante geschwungen. Mittel- und Hintertibien aussen ungefurcht aber etwas flach gedrückt, die beiden Enddornen der Tibien deutlich.

L. 10–10½ mm. Br. 4–4⅓ mm.

♂ und ♀ von Borneo ohne genaueren Fundort (von Dr. Staudinger & Bang-Haas erhalten) in meiner Sammlung.

Die einzige verwandte Art ist *M. orientalis*, Geb. von Java, der sich durch starke Punktierung des Vorderkörpers, andere Halsschildbildung, vollständig gerandetes Analsegment, &c., unterscheidet.

Sphenothorax, Geb.

Deutsche Entom. Zeitschr. 1906, p. 233.

Sphenothorax longimanus, n. sp.

Gestreckt, parallel, mässig gewölbt, stark glänzend, schwarz. *Kopf* mit scharfen und tiefen Augenfurchen, Stirn mit zwei tiefen, schmalen Längsfurchen, die mit den Augenfurchen eine Längsfalte bilden, die Frontalfurchen sind parallel und laufen vorn rechtwinklig in die scharf und tief eingeschnittene Clypealsutur, diese biegt an der Einmündungsstelle nach vorn und verflacht sich; der Canthus ist schmaler als die Augen und viel kürzer als ihr Längsdurchmesser, die Clypeusecken stark verrundet, der Clypeus ist sanft ausgeschnitten, die Oberlippe ragt kräftig vor, sie ist scharf quergekielt. Die Fühler erreichen die Mitte des Halsschildes, ihre letzten Glieder bilden eine deutliche, flachgedrückte Keule, Glied 3 ist etwas länger als 4, das 6. so lang wie breit, die folgenden stärker quer, die beiden vorletzten fast doppelt so breit wie lang, das letzte so breit wie lang mit gerader Basis. Die Punktierung des Kopfes ist ausserordentlich fein und wenig dicht. Das Mentum ist regelmässig sechseckig, die Mitte scharf längsgekielt, jederseits des Kieles befindet sich ein sehr tiefer Eindruck, der seitlich den ganzen Raum bis zum Rande einnimmt, die Tuberkel zwischen den Labialpalpen ist sehr hoch und stark quer. Der *Halsschild* quer (3½–4⅔ mm.), seitlich schwach gebogen, in oder vor der Mitte am breitesten, nach hinten sehr schwach verengt, nach vorn stark, die

Vorderecken ganz verrundet, die Spitze gerade abgeschnitten, die Hinterecken zapfenförmig in eine kleine Aushöhlung der Schultern ragend, diese Zapfen rund, die Randung (bis auf die Mitte des Vorderrandes) tief und scharf, die Punktierung fast mikroskopisch fein, die Mittellinie ganz vorn schwach angedeutet. *Flügeldecken* mit ziemlich groben Punktreihen, die gegen die Spitze feiner werden, nur der Nahtstreif vertieft, die flachen Zwischenräume äusserst fein punktiert. *Prosternum* zwischen den Hüften verhältnissmässig breit, mit starker Doppelfurche, welche den niedergedrückten, flachen Fortsatz randet, es ist ganz glatt, die Propleuren äusserst fein punktiert und mit einigen sehr schwachen Runzeln versehen, Mesosternum breit **V**-förmig augeschnitten, vorn mit senkrechtem Abfall, die Scheibe des Mesosternums mit zwei sehr feinen Tuberkeln, eine etwas grössere Tuberkel steht vor dem Hinterrand der Hinterbrust, die unmittelbar davor deutlich gefurcht ist, das Abdomen sehr fein punktiert und an dem Vorderrand der ersten Segmente runzlig. Analsegment sehr fein und vollständig gerandet. Vorderbeine sehr lang, ihre Schenkel verdickt und gekrümmt, die Tibien dünn und ungefähr gleich breit, nur innen in der Mitte sehr schwach erweitert, das Ende innen mit einem Fleck ziemlich langer, rotgoldener Haare, in denen die Enddornen versteckt sind, die kürzeren Mitteltibien schwach **S**-förmig gekrümmt, gegen das Ende verbreitert, mit fein gekerbter Innenkante, die Hinterbeine sehr kurz, ihre Schienen innen der Länge nach gefurcht und sehr fein gekerbt, alle Schienen aussen ungefurcht.

L. 14–16 mm. Br. 5–5¼ mm.

Von dieser hübschen Art liegen mir 2 Exemplare aus Borneo in meiner Sammlung vor.

Der einzige Gattungsgenosse: *Sph. nitidulus*, F., von dem ich in der Deutschen Ent. Zeitschr. 1906, p. 232, eine Neubeschreibung geliefert habe, liegt mir leider nicht vor, so dass ich über den feineren Bau der Beine keine Auskunft geben kann. Unsere Art unterscheidet sich durch den (wenn auch äusserst fein) punktierten Vorderkörper, die vortretende Oberlippe, den queren Thorax.

Catapiestus, Perty.

Obs. Col. Ind. or. 1831, p. 38.—Lacord. Gen. Col. v. 1859, p. 381.

Catapiestus mediocris, Guér. Rev. Zool. 1841, p. 124.—Fairm. Ann. Soc. Ent. Fr. (6) viii. 1888, p. 357.—Von Borneo und den Philippinen in meiner Sammlung. 1 Exempl. aus dem Sarawak Museum von Penrissan, Mai 1899.

Catapiestus simillimus, Fairm. Notes Leyd. Mus. xv. 1893, p. 28. Von Sumatra beschrieben. Das mir vorliegende Tier von Kuching, Jan. 1899, aus dem Sarawak Museum.

Toxicum, Latr.

Hist. Nat. Crust. Ins. iii. 1802, p. 74; x. 1804, p. 297.—Lacord. Gen. Col. v. 1859, p. 341.—Seidl. Naturg. Ins. Deutschl. v. 1896, p. 649.

Toxicum grande (Taf. I. fig. 10), Pasc. Ann. Mag. Nat. Hist. (4) viii. 1871, p. 352.—Waterh. Aid. ident. Ins. i. 1880–82, t. 34. Von Nordborneo beschrieben. Das Sarawak Museum sandte mir ein schönes Männchen von Kuching, 12. Okt. 1898.

Toxicum Heros, Friv. Term. füzetek vi. 1882, p. 139, t. 1 f. 5.—Aus der Matang-Bergen. Mir unbekannt.

Toxicum Goliath, Fairm. Ann. Soc. Ent. Fr. lxvii. 1898, p. 395.—Von Pontianak. Mir nicht vorgekommen.

Toxicum Moultoni, n. sp. (Taf. I. fig. 11.)

Sehr gross, schwarz, ganz matt, bis auf das Analsegment. *Kopf* gross, die Augen bis zur Mitte vom Canthus eingeschnürt, dieser reichlich doppelt so lang wie das Auge hinter ihm, und etwas schmäler, der lange Clypeus mit deutlichen Vorderecken, sanft ausgeschnitten, kräftig gewölbt, mit der Andeutung von zwei Höckern, die Clypealsutur undeutlich, sie wird in ihrer Lage nur durch die separat gewölbte Stirn und den Clypeus bezeichnet, die Furche ist vorn breit und stark vertieft und setzt die Mittelpartie von den Seiten ab, die Stirn ist flach, nicht eingedrückt und gegen den Nacken nicht abgesetzt. Hinten an den Innenwinkeln der Augen erheben sich zwei mässig lange und nicht sehr dicke, im grossen und ganzen parallelseitige, stielrunde, nicht mit Haarbüschel versehene Hörner, die am Grunde weit von einander entfernt sind; von vorn gesehen divergieren die Hörner etwas. Die Fühler schlank, sie überragen die Mitte des Halsschildes etwas, das 3. Glied fast doppelt so lang wie das 4., 4 = 5 = 6,

das 7. etwas breiter, das 8.–11. bilden eine Keule, diese Glieder sind quer, das 10. fast doppelt so breit wie lang, das letzte wenig quer. Der Kopf ist hinten mit mässig dichten, ziemlich groben, sehr tiefen Punkten besetzt, jeder Punkt am Hinterrande mit einem sehr kleinen, über den Punkt gelegten Börstchen von der Länge eines Punktes, der Vorderkopf ist viel feiner und flacher punktiert; das Mentum ist quer sechseckig, mit geradem Vorderrand, die Scheibe leicht vertieft, grob punktiert. *Halsschild* 7 mm. breit, $6\frac{1}{4}$ mm. lang, im ersten Viertel am breitesten, nach hinten geradlinig, schwach verengt, vorn kurz und stärker, Basalrand und Spitze gleich breit, die Vorderecken rechtwinklig, die Hinterecken etwas spitz, da die Basis kräftig doppelbuchtig ist, diese ist vollständig und dick gerandet, die Spitze nur unmittelbar an den Vorderecken; die mittlere Längslinie ist nicht sehr tief eingedrückt, die Punktierung gleicht der des Kopfes, ist aber etwas weitläufiger. Schildchen fünfeckig, die Spitze sehr scharf rechtwinklig. *Flügeldecken* unregelmässig punktiert, die Punkte, welche etwas gröber als die des Halsschildes sind, stehen viel weitläufiger und bilden nur hin und wieder Reihen, die Seiten sind etwas vor der Spitze überwölbt. *Prosternum* zwischen den Hüften eingedrückt, undeutlich gefurcht, das Ende schwach niedergedrückt, mit vorragender Tuberkel, die Propleuren tief eingestochen, weitläufig punktiert, das Mesosternum kaum eingedrückt, das Metasternum vorn spitz vorgezogen wie bei den andern Arten, die Punktierung des Abdomens auf den beiden ersten Segmenten ganz, auf dem 3. und 4. in der vorderen Hälfte ziemlich weitläufig und tief, ungefähr wie das Pronotum punktiert, das glänzende Analsegment schwach eingedrückt, viel feiner und dichter punktiert. Schenkel auf der Unterseite ungefurcht (im Gegensatz zu 4-cornis), auch die Schienen ohne Furchen, die vorderen fast stielrund, schwach gekrümmt, gegen das Ende nicht verbreitert, ohne Aussenendecke, das Klauenglied aller Füsse lang, das der hinteren so lang wie die anderen Glieder zusammen.

L. 27 mm. Br. elytr. 9 mm.

1 ♂ von Kuching, 25. Okt. 1899, aus dem Sarawak Museum.

Diese Art macht die Aufstellung einer neuen Gattung wünschenswert, deren Hauptcharakter die stark gerandete Basis des Halsschildes und die unten ungefurchten Schenkel sind, aber ich kenne *Toxicum Goliath* Fairm. nicht, die einzige Art, mit der unsere verwandt ist, sie

unterscheidet sich sofort durch die ganze andere Flügeldeckenskulptur von *T. Moultoni*.

Toxicum quadricorne, F. Syst. El. i. 1801, p. 153.—Cast. Hist. Nat. ii. 1840, p. 217.—Schauf. Horae Soc. Ent. Ross. xix. 1885, p. 201.—Im ganzen indischen Gebiet gemein, sowohl auf dem Festlande als auch auf allen Sundeinseln, auf Formosa, den Philippinen. Von Nordborneo in meiner Sammlung, von Kuching, 15. Dez. 1898, und 4th Mile Rock Road, 25 vi. 1909, aus dem Sarawak Museum.

Bestimmungstabelle der born. Toxicumarten.

1. ♂ auf dem Kopf mit zwei Hörnern. Sehr grosse Arten von 27 mm. Länge 2
   ♂ auf dem Kopf mit vier Hörnern, meist viel kleinere Arten 3
2. Flügeldecken mit je drei Doppelreihen regelmässiger Punkte. . . . . *Goliath*, Fairm.
   Flügeldecken regellos punktiert, selten sind die Punkte etwas reihig . . . . *Moultoni*, Geb.
3. Pronotum breit gefurcht, die vorderen Hörner an der Basis verbunden, Flügeldecken hier und da unregelmässig punktiert 26–27 mm. gross . . . . . *Heros*, Friv.
   Pronotum ungefurcht, die vorderen Hörner parallel, nicht verbunden, Flügeldecken mit regelmässigen Punktreihen, höchstens 20 mm. gross 4
4. Oberseite schwarzblau, stark glänzend, Beine rot, oder braun, ♂ die hinteren Hörner nach innen gekrümmt und behaart, Abdomen nackt *grande*, Pasc.
   Oberseite schwarz, meist ganz matt, Beine schwarz, ♂ Spitze der hinteren Hörner nach aussen gerichtet, die zwei ersten Segmente des Abdomens goldgelb behaart . . . *quadricorne*, F.

ANTHRACIAS, Redt.

Fn. Austr. ed. 2, 1858, p. 617.—Lacord. Gen. Col. v. 1859, p. 342.—Jacq. du Val. Gen. Col. Eur. iii. 1861, p. 310.—Seidl. Naturg. Ins. Deutschl. v. 1896, p. 649.

Anthracias sumatrensis, Fairm. Notes Leyd. Mus. iv. 1882, p. 227.—Von Sumatra beschrieben. Die Tiere des Sarawak Museums von: K. Baram, 12. Okt. 1910, und Pangga 1. vii. 1909, kann ich von meinen Sumatratieren nicht unterscheiden.

Subfam. Heterotarsinæ.

Lyprops, Hope.

Proc. Zool. Soc. i. 1833, p. 63; Trans. Zool. Soc. i. 1835, p. 101.—Lacord. Gen. Col. v. 1859, p. 397.

Lyprops forticornis, Fairm. Notes Leyd. Mus. v. 1883, p. 35.—Beschrieben von der Ins. Saleijer, nach Fairmaire auch von Sumatra. In meiner Sammlung von Sumatra und Borneo: Kinabalu. Frische Exemplare sind ganz behaart, ältere oft vollständig nackt. Der Seitenrand der Flügeldecken ist, was Fairmaire nicht erwähnt, im ersten Drittel fein gesägt.

Lyprops serrimargo, n. sp.

Schwarz, glänzend, nackt, nur mit Spuren von längeren Haaren an den Körperseiten und den Beinen. *Kopf* sehr grob und dicht punktiert, die Stirn so breit wie der Querdurchmesser eines Auges, der glänzende Canthus so breit vortretend wie die Augen und ebenso lang, die Clypealnaht tief eingedrückt, der ganz kurz vortretende Clypeus gerade abgestutzt, seitlich eingezogen. Fühler sehr kräftig entwickelt, die Glieder eng anschliessend, mit geraden Aussenseiten, Glied 2 ausserordentlich kurz, 3 etwas länger, aber viel kürzer als 4, die folgenden werden allmählich mehr quer, das vorletzte etwa $1\frac{1}{2}$ mal so breit wie lang, das letzte länger als breit, letztes Glied der Maxillarpalpen breit beilförmig, viel breiter als lang. *Halsschild* quer, doppelt so breit wie lang, seitlich ganz verflacht, die Seiten mit groben Zacken, die erste Zacke, welche die Vorderecke bildet, nach vorn etwas vorgezogen, aber wie die andern zur Seite gerichtet, der Seitenrand hat fünf solcher Zähne, von denen der letzte am Hinterrande doppelt ist, vor diesem befindet sich von der Seite her ein tiefer, runder Ausschnitt, der letzte Zahn bildet nicht den Hinterrand, sondern dieser, der vollständig gerade ist, tritt schwach hinter den Endzahn zurück; die Oberfläche ist sehr grob und gedrängt punktiert, die Mittellinie erhaben, glänzend. Der Seitenrand der *Flügeldecken* ist von oben sichtbar, er ist von der Basis bis über die Mitte fein aber scharf gesägt, die Naht schmal erhaben, die Punktierung grob und sehr dicht, die Zwischenräume der Punkte fliessen besonders in der Apikalhälfte zu Längs- und Querrunzeln zusammen, diese Runzeln sind aber kurz und unregelmässig. Die glänzende *Unterseite* ist grob aber viel weitläufiger als die Oberseite punktiert. Das Prosternum ist hinter den

Hüften kaum gesenkt, in eine kurze Spitze ausgezogen. Beine ohne Auszeichnung, an den Füssen ist das vorletzte Glied nicht breiter als die anderen, die Klauen klein, eng, am Grunde scheinbar verwachsen.

L. 8 mm.

1 Exemplar von Borneo (Waterstradt) in meiner Sammlung.

Der stark gezackte Seitenrand des Halsschildes scheidet diese Art von allen bisher bekannten Gattungsgenossen, dies Merkmal und das verkürzte 3. Fühlerglied machen später die Aufstellung einer neuen Gattung nötig.

Lyprops subæneus, n. sp.

Klein, ziemlich schmal, mit kleinem Halsschild, ziemlich flach, schwarz, schwach glänzend mit deutlichem Metallschimmer. *Kopf* dicht und grob punktiert, die Stirn zwischen den Augen viel breiter als der Querdurchmesser eines Auges, die Clypealsutur fehlt, da der Kopf in der Längsrichtung vom Clypeus bis zum Nacken sanft gewölbt ist, nur vor jedem Auge befindet sich ein rundliches Grübchen, die Punktierung ist grob und dicht; der Canthus ist von der Breite der Augen und so lang wie das Auge hinter ihm. Der Clypeus ist unmerklich ausgerandet, seine Ecken scharf stumpfwinklig, die Seiten des Kopfes vor dem Canthus einfach verengt, nicht deutlich ausgeschweift. Fühler lang und schlank, die Glieder sämtlich konisch, das 3. Glied länger als das 4., das letzte Glied breiter und länger als das vorletzte, am Ende schräg abgestutzt. Mentum mit erhöhter Mitte, Ligula mit starkem mittleren Zahn. *Halsschild* so lang wie breit, in oder etwas vor der Mitte am breitesten, die Basis viel schmäler als die Spitze, die Vorderecken sehr kurz vorgezogen, die Seitenrandkante hört wie bei andern Arten vor den Hinterecken auf; die Basis erscheint darum etwas halsartig verlängert, sie ist fein gerandet, die Oberfläche ist sehr grob und dicht punktiert, die Mittellinie zuweilen etwas eingedrückt, der Seitenrand ist glatt oder kaum gewellt. Die Flügeldecken sind hinten fast doppelt so breit wie der Halsschild, ziemlich flach, namentlich an der Naht, die Punktierung ist sehr grob und gedrängt, die Zwischenräume der Punkte zu kurzen und scharf erhabenen Längsrunzeln zusammengeflossen, der Seitenrand ist von oben nicht sichtbar, er ist ungesägt; die ganzen Flügeldecken sind sparsam abstehend behaart, die Behaarung zuweilen fast abgerieben. Schenkel und Schienen einfach,

das vorletzte Glied aller Füsse ist etwas breiter als die vorhergehenden, das schmale Klauenglied ist ganz an der Vorderkante des vorletzten Gliedes aufgesetzt, so dass von oben nur 4, 4 resp. 3 Glieder sichtbar sind. Diese Bildung unterscheidet sich also wesentlich von der bei Heterotarsus, wo das vorletzte Glied sehr klein und versteckt ist. Das Prosternum ist hinter den Hüften niedergedrückt, das Ende zuweilen schwach zahnförmig. Mesosternum sehr schwach eingedrückt. Abdomen glänzend, schwach punktiert.

L. 7–8½ mm.

4 Exemplare vom Kinabalu in meiner Sammlung.

Mit den beiden vorigen Arten nicht näher verwandt, sondern durch die Bildung des Halsschildes den meisten andern der Gattung, der *chrysophthalmus* und *sinensis* Gruppe näherstehend. Sie unterscheidet sich durch die deutliche Metallfarbe und die sehr grobe Punktur mit den kurzen Längsrunzeln. Eine Streifenbildung fehlt.

Die drei hier aufgeführten Arten sind alle weit von einander geschieden und lassen sich leicht so übersehen:

1. Halsschild fast so breit wie beide Flügeldecken, seitlich breit flach abgesetzt 2
   Halsschild kaum breiter als eine Flügeldecke, seitlich nicht abgesetzt . . . *subæneus*, Geb.
2. Halsschild seitlich stark gezackt, Fühlerglied 3 kürzer als 4, Beine schwarz . . *serrimargo*, Geb.
   Halsschild seitlich glatt, Fühlerglied 3 = 4, Beine gelb oder gelbbraun . . . *forticornis*, Fairm.

Subfam. Pycnocerinæ.

Pheugonius, Fairm.

Bull. Soc. Ent. Fr. 1899, p. 313.—Geb. Deutsche Ent. Zeitschr. 1904, p. 152.

Pheugonius giganteus, Geb. *l. c.* p. 157.—Diese grösste orientalische Tenebrionide ist bis jetzt nicht wieder aufgefunden. Das Exemplar des Leydener Museums ist Unicum.

Pheugonius borneensis, Fairm. Bull. Soc. Ent. Fr. 1899, p. 314.—Geb. *l. c.* p. 154.—Von Pontianak in meiner Sammlung, 1 Exemplar von Kuching, 31. Mai 1900, aus dem Sarawak Museum. Zwei Tiere aber auch in meiner Sammlung von Sumatra: Solok, bisher von dieser Insel nicht bekannt.

Ædiotorix, Bates.

Trans. Ent. Soc. 1868, p. 315 (= *Sipirocus*, Fairm. Notes Leyd Mus. xviii. 1896, p. 103).

Ædiotorix impressicollis, n. sp.

Schwarzbraun, matt, von der Gestalt des *Jansoni*, Bates. *Kopf* viel länger als breit, grob und rauh punktiert, der Canthus breiter als die Augen und nur wenig länger (ca. $1\frac{1}{3}$ mal) als die Augen hinter ihm, zwischen Augen und Canthus befindet sich nur ein seichter Eindruck, der Clypeus seitlich scharf stumpfwinklig vom Canthus abgesetzt, vorn sanft ausgeschnitten, der Quereindruck ist mässig stark, schlecht begrenzt, die Zwischenräume der Punkte bilden meist kleine, scharfe Körnchen. Die Fühler sind viel schlanker als bei den andern Arten, sie erreichen fast die Basis des Halsschildes, Glied 4–6 sind nicht quer, sondern so lang wie breit, die drei vorletzten Glieder sind ca. $1\frac{1}{2}$ mal so breit wie lang, die Teilungsfurche des letzten Gliedes nicht erkennbar. *Halsschild* länger als breit seitlich wenig gebogen, kräftig krenuliert, die Vorderecken treten seitlich vor, so dass die Spitze nicht viel schmaler als die Mitte ist, die Scheibe ist durch die schwach vertiefte Mittellinie und zwei stärkere seitliche Eindrücke uneben, die Punktierung wie die des Kopfes grob und zusammenfliessend, die Zwischenräume der Punkte körnchenartig oder schwach längs erhaben. *Flügeldecken* zusammen doppelt so breit wie der Halsschild, mit vier scharfen Längskielen, von denen der erste der längste ist, die drei anderen hinten verkürzt, auch der vierte ist kaum länger als die andern und vorn stark verkürzt, der Seitenrand kielt die Basis, der Skutellarkiel geht nicht in die (übrigens nicht deutlich erhabene) Naht über. Die Zwischenräume der Kiele haben drei Punktreihen, von denen die mittlere weitläufiger ist und sehr kurze aufrechte Borsten trägt. Epipleuren innen mit einer Reihe tiefer Punkte. *Prosternum* am Ende mit kleiner, spitzer, aufgesetzter Tuberkel. Mittelbrust vorn und seitlich grob punktiert, sonst glatt, in der Mittellinie hinten mit flacher Tuberkel, davor nicht deutlich eingedrückt. Abdomen in der Mitte spiegelglatt, die Seiten und der Spitzenrand breit grob punktiert. Vorderbeine viel schlanker als bei *Jansoni*, ihr Schenkel gekrümmt, unten, nahe der Basis ein scharf stumpfwinkliger Zahn, von dort an unten ungekantet, die Schienen lang nach innen gekrümmt, die Mittelschenkel ungezähnt, nur mit kleiner, glänzender Schwiele unten vor der Spitze,

die Mittelschienen von aussen gesehen an der Basis krumm und dünn, in der Endhälfte gerade, schwach verbreitert, die Hinterschenkel auf der Innenseite unten vor der Spitze mit grossem, verrundetem Zahn, die Hinterschienen vorne an der Innenseite mit krenulierter, verbreiterter Innenkante.

L. 17⅓ mm. Br. Halssch. 3 ; Flügeld. 6 mm.

1 ♂ aus dem Sarawak Museum von Penrissan 4200–4500′, Mai 1899.

Von den beiden andern Arten durch den langen Kopf, den Halsschild, der länger als breit ist und deutliche Eindrücke trägt, durch die Fühlerbildung, &c., verschieden.

Erklärung der Tafel I.

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H. GEBIEN: TENEBRIONIDEN BORNEOS.

II.—On Two New Species of Pheretima from Borneo. By W. Michaelsen, Hamburg.

The following descriptions are based upon a small lot of Earthworms collected by Mr. T. C. Moulton, Director of the Sarawak Museum, at Mt. Poi, in Sarawak, North-west Borneo. The first species especially, which I name in honour of its collector, is of great interest on account of its curious habitus, which is not at all that of a *Pheretima* in general.

Pheretima Moultoni, Michaelsen, n. sp.

Loc.—Borneo, Sarawak: Mt. Poi, 4000 ft. high, "curled up on a leaf"; T. C. Moulton leg.

Present 3 mature specimens.

External Characters.—Dimensions: Length, 45–55 mm.; greatest thickness, 2–2½ mm.; number of segments about 93–100 (hinder end of all specimens regenerated).

Head tanylobous, prostomium small. Hinder appendix of prostomium nearly as broad as the prostomium, with parallel borders, which get somewhat less distinct at their hinder end.

Habitus nearly that of a terrestrial Planarian.

Body flattened ventrally, and even somewhat hollowed in the ventral median line.

Colour: Dorsal part of body-wall showing a very characteristic pigmentation, consisting of small dark violet-brown, nearly black, spots. Around the dorsal pores, which are distinguished as small circular white points (*viz.*, intersegmentally), a lot of such dark spots join in order to form a large irregularly bordered figure. At the anteclitellar part of the body these intersegmental figures get relatively larger and tend to join each other, and are forming there a complete moniliform median dorsal stripe. In the meantime the scattered spots diminish in number, and at about the tenth segment they vanish altogether. The median dark stripe is tapering from about the sixth segment forward, and is ending in a foremost, more or less isolated spot at the intersegmental furrow 1–2 or 2–3. The largest number of dark spots upon one segment is about twenty, without including the larger dark figure on the median dorsal line. The prime colour of the body-wall is light yellowish-grey.

Setæ very tender and numerous. I did not succeed in counting the setæ of one segment. Their number may be nearly one hundred. The rows of setæ are not interrupted ventrally, but irregularly interrupted for a small space dorsally. Dorsally the distances between two neighbouring setæ are increasing distinctly.

First dorsal pore at the intersegmental furrow 9–10.

Clitellum ring-shaped, but ventrally somewhat less distinct, constantly occupying the hinder third part of the thirteenth segment together with the whole fourteenth, fifteenth, and sixteenth segments ($=3\frac{1}{3}$).

Male pores on the eighteenth segment on rather small circular porophors, distant from one another about $\frac{2}{5}$–$\frac{1}{4}$ of the whole circumference of the body.

Female pore unpaired, marked by a circular white spot, median ventrally upon the fore half of the fourteenth segment.

Spermathecal pores, three pairs upon the intersegmental furrows 4–5, 5–6, and 6–7. The two partners of one pair are distant from one another about one-third of the whole circumference of the body. The spermatal pores of the first pair are less distinct; those of the third pair are more distinct than those of the middle pair.

Accessory copulatory organs in general two pairs. Just before and behind each male pore, *i.e.*, at the fore part and at the hinder part of the eighteenth segment, but very little dislocated towards the median ventral line, there is seen a centrally depressed, sucker-like roundish papilla of about the same size as the male porophor. These papillæ are pushing back a little the frontiers of the eighteenth segment. In one specimen I found at the right side a supernumerary papilla of the same form just lateral from the normal one, and a little more lateral than the male porophor.

Internal Anatomy. — Septa all very tender, not one thickened, some before the ninth segment apparently failing.

Alimentary Tract: A moderately large longitudinal muscular gizzard before the first distinguishable septum, *viz.*, in the ninth or eighth segment, if not occupying both of them. Intestine without cæca.

Circulatory System: Dorsal vessel simple. Last heart in the thirteenth segment.

Excretory system micronephrical.

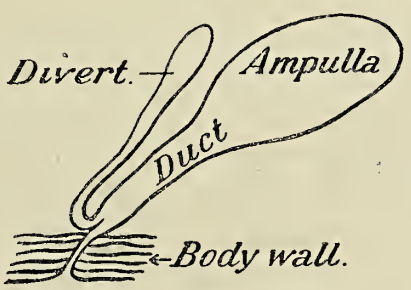
Anterior Male Organs: Two pairs of sperm duct funnels in the tenth and eleventh segment, each enclosed in a

large seminal vesicle. The seminal vesicles of the hinder pair in the eleventh segment are touching each other, as well as those of the first pair in the tenth segment, but they are nevertheless totally isolated. The seminal vesicles of the first pair seem to have a small communication with each other. Two pairs of irregular sac-like sperm sacs in the eleventh and twelfth segments, each sperm sac communicating with the seminal vesicle lying before it in the preceding segment.

Prostates: Glandular part large, occupying about five segments, somewhat longer than broad, with some very deep incisions and a great number of less deep incisions and furrows. Duct nearly straight, much shorter than the glandular part is broad; *in situ* totally hidden beneath the glandular part. The duct is opening directly; there is no copulatory pouch.

Spermathecæ of different sizes, those of the first pair smaller than those of the third pair and larger than the middle ones. Ampulla pear-shaped or sac-like. Duct much thinner than the ampulla, but nearly as long. The short extreme distal part piercing the body wall is abruptly much thinner. A single diverticulum opens into the duct of the main pouch just before it enters the body wall. The diverticula are tender, club-shaped, and of different lengths. Those of the hinder spermathecæ are nearly as long as the main pouch—at least distinctly longer than the ampulla; those of the first pair of spermathecæ are about as long as the duct of the ampulla. The distal end of the generally very tender stalk of the diverticula is a little thickened and sharply bent, opening in the direction from beneath to above into the duct of the ampulla.

Remarks.—This interesting little species of *Pheretima* is standing quite isolated in its genus on account of the



position of the spermathecal pores. The particular pigmentation and the singular shape of the body are giving to *P. Moultoni* a habitus quite uncommon in this genus.

Pheretima poiana, n. sp.

Loc.—North Borneo, Sarawak: Mt. Poi, 3300 ft. high, under moss on a stone; T. C. Moulton leg.

Present one mature specimen.

External Characters.—Dimensions: Length, 290 mm.; thickness, 9 mm.; number of segments, 136.

Colour dorsally in general chestnut brown, with pale intersegmental furrows; at the fore end of the body slate-coloured.

Head epilobous (about $\frac{1}{2}$).

Setæ standing ventrally somewhat nearer together than dorsally; rows of setæ interrupted ventrally, irregularly, and for a short space interrupted dorsally. Number of setæ about: 50–v., 54–x., 57–xii., 52–xix., and 65–xxvi. Apparently no setæ on the clitellum.

First dorsal pore on the intersegmental furrow 12–13.

Clitellum ring-shaped, occupying the fourteenth to sixteenth segments (=3), without setæ.

Male pores at the eighteenth segment about two-sevenths of the whole circumference of the body distant from one another, opposite to about the tenth seta from the medial ventral line. They are large transverse slits upon a rather large transversely oval porophor.

Female pore single and median, ventrally upon the fourteenth segment.

Spermathecal pores, three pairs upon the intersegmental furrows 6–7, 7–8, and 8–9, about in the lines of the eleventh seta from the median ventral line, those of one pair about $\frac{2}{5}$ of the whole circumference of the body distant from one another.

No accessory copulatory organs present.

Internal Anatomy.—The septa 7–8, 10–11, and 12–13 are rather strongly thickened, the septum 8–9 is wanting, and the septa 9–10 and 13–14 are a little thickened.

Alimentary Tract: A large gizzard between the septa 7–8 and 9–10. Intestine with very large cæca, which are stretching forward from the twenty-seventh segment as far as into the sixteenth segment. They are nearly simple, only slightly notched where piercing the septa; broad at the base, tapering towards the blind fore end.

Circulatory System: Dorsal vessel simple. Last hearts in the thirteenth segment.

Excretory system micronephric.

Anterior Male Organs: Two pairs of large, nearly globular, seminal vesicles in the tenth and eleventh seg-

ments, those of one side apparently being put into a small communication, those of one segment separated from one another. Two pairs of large sac-like sperm sacs in the eleventh and twelfth segments being connected each with the seminal vesicle lying just before and beneath in the preceding segment. Each large sperm sac bears dorsally a small appendix. A pair of smaller, grape-like supernumerary sperm sacs depend from the septum 12–13 into the thirteenth segment.

Prostates with rather small two-lobed glandular part, which occupies the sixteenth to twentieth segments. The surface of the glandular part is roughened by a net of furrows and more or less deep incisions. The duct is about as long as the glandular part, rather thick, bent in an S-like manner. It is opening into a large, nearly semiglobular, copulatory pouch.

Spermathecæ: Ampulla irregularly sac-like and thick. Duct about half as long as the ampulla, moderately thick, covered all over by nephridial tufts. A single diverticulum enters the duct of the ampulla at the point where it enters the body wall. The diverticulum consists of a short sausage-like sperm room about twice as long as thick, and a very tender, more or less strongly bent, stalk which is about as long as the sperm room, if not a little longer, and sharply set-off from the latter. In the whole, the diverticulum is somewhat shorter than the main pouch (ampulla +duct).

Remarks.—*Pheretima poiana* belongs to the group of *P. merabahensis*, Beddard & Fedarb,* *P. philippina*, Rosa,† *P. impudens*, Mich.,‡ and *P. bindjeyensis*, Mich.§ The new species is distinguished from *P. merabahensis* by the great distance between the male pores, which are said to be "close together" in *P. merabahensis*. In this character *P. merabahensis* seems to equal the *P. philippina*, in which the male pores are lying in the seventh or eighth row of setæ (of about thirty-five rows of setæ of one-half of a segment). I was able to examine a specimen from the Philippines which doubtless belongs to Rosa's species, and I can confirm this character. The distance between the centres of the slit-like male pores is relatively rather

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* *Perichæta merabahensis*, Beddard & Fedarb, in Ann. Mag. Nat. Hist. (6) xvi. p. 72.

† *P. philippina*, Rosa, in Ann. Hofmus. Wien, vi. p. 397, pl. xiii. fig. 5.

‡ *Amyntas impudens*, Michaelsen, in Mt. Mus. Hamburg, xvi. p. 84, fig. 13.

§ *A. bindjeyensis*, Michaelsen, in Mt. Mus. Hamburg, xvi. p. 94, fig. 18.

small, equalling about one-fifth of the whole circumference. I may add, that in accordance with the position of the male pores in *P. philippina*, also the spermathecal pores of one pair are rather close together, *viz.*, in the specimen examined by me, distant from one another about one-fifth of the whole circumference of the body in the zone of the pores. I suspect these two species, *P. philippina* and *P. merabahensis*, to be identical; but a definite statement can hardly be made without a re-examination of typical specimens of *P. merabahensis*.

Beddard * puts my *P. bindjeyensis* as a synonym to *P. philippina* of Rosa. This cannot be maintained. Beddard did not consider the great difference in the situation of the male pores and the spermathecal pores. This difference, indeed, is not easily to be conceived out of Rosa's and my modes of stating. In this character, *P. bindjeyensis* comes near the new species *P. poiana*. But *P. poiana* is a much larger form, differing from *P. bindjeyensis* by the shape of the spermathecal diverticula, by the shape of the sperm sacs, and by other characters of perhaps minor value.

From *P. impudens* as well, *P. poiana* is distinguished principally by the shape of the spermathecal diverticula.

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* In Proc. Zool. Soc. London, 1900, p. 616.

III.—Sea-Shells and their Makers. By A. J. Jukes-Browne, F.R.S., F.G.S.

A SHELL is the hard calcareous covering of a soft-bodied animal, and the term should properly be restricted to the coverings of those soft-bodied animals which are called the Mollusca. It should not be applied to the covering of a Crab or a Shrimp, such envelopes being called *carapaces*. The Mollusca include several different classes of animals, and they construct a great variety of shells, some forming simple conical caps like Limpets, others building spiral shells such as the Whelks and Periwinkles, and others, again, protecting their sides by two separate shells or valves which are hinged together at the top as in Cockles and Mussels.

The study of shells is known as Conchology, and when combined with that of the animals which make them it is often called Malacology. Every shell is, of course, closely related to the animal which made it, reflecting as it were the structure of that animal; but there are parts of the animal which have little to do with the construction or modification of the shell. These parts may vary in different kinds of molluscs, and consequently it is necessary to observe them while the animal is alive, in order to obtain a full knowledge of the creature and its relationships to others.

Shell-bearing Mollusca are divisible into three great classes: the *Cephalopoda* or Cuttle-fish; the *Gasteropoda* or Snails, whether land, freshwater, or marine; and, lastly, the *Conchifera* or Bivalves, such as Oysters, Mussels, and Clams, most of which live in the sea, though some inhabit rivers and lakes.

I do not propose to say much about the *Cephalopoda* because very few of them construct an external shell. Many of them possess an internal one, which is sometimes horny and sometimes calcareous in composition, the one kind being known as "sea-pens," the other as "cuttle-bones," and these are often thrown up on the shore. The shell of the *Argonauta*, however, is an external and very beautiful construction, consisting of a delicate white convolute shell, which is only produced by the female and serves as a protection for the eggs, which are fixed inside the spire. The

shell is clasped by two of the creature's tentacles, and it is said that when captured the Argonaut often disengages herself from the shell, leaving it to float on the surface of the water and to carry its burden of eggs till they are hatched. Another more common shell-bearing Cephalopod is the *Spirula*, which forms a small loosely coiled and chambered shell of pearly white, and this is embedded in the lower part of the animal's body, both of males and females, being of use in flotation and having nothing to do with the protection of eggs.

Lastly, there is the Nautilus, which actually lives in a shell—a large-chambered shell—the animal occupying the last and largest of the chambers, while those of the inner coils are partially filled with air or gas, giving buoyancy to the shell and enabling the animal to rise or sink at pleasure. The Nautilus usually lives on the bottom, in deep water, but is believed to come to the surface at certain seasons.

The *Gasteropoda* comprise a large number of shell-making animals, and have been divided into several orders or tribes, each including many families and genera. Their shells are always univalve, consisting of one piece, which is generally twisted into a spiral form. The animals have definite heads, which carry a pair of tentacles, a pair of eyes, and a sort of snout or proboscis which encloses the mouth. Inside the mouth there is a curious dental apparatus, not in the form of toothed jaws, but consisting of a hard and horny ribbon set with rows of minute teeth, this ribbon working backwards and forwards over a cartilaginous ridge or cushion. The dental ribbon or *radula* forms an interesting microscopic object, and is of importance to conchologists because the form and arrangement of the teeth vary in different genera, and they are found to be a useful means of classification. The teeth are siliceous, and it is by the scraping action of the teeth on the radula that the animals masticate their food.

Some of the *Gasteropoda* are vegetable feeders, browsing on the weeds which grow in such abundance on the sea-floor and in rock-pools between tide-marks. Others are carnivorous, and prey either upon their vegetarian relatives or on the bivalve mollusca; and some are carrion feeders, living upon dead fish and other creatures which die and leave their bodies on the sea-floor. No one can pick up dead shells on the sea-shore without sooner or later noticing that many of them are pierced by a small round hole, and

that when the shell is thick this hole is not cut straight through, but narrows downward as if it had been made by a conical file, such as that used to sink the head of a screw. The reason of this is that the animal has been killed by one of his carnivorous fellows who has bored a hole in the shell by means of his dental ribbon, which is curved from side to side so that the central teeth come into action first and the lateral teeth are only brought to bear as the hole is deepened.

Passing now to a consideration of the shell, we may first ask, what is the use of it? The primary reason for its existence seems to be the protection of the soft parts of the animal, and especially of the delicate gill or breathing organ; it also serves as a basis of attachment for the muscles of the foot and of those by which the animal retracts itself within its shell. The scar of this attachment is clearly seen inside a limpet-shell as a mark in the shape of a horseshoe, but in spiral shells the retractor muscle is attached to the central axis or "columella" round which the shell is coiled.

Here, also, it should be mentioned that most of the spiral *Gasteropoda* have a horny or shelly plate attached to the hinder part of the foot, so arranged that when the animal withdraws itself this plate or "operculum" comes last and closes the aperture of the shell, so as to afford protection from attack in that quarter. The shape and substance of the operculum vary in different genera, and thus it becomes of assistance in classification. It is generally fully developed and very tight-fitting in the spiral vegetarians, while among the carnivorous genera, though many possess opercula, they are often too small to close the aperture completely, and in some cases they are absent altogether.

The shell itself is either conical or spiral, and the spiral form may be regarded as a twisted cone. The Limpet has the simplest form of shell; the Bonnet-shells (*Capulus* and *Crucibulum*) show how the apex of the cone becomes twisted into the beginning of a spire. The Ear-shells, again (*Haliotis*), show how this can be coiled into a flattened whorl, and from this the transition is easy to the more elongate spiral form of a turbinate shell such as the Winkle (*Littorina*) or the Top-shells (*Turbo* and *Trochus*).

Some Gasteropods have a tube or siphon, through which water is passed into the gill-chamber, and when such a siphon exists, the aperture of the shell is notched at the

bottom or prolonged into a shelly canal for the protection of the siphon. This canal is formed by a prolongation of the columella and of the outer lip of the aperture, and is sometimes as long as or even longer than the spire, so that the shell is fusiform or spindle-shaped. One such shell, of which several species occur in the Indian Ocean, is called *Fusus*, which is the Latin for a "spindle"; another is known as *Fasciolaria*; *Murex* and *Turbinella* are also shells with long canals.

In other cases the whole shell is coiled up on its axis, and is then said to be convolute, the body-whorl being very large and the aperture a long narrow slit. The Cowries (*Cypræa*), so well known as ornamental shells, are an instance, but they are spiral when young, and only become convolute at a certain age. The Olive-shells (*Oliva*) are partially convolute, having a very short spire and a cylindrical body-whorl with a narrow aperture.

The mention of Cowries and Olives leads me to say a few words about the outer surface of shells, why some are smooth and even polished, others rough and ribbed, and others, again, tubercular, spiny, or frondose. The surface-layer of the shell is produced by the outer margins of the mantle or body-covering, and these margins are either smooth, rugose, or elongated into projections in accordance with the kind of surface which is produced, and which we must suppose is in some way beneficial to the animal.

In some cases the borders of the mantle are reflected over the shell, sometimes to such an extent that they cover nearly the whole of it, and in such cases the shell generally has quite a polished surface, as in *Cypræa*, *Oliva*, and *Natica*. But others produce shells with a similar natural polish, without any reflection of the mantle; such are the Auger-shells (*Terebra*), the Pheasant-shell (*Phasianella*), and *Eulima*. Again, there is at least one genus where the mantle is reflected over the shell, and yet that is rough, with a raised reticulate ornamentation; this genus is *Pirula*. Lastly, there are cases where some species of a genus are smooth and polished though the majority are ribbed or striated, such a contrast being found in two Bornean shells, *Nerita polita* and *Nerita lineata*. Hence it is clear that there is no relation between the smoothness of a shell and the reflection of its maker's mantle over its edges; it is evident that the smoothness or roughness of the shell is co-ordinated with some requirement of the animal's environment about which at present we know

very little, and observations directed to the elucidation of this point are much to be desired.

If we assume that the edges of the mantle can produce a smooth surface or a sculptured one according to the animal's requirements, we may perhaps also assume that a smooth shell is the normal product, formed when there is no special reason for it to be otherwise; for it is probable that the borders of the mantle are normally smooth, and that rugosities or prolongations are special modifications evolved mainly for protective purposes. Thus the foliaceous and frondose processes of the *Murex* shell may serve this purpose by imitating the fronds of seaweeds, and preserve the animal from the eyes of predatory carnivorous fish, but observations are needed to confirm this theory.

The third great class of Mollusca are those which make their shelly covering in two pieces or valves, each one covering and protecting one side of the animal; hence they are known as the Bivalves or *Conchifera*. These animals have no definite head and no dental apparatus of any kind, but they have a sort of mouth and they feed on small animalculæ brought to this mouth by the currents set up in the gills, which are supplied with water through two tubes called siphons.

In this class the whole body is covered by a mantle in two lobes which secrete the two valves of the shell; this mantle is sometimes open below, sometimes closed, but there is always an opening for the extrusion of the foot, a soft, muscular, elongate, and extensible organ, which is used for the purpose of propulsion. Further, the hinder part of the mantle is always converted into two tubes or siphons, one being the incurrent and the other an excurrent siphon. These siphons are sometimes short and sometimes very long, but are always strong, muscular, and contractile; in some cases they are separate from one another, while in others they are partially or wholly united, and in some genera they are both enclosed in a papery kind of epidermis.

The foot varies much in shape and length, being sometimes very small and degenerate, more usually it is tongue-shaped, and sometimes it is much prolonged and curved, as in the Cockles (*Cardium*), enabling them to jump several inches at a time and to burrow quickly into soft sand. The margins of the mantle are generally smooth, but are sometimes frilled and even fringed. It is on these organs, the mantle, foot, and siphons, that observations are wanted

with regard to the differences which they exhibit in different genera, for we know much less about the animals of Conchifera than about those of the Gasteropoda.

Bivalve shells should be obtained alive whenever that is possible, not only because observations on the animals are required, but because when thrown up on the beach the valves soon become detached and broken. After notes have been made about the points above mentioned, the animal can be easily removed by being placed in hot water, when the valves open and the muscles which hold the shell together can be cut. There are generally two of these "adductor" muscles, and the shell then opens more widely because the valves are pulled apart by an elastic ligament above the hinge-plate; while wet, however, they can be closed, and should be tied together with thin string or cotton. In the case of small shells this is quickly done by taking two or three turns of cotton round them and twisting the ends together between the fingers without troubling to tie a knot.

Most of the Bivalves live in sand or mud near or below low water-mark, but some attach themselves to rocks, and a few even bore holes in soft kinds of rock or in timber. Some, therefore, can be dug out at low water with a spade, and others extracted by breaking off pieces of rock or coral-reef at low water; but to obtain those from the sea-floor outside low water-mark a small dredge must be used from a sailing-boat. Occasionally some of these are torn from their hold in the sand or mud by storm-waves, and are thrown up on sandy beaches without being injured, so that such a beach is always worth searching after a storm, or after a strong wind from seaward. Most of the Conchifera are marine animals, but a few are to be found in the mud of estuaries, rivers, and lagoons.

It may perhaps be as well to mention some of the different kinds of Bivalves, for they differ much in shape and in texture of shell. Most of them have similar opposite valves, which are either smooth or sculptured, white or variously coloured; such are the ordinary Cockles (*Cardium*), scallops (*Pecten*), and Tellens (*Tellina*); others are elongate and covered with a dark-coloured epidermis, such as the various kinds of Mussels, *Mytilus*, *Modiola*, *Pinna*, and *Perna*; these are generally attached to rocks or timbers by a bundle of fibres secreted by the foot and known as a "byssus." Others, again, have a flattish shell with a scaly or platy structure, such as the Oysters,

both edible and pearly (*Ostrea* and *Meleagrina*). Lastly, some species fix themselves to rocks by one valve and form thick foliaceous or spiny shells, one valve of which is smaller than the other (*Chama* and *Spondylus*).

Bivalves differ also very greatly in the way in which the two valves are hinged together. In most cases the opposing edges are furnished with a set of projections or teeth which fit in between one another, and the arrangement of these teeth affords a basis of classification into families and genera. In some there are a great number of similar small teeth, as in the Ark-shells (*Arca*); in others there are two or three median teeth with elongate lateral teeth on each side, as in the Cockles (*Cardium*) and the genera called *Mactra* and *Donax*. Others, again, have only median teeth, and a few have no teeth at all (as in *Anatina*) or only a spoon-shaped process (as in *Mya*).

Bivalves are rather more local in their distribution than Univalves, and it is quite possible that some are common on the north coast of Borneo which are rare elsewhere.

This article has been written in the hope that I may interest some of the planters, officials, and traders who live on and near the seashore in the subject of Marine Mollusca, that I may induce them to observe the animals which construct all these various kinds of shells, and to collect the shells themselves, either for their own interest and study or for exhibition in the Rajah's Museum at Sarawak. I shall be happy to correspond with any one who resides in Sarawak or other part of Borneo, and would name any shells that are sent to me through the Curator of the Museum.

IV.—Notes on Collecting Ferns, with particular Reference to certain Bornean Ferns of Considerable Interest.

By D. H. Campbell, Professor of Botany, Stanford University, California.

No group of plants is more interesting to the botanist than the ferns which are, in a sense, connecting links between the seed-bearing plants and the lower mosses or liverworts.

Every collector of ferns knows that the classification is based mainly upon the position of the little capsules, or sporangia, which contain the spores. The latter are deposited as a fine powder, as will be seen if a leaf with ripe sporangia be laid upon a sheet of paper. If these spores are examined microscopically each is seen to be a single cell, whose outer membranes are more or less thickened to protect the contents against injury. Many persons who collect ferns are quite unaware that the plants developed from these spores are very different indeed from the fern as it is usually known.

If the spores are sown upon moist earth, or a bit of tile, in the course of a few weeks a crop of little plants will appear, which show no trace of the familiar fern leaf, but are thin, green, filmy structures, lying flat on the ground, and usually somewhat heart-shaped in outline. In most ferns these simple little plants—"prothallia" or "prothalli," to use their technical name—are not more than a quarter of an inch or less in diameter. In certain forms, however, the prothallia may be much larger.

The prothallia of many ferns may be easily found by examining moist banks, &c., where ferns are growing. When one wishes to collect prothallia of a given species it is best, if possible, to select a bank where the fern is growing in such a position as to allow the spores to fall in small crevices, or upon freshly exposed soil, where mosses, &c., have not had time to take possession. In a climate like that of Sarawak, almost any bank or recent cutting, where the earth has been freshly exposed, will almost invariably show a rich crop of fern prothallia.

Owing to the great similarity in the appearance of the prothallia of most common ferns, it is often difficult to tell to what species they belong. It is best to first select specimens with the little ferns attached to them, so that one can tell the species, and then examine others of the same group for the earlier stages.

For future study the prothallia may be preserved in ordinary alcohol, or alcohol to which 10 per cent. of strong acetic acid has been added.

Of course, the surest way to get the prothallia of a given species of fern is to grow them from the spores, and this plan may be recommended to those who are willing to take a little trouble. The fresh spores may be sown either upon fine earth, rotten wood, or bits of tile. These must be kept moist, but not as a rule soaking wet. It is advisable to sterilize the earth by heating. The bits of tile or rotten wood may be plunged into boiling water for an hour or so before the spores are sown. This checks the development of mosses and algæ, which otherwise are apt to choke out the young ferns. It is also advisable to remove from time to time such alien growths as may appear, in spite of the sterilizing of the soil.

A microscopic study of the prothallium shows that it bears reproductive organs within which are produced sexual cells—actively swimming sperms or male cells—and non-motile eggs, female cells, both sperms and eggs much resembling the corresponding reproductive cells of an animal. As in the latter there is a fusion of the two sex cells, the fertilized egg then developing into the future fern. This embryo plant soon shows the characteristic leaf, and a root is formed which grows downward into the earth. The young fern, however, retains its connection with the prothallium for some time, but ultimately the prothallium dies, leaving the little fern or "sporophyte" rooted in the ground.

The sporophyte, or fern as we usually know it, is a strictly non-sexual organism, as the reproductive cells or spores are produced by simple cell division, and there is nothing in the nature of fertilization preliminary to their germination.

It is thus evident that in the fern there is an alternate development of sexual plants (*prothallia*) derived from the germination of the spores, and of non-sexual plants (*sporophytes*) arising from the fertilized egg.

There is every reason to believe that the sexual plant or

prothallium is the older phase, and represents the ancestral plant from which later the non-sexual sporophyte was developed. A careful study of the prothallium is therefore of the greatest importance in determining the relationships of the different groups of ferns among themselves and to other plants.

In Borneo, as in all other countries, the great majority of the ferns belong to a single family, the Polypodiaceæ, whose prothallia have been very completely studied, and whose life-history is well known.

There are, however, a number of other ferns whose prothallia are much less known, and material of which might be of real scientific value. Of the Bornean ferns whose prothallia are quite unknown may be mentioned the two species of *Matonia—M. pectinata*, and *M. sarmentosa.*

The genus *Matonia* comprises but two species: *M. pectinata* is a handsome fern with large fan-shaped fronds borne on long stalks, sometimes 6 ft. or more in height. It was originally found on Mount Ophir in Malacca, but has since been collected in several other localities. In Sarawak it is known from near the summits of Matang and Santubong.

M. sarmentosa is known only from Sarawak, where it is found in the limestone caves of Niah, Bidi and Bau. Its slender pendent fronds are very unlike those of *M. pectinata.*

These two ferns are the only living representatives of the family Matoniaceæ, of which there are a number of fossil species, especially from the early secondary formations. It is very desirable that the prothallia should be found, as they would probably help to determine the relationship of the Matoniaceæ to other living ferns.

The peculiar genus *Schizæa*, one of which the writer found with prothallia on Mount Matang, also is incompletely known. *Schizæa malaccana* is a small fern with slender grass-like sterile leaves, the fertile ones being similar, but tipped by a cluster of small spore-bearing leaflets. This plant was abundant near the top of Matang, growing on steep, wet banks. The form of the peculiar alga-like prothallium is due probably to its almost aquatic habit. The prothallium of the related genus *Lygodium* (the common climbing ferns) is much like that of the ordinary ferns.

One of the most important families of ferns is that of the Marattiaceæ, represented in Sarawak by four genera,

none of which, however, can be said to be common. They occur only in small numbers, and usually in the deep jungle. The four Bornean genera are *Angiopteris*, *Marattia*, *Macroglossum* and *Kaulfussis*. Of these *Macroglossum* is, so far as is known, peculiar to Sarawak. In all of these the prothallium is often of relatively great size.

The Marattiaceæ are specially interesting to the botanist, because they are more nearly related to the majority of the older fossil ferns than are any other existing ferns. Most of the abundant ferns and fern-like plants occurring as fossils in the coal measures, for example, are either true Marattiaceæ, or are closely related to them.

The primitive nature of the living Marattiaceæ is shown by the prothallium, which attains much greater dimensions than that of any of the common ferns, and may live for several years. The writer recently, in Sumatra, found prothallia of a species of *Angiopteris* more than an inch across, and very thick and fleshy, so that it was hard to believe that they were fern-prothallia and not large liverworts.

The prothallium is always more massive than in the ordinary ferns, and the reproductive organs quite different. Where very young plants (sporophytes) are attached to the prothallium, they can at once be distinguished from the common ferns by their position. In the Marattiaceæ the young fern always grows through the prothallium, the first leaf emerging from the upper surface of the prothallium. In the ordinary ferns the first leaf emerges on the lower surface, and bends upward in front of the prothallium apex.

The most interesting of the Bornean Marattiaceæ is a fine fern to which Professor E. B. Copeland gave the name *Macroglossum alidæ*. This is a very handsome fern with leaves sometimes upwards of 12 ft. in length. It was found first at Bau by Mr. Young, and later by Mr. Moulton at Penrissen. The writer saw a single specimen at the base of Mount Matang, and also visited the station at Bau, where the plant was growing luxuriantly, and where a number of young plants and prothallia were secured. The latter are much like those of *Angiopteris*, with which *Macroglossum* is undoubtedly related.

Since leaving Borneo the writer made a brief visit to the famous botanical gardens at Buitenzorg in Java, and to his astonishment found there a fine plant of a fern apparently identical with the Sarawak species. This

plant, it seems, had been examined by a well-known botanist, Raciborski, who, about ten years ago, called it *Angiopteris Smithii*. There is no record of where the plant came from, but it has been in the gardens for many years.

As collections of plants are frequently sent from Borneo to Buitenzorg, it is extremely likely that the plant in question was sent from some part of Borneo; but whether from Sarawak or, what is more likely, from Dutch Borneo, can never be ascertained; so for the present, at least, the only known native localities for the plant are in Sarawak.*

Another peculiar family is that of the Ophioglossaceæ—adder-tongue ferns. They are not common in Sarawak, and the prothallium is especially difficult to find, as it is subterranean and quite destitute of the green colour of other fern prothallia.

The Ophioglossaceæ can be recognized at once by the characteristic fertile leaves. The sporangia are borne upon a sort of spike having usually a long stalk inserted at the base of the leaf-blade. The latter, in the genus *Ophioglossum*, is quite undivided, and not at all fern-like in appearance. In *Helminthostachys* the leaf-blade is palmately divided, and is in some respects not unlike the leaves of the Marattiaceæ.

There is much reason for assuming that the Ophioglossaceæ and Marattiaceæ are really related, and that the Ophioglossaceæ are also very old types. There is, however, very little fossil evidence—due perhaps to the fact that the Ophioglossaceæ are soft fleshy plants, not fitted to leave well-preserved fossil remains.

Most species of *Ophioglossum* are small terrestrial plants, sometimes only a couple of inches high, and seldom more than 6 to 8 inches. One species, however, *O. pendulum*, is an epiphyte, and its long pendent fronds, sometimes forked, may be 4 or 5 ft. in length.

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* [In a letter dated October 9th, 1913, Professor Campbell writes: "I am just now making a careful investigation of *Macroglossum*, and I find that the Sarawak form, while much resembling Raciborski's *Angiopteris Smithii*, is quite distinct. The material of the Buitenzorg plant I showed Copeland was not mature, but when I came to examine it more carefully on my return here, I found so many differences that I am convinced that the two forms are specifically distinct. Apart from the fact that the sori of the Sarawak species contain more than twice as many sporangia, there are differences in the structure of the sporangia and the indusium, as well as more marked differences in the anatomy of the leaf—so I think it is safe to say that Copeland's name will hold for your plant, while the other now becomes *Macroglossum Smithii*."]—Ed.

Helminthostachys has but a single species. It is usually found in rich humus soil in the lower forest. It is a foot or so in height.

Both genera, *Ophioglossum* and *Helminthostachys*, are reported from Sarawak, but they are evidently rare, and the chances of finding their prothallia are small.

V.—Some Notes on Birds in Sarawak.—By R. B. Williams.

[The following notes are from Mr. Williams' private sketch-book, in which he has brought together accurate paintings of about one hundred different species of birds shot by him during the last three years in Sarawak. Below each picture he has made full notes of the general colouring of the bird, and in many places he has been able to add short notes on their flight, food abundance, localities, &c. The Latin and English names of the bird are given at the top of each page, these being obtained by Mr. Williams by comparing his specimens or pictures with the collection in the Sarawak Museum from time to time. The paintings are so accurate and so carefully done that I have had no difficulty in verifying (and correcting in one or two instances) all Mr. Williams' identifications. The rough notes accompanying the pictures were written entirely for his own use, and not with the least idea of future publication; but they contained so much of interest and value, particularly the notes on the colour of the soft parts, that I have persuaded Mr. Williams to allow me to collect extracts for publication in the following article, only leaving out his descriptions of plumage, character of bill and feet, &c., which can be found in any of the standard books where descriptions are given, though usually from Museum specimens.]—J. C. Moulton.

Rhizothera longirostris, Temm.

(*The Long-billed Francolin.*)

Common but not often seen; very shy, but its shrill cry is heard almost anywhere in the morning or evening. The cry is a kind of shrill whistle, and is something like "kanking, kanking." They keep chiefly to the ground, but will often alight on a tree. I have flushed one which only flew a few yards, and then alighted on a low tree quite close to me. Good plump birds to eat, but do not give good

shooting, as they keep to the jungle and are more inclined to run than fly. The feet, tarsus, and claws are pale watery yellow. The iris is clear yellow-brown. The food is probably much the same as that of other partridges, but it is particularly fond of Indian corn, and may often be found feeding under a jungle fruit tree.

Lophura nobilis, Scl.

(*The Bornean Crested Fireback.*)

Sometimes these birds are found in coveys roosting in trees; five were shot quite close together one evening at Poak. They are inclined to be pugnacious; I saw one in a small cage, which would make a rush at the bars on a hand being placed close to it. The Dayak name is "Sumpidan," and Malay "Manok utan."

Butreron capelli, Temm.

(*The Large Thick-billed Green Pigeon.*)

The feet are orange.

Osmotreron fulvicollis, Wagl.

(*The Rufous-necked Fruit Pigeon.*)

The claws are grey. Eyelids grey with orange-yellow margins.

Osmotreron vernans, Linn.

(*The Rosy-necked Fruit Pigeon.*)

The most common variety of "punai" in Upper Sarawak. It may often be seen flying about in flocks of thirty to forty in the low jungle, and feeding chiefly on small berries, not in large fruit trees. It has a curious wailing whistle. The feet and tarsus are characteristic of the pigeons in Sarawak —very strong and muscular. A bird when shot in a tree will often cling upside down to a twig and then fall dead, after perhaps half a minute. The flight is that of a typical pigeon—swift and decided. Iris: there is an inner ring round the pupil of bright enamel-like blue, and outside this there is a ring of coral pink.

Male.—Bill blue-grey on the hard tip; the soft parts round the base and nostrils are green yellow with some orange. Feet crimson, claws grey.

Female.—Blue-grey at the tip, while the soft parts are green.

Osmotreron olax, Temm.

(*The Common Green Pigeon.*)

The iris of male and female has an inner ring of grey-white and an outer one of pink. The feet and tarsus are coral pink, claws grey. The bill is grey-green. The flight is very fast and typical.

Carpophaga ænea, Linn.

(*The Imperial Green Pigeon.*)

A rather heavy, clumsy bird, it flies with a slow steady beat of the wings as it makes its long straight flights to and from its feeding places in groups of two to five, or even singly; evening after evening they may be seen flying over the same spot during certain periods of the year, and are very difficult to bring down with a 12-bore gun, as they are usually just out of range and carry a lot of shot. The bill is a nondescript green-grey colour; the gape is very large and wide. I have shot them with crops full of fruit bigger than olives. The feet are large, strong, fleshy, and deep red in colour, claws black. Not an uncommon bird, and may often be heard making its deep "coo-coo" hour after hour, but is difficult to approach, as it sits in some small tree; but in the early morning it may be seen feeding ravenously in a fruit tree.

Chalcophaps indica, Linn.

(*The Bronze-winged Dove.*)

July 28*th*, 1912.—Shot eleven "Imbok" on the Sarawak river between Bau and Bidi. I never saw so many before. They were usually single, but at times in the middle of the day I put up three and four at a time, usually off the ground, and they keep entirely to low jungle. The flight is rapid and typical of a pigeon, but swerving in jungle like a woodcock. They are well adapted for living on the ground, running very rapidly through the grass. Strictly a jungle dove, and Bartlett says the eggs are a creamy white. Fairly common, especially about the banks of rivers. I saw a good many on the Samarahan and Sadong rivers, giving very sporting shots as they flew across.

One shot (February 16th, 1913) was apparently a young female. The bill, feet, and tarsus were not red, only showing pinkish through dusky brown.

Male.	*Female.*
Bill crimson, with top of the extremity slightly blackened.	Ditto, slightly darker at the top.
Iris dark brown.	Ditto.
Eyelids deep red, surrounded by a little red naked skin, extending to the base of the bill.	Ditto.
Feet and tarsus crimson; back of tarsus and soles of feet white, claws black.	Paler.

HYPOTÆNIDIA STRIATA, Linn.

(*The Blue-breasted Banded Rail.*)

Shot one at Bau in a small marsh in August, 1911; bill crimson; throat grey; feet and tarsus yellow; iris possibly orange.

RALLINA FASCIATA, Raffl.

(*The Malayan Banded Crake.*)

Shot one on June 15th, 1912, which was in a little boggy jungle stream, and flew up to alight in a small tree, where I shot it. Iris clear orange-brown; tarsus and feet crimson, claws grey; eyelids crimson; skin at base of bill and gape crimson. The stomach contained worms and grubs.

December 16*th*, 1912.—Shot a male (undoubtedly) with apparently good plumage, but very different from the above. The upper part of upper mandible was black, shading to pale green in the lower. The iris clear orange-brown. The crimson round the eye was entirely absent. The feet and tarsus were pinkish-brown, claws grey.

AMAURORNIS PHŒNICURA, Forster.

(*The White-breasted Water-hen.*)

Very common in almost any piece of swampy ground. In a female shot in June, 1912, there is a red yellow shield at the base of bill, which is green. The iris is yellow-brown, feet and claws very long—a muddy yellow colour. At the same time as the above another was shot, which may have been a male; the same as above, except that there was no shield on the forehead; bill, feet and tarsus were longer and stronger, and there was more grey about the head and neck. Possibly a young bird or a male in bad plumage.

November 17*th*, 1912.—Shot a "Kruak" as above, but it was a male with a good orange shield as above.

GLAREOLA ORIENTALIS, Leach.

(*The Large Indian Pratincole, or Swallow Plover.*)

I have never seen this species in Sarawak except for the above specimen, which I shot at Claudetown, where I watched it for some time soaring about. The bill is black, broad at the gape, which is coloured crimson. Feet and tarsus black; oil-gland tufted; iris brown.

BUBULCUS COROMANDUS, Bodd.

(*The Cattle Egret.*)

The legs and feet are dark green, almost black; the claws are black; iris bright yellow.

ACCIPITER VIRGATUS, Temm.

(*The Besra Sparrow-Hawk.*)

Not uncommon. The bill is typical, black, and the tip shading into grey. The cere is greenish yellow. The feet and tarsus are a fine yellow with black claws; iris bright yellow, as are also the eyelids.

ICTINÆTUS MALAYENSIS, Temm.

(*The Malayan Black Eagle.*)

The above specimen was shot in a tall tree at sundown. It is said by natives to be a night-bird. A very handsome bird with splendid feet and claws; the eyes are large and inclined to be owl-like. The native with me called it a "Menaul malam." The bill, cere, and nostril are black; feet yellow; iris bright yellow.

MICROHIERAX FRINGILLARIUS, Drap.

(*The Malayan Falconet.*)

Fairly common, usually seen in pairs sitting on a tall dead tree, from which they make short flights to catch the insects, on which they chiefly live. Iris light brown; thigh, tarsus, and feet black.

KETUPA KETUPA, Horsf.

(*The Fishing Owl.*)

There is a black cere; iris yellow.

Scops lempiji, Horsf.

(*The Collared Scops Owl.*)

The bird when sitting looks very like a ball of feathers, and is nearly as broad as it is long. The stomach contained insects. Oil-gland long and bare; iris light brown.

Loriculus galgulus, Linn.

(*The Blue-crowned Hanging Parroquet.*)

Fairly common and a popular cage bird with the Malays. The bill is black; iris dark brown; cere greenish; feet and claws a pale brown. These birds will often hang head downwards in a cage for hours. The note is a shrill little chirp.

Eurystomus orientalis, Linn.

(*The Eastern Roller.*)

Not common. I have only seen one specimen in Upper Sarawak. The bill is large, broad, and very decidedly hooked; bright crimson, only the hook being black; the feet are crimson and the claws black; iris brown.

Pelargopsis leucocephala, Gm.

(*The White-headed Kingfisher.*)

Not common, but may often be seen on big lakes and rivers. Iris brown, and not round; eyelids crimson; feet and tarsus red and typical, claws black. A female shot at Bau in February had its stomach empty and ovaries well-developed. Saw plenty of these up the Sadong river in April.

Alcedo meninting, Horsf.

(*The Malayan Kingfisher.*)

Not uncommon, but it keeps to the jungle streams chiefly.

August 27*th*, 1912.—Shot a male at Tai Ton on the Sarawak river. The bill is black but orange at the gape; feet and claws coral red. The flight is very swift, with short quick beats of the wings, like the common English Kingfisher. The stomach seemed to contain the remains of fish, but these may have been insects, as they were very much decomposed.

September 18*th*, 1912.—Noticed one of these Kingfishers catching fish by darting at them from a bush at the side

of a lake. Also heard the thin "cheep" made by it as it flies in a straight line like the common English Kingfisher; the flight is very similar too.

CEYX EUERYTHRA, Sharpe.

(*The Malayan Three-toed Kingfisher.*)

Not uncommon, but keeps to thick jungle; it is fairly common on the upper reaches of the Sadong and Samarahan rivers. The bill is scarlet; feet coral red with rather long sharp and very dainty claws; iris black. The note is a typical Kingfisher pipe; the flight direct and darting. The stomach of one was apparently full of insect remains, but may also have contained crustacea, as it smelt distinctly fishy.

HALCYON PILEATA, Bodd.

(*The Black-capped Kingfisher.*)

Common round ponds and rivers during September to April. This bird does not eat fish; the specimen shot had chiefly grasshoppers and insects in its stomach. A female shot in November had ovaries showing signs of developing.

HALCYON CONCRETUS, Temm.

(*The Brown-collared Kingfisher.*)

Uncommon, or not seen in Upper Sarawak. Bill is yellow and black: iris brown; eyelids yellow; feet and tarsus yellow. The stomach contained fish much decomposed, and smelt strongly of phosphorus.

HALCYON CHLORIS, Bodd.

(*The White-collared Kingfisher.*)

Commonest about the coast, often seen in mangrove swamps. Has a curious uncertain flight, like *H. pileata*, and the same cackling cry. Iris brown; lower mandible slightly violet.

ANTHRACOCEROS CONVEXUS, Temm.

(*The Javan Pied Hornbill.*)

Iris of female a clear brown. Flight slow, like that of a crow. I saw a great many of these birds in Samaharan and Sadong, usually in flocks of 10–20 or single, but they do not seem to be truly very gregarious; a bunch of them in a tree will not flush all out at once when alarmed, but

straggle away in twos and threes. The feathers are very loose, and it is difficult to skin, because in places there seem to be two skins, which separate easily from the body, but only the outer one can be preserved. Feet slate grey.

MEROPS SUMATRANUS, Raffl.

(*The Sumatran Bee-eater.*)

Fairly common during the months of April to September; often seen flying about, and may easily be mistaken for a swallow against the sky, but it is larger, and the wings are triangular when spread; also, when turning in the air after flies the tail is spread out in a bluntly forked fan. The two elongated feathers of the tail are in most cases nothing but the bare shafts of the feathers. These birds may often be seen ranging and quartering an area after flies, and making their hoarse whistle or cackle. The iris is crimson; feet brownish-black. Shot two at Tai Ton, which I had watched in a paddy field sitting on dead trees, every now and then making short flights to catch insects.

NYCTIORNIS AMICTA, Temm.

(*The Red-bearded Bee-eater.*)

Specimen shot at Jaguay (February 19th, 1912) was clambering about a tree on the banks of a stream; there were at least two together, and they seemed to be feeding on insects. Iris bright orange. Stomach full of beetles.

May 10*th*, 1912.—Shot a specimen of the above, presumably a young bird, at Lanchang, Samarahan, which showed no red, and the tail was quite short, but the black tip and the yellow under side to the tail were evident. The iris was browny-grey colour. The note is a hoarse cackle. The Lanchang Dayaks called it "Burong Haw Haw," but this does not quite represent the noise. This bird was a female. They probably catch all their food (insects) on the leaves and twigs of trees, and not on the wing.

CAPRIMULGUS MACRURUS, Horsf.

(*The Javan Goatsucker.*)

Common; it is seen swooping and flitting about at night, also hovering like a hawk, which it resembles in flight. The cry is a monotonous "jtock, jtock, jtock," uttered at irregular intervals, and it gives from one to seven "jtocks" at a time in quick succession.

MACROPTERYX LONGIPENNIS, Rafin.

(*The Long-winged Swift.*)

Fairly common in open spaces. Feet and tarsus dusky brown; iris dark brown. Oil-gland rather large, pointed and black.

MACROPTERYX COMATA, Temm.

(*The White Eye-browed Swift.*)

I have not seen it often, but on May 24th, 1913, I saw two sitting on low dead trees in an old clearing. They would sit still on their low perch, but make repeated short flights after insects and then return.

PYROTROGON DUVAUCELI, Temm.

(*The Small Black-headed Trogon.*)

Bartlett says this is the most abundant of the trogons, but I have not often seen it, doubtless because of its habits. It will sit for hours in a low tree, hunched up and with its feathers ruffled up. The bill is black at the tip and margins, from which margins it shades into deep, almost violet, blue; this colour is continued to the gape and beyond it, where there is a curious long patch of naked deep blue skin. There is a curious patch of rather light blue naked skin overhanging the eye. Iris dark brown; the feet are black. The stomach contained insects, and among them a fairly large grasshopper.

CUCULUS MICROPTERUS, Gould.

(*The Indian Cuckoo.*)

Bill black. The mandible black at the point and grey-green for the rest of the way to the gape, which has the outer skin canary yellow, as are also the protruding and very striking eyelids. Feet bright yellow; iris brown.

PENTHOCERYX SONNERATI, Lath.

(*The Banded Bay Cuckoo.*)

Common, especially during the north-east monsoon. It has a lazy, slow-flapping flight; it may often be seen on the ground, and it also frequents low trees and bushes. The bill is black, but shades to yellowish-grey, or even orange, towards the base of the mandible. Feet greenish-yellow with yellow soles; claws grey; iris brown.

EUDYNAMIS HONORATA, Linn.

(*The Black Indian Cuckoo.*)

The bill is black; the feet and tarsus are blue-grey; iris black.

RHOPODYTES BORNEENSIS, Sharpe.

(*The Bornean Green-billed Malkoha.*)

Quite common; it may often be seen clambering awkwardly in low jungle, and making short flights, giving a few beats with the wings and then gliding. Its food is chiefly insects caught on the leaves and branches. The bill is green (black inside); the iris is a milky-blue colour.

RHOPODYTES CHLOROPHÆA, Raffl.

(*Raffles' Green-billed Malkoha.*)

Common; usually seen near water clambering about the smaller branches of trees searching for insects, on which it lives, and making short flights—making a few beats of the wings and then gliding. The bill is a dull green, and the naked skin round the eye much the same colour; feet and tarsus blue-grey.

UROCOCCYX MICRORHINUS, Berlep.

(*The Large Bornean Malkoha.*)

Fairly common; it feeds on insects and beetles, and is usually seen clambering about in low jungle; it has a slow flapping-flight. The bill is pale green, but the base of the maxilla and most of the mandible are a deep red; this patch includes the nostril in the maxilla. The feet and tarsus are grey, dirty yellow in the soles; iris orange-yellow.

CALORHAMPHUS FULIGINOSUS, Temm.

(*The Bornean Red-throated Barbet.*)

Common in Upper Sarawak.

July 15*th*, 1912.—Shot a female. Iris yellow-brown; legs coral red; claws black-grey; the ovaries were not well-developed.

CHOTORHEA MYSTACOPHANES, Temm.

(*The Gaudy Barbet.*)

Very common, and may often be seen in numbers feeding in any fruit tree. The iris is black or dark brown; the claws are black. The note is a curious cooing whistle.

Flight direct and strong. Like the other Barbets, it is a voracious feeder on all kinds of fruit. The feet and tarsus are coloured greyish-green.

Mesobucco duvauceli, Less.

(*The Small Malayan Barbet.*)

Common; chiefly seen during the dry season—probably because it has more difficulty in finding food at that time. One of the commonest Barbets. The feet are greyish-green, zygodactylous, with black claws. A voracious feeder on fruit and flies, with the typical undulating flight of a Barbet; Iris dark brown.

Gecinus observandus, Hart.

(*The Bornean Crimson-winged Green Woodpecker.*)

The upper mandible is black, the lower blue grey.

Miglyptes grammithorax, Malk.

(*The Fulvous-rumped Barred Woodpecker.*)

The bill is black.

September 25*th*, 1912.—Shot a female. The iris was black.

December 22*nd*, 1912.—The iris is certainly very dark, but it has a distinct reddish tinge in a good light. This was a female also.

Miglyptes tukki, Less.

(*The Buff-necked Barred Woodpecker.*)

A common bird, and its shrill screech may often be heard from the tops of tall trees. The maxilla is black, mandible blue-grey; feet and tarsus greenish-brown; the oil-gland has a small tuft; iris deep red.

Hemicercus sordidus, Eyton.

(*The Grey and Buff Woodpecker.*)

A tiny woodpecker; not very common, I think, but probably keeps well out of sight. The bill is dark grey, squared off at the tip and sharp. There is a decided crest at the back of the head, which gives it a hammer-head look. Iris dark red.

Alophonerpes pulverulentus, Temm.

(*The Great Slaty Woodpecker.*)

Probably not uncommon in some districts. Two were shot for me in old jungle near Grogoh by a native, and he described them as being in a flock like Sparrows. The bill is mostly black, but has a part dirty yellow; the feet and claws are black; iris red.

Sasia abnormis, Hodgs.

(*The Malayan Piculet.*)

Not uncommon; often seen in lalang, tall grasses and canes, from the stem of which it gets its food of grubs and insects as a Woodpecker does. Iris red, and the eyelids are round and bulging out of naked crimson skin; upper mandible black, lower mandible pale yellow; the bill is hard and strong but loose, and the whole bird has rather a miserable appearance; the feet and tarsus are yellow.

Eurylæmus ochromelas, Raffl.

(*The Black and Yellow Broad-bill.*)

Found throughout the year. Iris yellow; bill blue to green at tips; legs flesh-coloured.

I have seen it clinging to the trunk of a tree like a Woodpecker hunting for its food—beetles and locusts.

Cymborhynchus macrorhynchus, Gm.

(*The Malayan Black and Red Broad-bill.*)

Builds a large nest of roots, sticks, rags, &c. Male, iris dark bottle-green; upper mandible sky-blue; lower, yellow, with blue-green margins; legs blue.

Chiefly met with near water—rivers, lakes, &c. The natives say that this bird catches and eats fish. But its chief food is certainly beetles.

Pitta granatina, Temm.

(*The Bornean Scarlet Pitta.*)

A specimen shot at Jaguany, February 19th, 1912, rose from the ground in a jungle path, and flew with a big twist and hurried flight like a Quail alarmed. Colours very brilliant, especially the purple mantle and blue on wings.

PITTA MULLERI, Bp.

(*Muller's Green Pitta.*)

One shot in Samarahan was sitting in a low tree, where it was whistling like a Common Thrush.

CYORNIS BECCARIANA, Salv.

(*Beccari's Blue Flycatcher.*)

Bartlett describes this as a very rare species, but in this district of Upper Sarawak it seems fairly common, and I have seen two or three together on the Sarawak river; also I have seen it on the borders of lakes, but never far from water. It seems to get its food from near the surface of water, making short jerky flights from its perch on the bank. The feet and tarsus are a dull brown; oil-gland bare; iris brown.

September 25th, 1912.—Shot a male, and saw several more in old jungle.

HYPOTHYMIS OCCIPITALIS, Vig.

(*The Black-crowned Blue Flycatcher.*)

Not uncommon in jungle. The tail is flicked about as in the case of other Flycatchers; feet and tarsus blue-grey; the oil-gland is bare; iris black; inside of mouth and tongue yellow-green. The above is a description of the male. In the female the bill is black, feet blue-grey; inside of mouth and tongue yellow; iris dark brown.

RHIPIDURA PERLATA, Mull.

(*The White-spotted Fantail Flycatcher.*)

Bill black, yellowish at the base of the mandible; feet and tarsus grey; oil-gland bare; iris black.

RHIPIDURA JAVANICA, Sparmm.

(*The Javan Fantail Flycatcher.*)

One of the commonest birds in Upper Sarawak. It has a curious jerky song, and is seen chiefly in the morning and evening flitting about in low trees, flirting out its fan-shaped tail and wings; iris black.

TERPSIPHONE AFFINIS, Blyth.

(*The Burmese Paradise Flycatcher.*)

Almost always found in old jungle, often near a river or stream. It is one of the most graceful and fairy-like of

birds as it flies amongst the huge trees with a weak irregular, but restless, flight. Not uncommon, though the male, owing to its colouring, is much more easily seen than the female. The bill is a blue-grey colour; the inside of the bill and mouth is bright yellow with a greenish tinge; iris dark brown or black; the eye has a protruding bare ring or wattle round it of a pretty Wedgwood blue; feet and tarsus are a pale blue-grey.

Lalage terat, Bodd.

(*The Pied Cuckoo-shrike.*)

A common bird, most abundant near the coast, but quite common in Upper Sarawak also. The bill is black, shading to orange at the base, where there are a few small bristles; iris brown; feet and tarsus black.

Chloropsis cyanopogon, Temm.

(*The Blue-whiskered Chloropsis.*)

Not very common, but difficult to see in the jungle. Female; iris dark brown; feet and tarsus grey; beak black.

Irena criniger, Sharpe.

(*The Fairy Blue Bird.*)

Fairly common in the fruit season, when it is seen on fruit trees and flying about with its straight graceful flight. It flies as a rule very straight but undulating, giving a few beats with the wings and then closing them, at the same time uttering its sharp "twing, twing." Male, bill black; iris deep red; oil-gland small and bare; feet, tarsus, and claws black. The female is a curious blue colour, quite different to the male—a much softer colour and not shiny, almost Wedgwood blue. One shot (January 20th, 1913) had four or five thin hairs at the back of the head, which might easily escape notice; iris crimson.

Microtarsus melanocephalus, Gm.

(*The Black-headed Bulbul.*)

Common during the months September to February, and fairly common all the year round. Iris blue-grey; beak and legs black. Utters its characteristic chirp and flies with a flickering undulating movement. A female shot (January 1st, 1913) with ovaries well-developed.

TRACHYCOMUS OCHROCEPHALUS, Gm.

(*The Yellow-crowned Bulbul.*)

Common, especially in gardens and along the banks of rivers; it however keeps very well hidden as a rule, but its irresponsible whistling babble is very common, and a very liquid note. I saw great numbers of these along the banks of the Sadong river in May, 1912. Feet, tarsus, and claws black. The Malays call it "Burong boya." Oil-gland bare; iris brick red.

PYCNONOTUS ANALIS, Horsf.

(*Horsfield's Bulbul.*)

One of the commonest birds in Upper Sarawak, as it is all over the country, and does a good deal of harm by eating pepper here. The feathers on the back of the head are erected when the bird is excited or surprised. Great numbers of these Bulbuls are often seen roosting together in low jungle, usually in a marsh, and making a great noise with their harsh bickerings. The flight is undulating. The iris is deep brown.

HYDROCICHLA RUFICAPILLA, Temm.

(*The Red-headed Fork-tail.*)

The feet and tarsus are pale yellow, so as to be almost white. Oil-gland bare; iris dark brown.

CITTOCINCLA SUAVIS, Scl.

(*The Long-tailed Thrush.*)

Fairly common; strictly a jungle bird, and keeps to the lower branches of trees, flitting and flying about like *Copsycus musicus*. The song is like that of a Thrush and very sweet, chiefly heard in the evening. It is a Dayak omen bird, almost always seen solitary. The iris is black or dark brown; the tail is inclined to fork outwards; tarsus, feet and claws pale brown; food—insects and seeds.

ORTHOTOMUS CINERASCEUS, Blyth.

(*The Ashy Tailor-bird.*)

Found in lalang and low jungle, where it clambers about, making a curious bleating noise; iris yellowish brown; very plentiful. A female shot at Bau (Dec. 5th, 1911) had well-developed ovaries. The bill is brown, lighter coloured

underneath; iris a dirty yellow; feet, claws and tarsus dull brown; oil-gland bare.

Burnesia superciliaris, Salv.

(*The Malayan Wren-warbler.*)

A very common bird, especially seen in open spaces along roads and in old lalang patches, where its plaintive pipe is very common, and also the curious snapping-flicking noise which it seems to make with its tail or wings and bill. Feet and tarsus a brownish-yellow; there is a slight ring of light brown naked flesh round the margin of the eyelids; iris light brown; oil-gland small and bare.

Artanus leucogaster, Valenc.

(*The White-bellied Wood-Swallow.*)

Not common in Upper Sarawak, but one day I saw three or four hawking about in a paddy field. At Bintulu, Baram and other places on the coast I saw plenty of these birds, and they seemed to like being near houses and villages; often flocks of ten to fifteen were seen on one tree. They are said by Malays to be very pugnacious and brave; and certainly they have that appearance, with their bullet-heads and strong sharp bill. Their flight is curious, and not unlike that of a Swallow, and they have triangular wings when spread. The bill is blue-grey, darker at the tip, very strong, and something like that of a Sparrow, but longer and sharper; feet and tarsus slate-grey; iris dark brown.

Platylophus coronatus, Raffl.

(*The Brown Jay-Shrike.*)

This seems to be quite an uncommon bird in Upper Sarawak. The Dayak name is "Bejampang," and it is an omen bird with the Sea-Dayaks. Bartlett says it is "rare and solitary," but the only time I have seen it there were two together; later a native brought me one.

The colour of the bill is black, shading to grey towards the base; the feet and claws are blue-grey, large and strong; iris brown.

Dendrophila corallipes, Sharpe.

(*The Coral-legged Nuthatch.*)

A pretty little bird, probably fairly common in old jungle; its habits are much the same as those of the

English species. The iris is red, with a ring of naked skin round the eyes. Feet and tarsus coral red.

Dicæum nigrimentum, Sharpe.

(*The Black-backed Flower-pecker.*)

Common in the dry season, but not so often seen as the other Flower-peckers.

Æthopyga siparaja, Raffl.

(*Raffles' Sunbird.*)

A common bird all the year round, but commonest during the wet season, perhaps. Male: tassel on the end of the long tongue is black and yellow; iris dark brown to black; the feet and tarsus greenish brown.

Cyrtostomus pectoralis, Horsf.

(*The Purple-throated Sunbird.*)

The bill is black, with the usual long tasselled tongue; iris dark brown.

Arachnothera longirostris, Lath.

(*The Little Spider-hunter.*)

These Arachnotheras are all very much alike except for slight differences in colour and size, and they usually fly at a great pace through the jungle, hence their name "Burong bodoh" ("stupid bird"), because they seem to be so aimlessly in a hurry, and usually give a shrill scrape as they pass.

Anthothreptes malaccensis, Scop.

(*The Malaccan Brown-throated Sunbird.*)

This is a common bird throughout the year. Male; iris reddish brown. The colours of the plumage seem to vary very much; of two shot at Santubong, September, 1911, one was much more blue than the other, which showed chiefly green, while one shot at Bau in October, 1911, had the metallic covering very imperfect: the colouring seemed to be only just appearing through dull grey feathers, though the feathers seemed to be fully grown and well fledged.

December 6th, 1912.—Male had black bill, with long tasselled tongue, but bill not so much curved as in other Sunbirds; iris brick-red; the feet and tarsus are dull

brown. The female of this species has a much duller plumage. The bill, feet, tarsus and iris are the same.

CHALCOPARIA PHŒNICOTIS, Temm.

(*The Ruby-cheeked Sunbird.*)

Seems to be rather uncommon. Maxilla black; mandible brown, shading to yellow at the base; feet and tarsus dark brown, slightly yellow at the soles; oil-gland bare; iris dark brown.

MUNIA BRUNNEICEPS, Wald.

(*The Brown-headed Weaver.*)

One of the commonest birds in Sarawak, but not so common as *U. fuscans*, with which species they are usually found associated in large flocks or singly. They frequent open spaces, especially fields and clearings; they are rather more shy than *U. fuscans*, and fly up with a whirr and a shrill "peep, peep." The bill is very powerful, pale blue, with the nostril a small hole at the base; the edges of both mandibles are turned in in a curious way, especially the lower; the upper forms a curious V into the forehead. Iris black or dark brown. The feet and claws are grey-blue.

UROLONCHA FUSCANS, 'Cass.

(*The Little Black Weaver.*)

One of the commonest birds in Upper Sarawak, to be found in all open spaces, roads, &c. Takes short flights, often in flocks of ten to twenty; may also often be seen flying high overhead. The cry is a shrill "pee, pee." The feathers are all brown, but the back and wings have a faint marking in different shades of brown which give the colouring something of an appearance of hammered silver. Nests in bushes such as pepper vines, and I have also seen a nest in the eaves of a house. The nest is of fine grass, an oblong ball with a hole at the end; the eggs are white, three to five in a nest.

The young are darker when fully fledged, and the bill is black, but white to cream at the gape; feet and claws a dirty brown.

EULABES JAVANENSIS, Osb.

(*The Javan Mynah.*)

A common bird, usually seen in pairs, but often in flocks of four to seven. Tarsus and feet bright yellow. The bird

has a curiously, unwieldy, stumpy shape, and has a trick of twisting its head, neck, and body into many different attitudes. Iris dark brown and very soft. Mynahs are often seen flying in pairs overhead, when their black and white wings may be seen from underneath. Each primary has a bright white band across it, which is seen above and below. The bill is large and unwieldy, but finely coloured in orange and yellow. Their whistling plaintive cry is very common, and the birds are very good mimics.

The nest is built in a high, dead tree, in a hole like that of a Woodpecker, possibly in old Woodpecker holes. The eggs are pale blue, sparingly spotted with pale brown, 1·55 by 1·10, two in a nest.

Mynahs are often kept as pets by natives, and in a Sultan's palace in Java, at Djocjakarta, I saw several kept in cages, and his wives apparently took great interest in them; some had been taught to speak and whistle. In Samarahan, December 5th, I often saw flocks of ten to twenty-five in the rice fields, after the crop had been gathered.

LAMPROCORAX CHALYBEA, Horsf.

(*The Glossy Starling.*)

This bird is very common; it frequents coco-nut palms chiefly, and is seen every day flying to or from these with its swift, straight flight, while it utters a curious metallic note. The Malays call it "Burong piling." The bill is black and very strong; feet and tarsus black and strong; iris deep red. The nest is generally in the hole of a tree, eggs pale blue. It exactly takes the place of the English starling, and has the same flight and actions.

ORIOLUS XANTHONOTUS, Horsf.

(*The Black-headed Oriole.*)

Not very common, but it keeps to old jungle and seems to be solitary. I shot two on February 20th, 1913, and another on December 2nd; both of these were in old jungle, whistling in their rather curious way. Bill a curious brick-red; iris crimson; oil-gland bare; feet and tarsus blue-grey. Malay name, "Burong mati bujang."

CHAPTIA MALAYENSIS, Blyth.

(*The Malayan Drongo.*)

Common in open spaces in old jungle, and very commonly seen on rivers, where it skims the water, catching

flies like a Swallow. A very plucky and pugnacious bird like the other Drongo. Feet and tarsus black. Probably most of its food is caught on the wing. Its flight is typical of a Flycatcher, uneven and darting; it will sit on a branch and make short excursions after flying insects, returning again to the same perch. Oil-gland bare and rounded; iris dark brown.

Dissemurus paradiseus, Linn.

(*The Racquet-tailed Drongo.*)

Fairly common, but not nearly so plentiful as it is in Java. When excited, the feathers on the forehead are erected. The flight is like that of a Flycatcher, and probably most of its food (insects) is captured on the wing. The feet are black, with strong, sharp claws, and altogether it is a formidable bird for its size. The Malays call it "Burong brani." The elongated tail feathers are the underneath pair. I have shot one in which these feathers were quite perfect, and had not the bare shafts usually seen; either this was a young one or the feathers were not full grown after the moult. The long tail feathers of the above measured $10\frac{3}{4}$ inches, with bare shafts after the tail proper was ended and before the racquet-like ends were reached. These racquets are finely scrolled, and the bare shafts have the appearance of being worn to that bare state. Iris black.

May 25th, 1913.—I saw three of these birds sitting on a low branch, two young ones and one full-grown; I shot the old bird, a male, and one young one; the iris of the old bird was dark red, while that of the younger was dull brown. The two racquet-tail feathers of the young specimen had not grown beyond the length of the other tail-feathers, but had just started to curl at the tips. While I gathered these two birds, another old bird, probably a female, came and sat on the same branch, with quite a large Lizard in its bill. About a year before this I shot one of these birds which must also have been young, as its iris was brown and the elongated tail-feathers, though nearly as long as in the mature specimen, had not the bare shafts, so that these shafts are probably worn bare by use.

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THE

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VI.—A Contribution to the Bibliography of the Botany of Borneo.

By E. D. Merrill, Bureau of Science, Manila, Philippine Islands.

In August, 1910, Mr. J. C. Moulton, Director of the Sarawak Museum, kindly undertook to secure for the Bureau of Science a native botanical collector, and to supervise his work. The arrangement was perfected with the object of securing for the Herbarium of the Bureau of Science some botanical material representing the Bornean flora for purposes of comparison with the Philippine flora, to determine more definitely the geographic distribution of certain species, and especially to determine the phytogeographic connections between the floras of Borneo and the Philippines. Borneo being only slightly explored botanically, it was thought that the paucity of species known to be common and confined to the Philippines and Borneo might be explained on this score; that is, our imperfect knowledge of the Bornean flora as compared with our much more extensive knowledge of that of the Philippines. The proximity of Borneo to the Philippines and the two manifest lines of connecting islands, to the south the Sulu Archipelago, and to the north Mindoro, the Calamianes group, Palawan, and Balabac, naturally leads one to expect that the Philippines and Borneo would present close botanical connections, yet this seems not to be the case. While the Bornean collections have not been studied in detail, yet a cursory examination of the collections so far received, comprising somewhat over 3000 numbers, shows that the floras of Borneo and the Philippines have comparatively little in common. It is true that most of the species found along the seashore in Borneo are also found in the Philippines; and this is also true of those species that are found in the cleared and more or less settled areas at low and medium altitudes. In general, however, most of those species found near the seashore and in the settled areas are of very wide Indo-Malayan

distribution, and very many of them are pantropic. When, however, we turn our attention to the characteristic elements of the primeval forest it is found that, while representatives of hundreds of genera are found in both the Philippines and in Borneo, the species are for the most part different, and but a single genus, *Philbornea*, is confined to the two regions, and this genus does not occur in the Philippines proper but in Palawan. Very few species are confined to the two regions.

At higher altitudes a very few species occur in both the Philippines and in Borneo, such as *Centrolepis philippinensis*, Merr., which are known only from the two regions; others occuring in Borneo and the Philippines are also found in other islands, such as Formosa, Celebes, and New Guinea. In the primeval forest, at low and medium altitudes, scarcely more species are known with the limited distribution of Borneo and the Philippines than are known from higher latitudes. This is in marked contrast to the Philippines and Celebes, where perhaps seventy species, many of them markedly characteristic, and five or six monotypic genera are known only from Celebes and the Philippines; relatively, the flora of Celebes is no better known than is that of Borneo. It seems as though the Philippine flora is just as closely allied to that of far distant Fiji and Samoa as it is to that of its close neighbour Borneo.

At the time our Bornean material was being received, considerable attention was being given to the publications bearing on the Indo-Malayan flora with a view to completing our card index to Philippine species. In connection with this Philippine work it entailed but slightly more time and labour to prepare a card index to those species credited to Borneo. At the same time, a set of cards was prepared representing the titles and authors of papers in which direct references are made to Borneo, and these cards have been the basis of the present bibliography.

It is not contended that the bibliography is complete, but it is hoped that most of the important references to Borneo are included. The bibliography was prepared with reference chiefly to those publications available in the library of the Bureau of Science, Manila, and this library dates only from the year 1902. Incompleteness in the present bibliography, as the bibliography is restricted below, may to a large degree be explained by the lack of library facilities in Manila. In the case of some botanical

periodicals our sets are complete only after the year 1902, and a few of the older periodicals are lacking entirely, notably 'Linnæa'; 'Flora,' before the year 1902, lacks many volumes, &c. Some of these periodicals that are not available in Manila contain papers in which Bornean species are considered.

In preparing the bibliography the author has constantly been confronted with the question of determining what to include and what to exclude. In general, only those papers have been mentioned which contain direct references to Borneo—either those in which new forms are described, or those in which older species are credited to Borneo, or both. It thus happens that practically no botanical publications issued before the year 1839 are included, and comparatively few issued before the year 1850. Miscellaneous references to Borneo in such works as Hooker's 'Icones Plantarum,' Curtis's 'Botanical Magazine,' and the 'Icones Bogoriensis' have not been indexed separately. In De Candolle's 'Prodromus,' for instance, no references are found to Borneo directly until volume fourteen (1856–57), except a single doubtful reference in volume five (1836).* Accordingly, the different monographs in volumes one to four and from six to thirteen of the 'Prodromus' have not been indexed, although many of these are essential to the student of the Bornean flora. Similarly, I have not included in this bibliography references to the fundamental and general works, published before 1850, of such authors as Linnæus, Burman, Willdenow, Vahl, Retzius, Loureiro, Kunth, Sprengel, Roemer and Schultes, Roxburgh, Roth, Hasskarl, Wallich, Gaertner, Presl, Gaudichaud, Endlicher, W. J. Hooker, Griffith, Lamarck, Forster, Don, Thunberg, &c., nor to pre-Linnean authors such as Rheede, Hermann, Burman, &c., as they contain no direct references to Borneo. For information regarding the works of these authors and the bibliography of botany in general, the student is referred to Pritzel's 'Thesaurus Literaturæ Botanicæ,' Jackson's 'Guide to the Literature of Botany,' Rehder's 'The Bradley Bibliography,' Just's 'Botanisches Jahresbericht,' the 'Botanisches Centralblatt,' and the 'International Index to Scientific Literature.'

It is true that many of the works of the above authors are fundamental, and must be consulted by all working botanists concerned with the investigation of the flora of

* DC. 'Prodromus,' 5 (1836) 451 sub *Pluchea indica*, Less. "Borneo? (h. Merat)."

Borneo, and very many of them are of greater value and are of more importance than are many of the titles that have been admitted in this bibliography. However, it was necessary to make some arbitrary distinction in order to keep the present paper within reasonable limits. It is felt, moreover, that most of the standard works of the above authors would be available in any large working library.

Little attention has been given to the literature of special groups of the lower plants, such as the mosses, hepatics, fungi, and lichens. In all of these groups a special literature has been built up, and for information regarding it reference may be had to Saccardo's 'Sylloge Fungorum' for the fungi; to De Toni's 'Sylloge Algarum' for the algæ; to Stephani's 'Species Hepaticarum' for the hepatics; to Paris' 'Index Bryologicus' for the mosses; to Engler & Prantl's 'Die Natürlichen Pflanzenfamilien' for all, and to other literature on these special groups.

One class of publications has been included, although it contains only occasional references to Borneo. This class includes the most important published 'Floras' on surrounding countries that have many species in common with Borneo, such as British India, the Malay Peninsula, Indo-China, Sumatra, Java, and the Malay Archipelago as a whole.

In preparing this bibliographical list one rather curious fact has been brought to light, and this is, that with a single exception in the pre-Linnean botanical literature, and a single exception in the post-Linnean botanical literature—and this a doubtful one—no direct references have been found to Borneo before the year 1839. The exception in the pre-Linnean literature is Rumphius' 'Herbarium Amboinense' (1741–55), in which about eight references to Borneo have been noted; and in the post-Linnean literature De Candolle's doubtful reference to *Pluchea indica*, Less., noted above.

This paucity of references to Borneo in the early botanical literature is readily explained. Those parts of the Orient that first received attention from botanists were chiefly those countries or islands colonized by the Europeans at an early date, or in which trading or mission stations were established, such as Ceylon, Amboina, India, Malacca, Cochinchina, Java, and the Philippines. Thus as early as 1717 we have Hermann's 'Musæum Zeylanicum'; in 1737 Burman's 'Thesaurus Zeylanicus'; in 1747

Linnæus' 'Flora Zeylanica'; in 1741–55 Rumphius' 'Herbarium Amboinense' (written, however, before the year 1700); in 1678–1703 Rheede's 'Hortus Malabaricus'; in 1790 Loureiro's 'Flora Cochinchinensis'; in 1704 Camell's 'Herbarium aliarumque stirpium in Insula Luzone Philippinarum primaria nascentium'; and many other similar works. Throughout the early period of European colonial history in the Orient there was no important permanent trading station or colony established in Borneo, and as a result no Bornean botanical material reached Europe at the time various botanists were commencing to devote their attention to the Malayan flora, and no local botanists were developed as in Amboina, the Philippines, &c.

The first large collection secured in Borneo seems to have been that made by the Dutch botanist, P. W. Korthals, in about the year 1836. Korthals commenced publishing on his Bornean material in the year 1839, issuing a series of papers between the years 1839–54, in which he described a large number of new species from Borneo. Since that time many botanists and collectors have explored Borneo, among whom may be cited Beccari, Motley, Low, Lobb, Teysmann, Ridley, Creagh, Haviland, Shelford, Hewitt, Moulton, Winkler, Hallier, Nieuwenhuis, Jaheri, Schlechter, Bishop Hose, Brooks, Foxworthy, and Miss Gibbs. In spite of the large amount of collecting that has been done, Borneo probably stands to-day as imperfectly known botanically—perhaps more imperfectly known—than any large island in the entire Malay Archipelago, not excepting Sumatra or New Guinea.

The indications are that the island has an immensely rich flora, and future exploration will certainly greatly extend the list of known species. At the present time probably less than three thousand species of plants in all groups are definitely known from this large island. It is estimated that the Philippine Archipelago, when fairly comprehensively explored, will present no fewer than 10,000 species of flowering plants and ferns. The comparatively small Island of Java has at least 5000 species of flowering plants alone; and there is every reason to believe that the Island of Borneo, with its enormous area, its great range in altitude, its high humidity, and its luxuriant vegetation will present at least as many distinct species as the entire Philippine Archipelago, and at least twice as many as its small neighbour Java.

In all, 479 titles are included in the present bibliography,* in practically all of which from one to many references are made to Borneo. In such papers as those by Dr. Stapf and Miss Gibbs on the flora of Mt. Kinabalu and Dr. Winkler's series of 'Beiträge,' where the authors have had the aid of collaborators in working up special families, the names of the collaborators have not been entered separately in this bibliography.

At the end of the bibliography is appended an index to the articles, indicating those works of a general nature for the entire Indo-Malayan region or for the entire world; and those on Borneo, or in which Bornean references are found, arranged by subjects: Palæobotany, Algæ, Fungi, Lichens, Bryophytes, Pteridophytes, and Spermatophytes. The last group is subdivided into general works, or those papers in which representatives of more than one family are considered, the others treating individual families, parts of families, or genera, arranged under the family names adopted in Engler & Prantl's 'Natürlichen Pflanzenfamilien.'

In the following list of papers those marked with an asterisk have not been seen by the author during the preparation of the manuscript.

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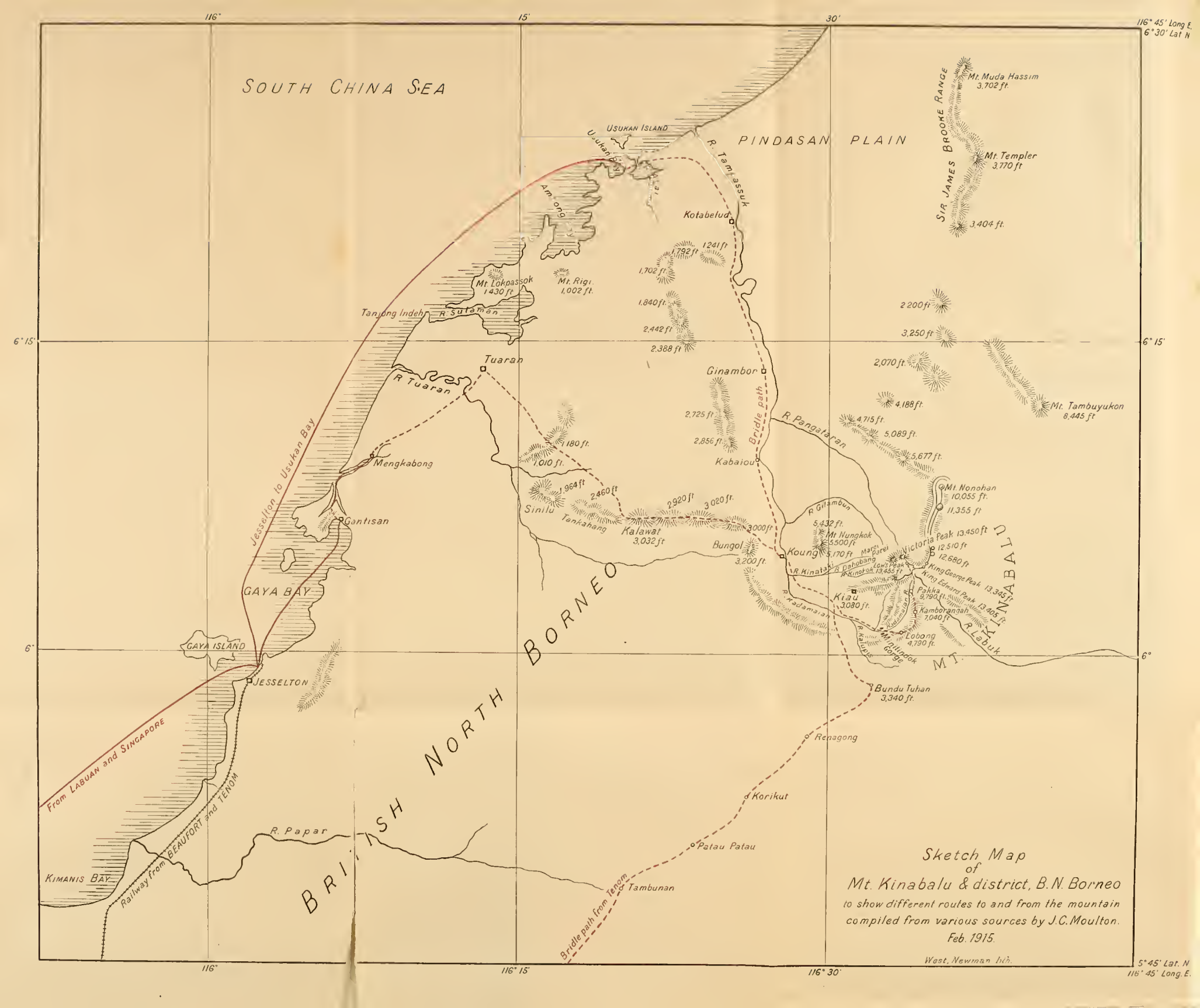
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Mt. Templer
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1,241 ft
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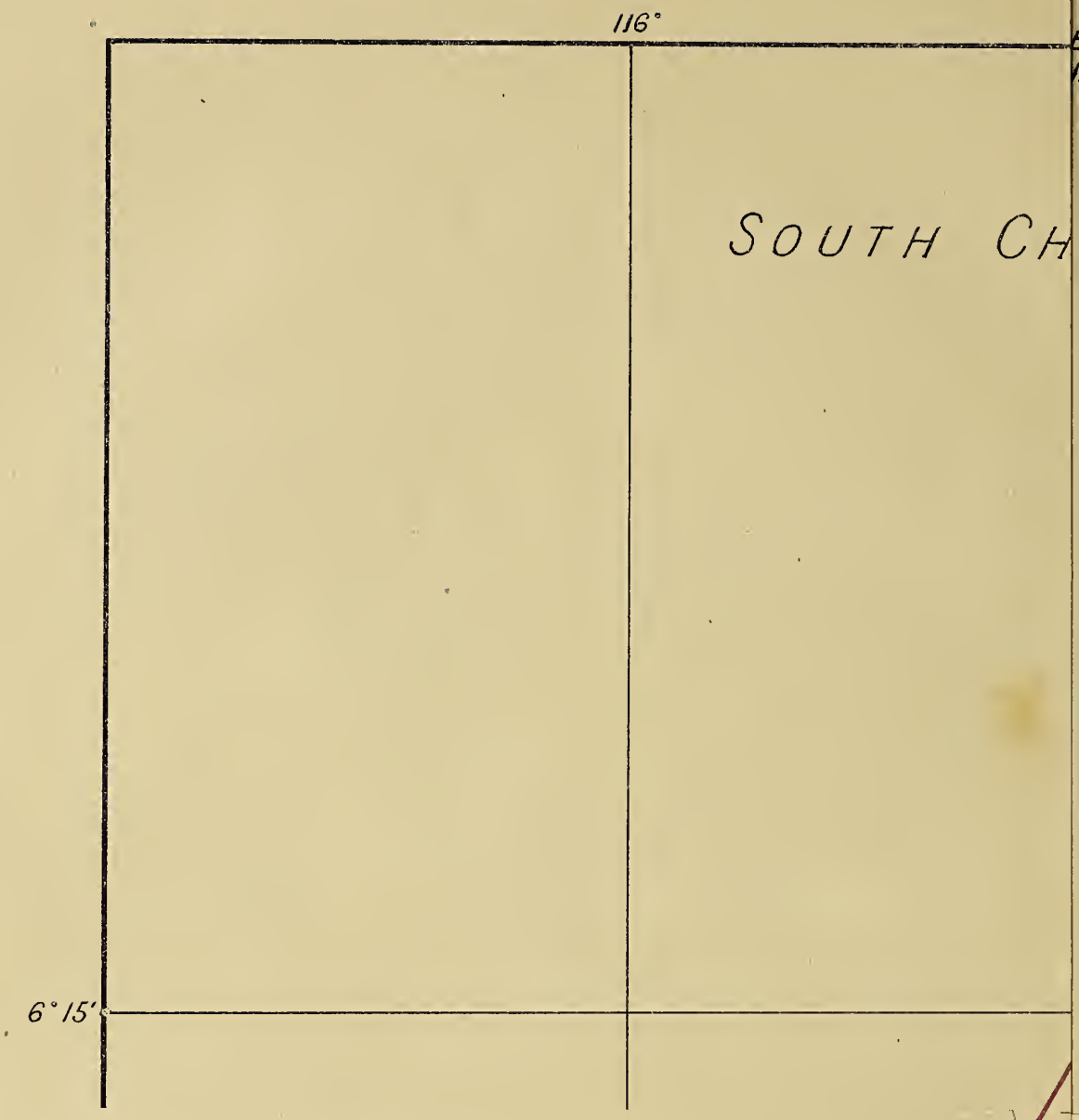
5,677 ft.
2,725 ft.
2,856 ft.
Kabaiou
180 ft.
1,010 ft.
Mengkabong
Jesselton to Usukan Bay
1,964 ft
2,460 ft
2,920 ft
3,020 ft.
Sinilu
Tankahang
Kalawat
3,032 ft
3000 ft
Gantisan
Bungol
3,200 ft.
R Gilambun
5,432 ft.
Mt Nungkok
5,500 ft
Koung
5,170 ft
Mt. Nonohan
10,055 ft.
11,355 ft
Victoria Peak 13,450 ft
12,510 ft
12,680 ft
King George Peak 13,435 ft
Pahka
9,790 ft.
Kamborangan
7,040 ft
Lobong
4,790 ft.
R. Labuk
MT. KINABALU
Margi Parei
Cow's Peak
R. Kinataki
R. Dahobang
R. Kinotok 13,435 ft
R. Kadamaian
Kiau
3,080 ft.
R. Kaiubis
Mintindok Gorge
GAYA BAY
GAYA ISLAND
JESSELTON
BRITISH NORTH BORNEO
Bundu Tuhan
3,340 ft.
From LABUAN and SINGAPORE
Renagong
Korikut
R. Papar
Patau Patau
KIMANIS BAY
Railway from BEAUFORT and TENOM
Tambunan
Bridle path from Tenom
Sketch Map
of
Mt. Kinabalu & district, B.N. Borneo
to show different routes to and from the mountain
compiled from various sources by J.C. Moulton.
Feb. 1915.
West, Newman hth.
116°
116° 15'
116° 30'
5° 45' Lat. N
116° 45' Long. E.


116°
SOUTH CH
6°15'

VII.—An Account of the Various Expeditions to Mt. Kinabalu.—By J. C. Moulton, Curator of the Sarawak Museum.

Having recently made an expedition to this great mountain in British North Borneo, I became interested in the literature on the subject, and with a view to being of some assistance to future travellers to the mountain I have compiled the following notes, the results of my researches. As far as I can ascertain, I have mentioned every European who has reached the higher altitudes and summit. No doubt there have been several visitors to the lower slopes who had no intention of climbing higher, or who, from some reason or other, were prevented from doing so. The earliest of these abortive expeditions was that of Thomas Lobb, a plant collector, who reached Kiau * in 1856, the Dusun village on a spur of Kinabalu (alt. 2800 ft.); he was prevented from going further by the natives of Kiau.

A weekly steamer runs from Singapore to Labuan (three days), and thence a few hours on to British North Borneo, calling at Jesselton, the principal town on the west coast, where the traveller has to disembark for Kinabalu.

Three routes are available from the coast to Kiau, which is the necessary starting-place for the actual ascent.

The Northern or Tampassuk Route.—For this the traveller takes the local steamer from Jesselton to Usukan Bay, a matter of three hours. A carefully graded bridle-path runs from here right up to Kiau, about forty miles. Having previously arranged matters with the Government officer in charge of this district, the traveller should find a pony at Usukan and several buffaloes in charge of Badjaus for his baggage. The first stage is a two hours' ride to Kotabelud, the Government station. The next, five hours to Kabaiou, where there is a small rest-house on the left

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* Variously spelt *Kiou*, *Kiow*, *Kiau*; the last syllable is pronounced "ow" as in *cow*, the first as "e" in *be*.

bank of the Tampassuk. The next to Koung, five hours, where there is another little rest-house. Here one has to cross the Tampassuk (or Kadamaian, as it is called here), and begin the ascent to Kiau. Unless the path is in good condition, this has to be walked; in three hours one should reach Kiau.

The Western or Tuaran Route.—One may ride the twenty odd miles from Jesselton to the Government station of Tuaran, or make a more interesting and varied day's journey of it by taking boat for two or three hours to Gantisan; disembark there, cross a narrow ridge of land, and take a fresh boat the other side for two hours to Mengkabong, a pretty Badjau village built over the water. Thence to Tuaran is an hour's walk. From here to Kiau is four days' walk; Dusuns have to be taken from Tuaran to carry baggage. The path is hilly, and, like most native paths, in a varying state of repair. The first stage is to Kappak, about five hours, the second day to Kalawat rather less; then a long day of seven hours to Koung, being careful to avoid the village of Bungol, which lies in a hollow on the right. Most travellers have spent the third night there, thus wasting the next day over a short journey to Koung. At Koung one joins the same path up to Kiau as by the Tampassuk route.

The Southern or Interior Route.—I have not been this way, but I understand one may take the train from Jesselton to Tenom, the station of the Resident of the Interior, and thence ride by bridle-path, six days, over the Tambunan Pass and down to Koung, and thence up to Kiau as by the other routes.

An examination of the accompanying map will make these routes clear.

From Kiau to the summit is three days' journey. The first stage is to a large overhanging rock known as Lobong (alt. 4700 ft.) To get to it, one may either descend from Kiau to the Kadamaian and follow that stream up and through the Minitindok gorge, or keep along the hillside from Kiau and strike the Kadamaian above the Minitindok gorge. Four or five hours are required for this journey, and if the river is at all high the route through the gorge is impossible. The second stage is a steep climb of six or seven hours to the Pakka cave (alt. 10,500 ft.), passing another camping ground (Kamborangah) at 7300 ft. From Pakka to the summit (13,455 ft.) is three hours up and three down.

I am indebted to the Librarian of the Royal Geographical Society, London, for references to some of the articles discussed in the following pages; to Capt. F. C. Learmonth, R.N., for his courteous permission to use his maps of the Kinabalu district; to Miss Gibbs and Dr. Pilz for sending me copies of their papers; and to Mr. P. C. M. Veitch for giving me some interesting information about his journey to Kinabalu in 1877 with the late Mr. Burbidge.

I.—Summary of Accounts of Visits to Kinabalu.

[1844. *Narrative of the Voyage of H.M.S. 'Samarang.'* 1848. By Capt. Sir Edward Belcher, R.N., C.B., F.R.A.S., F.G.S., &c. Vol. i. p. 190, he writes: "Our observations from several positions afford the mean height of its peak to be 13,698 ft." These observations were made in November, 1844.]

1851. *Journal of the Indian Archipelago and Eastern Asia.* 1852. Vol. vi. pp. 1–17.—"Notes of an ascent of the mountain Kina-Balow." This is Sir Hugh Low's account of his first expedition.

He left Labuan February 21st, 1851, reached Kimanis on the 24th, and the mouth of the Tuaran on the 26th. He followed the Tuaran route to Koung, stopping at Bawang, Kalawat, and Bungol on the way. He reached Koung on the morning of March 6th and Kiau that afternoon. His notes on the size of these villages are of interest for comparison with the greatly reduced numbers living in these same places to-day. Of Kalawat he says: "A collection of about forty houses"; Bungol, "about one hundred and twenty houses"; Koung, "the village is very large, containing certainly not less than two hundred and fifty to three hundred houses"; and of Kiau he writes: "The tribe of Kiow is said to be of comparatively great numerical strength, numbering upwards of 2000 fighting men." At Kalawat there are now (October, 1913) five or six houses only; at Koung about twenty; at Kiau a little over a hundred adult men.

The next day, March 7th, he left Kiau, descending the hillside to the Kadamaian and following the course of that river upwards through paddi farms, where he stayed the night. Next day he reached an overhanging rock, and the day after he writes: "At length, after 5 p.m., having descended a hundred feet into a ravine, I found myself upon the edge of a little torrent, and opposite to an over-

hanging rock of syenite, similar to that I had left in the morning, but less large. This was the highest point the Dyaks (*sic*) had ever reached; all beyond was perfectly unknown." He notes the thermometer at fifty-two degrees. There seems to be no doubt that this overhanging rock is what is known by later writers as the Pakka camp. The interesting point is that Low must have followed the *right* bank of the Kadamaian in order to arrive "on the edge of a little torrent (the Kadamaian) and opposite," whereas the path followed by others keeps along the *left* bank, and then, making a round to the west, rejoins the Kadamaian at Pakka still on the left bank. Whitehead mentions a path opposite the Pakka cave, which the natives told him led to Kiau. Low probably followed this.

Low reached Pakka on March 9th, and on the 11th, at 8 a.m., set out for the summit, of which he writes: "The remainder of our ascent was very toilsome, though apparently not so steep as much we had passed. It was over the 'herbless granite' which was scaling off in large masses and inclined at a considerable angle, probably about forty degrees. Shoes here were of no avail—I was forced to throw them off, and then the rough rain-worn surface of the syenitic granite was more easily passed. . . . Finally, after innumerable rests, we reached the base of one of the jagged peaks of the hill. . . . Instead of something like a tableland, which I had expected to find, on the summit of this part of the mountain was a sharp ridge not six inches broad. On placing my breast against it and looking over the ridge, I gazed into a circular amphitheatre about eighty yards broad, the bottom of which, from its great depth and my position overhanging it, was indiscernible, though I imagine I could see down two thousand feet. All its sides were overhanging precipices, except that opposite to my position, where I could see the sea-line of clouds through a rent or opening in the rocks looking northwards. I found the jagged summits of the hill to consist of thin fragments of syenitic granite, with sharp water-worn edges and of most fantastic shapes. My position was between the bases of two of them; they were about one hundred and fifty feet above my head. I could not remain long admiring the majestic scene around me, for the frightfully dangerous position we had passed in the ascent made me quite alive to the rapid lifting of the clouds from the valleys, which I knew would conceal everything from our view, and caused me, immediately after having finished a

bottle of excellent Madeira to Her Majesty's health and that of my far-distant friends, and deposited the bottle upside down with a paper in it in a conspicuous place, to read off the barometer and hastily begin my descent. . . . One of my men, despising the caution with which I avoided all the little runs of water and selected the best drained places, attempted to make a short cut by following the course of one of these. His life had well-nigh paid the penalty of his rashness. His feet slipped from under him and away he went at railway speed down the inclined plain; fortunately for him, he was wearing a long Sooloo kris in his girdle in a wooden sheath; this dragging along the rocks was caught in a crevice and saved its owner from destruction. He had slid about thirty yards; thirty more had shot him over a precipice. The roughness of the rock had made sad havoc of his flesh, but he fortunately escaped serious injury."

Low descended on March 12th to the paddi farms, "to the almost total deprivation of the use of my knee for a month afterwards."

As to altitudes, he made Pakka camp 8368 ft., the summit 8615 ft. Of this last record he writes: "But it is not trustworthy, as the mercury, which for ten minutes remained stationary at the same height as at the lower station, was still rapidly falling." The highest point reached he made "eleven or twelve hundred feet higher than the cave, or about 9500 ft.;" and then noted: "this, I think, is an underestimate, as the first part of the ascent was very steep, and the whole of it sufficiently so to be exceedingly fatiguing, and four and a half hours were occupied in overcoming it." He continues: "From what I saw, I feel certain the highest summit, wherever it is, which has been made by triangulation between 13,000 ft. and 14,000 ft., is inaccessible to any but winged animals. I conceived that I had reached the true summit of the mountain, and certainly no point within sight was more than 500 ft. or 600 ft. above me. I imagine that the measurement by triangulation considerably exceeds the true height."

A small collection of plants was obtained, and the more remarkable new species were described by Sir Joseph Hooker in *Icones Plantarum*, vol. ix. (1852).

Sir Hugh Low came out to Sarawak in 1845 as a naturalist. In 1848 he became Colonial Secretary of Labuan, where he remained till 1877, when he was

appointed Resident of Perak. He retired in 1884, and died April 18th, 1895.

1858. *Life in the Forests of the Far East.* 1863. By Spenser St. John, F.R.G.S., F.E.S. [Vol. i. Chaps. viii.–x. are devoted to the author's two expeditions to Kinabalu.]

In St. John's first expedition, accompanied by Sir (then Mr.) Hugh Low, he left Labuan on April 15th, 1858, reached Abai on the coast of North Borneo on the 17th, and proceeded up the short river of that name. They then joined the Tampassuk, and after two or three days arranging for guides and coolies, followed that river up to Koung, where they arrived on April 25th. Next day, on setting out for Kiau, they had to pass through the village of Labang, where the inhabitants gave them a hostile reception; however, the two Europeans showed themselves determined to pass and stand no nonsense, which they did without coming to blows. St. John notes that "the Kiaus are much dirtier than any tribes I have seen in the neighbourhood; the children and women are unwashed, and most of them are troubled with colds, rendering them in every sense unpleasant neighbours."

On the 28th they set out for the mountain, putting up for the night in one of the bamboo huts at the end of the paddi farms. Next morning St. John had to proceed alone, as his companion was unable to walk, having suffered much from walking with bare feet, to which he was unaccustomed. In two days he reached the Pakka cave, and the next day, May 1st, he climbed to the summit. He found the spot where Low had left the bottle in 1851,* and named the place Low's Gully; he then made his way further west to explore one of the higher peaks, afterwards known as St. John's Peak. He spent that night and the next at Pakka, and descended on the 3rd, finding Low still encamped on the paddi farm. After some trouble with the natives, who seemed keen not to let any goods leave their village, they got away from Kiau on the 6th, reached Abai (Low doing most of the journey on a raft down the Tampassuk) on the 8th, and Labuan five days later.

This was the first trial of the Tampassuk or northern route. In their next expedition they followed the Tuaran route, as Low had done originally in 1851.

They left Labuan early in July, and proceeding *via*

* Presumably still there, though there appears to be no other mention of it in the accounts of subsequent travellers. I was unable to find it in 1913.

Gantisan and Mengkabong, where they attended a fair (*tamu*), they reached the Tuaran and spent the night in the chief's house at Tamparuli. Mention of the fair at which both Badjaus and Dusuns met to trade is of interest, as the much talked-of hostility between these two tribes could not have been very remarkable even in those days before the arrival of British influence. St. John frequently comments on the "state of war" then existing between Kiau and the neighbouring villages—a condition of things which allowed small parties of women and children to wander far out to their farms unprotected and apparently unmolested.

The chief of Tamparuli is worth a passing note as the possessor of a daughter, "the loveliest girl in Borneo," of whom St. John further writes: "I have never seen a native surpass her in figure or equal her gentle, expressive countenance." From here they made six stages of it to Koung, sleeping at Bawang, Sinilu, Kalawat, Bungol, below Koung on the Tampassuk, and reaching Koung on the sixth day. At Sinilu (= Si Nilau) he notes the women wearing a black cloth over their breasts—a custom which still prevails among the Dusun women at Kiau and neighbouring villages. I can find no mention of the same custom among other Bornean tribes. The cloth is kept in place by rotan rings—red as used by the ladies of Kiau, white by those of Tuaran. The cloth is worn until the wearer becomes a mother.

The village of Kalawat (or Klowat) is noted as "a cluster of about ten long houses, containing upwards of eighty families." At Bungol there appeared to be above one hundred and sixty families.

On arriving at Kiau they made an excursion to the Marei Parei spur, and there discovered giant pitcher-plants even finer than those found by Low on his first ascent in 1851. They returned to Kiau, fetched their belongings, and spent another day or two at Marei Parei collecting plants. St. John remarks on the possibilities of the place thus: "... we were convinced that if ever the north of Borneo fall into the hands of a European Power, no spot could be better suited for barracks than Marei Parei. The climate is delightful; at sunrise the average was fifty-six degrees, mid-day seventy-five degrees, sunset sixty-three degrees, and this temperature would keep European soldiers in good health. There is water at hand, and up the western spur a road could be easily made suited to cattle and horses."

On their return to Kiau they set out for the summit,

and following the same path as before spent the first night at an elevation of 4400 ft., the next on a marshy spot—probably Kamborangah — and the third night reached Pakka, which he notes as more than 9000 ft. above the sea-level. They climbed to the summit, and St. John tried to climb the north-western peak, but failed to reach the top of it. The highest of them all, now known as Low's Peak, appears to have escaped his notice. According to the "Merlin" party, it is just five feet higher than any other; and so the fact of its being the highest is not obvious from the great plateau below. It is not so striking as Victoria Peak or St. John's Peak, as the plateau slopes easily up to within a few feet of the top.

The two travellers were overtaken by a heavy squall of hail and wind, the thermometer falling to forty-three degrees at 2 p.m., and their descent to Pakka Cave was fraught with considerable danger. An accident to the barometer and boiling-point thermometers prevented their taking the height of the summit plateau. The descent to Kiau occupied two days.

Mr. Low had made a large collection of plants which they wanted to get to the coast as quickly as possible. They accordingly settled up at Kiau, leaving the village on the friendliest terms, passed the night at Koung, and continued next day, *via* Bungol, straight through to Kalawat —a very long day's journey. The following day they passed Sinilu and reached Bawang, where cholera was rampant. The next day they reached Gantisan, and St. John remarks that Signor Cuarteron, the Spanish missionary, came to visit them. Bad weather prevented their sailing across to Labuan for several days.

The plants were described by Sir Joseph Hooker in the *Transactions of the Linnean Society*, 1860.

1873. *Bolletino della Società Geogr. Italiana.* 1874. "Un esplorazione in Borneo." By F. Giordano.

Cosmos di Guido Cora. 1875-6. Vol. iii. "Note di un viaggio a Borneo." By Giacome Bove.

Posewitz * states that these two travellers visited the north coast of Borneo in the Italian warship 'Governolo' in 1873. Their route seems to have been from Gantisan to Tuaran, and thence through Sinilau, Kalawat, Bungol, and Koung. I have not seen these accounts, but Posewitz

* *Borneo: its Geological and Mineral Resources.* By T. Posewitz. Pp. 62–3. 1892.

writes that after the first day's march from Koung 1800 metres had been ascended (2700 metres according to Giordano). "Here, on account of bad weather, they were obliged to turn back, and reached the coast by the same way as they had come."

Burbidge probably refers to these two travellers when he writes: "Some years later—I believe in 1866—an Italian expedition came here for natural history purposes, and the Dusun account is that they ascended 6000 ft. This expedition, according to native accounts, paid twice as much as was necessary—a precedent which gives these hill villagers an excuse for extortion." (*Gardens of the Sun*, p. 269.)

1877. *Gardens of the Sun; or a Naturalist's Journal on the Mountains and in the Forests and Swamps of Borneo and the Sulu Archipelago.* 1880. By F. W. Burbidge. [Chapters v., xiii., and xiv. are devoted to an account of Mr. Burbidge's two expeditions to the mountain.]

Accompanied by Mr. P. C. M. Veitch, two bird-hunters (in the employ of Mr. W. H. Treacher), and twenty-six men, Burbidge left Labuan on November 29th, 1877; their small steamer landed them at Gantisan next day. After the usual trouble of obtaining coolies they reached Mengkabong the following day, and the village of Tamparuli, on the Tuaran river, the day after. From here they pushed on to Bawang, where they slept the night. The following day they set out for Sinilu, but missed the way, and ended up in a Dusun house on the site of some lately deserted village. The next day they reached Kalawat, and after a rest proceeded on to Bungol, where they slept the night. The journey from here to Kiau, *viâ* Koung, was accomplished on the following day. Burbidge notes that they "met a large party of natives laden with baskets of tobacco and a little beeswax going on a trading expedition. There were some women among them, who, of course, carried the heaviest loads. . . . They showed no surprise at seeing us, and passed on apparently unconcerned as to our object." I quote this passage as it describes exactly a little party of Dusuns I met on my expedition thirty-six years after Burbidge.

After a day at Kiau they commenced the ascent, accompanied by eight Dusuns of Kiau and sixteen of their own followers. Rain prevented them making a long journey, and they slept beneath a large overhanging rock (possibly

Lobong, or a large rock between Minitindok and the mouth of the Kalupis). Next day they started at seven, noted the first *Nepenthes lowi* at about 5000 ft., further up *Nepenthes rajah*, and "*N. edwardsiana* was seen in two places. . . . Highest of all in the great Nepenthes zone came *N. villosa*, a beautiful plant, having rounded pitchers of the softest pink colour, with a crimson frilled orifice similar to that of *N. edwardsiana*. . . . To see these plants in all their health and vigour was a sensation I shall never forget—one of those which we experience but rarely in a whole lifetime!"

They reached the cave, noted as 9000 ft., about 3 o'clock, and Burbidge then goes on to say: "The next difficulty was to obtain water, since the men we had sent to search for it returned empty-handed, having failed to find any." There is rather a mystery about this cave, as the ordinary route leads through Kamborangah (7200 ft.), where there is no cave, to Pakka (about 10,000 ft.), where the cave, or overhanging rock, is on the edge of a rushing torrent. Burbidge states that his guides "slept under a rock a little further on * and higher up the mountain side, and they found a stream from which good water was procured."

They did not ascend beyond the top of the great ridge which leads to the foot of the granite cap, and after two nights in their cave descended to Kiau. The botanical pursuits of the two Europeans proved too much for the Dusuns' patience, so the Dusuns went on ahead; and the two botanists, left to themselves, lost the path and spent the night in the jungle. They reached Kiau safely next day, and after a two-days' excursion to Marei Parei, where they noted *Nepenthes edwardsiana* and *N. rajah* (the latter in abundance), they left Kiau for the coast. Following the same route they reached Gaya in six days and Labuan two days after. Burbidge writes that "after reaching Labuan both Mr. Veitch and myself had bad attacks of intermittent fever, the result of chilling exposure in wet clothes and ill-cooked food, accompanied by more than ordinary exertions."

1878. Burbidge made a second expedition to Kinabalu in August, 1878. Accompanied by a man called Smith, lent by the manager of the Labuan coal mine, he left Labuan on July 31st, and after sundry mishaps with the

* In his second expedition described as a quarter of a mile further on.

small sailing boat reached the Tampassuk river on August 5th, and pulled five hours up to the house of a Mr. Pretyman. From here buffaloes were used to transport them the seven days' journey to Kiau; *en route* they passed through the villages of Ghinambor, Buramhangan, Sineroup, Kambatuan, and Koung. The bad path and heavy fresh in the river delayed them.

Burbidge notes that Lemoung, the head-man of Kiau, had died since his last visit, and that his son Boloung had taken his place. Lemoung was one of St. John's guides twenty years before. His son and Kurou—another guide—escorted Burbidge on this trip. As before, two days were spent in the ascent, and apparently the same cave was used again at 9000 ft. On their arrival "one Dusun fetched us some water from a stream half a mile off." He also notes that they "had a view of the great waterfall on the bare granite rocks of the mountain opposite"; and that on leaving the place he carved his initials on the soft red sandstone wall of their cave.

Miss Gibbs states that "in the centre of the sheltered small forest above and below Pakapaka were huge red sandstone blocks," and she suggests that it was here Burbidge camped.

At 8000 ft. he writes: "Casuarina trees are commonly met with." Miss Gibbs, in comment, notes "the melancholy-looking *Lycopodium casuarinoides*—the only approach to anything like a *Casuarina* seen anywhere, though previous writers all record this unmistakable genus both here and on the Maraiparai."

They spent three days collecting plants round their camp, ascending only to 10,700 ft., as the summit was not the object of their expedition.

Of the four big Nepenthes, Burbidge remarks that *N. rajah* and *N. villosa* frequent open mossy patches, but that *N. lowi* and *N. edwardsiana* appear never to reach so high an altitude as the former two.

On August 18th they commenced the descent. Collecting as they went, they reached Kiau at 4 p.m.

The journey from Pakka or neighbourhood to Kiau is a good day's walk for a native unencumbered; but I should imagine quite impossible for a European to accomplish if he spent much time collecting on the way, besides loading himself with plants so that he had "both arms full besides the basket on his back," as Burbidge describes his arrival at Kiau. It seems more probable that they followed a

shorter route up the more northern spur which forms the right bank of the Kadamaian waterfall; the longer route followed by everyone else, with the possible exception of Low on his first ascent, leads one up the more southerly spur which forms the left bank of the Kadamaian.

Burbidge and his companion left Kiau on August 19th, following the Tampassuk again back to the coast; they accomplished the journey in five days, sleeping the nights at Koung, Kambatuan, Sineroup, Ghinambor, and the house of Mr. Pretyman. Thence they sailed to Labuan, reaching that island on August 30th.

Burbidge notes that this second journey occupied them thirty-one days from Labuan, and the first expedition twenty-three days.

In an appendix to this book the author remarks that the main object of his journey eastward was "the collection and introduction of beautiful new plants to the Veitchian Collection at Chelsea"; and in the summary of his results he considers that one of the most fortunate was the introduction alive of *Nepenthes rajah*.* He also states that "we were successful in finding all the large species of Nepenthes in one locality on the mountain for the first time."

Miss Gibbs comments on the fact that she saw no *Nepenthes rajah*, although she found the other three species. This accords with the observations of Low, St. John, Haviland and myself,† and led me to inquire if by chance these two travellers had followed some other route. I had hoped that Mr. Veitch might have preserved some notes on his expedition which would clear up once and for all the doubts concerning the route followed by himself and Burbidge, but, unfortunately, Mr. Veitch writes that his notes are now undecipherable owing to their having been wet in Borneo, and not cared for since. However, Mr. Veitch very kindly writes a most interesting letter, which I venture to quote almost in full:—

"I should not have said that *Nepenthes rajah* was at any time found in exactly the same locality as *N. edwardsiana*,

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* Sir H. J. Veitch very kindly writes to me from the Royal Exotic Nursery, Chelsea, as follows: "We never succeeded in cultivating very successfully the Nepenthes from Mt. Kinabalu, and I believe the only living plant of *N. rajah* is in the Botanic Gardens at Glasnevin, Dublin, where Sir Frederick Moore has succeeded in growing it well. *N. lowii* does not exist in Europe so far as I am aware."

† I found this very unmistakable *Nepenthes* in the Marei Parei spur, where it was not uncommon.

&c.; it was probably found on the same day, but it would be at higher altitudes, and always in the region of and among moss and excessive moisture, while the others were found in comparatively drier positions, and generally climbing over scrub or low trees.

"There was a happy valley we ascended as a separate excursion where the forest growth was less dense and overgrown, where we found a large number of Nepenthes—this to my mind was on the left or sea side of the main road to Kinabalu, and was made from the last house on the way to the mountain top. I should say this is the place Burbidge refers to where the species were growing together, but we climbed many hundred feet between finding *N. edwardsiana* and *N. rajah*.

"I have again been dipping into the 'Gardens of the Sun,' but find I cannot add anything to the particulars given there, which I regret, as I should have liked to help you in your research, had it been possible. My work was of the practical sort—looking after the men, our plants, and the pot!

"One last note. I always understood that Burbidge and I on our excursion followed the same route, *or nearly so*, as S. St. John, but routes and native villages change considerably in twenty years!

"Though I have, I fear, helped you but little, I still remember with the greatest delight my trip to Kinabalu. . . . Sir Hugh Low came to see me here several times after he retired from the Service, and I much enjoyed a chat with him."

It will be interesting if some future traveller can identify Burbidge's route beyond all question.*

His collections added over fifty species of Ferns to the Bornean list, of which thirteen were new to science. Of the seventeen species of Birds obtained on the two expeditions, five were described by R. B. Sharpe as new.

1879. *Bulletin de la Société belge de géographie.* 1881. "Borneo." By J. Peltzer.

I have not been able to consult this article, but Posewitz † states that this traveller "climbed the Marei-Parei Peak

* Mr. H. N. Ridley informs me that Mr. Burbidge wrote up his accounts in England, and in consequence made several inaccurate statements. Perhaps the Kinabalu puzzle is to be explained thus; however—*de mortuis nil nisi bonum.*

† Posewitz, p. 65.

of the Kina-Balu *massif.* Returning to Kian (=Kiau) he passed through the districts to the south-east of Kina-balu, and after scaling several mountain ridges, reached the great valley plain of Suan."

1887. *Journal of the Straits Branch, Royal Asiatic Society* (Singapore). No. 19. 1888. Pp. 1–25. "Report on a Journey from Tuaran to Kiau and Ascent of Kina-balu Mountain." By R. M. Little.

The object of this visit to Kinabalu was to receive the submission of the native chiefs of that district. Mr. R. M. Little, an Assistant-Resident in the service of the British North Borneo Company Government, left Gaya on February 16th, 1887, for this purpose. He followed the Tuaran route, which he summarizes briefly at the end of his paper thus :—

"Gaya Island to Borongis, Tuaran, *viâ* Mengkabong, by boat six hours, and across plain to Buntai, two hours' walk.

"Buntai village to Sinilau village, $3\frac{1}{4}$ hours' walk—hills.

"Sinilau village to Bungol village, $8\frac{1}{4}$ hours' walk—hills.

"Bungol village to Labong Labong village, six hours' walk—hills.

"Labong Labong village to Kiau village, $2\frac{3}{4}$ hours' walk —hills."

He also gives a summary of the Tampassuk route, remarking that it is the longest and by no means the easiest, owing to the continual crossing of rivers. This disadvantage, however, is obviated nowadays by the excellent bridle path which follows the left bank of the Tampassuk river all the way to Koung.

Little's summary of the Tampassuk route is given thus :—

"Gaya Island by boat to Government station, Tuaran, six hours.

"Station to Madang village, eight hours' flat walking.

"Lemawng village to Tambatuan village, five hours (hill) (on the Tampasuk river).

"Tambatuan village to Labong Labong village, five hours (flat) (on the Tampasuk river).

"Labong Labong village to Kiau, $2\frac{3}{4}$ hours (hill) (on the Tampasuk river)."

This traveller reached Labong Labong on March 5th, and next day received the oath of allegiance from the natives of the village, and established peace between the

coast and hill Dusuns, a rectangular stone being planted to commemorate the event.

Arriving at Kiau that day he noted that this village was "divided into three sections—upper, middle, and lower. The slopes around the houses are grazed by cattle and buffaloes; water is brought down by means of bamboo piping." Middle Kiau is given as 2635 ft. above the sea-level. Upper Kiau has since been deserted, though the remains of houses are still clearly seen.

Another treaty stone was planted at Kiau. On March 9th Mr. Little started for the summit of Kinabalu, following the Kadamaian river to Minitindok, where he passed the first night. He made this 2651 ft. above sea-level. Next day he and his Dusun followers continued up the river for half a mile, and then struck up the right bank in order to inspect some caves. A good view of the cascade, originally described by St. John, was obtained, and Little names it Regina Falls "in honour of her well beloved Majesty." The caves were reported as simply shallow holes.

On the 11th the party proceeded to Tamborangah (= Kamborangah), which they reached in three hours (alt. 7328 ft.), and next day reached Pakka cave after $4\frac{1}{2}$ hours' walk (alt. 10,262 ft.). On the 13th, accompanied by eleven of his followers, Little ascended to the summit plateau, reaching a spot between Victoria Peak, "the highest and most easterly, and the adjacent peak which the Kiau men have just climbed" (presumably Low's Peak, which is, however, 5 ft. higher than Victoria Peak). As will be seen in the map, the summit of Kinabalu is divided into an eastern summit plateau and a western summit ridge; the former accessible, the latter apparently not. On the eastern portion, the easternmost peak is not Victoria Peak, but one slightly lower, named in after years Alexandra Peak; it is possible that Little meant this for Victoria Peak, as he correctly gives the next peak to the west as St. John's Peak.

Little makes the total height 11,562 ft. Whitehead, who made the ascent a year later, states that Little only reached Low's Gully, which "he evidently considered the top." The Dusun sub-chief Gawang was entrusted with Little's bottle containing the names of the eleven natives and their European leader who had reached the summit plateau. Gawang deposited this on the summit of St. John's Peak. When they reached Kiau three days later it was found that Limbawan, the guide, had brought down

Messrs. Low & St. John's papers—the former's in a bottle, the latter's in a tin. The writing was partly indecipherable. Mr. Little confesses to feeling vexed with Limbawan for removing these historic papers, but he does not confess to having returned them.

On March 20th he left Kiau and followed the Tampassuk route as far as Ghinambor, and thence to Tuaran *viâ* Madang village.

[1888. *Proceedings of the Royal Geographical Society.* Vol. x. No. 3. 1888. Pp. 134–146. "Summary of Explorations in British North Borneo." By Admiral A. C. Mayne, C.B., M.P.

The explorations discussed in this article date from 1878 to 1887. This period only includes one ascent of Kinabalu, namely, that of R. M. Little, whose account has just been dealt with above. The following passage from Admiral Mayne's summary may be noted: "The latest journey of which we have the record was made last year by Mr. Little, the Assistant-Resident before-mentioned, who ascended our highest mountain, the Kinabalu, the elevation of which, as marked on the map, he considers 2000 ft. too much, though he claims to have reached a higher peak than either Low or St. John. Its position and altitude were fixed by the late Sir Edward Belcher when in H.M.S. 'Samarang'; and I doubt the propriety of seriously suggesting a reduction of 2000 ft. from his trigonometric determination on the unchecked authority of a small pocket aneroid not in its first youth."

This summary has some interesting notes on the supposed existence of a Kinabalu Lake, to which we shall refer later.]

1887. *Exploration of Mount Kina Balu, North Borneo.* By John Whitehead. 1893. Pp. 1–317, with plates and woodcuts. (Chapter vi. contains an account of Whitehead's first successful expedition.)

To the author of this book belongs the credit of the first extensive exploration of the mountain, and to him we owe our first real insight into its zoological treasures.

He spent over three years in the East, leaving England in October, 1884, and after visits to Malacca, Java, Palawan, and North Borneo, returned again in April, 1888.

During this period he made two unsuccessful attempts to reach Kinabalu, the first in 1885 and the next early in

1886. Unrest among the natives of that district prevented him getting further than Gaya on the first occasion and Tampassuk on the second.

On January 25th, 1887, he left Labuan on his third attempt to reach the mountain. He followed the Tampassuk route, using buffaloes as far as the junction of the Pangataran and Tampassuk, and thence on foot to Melangkap. From here he followed up the bed of the Pangataran, being told by the natives that Kinabalu could be ascended by this route. However, a hard day's walk convinced him of the impossibility of this, so a hut was built in the jungle, where he spent a month collecting.

During his stay here the Company's Officer, Mr. R. M. Little, paid a brief visit to the mountain, as described under our last heading. Whitehead comments on the useless nature of these hurried visits, especially when they take place but once in five or six years. He writes thus: "I know as a fact that the very tribes which this Officer visited, and settled their tribe disputes, made a head-hunting raid the following spring." Nowadays the Company's Government is very much more in touch with the natives, as the Officer in charge of a district is supposed to make a complete round of visits each month. In Whitehead's time the Kinabalu district was managed from Gaya, a week's journey in distance. But now that the districts are parcelled out into more manageable sub-districts, the natives live a more peaceful life under the restraining influence of a sound European government, which is more in evidence now than it was in Whitehead's day.

The greatest altitude reached by Whitehead during his stay on the Pangataran was 4800 ft. After a month in this camp he spent some three weeks at Melangkap, and returned again to the coast by the Tampassuk. He summarizes the results of this expedition as follows:—

"... eight weeks were spent in bird-collecting in the neighbourhood of Melangkap and amongst the mountain spurs. During this period we collected some three hundred birds, eighteen of which were new to science, and many others added to the ornis of Borneo for the first time. ... Besides birds, I had several new mammals, including two new squirrels and several rats. There were also four new reptiles—a *Draco*, a snake, and two new frogs; and six new butterflies, four of which were *Papilios*."

He reached Labuan again on April 16th.

1888. Chapters viii. and ix. are devoted to Whitehead's next visit to the mountain.

He left Labuan on his fourth and last expedition to Kinabalu in December, 1887. After the usual delays in getting carriers together, he left Abai on January 3rd, 1888, having engaged Illanuns and buffaloes to transport him to Melangkap. Their first day's journey brought them to Ghinambor, the second to Teung, a village on the right bank of the Pangataran, to which they had strayed in error. After a day's delay they did the two hours' journey to Melangkap (given as 1300 ft.). Whitehead spent a fortnight collecting here again, and then journeyed down-river to Tambatuan, and thence to Koung, where he stayed the night. Next day he reached Kiau, putting-up in the house of Kabong, one of the headmen of the village, a position which was shared by Kurou, who acted as guide for Burbidge ten years before. Whitehead notes that this man remembered Low and St. John, and "speaks of these two gentlemen as the only two white men he ever took a fancy to."

On January 25th they left Kiau for the ascent, accompanied by Kurou, "bringing with him his son—a precocious boy of ten years old with a loud voice and a huge mouth," who developed later into Sumpot, taker of two heads, chief of Kiau and guide with me in 1913.

They followed the usual course of the Tampassuk or Kadamaian River—to give it the proper name for this upper portion of the Tampassuk—and reached Lobong (given as 4800 ft.), which was christened by Burbidge as "Sunless hole." Whitehead mentions the slender orange tree in front of the big overhanging rock, which the natives told him had been planted by Low. Whitehead laments the miserable damp of this place, where he spent five days. The excessively steep sides to this narrow gorge make it very difficult to get about for any collecting. During my stay there in September, 1913, I had the only flat bit of ground cleared just in front of the rock; this let in the sun and improved the place considerably. Bird and insect life were then more in evidence.

On January 31st Whitehead moved up to Kamborangah, where he stayed until March 3rd, suffering much from ill-health and exposure to the raw climate, but doggedly persevering all the time in his collecting work. The results amply repaid him, as he obtained no less than ten new species of birds, four of which represented new genera, besides a new rat and a new frog.

During his stay in this bleak spot Whitehead made one excursion to the summit, leaving Kamborangah on February 10th, and sleeping the night at the Pakka cave. Accompanied by some Dusuns of Kiau he climbed to the summit the following day, reaching Low's Peak, which he made out 13,525 ft. Whitehead is the first to note that this is higher than St. John's Peak—a lucky guess on his part, although he writes "decidedly higher," as the difference is only 15 ft. He left a note in a bottle giving the names of his little party, the date, temperature (fifty-nine degrees), and time (11 a.m.). This he buried beneath some stones on the summit. Subsequent visitors do not mention finding it. After visiting Low's Gully he returned to Pakka, and thence to his camp at Kamborangah. During his month there the temperature at night varied from forty-two degrees to fifty-two degrees; in the day from sixty degrees to seventy degrees Fahr. The height of Kamborangah is given as 7850 ft.

Whitehead reached Kiau in two days, and then went on to Melangkap, a journey which he accomplished in six hours, thanks to "the splendid carrying powers of the Kiau Dusuns." During his absence on the mountain a native collector had been busy at Kiau and two more at Melangkap, who all helped to swell the size of his collections.

On March 10th he returned to Kiau again, and on the 12th went down to the Kinokok valley, where he spent four weeks encamped at 3650 ft. The greatest find here was the beautiful new Trogon, afterwards named by Dr. Sharpe *Pyrotrogon whiteheadi* in honour of its discoverer. On April 9th he returned again to Kiau and thence to Melangkap. He gives a little description of Kabong's house at Kiau:—"This house is quite a zoo; below a herd of pigs grunt and squeak, dogs fight and snarl, cocks crow, hens cackle; above babies squealing, men and women laughing and talking. Combine all these sounds and you get an idea of the babel in a Dusun house." To complete the picture he might have suggested that most of the above members of the animal kingdom, when living in a confined space, are liable to produce a variety of *smells* not altogether attractive to the human nasal organ. Then there is the smoke of the house to fill the eyes and throat of the visitors: and last of all the bed-bug, known to the Dusun as "wongking," which effectively prevents any thought of sleep if all the other above-mentioned "in-

gredients" of a Dusun house have failed to do so. However, the Dusuns are not the only tribe in Borneo who can provide a similar "rest" for the traveller; nor, perhaps, is Borneo the only country where such are to be found.

Not content with his prolonged exploration of Kinabalu, and in spite of ill-health, Whitehead spent another six weeks at Melangkap and neighbourhood, finding new birds up to the last; thus his entry on May 14th: "Tungal brought me three specimens of a Whistling Thrush closely allied to one of the Himalayan species; this was new, and has been named *Garrulax schistochlamys*." Then, again, on May 21st: "The Kadyans returned from Kapar with our last new bird—an interesting little Timeliine closely allied to a Himalayan species; this bird has been named *Turdinulus exsul*."

On May 23rd he left Melangkap, and, following the Tampassuk, reached the coast on the 26th, and thence by boat to Gaya and Labuan, where he arrived on May 30th after an absence of nearly six months.

Whitehead's book contains some fine pictures of Kinabalu drawn by himself, as well as beautifully coloured plates of the finest of his new birds and insects. For altitudes he gives Kiau as 2800 ft., Kamborangah as 7350 ft., and Pakka as 10,300 ft. The results of his expeditions are described in the following papers:—

(a) Mammals, by Oldfield Thomas, in Proc. Zool. Soc. Lond. 1889. Of the twenty-one species obtained eight * were new to science, five more new to Borneo.

(b) Birds, by R. B. Sharpe, *Ibis*, 1887–1890. The author notes that Whitehead added sixty-nine species and twenty-five genera of birds to the Bornean list. Of these Dr. Sharpe's list shows that forty-two species and four genera were also new to science. The total number of species collected by Whitehead in Borneo was two hundred and eighty-six, of which one hundred and sixty-one, representing one hundred and twenty-six genera, were found on Kinabalu.

(c) Reptiles and Batrachians, by M. F. Mocquard, in *Nouvelles Archives du Museum* (Paris), 1890. Of

* The author of this paper gives six, but Whitehead claims to have been the first to discover *Semnopithecus hosei* and *Tupaia montana*.

the forty-six species collected, ten are described as new, two necessitating new genera.*

(d) Land-Shells, by E. A. Smith, in Ann. Mag. Nat. Hist., and by Lieut.-Col. Godwin-Austen in Proc. Zool. Soc. Lond. 1891. Ten species collected, three new to science.

(e) Beetles, by H. W. Bates, in Proc. Zool. Soc. Lond., and H. S. Gorham, descriptions of twenty-five new species and seven new genera.

(f) Butterflies, by H. Grose Smith, in Ann. Mag. Nat. Hist. Sixteen new species described.

(g) Rhynchota, by W. L. Distant, in Ann. Mag. Nat. Hist. Four new Cicadas and one Coreid described.

In concluding our summary of Whitehead's expedition, it may not be out of place to quote Dr. R. B. Sharpe's concluding paragraph to his series of papers on the birds of Kinabalu. He writes: "In conclusion, I once more offer my congratulations to Mr. John Whitehead on the success of an expedition planned and executed with so much determination in the face of so many obstacles and dangers; while his father, Mr. Jeffery Whitehead, who provided the 'sinews of war,' must feel proud that his son has carried out one of the most important, as well as one of the most successful, scientific expeditions of modern times—one, too, from which the gain resulting to our ornithological knowledge has not yet been thoroughly gauged." (*Ibis*, 1890, p. 292.)

Some ten years later Whitehead met his death in Formosa while on a similar expedition in the interests of his favourite branch of natural history.

1892. *Transactions of the Linnean Society of London.* Second ser., Botany. 1894. Vol. iv. Part 2, pp. 69–263, pls. xi.–xx. "On the Flora of Mount Kinabalu, in North Borneo." By O. Stapf, Ph.D., &c.

The author of this paper discusses all the plants known from Kinabalu up to that date; the greater part of the material studied comes from the collection of Dr. G. D. Haviland, who, as Curator of the Sarawak Museum, made an expedition to Kinabalu early in 1892.

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* Dr. Boulenger, in Ann. Mag. Nat. Hist. 1891, ser. 6. vol. vii. p. 341, states that the first Reptiles and Batrachians from Kinabalu were described by him. He considers that some of Mocquard's species are not valid, but he recognises altogether twelve new species collected by Whitehead.

Accompanied by his cousin, Dr. Haviland left Kuching, Sarawak, on March 1, and reached Gaya (the island off Jesselton, and at that time the seat of the Government of the West Coast) on the 5th. After five days they proceeded to Tuaran, and on the 12th commenced the land journey to the mountain. Three days brought them to Bungol, the fourth to Koung, and the next day they reached Kiau. After a day's collecting here and another day wasted by a journey of half a mile to the Dusuns' farms, they commenced the ascent on the 19th, and reached Lobong (noted as 5000 ft. above the sea) that afternoon. After a week here they ascended to Temburungo (= Kamburangah), and next day (the 27th) to the Pakka cave, where Dr. Haviland noted the temperature of the air at 5 p.m. as 11° C., of the water in the torrent 10° C. "The aneroid read 20.84; the boiling-point was by one thermometer 194° F., by another 90° C." At daybreak on the 28th the temperature was 8° C.

Dr. Haviland writes that they "reached the top of the sharp northern ridge about its middle"—no doubt Low's Peak. They returned to Kamborangah that day, but ascended again to Pakka on April 2nd, and stayed there till the 9th, continual clouds preventing them going to the top again. The height of the cave was given as 10,450 ft., Kamborangah as 7750 ft.

They returned to Lobong on the 11th, to Kiau next day. Ten days were then spent in the Pinokok valley, whence a visit was made to Marei Parei. On April 24th the expedition commenced the return journey to the coast.

The botanical importance of this expedition may be judged from Dr. Stapf's list of the Kinabalu flora, in which he enumerates four hundred and fifty-one species, of which no less than one hundred and ninety-seven are described as new. Of these new species Dr. Haviland alone was responsible for over a hundred and fifty. Dr. Haviland also collected a few mammals, birds, and insects for the Sarawak Museum, but the greater portion of his time was devoted to botany.

The latter part of Dr. Stapf's paper is devoted to an enumeration and description of the species (pp. 127–263), but the first portion has much of interest for the general reader. He distinguishes four zones:—

"1. The *zone* of the *plains and low hills*, or, briefly, the *hill zone*, from the littoral which skirts the coast as a belt of varying breadth up to 3000 ft.

2. The *lower mountain zone*, from 3000 ft. to 6000 ft.
3. The *upper mountain zone*, from 6000 ft. to 10,500 ft.
4. The *summit zone*, from 10,500 ft. to the very summit (13,698 ft.)."

Several pages are devoted to a discussion of the affinities of the flora of these different zones, and a table is given to show the geographical distribution of all the species. Perhaps the most interesting point that comes out is the relationship of the summit zone flora to that of the Boreal-Himalayan region on the one hand, and to the Australian, New Zealand, and South American region on the other. For instance, we may notice two species of Gramineæ (Grasses) collected by Haviland at 13,000 ft.: (i) *Agrostis canina* occurs in the northern hemisphere from North America and Europe east to Siberia and south as far as the Himalayas, and in the southern hemisphere in Patagonia and New Zealand; (ii) *Deschampsia flexuosa* ranges in Europe from Scandinavia to the Mediterranean and to the Caucasus; in North America from Greenland to Canada and the northern United States; in the southern hemisphere it occurs in the Falkland Islands and Magellan Strait. The summit of Kinabalu helps to bridge the enormous gap in the range of these two species.

The next important paper on the flora of Kinabalu is that by Miss L. S. Gibbs, published in 1914, to which we shall refer later.

1899. *Journal of the Straits Branch, Royal Asiatic Society* (Singapore). No. 34, July, 1900, pp. 49–88, pls. i.–iv. "An Expedition to Mount Kina Balu, British North Borneo." By R. Hanitsch, Ph.D.

This is an account of a collecting expedition undertaken by Dr. Hanitsch, Director of the Raffles Museum, Singapore. He was given six weeks' leave for the trip, and starting from Singapore on March 4th, 1899, he reached Gaya, the island opposite Jesselton, British North Borneo, on March 11th, and the mainland next day. The Tuaran route was chosen, and a start for the land journey made from Panjut on the 13th. The succeeding nights were passed at Bandeian (on the Tuaran river), Kappak, Kalawat, Bungol, Koung, and Kiau, the last-named village being reached on March 18th. After the usual delays for coolies, a start for the ascent was made on the 21st, and they camped that night under a huge slanting rock, presumably Minitindok. The following day they reached

another large overhanging rock, which was evidently Lobong,* the altitude being noted as 4140 ft.

Owing to lack of time all idea of any further ascent had to be given up, so two days were spent in collecting at this spot, and then the descent was commenced on March 25th. Another day was allowed for collecting at Minitindok, after which the expedition proceeded to Kiau, leaving again next day, March 28th, for the return journey to the coast. The same route was followed, nights being passed at Koung, the river Menternan, Bungol, Kalawat, Kappak, and Panjut. At Kalawat they met Mr. H. T. Burls, an oil-prospector, on his way to Kinabalu. On April 4th Dr. Hanitsch left Panjut, and after sundry delays reached Gaya on the 9th, Labuan next day, and Singapore on the 14th, after an absence of six weeks exactly.

His collections included the following species new to science: Two snakes, one lizard, one frog, one freshwater fish, and one crab. Considering the very short time spent in collecting, these results form an interesting indication of what might be done on a longer visit.

1899. *The Geographical Journal.* Vol. xiv. No. 2. August, 1899. Pp. 207, 208. "Observations on Mount Kinabalu." Mr. H. T. Burls sends an account of his ascent to the Royal Geographical Society.

The following points of interest may be taken from this account:—

"Mr. Burls . . . succeeded in reaching a point where the boiling-point thermometer read 191°·9 at an air-temperature of 49°, giving an altitude of 11,643 ft. The distance to the summit he estimated at only 400 ft., which would give the total height of the mountain as 12,043 ft."

A bottle containing the name of this traveller was found on the summit of one of the peaks some eleven years later by Mr. D. R. Maxwell, in which case the following passage is worthy of remark: "The upper 1200 ft. was a surface of bare rock so steep that it was impossible to walk on it with boots, and, being unprovided with any substitutes, Mr. Burls was obliged to give in after covering two-thirds of the distance, but his Chinese servant and four Dusun carriers completed the ascent."

The lowest temperature recorded was forty-four degrees at 10,360 ft. on the night of April 13th, presumably in

* Sumpot, the chief of Kiau, remembered Dr. Hanitsch's ascent, and informed me that his expedition camped here.

Pakka cave. This traveller notes that the central core of the mountain is syenite; that he did not find metamorphic rock surrounding the mountain; and that at 8800 ft. there was a direct transition from limestone to syenite, the former of which appears to be underlain by a shale, followed by a sandstone at 7175 ft.

1899. About this time John Waterstradt, a professional insect-collector, made an ascent. I have been unable to trace any written records of his visits to Kinabalu, but I gathered from the natives at Kiau that he had made three lengthy visits: the first about 1894, the next about this date (1899), when he went to the summit for the first time, and, lastly, about 1908. The large number of butterflies and beetles on sale in many dealers' catalogues are the results of his work; also the remarkable proficiency of the natives of Kiau in the art of "bug-hunting." They told me Mr. Waterstradt had a regular scale of pay for each kind of butterfly—two or three cents each for some, two for a cent for another kind, five cents, perhaps, for another. I made a note of some of them, as they afford an interesting comparison with a dealer's price list, where *Papilio andromache* is marked 50 marks, and others similarly priced.

1910. *The British North Borneo Herald.* Vol. xxviii. April 1st, 1910. Pp. 65–67. "Ascent of Mount Kinabalu." Report by D. R. Maxwell, Assistant District Officer, Province Keppel.

The writer of this account escorted Miss L. S. Gibbs, a botanist, to the summit of Kinabalu. This lady went by train from Jesselton to Tenom, and thence by bridle path to Kiau, whence she paid a visit to the Marei Parei spur before making the ascent. This was accomplished in the usual three stages, the nights being passed at Lobong, Kamborangah, and Pakka. The summit was reached on February 20th, and a bottle containing the names of Miss Gibbs and Mr. Maxwell deposited on Low's Peak.

Mr. Maxwell climbed another peak, where he found "a bottle saying that on April 13th, 1899, H. T. Burls had accomplished the ascent with one Chinaman and four Kiau Dusuns. Mr. Waterstradt's bottle was also found below."

The thermometer readings noted daily at 4.30 p.m. and at nightfall were:

Lobong, 65°–61° Fahr.
Kamborangah, 56°–52° Fahr.
Pakka, 50°–40° Fahr.

The summit of Kinabalu was noted as ten degrees (sheltered), and ice was found on the top. I was fortunate enough to meet Mr. Maxwell in Jesselton, and he told me that his record of the temperature for the summit was undoubtedly due to some mistake, but that there was no doubt of the ice being found there.

St. John speaks of a hoar-frost at Pakka and of hail on the summit; but this seems to be the first record of ice. The glistening white granite cap has given rise to stories of snow on the top, but actual records of snow are still wanting.

Mr. Maxwell's report contains much information of use to anyone wishing to make the ascent. He gives a short summary of the geographical features of the Kiau side of Kinabalu, and useful notes on the stages of the ascent and return. He mentions the recognised scale of wages, *viz.* ten dollars * to each guide and three dollars to each coolie for the journey from Kiau to summit and back

Miss Gibbs read a paper on the botanical results of her expedition before the Linnean Society of London in June, 1913, from which we get more details.

1910. *Journal of the Linnean Society* (Botany), 1914. Vol. xlii. No. 285, pp. 1–240, pls. 1–8. "A Contribution to the Flora and Plant Formations of Mount Kinabalu and the Highlands of British North Borneo." By Lilian S. Gibbs, F.L.S.

Miss Gibbs, the first lady to visit Kinabalu, broke entirely new ground by approaching the mountain from the south instead of the usual routes (Tampassuk or Tuaran).

Landing in Jesselton, the train took her eighty-seven miles south and away from Kinabalu to Tenom, the Residency of the interior. From here Miss Gibbs followed the bridle path, passing through Melalap and Senagong to the Kaningau plain, which is given as 1000 ft. above the sea and about twenty miles long. After two days at the Government Residency here, the journey was continued across the plain to Apin Apin, thence to Tambunan, situated on the plain of that name, 1870 ft. A District Officer

* The Straits Settlements dollar is used in British North Borneo, value two shillings and fourpence in English currency.

is stationed here, and Miss Gibbs notes that this is the farthest station in the interior at present. Continuing the journey north, Korikut is the objective of the next stage, which Miss Gibbs failed to reach that day owing to floods; the following day she arrived at Mensangau, and the next at Bundu Tuhan rest-house, which is perched on a ridge 2700 ft. just opposite the Kinabalu mass. Thence to Kiau was the last day's journey.

"Arriving at Kiau was like treading on classic ground," writes Miss Gibbs, and continues thus: "Amongst the usual crowd of natives squatting in the public apartment of the rest-house, Sumpot, an oldish man of self-respecting appearance, was presented as the headman of the village. He immediately handed me a letter written by Haviland, stating that he had acted as guide to him in his expedition up the mountain. My mind was already full of the previous experience and the results of those whose devoted work had rendered this mountain a Mecca to biologists for the present day; and that letter seemed almost an augury from one whose unknown fate in South Africa was met in the quest of his life's work."

Sumpot still has this letter; he showed it to me with great pride in 1913, relating how interested other European travellers were on reading it. I explained that it was of particular interest to me, as Dr. Haviland came from the Sarawak Museum like myself.

Bad weather prevented Miss Gibbs from making the ascent at once, so a few days were spent in a botanical examination of the Gurulau spur which runs up behind the village of Kiau, and a few more days on the Marei Parei spur. It is noteworthy that Miss Gibbs failed to find any sign of the big Pitcher-plant, *Nepenthes rajah*, recorded by St. John and Burbidge from this place, and found by me, three years after Miss Gibbs, in some quantity. She explored the higher slopes above this plateau, reaching an altitude of 8000 ft., which was some 2000 ft. higher than St. John and Low's record.

On returning to Kiau the weather improved, and Miss Gibbs writes that a start was made for the ascent on February 22nd, and that she returned to Kiau on February 27th. The note I found on the summit, however, records her arrival there on February 20th.

The usual route was followed to the summit, but Miss Gibbs' full account of the varied flora observed on the way up should be carefully read by a botanist. She notes Kam-

borangah as the only locality for *Patersonia* (Iridaceæ) outside extra-tropical Australia,* and "a few dead trees wreathed in some melancholy-looking *Lycopodium casuarinoides*, the only approach to anything like a *Casuarina* seen anywhere, though previous writers all record this unmistakable genus both here and on the Maraiparai."

Miss Gibbs comments on the helplessness of the natives in enduring the cold at this altitude, and in the final part of the ascent she records "an appreciable film of ice about 5 mm. thick," filling the cracks and holes by the side of the Kadamaian. As noted in the last account of this expedition, the party reached Low's Peak and deposited records of their visit under a stone.

The zones of vegetation suggested by Stapf are modified somewhat by Miss Gibbs, who recognizes seven formations:—

1. The secondary forest (2500 ft.–4000 ft.).
2. The primary high forest (3500 ft.–6000 ft.).
3. The mossy forest (6000 ft.–9000 ft.).
4. The scrub formation (on the exposed serpentine).
5. The low-sheltered forest (9500 ft.–10,500 ft.).
6. The sub-summit dwarf forest (above 10,500 ft.).
7. The granite core (above 10,500 ft.).

The return journey was made by the Tampassuk route to Kotabelud and thence to Tuaran.

Pages 56 to 239 of this paper are devoted to the botanical collection, which were particularly valuable and interesting, as the following figures indicate:—

The author's summary shows that about one thousand plants in all were collected, of which eighty-seven proved new to science. Of these Kinabalu claims three hundred and thirty-seven specimens, comprising three new genera and thirty-eight new species. She added no less than one hundred and twenty-nine species to Stapf's list of Kinabalu plants.

1910. *The Sierra Club Bulletin.* Vol. viii. No. 1. January, 1911. Pp. 18–24, pls. xiv., xv. "A Vacation Trip to Mount Kinabalu in British North Borneo." By F. W. Foxworthy.

Dr. Foxworthy made his visit just a month after Miss Gibbs. He came down from Manila to Jesselton, and thence up the coast again to Usukan Bay, and on to the

* Another species, *P. lowii*, Stapf, grows on the Marei Parei spur at 5500 ft.

Government station at Kotabelud. From here to the base of the mountain he notes as thirty-four miles, which he accomplished in two days, following the Tampassuk route to Kiau. After the usual day of preparation at Kiau, he commenced the ascent on March 16th, and reached Pakka on the 18th, where he noted the highest temperature as fifty-four degrees at 1 p.m. The summit was reached next day, and "a Sierra Club cylinder containing a record of the date and the names of the men accompanying me" was deposited alongside the bottle left by Miss Gibbs the month before.

When I visited the summit three years after, the Sierra Club cylinder had been appropriated by the spirits of the mountain, though Dr. Foxworthy's note was found in a bottle with that of Miss Gibbs.

Dr. Foxworthy left Pakka on the 20th, and reached Kotabelud again on March 24th. His article is illustrated by pictures of Kamborangah, Pakka, and the summit. The first and last of these pictures are reproduced in Miss Gibbs' paper which we have just discussed.

1910. *The British North Borneo Herald.* Sept. 1st, 1910, pp. 157, 158. "The Ascent of Mount Kinabalu." By H. W. L. Bunbury.

This appears to be the only official account published of one of the most important expeditions to the mountain. The party of visitors consisted of Capt. Learmonth, R.N., and Lieut. Harvey, R.N., of H.M.S. 'Merlin'; Mr. Clarke, of the British Borneo Exploration Company, and Mr. Scott Brown, of the Hepworth Cinematograph Company.

Mr. H. W. L. Bunbury, the District Officer, met the party at Usukan Bay on June 4th, 1910, and after a week at Kotabelud they set out on the expedition proper on June 12th. Nights were spent at Kabaion, Koung, and Kiau. Leaving the last-named village on the 16th they followed a path through the paddi farms, striking the Kadamaian above the Minitindok gorge; thence by the usual route to Lobang. Next morning Kamborangah was reached in three hours and forty minutes, the next stage to Pakka cave taking about the same time. On the 18th a preliminary trip to the summit plateau was undertaken to find a suitable spot for another camp. The next day the whole party, with the exception of Mr. Clarke,* moved

* Mr. Clarke visited the summit on the 20th, returning to Pakka the same day and to Kiau the next day.

up to their new camp, of which Mr. Bunbury writes: "The place where we camped was a patch of heather overlooking Ranau plain, and we named it Saiat Saiat (Dusun for heather)." The altitude is noted as about 12,000 ft.

This is the highest point that any Europeans have ever camped on the mountain. The party stayed there five nights, undergoing no light hardships owing to the raw weather and their exposed position. Mr. Bunbury notes that, in addition to the four Europeans, ten natives remained with the party at this camp; and he pays a tribute to the plucky way in which the Dusuns stuck to it "in spite of the cold and rain and sore feet caused by the constant climbing over rough wet rock." One of these—Umpoh—son of a former chief, told me, on my visit three years later, that Lieut. Harvey spent one night just below Low's Peak, altitude about 13,000 ft. This is not mentioned in Mr. Bunbury's account.

The five days were spent in careful survey work, resulting in the map of the summit plateau, which Capt. Learmonth has kindly allowed me to reproduce in this paper. As this is the only expedition that seems to have been properly equipped with surveying instruments, we may accept Capt. Learmonth's altitudes in preference to those of former writers. He makes the highest point (Low's Peak) 13,455 ft., *i. e.* some 200 ft. less than Sir E. Belcher made it seventy years ago. Altitudes of other peaks are given in the map.

Mr. Bunbury notes that they were unable to find a way round the head of Low's Gully which would lead to the unexplored north-eastern half of the summit.

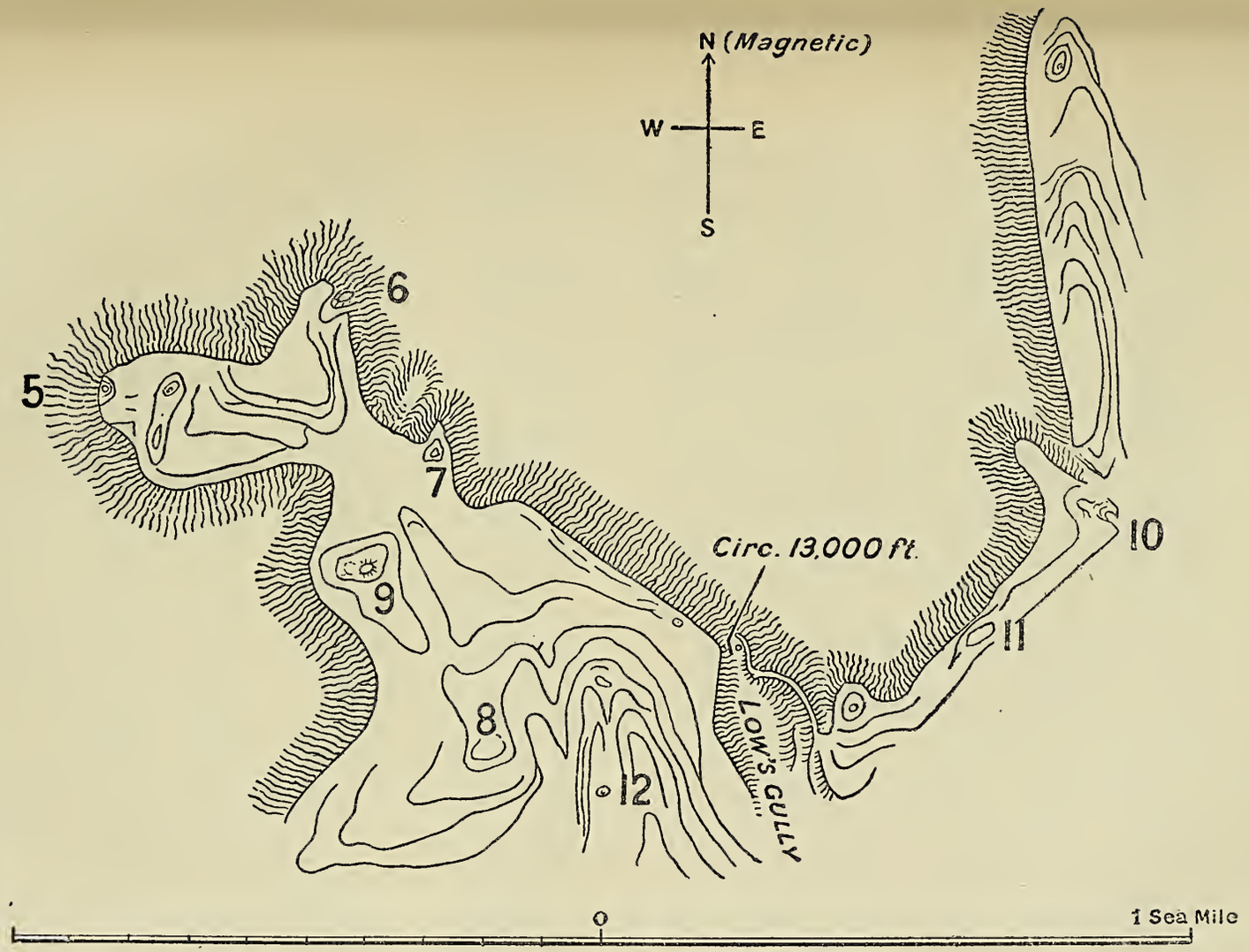
The party returned to Pakka on the 24th, to Lobang next day, and arrived at Kiau on the 26th. The return to the coast was accomplished *viâ* Tenom, the journey to that place occupying seven days.

Mention is made of a bottle found on the summit containing a document (apparently undated), on which a few lines of verse were written with the "Compliments of George H. Goss, Manhattan Hotel, New York, and Douglas Dodge, Simsbury, Connecticut."

I can find no other mention of these two names.

1910. *The British North Borneo Herald.* August 16th, 1910, pp. 146, 147. "An Unofficial Account of an Ascent of Kinabalu." By "Insaf."

This is an amusing account of the same expedition just



SUMMIT OF MT. KINABALU.

Traced from Map by Capt. F. C. Learmonth, R.N., who visited it June 18–24, 1910.

Names and altitudes of peaks, from Capt. Learmonth's survey:—

5. Alexandra Peak, 13,135 ft.
6. Victoria Peak, 13,450 ft.
7. Low's Peak, 13,455 ft.
8. Harvey's Peak, 12,860 ft.
9. St. John's Peak, 13,440 ft.
10. King George Peak, 13,346 ft.
11. King Edward Peak, 13,405 ft.
12. Sayat Sayat Camp, 12,500 ft.

described. The misfortunes of some of the members, particularly of the writer, who describes himself as a welter weight, make interesting reading. His descriptions of native life add fresh details to what has already been written on Kinabalu.

1910. *Jahresbericht der Freiberger Geol. Gesell.* vi. 1913, pp. 12–39 and map. "Geologische Studien in Britisch-Nordborneo." By Dr. R. Pilz, Consulting Geologist to the British Borneo Exploration Company.

The above paper is a general descriptive essay on British North Borneo, with special reference to its geological features and mineralogical wealth. The Kinabalu massif is called by the author a tonalite rather than syenite or hornblende granite; however, I am given to understand by a competent authority that the distinctions between these two are very small, and that a sample I brought from the summit is undoubtedly hornblende granite.

Dr. Pilz gives no account of his expedition to the mountain, which took place in July, 1910. The record of his visit was found on the summit of Low's Peak, dated July 27th, 1910.

1911. In the same place another record of one Albert Grubauer, of Munich, was found, dated June 29th, 1911. After this the mountain appears to have been left in peace till my own visit two years later.

1913. *The Sarawak Gazette*, 1913. Vol. xliii. pp. 248–250, 262–264. "A Collecting Expedition to Mt. Kinabalu, British North Borneo." By J. C. Moulton, Curator of the Sarawak Museum.

This is a brief report on my expedition to the mountain in August and September, 1913. Accompanied by seven native collectors I left Kuching on August 8th, reached Jesselton on the 15th, and, following the Tampassuk route, reached Kiau on the 20th, Pakka cave on the 24th, and the summit of Low's Peak on August 25th. In all, six weeks were spent on the mountain—camps were made at Pakka, Kamborangah, Lobong, Minitindok, Kalupis, Marei Parei, and Kinokok. The return journey was commenced from Kiau on October 2nd, the Tuaran route being followed instead of the Tampassuk. Reached Jesselton on October 7th, Singapore on the 12th, and Sarawak on the 16th. The first part of the above report was published in the 'Sarawak

Gazette' a fortnight later—November 1st—so that beyond an account of the journey little could be said of the scientific results of the expedition.

These may now be summarized as follows: No mammals or birds new to science were obtained; of the former, thirty specimens, representing thirteen species, were collected; of the birds, one hundred and eighty-seven specimens, representing sixty-two species. Owing to accidents with the spirit jars, our collections of fish, reptiles, and amphibia were poor. This deficiency, however, was more than made up by very large insect collections, which are still in process of being worked out. New butterflies (*Lycænidæ* and *Hesperidæ*) have been reported *; many new Coleoptera,† ten of them in the one family Tenebrionidæ; seven new dragonflies have already been described, including one new genus ‡; some of the new species of Hymenoptera and Heteroptera are described in the present number of this Journal. Plants have not been completely studied as yet, although I have little doubt that there will be some novelties § among the one hundred and twenty species gathered, in addition to a Begonia which Mr. H. N. Ridley describes as new in this Journal.

Permission to make this expedition was obtained from the British North Borneo Company Government, and, thanks to their officers, every facility was afforded me for making the journey to and from the mountain without difficulty or loss of time. The Assistant District Officer at Kotabelud, Mr. P. Skene Keith, was deputed to accompany me to the mountain, and we broached a bottle of champagne together on the summit of Low's Peak on August 25th. I owe much to the forethought and general efficient way in which this young officer managed our transport arrangements from the coast to the mountain. It was with the deepest regret that I heard of his death less than a year

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* "Some Undescribed Bornean Nymphalidæ," by J. C. Moulton, F.E.S. *Entomologist*, vol. xlviii. pp. 97–100, May, 1915. (Describes three Kinabalu forms in addition to those noted as new in the two families mentioned above.)

† "A New Cicindelid from Borneo," by J. C. Moulton, B.Sc., F.E.S. *Entomologist's Monthly Magazine*, No. 611, pp. 129, 130, and fig., April, 1915. Descriptions of other new Coleoptera have not been published yet.

‡ "Contributions to a Study of the Dragonfly Fauna of Borneo. Part III.—A Collection made on Mount Kina Balu by Mr. J. C. Moulton in September and October, 1913," by F. F. Laidlaw, M.A. (Camb.), F.Z.S. Proc. Zool. Soc. Lond., pp. 25–39, 1915.

§ Two species are described by W. W. Smith in Notes Roy. Bot. Gard. Edinburgh, No. xl., 1915.

later. He died in Jesselton hospital on July 6th, 1914, from wounds received in an affray with native outlaws not far from his station. A kinder host and nicer travelling companion it would have been difficult to find.

II. Native Guides from Kiau.

An inquiry as to who is the chief of Kiau leads one into a maze of intricate history, which I am afraid I did not succeed in unravelling. It seems that for a long time there have been two reigning houses, who, more or less, take it in turn to provide a chief of Kiau; occasionally a third family seems to come in. These headmen (the chief and pretender for the time) always accompany any Europeans on an ascent of Kinabalu.

On Low's first ascent, in 1851, Lemaing was the guide; in 1858, when St. John and Low reached Kiau, Lemaing was again called in to act as guide. St. John gives an amusing account of a dispute between Lemaing and Lemoung, the chief men of Kiau, the quarrel originally arising over the division of Low's goods seven years before! St. John writes: "The guide Lemaing carried an enormous bundle of charms, and on him fell the duty of praying or repeating some forms, which he continued for two hours by my watch. To discover what he said, or the real object to whom he addressed himself, was almost impossible through the medium of our bad interpreters; but I could hear him repeating my name, and they said he was addressing the spirits of his ancestors, and imploring their forgiveness for invading in our company their place of rest, for it is the belief of all the Ida'an that the summit of Kina Balu is the heaven of their race."

Later St. John recounts how Lemaing walked off with some brass wire. He goes on to say: "I am afraid I very much disconcerted him, as with one hand I tore the prize from his grasp, and with the other put a revolver to his head, and told him to beware of meddling with our baggage." On my visit to Kinabalu in 1913 I asked Sumpot, the present chief of Kiau, if he knew of this incident; he laughed, and replied that he had often heard his father, Kurou, speak of it. Kurou was the son of Lemaing; the present chief is thus the grandson of Low's guide.

On St. John's second journey Lemoung was chosen as guide, as Lemaing had been so unsatisfactory before.

The three ruling families of Kiau and the part they have

played in European visits may be better understood from the following tables:—

A. LEMOUNG'S FAMILY.

LEMOUNG, chief of Kiau on Low's visit in 1851; guide to St. John and Low on their second ascent of the mountain in 1858; died 1877–1878.

BOLOUNG, his son, and chief of Kiau on Lemoung's death (according to Burbidge).

B. LEMAING'S FAMILY.

LEMAING, guide to Low in 1851; to St. John and Low, on their first ascent, 1858.

KUROU, his son; guide to Burbidge 1877–1878, chief of Kiau, presumably on death of Boloung.

SUMPOT, his son; guide to Haviland in 1892, and to other Europeans, including myself in 1913. He became chief of Kiau on the death of Kabong (see below, Kabong's family). He has no son, and on his death will probably be succeeded by a son of Kabong.

C. KABONG'S FAMILY.

SANGAT; no information about him.

GUMBAL, his son; no information about him.

KABONG, his son; chief of Kiau in Whitehead's time (1887–1888); succeeded Kurou.

UMPOH, his son, a young man now; has accompanied expeditions from 1910 onwards; is looked upon as next chief of Kiau.

There remain three men whom I did not trace: *Limbawan* and *Tambias*, guides to Little in 1887, and *Lamat*, described by Miss Gibbs as "the potential headman of Kiau."

As explained in the foregoing accounts of Kiau, this big village is built on the side of the hill, and in earlier days consisted of three separate villages—one at the top of this spur, another half-way down, and a third close to the banks

of the Kadamaian below. This is probably the origin of the three reigning families of Kiau. At present there are only two villages, as Upper Kiau has joined up with Middle Kiau.

Little states that "*Kabong* was the headman of the middle village together with *Baging*," and that "*Bunahow* owns the lower village." These last two names I did not hear mentioned.

III. The Lake of Kinabalu.

Old writers refer to a lake on or near Kinabalu, and each visitor to the mountain, having failed to find it, has had to offer some new suggestion to account for it.

Low* dismisses it summarily: "I made diligent inquiries of the Dyaks, but could learn nothing satisfactory about it. Very few had ever heard of such a lake."

St. John,† in a paper read before the Geographical Society in London, states: "That it exists to the east of the mountain appears from inquiry to be certain; its size it is unnecessary to estimate, though our informant stated that, standing on one bank, it was not possible to see the opposite one. . . . We jointly questioned the Ida'an on many questions during our long stay at Kiau village; they spoke of it as a certainty, many affirming that they themselves had been on trading expeditions to it."

Several travellers having tried hard to be the first to find this elusive lake, it became rather the thing to prove definitely its non-existence. Treacher,‡ in a discussion on Admiral Mayne's article on explorations in British North Borneo, states that "the late Mr. Witti settled once for all the vexed question of the existence of the large mythical Kinabalu lake which had figured in all maps and charts of Borneo up to this time." He goes on to observe that "the late Mr. Frank Hatton supplemented Mr. Witti's investigations in that quarter; but visiting it at a different time of year he found that its flooded condition from the waters of the Linogu or Labuk river gave some little foundation to the ancient tradition of the lake's existence." Treacher refers to a plain some thirty miles east of Kinabalu, which is known as *Danau*—a word of no particular meaning to the Dusuns, but in Malay meaning *lake*. This plain is 1600 ft. above sea-level, and measures roughly four miles

* Journ. Ind. Arch. and East. Asia, 1852, vol. vi. p. 17.
† Journ. Roy. Geogr. Soc. 1863, p. 221.
‡ Proc. Roy. Geogr. Soc. 1888, p. 145.

long by one mile in width; it is surrounded by mountains which drain into this plain, flooding it at certain times of the year, so that this might well account for the mysterious lake which some knew of for certain, while others had looked for it all over the country in vain. Witti's long journeys in this district took place in 1881 and 1882. Between these two journeys W. B. Pryer took a long journey up the Kinabatangan, and Mrs. Pryer* relates how her husband "travelled within the limits of the lake, as marked on the map, for many miles. Inquiries from natives failed to elicit any information as to the existence of any large sheet of water anywhere in these parts, and W. therefore duly reported home the non-existence of the supposed Kina Balu lake." From Mrs. Pryer's book it would appear that her husband found this out in 1878, so that Treacher would then be wrong in crediting Witti as the first European to prove definitely the non-existence of the lake.

Personally I feel by no means convinced that the lake of Kinabalu is to be disposed of so easily. From my own inquiries among the natives of Kiau, I think that beyond doubt they have a legend to the effect that a lake did exist at one time on the mountain itself. It stands to reason that the passing traveller, usually with an imperfect knowledge of Malay, and almost always in entire ignorance of the Dusun language, cannot get such information out of a native at a moment's notice. To begin with, the younger generation of Dusuns on Kiau seemed to be remarkably ignorant or reticent about any local traditions or tribal legends; the older and more important men, on the other hand, were inclined to be more communicative, but unfortunately they knew very little Malay in comparison with the younger Dusuns, many of whom spoke this *lingua franca* of the country quite fluently. Although I lived with these people for six weeks, it was only towards the end of my stay on the mountain that I could get beneath the surface in my talks with some of them. From the moment of my arrival, however, they were always pleasant and easy to get on with, but questions about themselves, their customs, legends, &c., were nearly always received with suspicion, however delicately or circuitously I might lead up to them. Unlike up-river natives in Sarawak, these Dusuns seemed to be in deadly fear that what they said would one day be brought up in evidence against them. We must therefore look for trustworthy information from someone who will

* *A Decade in Borneo.* 1894, pp. 26, 27.

live among these people of Kiau, get to know them really well, gain their confidence, and, if possible, learn their language. From some such person we should be able to get a definite account of the Dusun idea of the lake of Kinabalu.

In the account of my expedition to the mountain in 1913 * I have suggested another solution to the problem, which had the merit of finding approval (rather a non-committal approval, I confess!) with Sumpot, the chief of Kiau. I have suggested that in the Minitindok gorge lies the key to the mystery. "This gorge is about 200 ft. high and barely 50 ft. wide; the sides even now are gradually falling in. Now if this narrow gorge were filled up—and its appearance suggests that the Kadamaian has only broken through at no great distant date—a fine lake would be formed, enclosed by the two southern spurs of Kinabalu which divide above the Pakka camp."

A geologist should have no difficulty in finding evidence to support or refute my suggestion.

IV. Meaning of the Name Kinabalu.

The following derivations of the name Kinabalu have been suggested from time to time:—

(i) That the word is *Kina Balu*, meaning *Chinese Widow*, owing to the white appearance of the mountain, and to the fact that a long time ago a large number of Chinese visited the mountain or lived near it. Another story is that the Chinese tried to obtain the treasure from the summit, but the dragon on guard killed so many that the mountain was called Chinese Widow on account of the number of Chinese ladies who lost their husbands on that occasion.

(ii) That the word is a corruption of *Kina Bahru*, meaning *New China*, in allusion to a former Chinese colony in that region. As is well known, Chinese have difficulty in pronouncing the letter "r," so the corruption of *Kina Bahru* to *Kina Balu* is not unnatural.

(iii) That the word is *Nabalu*, which in the Dusun language means *Resting-place of the Dead*. The Dusuns believe that after death their souls go to the top of this mountain, which they speak of by

* *Sarawak Gazette*, November 17th, 1913.

this name, accentuating the middle syllable.* This last explanation seems to me the most acceptable.

The subject has been discussed again quite recently in the correspondence columns of the *British North Borneo Herald*, where Mr. E. O. Rutter suggests that the word is really *Aki-na-balu*, meaning *The Solitary Father*, "aki" being the Dusun and Murut word for "grandfather"; "na," he states, is a prefix "which constantly occurs in the Dusun and Murut languages, sometimes denoting a past participle (= Malay 'ber'), sometimes interrogatory ('nakito ku,' do you see?), and in other cases apparently for the sake of euphony." He then states that "the word 'nabalu' in Dusun means widowed, without a partner ('balu'=widow or widower)." The solitary grandeur of the mountain is supposed to fit this ingenious name. The unfortunate part about this suggestion is that the Dusuns on the mountain do *not* refer to it as *Kinabalu*, but as *Nabalu* only. Perhaps we can find a *via media* between his translation of the word *Nabalu* ("without a partner") and mine ("the resting-place of the dead")? May it not mean "the place of separation," "the place set apart"? Perhaps some such translation would embrace both our suggestions.

V. Agenda.

In conclusion, I should like to call the attention of future visitors to Kinabalu to the following points, which, as far as I know, are all untouched and require investigation:—

An exploration of the north side of the mountain; in particular, the great chasm which lies immediately below Low's Gully.

An exploration of the long row of peaks running off to the north of Low's Gully.

An exploration of the path on the mountain leading beyond the Marei Parei spur to the head of the Pangataram stream and on beyond. One should be able to descend from Kiau that way, but I believe no European has done it.

Is it possible to ascend the spur bordering the *right* bank of the Kadamaian?—the Kamborangah spur leads up to the *left* bank.

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* St. John states that the mountain is "called *Kini* by the Dusuns and Ida'an." (*Life in the Forests of the Far East.* 1863. [2nd ed.] vol. i. p. 365, footnote.) St. John's excellent book, which is so accurate in most statements, nevertheless contains several blunders, and I conclude this must be one. Dusuns and Ida'an, by the way, are one and the same people.

Is it possible to make the ascent from the next valley to the south-east, which leads up to the summit plateau near the entrance to Low's Gully ?

Natural history collections have been made on the western and southern sides only. Are there any striking novelties to be found on the other slopes ?

There are several small caves or rock shelters in different parts of the mountain ; in view of the great height of the mountain and its comparatively isolated fauna, a thorough search for bone remains would be of exceptional interest.

Collecting in a tropical country results in the discovery of a never-ending series of new species. Kinabalu, of course, is particularly attractive in this way, and an immense amount of work remains to be done before we can say the fauna and flora of the mountain is really known. Whitehead has done the birds and mammals, and I think the odds are rather against turning up anything new in those two classes; but that does not apply to the Vegetable Kingdom, or to any other branch of the Animal Kingdom.

VIII.—A New Begonia from Borneo. By H. N. Ridley, C.M.G., F.R.S.

A very pretty new *Begonia* was obtained on Mt. Kinabalu recently (October, 1913), by Mr. Moulton, and brought down alive to Kuching, where I saw it in cultivation. It gives me great pleasure to name it after Mrs. J. C. Moulton, whose kind hospitality I enjoyed during my recent stay in Kuching.

Begonia Beryllæ, sp. nov.

Herba ad 4 pedes crescens, erecta. Folia ovata, obtusa, basi rotundata, inæquilateralia 4 poll. longa, 2·25 poll. lata, glabra, nervis rubris 8, margine undulato, petiolo rubro 0·5 poll. longo. Flores paniculati, plures; panicula multiramosa, fere sessilis, 1·5–2 poll. longa. Bracteæ binæ, obovatæ, truncatæ, medio dente instructæ, albæ vel viridescenti-albæ, 0·25 poll. longæ, glabræ. Flores masculi plures, 0·5 poll. lati, albi. Sepala 2, elliptica, obtusa, 0·25 poll. lata. Petala 2, anguste linearia. Stamina perparva, circiter 15, fere ad basem libera, antheris oblongis obtusis. Flores feminei 2–3 in ramis paniculæ inferioribus. Ovarium 0·3 poll. longum, 0·25 poll. latum, alis æqualibus haud multo elevatis. Sepala et petala subæqualia, 4 (vel 5), 0·25 poll. longa, alba. Stigmata haud ramosa, contorta.

Borneo: Mt. Kinabalu ad 4600–5000 pedes altitudinis.

This charming plant was found on high rocky banks of Kinabalu at from 4600 to 5000 ft. altitude. The stem, branching and almost woody, though not very stout, attained a height of about 3 ft. The ovate blunt leaves have an unequal rounded base, and are 4 in. long and $2\frac{1}{2}$ in. wide, of a smooth, light green and quite glabrous; the veins are bright red beneath, as is the petiole. The leaves are crowded at the tip of the stem. The small but numerous

white flowers are crowded in short panicles, the females being two or three in number on branches at the base. Each flower has a pair of oblong white bracts with a short central tooth; so that this plant belongs to the *Bractei-begoniæ* group. The male flowers, only $\frac{1}{2}$ in. wide, have two outer sepals and two narrow inner ones and few stamens. The female flowers usually have the sepals and petals nearly equal, the petals slightly falcate but otherwise similar to the sepals, and an extra narrow petal. The fruit is shield-shaped in outline, narrowed to the base, above wide, truncate, with the outer angles blunt, the three wings equal and very narrow.

The plant is most nearly allied to *B. Havilandii*, Ridl., in its white bracts and in the form of flowers, but differs in its completely glabrous habit and its tall erect stems.

IX.—Description of a Species of Heteroptera from Mt. Kinabalu, British North Borneo.—By W. L. Distant.

Fam. Pentatomidæ.

Subfam. Tessaratominæ.

Dalcantha angularis, Bredd. Wien. Ent. Zeit. xxiii. p. 17 (1904).

Head, pronotum, and scutellum very dark, dull, olivaceous-green, posterior area of pronotum dull purplish-brown; eyes and lateral margins of head behind them, and apex of scutellum, ochraceous; corium dull purplish-brown, base of lateral margin ochraceous, the clavus dark, dull, olivaceous-green; membrane bronzy-brown; connexivum olivaceous-green, outwardly and inwardly spotted with ochraceous; body beneath and legs ochraceous, prosternal margins and an oblique line near base, anterior margins of coxæ, a central longitudinal fascia to abdomen, spiracles, and an almost continuous narrow lateral abdominal margin dark olivaceous-green; antennæ with the basal and apical joints ochraceous; second, third, and base of fourth joint olivaceous-green; basal joint stout, passing apex of head, second and third longest, subequal in length, each a little longer than fourth; head with the lateral lobes a little longer than the central lobe, their apices broadly, obliquely truncate, their lateral margins concave, the whole finely granulate, eyes a little upwardly recurved; pronotum with the anterior area finely granulose, the posterior area transversely strigose, the anterior angles broad, their anterior margins sinuate, the apices acute; scutellum transversely strigose; corium obscurely finely granulose and palely pilose; tegmina with the veins prominent and

dark; connexivum strongly, acutely dilated on each side, the apices of the dilated segments acute.

Long. ♂ 19 mm.; breadth pronot. angl. 11 mm.; greatest abdom. breadth 16 mm.

Hab.—Kinabalu Mt. 2700–3000 ft. (J. C. Moulton; Brit. Mus.)

From its smaller size I was at first inclined to consider this specimen as distinct from Breddin's species. The British Museum has, however, recently received specimens from Sumatra which prevents this conclusion being maintained.

X.—A New Geometrid Moth from Kinabalu.

—By L. B. Prout.

Boarmia (*Cleora*) *versicolor*, n. sp.

♀, 42 mm. Shape and coloration of *megaspilaria*, Moore (Proc. Zool. Soc. Lond. 1867, p. 629), but with rather more reddish admixture in fore wing (especially between postmedian and subterminal lines) and at inner margin of hind wing; postmedian line of fore wing shaped nearly as in *semiclarata*, Walk. (List Lep. Ins. xxiv. p. 1029), but not quite so much incurved after the projection at R^{1-2}; differs from both the allies in venation (SC^1 of fore wing arising from SC^2 near its base, anastomosing with C), in its large size, in having a narrow whitish band edging the postmedian line proximally (and reappearing at inner margin of hind wing) and the subterminal acutely dentate with some heavy black shading proximally.

Mt. Kinabalu, 10,000–10,500 ft., August 27th, 1913. Type in coll. Brit. Mus. A second example, rather smaller, in coll. Sarawak Mus. (Register number 8.)

XI. — Two New Wasps of the Genus Ampulex.—By Rowland E. Turner, F.Z.S., F.E.S.

Ampulex atrohirta, sp. n.

Viridi-cærulea, nitida; antennis tarsisque nigris; mandibulis piceis; tibiis anticis infra, femoribusque posticis rufis; alis hyalinis, ante apicem late infumatis; vena prima transverso-cubitali obliterata.

Long. 16 mm.

♀.—Antennæ short and stout, the second joint of the flagellum equal in length to the third. Scape, clypeus, front, pronotum and sides of the mesonotum rather thickly clothed with long black hairs. Clypeus with a longitudinal carina, very narrowly produced at the apex and ending in a shallowly emarginate process overhanging the mandibles. Head deeply punctured, a very large space surrounding the ocelli smooth and shining. Eyes converging very slightly towards the vertex, where they are separated by a distance about twice as great as the length of the second joint of the flagellum; ocelli in an equilateral triangle, very near together; head not produced behind the eyes. Pronotum without a sulcus or tubercle, deeply but not closely punctured, broader than long; mesonotum deeply but sparsely punctured anteriorly, almost smooth posteriorly; scutellum smooth, with a row of deep punctures at the base and at the apex. Mesopleuræ deeply punctured, without a longitudinal groove. Median segment half as broad again at the base as long, the tooth at the posterior angles very short and blunt, the third longitudinal carina is almost twice as far in the middle from the second as from the fourth, the space between the second and third carinæ more finely striated than the space between the first and second. Abdomen smooth and shining, the second dorsal segment nearly half as long again as broad; apical

segments moderately compressed laterally. Radial cell pointed at the apex; only two cubital cells, the third abscissa of the radius half as long as the second, so that the second transverse cubital nervure is received at a considerable distance from the apex of the radial cell. The penultimate joint of the tarsi is more than half as long as the apical joint, which is inserted at the base of the penultimate.

Hab.—Limbang River, Sarawak. April, 1910. (J. C. Moulton.)

This does not seem to be very near to any described species, though resembling *A. trichiosoma*, Cam., in the long black hairs on the head and thorax, but the head in that species is narrowed into a neck behind the eyes.

Ampulex moultoni, sp. n.

Viridi-cærulea, nitida; antennis, clypeo, mandibulis tarsisque nigris; tibiis anticis piceis; femoribus posticis et intermediis rufis; alis hyalinis, leviter infumatis, vena prima transverso-cubitali obliterata.

Long. 18 mm.

♀.—Antennæ short and stout, the second joint of the flagellum longer than the third by about one quarter. Clypeus strongly raised in the middle, the longitudinal carina from the base branching before the middle, the branches produced to the apex of the clypeus and enclosing an elongate triangular area. Head rather deeply punctured, rather closely on the front, very sparsely on the vertex. Eyes converging strongly towards the vertex, where they are separated by a distance about equal to the length of the second and third joints of the flagellum. Head slightly produced behind the eyes. Pronotum a little broader in the middle than long, very deeply punctured, with a longitudinal sulcus reaching from the anterior margin to the middle. Mesonotum and scutellum very sparsely punctured; the mesopleuræ rather more closely punctured and without a longitudinal groove. Median segment a little broader in the middle than long, the tooth at the posterior angles rather short and blunt, but better defined than in *atrohirta*; the third longitudinal carina is nearly twice as far in the middle from the second as from the fourth. Abdomen shining, with a few minute punctures, somewhat compressed laterally in all the segments, very strongly in the apical segments; the second dorsal segment nearly twice as long as the median breadth. Penultimate joint

of the tarsi less than half as long as the apical joint. Radial cell rounded at the apex; only two cubital cells, the third abscissa of the radius less than half as long as the first transverse cubital nervure, so that the second transverse cubital nervure is received very near the apex of the radial cell.

Hab.—Mt. Kinabalu, North Borneo. About 3000 ft. September 1913. (J. C. Moulton.)

This is allied to *A. cognata*, Kohl, but differs in the much coarser sculpture of the pronotum and the lesser development of the pronotal sulcus, in the shape of the head and pronotum, and in the position of the second transverse cubital nervure, which is a little further from the apex of the radial cell. It is still more closely allied to *A. latifrons*, Kohl (*brevicornis*, Cam.), from N.-E. India, and to *A. javana*, Cam., from Java; and is doubtless the Bornean representative of those forms, from both of which it differs in the closer and deeper puncturation of the head, especially on the front. From *latifrons*, also, in the much greater extent of the triangular enclosure on the clypeus, and the greater elongation of the head behind the eyes. I only know *javana* from the description, but the proportionate length of the joints of the flagellum appears to be different, apparently also the colour of the intermediate femora; but on the latter point the description is confused. *A. hospes*, Sm., from Borneo, which in many points approaches *cognata*, has the clypeus quite differently formed.

XII.—Ethnological Notes.

A Dayak Song.

The following song (*lagu*) was taken down in a Sea-Dayak house near the head-waters of the Oya River (Sarawak). It is sung, or perhaps rather hummed, without accompaniment in a monotone by four or five unmarried Dayak girls. Standing one behind the other they move slowly round in a circle, beating time with their feet and waving their arms in graceful movements. The girl in front leads the *lagu*, which can go on indefinitely; it is not sung straight through, as she may select any two lines and repeat the same several times in succession.

Like other Dayak songs, it is practically impossible to translate; several words are inserted which have no meaning, as they are brought in solely for rhyming purposes; these usually end in "n" or "ng," and enable the singers to produce the humming effect by dwelling on these consonants. Other words belong to an old language which is only kept alive in such songs as these, and to most Dayaks they are now meaningless; in some cases, no one at all can suggest a translation.

1. Undang jangut Undang.
2. Kuku gramar batang.
3. Undai jangut Undai.
4. Kuku gramar sungai.
5. Sugu gaiu, ulu Mugang.
6. Untun munyun tiup daun.
7. Tapis nawan, tapai nabai.
8. Intabar unti mulai.
9. Injang sanyan, injang saja.
10. Dikor nabau dikor sawar.
11. Dikor sawar tedong.
12. Kelong besai nampar.
13. Ingjin niok ingjin.
14. Dudi jadi dhulu ingjin.
15. Inja niok inja.
16. Dudi jadi dhulu darah.

1. "The beard of the prawns."
2. "The claws of the prawns that live in the wood in the river-bed."

3. "The beard of the prawns."
4. "The claws of the prawns that live in the river."
5. "The musical instruments made with a comb used in the head-waters of the Mugang."
6. "The insect *munyun* blows on the leaves."
7 & 8. These lines are in the old language. The Dayaks themselves do not know the meaning.
9. "Shaking *sanyan*, shaking only."
10. "The place of the dragon, the place of the python."
11. "The place of the cobra."
12. "The large circle made of them can be seen."
13, 14, 15, 16. "Before they were only in love;
"Now they are married to one another."

W. R. Barry Gifford.

"Ulid Puoad" and "Pasang Salang"; Customs observed at Death among the Bisayas of Sarawak.

The following notes were collected on some recent visits up the Limbang River, Northern Sarawak:—

"Ulid Puoad."

The corpse is laid on a bier resting on six gongs, which in turn rest on another bier supported by four cannon lying on the ground.

The feet of the corpse must point towards the West, as the Bisayas believe that the souls of the dead abide in the place where the sun sets; they point the feet of the dead in that direction so that the soul, on leaving the body, shall have a straight road to travel on; the body is also buried in this position.*

The husband of the dead woman (or *vice versa*) may not leave the house for forty † days, *i. e.* may not sleep in any other house; this, however, is mitigated slightly in this way:—

"For fourteen † days the mourner may not leave the

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* [Compare the Christian custom of burying the dead in the opposite direction, so that on rising they may face the East, where, from a westerner's point of view, Christ appeared. Like many other customs in the Christian religion, it has been borrowed, probably, from older Pagan ideas and adopted to suit the requirements of the newer religion. As a relic of sun-worship we may remember that Christ is called "the Sun of Righteousness."—Ed.]

† I am informed that the number of days has no particular significance nowadays; it is simply the old custom.

house or bathe on any account whatsoever, but after the feast, which is held on the fourteenth day, he may go out of the house by a ladder, which is specially made for this purpose. The ladder is then destroyed, and he returns to the house by the public way. Nobody else may use the special ladder." During the rest of the mourning, he may go to work, &c., but may not sleep in another house.

The mourner is always dressed in white during the forty days. It is only the very rich people and those of great importance in the land who may use black for mourning.

At the time of death, guns are fired and gongs beaten; this occurs at stated intervals throughout the day. The corpse is buried the day after death, with the cannon (*bedil*) and gongs on which it has rested.

The body is put into a box of hard wood (*bilian*), which has a pointed roof on the lid, and under the roof are put the *bedils*, &c., gold, silver, and money. This property is all buried and may not be exhumed. The coffin has a post at each corner which holds it together and prevents the roof from slipping off. Any other relations dying afterwards are buried in the same coffin, which is opened for that purpose. As many as twenty people are buried in one coffin.

Another custom is that the corpse is put into a coffin of soft wood (*plai*), which is kept in the house, against the wall, covered up with gongs, and resting on *bedils*. After one year the coffin is opened and the bones transferred to another coffin of hard wood (*bilian*), which is then buried. They also hold a big feast for this ceremony which is known as "Mentulang." A death is the signal for a great feast, at which much "Pengasi" (native spirit made of rice, paddi, sugar-cane, and wood-ash) is drunk, and many buffaloes killed. This feast lasts for two or three days. Another is held after fourteen days, and another and final one after forty days.

"Pasang Salang."

After the corpse has been disposed of, a big flare is lighted in the living-room (*bilek*) that night. The fire is made of "Upeh Pinang" (the outer cover of the skin which protects the young betel-nut) which contains powdered Damar, and is about a foot and a half long. This "candle" is called "Salang." The *salang* is placed erect on a pile of *bedils* and gongs, and is lighted at sundown and extinguished at dawn every day during the forty days. The people take it in turns to watch this fire, so as to save accidents. If,

during the forty days of mourning, a boat with awnings goes up river the mourners have a right to call to the boat and ask for alms (*minta sedika*). If the people in the boat do not comply, they can be fined a "Gangsa" or some other brass utensil. Also, if a person strikes a gong (other than those used for mourning) near the house, on land or on the river, he can be fined. Boats going down river are not required to give alms. The old people say that at night when the *salang* is burning, if the flame burns low, it is a sign that a boat is passing the house with a fowl on board. They then have to call the boat and take some of the fowl's feathers to rekindle the flame. If they neglect to do this, the candle will go out, which signifies bad luck. The above custom refers to married people only.

The Bisayas believe in a future state, which takes the form of a life similar to this, but under more beneficial terms. They think that the land to which they will go will be richer and more fertile than their present abode, and that there they will meet all those who have gone before. They also believe that there is a wonderful tree growing there which has every kind of fruit growing on it, and a branch for each kind; also that as fast as the fruit falls more fruit springs out of its branches.

P. C. B. Newington.

Note on a Penggang "Melegong."

This plate originally belonged to a Treng woman who was captured by a Mitting man in a raid; afterwards, these tribes made peace, and the Mitting man married his captive, who was of high birth (*bangsa Rajah*). The offspring of this marriage was Aban Tassan, of Batu Blah, the last owner of the plate.

The plate is curious on account of the chips made in its rim. This chipping apparently was a well-known Treng custom, and at the death of the owner of any property such as a plate or a jar, a chip was made in the rim (or in the case of a jar an ear was knocked off), in memory of the occasion and also as deceased's share of this property. This performance could only be done by a chief or an old man who had taken a head, and it was made the occasion of a feast and typical native debauch; a present was made to the man who performed the ceremony.

The Trengs and Mittings are two of the older established

tribes of Borneo, and inhabited respectively districts on the Tutau and Tinjar rivers, tributaries of the Baram. They are practically extinct now.

The same curious custom occurs amongst the Alfours or Alfuros in the Molucca Islands, bowls or plates being slightly chipped in honour of the spirits of the departed ones, and also as their share of the property.*

C. D. Adams.

Measurements of some Dusuns.

On my expedition to Mt. Kinabalu, British North Borneo, I stayed several days in the Dusun village of Kiau, which is built on one of the spurs of the mountain, some 3000 ft. above sea-level. This village became my base, from which the ascent was made, as well as other excursions to different parts of the mountain. The natives of the village acted as carriers on these occasions, and I saw a good deal of them in one way and another; for instance, seeing that natural history specimens were the object of my visit, they used to swarm into my quarters at all hours of the day, to bring me plants, insects, and odds and ends, for which I doled out innumerable cents, wads of gambier, reels of cotton, needles, matches, &c.; then they used to take me to their houses to have a quiet talk sometimes, or perhaps to spend a cheery evening, enlivened with dances, beating of gongs, and a rather pleasant intoxicant made from fermented coconut water.

They were a friendly, hospitable lot, and I took the opportunity of measuring seventy-five of them, with the idea of comparing the measurements of their height with that of their span. I also got them to stretch their hands on a ruler and then noted in millimeters the measurement of their stretch from thumb to little finger. They made no objection to this performance, but treated the whole thing as a joke, the "patient" for the moment usually becoming the object of good-humoured gibes from his or her friends standing by.

The following three tables show the measurements of (1) forty-five adult men, (2) twenty boys, and (3) ten adult women.

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* Vide *Java, Sumatra, and other islands of the Dutch East Indies*, by A. Cabaton.

TABLE I.

Measurements of Adult Dusun Men of Kiau.

Name.	Height in feet and inches.	Span in feet and inches.	Excess of span over height in inches.	Hand stretch in millimeters	Remarks.
1. Segugar ..	5·0½	5·2¼	1¾	220	
2. Moian	5·3¼	5·5½	2¼	205	
3. Ginulu....	4·9½	4·11¾	2¼	192	
4. Kentuan ..	4·11	4·11¾	¾	180	
5. Yali	4·11½	5·3½	4	200	
6. Gandilo ..	5·0½	5·4¾	4½	188	
7. Gandilo ..	5·2½	5·5¾	3¼	198	
8. Baliong ..	4·11	5·1½	2½	189	
9. Gumpitan	4·11¾	5·1½	1¾	191	
10. Sumpot ..	5·4⅛	5·8¼	4⅛	187	Chief of Kiau
11. Tembaging	5·1¾	5·5⅝	3⅝	195	
12. Dumalan ..	4·10½	5·1¼	2¾	190	juv.
13. Rantian ..	5·2	5·3¾	1¾	190	
14. Segobun ..	5·3¾	5·7⅜	3⅝	213	
15. Berangit ..	4·11	5·1	2	195	
16. Yampungan	4·11¼	5·2	2¾	188	
17. Yobut	5·2½	5·7¼	4¾	221	
18. Tingak....	5·2	5·4½	2½	191	
19. Segidun ..	5·3½	5·5¼	1¾	194	
20. Damit	5·1	5·4¾	3¾	199	
21. Gaduan ..	5·1¾	5·2¼	½	195	
22. Gombat ..	5·0¾	5·3¾	3	200	
23. Tingaian ..	5·0¼	5·1½	1¼	207	
24. Timbangan	5·0¾	5·4¾	4	185	
25. Lantou....	5·2¾	5·6¼	3½	205	
26. Pendiling..	4·7	4·10¼	3¼	182	juv.
27. Mergis	4·9¼	5·0¾	3½	180	juv.
28. Linkidun..	5·2½	5·7¾	5¼	202	
29. Kelaman ..	4·11¾	5·4¼	4½	178	
30. Gimundok	5·3¾	5·7	3¼	206	
31. Ambang ..	5·—	5·4⅛	4⅛	191	
32. Lihoban ..	5·1½	5·3½	2	191	
33. Magaiou ..	4·10¾	5·1¾	3	187	
34. Koroh	5·1¾	5·4¾	3	204	
35. Sihoban ..	4·11½	5·2¼	2¾	190	
36. Sindongat	5·—	4·11½*	—½	189	* right arm stiff at elbow and slightly bent
37. Liman	5·0¾	5·5½	4¾	208	
38. Timbangan	4·10	5·1¼	3¼	197	
39. Umpoh....	5·3	5·6¾	3¾	200	
40. Runggan ..	5·1	5·3	2	193	
41. Tembogok	5·0¾	5·4¼	3½	205	
42. Ikatong ..	4·8¼	4·9¾	1½	191	
43. Selagan ..	5·0½	5·3½	3	220	
44. Sudaran ..	4·11¼	5·2	2¾	187	
45. Sapoh	5·—	5·2½	2½	198	
Average ...	5 ft. 0·533 n.	5 ft. 3·416 in.	2·883 in.	191·48 mm.	

TABLE II.

Measurements of Dusun Boys of Kiau.

Name.	Height in feet and inches.	Span in feet and inches.	Difference in inches.	Hand stretch in millimeters	Remarks.
1. Poriak ..	3·7¾	3·8½	¾	156	"8 years"
2. Baioh ..	3·11¼	4·2	2¾	150	"10 years"
3. Kadok ..	4·6¼	4·6¾	½	185	? 14
4. Gunak ..	4·7	4·8⅛	1⅛	170	
5. Lompok	4·2¾	4·2¾	—	177	"9 years"
6. Bangku	4·8¾	4·11½	2¾	175	? 14
7. Gitik ..	4·5½	4·6½	1	165	? 11
8. Gunting	4·2	4·2¼	¼	159	? 9
9. Seribu ..	3·10	3·11¾	1¾	156	? 9
10. Temuk ..	4·0½	4·0¼	—¼	154	
11. Labi	4·4	4·5	1	155	
12. Gunak ..	4·0¼	4·2⅞	2⅝	154	
13. Ludin ..	3·11	4·0¾	1¾	152	
14. Gindat ..	4·9¼	5·0½	3¼	197	? 15
15. Yapak ..	4·8½	4·10½	2	177	
16. Kiloh ..	4·5½	4·8	2½	175	
17. Duli	4·7¼	4·9¾	2½	180	
18. Kandu ..	4·7¼	4·9¼	2	172	
19. Gadas ..	4·7½	4·6⅝	—⅞	174	
20. Kendapak	4·—	4·1¼	1¼	175	
Average ..	4 ft. 3·7125 in.	4ft. 5·14375 in.	1·43125 in.	167·9 mm.	

TABLE III.

Measurements of Dusun Women of Kiau.

Name.	Height in feet and inches.	Span in feet and inches.	Difference in inches.	Hand stretch in millimeters.
1. Tokala	4·7¾	4·10¾	3	200
2. Rampaian	4·10½	4·11½	1	190
3. Kantihay	4·6	4·9¼	3¼	182
4. Sindahan.....	4·7	4·6½	—½	175
5. Rinsayat	4·8½	4·8¾	¼	182
6. Kundisin	4·8⅜	4·10¼	1⅞	194
7. Surugou	4·6	4·6¾	¾	177
8. Nigoh	4·8½	4·9¾	1¼	195
9. Limpoka	4·9⅞	4·9	—⅞	190
10. Siapah	4·4½	4·5¾	1¼	180
Average	4ft. 7·7 in.	4ft. 8.825 in.	1·125 in.	186·5 mm.

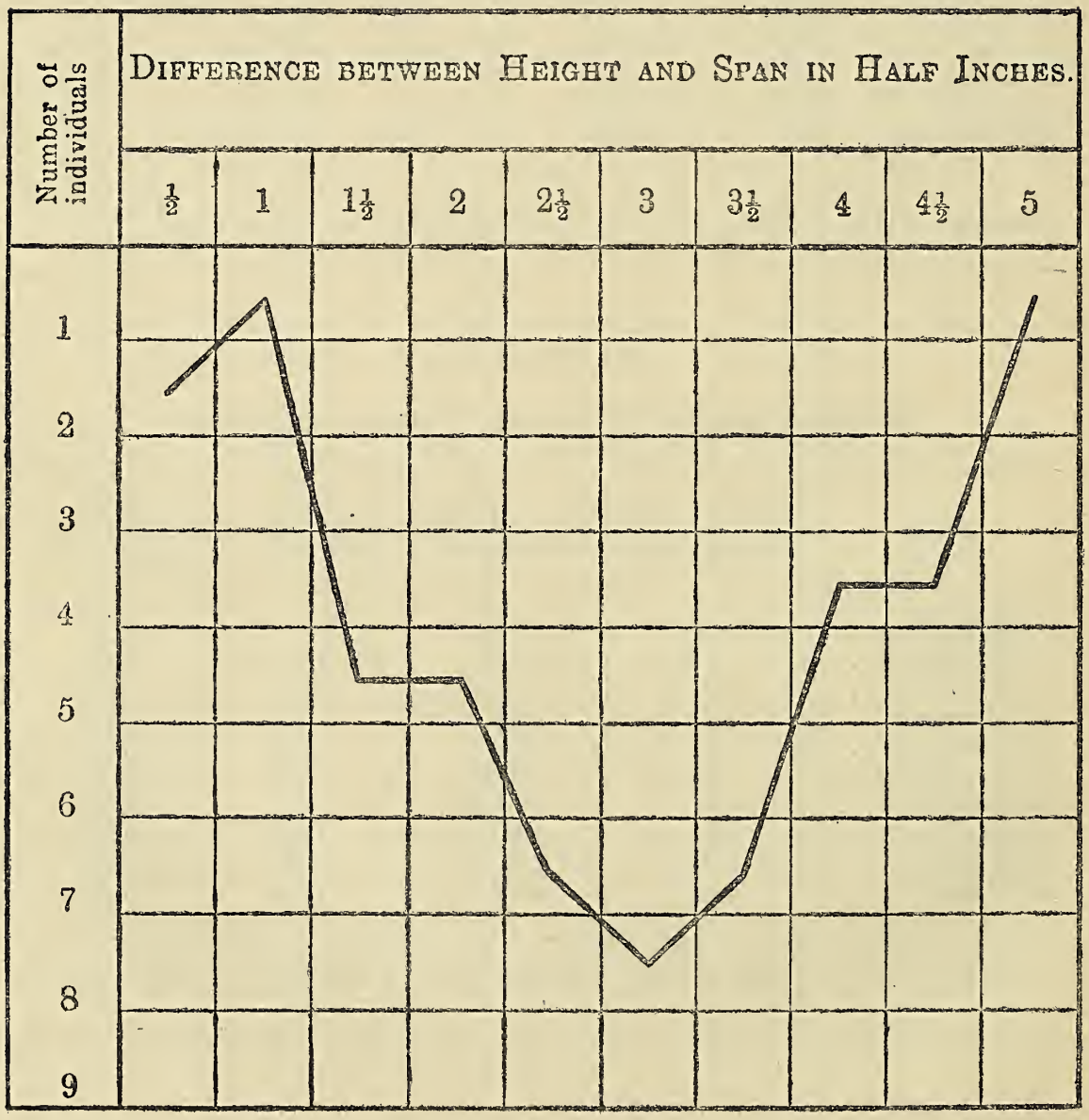
It is unsafe to generalize on such a small percentage of the Dusun tribe, but a few facts of interest emerge from these tables, which I think are not without value, at any rate as an indication of what we might expect from measuring a greater number of individuals.

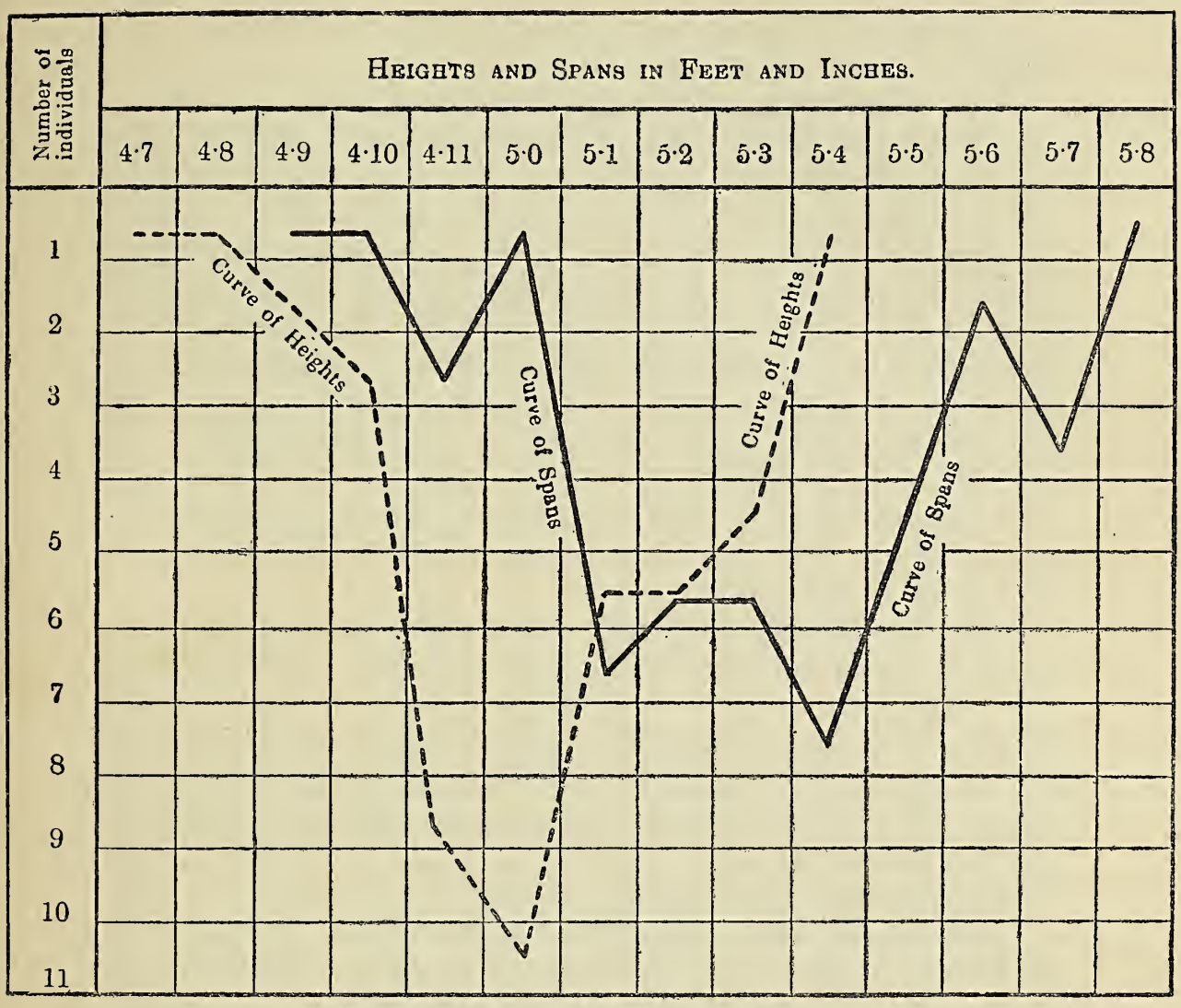
The average height of the men works out as 5 ft. $0\frac{1}{2}$ in., with average span of nearly three inches more. In one case only was the span less than the height, *viz.* in one man whose right arm was stiff at the elbow and slightly bent. Two out of the remaining forty-four men spanned less than an inch over their height, six spanned less than 2 in. over their height. One man spanned $5\frac{1}{2}$ in. more than his height.

Two of the shortest men measured 4 ft. 7 in. and 4 ft. $9\frac{1}{4}$ in., but I noted that they were probably not full grown. One of older years measured 4ft. $8\frac{1}{4}$ in.

The tallest man measured 5 ft. $4\frac{1}{8}$ in. and spanned 5 ft. $8\frac{1}{4}$ in. This was Sumpot, the present Chief of Kiau.

The following curves illustrate the foregoing remarks :—





Curves made from Table I.

The hand-stretches of the men ranged from 178 to 221 mm.; the average worked out as 191½ mm.

In the second table we can see a less uniform difference between height and span. Out of the twenty boys measured, two spanned less than their height, one was "all square," three spanned less than an inch over their height, two spanned exactly an inch more, while one, who was older than most of the others, reached the maximum difference of 3¼ in.

Their heights ranged from 3 ft. 7¾ in. (for an eight-year old), with span of 3 ft. 8½ in., to 4 ft. 9¼ in., with span of 5 ft. 0½ in. for the above-mentioned older boy, whose age I put down as about fifteen. In three cases they told me what they thought was the age of the boys, and between us we guessed it for others. Of course, like other Bornean tribes, they have no system of counting the years, and one

can only get at any particular date by comparison with local events of some importance.

The interesting point about these two tables is that, in the adult the span invariably exceeds the height, and that the average difference is approximately *one-twentieth* of their average height, while in the boys the span does *not* always exceed the height, and in the twenty measured the average difference was only *one thirty-sixth* of their average height. Now there is no reason to suppose that the twenty boys I measured were below the average build of Dusun boys, so it looks as if the excess of span over height comes with increasing years, and as a factor in this development the life of the Kiau Dusuns strongly suggests use. The Dusun boy begins manual work at an early age, and for the last two or three years of his growing period probably does the full work of an adult.

One has often read that, as a proof (one of many) of man's simian ancestry, primitive races have a greater span in proportion to their height than more advanced races, but in that case should we not find it more marked in the young than in the adult? However, as stated above, it is unsafe to generalize from such meagre statistics as these; nevertheless, this little point is, I think, worth mentioning if only as one requiring more study.

Our third table contains measurements for only ten women, mostly adult but unmarried girls. They are not sufficient in number to need more than a very brief note.

Their heights range from 4 ft. $4\frac{1}{2}$ in. to 4 ft. $10\frac{1}{2}$ in., with an average of 4 ft. $7\frac{3}{4}$ in.; their span averages out as 1 in. more than their height. In two cases it is less than their height, in two more it is less than 1 in. over their height, while the maximum of 3 in. and $3\frac{1}{4}$ in. is reached by two other girls. Their average hand-stretch is 186·5 mm., or 5 mm. less than the average hand-stretch of the adult men.

J. C. Moulton.

XIII.—The Butterflies of Borneo, with Notes on their Geographical Distribution, and Keys for Identification.

By J. C. Moulton, B.Sc., F.E.S., Curator of the Sarawak Museum.

Part I.

The earlier lists of Bornean butterflies appeared between 1887 and 1896 under the old binomial system. In 1904 the late Mr. Shelford began the task of bringing these lists up to date, and introducing in part the trinomial system. His work was published in 1904 and 1906, and dealt with the families Nymphalidæ and Lemoniidæ, 256 species in all. The present writer continued the work by publishing a part on the Lycænidæ, 300 species, in 1912, and another on the Papilionidæ, 78 species, in 1914. The concluding part on the Hesperidæ, about 160 species, is still unwritten.

Since the publication of Mr. Shelford's papers, several important works have appeared, which show the necessity of modifying the nomenclature and system used ten years ago. Principal among these is Seitz's *Macro-Lepidoptera of the World*, in which the trinomial system is adopted in its entirety. I have thought it a good opportunity to follow this great work and bring our Bornean list up to date.

The present part deals with the Nymphalidæ. The next will deal with the Libythæidæ and Lycænidæ, while a third will be devoted to the two remaining familes, the Papilionidæ and Hesperidæ.

With so much written on Bornean butterflies (and, be it confessed, so little known about them) I have thought it better not to give scattered notes on life-histories, and to

refrain as far as possible from lengthy discursions on questions of nomenclature. Numerous footnotes indicate that this latter temptation has been too much for me in many instances. The object of my list is primarily to enable anyone to identify a Bornean butterfly, and to invest it with its full and most up to date title.

It is a melancholy fact that some of our most conspicuous and unmistakable species should suffer a continual change of name; thus, first, the generic name is altered, then the specific name goes, then perhaps another generic name appears, followed by a revival of the older specific name. For a few years the student congratulates himself on stability at last, and then comes a subspecific name to remember, which is no sooner published than shown to be synonymous with some other form, which also bears another name.

I have departed from the usual method of writing trinomials by inserting the name of the author of the specific name as well as that of the subspecific name.

In recording the geographical distribution of each form, I have given first Borneo and any other country in which that identical subspecies occurs, separated by a semicolon from other countries in which different subspecies or races of that same species occur.

A glance through the list indicates one very obvious fact, namely that the three countries, Borneo, Sumatra and the Malay Peninsula, have a very large number of forms common to all three, and at the same time well separated from allied forms in neighbouring countries. For these three countries I propose to introduce the collective name "Neomalaya." The former connection of the three countries as one land mass is geologically a comparatively recent event, and on that account forms the explanation of the above faunistic relation. Similarly, their long separation from Burma in the north, Java in the south, and the Philippines in the north-east accounts for the comparatively distant relationship between the forms of those countries and those of Neomalaya.

Wallace called attention to this peculiarity long ago, but subsequent writers have been inclined to modify his outspoken words. Perhaps the latest modification is that of Fruhstorfer, who introduces the term "Macromalayana" to distinguish the Malay Peninsula and the three Greater Sunda Isles. Now, to my mind the fauna of Java is just as distinct from that of the Malay Peninsula as is that of

Burma. These three countries share an older eastern element of continental origin, but the Malay Peninsula alone of these has an essentially Malayan element, which it shares with the true Malayan countries of Borneo and Sumatra, together with their adjacent islands (Billiton, Banka, Natunas, &c.).

The so-called Malayan fauna no doubt had its origin in the eastern portion of the Asiatic continent. We may refer to it by a general term "Indo-Malayan" as opposed to the "Austro-Malayan" fauna which characterizes the eastern portion of the Malay Archipelago, and whose character has been determined by a northern extension of Australian (*s. l.*) forms. Within our "Indo-Malayan" region we get the formation of a purer Malayan fauna in the more restricted area I have called "Neomalaya."

The following bibliography refers to papers on Bornean butterflies only. More general works, like Distant's *Rhopalocera Malayana*, Moore's *Lepidoptera Indica*, and Staudinger's *Schmetterlinge das Inseln Philippinischen*, &c., contain references to Bornean species, but they are too well known to need mention.

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Fam. I. NYMPHALIDÆ.

Subfam. 1. Danainæ.

1. Hestia logani Moore *virgo* Fruhst.[1]
   Borneo; Neomalaya, Java, Sulu Isles.
2. H. lynceus Drury *fumata* Fruhst.[2]
   Borneo; Neomalaya, Java.
3. H. hypermnestra Westw. *hypermnestra* Westw.
   Borneo (south and south-east), Natunas; Neomalaya, Java.
4. H. hypermnestra Westw. *arbela* Fruhst.[3]
   North Borneo (Kinabalu).

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[1] Fruhstorfer gives two subspecies from Borneo: *alcine* from Pontianak and *virgo* from northern Borneo. The Sarawak series embraces the small differences between the two, so I place them all under the older of the two names. Shelford recorded it as *H. lynceus druryi*, a name which has now become *logani druryi* and restricted for the Sumatran form of this species.

[2] Fruhstorfer again gives two subspecies from Borneo: *favorinus* from Kinabalu, west to Pontianak, and *fumata* from Amuntai and Banjermasin. This latter is distinguished by the dorsal part of the abdomen being "brown instead of deep black," and "the roundish patches of both wings above dull brown-black instead of deep black." I have examples from Kinabalu and Sarawak before me, agreeing well with this description of the South Bornean form, and I therefore merge the two names under *fumata* (the older).

There appears to be some difference of opinion as to the original habitat of Drury's *lynceus*. Thus, Drury (1773) writes: "I received it from the island of Johanna, near Madagascar, in the Indian Ocean"; de Niceville (1882) says there is "no doubt that the large *Hestias* from the Wynaad (India) are identical with *H. lynceus*, Drury"; Moore (1890) describes *Hestia lynceus* as "the type of the genus; with very elongated and narrow wings. Occurs only in Borneo"; Bingham (1905) writes under *Hestia*, "Type, *H. lyncea*, Drury, from the Malay Peninsula"; and lastly, Fruhstorfer (1910) says, "The name-type *lynceus*, Drury, probably came from Sumatra."

The Bornean examples before me differ from Drury's figure in the distinct brown shade of the ground-colour and spots as opposed to his grey and black insect.

[3] Shelford gives the two Bornean subspecies as *Hestia belia hypermnestra* and *Hestia belia belina* Fruhst. This latter is a lighter form connected by transitions to typical *hypermnestra*. Westwood originally figured *hypermnestra* and *belia* on the same page, numbered figs. 1 and 2 respectively, so *hypermnestra* becomes the type of the species.

5. H. LEUCONOË Eschsch. *chersonesia* Fruhst.[4]
   Borneo, Malay Peninsula, Banca; Formosa, Philippines, Java.

6. IDEOPSIS DAOS Boisduv. *daos* Boisduv.[5]
   Borneo; Neomalaya, Palawan.

7. DANAIDA JUVENTA Cr. *kinitis* Fruhst.
   North Borneo; Malay Peninsula and Archipelago to Solomon Isles.

8. D. SIMILIS Linn. *vulgaris* Butl.[6]
   Borneo, Sumatra, Malay Peninsula, Java; Loo Choo Islands to Palawan, Sumbawa and Ceylon.

9. D. CROWLEYI Jenner-Weir.
   Mountains of North Borneo and Sarawak.

10. D. LUZONENSIS Feld. *præmacaristus* Fruhst.[7]
    Mountains of North Borneo and Sarawak; Philippines, Java, Lombok, Sumba, Sumbawa.

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[4] The Sarawak Museum series has examples with dark apex from North Borneo (= *nigriana* Gr.-Sm.), connected by a slightly lighter form from Northern Sarawak to typical Sarawak forms with broad white submarginal area and marked yellow tinge at base of fore wing (= *chersonesia* Fruhst.); there is also a Sarawak specimen without the yellow tinge and with rather lighter ground-colour (= *natunensis* Snell.).

As the last two occur together and the first two are connected by transitions, I unite all three under one subspecific name *chersonesia*, noting, however, that this Bornean subspecies has melanistic tendencies as it proceeds further north.

Shelford queried the subspecific value of the above three forms.

The Javan form *javana* Fruhst., described as intermediate between *chersonesia* and *nigriana*, should also be merged with *chersonesia* in all probability.

[5] Fruhstorfer refers typical *daos* to South Borneo, with darker males called form *infumata* from South-east and South-west Borneo, and a separate subspecies *ardana* from Kinabalu. The slight differences given by Fruhstorfer are not maintained in a series before me from Kinabalu, Sarawak mountains and Sarawak low country.

[6] Fruhstorfer separates the Bornean form as *kinitis*; the differences do not appear to me sufficiently distinct or constant to separate it from the forms found in the Malay Peninsula, Sumatra and Java.

[7] According to Fruhstorfer (1910) this subspecies is "very rare, hitherto only one male described from coll. Fruhstorfer." Shelford (1904) reported it as common on Mt. Penrissen in 1899. A female was obtained on my visit to that mountain in 1900; it differs from the male in having the white spots of the submarginal border in the hind wing rather more prominent. The wings are slightly broader and less pointed as in *crowleyi*. The abdomen beneath is white, not grey, as stated by Fruhstorfer.

11. D. ERYX Fab.[8]
Borneo, Java and Sumatra to Nias, Nicobars, Burma and Siam.

12. D. ASPASIA Fab. *shelfordi* Fruhst.
Borneo; Malay Peninsula, Palawan, Sumatra, Nias, Engano, Java.

13. D. LIMNIACE Cr. *kuchingana* Moulton.[9]
Sarawak; India to Formosa and the Philippines, Celebes, Java.

14. D. MELISSA Cr. *microsticta* Butler.
Borneo; India, China and Malaya to the South Sea Islands.

15. D. CHRYSIPPUS Linn. *chrysippus* Linn.
Borneo, India, China, Malaya to New Guinea; South-eastern Europe, Africa.

16. D. PLEXIPPUS Linn. *intensa* Moore.
Borneo, Java, Bali, Bawean; India to Formosa and south to Australia.

17. D. MELANIPPUS Cr. *hegesippus* Cr.
Borneo, Sumatra, Malay Peninsula, Natunas; India and Malaya to Java and Celebes.

18. D. LOTIS Cr. *lotis* Cr.
Borneo; Palawan, Philippines, Celebes.

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[8] The Sarawak series presents several variations, which seem to indicate that Fruhstorfer's subspecies should be merged under one name. Thus in some the inter-nervular areas are whitish, in others distinctly grey-green; in one the whitish lines are reduced to half the width of those in others from the same locality. Fruhstorfer uses Staudinger's name *borneensis* for the Bornean form.

[9] My description of this subspecies was published in the *Entomologist* for May, 1915 (p. 97). I quote it below:—

"Shelford records both *septentrionis* and *microsticta* from Borneo, the latter, I think, based on one female in the Sarawak Museum, which should be referred to *limniace*, hitherto unrecorded from Borneo.

"Typical *limniace* comes from the Himalayas, China, Hong Kong and Formosa. A lighter form from Ceylon and South India has been named *mutina* by Fruhstorfer. The single Bornean female before me differs from this last subspecies in the following points:—hyaline streak from base of cell in fore wing larger, hyaline patch below cell divided, and a circular spot cut off distally. In the hind wing the cell is divided by prominent cell streak nearly reaching the base of wing; the white lines bordering the median and submedian nervures are as long as the next pair which border the submedian and internal nervures. Beneath (including abdomen) the general colour is dull golden-olive, the discal region of the fore wing browner. Exp. al., 90 mm.

"I name this subspecies *kuchingana*, as the only known specimen bears the label 'Kuching (Sarawak), December 23rd, 1895.'"

19. D. LOTIS Cr. *mezentius* Fruhst.
North-east Borneo (Sandakan).

20. EUPLŒA MOOREI Butl. *brookei* Moore.[10]
Borneo; Sumatra, Nias, Mentawei.

21. E. CRAMERI Luc. *crameri* Luc.[11]
Borneo, Natunas; Tenasserim, Malay Peninsula, Nicobars, Nias, Sumatra, Java, Bali.

22. E. MALAYICA Butl. *scudderi* Butl.
Borneo; Malay Peninsula, Sumatra, Nias, Java, Palawan.

23. E. MODESTA Butl. *lorzæ* Moore.
North Borneo; Burma, Siam, Sumatra.

24. E. ALCATHOË Godt. *uniformis* Moore.
Borneo; Burma and Assam south to the Greater Sunda Isles, Bali, Lombok and Palawan.

25. E. DEIONE Westw. *masina* Fruhst.[12]
South-east Borneo; Burma and Assam south to the Greater Sunda Isles, Nias, Lombok, Palawan, Billiton.

26. E. DEIONE Westw. *zonata* Druce.[13]
Borneo.

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[10] Shelford united this subspecies with *crameri*, but I have been able to arrange the long series in the Sarawak Museum under two distinct forms, the one with expanse of wings averaging from 85–95 mm., the other 70–80 mm., the former with very dark velvety males, the latter with much duller fuscous males, which I regard as this subspecies (*brookei*) and the former as *crameri*.

[11] Fruhstorfer recognizes typical *crameri* from the whole of Borneo, except Sandakan and the Islands of Labuan and Daat, where the following subspecies are said to occur respectively: *pryeri*, *labuana* and *daatensis*. The Sarawak series shows all these forms, so I agree with Shelford in merging them all under *crameri*. Fruhstorfer's subspecies *lanista* from Natunas appears to be inseparable also.

[12] The description in Seitz's *Macro-Lepidoptera of the World* suggests relationship with the last subspecies (*uniformis*) rather than with the next (*zonata*).

[13] Fruhstorfer states that the female is unknown. The single female in the Sarawak Museum differs from the males in the more distinct row of small marginal spots on the hind wing above, an additional row of submarginal spots below, which faintly show through above, and a second (distal) spot on the under side of fore wing between the second and third median nervules. One male is similarly distinguished from the other six in the Museum series.

27. E. DUFRESNE Godt. *tyrianthina* Moore.[14]
North Borneo (Kinabalu) and South-east Borneo; Assam, China, Philippines, Malay Peninsula and Archipelago to Lombok and Sumbawa.

28. E. MULCIBER Cr. *portia* Fruhst.[15]
Borneo, Natunas; India and China to Philippines, the Greater Sunda Isles and Bali.

29. E. MAZARES Moore *aristotelis* Moore.
Borneo; Malay Peninsula and Archipelago to Flores.

30. E. MAZARES Moore *cabeira* Fruhst.
South-east Borneo.

31. E. CORUS Fab. *butleri* Moore.
Borneo; Ceylon and Burma south to the Greater Sunda Isles, Palawan and Celebes.

32. E. LEUCOSTICTOS Gmel. *syra* Fruhst.[16]
Borneo, Palawan; Burma to Formosa and the Philippines, south to the Greater Sunda Isles, Bali, Sumba and Sumbawa.

33. E. ÆGYPTUS Butl. *ægyptus* Butl.[17]
Borneo; Malay Peninsula, Sumatra, Java, Nias.

34. E. SIMILLIMA Moore *ælia* Fruhst.
North-east Borneo; Palawan and Philippines.

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[14] The forms grouped under *harrisi* (continental), *lacordairei* (Malayan) and *dufresne* (Philippine), seem best united as one collective species; hence the combination *dufresne tyrianthina* (as given by Shelford) instead of Fruhstorfer's *lacordairei tyrianthina* for the Bornean subspecies.

[15] Recorded by Shelford as *Euplœa claudius mulciber*. Most authors seem to agree that Cramer's *mulciber* came from the continent, so that the Bornean race required a new name. It seems to me hardly separable from Malay Peninsula, Sumatra and Java forms.

[16] Shelford records a second subspecies, *kadu*, Esch., from North Borneo, Palawan and the Philippines. Two examples from Kinabalu do not differ in the least from *syra* caught on Mt. Matang, in Western Sarawak. The form *kadu* is restricted to the Philippines; *syra* alone occurs in Borneo. Fruhstorfer describes a female form of *syra* as *kadina*, distinguished by a second spot between the median veins in the fore wing and by "two to three quadrate discal patches beyond the cell-wall" in hind wing. The Matang females before me belong to this form.

[17] Shelford records *E. lowei* Moore and remarks that it is "possibly a subspecies of *ægyptus*"; Fruhstorfer seems to me right in regarding it only as "an unimportant aberration."

Shelford also records *E. rafflesi sophia* Moore from Borneo. Both these names are now used for restricted subspecies of *ægyptus*, thus *rafflesi* from Java and *sophia* from North-east Sumatra.

35. E. DIOCLETIANUS Fab. *lowi* Butl.[18]
Borneo; Burma and Siam south to the Greater Sunda Isles and Natunas.

Subfam. 2. SATYRINÆ.

36. YPTHIMA FASCIATA Hew. *fasciata* Hew.
Borneo, Natunas; Malay Peninsula and Sumatra.

37. Y. BALDUS Fab. *selinutius* Fruhst.
Borneo, Natunas; Japan, Hong-Kong and India south to the Greater Sunda Isles.

38. Y. PANDOCUS Moore.[19]
Borneo, Malay Peninsula, Sumatra, Java.

39. Y. ABNORMIS Shelford.[20]
Sarawak.

40. ERITES ARGENTINA Butl. *argentina* Butl.[21]
Borneo; Sumatra, Malay Peninsula, Java.

41. E. ELEGANS Butl. *elegans* Butl.
Borneo; Sumatra.

42. E. THETIS Shelford.[22]
Sarawak.

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[18] Originally written *lowei*, which I alter to *lowi*, as the insect was named after Sir Hugh Low, whose name is thus spelt.

[19] Fruhstorfer separates as four different subspecies the individuals of this species from the Malay Peninsula, Java, Sumatra and Borneo. The Bornean form named *sertorius* is separated from the Javan form by the larger apical eye-spot of the female, from the Malay Peninsula form by the larger size and more extended black-brown shading on the under surface. A good series from Sarawak does not uphold these small distinctions; some specimens agree admirably with Fruhstorfer's figure of the Javan *pandocus*, others show gradations from it to his Bornean *sertorius*. I agree with Shelford in uniting them all under the typical name *pandocus*.

[20] The type and only known specimen is in the British Museum.

[21] The Sarawak series seems to me intermediate between the forms recognized by Fruhstorfer as *argentina* from North Borneo, and *ines* from South-east Borneo; and they appear very doubtfully distinct from forms from Sumatra and the Malay Peninsula. The Javan race, on the other hand, has some good distinctions.

[22] This species is perfectly distinct from *E. elegans*, which is not rare in the neighbourhood of Kuching (the provenance of *thetis*). Fruhstorfer in *Iris*, 1903, refers it quite inaccurately to *E. madura ines* (now = *argentina ines*). In Seitz's *Macro-Lepidoptera* he suggests it is the Sarawak local race of *elegans* which, as stated above, occurs in Sarawak and is abundantly distinct.

Like *elegans* there is no ocellus on the fore wing, but there the resemblance ceases, as the under side—fully described by Shelford—is quite different.

43. Lethe europa Fab. *europa* Fab.
Borneo, Malay Peninsula, Sumatra, Java; Philippines, China and India.

44. L. mekara Moore.[23]
Borneo, Sumatra, Malay Peninsula, Assam and India.

45. L. delila Staud.
North Borneo (Mts. Kinabalu and Marapok).

46. L. dora Staud.[24]
Borneo (Sarawak and South-east Borneo).

47. L. perimede Staud.
North Borneo (Mt. Kinabalu).

48. L. darena Feld. *borneensis* Staud.
North Borneo (Mt. Kinabalu); Sumatra, Java.

49. Neorina lowi Doubld. *lowi* Doubld.
Borneo; Sumatra, Nias, Malay Peninsula, Palawan.

50. Cœlites epiminthia Westw. *epiminthia* Westw.[25]
Borneo, Sumatra, Malay Peninsula; Tenasserim, Celebes.

51. C. euptychioides Feld. *euptychioides* Feld.
Borneo; Sumatra and Malay Peninsula.

52. Orsotriæna medus Fab.
Borneo, India to the Greater Sunda Isles; Celebes and Lesser Sunda Isles to South Sea Islands and Australia.

53. Mycalesis marginata Moore *pitana* Staud.
North Borneo (Mt. Kinabalu); Sumatra.

54. M. anapita Moore.[26]
Borneo, Malay Peninsula, Sumatra, Banka, Billiton.

55. M. mnasicles Hew. *mnasicles* Hew.
Borneo, Sumatra; Malay Peninsula, Burma.

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[23] Fruhstorfer splits this variable species into a number of geographical races, which do not appear to me sufficiently distinct, as they are founded on particularly variable characters. Some Sarawak males, for instance, agree well with his figure of the Tonkin form.

[24] Described by Shelford as *cerama*.

[25] Regarded by Shelford as a subspecies of *nothis* from Siam, which is treated by Fruhstorfer as a separate species.

[26] The black distal border of the hind wing is variable in a long Sarawak series before me, and is insufficient in development and constancy to warrant Fruhstorfer's separation as a distinct race (*fucentia*).

56. M. AMŒNA Druce *amœna* Druce.
Borneo (Sarawak).

57. M. AMŒNA Druce *rampaiana* Moulton.[27]
North Borneo (Mt. Kinabalu).

58. M. JANARDANA Moore *baluna* Fruhst.[28]
North Borneo (Mt. Kinabalu); Malay Peninsula and Archipelago to Philippines and Moluccas.

59. M. PERSEUS Fab. *cepheus* Butl.[29]
Borneo, Malay Peninsula, Sumatra, Java; India to Australia.

60. M. HORSFIELDI Moore *hermana* Fruhst.
Borneo, Sumatra; Malay Peninsula, Annam, Formosa, Palawan, Celebes, Java.

61. M. KINA Staud.
North Borneo (Mt. Kinabalu, Lawas).

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[27] Described in the *Entomologist* (*l. c.*) as follows:—

"*M. amœna* was described from Sarawak. This was verified for me by Mr. N. D. Riley, who kindly examined the type in the British Museum for me. Fruhstorfer, in Seitz's *Macro-Lepidoptera of the World*, vol. ix. p. 341, notes it in his collection from North Borneo only, and figures a typical Kinabalu under side. A short series from Kinabalu, collected in September, 1913, shows several points of difference on comparison with the Sarawak series, so that it becomes necessary to restrict typical *amœna* for Sarawak specimens, and separate those from Kinabalu as a distinct subspecies, which I name *M. amœna rampaiana*, subsp. nov., and describe as follows:—

"Upper side of both sexes differs from typical *amœna* in the heavier fuscous apical shading; in the male this hides the apical ocelli which are visible in *amœna*.

"General colouring below dark fuscous brown instead of reddish brown; one broad median band across both wings, which is darker on the margins, lighter in the centre. In typical *amœna* this band is divided into two narrow reddish brown bands separated by a broader band of ground-colour; in fore wing of male *amœna* the basal band is obsolete.

The tuft of hairs on the costal margin of the hind wing above in male is greyish-ochreous, not conspicuous; in typical *amœna* this is pale yellow and at once seen on raising the fore wing."

[28] Fruhstorfer states that only two examples are known. Dr. Hanitsch obtained it on Kinabalu in 1899; the Sarawak Museum has a small series obtained at 3000 ft. on the same mountain during my expedition of August and September, 1913.

[29] A very similar species, *M. mineus* Linn., is recorded from much the same region as *M. perseus*. Fruhstorfer describes a subspecies *macromalayana* from Singapore and Sumatra; but apparently as yet unknown from Borneo. The male may be distinguished from *perseus* by the larger blackish sexual mark on the fore wing below, and from *horsfieldi* by the absence of the silky extension to the scent-patch on the hind wing above.

Shelford records *polydecta* from Sarawak, and states that he had not met with *perseus* in Borneo. The Museum series labelled *polydecta* contained both *perseus* and *horsfieldi*. Fruhstorfer restricts the name *polydecta* to the Indian form of *mineus*.

62. M. THYATEIRA Fruhst.[30]
North Borneo (Brunei), South-east Borneo.

63. M. FUSCUM Feld. *adustata* Fruhst.
Borneo; Malay Peninsula, Sumatra, Nias, Banka, Java.

64. M. ORSEIS Hew. *orseis* Hew.[31]
Borneo, Malay Peninsula, Sumatra, Nias; Celebes.

65. M. MAIANEAS Hew. *maianeas* Hew.
Borneo, Malay Peninsula; Sumatra, Banka.

66. M. DOHERTYI Elw. *excelsior* Fruhst.[32]
North Borneo (Mt. Kinabalu); Malay Peninsula and Sumatra.

67. RAGADIA MELINDENA Feld. *annulata* Gr.-Sm.[33]
North Borneo (Mt. Kinabalu); Southern Philippines (Mindanao).

68. R. CRISIA Hübn.[34]
Borneo, Natunas, Malay Peninsula, Sumatra, Java.

69. MELANITIS LEDA Linn. *ismene* Cr.
Borneo, India, China, Malay Peninsula, Sumatra; Java, Celebes to Australia and Madagascar.

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[30] Described by Fruhstorfer in Seitz's *Macro-Lepidoptera of the World*, vol. ix., p. 349, 1910.

[31] Fruhstorfer separates the Bornean form as *borneensis*, characterized by the smaller black scent-patch of the hind wing, which he states is composed of two nearly distinct spots instead of being confluent as in *orseis*. Several Sarawak males before me have this patch large and confluent. Again, the lines and bands below are said to be sharper and the eye-spots smaller. Both these features are variable in the Sarawak series, and in some the tortuous basal line is very indistinct as noted for his Nias form. The continental form is stated to be smaller and paler. The Sarawak males measure 40–54 mm., the females 43–57 mm. The colouring of both under side and upper side is variable in both sexes. I therefore use the name *orseis* to include the forms now known from Borneo, the Malay Peninsula, Sumatra and Nias. The form from Celebes described by Staudinger certainly seems sufficiently distinct to merit subspecific separation.

[32] Fruhstorfer comments on the rarity of this species thus:—"Dr. Martin only netted four in Sumatra in thirteen years. *I received from Waterstradt the one female out of a collection containing 20,000 specimens.*" (The italics are mine.) Dr. Sharp has called attention to a similar figure in his volume on Insects in the *Cambridge Natural History*, illustrating the depredations of the professional collector.

[33] This form seems sufficiently close to *melindena* to be considered a subspecies of it. Probably both should be regarded as subspecies of the continental *crisilda* Hew. Fruhstorfer and others regard the two as distinct species.

Shelford lists *R. melita* Staud. from Kinabalu. Fruhstorfer merges it as a synonym of *annulata*.

[34] Fruhstorfer divides this species into four geographical races on what seem to me totally insufficient grounds. He calls the Bornean form *umbrata*.

70. M. ZITENIUS Herbst. *rufinus* Fruhst.
Borneo; India to Tonkin and south to the Greater Sunda Isles, Lombok, Sumbawa.

Subfam. 3. ELYMNIINÆ.

71. ELYMNIAS PANTHERA Fab. *labuana* Staud.[35]
Borneo; Malay Peninsula, Sumatra, Java, Nicobars to Engano, Bali.

72. E. DARA Dist. *dara* Dist.
Borneo (Mt. Kinabalu, British North Borneo and Sarawak); Palawan, Java, Sumatra and Burma.

73. E. NIGRESCENS Butl. *nigrescens* Butl.[36]
Borneo; Formosa and Tonkin south to the Malay Peninsula, Sumatra, Lombok, Sumbawa, Sumba, Timor.

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[35] The eight males in the Sarawak Museum come from North Borneo. From the colouring of the upper side they may be referred to five different forms:—(i) with pale marginal band entirely absent in fore wing, but well-developed in the hind wing; (ii) similar, but pale band twice as broad in hind wing; (iii) similar to (i), but faint trace of marginal band in fore wing culminating in noticeable pale streak below costa; (iv) bands on both wings very indistinct; and (v) pale bands on both wings narrow but conspicuous.

Even in this short series some suggest intermediate stages, and I do not doubt that a long series would provide small gradations between all the above forms. The band in (ii) is pale dull gold, in the others yellowish white lightly washed with brown. In such a variable species it seems unsafe to separate the Bornean form from typical *pantherina*, which is referred by Fruhstorfer to the Malay Peninsula. In any case Fruhstorfer's *alfredi* as a geographical race from South-east Borneo must go, as it occurs on Kinabalu with *labuana*. He differentiates two forms of female: (i) "with dull, but extensive red gloss on the fore wings" = *pantherina*, and (ii) "with much narrower, darker yellow-brown submarginal region of the hind wings, which is also covered with brown scales" = *alfredi*.

[36] Shelford regards *hecate* as a distinct species. Fruhstorfer suggests it is the hill form or dry-season form of *nigrescens*. Shelford has already pointed out that it occurs in low country with *nigrescens*, and the capture of specimens in November and February preclude the idea of a dry-season form. I regard it as an extreme form of *nigrescens*, but inseparable as such, since there are specimens before me giving a complete gradation from it to the typical form.

Fruhstorfer distinguishes three female forms: *pseudagrina* with submarginal spots predominantly white, *edela* with submarginal spots blue, and *virilis* with red distal borders to both wings and without white spots. Sarawak specimens show intermediates, so I prefer not to burden our list with further names. The naming of distinct forms, *which are never connected by intermediates*, is useful; but where there is room for doubt as to which form an individual ought to be referred, it seems to me infinitely preferable to abstain from naming those forms altogether, however far apart the extremes of a gradation may be. Suffice it that they belong to one species; and it is not always easy to make sure of that!

74. E. NESÆA Linn. *hypereides* Fruhst.[37]
North Borneo, Sarawak; Sikkim and Assam south to the Greater Sunda Isles.

75. E. NESÆA Linn. *cœlifrons* Fruhst.
South-east Borneo.

76. E. PELLUCIDA Fruhst.
N. Borneo (Mt. Kinabalu), Sarawak (Mt. Penrissen).

77. E. HARTERTI Honr. *brookei* Shelford.
Labuan, Sarawak; Perak.

78. E. SMITHI Moulton.[38]
Sarawak (Mt. Molu).

79. E. PENANGA Westw. *konga* Gr.-Sm.[39]
North Borneo, Sarawak; Burma, Malay Peninsula, Sumatra.

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[37] Recorded by Shelford as *Elymnias lais* Cr.

[38] Shelford recognized two species in Borneo: *E. penanga trepsichroides* and *E. abrisa konga*. According to Fruhstorfer, Distant's male *abrisa* is really a female, and if this is the case, Fruhstorfer is probably right in accepting but one species, viz. *penanga*, which is characterized by one male form and three female forms.

Fruhstorfer names the three female forms occurring in Borneo as *konga* Gr.-Sm. (typical form), *mehidina* Fruhst. (*trepsichroides* Shelford) and *ptychandrina* Fruhst. As Shelford's name has three years' priority over *mehidina*, I accept it in preference to Fruhstorfer's name.

Of *konga*, Fruhstorfer writes: "The male has three subapical blue streaks on the upper side of the fore wing instead of five, like the other local forms." Two Sarawak specimens have five streaks, five others only three.

[39] "ELYMNIAS SMITHI, sp. n.—*Female*.—Upper side: a rough mimic of female *Euplœa diocletianus lowi*. Forewing: brown-fuscous, a rusty-brown tinge on inner marginal area; three large confluent internervular white spots obliquely placed beyond cell, the lowest below the third median nervule, but not reaching the second median nervule. Some white scales about the centre of costa Hind wing: more rusty-brown than in fore wing, especially in the post-discal and apical region; a white patch in lower corner of cell, slightly extending beyond cell below, but not above, the radial nervure, and spreading more below median nervure from base of second and third median nervules to the submedian nervure. Cilia white. Under side: mottled fuscous relieved by white distal patch in fore wing and white discal patch in hind wing. A submarginal row (on the hind wing only) of five small black internervular spots inwardly touched with white scales. The hind margin of the fore wing is conspicuously scalloped as in *E. nesæa*; the largest tooth-like projection between third and second median nervules. The hind wing also scalloped; prominent tail formed by prolongation of third median nervule. Exp. al. 77 mm.

"Type and only known specimen collected by Professor Harrison W. Smith on or near Mt. Molu, Sarawak, in 1912.

"As the male is unknown, it is impossible to assign any definite place for this species in the genus *Elymnias*. But for the fact of its being a Euplœine mimic instead of Danaine, I should have placed it near *hypermnestra* and *caudata*. On coloration alone I place it provisionally near *hicetina* which it resembles roughly. The tailed hind wing of course separates it from this Celebes species, and the white patch on the hind wing is nearer the base in *smithi*. In *hicetina* it is clear of the cell. The distal white marks of the fore wing are about half the size of those in *hicetina*." (*Entomologist*, May 1915, p. 98, pl. vi., figs. 1, and 2.

80. E. ESACA Westw. *borneensis* Wall.
North Borneo (Mt. Kinabalu), Sarawak; Malay Peninsula, Sumatra, Philippines.

81. E. ESACA Westw. *tæniola* Fruhst.
South-east Borneo.

Subfam. 4. AMATHUSIINÆ.

82. FAUNIS ARCESILAUS Fab. *borneensis* Fruhst.
Borneo, Natunas; Burma, Malay Peninsula, Sumatra, Nias, Java.

83. F. KIRATA de Nicév.
Neomalaya (Borneo, Malay Peninsula, Sumatra).

84. F. GRACILIS Butl.
Neomalaya (Borneo, Malay Peninsula, Sumatra).

85. F. STOMPHAX Westw. *stomphax* Westw.
Borneo (Sarawak and South-east Borneo); Palawan.

86. F. STOMPHAX Westw. *barrauti* Moulton.[40]
North Borneo (Mt. Kinabalu and Limbang).

87. F. BESA Hew.[41]
Borneo.

88. XANTHOTÆNIA BUSIRIS Westw. *burra* Stich.
Borneo; Tenasserim, Malay Peninsula, Sumatra, Nias, Mentawei.

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[40] "FAUNIS STOMPHAX BARRAUTI, subsp. n.—Differs from typical *stomphax*, in lacking the white band across the apex of fore wing below. A thin dark brown line replaces it in *barrauti*.

"*Habitat.*—North Borneo (Mt. Kinabalu, Marapok Mts. and Limbang). Further west and south it is replaced by typical *stomphax*, which Fruhstorfer states also occurs in the Kinabalu district. All the individuals collected on my recent expedition there are referable to *barrauti*, as also specimens from Northern Sarawak (Marapok Mts. and Limbang); the only typical *stomphax* before me come from Western Sarawak.

"Named in honour of the Hon. E. H. Barraut, Resident of the West Coast, British North Borneo, to whom I am greatly indebted for much kind help in facilitating my expedition to Kinabalu." (*Entomologist*, May, 1915, p. 99.)

[41] Fruhstorfer treats this species as a form of *stomphax*. His *besa* is no doubt the same as *barrauti* described above. Hewitson's *besa* is a different insect, with more rounded hind wings and differently placed band on hind wing below (*vide* key to the species at the end of this paper). Hewitson gives "Borneo" only as locality. The single female in the Sarawak Museum comes from Limbang.

89. Tænaris horsfieldi Swains. *occulta* Gr.-Sm.[42]
Borneo; Singapore, Sumatra, Java, Palawan.

90. Amathusia phidippus Linn. *dilutus* Fruhst.
Borneo; Burma and the Philippines south to Java and Celebes.

91. A. schonbergi Honr. *borneensis* Fruhst.
South Borneo; Perak and Sumatra.

92. A. ochraceofusca Honr. *gabriela* Fruhst.
South Borneo; Perak and Sumatra.

93. A. perakana Honr. *staudingeri* Röber.
South-east Borneo; Malay Peninsula, Natunas, Java, Lombok.

94. A. masina Fruhst. *masina* Fruhst.[43]
Borneo (Sarawak and South-east Borneo); Bangka.

95. Amathuxidia amythaon Doubld. *ottomana* Butl.
North Borneo and Sarawak; Burma, Sumatra, Java, Philippines.

96. A. amythaon Doubld. *octacilia* Fruhst.
South-east Borneo.

97. Zeuxidia amethystus Butl. *wallacei* Feld.[44]
Borneo; Malay Peninsula, Sumatra, Palawan, Mindanao.

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[42] Fruhstorfer states that this subspecies "does not differ from *birchi* in any essential character, as far as I can tell from Distant's figure," and he suggests that *birchi*, which is only known from a single Singapore specimen, really comes from Borneo.

A good series in the Sarawak Museum from several localities in Borneo agree in one feature, wherein they all differ from *birchi*; that is, the greater development of the black scaling at the base of the hind wing below. In *occulta* this is slightly concave below costa as if to make room for the costal ocellus, and then markedly convex before continuing to the inner margin. In *birchi* this basal region is obliquely marked off from costa direct to inner margin. It appears to be a local race in Borneo; the late Messrs. Bartlett and Shelford, who were so successful in forming the greater part of the Sarawak Museum collection, from 1894 to 1904, failed to obtain it. The establishment of prolific *Homo sapiens* and his works in Singapore is sufficient to account for the rarity and probable extinction of *Tænaris horsfieldi birchi*.

[43] Omitted by Shelford.

[44] Shelford records both *amethystus* and *wallacei* from Borneo.

98. Z. DOUBLEDAYI Westw. *doubledayi* Westw.[45]
Borneo; Malay Peninsula, Sumatra, Bangka.

99. Z. AURELIUS Cr. *aureliana* Honr.[46]
Borneo; Malay Peninsula, Sumatra.

100. THAUMANTIS LUCIPOR Westw.[47]
Neomalaya (Borneo, Malay Peninsula, Sumatra).

101. T. NOUREDDIN Westw.[48]
Neomalaya (Borneo, Malay Peninsula, Sumatra).

102. T. ODANA Godt. *cyclops* Röber.[49]
Borneo; Malay Peninsula, Sumatra, Nias, Java.

103. THAURIA ALIRIS Westw. *aliris* Westw.
Borneo; Malay Peninsula, Burma and Tonkin.

Subfam. 5. DISCOPHORINÆ.

104. DISCOPHORA TULLIA Cr. *symphronia* Fruhst.[50]
Neomalaya (Borneo, Malay Peninsula, Sumatra); Java, Bali, India, China, Philippines.

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[45] Spelt *doubledaii* originally and by most subsequent authors. Fruhstorfer separates the form from South-east Borneo as *horsfieldi* Feld., on account of "the reduced violet-blue oblique bars on the fore wings of females." Three Sarawak females vary in this point, so much so that I have no hesitation in merging this subspecific name with typical *doubledaii*.

Z. pryeri Butl., treated by Shelford as a distinct species, is considered by Fruhstorfer to be an abnormal form (only known from one male) of *Z. doubledayi*.

[46] Fruhstorfer describes a second subspecies, *euthycrite*, from North Borneo; distinguished from the South-east Bornean form *aureliana* by its larger size, darker blue subapical bands in the male, and more richly white marked females.

The Sarawak males measure 107–126 mm. in expanse of wings; the single female 140 mm. The blue of the subapical band in the males is distinctly lighter in one large specimen than in the smaller. The large female, which on size alone should be referred to *euthycrite*, has the white markings less richly developed than in *aureliana* figured by Fruhstorfer. I therefore recognize but one subspecies in Borneo, viz. *aureliana*.

[47] The Sumatran form *candika* Fruhst. seems inseparable from a variable Sarawak series. Thus the ocelli on the hind wing below of the males are often very much reduced, so much so that one or other is absent altogether. Similarly a female from Sarawak has the fulvous apical markings in the fore wing above even more reduced than in the figure of *candika*.

[48] Fruhstorfer recognizes four geographical races of this species, all founded on variable characters which are fully represented by a Sarawak series before me. He gives the name *chatra* to North Bornean forms and Stichel's name *sultanus* to those from South Borneo. Sarawak males vary in size from 87–97 mm., the females from 92–107 mm.

[49] The North Bornean form is separated by Fruhstorfer as *panwila*; the differences appear to be very slight.

[50] Recorded by Shelford and others as *sondaica* Boisduv., which name is now restricted to the Javan subspecies.

105. D. SIMPLEX Staud. *amethystina* Stich.
North Borneo (Mt. Kinabalu); Palawan.

106. D. NECHO Feld. *cheops* Feld.
North Borneo; Malay Peninsula, Sumatra, Nias, Java, Palawan, Philippines.

107. D. NECHO Feld. *helvidius* Fruhst.
South-east Borneo.

108. ENISPE EUTHYMIUS Doubld. *milvus* Staud.
North Borneo (Mt. Kinabalu); Sikkim, Assam, Burma, Sumatra.

Subfam. 6. NYMPHALINÆ.

109. ERGOLIS ARIADNE Linn. *ariadne* Linn.
Borneo, Sumatra, Malay Peninsula, Java; India and China to Celebes and Flores.

110. E. SPECULARIA Fruhst. *specularia* Fruhst.
South-east Borneo, Java; Siam, Sumbawa.

111. E. ISÆUS Wall. *isæus* Wall.[51]
West Borneo (Pontianak), Malay Peninsula and Sumatra; Nias, Java.

112. LARINGA CASTELNAUI Feld. *castelnaui* Feld.[52]
Borneo, Tenasserim, Malay Peninsula, Sumatra; Nias, Java.

113. CUPHA ERYMANTHIS Drury *lotis* Sulz.[53]
Borneo, India, Burma, Malay Peninsula, Sumatra; Java, China, Palawan.

114. C. ARIAS Feld. *cacina* Fruhst.
North Borneo (Mantanani Isle), Palawan; Philippines, Celebes.

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[51] Omitted by Shelford.

[52] Fruhstorfer separates the Bornean as *ochus* on the characters of the male which he describes as much larger and of darker blue ground colour, with the apex of fore wings more clouded with black and the under side showing more extended and darker black bands on both wings.

Two males in the Sarawak Museum from British North Borneo are rather darker blue than another from Sarawak, which agrees well with Distant's figure of a Malay Peninsula specimen; females from British North Borneo are similarly not to be distinguished, so I merge Fruhstorfer's name with the type-form *castelnaui*. (The female was unknown to Fruhstorfer.)

[53] Fruhstorfer separates forms from West Sumatra and Borneo as *nagara* on what appear to me to be insufficient grounds. The yellow subapical spot of the fore wing above is more often present—and in some quite conspicuous—seldom obsolete as Fruhstorfer states of Bornean specimens.

115. Atella alcippe Cr. *alcippoides* Moore.
Borneo, Tenasserim, Malay Peninsula, Sumatra; Ceylon, Java, Palawan, Moluccas, New Guinea.

116. Issoria sinha Koll. *macromalayana* Fruhst.
Borneo, Malay Peninsula, Sumatra, Java, Palawan, Philippines; India, Moluccas, New Guinea, Samoa, Solomon Isles.

117. Cynthia erota Fab. *erotella* Butl.
Borneo, Malay Peninsula, Sumatra, Java; India, Lesser Sunda Isles, Celebes, Philippines.

118. Ducapa fasciata Feld. *alleni* Moulton.[54]
Borneo (Mt. Kinabalu and Sarawak); Tenasserim, Malay Peninsula, Sumatra, Java, Palawan, Philippines.

119. Cirrochroa tyche Feld. *thilina* Fruhst.[55]
North Borneo and Sarawak; India, Burma, Malay Peninsula, Sumatra, Java, Palawan and Philippines.

120. C. emalea Guér. *ravana* Moore.[56]
Borneo; Malay Peninsula, Sumatra, Nias, Java.

121. C. malaya Feld. *calypso* Wall.[57]
N. Borneo and Sarawak; Malay Peninsula, Sumatra.

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[54] "Ducapa fasciata alleni, subsp. nov.—Differs from the continental form figured by Moore (*Lepidoptera Indica*, iv. pl. 363, figs. 3, 3*a*, 3*b*, 3*c*) in the much narrower yellow postmedian band on the hind wing above, which is only half as broad (or less) as the succeeding (distally) fuscous band of ground colour. By this character alone *alleni* in both sexes can be distinguished from all other races, in which the yellow postmedian band is broader than the distal band of fuscous ground-colour.

"The yellow spots of the fore wing above are also reduced in both sexes, especially in the female, which differs from the male in having the median yellow band nearly twice as broad.

"A local species in Borneo. The Sarawak Museum series comes from Mt. Kinabalu, Baram, Tatau and Banting; at the last-mentioned locality I obtained it first in 1909. There is a Mission station here in charge of the Rev. G. Dexter Allen, with whom I stayed on that occasion and after whom I now name this subspecies.

"Fruhstorfer, Bingham and de Nicéville place this in the genus *Cirrochroa*, but I prefer to follow Moore and Shelford in giving it full generic distinction." (*Vide* the characters shown in the key on p. 248). (*Entomologist*, May, 1915, p. 99.)

[55] Recorded by Shelford as *C. mithila rotundata* Butl. The Bengal form is now known as *mithila*, and that from the Malay Peninsula as *rotundata*, from which this Bornean form differs in having a well-developed fuscous marginal border.

[56] Fruhstorfer states that *emalea* Guérin is the Malayan form, and therefore replaces Moore's long-used name *bajadeta*.

[57] A form "peculiar to the mountains and rainy season" is described by Fruhstorfer as *baluna*, from Kinabalu. I can find no constant difference between Kinabalu specimens and a series from Sarawak mountains and lowlands.

122. C. SATELLITA Butl.[58]
North Borneo and Sarawak, Malay Peninsula, Sumatra, Palawan.

123. C. ORISSA Feld. *orissides* Fruhst.
North Borneo and Sarawak; Malay Peninsula, Sumatra.

124. TERINOS TERPANDER Hew. *terpander* Hew.[59]
Borneo ; Malay Peninsula, Natunas, Sumatra, Nias, Banka, Java.

125. T. CLARISSA Boisd. *nympha* Wall.[60]
Borneo ; Siam, Malay Peninsula, Sumatra, Java, Palawan, Philippines.

126. T. ATLITA Fab. *albonotata* Moulton.[61]
Sarawak ; Malay Peninsula, Sumatra.

127. T. FULMINANS Butl.[62]
Borneo.

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[58] Fruhstorfer separates the Bornean form as *illergata* on a difference in the orange band of fore wing which, he states (and figures), does not broaden towards the anal angle. Some Kuching specimens agree with this, but others, including one from Kinabalu (whence Fruhstorfer describes the form), have the band broaden in goutanally as in examples from the Malay Peninsula and Sumatra.

[59] Recorded as *T. fulminans* Butl. by Shelford, who wrote, "*Terinos terpander* Hew. (syn. *T. nympha* Wall.) seem to have been wrongly recorded from Borneo, the species is confined to Sumatra." This is quite at variance with Fruhstorfer's arrangement, which seems more reasonable.

[60] Shelford gives this as *clarissa*.

[61] "TERINOS ATLITA ALBONOTATA, subsp. nov.—Recorded by Shelford as *teuthras* Hew., from which it differs, on comparison with Distant's figure of the upper side, in the absence of fuscous scales at the base of the inner margin in fore wing and in cell of hind wing, in the fuscous scales of the inner margin in hind wing extending to the first median nervule, and in the much reduced white distal edging to the two large violet-white subanal spots on the hind wing.

"Type and only known specimen (a male) from Simanggang, Sarawak, August, 1900.

"The colouring above is very different to that of *fulminans*, with which it agrees, however, on the under side and square caudate hind wing." (*Entomologist*, May, 1915, pp. 99, 100.)

[62] Fruhstorfer places *T. fulminans* as a subspecies of *atlites*, but in view of the occurrence of another subspecies (just described above) in Sarawak, it would appear preferable to give it specific distinction. The under sides of *fulminans* and *albonotata* are exactly similar, but the upper sides are entirely different. Fruhstorfer notes that *fulminans* occurs in both North and South-east Borneo; it is in the Sarawak Museum from Kinabalu, but not from Sarawak. It is, of course, possible that *albonotata* takes its place there, but the upper side is sufficiently different to render this unlikely to my mind.

128. Cethosia biblis Drury *sandakana* Fruhst.
North Borneo (Sandakan); India, China, Malaya.

129. C. hypsea Doubld. *hypsea* Doubld.
Borneo; Malay Peninsula, Sumatra, Java, Banka, Palawan.

130. Precis iphita Cr. *horsfieldi* Moore.[63]
Borneo, Malay Peninsula, Sumatra, Java, Palawan; China, India, Ceylon, Sumba, Lombok.

131. P. hedonia Linn. *ida* Cr.
Borneo, Malay Peninsula, Sumatra, Java, Philippines; Celebes, Moluccas, New Guinea, Australia.

132. P. atlites Linn. *atlites* Linn.
Borneo, India, China and Malaya; Celebes.

133. P. almana Linn. *javana* Feld.
North Borneo, Malay Peninsula, Sumatra, Java, Lombok; India, China, Japan, Philippines, Celebes, Sumba, Sumbawa.

134. P. orithya Linn. *metion* Fruhst.[64]
Borneo; China, India, Malaya, Australia, Africa.

135. Vanessa canace Linn. *perakana* Dist.[65]
North Borneo (Kinabalu), Perak; Sumatra, Java, Philippines, Japan, China, India and Ceylon.

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[63] Shelford demurred to the splitting of *Precis iphita* into subspecies on the grounds of its variability and our lack of breeding experiments; but he accepted Fruhstorfer's name *tosca* for the Sumatran and Bornean forms. The Sarawak series is very variable in colour, and on that character alone embraces the forms recognized by Fruhstorfer as *tosca* (Sumatra), *horsfieldi* (Perak, Java, Bali), *viridis* (Kinabalu), *neglecta* (Sandakan) and *adelaida* (Palawan).

From the continental form all these forms may be known by the broader and more pronounced dark postmedian band of the hind wing above. In the fore wing the dark median band in Bornean specimens is usually much produced distally at the cell to touch the postmedian band, but in two examples there is an even band of light grey-green or grey-brown from costa to inner margin uninterrupted, though angled at cell.

Subspecific names, it seems to me, should be given only when we are completely satisfied that the forms so separated really represent distinct geographical races. With a variable widespread species this is extremely difficult to settle, and a "blanket" name is better employed provisionally.

[64] Recorded by Shelford and others as *P. orithya wallacei* Dist., which occurs in the Malay Peninsula and differs from the Bornean form in a few small, but apparently constant, features.

[65] The Bornean form is separated by Fruhstorfer as *maniliana* on "the presence of the very broad, light blue band on the fore wing, which is united with the discoidal spot," and the darker under side. A good series from Kinabalu shows no difference in the width of fore wing on comparison with Distant's figure of *perakana*, and the discoidal spot is certainly separated in most. The under side is certainly a little darker, but this counts for nothing in a procryptic pattern of the *Vanessa* type.

136. SYMBRENTHIA HIPPOCLUS Cr. *marius* Fruhst.
Borneo; India, China, Malaya to New Guinea.

137. S. HYPSELIS Godt. *balunda* Staud.
North Borneo (Mt. Kinabalu) and South-east Borneo; China, India, Malay Peninsula, Sumatra, Nias, Java, Bali and Palawan.

138. S. HYPATIA Wall. *hippocrene* Staud.
North Borneo and Sarawak; Malay Peninsula, Sumatra, Java.

139. RHINOPALPA POLYNICE Cr. *helionice* Fruhst.
North Borneo and Sarawak; Burma, Malay Peninsula, Sumatra, Java, Philippines, Celebes.

140. HYPOLIMNAS ANTILOPE Cr. *anomala* Wall.[66]
Borneo, Malay Peninsula, Sumatra, Java; Nias, Lesser Sunda Isles, Philippines, Celebes, Moluccas, New Guinea.

141. H. MISIPPUS Linn.[67]
Borneo, Oriental, Ethiopian, Neotropical, Nearctic Regions.

142. H. BOLINA Linn. *bolina* Linn.[68]
Borneo, India, Malay Peninsula and Archipelago to Philippines, Borneo, Java; Moluccas, New Guinea, Australia.

143. DOLESCHALLIA BISALTIDE Cr. *borneensis* Fruhst.
Borneo; India and Malaya to the Bismarck Archipelago.

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[66] A large and variable series in the Sarawak Museum, from Sarawak and North Borneo, shows that Fruhstorfer's *interstincta* cannot be kept separate from *anomala*.

[67] Shelford noted that he had not met with it in Sarawak. In June, 1910, a male was taken in the neighbourhood of Kuching, Sarawak, and two more in August, 1911.

[68] As Shelford observes, this species is so variable that it does not seem possible to divide it up into constant races. Nevertheless, Fruhstorfer has made a bold attempt, utilizing a fine array of names old and new for different races and forms. In regard to the Bornean forms this does not seem to be successful; for instance, *labuana* from North Borneo is characterized by the absence of white-blue submarginal dots on the upper side of the males, according to Fruhstorfer; but some Sarawak males have them, some are without. The different female forms are listed in a footnote to the key to *Hypolimnas* species (see p. 253).

144. KALLIMA INACHUS Boisd. *buxtoni* Moore.[69]
Borneo; India, China, Malay Peninsula, Greater Sunda Isles.

145. AMNOSIA DECORA Doubld. & Hew. *baluana* Fruhst.[70]
Borneo; Malay Peninsula, Sumatra, Nias, Java.

146. STIBOCHIONA SCHŒNBERGI Honr.[71]
N. Borneo (Mt. Kinabalu) and Sarawak (Mt. Matang).

147. CYRESTIS COCLES Fab. *sericeus* Butl.[72]
Borneo; India, Assam, Tenasserim, Hainan.

148. C. NIVEA Zink.-Somm. *nivalis* Feld.[73]
Borneo, Malay Peninsula, Sumatra, Burma; Philippines, Java to Sumbawa.

149. C. MÆNALIS Erichs. *seminigra* Gr.-Sm.
Borneo; Malay Peninsula, Sumatra, Nias, Philippines.

150. C. THERESÆ de Nicév.[74]
Borneo, Sumatra.

151. CHERSONESIA RISA Doubld. *cyanee* de Nicév.[75]
North Borneo (Mt. Kinabalu), Sumatra; Himalayas, Tonkin, Annam.

152. C. EXCELLENS Mart.[75]
North Borneo (Mt. Kinabalu).

153. C. RAHRIA Moore.
Borneo, Malay Peninsula, Sumatra, Nias, Java; Celebes.

154. C. INTERMEDIA Mart.[75]
Neomalaya (Borneo, Malay Peninsula, Sumatra).

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[69] Fruhstorfer treats this as a subspecies of the Burmese form *limborgi*, *i.e.* specifically distinct from the more northern *inachus*. They appear to be obviously geographical races of one species.

[70] The form described as *petronia* Fruhst. from "the low plains of Northern Borneo" does not appear to differ from several examples before me from Kinabalu and Sarawak. The white-banded female from Banjermasin, known as *martini* Honr., is surely only an aberration.

[71] Fruhstorfer mentions three minute white dots below the costal spot on the under side of fore wing in the male; these are absent in the only Sarawak male in the Sarawak Museum.

[72] A very distinct form, perhaps worthy of specific distinction.

[73] *C. nivea borneensis* Fruhst. is founded on a small point in the colouring of the anal region of the hind wing. A series from Sarawak and Kinabalu before me shows that this is variable and that some specimens cannot be separated from *C. nivea nivalis*, under which name I re-unite the Bornean form.

[74] Shelford records both *C. theresæ* and *C. neela* from Borneo, suggesting, however, that they may be synonymous, which Fruhstorfer now corroborates, noting that *C. theresæ* has priority by six months.

[75] Not recorded by Shelford.

155. C. PERAKA Dist.
Borneo, Tenasserim, Malay Peninsula, Sumatra, Nias, Java, Bali.

156. RAHINDA HORDONIA Stoll. *senthes* Fruhst.[76]
Borneo, Sumatra; India, Burma, Formosa, Malay Peninsula, Nias, Java, Bali, Sumbawa.

157. R. PARAKA Butl. *paraka* Butl.
Borneo, Tenasserim, Malay Peninsula, Sumatra, Java, Banka, Palawan; Assam, Burma.

158. R. DINDINGA Butl. *dindinga* Butl.
Borneo, Burma, Malay Peninsula; Sumatra.

159. R. AURELIA Staud.
Borneo, Assam, Tenasserim, Malay Peninsula, Sumatra.

160. NEPTIS HYLAS Linn. *sopatra* Fruhst.[77]
Borneo; Germany to Japan and south to Celebes and the Lesser Sunda Isles.

161. N. MAGADHA Feld. *plautia* Fruhst.[78]
North Borneo (Mt. Kinabalu); Burma, Annam, Malay Peninsula, Java, Sumatra.

162. N. DURYODANA Moore *duryodana* Moore.
Borneo; Malay Peninsula, Sumatra, Java, Palawan.

163. N. NATA Moore *nata* Moore.
Borneo (except mountains and South-east Borneo); Tonkin, Malay Peninsula, Sumatra, Nias, Java.

164. N. NATA Moore *rasilis* Fruhst.[78]
North Borneo (Mt. Kinabalu).

165. N. NATA Moore *egestas* Fruhst.[78]
South-east Borneo.

166. N. NANDINA Moore *ila* Fruhst.[79]
North Borneo (Mt. Kinabalu); India to Formosa, Philippines, Malay Peninsula and Archipelago to Lombok and Flores.

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[76] This and the next three species are placed in the *Rahinda* section of the genus *Neptis* by Shelford. The position of the second subcostal nervule in the fore wing seems to justify Fruhstorfer in giving this section full generic distinction.

[77] Recorded by Shelford as *N. leucothœ matuta* Hübn. Fruhstorfer shows that *hylas* is the older specific name, and that *matuta* should be confined to the Javan form.

[78] Omitted by Shelford.

[79] Recorded by Shelford as *susruta* Moore, which is now used for the form from Upper Burma and the Himalayas.

167. N. HELIODORE Fab. *dorelia* Butl.[80]
Borneo, Malay Peninsula; Sumatra, Nias, Java, Burma, Siam.

168. N. VIKASI Horsf. *salpona* Fruhst.[81]
North Borneo, Sarawak; Malay Peninsula, Sumatra, Java, Celebes, Palawan, Philippines, Tonkin, India.

169. N. ANJANA Moore *discerna* Fruhst.[82]
Borneo; Malay Peninsula, Sumatra, Nias, Java, Palawan.

170. N. MIAH Moore *sarochoa* Fruhst.[83]
Sarawak, Malay Peninsula; China, Sikkim, Assam, Sumatra, Java.

171. N. MIAH Moore *digitia* Fruhst.
North Borneo (Mt. Kinabalu).

172. N. FULIGINOSA Moore *arnoldi* Fruhst.
Borneo; Tenasserim, Malay Peninsula, Banka, Sumatra.

173. PANTOPORIA PRAVARA Moore *pravara* Moore.[84]
Borneo; Assam, Burma, Tenasserim, Malay Peninsula, Sumatra, Java, Palawan.

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[80] Shelford records both *siaka* and *heliodore* from Borneo; the former is the Sumatran form of *heliodore*, which occurs typically in Siam.

[81] Recorded by Shelford as *harita* (the Indian form), which he suggests is only a subspecies of *vikasi*. He also records the Sumatran form *omeroda* from Borneo as a separate species, remarking on its close resemblance to *vikasi* and *harita*. As Fruhstorfer places it, it is undoubtedly only the Sumatran representative of *vikasi*, slightly differing from the Bornean form, which Fruhstorfer has separated as *salpona*.

[82] Fruhstorfer recognizes two forms from Borneo: *discerna* from the south-east, distinguished by very narrow grey-brown stripes above, and *elegantia* from Kinabalu, distinguished by the broader, yellower bands above, and more intensely violet colouring below.
The Sarawak series includes sufficient variations to suggest that the two forms are hardly separable, and I prefer to unite them under the one name *discerna*. Shelford recorded them as *anjana* (the Malay Peninsula form, which appears to be distinct).

[83] The Sarawak specimens were identified by Shelford as *miah batara* Moore, which, however, refers to the broader banded form from Sumatra. They are certainly separable from the Kinabalu form, and if not worthy of subspecific distinction themselves, are better placed with the Malay Peninsula form, which Fruhstorfer has named *miah sarochoa*.

[84] In the same group as this species is *P. perius* Linn., which Fruhstorfer records from "the Sunda Islands from Sumatra to Sumbawa, Sumba." I can find no record of it for Borneo.

174. P. ASURA Moore *anaka* Fruhst.[85]
Borneo; South China, Burma, Formosa, Malay Peninsula, Sumatra, Banka, Java.

175. P. LARYMNA Doubld. *elisa* Fruhst.
Borneo; Tenasserim, Siam, Malay Peninsula, Sumatra, Banka, Nias, Java.

176. P. KANWA Moore *kanwa* Moore.
Borneo, Singapore; Burma, Assam, Sumatra, Banka, Nias.

177. P. RETA Moore *kresna* Moore.[86]
Borneo; Assam, Burma, Malay Peninsula, Sumatra, Banka, Nias, Mentawei.

178. P. ABIASA Moore *matanga* Fruhst.[87]
Borneo; Malay Peninsula, Sumatra, Banka, Nias, Java.

179. P. SELENOPHORA Koll. *amhara* Druce.[88]
North Borneo (Mt. Kinabalu) and Sarawak (Mt. Matang); India, China, Burma, Malay Peninsula, Sumatra, Java.

180. P. EULOCA Shelfd.[89]
Sarawak (Mt. Matang).

181. P. CAMA Moore *ambra* Staud.[90]
North Borneo (Mt. Kinabalu); Perak, Sumatra, Formosa, Assam, Himalayas.

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[85] Shelford records this as *Athyma idita* Moore, which is now used for the Malay Peninsula form of *asura*.

[86] The female of this Bornean form is unknown, although Shelford follows Moore in regarding *subrata* Moore as the female of this species. The markings of *subrata* agree much better with *Pantoporia nefte*, and there seems no doubt that Fruhstorfer is right in regarding *subrata* as one of the two female forms of that species.

[87] Recorded by Shelford as *abiasa* Moore, which was described from Java, and now designates that race only.

[88] Recorded by Shelford as a distinct species, with subspecies *amharina* in the Malay Peninsula.

[89] This species is described from a single male now in the British Museum. Fruhstorfer omits it in his account of the Indo-Australian Nymphalinæ in Seitz's *Macro-Lepidoptera of the World*. From the description it appears to be quite distinct from any other species of the genus.

[90] Fruhstorfer writes of *ambra*: "undoubtedly a variety of the preceding" (*cama*), and then gives it specific distinction. There seems to be no reason for not treating it as a subspecies of *cama*, as Shelford has done.

182. P. NEFTE Cr. *matthiola* Fruhst.[91]
Borneo; India to China and south to Sumatra and Java.

183. LIMENITIS DARAXA Doubld. & Hew. *viridicans* Fruhst.
North Borneo (Mt. Kinabalu) and Sarawak (Mt. Matang); Assam, Burma, Malay Peninsula, Sumatra (Battak Mts.).

184. L. PROCRIS Cr. *agnata* Fruhst.
Borneo; India, China, Burma, Malay Peninsula, Sumatra, Java, Lombok, Flores.

185. PANDITA SINOPE Moore *sinoria* Feld.
Borneo, Natunas, Palawan; Malay Peninsula, Sumatra, Java.

186. LEBADEA MARTHA Fab. *martha* Fab.[92]
Sarawak, Annam, Tonkin, Siam, Tenasserim; Assam, Sikkim, Bhotan.

187. L. ALANKARA Horsf. *paduca* Moore.
Borneo; Malay Peninsula, Palawan, Sumatra, Banka, Java.

188. PARTHENOS SYLVIA Cr. *borneensis* Staud.[93]
Borneo; India, Ceylon, Burma, China, Philippines and south to the Greater Sunda Isles, Celebes, New Guinea and the Solomon Islands.

189. TANÆCIA AMISA Gr.-Sm.
North Borneo (Mt. Kinabalu).

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[91] Recorded by Shelford as *Athyma nefte nivifera*, which designates the broader-banded form from the Malay Peninsula. The grey-brown female was placed by Shelford as the female of *P. kresna*. I have named it *liomattha*, female, form. nov. (See footnote to this species in the following key for identification.)

Fruhstorfer records both female forms, but without naming them. His figured female is the orange-barred form, which may therefore be regarded as typical *matthiola*.

[92] Shelford records the only known Bornean specimen of this species, and remarks that it "is quite indistinguishable from Burmese males of the wet-season brood."

[93] Fruhstorfer describes and figures a subspecies, from South-east Borneo (presumably), as *bellimontis*, differing from typical *borneensis* in the colour of the submarginal band, which is red-brown instead of green. Several Sarawak specimens are so close to this that I prefer to place all the Bornean examples under the one name. Those from the Malay Peninsula and Sumatra also seem doubtfully distinct.

190. T. PELEA Fab. *crowleyi* Butl.[94]
North Borneo ; Malay Peninsula, Sumatra, Natunas, Billiton, Banka.

191. T. LUTALA Moore *lutala* Moore.[95]
Borneo ; Sulu Isles.

192. T. VALMIKIS Feld.
Borneo, Natunas.

193. T. ORPHNE Butl.
North Borneo (Mt. Kinabalu).

194. T. MUNDA Fruhst. *munda* Fruhst.[96]
Borneo (mountains) ; Neomalaya (Natunas, Malay Peninsula, Sumatra).

195. T. MUNDA Fruhst. *fruhstorferi* Butl.
Borneo (lowlands).

196. T. CLATHRATA Voll. *clathrata* Voll.
Sarawak (low country) and South Borneo ; Perak, Sumatra.

197. T. CLATHRATA Voll. *cœrulescens* Gr.-Sm.
North Borneo and Sarawak (mountains).

198. T. ARUNA Feld. *pardalis* Voll.
South Borneo; Malay Peninsula, Sumatra, Banka, Sulu Isles.

199. T. ARUNA Feld. *apsarasa* Voll.
North Borneo (lowlands) and South-east Borneo.

200. T. ARUNA Feld. *subochrea* Butl.[97]
North Borneo (mountains).

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[94] Recorded by Shelford as the Singapore form *consanguinea* Dist., with the statement, "confined to Borneo." This is an inexplicable mistake, as Distant describes and records it from the Malay Peninsula and Singapore only. (See *Rhopalocera Malayana*, p. 440.)

[95] Vollenhoven's form *varuna* was described from Java ; but Fruhstorfer suggests it probably embraces the South Bornean form. The more distinct black submarginal sagittate spots seem to be the only difference between it and the North Bornean forms. In a variable species this seems insufficient to warrant subspecific separation. The next species *valmikis* seems to me better merged with this species.

[96] Shelford records it as *T. apsarasa munda*.

[97] Shelford records as four doubtful species, *T. subochrea* Butl. (which he notes as doubtfully distinct from *lutala*), *T. margarita* Butl. (now regarded by Fruhstorfer as a form of the last), *T. evanescens* and *T. albifasciata* (both of which Shelford would refer to *apsarasa*, but Fruhstorfer places as forms of *munda*).

As noted elsewhere, the Bornean forms of this genus are in a very unsatisfactory condition ; extensive breeding experiments alone will better it.

201. Euthalia godarti Gray *vacillaria* Butl.
Borneo; Malay Peninsula, Sumatra, Nias, Java, Philippines.

202. E. cocytina Horsf. *ambalika* Moore.[98] [99]
Borneo; Malay Peninsula, Banka, Sumatra, Sulu Isles.

203. E. monina Fab. *bipunctata* Voll.[100]
Borneo; Malay Peninsula, Sumatra, Banka, Java, Bali, Lombok, Sulu Isles.

204. E. garuda Moore *sandakana* Moore.
Borneo; India, Burma, Malay Peninsula, Sumatra, Palawan, Sulu Isles.

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[98] Of the seven species of this sub-genus recorded from Borneo up to 1904, Shelford accepted four. Fruhstorfer's bold step now reduces this number to two only, the other so-called "species" being regarded as forms only of the variable *E. cocytina ambalika*.

Whether breeding experiments will bear this out remains to be seen. The number of intermediates certainly favours this arrangement more than that of Shelford, whose differences do not hold good in many examples.

[99] Butler records *Euthalia tanagra* Staud. from Borneo, as well as from Palawan. Fruhstorfer gives Palawan only. The Bornean record wants confirmation.

[100] Fruhstorfer offers another bold solution to the tangle of *Nora*-forms, by treating the various "species" of other authors as forms of one. Adopting Shelford's list to this arrangement, we have the following synonomy (Fruhstorfer's names on the left, and the corresponding names used by Shelford on the right):—

Euthalia monina bipunctata Voll. = { *Euthalia ramada surjas* Voll. / *E. laverna* Butl. / *E. cordelia* Fruhst. / *E. indras* Voll. / *E. indistincta* Butl. / *E. bipunctata* Voll. }

Fruhstorfer recognizes the following names for male and female forms (left column); Shelford's names are referred to them in the right column:—

♂ f. *typica*	= *Euthalia bipunctata* Voll.
♂ f. *stictica* Fruhst.	= *E. indras* Shelford, male.
♂ f. *cordelia* Fruhst.	= *E. cordelia* Fruhst.
♂ f. *lavernalis* de Nicév.	= *E. laverna* Butl.
♂ f. *ilka* Fruhst.	= *E. cordelia* ab. *ilka* Fruhst.
♂ f. *limbata* Fruhst.	= *E. ramada surjas* Voll.

To these may be added, as male-form *indistincta*, the male described by Shelford as a mate to Butler's unique Bornean female (*indistincta* Butl.), which last Fruhstorfer refers to the very different *Euthalia mahadeva zichri* Butl., then known from males only.

Four female forms are separable, though not so distinct as the male forms. These are forma *typica*, *indras* Voll., which occurs in Sarawak as well as South Borneo, *cordelia* and *ilka*. For differences, see note to key for identification.

205. E. ALPHEDA Godt. *parta* Moore.[101]
North Borneo; Malay Peninsula, Sumatra, Banka, Java, Sulu Isles.

206. E. ALPHEDA Godt. *krannon* Fruhst.
South Borneo.

207. E. MERTA Moore *apicalis* Voll.[102]
Borneo, Sulu; Malay Peninsula, Tenasserim.

208. E. KANDA Moore *kanda* Moore.
Borneo, Malay Peninsula; Burma, Tenasserim, Sumatra, Nias.

209. E. TINNA Fruhst. *tinna* Fruhst.[103]
North Borneo (Mt. Kinabalu) and Sarawak (mountains); Malay Peninsula, Sumatra.

210. E. ANOSIA Moore.[104]
Borneo, Assam, Sikkim, Malay Peninsula, Sumatra.

211. E. EUPHEMIUS Staud.[105]
North Borneo (Mt. Kinabalu).

212. E. MAHADEVA Moore *zichri* Butl.[106]
Borneo; Sumatra, Palawan, Malay Peninsula, Tenasserim, Java.

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[101] The male was recorded by Shelford as *jama* Feld., a name which is now reserved for the Assam species, which represents the insular species *alpheda* on the Continent. Two females in the Sarawak Museum were rightly named *parta* by Shelford.

[102] Both *apicalis* and *eriphyle* were recorded by Shelford from Borneo, the latter on a female, which seems to be the lighter female form of *sandakana*. De Nicéville's species *eriphyle* is confined to Burma and Tonkin.

[103] Recorded by Shelford as *Euthalia aconthea* Cr. on a short series from Mt. Matang, 3200 ft., Sarawak. A Kinabalu female differs in the slightly smaller whitish spots of the fore wing band. The Matang males agree exactly with Fruhstorfer's excellent figure of *tinna*.

[104] This very distinct species has just (1913) been divided up by Fruhstorfer into six different local races. The differences appear to me insufficient, especially as they are founded in most cases on very few specimens. The three females in the Sarawak Museum are variable.
Fruhstorfer's name for the Bornean form is *yapola*.

[105] Known from one pair only.

[106] Fruhstorfer notes that Butler's name *indistincta* is synonymous with *zichri*. Shelford, however, described a male *Nora* under this name, which I now retain for a male form of *E. monina bipunctata*. (*Vide* note on that species.)

213. E. LUBENTINA Cr. *whiteheadi* Gr.-Sm.[107]
Mountains of North Borneo and Sarawak; India, Ceylon, China, Malay Peninsula, Sumatra, Java, Philippines.

214. E. LUBENTINA Cr. *adeonides* Fruhst.
South-east Borneo.

215. E. ADEONA Gr.-Sm.[108]
North Borneo (Silam).

216. E. DJATA Dist. *djata* Dist.
North Borneo (Sandakan) and Sarawak (Kuching); Palawan.

217. E. ADONIA Cr. *montana* Fruhst.
North Borneo (Mt. Kinabalu).

218. E. BELLATA Druce *bellata* Druce.
Borneo; Natunas, Malay Peninsula, Tenasserim, Nias, Sumatra, Java, Palawan.

219. E. EVELINA Stoll. *mahonia* Fruhst.[109]
Borneo, Sumatra; Malay Peninsula, Burma, China, India, Ceylon, Sumatra, Java, Celebes, Philippines.

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[107] Shelford records a male *whiteheadi* and a female *adonia* "caught together, close to Kuching." The only female now in the Sarawak Museum is labelled "Tabuan (near Kuching), October, 1895." There is no male from this locality in the Museum now, and it should be noted that the Tabuan female was collected before Mr. Shelford's arrival in the country. Now the essential difference between *whiteheadi* and *adonia* lies in the palpi and fore legs, which are whitish in the former, bright red in the latter. Shelford's female *whiteheadi* has both unmistakably *red*. On these grounds I reject his arrangement and adopt that of Fruhstorfer. The synonymy reads as follows:—
Euthalia lubentina whiteheadi Fruhst. = *Euthalia adonia whiteheadi* Shelfd.
E. adonia montana Fruhst. = *E. lubentina montana* Shelfd.

[108] Fruhstorfer places this species as another subspecies of *lubentina*. But the female is so different from *lubentina whiteheadi* that I cannot accept this; moreover, the males from Matang, which Fruhstorfer suggests are *adeona*, do not differ in the least from the Kinabalu males of *whiteheadi*, so I prefer to regard *adeona* as a distinct species as yet only known from a mateless female.

[109] The forms from the Malay Peninsula, Sumatra and Borneo, were formerly united under *compta* by Fruhstorfer, who, however, now separates them as three distinct races. That from the Malay Peninsula may be distinguished by the presence of three red spots on the hind wing beneath (= *compta*); those from Sumatra and Borneo have but two; the slight differences, *inter se*, appear to be inconstant and insufficient to warrant further separation, so I place the last two under the Sumatran name (*mahonia*), with the Bornean *magama* Fruhst. as a synonym.

In a Sarawak series before me the expanse of wings ranges from 87 mm. (the smallest male) to 115 mm. (the largest female). The coloration is variable beneath; similarly the lunulate hind marginal border of the hind wing may be well marked or obsolescent.

220. E. DUNYA Doubld & Hew. *dunya* Doubld. & Hew.[110]
Borneo, Tenasserim, Malay Peninsula, Sumatra, Java; Nias.

221. E. DIRTEA Fab. *dirtea* Fab.[111]
Neomalaya (Borneo, Malay Peninsula, Sumatra); Java, Nias, Palawan, Burma, India, Hainan.

222. E. CANESCENS Butl. *canescens* Butl.
Borneo; Malay Peninsula, Sumatra, Banka, Sulu Isles.

223. E. CYANIPARDUS Butl. *sandakanus* Fruhst.
Borneo; Sumatra, Banka, Assam, Siam.

224. DICHORRAGIA NESIMACHUS Boisd. *derdas* Fruhst.[112]
Borneo; Sumatra, Java, Celebes and Malay Peninsula north to India, China and Japan.

225. APATURA PARISATIS Westw. *borneana* Fruhst.[113]
North Borneo (Mt. Kinabalu); Philippines and Hong-Kong to Ceylon and the Greater Sunda Isles.

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[110] Fruhstorfer divides this variable species into five local races. A Sarawak series covers all the differences mentioned, except those for the well-separated Nias form. I therefore treat Fruhstorfer's three new names as pure synonyms of Doubleday's *dunya*.

[111] The splitting of this species into numerous subspecies appears to be of doubtful use. I fail to see how Fruhstorfer's Bornean form *chalcedonides* can be kept separate from typical *dirtea*.

[112] Recorded by Shelford as *D. nesimachus mannus* Fruhst., a name which is now retained for the Javanese form only.

[113] Omitted by Shelford.

"The female of the Bornean form appears to be undescribed. I have five before me taken on Mt. Kinabalu in September, 1913, at an altitude of about 3000 ft.

"General colouring above tawny ochreous, close to the Ceylon form *camiba* as figured by Fruhstorfer in Seitz's *Macro-Lepidoptera of the World*, but lacking the rufous tinge of that form. From the same author's figure of *javana* it differs in the more pronounced row of four black spots in the postmedian area of the hind wing above. Beneath, a fifth spot is just visible below the first subcostal nervule. In the fore wing beneath the two apical spots of the submarginal row are white, the next three inwardly edged with black, the sixth large and black, the last also black but smaller.

"A sixth female from the same locality and taken at the same time differs from the above in the absence of all ochreous colouring, the general colour above and below being grey-brown, banded with white instead of orange. For this I propose the name *balua* (female) form. nov." (*Entomologist*, May, 1915, p. 100.)

226. Eulaceura osteria Westw. *osteria* Westw.[114]
Borneo, Sumatra, Malay Peninsula, Java; Nias, Hainan.

227. Herona sumatrana Moore *schœnbergi* Staud.
South-east Borneo; Sumatra, Java, Bali.

228. Euripus halitherses Doubld. *borneensis* Dist.[115]
Borneo; Malay Peninsula, Burma, India, Java, Sumatra, Philippines.

229. Prothoe calydonia Hew.
Neomalaya (Borneo, Malay Peninsula, Sumatra).

230. P. francki Godt. *angelica* Butl.
Borneo, Tenasserim, Malay Peninsula, Sumatra, Billiton; Java, Banka, Nias, Palawan, Philippines.

231. Charaxes distanti Honr.
Borneo, Tenasserim, Malay Peninsula, Natunas, Sumatra.

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[114] Fruhstorfer separates the Bornean form as *jembala* on a dark female from Mt. Marapok. The Sarawak Museum has one answering to the description of this form from Kuching, as well as a white-banded form like typical *osteria* and intermediates, all from the same locality. The Kuching males (and one from Kinabalu) agree well with the Javanese male figured by Fruhstorfer.

The forms from Hainan and Nias seem to be worthy of subspecific distinction, but the others, to my mind, are better "lumped."

[115] Shelford raises a word of protest against the piling up of names for a polymorphic species like this. Fruhstorfer's recent work illustrates the possibilities. For instance, *Euripus halitherses*, in the typical form, occurs in Assam and Siam, with twelve different subspecies from neighbouring countries. Now the female in many of these countries is polymorphic; in Assam and Siam Fruhstorfer records, in addition to the typical form, no less than seven others, each of which are named. Granting a similar number to each of our twelve subspecies, we have a little matter of *one hundred and four names* to remember for this one species!

Shelford, who is unwilling to accept the lesser marked forms, justly remarks that it appears less confusing to recognize in the distributional area of the species merely three female forms with distinctive names or numbers, than to name indiscriminately every topomorph differing from closely relating topomorphs in most trifling details.

It might, perhaps, simplify matters if we were more chary of conferring subspecific rank on some of the forms; thus form "a" may have two females identical with two females of form "b," but the other three females of form "a" may differ slightly but constantly from the corresponding three females of form "b." Because of the first two similar females we might deny form "b" subspecific separation from form "a," and thus reduce that huge catalogue of names.

However, since the present paper concerns Borneo only, I refrain from introducing any drastic change, and merely follow Fruhstorfer in recognizing our subspecies with its own little coterie of females.

232. C. HARMODIUS Feld. *infernus* Rothsch.
Borneo (Mahakkam) ; Java, Sumatra, Palawan.

233. C. POLYXENA Cr. *repetitus* Butl.
Borneo, Malay Peninsula, Natunas, Banka, Billiton, Sumatra ; Java, Palawan, India, China.

234. C. BORNEENSIS Butl.
Neomalaya (Borneo, Malay Peninsula, Sumatra).

235. C. DURNFORDI Dist. *everetti* Rothsch.
North Borneo and Sarawak; Malay Peninsula, Burma, Sumatra, Java.

C. FABIUS Fab. *echo* Butl.
Neomalaya (Borneo, Malay Peninsula, Sumatra) ; Philippines, Celebes, Burma, India, Ceylon.

237. EULEPIS DELPHIS Doubld. *concha* Voll.
Borneo, Burma, Malay Peninsula, Sumatra ; Assam, Java, Palawan.

238. E. JALYSUS Feld.
Borneo, Burma, Malay Peninsula, Sumatra.

239. E. ATHAMAS Drury *uræus* Rothsch.
Borneo, Sumatra, Natunas; India, Burma, Malay Peninsula, South China, Philippines, Palawan, Java, Timor.

240. E. MOORI Dist. *heracles* Rob.
Borneo ; Assam and Burma to Sumatra and Java.

241. E. HEBE Butl. *ganymedes* Staud.
Borneo ; Malay Peninsula, Sumatra, Java and the Lesser Sunda Isles.

242. E. SCHREIBER Godt. *malayicus* Rothsch.
Borneo, Malay Peninsula, Sumatra, Banka, Billiton ; Java, Nias, Philippines, Burma, India.

KEYS TO IDENTIFICATION.

*Key to the Families of Bornean Rhopalocera.**

a. Antennæ close together at origin; tibiæ of hind pair of legs with one terminal pair of spurs only.
  b. Front legs much reduced in both sexes; male fore tarsi usually one jointed, female five jointed, but without claws . . I. NYMPHALIDÆ.
  *b*¹. Fore tarsi of male imperfect, of female perfect.
    c. Hind wing: precostal nervure present II. LIBYTHÆIDÆ.
    *c.*¹ Hind wing: without precostal nervure III. LYCÆNIDÆ.
  *b*². Fore tarsi perfect in both sexes IV. PAPILIONIDÆ.
*a*¹. Antennæ wide apart at origin; tibiæ of hind pair of legs with two pairs of spurs V. HESPERIDÆ.

Fam. I. NYMPHALIDÆ.

Key to the Subfamilies of Bornean Nymphalidæ.

a. Fore wing: submedian nervure forked at base. Palpi short and slender . . . 1. Danainæ.
*a*¹. Fore wing: submedian nervure not forked at base; palpi strongly compressed.
  b. Cell of both wings closed. Fore wing: one or more veins at base swollen.
    c. Hind wing: no prediscoidal cell . 2. Satyrinæ.
    *c*¹. Hind wing: with prediscoidal cell 3. Elymniinæ.
  *b*¹. Cell of hind wing open or closed with slender veinlet only. Fore wing: veins at base very rarely swollen.
    c. Palpi small, narrow, pointed.
      d. Fore wing: middle discocellular present 4. Amathusiinæ.
      *d*¹. Fore wing: middle discocellular absent 5. Discophorinæ.
    *c*¹. Palpi large, broad, blunt or rounded in front 6. Nymphalinæ.

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* This key and the key to the Nymphalid subfamilies are based on those of Aurivillius (*Rhopalocera Æthiopica*), Trimen (*South African Butterflies*), Eltringham (*African Mimetic Butterflies*), Bingham (*Fauna of British India*), and Seitz (*Macro-Lepidoptera of the World*).

Subfam. 1. Danainæ.

Key to the Genera of Bornean Danainæ.

a. Wings usually with hyaline ground-colour, spots and stripes, or fore wings fulvous brown or white with dark fuscous stripes; wings never glossed with blue.
  b. General pattern of large black spots on whitish ground-colour.
    c. Large black spot near centre of cell in both wings. Exp. al. 147–180 mm. . . . *Hestia*.
    *c*¹. No black spot near centre of cell. Exp. al. 88–112 mm. . . . . *Ideopsis*.
  *b*¹. General pattern of white lines and spots on dark fuscous ground-colour, or with partially fulvous brown fore wing, or with partially yellow hind wing . . . . . *Danaida*.
*a*¹. Wings dark fuscous brown, slightly spotted with white or glossed with purplish blue; never with hyaline spots or stripes . . . . . *Euplœa*.

Genus 1. Hestia, Hübn.

a. Wings elongate and weak; hind wing with three irregular dark spots in space between costa and subcostal (subgen. *Hestia*).
  b. Spots comparatively small, ground-colour grey white; small basal spot below median nervure on hind wing above obsolete or barely visible below fuscous line on submedian fold . 1. *virgo*.
  *b*¹. Spots larger, ground-colour more smoky; spot on submedian fold larger and divided by fuscous line . . . . . 2. *fumata*.
*a*¹. Wings rounded and stronger, hind wing with two irregular spots in costal interspace (subgen. *Nectaria*).
  b. Hind marginal row of alternately large and small black spots.
    c. Black spots small . . . . 3. *hypermnestra*.
    *c*¹. Black spots larger . . . . 4. *arbela*.
  *b*¹. Hind marginal row of white spots . . 5. *chersonesia*.

Genus 2. Ideopsis, Horsf.

Wings smoky vitreous with large black spots. Margins of both wings touched with white spots, more noticeable in the female . . . 6. *daos*.

Genus 3. Danaida, Latr.

The subgenera may be distinguished for the most part by the sexual scent patches of the males thus:—

a. Males without scent patch on hind wing (7, 8) *Radena.*
*a*¹. Males with scent patches on hind wing.
  b. Two patches at anal angle, on first median nervule and submedian nervure.
    c. Below, the submedian nervure noticeably dilated . . . . . (9, 10) *Chittira.*
    *c*¹. Submedian nervure not noticeably dilated.
      d. Base of hind wing not yellow . (11) *Parantica.*
      *d*¹. Base of hind wing canary yellow . (12) *Ravadeba.*
  *b*¹. One patch only, on under side between first median nervule and submedian nervure.
    c. Protruding as a prominent flap (13, 14) *Tirumala.*
    *c*¹. Smaller and less prominent.
      d. Middle discocellular of hind wing strongly angled in male . . . . (15) *Limnas.*
      *d*¹. Middle discocellular slightly incurved in male . . . . . (16–19) *Danaida.*

The colour pattern alone is sufficiently distinctive in each species to differentiate them without dividing into subgenera:—

a. Fore wing fuscous with blue-white subhyaline streaks and spots.
  b. Hind wing with white spots in the two angles formed by the bases of median nervules.
    c. Base of hind wing never yellow.
      d. Hind wing: angle between first and second median nervules completely filled in by subhyaline white, and discal region of both wings essentially this colour . 7. *kinitis.*
      *d*¹. Hind wing: long white line in median interspace; no spot, except the two pairs forming part of the submarginal border 8. *vulgaris.*
      *d*². Hind wing: short white line followed by small white spot in median interspace, besides the two pairs of the submarginal border.
        e. Exp. al. 85–110 mm. Whitish spots and lines large and very prominent.
          f. Two subhyaline bars beyond cell in fore wing equally broad outwardly 9. *crowleyi.*
          *f*¹. Both subhyaline bars narrower, the lower one longer and tapering outwards, the upper bar shorter, rarely more than half the length of lower 10. *præmacaristus.*

e^1. Exp. al. 65–75 mm. Spots and lines very much reduced. Fuscous ground-colour predominating . . . 11. *eryx*.
c^1. Base of hind wing canary yellow . 12. *shelfordi*.
b^1. Two basal angles, formed by the median nervules in hind wing, delineated by fine whitish lines.
c. Subhyaline spots and lines whitish and large . . . . . 13. *kuchingana*.
c^1. Subhyaline spots and lines bluish and much reduced . . . . . 14. *microsticta*.
a^1. Fore wing fulvous brown or white, never subhyaline.
b. Both wings fulvous brown.
c. Hind wing; veins not prominent; but three or four dark discal spots present . 15. *chrysippus*.
c^1 Hind wing; veins heavily lined with dark fuscous scales; no discal spots, except sexual mark in male . . . . . 16. *intensa*.
b^1 Fore wing fulvous brown, hind wing white, neuration lined with dark fuscous scales 17. *hegesippus*.
b^2. Both wings white, heavily shaded with dark fuscous, especially the neuration.
c. Beneath, veins heavily marked with fuscous scales; fuscous colouring more developed 18. *lotis*.
c^1. Beneath, veins lightly marked; white colouring more developed . . . . 19. *mezentius*.

Genus 4. Euplœa, Fab.

As in the genus *Danaida*, the species of *Euplœa* may be grouped into subgenera on the character of the scent patches of the male :—

a. Without pale patch of specialized scales in the costal region of the hind wing of the male.
b. Without sexual brand on fore wing (20–23) *Menama*.
b^1. With one well-defined sexual brand between median and internal nervures of fore wing in male . . . . . (24–26) *Crastia*.
b^2. With two well-defined sexual brands between median and internal nervures of fore wing in male . . . . . (27) *Stictoplœa*
a^1. With pale patch of specialized scales in the costal region of the hind wing in male.
b. Patch quite small and placed in cell of hind wing below origin of first subcostal nervule. Fore wings pointed . . . (28) *Trepsichrois*.

*b*¹. Patch large, covering half or more than half the upper portion of cell in hind wing.
c. Fore wing without sexual spot below first median nervule beneath.
d. Fore wing rounded. Exp. al. 65–70 mm. (29, 30) *Calliplœa*.
*d*¹. Fore wing more pointed. Exp. al. 105–110 mm. . . . . (31) *Macroplœa*.
*c*¹. Fore wing with small patch of specialized scales below first median nervule (32–35) *Salpinx*.

Key to the Bornean Species of Euplœa.

a. Fore wing without prominent white patch in end of cell, which is usually uniform fuscous or more rarely with one small white spot.
b. Fore wing fuscous, with or without white apical spots, or fuscous glossed with blue. If unglossed and with white apical spots, the second spot smaller than first and third, and the male without sexual mark in fore wing.
c. Wings dark fuscous, without noticeable blue gloss.
d. Fore wings with white apical spots.
e. Submarginal spots in fore wing absent or much smaller than apical spots.
f. First three apical spots not greatly differing in size. Exp. al. 70–80 mm. Males dull fuscous brown . 20. *brookei*.
*f*¹. Second apical spot very small, third very large. Exp. al. 85–90 mm. Males dark velvety fuscous black 21. *crameri*.
*e*¹. Submarginal spots in fore wing same size as apical spots. Exp. al. 95–110 mm. 22. *scudderi*.
*e*². Submarginal spots in fore wing absent; three wedge-shaped white subapical spots in fore wing . . . 23. *lorzæ*.
*d*¹. Fore wings without white apical spots.
e. Males with narrow sexual brand in fore wing less than 12 mm. long. Females with whitish internervular postdiscal stripes in hind wing.
f. Males with indistinct traces (often absent altogether) of submarginal stripes . . . . . 24. *uniformis*.
*f*¹. Males with complete row of distinct submarginal striæ . . . 25. *masina*.

e^1. Males with broader sexual brand, measuring over 16 mm. long. Females without internervular stripes in hind wing . . . . . 26. *zonata*.

c^1. Wings with distinct blue or purple gloss.

d. Fore wing above without bluish patch below first median nervule.

e. Fore wing above without trace of small costal spot above end of cell. Hind wing cell in both sexes uniform fuscous. Male with two long sexual brands on fore wing above, between first median nervule and the submedian nervure 27. *tyrianthina*.

e^1. Fore wing above usually with small costal spot above the end of cell. Hind wing of males with upper portion whitish; fore wing of males without two long sexual brands between first median nervule and the submedian nervure.

f. Female hind wing with white internervular stripes. Male fore wing pointed and strongly glossed with steel-blue; a spot in the end of cell 28. *portia*.

f^1. Female hind wing without white internervular stripes.

g. Fore wings rounded; size small; male without spot in end of cell.

h. Without conspicuous double row of submarginal spots . 29. *adyte*.

h^1. Darker and more glossy blue above and beneath, with pronounced double row of white submarginal spots . . 30. *cabeira*.

g^1. Fore wings more pointed; size large. Male with velvety purple gloss, and spot in end of cell of fore wing below, barely visible above . . . . . 31. *butleri*.

d^1. Fore wing above with light blue patch below first median nervule . . 32. *syra*.

b^1. Both wings dark fuscous, never glossed with blue. Five white apical spots in fore wing, second larger than first, third larger than second. The male with sexual mark below first median nervule . . . . 33. *ægyptus*.

c. Hind wing beneath with uniform fuscous internervular areas . . . . . 34. *ælia*.
*c*¹. Hind wing beneath with light internervular streaks.
*a*¹. Fore wing with prominent white patch in end of cell of both sexes . . . . . 35. *lowi*.

Subfam. 2. Satyrinæ.

*Key to the Genera of Bornean Satyrinæ.**

a. Fore wing nervures (costal, or both costal and median) swollen at base.
b. Hind wing cell normal.
c. Fore wing: costal nervure swollen at base, median noticeably less than the costal or not at all.
d. Outer margin of hind wing rounded . *Ypthima*.
*d*¹. Outer margin of hind wing dentate, angulate or caudate.
e. Fore wing cell about two-thirds the length of fore wing . . . *Erites*.
*e*¹. Fore wing cell about half the length of fore wing or less.
f. Apex of hind wing cell at origin of second median nervule.
g. Eyes hairy; size moderate; wings angulate and dentate . . *Lethe*.
*g*¹. Eyes naked.
h. Size large; hind wing caudate *Neorina*.
*h*¹. Size moderate; hind wing angulate . . . . . *Cœlites*.
*f*¹. Apex of hind wing cell well beyond the origin of second median nervule. *Orsotriæna*.
*c*¹. Fore wing: costal and median nervures swollen at base . . . . . *Mycalesis*.
*b*¹. Hind wing cell abnormal: in male very short and acute, the lower discocellular nervule originating from subcostal near base of wing; in the female the cell is closed by one long oblique discocellular . . . . . *Ragadia*.
*a*¹. Fore wing nervures not swollen at base . *Melanitis*.

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* Fruhstorfer and others include *Elymnias* in this subfamily. I follow Shelford in keeping it in a distinct subfamily.

Genus 5. Ypthima, Hübn.

a. With eye spots above and below.
  b. Under side of hind wing with even submarginal row of six spots, the anal spot double 36. *fasciata*.
  *b*¹. Under side of hind wing with discontinuous row of submarginal spots.
    c. Hind wing beneath with five internervular spots, the anal spot double, giving the appearance of six spots altogether arranged in three pairs. No spot in space above third median nervule . . . . . 37. *selinutius*.
    *c*¹. Hind wing beneath with three internervular spots . . . . . 38. *pandocus*.
*a*¹. Without eye spots above or below . . 39. *abnormis*.

Genus 6. Erites, Westw.

a. With large anal ocellus on fore wing above 40. *argentina*.
*a*¹. Without anal ocellus on fore wing above.
  b. Outer half of hind wing beneath with two yellow bands, the first median and bent, the second marginal and bearing five eye spots. Ground-colour light ashy . . . 41. *elegans*.
  *b*¹. Outer half of hind wing beneath dull yellow, bearing four hind marginal eye spots. Ground-colour at base of wing fuscous ashy . 42. *thetis*.

Genus 7. Lethe, Hübn.

a. Fore wing of males above without yellow marginal spots; fore wing of females above with white subapical band or unbanded.*
  b. Under side: marginal border of large diffuse conterminous spots . . . . 43. *europa*.
  *b*¹. Under side: marginal border of neat internervular ocelli, in the fore wing especially small and well separated.
    c. Without steel-blue longitudinal bands on fore wing below.
      d. Hind wing beneath with median line very slightly excurved below subapical ocellus 44. *mekara*.
      *d*¹. Hind wing beneath with median line conspicuously excurved below subapical ocellus.
        e. Also excurved above subapical ocellus 45. *delila*.

* The female of *delila* is described as having a broad clay yellow oblique band on the fore wing above.

e^1. Not excurved above subapical ocellus . . . . . 46. *dora*.

c^1. With steel-blue longitudinal bands on light grey-brown ground-colour of fore wing below . . . . . 47. *perimede*.

a^1. Fore wing of males above with yellow marginal spots; fore wing of females above with yellow subapical band . . . . . 48. *borneensis*.

Genus 8. Neorina, Westw.

Dark fuscous above, relieved by large pale yellow patch at apex of hind wing, and on the inner margin of fore wing near the anal angle. Four submarginal white spots on fore wing, and inconspicuous dark ocellus near apex. . . 49. *lowi*.

Genus 9. Cœlites, Boisd.

a. Blue-violet iridescence covering the greater portion of both wings above . . . . . 50. *epiminthia*.

a^1. Fuscous brown above, except for bright blue-violet iridescence covering anal portion of hind wing . . . . . 51. *euptychioides*.

Genus 10. Orsotriæna, Wallengr.

Uniform fuscous above; beneath relieved by white postdiscal line and series of five eye spots . 52. *medus*.

Genus 11. Mycalesis, Hübn.

a. Both wings above orange-fulvous, margined with dark fuscous.

b. Ocellus above first median nervule in fore wing enclosed in broad fuscous marginal border. Exp. al. 47–52 mm. . . . . 53. *pitana*.

b^1. Ocellus not enclosed by narrow fuscous marginal border, which widens again over apex. Exp. al. 37–42 mm. . . . . 54. *anapita*.

a^1. Both wings fuscous above, or dull fulvous-brown or dull purple, without well-marked fuscous borders.

b. Exp. al. 50–65 mm. Colouring above fulvous-brown.

c. Dull fulvous-brown above. Hind wing beneath with distal row of small eye spots, all about the same size . . . . . 55. *mnasicles*.

c^1. Rich fulvous-brown above. Hind wing beneath with more prominent row of eye spots, in which the first and fifth are always larger than the others.

d. Reddish brown below, with two narrow red-brown bands across both wings (the basal band in fore wing of males is obsolete) . . . . . 56. *amœna.*

d^1. Dark fuscous brown below, one broad dark median band across both wings, rather lighter in centre of band . . 57. *rampaiana.*

b^1. Exp. al. 40–50 mm. Colouring above dark fuscous or dull purple.

c. Under side crossed by whitish median line, dull in males, brighter in females.

d. Marginal ocelli beneath small and of equal size. Male with two separated scent-tufts on hind wing above . 58. *baluna.*

d^1. Marginal ocelli beneath unequal, the second and third on hind wing always smaller than first and fourth.

e. Male with very small black brown sexual mark on submedian nervure of fore wing beneath,* androconial patch on costa of hind wing above without pale yellowish extension distally . 59. *cepheus.*

e^1. Male with conspicuous oval black-brown sexual mark. Androconial patch with pale yellowish club-like extension distally . . . . . 60. *hermana*

c^1. Under side crossed by one or two bands, but without a white line.

d. Fore wing beneath with less than five ocelli. Males not purple above, and hind wing without large sexual patch.

e. Under side dark grey-brown with deep red-brown bands. Fore wing with three ocelli (two apical and one subanal) 61. *kina.*

e^1. Under side with broad violet median band on red-brown ground-colour. Fore wing with two ocelli . . 62. *thyateria.*

e^2. Under side reddish-yellow with two narrow red-brown bands. Fore wing with four ocelli (three apical—the first sometimes obsolescent—and one subanal) . . . . . 63. *adustata.*

* This and the next species are very like one another, so much so that it seems impossible to find any characters sufficiently constant to separate the females; the males, however, can be distinguished by the sexual marks.

d^1. Fore wing beneath with five ocelli. Male above purple, and hind wing above with large blackish sexual patch . . 64. *orseis.*

c^2. Underside not banded. Upper side of male rich velvety brown-black with touch of purple iridescence. Female above dull brown fuscous, relieved by large yellow subapical patch in fore wing . . 65. *maianeas.*

c^3. Under side crossed by three bands . 66. *excelsior.*

Genus 12. Ragadia, Westw.

a. Ground-colour above and below creamy white. Hind wing with three brown bands beneath, two showing through above; the outer band enclosing the submarginal row of ocelli . . 67. *annulata.*

a^1. Ground-colour above light fuscous, below fulvous white. Hind wing with three brown bands beneath and showing through above; the outer band within and clear of the submarginal row of silvery ocelli . . . . . 68. *crisia.*

Genus 13. Melanitis, Fab.

a. Black apical ocellus, usually with two white pupils, on fore wing above. General colouring grey-brown fuscous . . . . . 69. *ismene.**

a^1. Black apical ocellus replaced by orange subapical band. General colouring red-brown fuscous 70. *rufinus.*

Subfam. 3. Elymniinæ.

The only genus in this subfamily is placed by many authors in the last subfamily (Satyrinæ).

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* The following forms of this species are found in Borneo:—

a. Under side with eye spots (wet season) . . . . f. *determinata.*

a^1. Under side without eye spots (dry season).

b. Apical ocellus on fore wing above with slight touch of orange-red border (typical form) . . . . f. *ismene.*

b^1. Apical ocellus approached by broad orange-red patch (aberration) . . . . . ab. *mycena.*

Shelford has shown that so-called wet and dry season forms occur together in Borneo on the same day and locality.

Genus 14. Elymnias, Hübn.

a. Hind margins strongly dentate, especially in the hind wing.
  b. Hind wing margin with three more or less prominent tooth-like projections.
    c. Under surface mottled; fore wing without marginal spots.
      d. No trace of blue on upper side. General colouring brown fuscous with narrow whitish marginal border, often obsolescent in one or both wings . . . 71. *labuana*.
      *d*¹. A bluish gloss on fore wing above.
        e. A broad postdiscal white band, faintly tinged with violet in the female, more noticeably in the male, across hind wing above . . . . . 72. *dara*.
        *e*¹. Without postdiscal band across hind wing.
          f. General colouring above dark fuscous with submarginal border of bluish spots on fore wing . . . 73. *nigrescens*.
          *f*¹. General pattern above striped green or blue on dark brown fuscous.
            g. Upper side of fore wing in male with one small stripe in space beyond cell above third median nervule. Hind wing of female above with brown stripes broader than the whitish stripes . . 74. *hypereides*.
            *g*¹. Upper side of fore wing in male with two long stripes beyond cell. Hind wing of female above with whitish stripes broader than the brown . . . . . 75. *cœlifrons*.
    *c*¹. Under surface ground-colour uniform brown. Fore wing above and below with series of small yellowish white submarginal spots, repeated on a larger scale on hind wing 76. *pellucida*.
  b. Hind wing with distinct tail-like projection from third median nervule.
    *c*¹. Without white spots beyond cell, or in cell of either wing. Both wings with pale greenish-white submarginal border, clearer across apex of fore wing . . . 77. *brookei*.
    *c*¹. Wings without submarginal border. A white patch beyond cell in fore wing, another near base of hind wing, male unknown . 78. *smithi*.

a^1. Hind margins very slightly dentate. Fore wing long and pointed or short and broad.
  b. Fore wing long and pointed. Male above glossy violet blue. Female dull violet or bluish with or without white discal patches . 79. *konga*.*
  b^1. Fore wing short and very broad. Male above blackish, margined with light blue green. Female mimics the Pierine genus *Delias*.
    c. Red basal spot on hind wing below . 80. *borneensis*.
    c^1. No red basal spot . . . . 81. *tæniola*.

Subfam. 4. Amathusiinæ.

a. Fore wing: five subcostal nervules free and well separate, with the exception of the first, which runs close to the costal in *Amathusia*. Size moderate, exp. al. 55–115 mm.
  b. Hind wing cell without membranal fold at end.
    c. Colouring above ochreous or chestnut brown. No ocelli on hind wing above.
      d. Cell of hind wing open . . . . *Faunis*.
      d^1. Cell of hind wing closed . . . *Xantho-tænia*.
    c^1. Colouring semi-transparent grey fuscous. Two large ocelli on each hind wing . . *Tænaris*.
  b^1. Hind wing cell apparently closed by transverse fold in the wing membrane . . *Amathusia*.
a^1. Fore wing: first subcostal nervule anastomosed with costal nervure.
  b. Apex of fore wing pointed.
    c. Third median nervule without spur . . *Amathuxidia*.
    c^1. Third median nervule with upwardly directed spur . . . . . *Zeuxidia*.
  b^1. Apex of fore wing rounded . . . . *Thaumantis*.

a^2. Fore wing: five subcostal nervules free, but first and second subcostal nervules run very close to the costal nervure. Size very large and square. Exp. al. 110–150 mm. . . . . *Thauria*.

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* The four forms of this species may be differentiated thus :—

a. Dark glossy blue above . . . . . ♂ f. *konga*.
a. Not dark glossy blue above.
  b. Uniform dull purplish dove-colour above . . ♀ f. *konga*.
  b^1. With white apical band in fore wing.
    c. Disc of both wings above not white . . ♀ f. *trepsichroides*.
    c^1. Disc of both wings white . . . . . ♀ f. *ptychandrina*.

Genus 15. Faunis, Hübn.

a. Underside: without ocelli on either wing.
  b. Fore wing somewhat rounded. Upper side light ochre yellow . . . . . 82. *borneensis*.
  b. Fore wing quadrate. Upper side ochreous reddish-brown . . . . . 83. *kirata*.
*a*¹. Under side: with two ocelli on hind wing.
  b. Fore wing below crossed by two median lines 84. *gracilis*.
  *b*¹. Fore wing below without two median lines (occasionally a basal line only visible).
    c. Fore wing below with conspicuous narrow white band across apex . . . 85. *stomphax*.
    *c*¹. Fore wing below without white apical band.
      d. Hind wing below: two transverse lines across discal region parallel, the outer not reaching costal ocellus. Hind wing subquadrate . . . . . 86. *barrauti*.
      *d*¹. Hind wing below: two transverse lines across discal region closer together towards inner margin and diverging towards costa so that the outer line touches costal ocellus. Hind wing more rounded 87. *besa*.

Genus 16. Xanthotænia, Westw.

Rich chestnut-brown above, relieved in fore wing by bright yellow band across apex, and a small pale yellow or white apical spot . . . . 88. *burra*.

Genus 17. Tænaris, Hübn.

Fore wing uniform semi-transparent grey fuscous. Hind wing with large black anal ocellus and smaller one on costa, each broadly margined with yellow. Anal region of hind wing white 89. *occulta*.

Genus 18. Amathusia, Fab.

a. Male without androconial cavity on hind wing.
  b. Longitudinal streaks below whitish or pale violet.
    c. Median band below not indented, or but slightly so on hind wing; narrower than postmedian band . . . . . 90. *dilutus*.
    *c*¹. Median band below, broad, velvety-brown and deeply indented.
      d. Male hair tufts on the hind wing blackish 91. *borneensis*.

d^1. Male hair tufts light brown; hind wings shorter; size smaller . . . 92. *gabriela.*
b^1. Longitudinal streaks below yellow . 93. *staudingeri.*
a^1. Male with androconial cavity producing a small cup-like excrescence on the under side of hind wing below costal nervure. White median band prominent . . . . . 94. *masina.*

Genus 19. AMATHUXIDIA, Staud.

a. Dark fuscous above, relieved by broad subapical band, violet-blue in the male, dull orange-yellow in the female . . . . . 95. *ottomana.*
a^1. Size small; male subapical band abbreviated posteriorly; female with "a very narrow ochre-yellow scarf." * . . . . . 96. *octacilia.*

Genus 20. ZEUXIDIA, Hübn.

a. Blue band on fore wing of male above, not touching cell; markings on female above yellowish or pale violet.
b. Hind wing of male above with blue anal patch; hind wing of female above with fulvous apical and marginal spots . . . . 97. *wallacei.*
b^1. Hind wing of male above with even blue marginal border from costa to anal angle; female markings above pale violet . . . 98. *doubledayi.*
a^1. Blue band on fore wing of male above extending over upper half of cell; female above with white markings untouched with yellow or pale violet 99. *aureliana.*

Genus 21. THAUMANTIS, Hübn.

a. Fore wing above without blue subapical band.
b. Fore wing of male bright iridescent blue above. Fore wing of female with blue iridescence from base to well beyond cell. Centre of anal ocellus of hind wing below blackish . . . 100. *lucipor.*
b^1. Fore wing of male dark fuscous, slightly glossed with blue; hind margin of both wings dull fulvous. Fore wing of female with blue iridescence not reaching end of cell. Centre of anal ocellus of hind wing below brown like ground-colour . . . . . 101. *noureddin.*
a^1. Fore wing above with blue subapical band 102. *cyclops.*†

* I quote Fruhstorfer's description, not having seen this subspecies.
† An aberration without the apical ocelli on hind wing is called *depupillata* Fruhst.

Genus 22. Thauria, Moore.

Size very large. Fore wing above: broad cream white band from costa to anal angle. Hind wing: broad orange fulvous anal patch . . 103. *aliris.*

Subfam. 5. Discophorinæ.

a. Fore wing: five subcostal nervules present; males with conspicuous androconial patch on hind wing above . . . . . *Discophora.*

*a*¹. Fore wing: four subcostal nervules present; males with androconial patch replaced by tuft of long hairs, covering cell of hind wing . . *Enispe.*

Genus 23. Discophora, Boisd.

a. Male without subapical band in fore wing above, but a row of three (sometimes four) obsolescent pale blue spots present beyond cell. Female with pale violet spots on fore wing above . 104. *symphronia.**

*a*¹. Male fore wing above with pale blue subapical band.

b. Band broad and continuous (female unknown) 105. *amethystina.*

*b*¹. Subapical band of male narrow and composed of cuneiform spots more or less fused distally. Female with broad orange subapical band.

c. Spots on fore wing of male moderate; below costa on hind wing of female well developed . . . . . 106. *cheops.*†

*c*¹. Spots on fore wing of male twice as broad; below costa on hind wing of female obsolescent . . . . . 107. *helvidius.*

Genus 24. Enispe, Westw.

Ground-colour of male above brown with ochreous markings; female paler, with white costal spots 108. *milvus.*

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* A male aberration with blue spots of fore wing entirely missing is called *despoliata* Stichel.

† An aberration with three additional ocelli on hind wing below, between the costal and anal ocelli, is called *orbicularia* Stichel.

Subfam. 6. Nymphalinæ.

To prepare a key for the identification of the genera of this large subfamily so that they fall into one particular sequence has proved too much for me; I have, therefore, abandoned the attempt, and adopted more or less Bingham's arrangement for the Indian genera. As explained by Fruhstorfer, it is quite impossible to rely on any one character to distinguish Nymphaline genera; any attempt to do so must result in an artificial arrangement; however, as identification is the object of a key, arrangement in sequence (which is still indicated by the numbers in front of the genera) is considered here of secondary importance.

a. Fore wing: costal nervure greatly inflated at base.
  b. Males with large dark glandular patch from median nervure to inner margin on under side of fore wing. Colouring above rich ochreous brown . . . . . 24. *Ergolis*.
  b^1. Males without glandular patch. Colouring above blue in males, olive fuscous in females . . . . . 25. *Laringa*.
a^1. Fore wing: costal nervure not inflated at base.
  b. Fore wing: costa not serrated.
    c. Fore wing: fourth subcostal nervule ending on costa well before apex . . . . . 26. *Cupha*.
    c^1. Fore wing: fourth subcostal nervule ending at or near apex or on hind margin.
      d. Cell of hind wing closed.
        e. Fore wing: second subcostal nervule emitted well beyond apex of cell.
          f. Fore wing: first subcostal nervule emitted well before apex of cell . . . . . 27. *Atella*.
          f^1. Fore wing: first subcostal nervule emitted from apex of cell . . . . . 28. *Issoria*.
        e^1. Fore wing: second subcostal nervule emitted from apex of cell or just beyond cell.
          f. Cell of hind wing closed by membranal fold . 29. *Cynthia*.
          f^1. Cell of hind wing closed by small vein.
            g. Male with large velvety patches of specialized scales. Hind wing angulate. Colouring above violet 32. *Terinos*.
            g^1. Male without large sexual patches. Hind wing usually not angulate, but, if angulate, colouring above not violet.
              h. Hind margin of hind wing strongly dentate 33. *Cethosia*.
              h^1. Hind margin of hind wing not dentate.
                i. Fore wing: third median nervule not strongly arched.
                  j. Hind margin of both wings scalloped 35. *Vanessa*.
                  j.^{1} Hind margin of fore wing not scalloped; not deeply excavate, unless hind wing is tailed.
                    k. Hind wing without prediscoidal cell.
                      l. Fore wing not elongate.
                        m. Hind wing without tail from second median nervule.

n. Hind wing with tail from sub-median nervure . . . 40. *Kallima*.
*n*¹. Hind wing not tailed.
o. Under side with prominent eye spots . . . . . 41. *Amnosia*.
*o*¹. Under side without eye spots.
p. Fore wing: second subcostal nervule from apex of cell or just before . . 38. *Hypolimnas*.
p.¹ Fore wing: second subcostal nervule from beyond cell 42. *Stibochiana*.
*m*¹. Hind wing tailed and lobed (both almost obsolete in *Chersonesia*).
n. Fore wing: fifth subcostal ends below apex on hind margin 43. *Cyrestis*.
*n*¹. Fore wing: fifth subcostal ends at apex . . . 44. *Chersonesia*.
*l*¹. Fore wing elongated with apex broadly produced; outer margin emarginate 50. *Lebadea*.
*k*¹. Hind wing with prediscoidal cell 51. *Parthenos*.
*j*². Fore wing: hind margin deeply excavate, with apex broadly rounded; hind wing not tailed . . . . . 53. *Euthalia* (part).*
*i*¹. Fore wing: third median nervule strongly arched . . . . . 54. *Dicchorragia*.
*d*¹. Cell of hind wing open.
e. Cell of fore wing closed.
f. Fore wing: second subcostal nervule emitted at or just before apex of cell.
g. Ground-colour above fuscous banded with yellow. Male with sex marks on radial nervules in fore wing, and on subcostal nervules in hind wing 30. *Ducapa*.†
*g*¹ Ground-colour above orange fulvous. Males without sex marks . . . . 31. *Cirrochroa*.
*f*¹. Fore wing: second subcostal emitted well before apex of cell.
g. Hind wing with distinct tooth-like projection at third median nervule . . . 36. *Symbrenthia*.
*g*¹. Hind wing with distinct tooth-like projection at radial nervule . . . . . 37. *Rhinopalpa*.
*g*². Hind wing without tooth-like projections or tails.
h. Hind wing above: complete white or yellow band from costa to base, and across abdomen 47. *Pantoporia*.‡

* The subgenus *Dophla* only (species nos. 218–220).

† A rudimentary discocellular can be seen with a glass, closing the cell of hind wing in this genus. The sex marks in the males, however, render it easy to recognize.

‡ Cell of fore wing in the *Athyma* group of this genus (species nos. 173, 174) is open or only closed by very fine discocellular.

h^1. Hind wing above: whitish or yellow band from costa towards anal angle; not across abdomen.
i. Fore wing: end of second subcostal nervule before origin of fourth . . . . 48. *Limenitis*.
i^1. Fore wing: end of second subcostal nervule beyond origin of fourth . . . 49. *Pandita*.
h^2. Hind wing above: band of yellow spots from costa to base and across abdomen, or with blue marginal band from apex to anal angle . 53. *Euthalia* (part).*
g^3. Hind wing with broad tail between second and third median nervules . . . . 59. *Prothoe*.
e^1. Cell of fore wing open.
f. Femora more or less unicolorous.
g. Club of antennæ usually short, broad and flat, not long, narrow or cylindrical.
h. Under side with submarginal eye spots.
i. Hind wing: inner margin excavate before anal angle; without tail . . . 34. *Precis*.
i^1. Hind wing: inner margin excavate before anal angle; prominent lobate tail from submedian nervure . . . . . 39. *Doleschallia*.
h^1. Under side without submarginal eye spots.
i. Fore wing: second subcostal nervule emitted well beyond cell . . . . . 45. *Rahinda*.
i^1. Fore wing: second subcostal nervule emitted just before end of cell . . . . 46. *Neptis*.
i^2. Fore wing: second subcostal nervule emitted well before end of cell.
j. Terminal segment of palpi at right angles to middle segment . . . . 52. *Tanæcia*.
j^1. Terminal segment of palpi long and straight . . . . . 53. *Euthalia* (part).†
g^1. Club of antennæ long, narrow and cylindrical.
h. Hind wing: precostal strongly curved, so that the distal half runs parallel to the costal nervure.
i. Fore wing short, not falcate . . . 55. *Apatura*.
i^1. Fore wing long, subfalcate . . . 56. *Eulaceura*.
h^1. Hind wing: precostal vertical . . 57. *Herona*.
f^1. Femora beneath pure white, in sharp contrast to black above . . . . . 58. *Euripus*.
b^1. Fore wing: costa serrated.
c. Cell of both wings closed . . . . . 60. *Charaxes*.
c^1. Cell of fore wing closed, hind wing open . . . 61. *Eulepis*.

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* The subgenus *Adolias* only (species nos. 221–223).
† The subgenera *Cynitia* and *Euthalia* (species nos. 201–217).

Genus 25. Ergolis, Boisd.

a. Fore wing with small white preapical spot . . . 109. *ariadne*.

*a*¹. Fore wing without white preapical spot.

b. Under side of fore wing in male with one androconial streak . . . . . 110. *specularia*.

*b*¹. Under side of fore wing in male with androconial streaks on all veins . . . 111. *isæus*.

Genus 26. Laringa, Moore.

Male uniform ultramarine-blue above; female grey brown, with paler median band in fore wing interrupted beyond cell . . . . . 112. *castelnaui*.

Genus 27. Cupha, Bilb.

a. Yellow subapical band of fore wing angled at apex of cell . . . . . 113. *lotis*.

*a*¹. Yellow subapical band of fore wing broader, straighter, and not angled at apex of cell . 114. *cacina*.*

Genus 28. Atella, Doubld.

Ochreous brown above with delicate fuscous fritillary-like markings. Exp. al. 40–46 mm. . . . 115. *alcippoides*.

Genus 29. Issoria, Hübn.

Rich ochreous brown above; fore wing with blackish markings on costa and at apex. Hind wing usually dusted with black above, pale grey-green below . . . . . 116. *macromalayana*.

Genus 30. Cynthia, Fab.

Male orange-brown above, with dark costal and marginal markings on fore wing, two ocelli on hind wing. Female: basal half grey-green, succeeded by white median band, and marginal border of grey fuscous in fore wing, ochreous in hind wing . . . . . 117. *erotella*.†

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* A dry-season form from Mantanani is called *pseudarias* Fruhst. It may be distinguished from typical *cacina* by the paler colour above, and the transverse bands of the fore wings being distally whitish.

† Fruhstorfer recognizes a tableland form of female as *dejakorum* with reduced white discal band, and a mountain form from Kinabalu as *montana*, characterized by darker green base of wing and richly striped under side. Both forms and intermediates occur in Sarawak, apparently regardless of altitude or season. The males vary in size from 68–88 mm.; a Kuching male taken in March measures 68 mm., another taken in February 85 mm. Similarly, of two females from the same district, one taken in April measures 84 mm., the other 101 mm. The interruption of band beyond cell is variable, perhaps most pronounced in two females from Mts. Matang and Kinabalu.

Genus 31. Cirrochroa, Doubld.

a. Fore wing without subapical band.
  b. Basal half of wings above red-brown, or slightly dusted with fuscous scales, and edged distally by very irregular dark line.
    c. Fore wing above: fuscous marginal border light, and invaded by traces of orange-brown from anal angle nearly to apex . . 119. *thilina*.
    *c*¹. Fore wing above: dark fuscous marginal border, in which the apical half has no trace of a line of orange-brown ground-colour.
      d. Small spot at apex of fore wing above; median line on hind wing below strongly constricted at cell . . . . 120. *ravana*.
      *d*¹. No spot at apex of fore wing above; median line on hind wing below hardly constricted at all . . . . 121. *calypso*.
  b. Basal half of wings above uniform fuscous brown, slightly lighter than uniform fuscous marginal borders; not edged distally with dark line . . . . . 122. *satellita*.
*a*¹. Fore wing: broad subapical band yellow above, white below . . . . . 123. *orissides*.

Genus 32. Terinos, Boisd.

a. Hind wing rounded, anally violet-orange, and immaculate above. Exp. al. 63–73 mm. . 124. *terpander*.
*a*¹. Hind wing quadrate and distinctly tailed. Exp. al. 74–80 mm.
  b. Hind wing above anally orange-violet, with violet lunules . . . . . 125. *nympha*.
  *b*¹. Hind wing above without orange-violet; two large white spots towards anal angle . 126. *albonotata*.
  *b*². Hind wing above anally orange-violet, without violet lunules . . . . . 127. *fulminans*.

Genus 33. Cethosia, Fab.

a. Fore wing above: without pale yellow subapical band . . . . . 128. *sandakana*.
*a*¹. Fore wing above: pale yellow subapical band 129. *hypsea*.

Genus 34. Precis, Hübn.

a. Fore wing noticeably hooked; an indistinct submarginal row of eye spots barely visible.
  b. Hind wing above: with dark postmedian band almost concealing row of small eye spots 130. *horsfieldi*.

*b*¹. Hind wing above: conspicuous row of well-developed eye spots . . . . . 131. *ida.*

*a*¹. Fore wing very slightly hooked; submarginal eye spots prominent.

b. General colouring above pale grey; five or six submarginal eye spots on hind wing above 132. *atlites.*

*b*¹. Only two eye spots on hind wing above.

c. Orange-brown above, without subapical band in fore wing . . . . . 133. *javana.*

c.¹ Hind wing of male blue above, fore wing dark fuscous shaded with blue; female dark fuscous without blue shading; both sexes relieved in fore wing by pale buff subapical band . . . . . 134. *metion.*

Genus 35. Vanessa, Fab.

Dark blue above with light blue submarginal band from costa of fore wing to inner margin of hind wing . . . . . 135. *perakana.*

Genus 36. Symbrenthia, Hübn.

a. Colouring beneath red-brown on orange . 136. *marius.*

*a*¹. Ground-colour beneath cream-white.

b. Fore wing markings principally black below 137. *balunda.*

*b*¹. Fore wing markings principally chocolate-brown below . . . . . 138. *hippocrene.*

Genus 37. Rhinopalpa, Feld.

Chestnut brown above with heavy hind marginal border of fuscous black. Beneath, blackish with thin blue lines and hind marginal eye spots 139. *helionice.**

Genus 38. Hypolimnas, Hübn.

a. *Euplœa*-mimic. No white or blue subapical bar in fore wing above; occasionally three small whitish internervular streaks visible beyond cell in fore wing above . . . . . 140. *anomala.*

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* The male and two forms of female may be distinguished thus:—

a. Basal portion of fore wing above not noticeably darker than median area . . . . . ♂ f. *typica.*

*a*¹. Basal portion of fore wing above fuscous brown, in sharp contrast to yellow-brown median area.

b. A submarginal row of eye spots on hind wing above, but no spots in median area . . . . . ♀ f. *typica.*

*b*¹. Median area of hind wing above with eye spots in addition to submarginal row . . . . . ♀ f. *elena.*

a^1. A prominent white or blue subapical bar in fore wing above.
  b. Males small, with very broad white median band across hind wing below, females tawny fulvous above; exact mimic of *Danais chrysippus* . . . . . 141. *misippus*.
  b^1. Males larger, usually with only faint trace of white median band on hind wing below; females fuscous black above, with blue or white bar and marginal spots . . 142. *bolina*.*

Genus 39. Doleschallia, Feld.

Shape of wings under side leaf-like; above brown, apical half of fore wing blackish barred with orange-yellow . . . . . 143. *borneensis*.

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* The male forms in the Sarawak Museum may be separated thus:—

a. Postdiscal bar on fore wing above, and discal spot on hind wing centrally white . . . . . ♂ form 1.
a^1. Postdiscal bar and discal spot centrally pale blue.
  b. Submarginal row of whitish spots on hind wing above . ♂ form 2.
  b^1. No submarginal row of whitish spots on hind wing above ♂ form 3.
a^2. Postdiscal bar centrally pale blue, but discal spot of hind wing uniform dark iridescent blue . . . . . ♂ form 4.

The females may be distinguished by the duller fuscous ground-colour as opposed to the velvety blue-black of the males. The different forms in the Sarawak Museum (N.B.—all from Borneo) may be distinguished thus:—

a. Discal portion of hind wing above broadly white; an orange patch near anal angle on fore wing above . . . . ♀ form 1.
a^1. Discal portion of hind wing above slightly washed with white; no trace of orange on upper side of either wing . ♀ form 2.
a^2. No white on discal portion of hind wing above.
  b. No sign of orange on either wing above.
    c. A noticeable blue discal patch on hind wing above.
      d. Fore wing postdiscal bar above more blue than white.
        e. Hind wing above: submarginal row of white dots scarcely traceable . . . . . ♀ form 3.
        e^1. Hind wing above: submarginal row of white dots well-developed and conspicuous . . . . ♀ form 4.
      d^1. Fore wing postdiscal bar above white . . . ♀ form 5.
    c^1. No blue discal patch on hind wing above . . . ♀ form 6.
  b^1. A small orange patch near anal angle on fore wing above ♀ form 7.

I do not see that any good is attained by preserving names for all these forms, especially as the above eleven forms are represented by a series of only fifteen specimens. No doubt many more forms requiring distinction could be found, say, in a series of a hundred.

Fruhstorfer recognizes sixty-two names for the different subspecies and forms of *Hypolimnas bolina*, many of which are no doubt well justified, as the species has a very large range, and in many localities no doubt produces constant races.

Genus 40. Kallima, Doubld.

Shape of wings and under side leaf-like; above steel-blue with broad orange band from middle of costa to hind margin near anal angle in fore wing . . . . . 144. *buxtoni.*

Genus 41. Amnosia, Westw.

Male fuscous black above, with bright blue band from centre of costa to anal angle in fore wing. Female dull brown, with yellow band in fore wing, reaching hind margin slightly above anal angle. Submarginal border of large eye spots on hind wing below in both sexes . . 145. *baluana.*

Genus 42. Stibochiona, Butl.

Male rich velvety brown-black above and below; female dull fuscous black with broad macular hind marginal pale violet-pink border in hind wing continued much narrower and immaculate into the fore wing . . . . . 146. *schœnbergi.*

Genus 43. Cyrestis, Boisd.

a. Ground-colour white.
  b. Markings above pale grey . . . 147. *sericeus.*
  *b*¹. Black marginal borders and three thin black longitudinal lines across both wings, sharply defined above . . . . . 148. *nivalis.*
  *b*². Heavy black markings above obliterating most of the white ground-colour . . . 149. *seminigra.*
*a*¹. Ground-colour orange-brown, crossed by blackish longitudinal lines . . . . . 150. *theresæ.*

Genus 44. Chersonesia, Dist.

a. Fore wing: fourth longitudinal band straight to costa.
  b. Ground-colour above orange-yellow . 151. *cyanee.*
  *b*¹. Ground-colour rich orange-brown, more heavily banded with fuscous black . . . 152. *excellens.*
*a*¹. Fore wing: fourth longitudinal band sinuate.
  b. Fore wing: first and second longitudinal bands filled in with orange-brown ground-colour 153. *rahria.*
  *b*¹. Fore wing: first and second longitudinal band filled in with fuscous, size small.
    c. Fore wing: third longitudinal band not lined. . . . . 154. *intermedia.*
    *c*¹. Fore wing: third longitudinal band lined like first and second . . . . 155. *peraka.*

Genus 45. Rahinda, Moore.

a. Fore wing pointed: hind marginal line if single narrower than its distal and proximal fuscous borders.
  b. Fore wing: orange hind marginal line single 156. *senthes*.
  *b*¹. Fore wing: hind marginal line double.
    c. Hind marginal line orange . . 157. *paraka*.*
    *c*¹. Hind marginal line grey . . . 158. *dindinga*.
*a*¹. Fore wing slightly rounded; orange hind marginal line as broad as its distal and broader than its proximal fuscous borders . . . . 159. *aurelia*.

Genus 46. Neptis, Fab.

a. Upper side black and white.
  b. Under side rich ochreous barred and spotted with white . . . . . 160. *sopatra*.
  *b*¹. Under side brownish-black or reddish-brown, barred and spotted with white.
    c. Hind wing above: postdiscal series of white spots rounded or conical . . . 161. *plautia*.
    *c*¹. Hind wing above: postdiscal series of white spots transverse (the two apical spots sometimes excepted).
      d. Subapical and submedian spots on fore wing above with conspicuous white lines distally . . . . . 162. *duryodana*.
      *d*¹. Only one broken series of small white lines distal to the subapical and submedian spots in fore wing.
        e. White subbasal line on hind wing above not reaching costa.
          f. Fore wing: subapical and submedian spots normal.
            g. Fore wing: white triangle in apex of cell separated from basal streak 163. *nata*.
            *g*¹. Fore wing: white triangle practically fused with basal streak 164. *rasilis*.
          *f*¹. Fore wing: subapical and submedian spots reduced to mere dots . 165. *egestas*.
        *e*¹. Hind wing above: white subbasal line extending to costa . . . 166. *ila*.

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* An aberration with yellow patches on fore wing confluent is called ab. *sandaka* Butl.

*a*¹. Upper side orange and black or dark brown barred with lighter brown.
b. Fore wing above: orange triangle in apex of cell broad and separated from basal streak . 167. *dorelia*.
*b*¹. Fore wing above: triangle in apex of cell long and narrow, almost completely fused with basal streak.
c. Fore wing above: no light spots immediately above cell triangle.
d. Dark median band of hind wing above with lighter central line . . 168. *salpona*.
*d*¹. Dark median band of hind wing above without lighter central line.
e. Rich black-brown above, barred with grey-brown . . . . 169. *discerna*.
*e*¹. Fuscous brown above, barred with bright orange.
f. Hind wing above: two orange bands about one-third the width of intervening fuscous ground-colour; colouring beneath paler . . . 170. *sarachoa*.
*f*¹. Hind wing beneath: two orange bands about one-fifth the width of intervening fuscous ground-colour; bands beneath richer reddish-brown and purple . . . . . 171. *digitia*.
*c*¹. Fore wing above: two light brown spots immediately above cell triangle . . 172. *arnoldi*.

Genus 47. Pantoporia, Hübn.

a. Fore wing above: narrow hind marginal line white, never brown, orange or grey-brown.
b. Basal streak in cell of fore wing continuous to apex . . . . . 173. *pravara*.
*b*¹. Basal streak in cell of fore wing interrupted towards apex.
c. White submarginal spots on fore wing beneath dark centred . . . . 174. *anaka*.
*c*¹. White submarginal spots on fore wing beneath not dark centred.
d. Hind wing above: white discal band well-developed.
e. Fore wing above: no white spot of median band between second and third median nervules.
f. Exp. al. 75–87 mm.; basal streak of fore wing cell distinctly broken into three, in addition to the well-separated white triangle in apex of cell . 175. *elisa*

f^1. Exp. al. 51–60 mm.; basal streak unbroken, but separate from white triangle in apex of cell . . 176. *kanwa*.

f^2. Exp. al. 53–60 mm.; basal streak broken into three portions, the distal spot distinctly separate, the second barely; the white triangle well separate . . . . . 177. *kresna*.

e^1. Fore wing above: a white spot between second and third median nervules, placed further in than the spot below in the male, further out in the female.

f. Fore wing above: small spot above submedian nervure well separate from large spot in internervular space above 178. *matanga*.

f^1. Fore wing above: long spot above submedian nervure reaching large spot in internervular space above 179. *amhara*.

d^1. Hind wing above: white discal band reduced to two spots . . . 180. *euloca*.

a^1. Fore wing above: narrow hind marginal line brown, orange or grey-brown (touched with white in male *matthiola*).

b. Basal streak in cell of fore wing absent altogether . . . . . 181. *ambra*.

b^1. Basal streak in cell of fore wing long and partially fused with white triangle at apex 182. *matthiola*.*

Genus 48. Limenitis, Fab.

a. Band across fore wing pale green, narrow, nearly straight . . . . . 183. *viridicans*.

a^1. Band across fore wing white, broad, curved 184. *agnata*.

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* Fruhstorfer separates the Bornean subspecies as *matthiola*, and figures the male and an orange female; the latter may be regarded thus as typical female *matthiola*; while for the grey-brown female, corresponding to *gandara* Feld. in Java, I propose the name *liomattha*.

The male and two females may be recognized thus:—

a. Bars above white . . . . . ♂ f. *typica*.
a^1. Bars above orange . . . . . ♀ f. *typica*.
a^2. Bars above grey-brown . . . . . ♀ f. *liomattha* Moulton.

Genus 49. Pandita, Moore.

Orange-brown above with longitudinal fuscous bands 185. *sinoria.*

Genus 50. Lebadea, Feld.

a. Fore wing of male subfalcate. White spot above submedian nervure in fore wing above nearly as wide as spot above it . . . . 186. *martha.*
a[1]. Fore wing of male sinuate. White spot above submedian nervure very narrow . . 187. *paduca.*

Genus 51. Parthenos, Hübn.

Size large (exp. al. 85–100 mm.). Olive-green above, heavily barred and streaked with black; fore wing with postmedian band of large white spots . . . . . 188. *borneensis.*

Genus 52. Tanæcia, Butl.

The Bornean species are extremely difficult to separate, as no two authors agree on the constitution of hardly any one species, thus "a" may be a separate *species*, or a *subspecies* of "b," or a form of "c." Breeding experiments alone will settle this. I follow Fruhstorfer's arrangement as far as possible, and the following key is based on the distinctions given by him. They are, however, insufficient for me to identify the specimens in the Sarawak Museum, but since the determination in any case is bound to be doubtful until the species are bred out, perhaps this is of less importance.

a. Colouring above dark brown-black with broad white band across both wings . . . 189. *amisa.*
a[1]. Colouring above grey-brown, relieved in some with violet tinge and black and white sagittate submarginal borders, or in some males fuscous black above with blue hind-marginal borders.
  b. Uncus sickle-shaped.
    c. Both sexes with white in submarginal border of hind wing above . . . . 190. *crowleyi.*
    c[1]. Both sexes: black sagittate spots of submarginal border without pure white edge.
      d. Submarginal spots on hind wing pointed 191. *lutala.*

d^1. Submarginal spots on hind wing rounded 192. *valmikis.**

b^1. Uncus straight, sharp-pointed.
  c. Males grey-brown like the females.
    d. Upper side dark-grey or black-brown above without violet suffusion . 193. *orphne*.
    d^1. Upper side with violet-blue suffusion.
      e. White inner portion of median band well-developed . . . . 194. *munda*.
      e^1. White inner portion of median band absent or obsolescent . 195. *fruhstorferi*.†
  c^1. Males dark fuscous, margined with blue, unlike the females.
    d. Above marked with white pearl-shaped spots . . . . . 196. *clathrata*.
    d^1. With two or three white dots near the costa of the hind wing . . . 197. *cœrulescens*.
b^2. Uncus snake-shaped at end.
  c. Colouring above brown without blue markings . . . . . 198. *pardalis*.
  c^1. Male with blue markings; both sexes with middle row of black spots showing through as a blue undulate band on the hind wing above . . . . . 199. *apsarasa*.
  c^2. Deeper brown ground-colour; white markings of fore wing more sharply defined 200. *subochrea*.‡

The above key is very unsatisfactory, but without comparison with types and long series I am unable to make it more useful.

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* Two Bornean forms are characterized by Fruhstorfer thus:—

a. Posterior portion of the very broad median area of the hind wings above suffused with a lovely violet-blue . *viola* Fruhst.
a^1. Intramedian spots shaded with grey, and on the hind wings the median band nearly clear white without any lustre of blue or violet . . . . . *lutalina* Fruhst.

The first is described as a new "subspecies," the latter as a new form from South-east Borneo.

The separation of *valmikis* from *lutala* seems of doubtful merit.

† Different forms of the males and females are separated thus:—

MALES.

a. With violet-blue suffusion on hind wing . ♂ f. *typica*.
a^1. Without violet-blue suffusion on hind wing . ♂ f. *salina* Fruhst.

FEMALES.

a. Hind wing: narrow band in middle of wing . ♀ f. *typica*.
a^1. Hind wing: a broadly white proximal area . ♀ f. *albifasciata* Butl.
a^2. Hind wing: dark brown on both sides; white markings nearly confluent . . . . ♀ f. *evanescens* Butl.

‡ Fruhstorfer notes a form from North Borneo distinguished by the rounded instead of pointed internervular spots on the upper side of hind wing = *margarita* Butl.

Genus 53. Euthalia, Hübn.

The Bornean species come under the following subgenera:—

a. Cells of both wings open.
  b. Precostal of hind wing straight, bifurcate . *Cynitia*.
  b^1. Precostal curved, single . . . . . *Euthalia*.
a^1. Cell of both wings closed; in the hind wing the discocellular is sometimes barely perceptible . *Dophla*.
a^2. Cell of fore wing closed, hind wing open . . *Adolias*.

Subgen. Cynitia, Snell.

a. Males black, margined with light blue; a light frictional patch on fore wing below. Females with dull hyaline spots on fore wing, no white spotted bands . . . . . 201. *vacillaria*.*
a^1. Males black, margined with light blue; without frictional patch on fore wing below. Females with white spotted postmedian bands, no dull hyaline spots . . . . . 202. *ambalika*.†

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* A female form characterized by a complete light-coloured band on the hind wing is called *arama*, Fruhst.

† The males vary above in the pale blue or violet blue of the marginal border, which also varies in extent: almost absent in fore wing of some specimens, quite narrow or broad to anal angle of fore wing, reaching apex of fore wing in some or not in others. Beneath, the colouring varies from ochreous to rufous or violaceous-brown.

The female forms may be separated thus:—

a. White hind marginal spots of fore wing above well-developed . . . . . ♀ f. *tiara* Fruhst.
a^1. White spots of fore wing confluent . . ♀ f. *trilobita* Fruhst.
a^2. No white spots on fore wing . . . . ♀ f. *paramitra* Fruhst.
a^3. Fore wing with small, well separated white spots beyond cell, and hind wing with broad violet-blue band . . . . . ♀ f. *magnolia* Staud.
a^4. Fore wing with white postmedian spots well-developed, violet band of hind wing absent or obsolescent . . . . . ♀ f. *typica*.
a^5. Hind wing with broad violet-blue band; fore wing spots well-developed, but often dusted with brown . . . . . ♀ f. *diardi* Voll.
a^6. Hind wing with but faint traces of white median spots . . . . . ♀ f. *martini* Fruhst.

Two more forms are recorded by Fruhstorfer: *gandarva* Voll., which seems to be a transition between the last three, and *colorata* Fruhst., which is a pale-brown form of *martini*. Some Sarawak specimens seem to be rather too dark for this, and, at same time, a little light for *martini*.

Subgen. EUTHALIA, Hübn.

a. Upper and under side without red spots.
b. Hind wing under side in both sexes with continuous zigzag submarginal line. Both sexes polymorphic . . . . . 203. *bipunctata*.*
*b*¹. Hind wing under side in both sexes with submarginal line formed of small internervular spots, with or without traces of zigzag connecting lines. Both sexes nearly always monomorphic.
c. Hind wing of male not bordered by blue band.
d. Fore wings slightly subfalcate. General colouring not marbled green.
e. Males without distinct white spots beyond cell in fore wing. Females without postmedian white band across both wings.
f. Fore wing beneath white tipped.
g. Male and female with inconspicuous brown-dusted subhyaline spots beyond cell in fore wing above 204. *sandakana*.

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* The male forms may be distinguished thus :—

a. Upper side dull brown, without white, blue or green marginal bands . . . . . ♂ f. *typica*.
*a*¹. Upper side with irregular white sagittate markings on fore wing, but without blue, violet or green distal border on hind wing.
b. Fifth white sagittate marking on fore wing above indistinct; exp. al. 49–52 mm. Male mark on hind wing prominent . . . . . ♂ f. *stictica*.
*b*¹. Five white sagittate markings on fore wing larger and well-defined. Exp. al. 58–60 mm. Male mark on hind wing less prominent . . . . . ♂ f. *indistincta*.
*a*². Upper side with blue, violet or green distal border on hind wing.
b. Fore wing without white band; hind wing distal band green . . . . . ♂ f. *cordelia*.
*b*¹. Fore wing white banded.
c. Hind wing distal band greenish blue . . . ♂ f. *lavernalis*.
*c*¹. Hind wing distal band violet-blue . . . ♂ f. *ilka*.
*b*². Fore wing without white band; hind wing distal band violet-blue . . . . . ♂ f. *limbata*.

The female forms may be separated thus :—

a. Upper side without noticeable violet suffusion.
b. White sagittate bands prominent . . . . . ♀ f. *typica*.
*b*¹. White sagittate bands obsolescent, especially in hind wing . . . . . ♀ f. *indras*.
*a*¹. Upper side with noticeable violet suffusion, especially on distal area of hind wing.
b. Black sagittate markings on hind wing above well-developed; one present below first median nervule . ♀ f. *cordelia*.
*b*¹. Black sagittate markings obsolescent towards inner margin; none present below first median nervule . ♀ f. *ilka*.

g^1. Male without trace of postcellular spots in fore wing. Female with more conspicuous whitish spots beyond cell in fore wing.

h. Dark submarginal band on fore wing of male beneath continuous with median band of hind wing. Whitish spots on fore wing of female above very long.

i. Under surface olivaceous. Female above dominantly greenish-olive . . . 205. *parta*.

i^1. Under surface darker. Female above with noticeable purplish sheen . . . . 206. *krannon*.

h^1. Dark submarginal line of spots on fore wing of male beneath continuous with submarginal line of spots of hind wing. Whitish spots beyond cell of fore wing in female above normal 207. *apicalis*.

f^1. Fore wing beneath without white apical spot . . . . 208. *kanda*.

e^1. Male with distinct white spots in fore wing beyond cell. Upper side glossed with dark purple. Female above and below with well-developed white postmedian band across both wings, on the hind wing above glossed with purple 209. *tinna*.

d^1. Fore wings noticeably falcate; general colouring above and below marbled green (under side lighter). Female with confluent postcellular white spots; male without . . . . . 210. *anosia*.

c^1. Male with hind wing bordered by broad milky-blue terminal band.

d. Marginal border of hind wing in male violet. Female with white macular band obsolete . . . . . 211. *euphemius*.*

d^1. Marginal border of hind wing in male blue. Female like that of *bipunctata* 212. *zichri*.*

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* I have not seen these two species.

a^1. Upper and under side with red spots.
  b. Palpi and fore legs whitish-buff.
    c. Female with two large red spots before the apex on hind wing above.
      d^1. White spots of the fore wing well-marked in both sexes . . . . . 213. *whiteheadi*.
      d^1. White spots of the fore wing diminished, submedian patch beneath obsolescent 214. *adeonides*.
    c^1. Female without red spots before the apex on hind wing above . . . . 215. *adeona*.
  b^1. Palpi and fore legs red.
    c. Male without white spots on fore wing 216. *djata*.
    c^1. Male with white spots on fore wing; female with broad white macular band across both wings . . . . . 217. *montana*.

Subgenus Dophla, Moore.

a. Upper side crossed by continuous macular band, yellow on dark fuscous in males, white on violet-tinged grey in female . . . . 218. *bellata*.
a^1. Upper side dull olive-brown without light median band. A red spot noticeable in cell. . 219. *mahonia*.
a^2. Upper side dull olive-brown, crossed by an incomplete line of small yellow spots which are usually edged with blackish . . . 220. *dunya*.

Subgenus Adolias, Boisd.

a. Palpi fulvous.
  b. Male black above with light iridescent blue marginal band, very broad on hind wing; colouring beneath orange fulvous. Female above brown, spotted with yellow; beneath greenish . . . . . 221. *dirtea*.
  b^1. Under side both sexes yellow and brown. Upper side both sexes brown spotted with yellow; female largely spotted with white 222. *canescens*.
a^1. Palpi dull brown, in the female with longitudinal grey stripe. Male black above with iridescent blue marginal border. Female above blackish, spotted with light blue-green . . . 223. *sandakanus*.

Genus 54. Dichorragia, Butl.

Ground-colour above olive-blue-green, spotted with black and blue, beneath blackish striated with white in the apical half of fore wing and on the hind margin of hind wing . . . 224. *derdas.*

Genus 55. Apatura, Fab.

Males velvety brown-black above; females ochreous-brown; a submarginal row of small black spots, those near apex of fore wing touched with white. Exp. al. 46–51 mm. . . . . 225. *borneana.*

Genus 56. Eulaceura, Butl.

Males velvety black-brown above, relieved by narrow white median band from third median nervule in fore wing to inner margin and across hind wing. Female dull grey-brown above, irregularly washed with white and dark spotted in distal half. Under side pearly white . . . . . 226. *osteria.*

Genus 57. Herona, Westw.

Ground-colour above grey-brown; postdiscal region of hind wing spotted with white; in fore wing a large yellowish spot below second median nervule in addition to a few postdiscal white spots 227. *schœnbergi.*

Genus 58. Euripus, Westw.

Male blackish-brown, streaked and spotted with white. Female uniform brown or violet-tinged, or mimicking *Euplœa lowi* . . . 228. *borneensis.**

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* The male and different female forms of this species may be distinguished thus:—

a. A submarginal row of double white streaks on both wings above.
  b. Apex of fore wing not striped with blue . ♂ f. *typica*.
  *b*¹. Apex of fore wing striped with blue . . ♀ f. *biseriata* Fruhst.
*a*¹. No submarginal row of double white streaks.
  b. Mimic of *Euplœa lowi*.
    c. Ground-colour brown . . . . ♀ f. *loweimima* Fruhst.
    *c*¹. Ground-colour blue . . . . . ♀ f. *euplœina* Fruhst.
  *b*¹. Not a mimic of *Euplœa lowi*.
    c. Upper surface uniform brown . . . ♀ f. *uniformis* Fruhst.
    *c*¹. Upper surface steel-blue, apex of fore wing whitish violet . . . . . ♀ f. *crastiana* Fruhst.
    *c*². Hind wing with blackish-blue basal stripes, distal area light brown . . . . ♀ f. *strigata* Fruhst.

Genus 59. Prothoe, Hübn.

a. Colouring above creamy-yellow, heavily margined with fuscous. A subapical row of four yellowish spots on fore wing above, which are sometimes partially fused . . . . . 229. *calydonia*.

*a*¹. Colouring above dark blue; fore wing crossed by lighter blue oblique median band; three white spots at apex . . . . . 230. *angelica*.

Genus 60. Charaxes, Ochs.

a. Colouring above orange, without white band or spots.

b. Hind margin of fore wing above narrowly bordered with fuscous brown.

c. A submarginal row of small black spots on hind wing above . . . . . 231. *distanti*.

*c*¹. A submarginal row of larger black spots on hind wing above, the two apical spots large and confluent . . . . . 232. *infernus*.

*b*¹. Hind margin of fore wing very broadly bordered with black-brown, especially over apical region . . . . . 233. *repetitus*.

*a*¹. Colouring above relieved by white band or chain of white or yellow spots.

b. Broad white band across fore wing above, reaching costa in female, but beyond cell only in male . . . . . 234. *borneensis*.

*b*¹. Double band of elongated white lunules across distal half of fore wing above . . 235. *everetti*.

*b*². A narrow yellow macular band across both wings above on blackish ground-colour 236. *echo*.

Genus 61. Eulepis, Moore.

a. Ground-colour of upper side pale yellow.

b. Under side fore wing with four prominent black discal spots. Fore wing above: inner margin entirely yellow . . . . . 237. *concha*.

*b*¹. Under side fore wing not spotted with black. Fore wing above: inner margin fuscous at anal angle and slightly at base.

c. Inner margin of hind wing below broadly white, very slightly tinged with brown 238. *jalysus*.

c^1. Inner margin of hind wing below broadly chocolate-brown.
d. Basal region of both wings above dark fuscous . . . . . 239. *uræus*.
d^1. Basal region of both wings above greyish, darker on costa of fore wing.
e. Pale median band of ground-colour on hind wing beneath broad (13 mm. on costa) . . . . . 240. *heracles*.
e^1. Pale median band of ground-colour on hind wing beneath narrow (7 mm. on costa) . . . . . 241. *ganymedes*.
a^1. Ground-colour of upper side white, tinged with blue and very broadly margined with fuscous black . . . . . 242. *malayicus*.

XIV. — A Preliminary Account of the Thysanoptera of Borneo.—By Richard S. Bagnall, F.L.S.

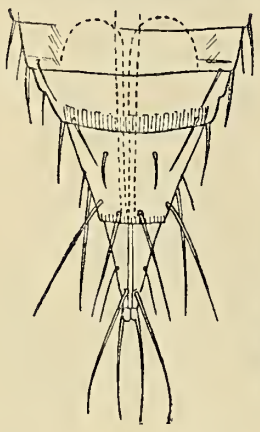
At Mr. Moulton's request I write this brief review of the Thysanoptera of Borneo. Although many Malayan and Indo-Malayan species have been described in recent years, only two species had, until very recently, been recorded from Borneo, namely, *Adiaphorothrips simplex* and *Dinothrips sumatrensis*. Mr. G. E. Bryant, however, whilst collecting small Coleoptera in the neighbourhood of Mt. Matang in the winter of 1913–4, made a small collection of Thrips which has proved to be one of the most interesting collections I have yet examined, containing many new species, including the types of some very interesting new genera, and also adding considerably to our knowledge of the Malayan Thysanoptera.

Mr. Bryant's collection shows that the Thrips of Borneo are somewhat specialized, and it would well repay other entomologists to make special collections in this obscure group. The minute flower-loving species, at least, should be collected into about sixty per cent. of alcohol. I should welcome material from other correspondents resident or journeying in Borneo, and take this opportunity of conveying to Mr. G. E. Bryant my hearty thanks for his carefully collected material. I also owe my gratitude to the Editors of the *Annals and Magazine of Natural History* for the loan of three of the blocks reproduced herein.

Suborder TEREBRANTIA.

Family THRIPIDÆ.

(a) *Physothrips* group.



MEGALUROTHRIPS TYPICUS, Bagn., end of abdomen.

Genus MEGALUROTHRIPS, Bagn.

Megalurothrips typicus, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 590.

Described from a single example taken by Mr. Bryant, and forming the type of a new genus characterized chiefly by the abnormal 9th and 10th abdominal segments.

W. SARAWAK, Mt. Matang, one female. Caught on the wing, December, 1913 (G. E. Bryant).

(b) *Thrips* group.

Genus ISONEUROTHRIPS, Bagn.

Isoneurothrips orientalis, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 593.

Also new and forming, together with an Australian species, the genus *Isoneurothrips* separated from *Thrips* s. str. by having both veins of fore-wing regularly set with setæ.

W. SARAWAK, Mt. Matang, two females and one male, taken by Mr. Bryant in a white flower at about 1000 ft. altitude.

Suborder TUBULIFERA.

Family IDOLOTHRIPIDÆ.

Genus ACANTHINOTHRIPS, Bagn.

Acanthinothrips annulipes, Bagnall, 1914.

Ann. & Mag. Nat. Hist. ser. 8, xiv. p. 378.

A fine large species described from examples taken by Mr. Bryant, and readily distinguished from the Australian species *A. spectrum* (Hal.), and the recently described Javanese form *A. nigro dentatus*, Karny, by the distinctive coloration of the legs. In some specimens the stems of antennal joints 5 and 6 are greyish-yellow in colour.

W. SARAWAK, Mt. Matang, up to 2000 ft., December, 1913–January, 1914. On the wing, by beating dead leaves and on dead bark (G. E. Bryant).

Genus KLEOTHRIPS, Schmutz (= *Dracothrips*, Bagn.).

Kleothrips, sp.

There are three examples (varying extraordinarily in size) of a species of this genus differing from *K. gigans*, Schmutz (= *Dracothrips ceylonicus*, Bagn.) in its shorter tube, which is only about 5·5 times the length of the head. It comes nearer to *K. simplex* (Bagn.), from the Philippines, the type of which is in the British Museum, and with which I hope to compare the Bornean examples in the early future.

W. SARAWAK, Mt. Matang, December, 1913, and Quop, March, 1914.

HOLUROTHRIPS ORNATUS, Bagn.

Family HYSTRICHOTHRIPIDÆ.

Genus HOLUROTHRIPS, Bagn.

Holurothrips ornatus, Bagnall, 1914.

Ann. & Mag. Nat. Hist. ser. 8, xiv. p. 376.

A bizarre form described from two examples taken by Mr. Bryant, and forming the type of the genus.

W. SARAWAK, Mt. Matang, two examples from amongst decaying leaves, December 2nd, 1913 (G. E. Bryant).

Family PHLŒOTHRIPIDÆ.

(a) *Macrothrips* group.

Genus MACHATOTHRIPS, Bagn.

Machatothrips biuncinatus, Bagnall, 1908.

Originally described from South New Guinea, this species has since been recorded by Dr. Buffa from Penang, Sumatra, and the islands Mentawei and Engano.

W. SARAWAK, Mt. Matang, one male taken on dead tree with *Ecacanthothrips bryanti*, sp. n., December 17th, 1913 (G. E. Bryant).

Genus ADIAPHOROTHRIPS, Bagn.

Adiaphorothrips simplex, Bagnall, 1908.

Described from two male examples taken by Mr. Th. F.

Lucassen at Sambas in May, 1890. The female is smaller, and may be recognized by its less swollen fore-legs and the smaller fore-tarsal tooth.

W. Borneo, two males, Sambas, May, 1890 (Lucassen); W. Sarawak, two males, Matang, from dead bark, December, 1913, and another in January, 1914; one female, Quop, March, 1914 (G. E. Bryant); not yet recorded from elsewhere.

Adiaphorothrips antennatus, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 594.

A new species separated from *A. simplex* by the shorter head, the stronger cephalic spines, and the shorter intermediate antennal joints, 3 and 4 being subequal.

W. Sarawak, two males, one from Matang from under bark of dead tree, December 7th, 1913, and the other from Quop, March 28th, 1914 (G. E. Bryant).

Genus Dinothrips, Bagn.

Dinothrips sumatrensis, Bagnall, 1908.

It seems that there are more than one species of *Dinothrips*. Schmutz describes *D. furcifer* from Ceylon, but does not compare it with *sumatrensis*, and it is desirable that his specimens should be re-examined. *D. sumatrensis* is recorded from Sumatra, Java, New Guinea, Central Tonkin, Birmania, Penang, Borneo, Singapore, and the islands Mentawei, Engano, and Nias, but it is doubtful if all these records refer to the true *sumatrensis*. In Mr. Bryant's collection there are evidently two forms, the present species being provisionally characterised by the relatively shorter and stouter third antennal joint and the distinctly longer ante-ocellar spines. The third antennal joint is of a clear yellow colour, broadly banded with black basally and distally. The male is larger than the female. The other species, which may be called

Dinothrips affinis, sp. n.,

has the female larger than the female of *sumatrensis*, and in the few specimens at my disposal distinctly larger than the male. The third antennal joint is not only more slender, but distinctly longer than in *sumatrensis*, yellowish- to reddish-brown, rarely darker basally, and only narrowly blackish-brown at apex. The ante-ocellar spines are stout and rather short.

I hope to make a closer study of this genus from other material in my possession which is not at the moment available, and from, I hope, the large amount of material recorded by Professor Buffa.

W. Sarawak; both species from dead bark and trees; Mt. Matang, December, 1913 (G. E. Bryant).

(b) *Docessissophothrips* group.

Genus Docessissophothrips, Bagn.

Docessissophothrips laticeps, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 322.

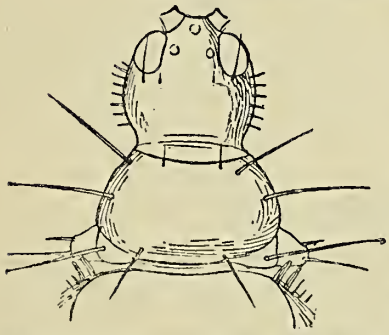
The species of this curious genus are apparently very rare; I have described five from remote parts of the world, and each is represented by but a single example. Mr. Bryant's record suggests that the extreme rarity may be due to a specialized habitat.

W. Sarawak, one male, Mt. Matang, January 28th, 1914, under bark with termites (G. E. Bryant).

(c) *Trichothrips* group.

Genus Tetracanthothrips, Bagn.

Tetracanthothrips borneensis, Bagnall, 1915.



Tetracanthothrips borneensis, Bagn., head & prothorax.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 595.

A single male example discovered by Mr. Bryant is the type of this curious genus, chiefly characterized by the two pairs of finger-like mesonotal spines. It is quite a small insect, and apparently comes in the *Trichothrips* group.

W. Sarawak, Mt. Matang, one brachypterous male, December, 1913 (G. E. Bryant).

Genus Allothrips, Hood.

Allothrips caudatus, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 595.

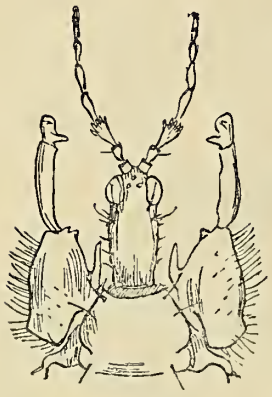
Described from a single specimen collected by Mr. Bryant. Hood erected the genus—separated from *Trichothrips* by the 7-jointed antennæ, joints 7 and 8 being fused together—for a Nearctic species.

W. Sarawak, Mt. Matang, one male, December 11th, 1913 (G. E. Bryant).

Family ECACANTHOTHRIPIDÆ.

Genus ECACANTHOTHRIPS, Bagn.

Ecacanthothrips bryanti, Bagnall, 1915.



ECACANTHOTHRIPS BRYANTI, Bagn.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 321, fig. 2.

A species easily recognized by the long hairs on the fore-femora, and which I have found particular pleasure in naming in Mr. Bryant's honour.

W. SARAWAK, Mt. Matang, one male, at 1000 ft., December, 1913, on dead tree; two males, January, 1914 (G. E. Bryant).

Ecacanthothrips coxalis, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 597.

Amongst Mr. Bryant's material are several examples separated from the known species by the simple fore-coxæ of the male. There appear to be three species—a small one, an ordinary sized one, with all tibiæ clear yellow, and a black one. I have described the first under the name of *coxalis* and the second *flavipes*.

W. SARAWAK, Mt. Matang, one male, February 2nd, 1914, and one female on dead tree, December 17th, 1913; Sungei China, foot of Matang, one female to light, December 14th, 1913 (G. E. Bryant).

Ecacanthothrips flavipes, Bagnall, 1915.

Ann. & Mag. Nat. Hist. ser. 8, xv. p. 597.

W. SARAWAK, Mt. Matang, at 1000 ft., males only; one in a white flower and three on dead bark, December, 1913 (G. E. Bryant).

Genus ORMOTHRIPS, Buffa.

Ormothrips inermis, Buffa, 1909.

This species was described by Buffa from a single female from New Guinea. A single example taken by Mr. Bryant is *perhaps* referable to this species; Buffa's description is inadequate.

W. SARAWAK, one female, Mt. Matang, December, 1913 G. E. Bryant).

XV.—Some Additions to the Dragonfly Fauna of Borneo. By F. F. Laidlaw.

Calopteryginæ.

1. *Vestalis beryllæ*, n. sp.

One male, Retuh.

Length of abdomen 70 mm., of hind wing 41 mm.

A single row of cells between Cu_1 and Cu_2. In the front wing this row breaks up into several near the wing margin; in the hind wing it remains single up to the marginal cell. The wings are slightly tinged with yellow. The body is entirely metallic green in colour, save for the under surface of the head which is black, as are the legs and anal appendages; whilst the under surface of the thorax is powdered with whitish bloom. The great relative length of the abdomen is more remarkable than is the case even in *V. gracilis*, Ramb., a species to which the present form bears a close resemblance.

The upper anal appendages are long and rather stout; at first curved inward they then diverge, and finally approach each other again, resembling when seen from above two figures ∞ inverted and facing each other. The lower pair are short, one-half the length of the upper pair, cylindrical, slender, and nearly straight.

This very distinct new species is an interesting addition to the genus.

The type is in the British Museum.

2. *Rhinocypha karschi*, Kruger.

> *R. karschi*, Kruger, Stettin Entomol. Zeit. 1898, pp. 83–85; Laidlaw, Proc. Zool. Soc. London, 1902, p. 90.

Three males, Tatau.

This interesting species has the stature and appearance of a *Micromerus*, but its venation is that of a *Rhinocypha*. It appears to be the only species of the genus which is

found in the Malay Peninsula, Sumatra and Borneo together.

I have not had an opportunity of discussing the matter with M. Martin, but I am inclined to think that his *Micromerus robropictus* is synonymous (see Martin, Bull. Mus. d'Hist. Nat. 1902, no. 7, p. 508).

Agrioninæ.

3. *Ceriagrion bellona*, sp. n.

Two males, Mt. Matang, Sarawak, December, 1913; one male, Kina Balu (imperfect), September, 1913.

A* separating before the level of the cubito-anal cross-vein. Twelve postnodal nerves. Wings in the maturer specimens lightly tinged with brownish-yellow. Pterostigmata dark brown. Excision on hind margin of segment 10 ∧-shaped.

Anal appendages: upper pair dark brown in colour, truncate, slightly decurved at their apices. Lower pair twice as long as upper pair, directed upwards, straight, rather awn-shaped, dark brown at base, distal half black.

Head: orange-brown above, greenish-white below.

Prothorax and thorax: coppery-brown above, fading to a yellowish-green on under surfaces.

Abdomen: first segment coppery-brown; second to sixth rich carmine; the remainder dull brown. The central segments are scarlet underneath, the anterior and posterior segments dull brown.

Length of abdomen 28·5 mm.; of hind wing 20 mm.

The species resembles very closely *C. erubescens*, Selys.

The principal differences on which the specific determination rests have been tabulated for me by Mr. H. Campion, who has kindly compared the type with an authentic specimen of *C. erubescens* from Queensland.

	C. erubescens, Selys.	*C. bellona*, n. sp.
I.	A* originates *at* cubito-anal cross-vein.	A* originates *before* level of cubito-anal cross-vein.
II.	Excision on hind margin of segment 10 semi-circular.	Excision on hind margin of segment 10 ∧-shaped.
III.	Lower anal appendages of male short and stout, reddish in colour.	Lower anal appendages of male long and slender, dark brown in colour, largely marked with black.

The type specimen will be deposited in the British Museum.

4. *Pseudagrion pruinosum*, (Burm.).

Pseudagrion pruinosum, Kirby, Cat. Odonata, 1890, p. 153; Kruger, Stettin Entom. Zeit. 1898, p. 119.

Two males, Mt. Merinjak, January 18th, 1914.

An addition to the fauna. I have been able to compare these specimens with an example from Penang in the Indian Museum, labelled by de Selys.

5. *Disparoneura analis*, (de Selys).

Alloneura analis, Selys, Bull. Acad. Belg. (2) x. p. 451 (1860).

Disparoneura analis, Selys, Mem. Cour. Acad. Belg. xxxviii. p. 169 (1886); Kirby, Cat. Odon. p. 134 (1890); Kruger, Stettin Ent. Zeit. 1898, p. 111; Förster, Fascic. Malay. (sep.) Odonata, pt. ii. p. 11 (1907).

Two males, Baram, March 28th, 1910.

This species is additional to my list of the Bornean "Protoneura," and was overlooked by me in compiling the list. It has not been recorded from the island before.

XVI.—Moultonia: a New Bornean Gesneraceous Genus.

By Professor Bayley Balfour, F.R.S., and W. W. Smith, M.A.

We have published recently* an account of a new Gesneraceous genus *Moultonia* discovered last year in Sarawak, Borneo, by Mr. J. C. Moulton, Curator of the Sarawak Museum. The genus presents interesting morphological features, the explanation of which is not yet complete. The dried specimens of the plant hitherto available are inadequate; observations on its habitat, on its vegetative development, on its fruit-structure and especially on the development of its seedling are very much desired. Consequently we gladly accept the opportunity offered by Mr. Moulton of giving the following short notice of the plant and its peculiarities in the Journal of the Sarawak Museum, in the hope that it may guide residents in Borneo who may be willing to help forward the investigation by sending further material or notes of observations on the spot and especially by securing seed. We also give a figure † of a sheet of a dried specimen of the plant, which may be an aid to its identification in the field and will show also how fragmentary is the material as yet received of a type of vegetation which presents inviting problems to both botanist and gardener.

We give first of all a botanical account of the plant so far as we know it and then a summary of the problems which it is hoped residents in Borneo will aid in solving.

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* Notes Roy. Bot. Gard. Edin. xl. p. 349, March, 1915.

† The figure is reproduced by permission from our paper in Notes Roy. Bot. Gard. Edin. xl., in which it first appeared.

Moultonia singularis, Balf. fil. et W. W. Sm.

A stout herbaceous plant with a single leaf; stem above ground none; petiole 30–40 cm. long, 1 cm. or more in diameter, striate, with a limy scurf over the whole surface, channelled above and bearing flowers in the channel; the lamina of the leaf 30–35 cm. long, 20–30 cm. broad, ovate or oblong-ovate with cordate base (apex not seen), entire, in the living state no doubt fleshy, above dark green glabrous, below covered with a rough limy scurf; midrib channelled above bearing numerous flowers throughout almost its whole length, below showing a stout projecting ridge 5 mm. broad or more; the primary nerves 20–30, very conspicuous and sub-parallel, 1–3 cm. distant from one another, given off from the midrib at a right angle and much bent on approaching the margin. Peduncles very short, 1–3-flowered; pedicels 3–4 mm. long, lengthened in fruit to 1 cm., covered with a limy scurf; bracts and bracteoles very small, only about 1 mm. long and somewhat fleshy. Flowers small, arising in the furrow of the petiole and in the furrow of the midrib, forming an almost continuous line. Calyx bell-shaped about 4 mm. long, slightly enlarged in fruit, deeply 4-cleft; lobes slightly imbricate, erect, closely appressed in fruit, oblong, more or less obtuse with membranous margins, on the outside with limy scurf, on the inside with a definite limy cushion. Corolla small (no fully developed specimens available for examination); tube short, limb bifid, the posterior lip bifid, the anterior lip (seen only in the bud) undivided, but in the developed flower this lip will probably be trifid. Perfect stamens 4, sub-equal, about 1 mm. long inserted in the middle of the tube; filaments dark coloured, glabrous, about $\frac{1}{2}$ mm. long; anthers all cohering laterally, in shape reniform or almost ear-shaped, scarcely 1 mm. in diameter. Disc cup-shaped, reaching almost to the middle of the ovary. Ovary superior, globose, with a linear style a little longer than the ovary and a small truncate stigma. The lower and seed-bearing half of the mature fruit globose, about $1\frac{1}{2}$ mm. in diameter, with its walls membranous and easily broken, apparently scattering its seeds by an irregular transverse rupture; the upper part of the capsule forming a narrow cone suggesting somewhat the top of a moss capsule, about 4 mm. long and at the base about 1 mm. broad, solid, and at maturity protruding a little from the enclosing segments of the calyx. Seeds very numerous, ovoid or rounded or sometimes more or less quadrate and

angular, of a dark brown tint with an areolate seed-coat; they are scarcely $\frac{1}{4}$ mm. in length.

Obtained by a native collector, working under Mr. J. C. Moulton's supervision, from near Sudan in the State of Sarawak, in February, 1914.

For those to whom botanical terms may present difficulty, the important characters which will aid (apart from the figure) in their search for the plant are:—A stout herb with no apparent stem, a single large leaf 1 foot or more in diameter with a stout stalk at least 1 foot long, and, most characteristic of all, with numerous small flowers attached to the furrow of the leaf-stalk and to the furrow of the midrib of the blade. The plant is so unique in these characters that its recognition is easy. It is, in all probability, a shade-plant in wet forest.

We have described this plant as possessing a single leaf with a leaf-petiole and epiphyllous inflorescence, and the dried material at our disposal sanctions no other course. If we follow convention in this we by no means intend thereby to express our view of the morphological value of the vegetative parts described. The plant seems to us to have special interest from the morphological side, but the true explanation of its parts can only be arrived at by an investigation of the living plant. Meanwhile we may give here the morphological interpretation which appears to us as probably the right one of the parts as we know them.

We suggest that the stalk and broad lamina are the parts of an outgrowth from the primitive protocorm of the plant—the stalk being hypocotyl, the lamina cotyledon—which it will not surprise us to learn has no other vegetative organs. From this protocormic outgrowth which possesses great meristematic activity the flowers arise. The whole construction of *Moultonia* is to us that of a plant showing a permanently embryonic vegetative state.

Let us clearly understand what this means.

Of the egg, out of which every angiospermous plant develops, one-half is devoted to the formation of a body of meristem-cells which is the primitive corm—protocorm—of a future plant; to the other half which forms the suspensor is assigned the primary duty of regulating the position of the protocorm within the seed and of aiding in the feeding of it. The whole product of the egg—suspensor and protocorm—is commonly known as the proembryo,

and is adapted to the intraseminal phase of life of the organism preceding the period of rest incidental to the seed habit. The degree to which development proceeds up to rest varies. As a minimum the suspensor may be no more than a single cell and the protocorm an undifferentiated body of a few meristem-cells. More advanced the suspensor may be pluricellular, even massive, with haustorial outgrowths penetrating far in search of food, and likewise the protocorm becomes a body with haustorial extension in the form of lobes (one in Monocotyledons, two in Dicotyledons)—the cotyledon; so that there is differentiation into a central mass—hypocotyl—and cotyledon one or more. This may be all. But in more advanced states—and these are perhaps the more usual—a primordium of the hypogeous axis of the mature plant is laid down at the basal end of the protocorm as the primary root, and a primordium of the epigeous axis is laid down—at the apical end of the protocorm when there are two or more lateral cotyledons, at the side when there is one terminal one—as the plumular bud. There may be several such primordia. What has to be emphasised here is that the ordinary angiospermous plant, as we see it, is the product of two primordia arising out of the protocorm. The protocorm is the embryonic stage. The root and shoot of the plant are the mature stage. In the former, potential meristematic activity is spread through the whole protocorm, and this is very different from the restricted meristematic activity that is found in the epicotylar shoot. In most Angiosperms the embryonic protocorm, shedding its haustorial cotyledons after they have performed their function during transition of the organism from intraseminal to extraseminal life, loses individuality in its fate as connecting link betwixt the root and shoot of the mature plant.

In the light of what we have just said, we suggest that *Moultonia* is one of those plants which never goes beyond the stage of the protocorm. It never forms primordia of primary root or plumular bud. The vegetative apparatus—long-stalked lamina—is a primitive outgrowth, become assimilating, of the protocorm. That it will have at its base many adventitious absorbing roots we expect, though our material gives no indication of them. The laminar portion we take to be cotyledon. Probably the stalk part of it may be less cotyledon than hypocotyl, but of that we can say nothing definite. We are more certain of the correctness of the suggestion we make that this outgrowth

is persistently meristematic throughout, and in the mid-line of its upper surface at least, for it is there that the flower-buds arise in linear series but not in age sequence from below upwards or from above downwards. Young and old are intermingled throughout the length.*

It may be asked what are the grounds upon which we base the views expressed above. We will explain.

To do this we recall the well-known features of germination exhibited by other genera of Gesneraceæ. Let us begin with *Streptocarpus*.† Taking in the first instance *S. polyanthus*, Hook., we find within its seed at the period when it is ripe the protocorm of the embryo as an elongated ovoid body showing towards the apical end two lateral outgrowths of equal size—the cotyledons. There is no trace of a primordium of a primary root, nor of a plumular bud, and there never is. When germination takes place, the whole surface of the protocorm becomes covered with absorptive hairs. One of the cotyledons is arrested in growth, the other elongates and growing rapidly by basal intercalary growth forms in time a broad green lamina without stalk. Soon a series of adventitious roots develop from the hypocotyl and also from the cotyledon base. The top of the hypocotyl where the cotyledons are does not in this species show much growth in length, and the cotyledons remain about the same level. Soon the smaller

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* A cotyledon is often like a leaf in its later stages of life, and is perhaps most commonly spoken of as a leaf. But a leaf is an organ of the epicotylar axis proceeding from the plumular bud. The leaf arises as a lateral structure from one of its nodes. A cotyledon as an extension of the embryonic protocorm may proceed from the end of the protocorm or from its sides, and does not present in its evolution the fundamental criteria required by the foundations of morphology for being reckoned the homologue of an epicotylar leaf. Entering this caveat, we are content in our systematic description to speak of the vegetative body of *Moultonia* as a leaf with a petiole and having epiphyllous inflorescence.

† Crocker, "Notes on Germination of Certain Species of Cyrtandreæ" in Journ. Linn. Soc. v. (1861), 65, t. iv.; Dickie, "Note of Observations and Experiments in Germination" in Journ. Linn. Soc. ix. (1867), 126; Dickson, "On the Germination of *Streptocarpus caulescens*" in Trans. Bot. Soc. Edin. xiv. (1883), 362, pl. xiv.; Hielscher, "Anatomie und Biologie der Gattung Streptocarpus" in Cohn's Beiträge iii. (1883), 1, tt. i.–iii.; Fritsch, "Ueber die Entwicklung des Gesneraceen" in Ber. d. deutsch. Bot. Gesellsch. (Gen. Versamml.) xii. (1894), 26.

Crocker was foreman of the Propagation Department, Royal Gardens, Kew, and was the first to record the features of germination of *Streptocarpus*. His observations were exact, and he distinctly states that there is an absence of all trace of plumule. His figures found their way into the botanical text-books of the period. We mention this because his work, as well as that of Dickie and Dickson, is ignored by Hielscher, who is quoted in most modern German books as if he were the observer who first made known the facts.

arrested one withers and dies off, so that the whole vegetative organisation of the plant is an enlarged green cotyledon with a basal portion of hypocotyl and adventitious rootlets. Year by year the intercalary growth of the cotyledon proceeds and further rootlets are formed. That is the whole mature vegetative plant. If at an early period the enlarging cotyledon be removed, the arrested one opposite to it on the protocorm may develop into the same form. Here there is never a vegetative epicotyl, never a primary root. The vegetative body is a persistently growing extension of the embryonic state. A like explanation covers the case of *Lemna* amongst Monocotyls—only there the embryonic form repeats itself in successive branchings.

This is the type of what in systematic works is named the "Unifoliate" Streptocarpi.

At flowering period the inflorescence takes origin in the hypocotyl within the sinus at the base of the enlarged cotyledon, and develops a scapose axis or scapose axes with many flowers in biparous cymose branching. It never spreads over the laminar area. Meristematic activity seems to be located in the hypocotyl at the base of the cotyledonary lamina. How exactly the flower-axis arises has not been really observed in this species. We do not yet know whether the apex of the hypocotyl forms a primordium which can be interpreted as a postponed plumular bud with destiny of flower production only, or whether the origin of the inflorescence is spread over a wider linear or broader area of the hypocotyl. The figure of *Acanthonema strigosum*, Hook. f., in the *Botanical Magazine* (1862), t. 5339, indicates a like history of development in that species.

Take now the case of *S. Rexii*, Lindl., as described by Dickie (with which that of *S. primuloides*, Dickie, conforms). Here the development starts as in the preceding case, but the top of the hypocotyl on the side next and below one of the cotyledons grows out for a short distance so that the two cotyledons are separated by a length of hypocotyl. The cotyledon left behind is the arrested one. The other enlarges, and a cursory examination of a seedling at this stage might suggest the presence of two cotyledons: one sessile small, and one petiolate large. The apparent petiole—and it is so called by Hielscher—is really the hypocotyl. When *S. Rexii*, Lindl., flowers it forms one-flowered scapes, and these take origin close to the sinus of the cotyledonary lamina from the hypocotyl

meristem tissue in a "simple tangential row." Here we have the case of *S. polyanthus* over again, only that the elongation of the hypocotyl has created the appearance of a petiole, and so the flower-axis seems to come from where an apparent petiole joins a lamina. This is not all, however. In *S. Rexii*, Lindl., there appears at the cotyledonary sinus a cluster of stalked leaf-like structures. These form a sort of rosette and are characteristic of the "Rosulate" Streptocarpi. The published accounts of their origin are vague in terms, and their relation to the inflorescence is not clear. They are said to come off alternately from a whole series of centres, whilst the inflorescences are developed in a simple basifugal row. We are in no better case here than with *S. polyanthus*, Hook., for the determination of the morphological relationship of these later vegetative structures and of the inflorescence to the protocorm. All we can recognise is that there is a vegetative organisation superposed upon the condition that is permanent in *S. polyanthus*, Hook. For its reconciliation with normal plumular development further investigation is required.

Then we have a state of further differentiation in *S. caulescens*, Vatke, as Dickson showed, typical of the whole series of "Streptocarpi Caulescentes." Here the same general lines of early development of the protocorm are followed, and there is an elongation of the hypocotyl between the cotyledons, the upper of which is the larger. This upper cotyledon does not reach extravagant size; it has quite the appearance of a petiolate cotyledon coming off from the hypocotyl. From the hypocotyl and in apparent upward continuation of it ascends an axis like an ordinary epicotylar noded axis bearing foliage-leaves which are like the larger cotyledon in form. How this axis arises, if from a plumular bud or no, is not described. Its appearance suggests such normal evolution as occurs in many other Gesneraceæ.

The suggestions conveyed in the construction of these Streptocarpi have led us to the interpretation we have predicated for *Moultonia*. One may suppose that the hypocotyl below an upper enlarged cotyledon has grown out to form the stalk with the lamina of the cotyledon at its end, and that the inflorescence meristem, instead of being strictly limited to an area at the base of the cotyledon, is spread along the hypocotyl and also along the lamina.

As an intermediate condition we may bring into the case the evidence offered by *Monophyllæa*.

We have pointed out that *Moultonia* is allied to *Monophyllæa*. This genus we only know from the description and figure given by Clarke.* Clarke suggests, we think rightly, that the *folium unicum* of his plant is a cotyledon. There appears to be in *Monophyllæa* a single stalked leaf—to speak conventionally—as in *Moultonia*, but the stalk is shorter and at the junction of lamina and stalk scapose inflorescences arise. At the summit of the scapes the flowers are disposed in a unilateral, spicate raceme which curls over circinately. We should interpret all this construction as that of a hypocotyl elongated in the form of a petiole and bearing at its extremity a cotyledonary lamina. We should expect in the young protocorm to find a second smaller arrested cotyledon. At the point where cotyledonary lamina and hypocotyl join, the inflorescence arises from the hypocotyl. The meristem for the inflorescence is localised at this region.

Now *Monophyllæa* is of special interest to residents in Borneo, as that country contains at least three of its known species—some ten in number. The study of its morphology from the seedling stage would be full of value and would throw much light on the problems raised by *Moultonia*. We therefore hope that those interested will try to secure specimens and seeds of both genera. *Monophyllæa* can be recognized among the Gesnerads by its single large leaf, presenting a similar appearance to that of *Moultonia* but with the inflorescences, as indicated above, distinct from the leaf-stalk and midrib.

Of the allied *Epithema* we have insufficient knowledge to allow of our making a suggestion of interpretation.

The following morphological series within the plants named issues from what we have said:—

Streptocarpus polyanthus, Hook.—Hypocotyl not elongated, cotyledon sessile, scapose inflorescence with open biparous branching developing from hypocotyl base of cotyledonar lamina.

Streptocarpus Rexii, Lindl.—Hypocotyl shortly elongated, giving apparent stalk to cotyledon, scapose

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* C. B. Clarke, Cyrtandreæ in De Candolle Monogr. Phanerog. v. (1883–87), 181, t. xx.

inflorescence (one flower) developing from hypocotyl at base of cotyledonar lamina.

Monophyllæa.—Hypocotyl much elongated, giving apparent long stalk to cotyledon, scapose inflorescence with unilateral racemes developing from hypocotyl at base of cotyledonar lamina.

Moultonia.—Hypocotyl very much elongated, giving apparent very long stalk to cotyledon, inflorescence disposed in umbels originating along middle line on upper surface of whole length of elongated hypocotyl and on midrib of lamina (but not showing special relation to the primary veins).

We do not overlook other explanations that might be given of the construction in *Moultonia*. Thus, in absence of all evidence of the seedling condition, it might be held that in both *Moultonia* and *Monophyllæa* the *folium unicum* is really an epicotylar leaf with which the inflorescence is more or less "congenitally concrescent." In such a view, the unilateral disposition of the flowers on the scapes in *Monophyllæa* might be regarded as a stage towards the complete fusion of scape with leaf in *Moultonia*. To us such concrescences do not appeal.

A more illuminative comparison may be made with what is seen in *Chirita hamosa*, R. Br., of which, however, we have not yet the clear explanation. In Plate III. is a figure of this plant when in flower. The opposite leaves are petiolate, and the flowers arise in a line upon the upper surface of each petiole. They are epipetiolar. The buds on the petiole are not, however, all flower-buds; some are foliage. The sequence is irregular. The position of the inflorescence partially recalls that of *Moultonia*. There is no concrescence here; simply foliar evolution of flower and buds. The seedling of *Chirita hamosa* has cotyledons differing in size and separated by a hypocotylar elongation. The upper is the larger, becomes stalked, and has quite the form of the adult leaf, but it never bears flowers or buds. Possibly, then, what we have been describing in *Moultonia* as a protocorm outgrowth may be after all an epicotylar leaf with epiphyllous inflorescences more extended than in *Chirita hamosa*.

The flower-structure of *Moultonia* is not without special interest. The gynæceum is closed at the top by a solid cone like a style supported upon a stylopod, and this seems

to separate as an operculum from the lower portion of the capsule which remains enclosed in the calyx. For a clear understanding of the mechanism of dehiscence better material than that at our disposal is necessary.

Explanation of Plates II. and III.

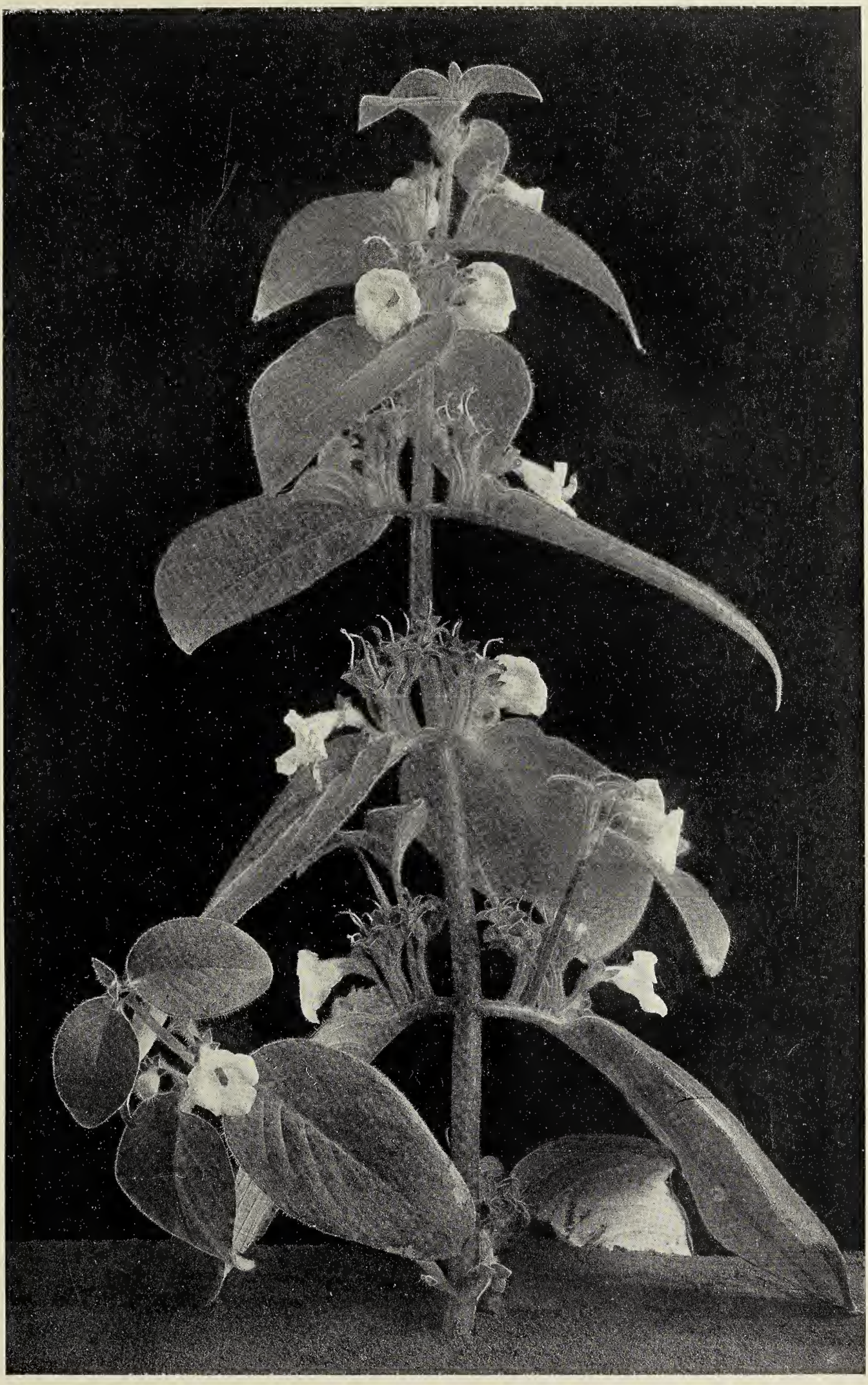
Illustrating Professor Bayley Balfour and Mr. W. W. Smith's paper on *Moultonia*.

(The Plates are taken from photographs by Mr. Robert M. Adam.)

Plate II. *Moultonia singularis*, Balf. fil. et W. W. Sm.

,, III. *Chirita hamosa*, R. Br. Plant in flower in the Royal Botanic Garden, Edinburgh.

MOULTONIA SINGULARIS, Balf. fil. et W. W. Smith.



CHIRITA HAMOSA, R. Br.

Vol. II. (Part III.) No. 7.

THE

SARAWAK MUSEUM JOURNAL

ISSUED BY THE SARAWAK MUSEUM
UNDER THE AUTHORITY OF HIS HIGHNESS THE RAJAH

JUNE, 1917.

SINGAPORE:
KELLY & WALSH, LIMITED,
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For the Promotion of Scientific Knowledge and Study of the Natives and Natural History of the Island of Borneo.

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XVII.—Keys to the Ferns of Borneo.

By Edwin Bingham Copeland, Dean and Professor of Plant Physiology, College of Agriculture, University of the Philippines.

INTRODUCTION.

In the extent to which its ferns, as well as its other native plants, have been collected and studied, Borneo has remained very far behind Java, on the south, and the Philippines, on the north-east; Sumatra, to the west, and Celebes to the south-east have likewise remained behind, perhaps even further than Borneo. There is no reasonable doubt that Borneo has the largest fern flora of any of the Malayan islands. And, with the improbable exception of New Guinea, its fern flora, when well investigated, may be expected to prove the richest in the world. In spite of the years of collecting by such keen friends of the ferns as Bishop Hose and Mr. Brooks, it remains the case to-day that a few very small localities in Western Sarawak and one trail up to Mt. Kinabalu are the only places in Borneo, which can be considered scenes of reasonably thorough reconnaissance collecting. Judging from experience in the Philippines, it may well be supposed that 40 per cent. of the species of Bornean ferns still remain to be discovered; and that of endemic species, we are acquainted at the present time with decidedly less than half.

It is now nearly twenty years since Bishop Hose, near the close of his own period of active collection, listed the ferns then known in Borneo, 430 in number. In the intervening years, Christ has described a considerable number of novelties sent to him by Dutch collectors; a number of species from the same sources have been described by Van Alderwerelt and Rosenstock; a considerable number of Sarawak ferns have come to me for identification and description; and there have been a few additions to the Kinabalu flora. It is believed that all the ferns in Bishop Hose's list, a few others from earlier collections, and all more recent publications regarding Bornean ferns have been considered in making the following list. The number of species which seem to me to be distinctly known is now approximately 700; including species of decidedly doubtful occurrence, which I have thought it better to mention without including them in the keys, the number is somewhat greater.

The list is prepared at the request of the late curator of the Sarawak Museum, Mr. J. C. Moulton, with the joint feeling that it should facilitate the local identification of the ferns of Borneo, and in this way materially encourage their collection and study. The following treatment falls into several parts:

(*a*) A systematic enumeration of the families and genera of Bornean ferns, in the best approximation which I can at this moment make to their natural arrangements.

(*b*) Keys to the families; under the families, to the genera; and under the genera, to the species of known Bornean ferns.

(*c*) An enumeration under each genus of the known species, including, in the case of single collections, the definite location, if this has been published; also a state-

ment of the major political divisions of Borneo in which each species has been collected, and a rough statement of the supposed or known range outside of Borneo.

But few synonyms are included, except where the name adopted is a new combination. Thirty-three species, which are known elsewhere, are now recorded from Borneo for the first time. The diagnoses of the "new species" appearing in this list, 44 in number, are being published in the Philippine Journal of Science.

In the preparation of keys and list, I have had the use of practically complete (so far as I know, complete) literature* regarding the ferns of Borneo, and of the Herbarium of the Bureau of Science and my own Herbarium. Included in these are the following collections:

First: A small number of specimens in the Herbarium of the Bureau of Science, received in exchange, and collected by Bishop Hose and various Dutch expeditions.

Second: Collections made by Dr. F. W. Foxworthy on several visits to Sarawak and North Borneo.

Third: Collections made by native collectors employed by the Bureau of Science, working under the direction of the Sarawak Museum.

Fourth: Very valuable collections by Mr. C. J. Brooks, then a chemist employed by the Borneo Company in Sarawak, who was particularly interested in ferns and exceptionally discriminating in their collection.

Fifth: Collections sent to me by the Curator of the Sarawak Museum for determination, including specimens collected by himself (Mr. Hewitt or Mr. Moulton), and unidentified specimens collected at previous dates.

* In connection with the preparation of bibliography of Bornean botany (*Sar. Mus. Journ.* Vol. II. No. 6. 1915, pp. 99–136) Mr. Merrill prepared a card catalogue of the plants reported from Borneo. This list, with the citations, has naturally been of the greatest possible use to me.

Sixth: Collections made in 1916 on a trip to Mt. Kinabalu by Mrs. Clemens and Mr. Topping, which together constitute very much the largest collection of Bornean ferns which has ever left the island at one time. Mr. Topping is an enthusiastic fern amateur of long standing, and Mrs. Clemens is an unusually keen collector of ferns, as well as of other plants. Their collections have revealed for the first time the presence of a considerable fern flora at and above the tree-line, the absence of which has been a puzzle to me for years.

The enumeration of the collections which have been in my hands, and the use of these collections, with the literature on the subject, as the material basis for the preparation of a general paper on the ferns of Borneo, must not be construed as even an implication that there have not been other and very important collections of Bornean ferns. Authors as early as Mettenius had the use of collections of considerable size made chiefly by Dutch botanists. Various visitors to Mt. Kinabalu have collected extensively there, and to some extent elsewhere in the Island; among these, Burbidge and Haviland should be particularly mentioned. And the years of work of Bishop Hose must receive permanent and most emphatic appreciation. The papers, chiefly by Baker, dealing with these various collections, have contributed to our present knowledge of the ferns of Borneo in a manner which is most evident if one notes the number of species which Baker has described there. A complete bibliography of Bornean botany, including all papers known to me on Bornean ferns up to the date of its publication, prepared by Mr. E. D. Merrill, is found in this journal, Vol. II, No. 6, 1915.

In the arrangement of the genera of the Polypodiaceæ and in fixing the limits which should be recognized for

this family, I have attempted a natural classification, and in consequence am using an arrangement which demands, and I hope merits, explanation.

It is a principle which must be accepted in systematic botany that each group we recognize, whatever its rank– species, genus, tribe, family or order,– is an expression of our ideas of real relationship, that is, of phylogeny. If this principle be accepted, definitions and convenience of definition cease to be controlling factors in determining what plants should be included in each group; although convenience of definition of course remains a dominant consideration in determining how large our genera should be made. For example, *Davallia* has usually been defined or diagnosed in such a way as to include *Prosaptia*. There was a time when this was a valid reason for including *Prosaptia* under *Davallia*. There is absolutely no doubt that *Prosaptia* is a group descended from *Eupolypodium*, and this is a justification for the practice, adopted by a few writers, of including it in *Polypodium*. At this point, the question of convenience comes up, and it seems to me decidedly more convenient to treat *Prosaptia* as a distinct genus closely related to *Polypodium*, and to define it completely enough to avoid possible confusion with *Davallia*. Again, we have had in *Polypodium* a sub-genus *Goniophlebium*, recognized by definition, and sometimes treated as a genus. When so treated, it has, invariably, I believe, been made to include a considerable number of American species, along with the Oriental species to which the name was originally given. These American species represent two or more lines of descent, independent of that of the Oriental *Goniophlebium*, having a clearly distinct ancestry outside the group. Logically, it is clear that we have but two alternatives, either to include all of these lines of descent, back to a common source, in

Polypodium; or else, if we choose to dismember *Polypodium*, to create an independent and distinct genus for each of the independent lines of descent.

The immediate application of this argument is in the limits which I am giving to the family Polypodiaceae. In all recent fern works, Cyatheaceae, Matoniaceae and Polypodiaceae are treated as distinct families. To the naturalness of this treatment, *Dicksonia*, with the habit and sporangia of *Cyathea*, but with the undoubted affinity of *Dicksonia* to *Dennstaedtia*, has afforded a serious stumbling-block, which has been passed over or around by different writers by assigning different and varying limits to *Dicksonia*, and treating it as more or less distinct from the Cyatheaceæ. Recent studies, chiefly in England, have shown an unquestionable, even if not very close, relation, between *Cyathea* and such Polypodiaceae as *Peranema* and *Diacalpe*. I am personally satisfied that *Monachosorum* belongs in the same general group, and that the more primitive species of *Dryopteris* are not very remotely related to it. It has long been understood by many pteridologists, that primitive *Athyrium* is hardly distinguishable from *Dryopteris*. The line between *Cyathea* and the Polypodiaceae has, therefore, been breaking down.

Other study in England has convinced me that *Matonia*, or the ancient group of which it is a survivor, represents the ancestry of a number of other genera recognized as Polypodiaceous such as *Dipteris*, *Cheiropleuria* and *Platycerium*.

Independent of *Cyathea* and its relatives, and of the Matoniaceae and their descendants, we have in the Polypodiaceae several clear-cut series of descendants of *Dennstaedtia*, or of ancient ferns now best represented by *Dennstaedtia*. These series cross the old tribal lines of the Polypodiaceae, sometimes with but little regard for

them. · The old artificial tribes, the Aspidieae, Asplenieae, Davallieae, Pterideae, and Vittarieae and Polypodieae, not to speak of the Acrosticheae as a tribe in the older sense, have, therefore, to be recast or abandoned. As to the family conception, it seems to me clear that *Dryopteris*, and even *Athyrium*, as well as *Peranema*, *Diacalpe*, *Monachosorum* and *Acrophorus*, and probably all of the Woodsieae, must fall in one family with *Cyathea*; while the descendants of *Dennstaedtia*, including possibly the Polypodieae and Vittarieae, and certainly all of the real Davallieae and Pterideae, form another family; and while the descendants of the Matoniaceae fall in that family—or else we must include in the Polypodiaceae, as completely as we know how to do so, the nearest common ancestry of all of these distinct phylogenetic lines. If we adopt the former alternative, the definition of the resulting families by diagnosis will become a pure impossibility. There seems to me, therefore, no alternative but to include Cyatheae, Matoniaceae and Polypodiaceae in one family, retaining, for the resulting great family, the name by which the overwhelmingly largest part of it is already known.

In every attempt at a natural classification there are two inherent difficulties, and a third very great one which it is our business to outgrow. The first of these is the fact that our arrangement is necessarily a linear one, in which at the completion of one phylogenetic series we move back to an earlier, more primitive point to begin the treatment of another series. The second difficulty is the fact that in the evolution of series of plants, nature has not had regard for our convenience of definition, and that it is very unusual to find a large natural series which can be easily distinguished from other natural groups by diagnosis. In practice, this difficulty is passed around by making artificial keys, by which those who are not yet

familiar with the groups may identify the members of different groups by convenient characters which do not serve for the recognition of groups as a whole.

The third difficulty is our own ignorance. We outgrow this, year by year, and are able, with each year's progress, to make our classification a little more natural. The recognition of *Taenitis* and *Pteridium*, as descendants (along very distinct lines) of *Dennstaedtia*, is a result of quite recent progress. The classification presented in this paper is decidedly more natural, I believe, than any general one previously used; and yet, even the largest of all the fern genera, as construed here, *Polypodium*, is located by convenience rather than by understanding; I do not feel sure even as to whether it should be regarded as more nearly related to the descendants of the Matoniaceae or of *Dennstaedtia*. *Nephrolepis* has been no less of a puzzle; but the work I have just been doing on Bornean ferns has shown its general line of descent to my fairly complete satisfaction.

Borneo occupies the centre of the world's greatest fern area. Of all parts of the earth, it is the one whose living ferns are most likely to reveal the relationship of groups and to perfect our knowledge of their descent. If these keys encourage fern work in Borneo, and result in increased activity in the collection and study of Borneo ferns, their preparation will have been much more than worth while.

I have added an Appendix for the assistance of those who are perhaps unfamiliar with all the technical terms used in the following pages.

SYSTEMATIC LIST OF FAMILIES AND GENERA.

Families and Genera.	Number of Genera.	Number of species.
1. OPHIOGLOSSACEÆ	3	7
1. Ophioglossum		5
2. Botrychium		1
3. Helminthostachys		1
2. MARATTIACEÆ	4	9
1. Christensenia		1
2. Macroglossum		1
3. Angiopteris		5
4. Marattia		2
3. OSMUNDACEÆ	1	1
1. Osmunda		1
4. SCHIZAEACEÆ	2	8
1. Schizæa		4
2. Lygodium		4
5. GLEICHENIACEÆ	1	10
1. Gleichenia		10
6. HYMENOPHYLLACEÆ	2	73
1. Hymenophyllum		31
2. Trichomanes		42
7. POLYPODIACEÆ	73	587
The relatives of Dicksonia and their descendants.		
1. Cibotium		1
2. Dennstaedtia		3
3. Microlepia		3
4. Tapeinidium		2
5. Schizoloma		11
6. Syngramma		9
7. Craspedodictyum		1
8. Taenitis		5
9. Coniogramme		1
10. Ceropteris		1
11. Cheilanthes		1
12. Adiantum		8
13. Hypolepis		1
14. Paesia		1
15. Pteridium		1

Genera.	Number of species.
16. Histiopteris	3
17. Pteris	19
18. Balantium	2
19. Davallodes	3
20. Leucostegia	4
21. Humata	12
22. Oleandra	6
23. Davallia	7
24. Scyphularia	1
25. Protolindsaya	1
26. Lindsaya	17
27. Odontosoria	1
28. Cystodium	1
29. Nephrolepis	9
30. Cyathea	45
Primitive relatives of Dryopteris.	
31. Diacalpe	1
32. Acrophorus	1
33. Monachosorum	1
Dryopteris and its descendants.	
34. Dryopteris	78
35. Mesochlæna	3
36. Polystichum	3
37. Didymochlæna	1
38. Cyclopeltis	2
39. Polybotrya	2
40. Tectaria	27
41. Hemigramma	1
42. Stenosemia	1
43. Leptochilus	12
44. Lomagramma	2
Athyrium and its relatives.	
45. Athyrium	35
46. Asplenium	33
47. Phyllitis	1
48. Stenochlaena	2
49. Blechnum	7
50. Plagiogyria	5

Families and Genera.	Number of Genera.	Number of species.
Matonia and the descendants of its group.		
51. MATONIA		2
52. PHANEROSORUS		1
53. DIPTERIS		4
54. CHEIROPLEURIA		1
55. PLATYCERIUM		3
56. ACROSTICHUM		1
Polypodium and its relatives.		
57. POLYPODIUM		112
EUPOLYPODIUM		
GONIOPHLEBIUM		
PHYMATODES		
SELLIGUEA		
MYRMECOPHILA		
DRYNARIOPSIS		
58. PROSAPTIA		3
59. OREOGRAMMITIS		1
60. LOXOGRAMME		6
61. CYCLOPHORUS		9
62. DRYMOGLOSSUM		1
63. HYMENOLEPIS		2
64. ELAPHOGLOSSUM		3
65. LECANOPTERIS		5
66. AGLAOMORPHA		1
67. MERINTHOSORUS		1
68. DRYNARIA		4
69. PHOTINOPTERIS		1
The Vittarieae.		
70. ANTROPHYUM		11
71. VITTARIA		11
72. SCLEROGLOSSUM		4
73. MONOGRAMMA		2
8. PARKERIACEÆ	1	1
1. CERATOPTERIS		1
9. MARSILEACEÆ	1	1
1. MARSILEA		1
Total ..	88	697

KEY TO THE FAMILIES OF BORNEAN FERNS.

a. Sporangia large, without an annulus, each derived from plural cells — **Eusporangiatæ.**

b. Stipules wanting, sori on specialized segments without lamina, prothallium tuberous — 1. OPHIOGLOSSACEÆ.

*b*1. Stipules present, sori on normal segments of frond — 2. MARATTIACEÆ.

*a*1. Sporangia smaller, each derived from one cell — **Leptosporangiatæ.**

b. Spores uniform, leaves not cruciform — FILICES.

c. Annulus horizontal, incomplete or rudimentary — 3. OSMUNDACEÆ.

*c*1. Annulus surrounding the apex of the sporangium — 4. SCHIZÆACEÆ.

*c*2. Annulus complete, more or less horizontal, around the middle of the sporangium.

d. Sori round, dorsal, exindusiate — 5. GLEICHENIACEÆ.

*d*1. Sporangia on free tips of veins, surrounded by a tubular or equally two lipped involucre (indusium) — 6. HYMENOPHYLLACEÆ.

*c*3. Annulus subvertical and complete, or vertical and interrupted by the stalk of the sporangium — 7. POLYPODIACEÆ.

*c*4. Annulus vertical, decidedly incomplete — 8. PARKERIACEÆ.

*b*1. Spores of two kinds, large and small — HYDROPTERIDES.

Leaves cruciform — 9. MARSILEACEÆ.

FAM. I. OPHIOGLOSSACEÆ.

a. Veins reticulate	1. OPHIOGLOSSUM.
*a*1. Veins free.	
b. Fertile division of frond loosely compound	2. BOTRYCHIUM.
*b*1. Fertile division compact	3. HELMINTHOSTACHYS.

1. OPHIOGLOSSUM LINNÆUS.

a. Fertile and sterile segments separating at or below the base of the sterile.	
b. Sterile segment cordate	1. *O. reticulatum*.
*b*1. Sterile segment not cordate	2. *O. pedunculosum*.
*a*1. Fertile segment rising from sterile.	
b. Terrestrial	3. *O. intermedium*.
*b*1. Epiphytic.	
c. Stipe as long as blade	4. *O. Moultoni*.
*c*1. Stipe relatively short	5. *O. pendulum*.

1. O. RETICULATUM L.
   Sarawak, Kinabalu.
   Pantropical.

2. O. PEDUNCULOSUM Desv.
   O. cumingianum Presl.
   Sarawak, North Borneo (Kinabalu and Sandakan).
   Malaya to India, Japan and New Zealand.

3. O. INTERMEDIUM Baker.
   Sarawak, Kinabalu.
   Java, Mindoro, New Guinea.

4. O. MOULTONI Copel.
   Sarawak (Bukit Buyo).
   Local.

5. O. PENDULUM L.
   Sarawak.
   Mauritius to Hawaii.

2. BOTRYCHIUM Swartz.

A single species — *B. daucifolium*.

B. DAUCIFOLIUM Wall.

Kinabalu.

Java, Philippines, India.

3. HELMINTHOSTACHYS Kaulfuss.

A single species — *H. zeylanica*.

H. ZEYLANICA (L.) Hooker.

Sarawak, Dutch Borneo.

Malaya to India, Formosa, New Caledonia and Australia.

FAM. II. MARATTIACEÆ.

a. Frond palmate	1. Christensenia.
*a*1. Frond simply pinnate	2. Macroglossum.
*a*2. Frond at least bipinnate.	
b. Sporangia contiguous but free	3. Angiopteris.
*b*1. Sporangia of each sorus fused together	4. Marattia.

1. CHRISTENSENIA Maxon.

A single species — *C. æsculifolia*

C. ÆSCULIFOLIA (Bl.) Maxon (Kaulfussia Blume).

Sarawak, Dutch Borneo.

Malaya to India.

2. MACROGLOSSUM Copeland.*

A single known Bornean species — *M. Alidæ*.

M. ALIDÆ Copeland.

Sarawak (described from Bidi).

Endemic.

[*M. Smithii (Racib.) Campbell, described from a plant in the Buitenzorg garden, supposed to have come from Borneo, has been found wild in Bencoelen by Brooks. This may have been the source of the Buitenzorg specimen.]

3. ANGIOPTERIS Hoffmann.

a. Stipe and rachis very scaly	1. *A. ferox*.
*a*1. Stipe and rachis not very scaly.	
b. Recurrent veins not evident.	
c. Sori not marginal	2. *A. muricata*.
*c*1. Sori very near the margin	3. *A. Brooksii*.
*b*1. Recurrent veins evident.	
c. Costa pale	4. *A. subintegerrima*.
*c*1. Costa dark	5. *A. evecta*.

1. A. FEROX Copel.

Sarawak (Mt. Penrissen).

Local.

2. A. MURICATA Presl.

"Borneo."

Endemic.

3. A. BROOKSII.

Sarawak (described from Bau).

Endemic.

4. A. SUBINTEGERRIMA v. A. v. R.

Dutch Borneo (Semedoem).

Local.

Not clearly distinguished from *A. evecta*.

5. A. EVECTA (Forst.) Hoffm.

Reported from Sarawak, Dutch Borneo and North Borneo.

The Kew idea has been to reduce the whole large genus to this species, with the result that its actual distribution is altogether in doubt.

From Kinabalu we have an apparently undescribed species, and many more may be expected from Borneo when they are carefully collected.

4. MARATTIA Swartz.

a. Rachis smooth	1. *M. fraxinea*.
*a*1. Rachis fleshy-wrinkled	2. *M. Brooksii*.

1. M. FRAXINEA Sm.

Sarawak, Dutch Borneo.

Palæotropical (?); range in doubt because this has been made to include many species.

2. M. Brooksii Copel (M. Brooksi, err. typ.).
Sarawak (Mt. Poé).
Local.

FAM. III. OSMUNDACEÆ.

OSMUNDA Linnæus.

O. javanica Bl.
Borneo.
Java, Sumatra, Celebes.
The citation is from Christensen's Index.

FAM. IV. SCHIZAEACEÆ.

a. Frond small, erect	1. Schizæa.
*a*1. Frond scandent	2. Lygodium.

1. SCHIZÆA Smith.

a. Fertile spikes pinnately arranged.	
b. Frond terete.	
c. Spikes 4 to 6 on each side	1. *S. malaccana*.
*c*1. Spikes 10 to 20 on each side	2. *S. fistulosa*.
*b*1. Frond flattened	3. *S. dichotoma*.
*a*1. Fertile spike digitately arranged	4. *S. digitata*.

1. S. malaccana Baker.
Sarawak, North Borneo.
Malaya to Burma.

2. S. fistulosa Labill.
Dutch Borneo, Kinabalu.
Madagascar eastward to Chili.

3. S. dichotoma (L.) Sm.
Apparently common.
Madagascar to India and Polynesia.

4. S. digitata (L.) Sw.
Sarawak, Dutch Borneo, Labuan.
Malaya to India and Polynesia; Madagascar (?).

2. LYGODIUM Swartz.

a.	Half-pinnæ forked.	
b.	Fertile segments like sterile	1. *L. borneense*.
*b*1.	Fertile segments contracted	2. *L. circinnatum*.
*a*1.	Half-pinnæ pinnate.	
b.	Leaflets not articulate	3. *L. flexuosum*.
*b*1.	Leaflets articulate to stalks	4. *L. scandens*.

1. L. BORNEENSE v. A. v. R.

Dutch Borneo (Mt. Uja).

Local.

The same collection is apparently responsible for reports of *L. digitatum* and *L. semihastatum* from Borneo.

Var. *Samarindæ* v. A. v. R. is from Samarinda; it has larger leaflets.

2. L. CIRCINNATUM (Burm.) Sw.

Common.

Malaya to India and Queensland.

3. L. FLEXUOSUM (L.) Sw.

Common.

Malaya to China and Queensland.

4. L. SCANDENS (L.) Sw.

Common.

Palæotropical.

The last two species have been confused. The very common one in Sarawak is *L. flexuosum*.

FAM. V. GLEICHENIACEÆ.

GLEICHENIA Smith.

a.	Segments round and very small	*EUGLEICHENIA*.
*a*1.	Segments oblong to linear, larger	*DICRANOPTERIS*.

Subgenus I. *EUGLEICHENIA*.

a.	Scales up to 1 mm long, very lacerate	1. *G. circinnata*.
*a*1.	Largest scales 1.5—2 mm. long	2. *G. vulcanica*.

1. G. CIRCINNATA Swtz.

Kinabalu, Dutch Borneo.

Malaya to New Zealand.

Baker described a rather naked form with long pinnæ, from Kinabalu, as var. *borneensis*.

2. G. VULCANICA Bl.

Kinabalu.

Java, Celebes, Philippines.

Not very distinct from the preceding.

Subgenus II. *DICRANOPTERIS.*

a. Fronds pinnatifid or pinnate above highest fork.
  b. Without special leaflets at the forks.
    c. Segments coriaceous.
      d. Segments somewhat oblique, linear oblong — 3. *G. vestita.*
      *d*¹. Segments horizontal, linear — 4. *G. lævigata.*
    *c*¹. Thin herbaceous — 5. *G. Hallieri.*
  *b*¹. With two special leaflets at each fork.
    c. Ultimate branches short, with few segments — 6. *G. Warburgii.*
    *c*¹. Ultimate branches bearing many segments — 7. *G. linearis.*
*a*¹. Frond bipinnatifid above any fork.
  b. Segments densely pubescent beneath — 8. *G. bullata.*
  *b*¹. Not densely pubescent.
    c. Pinnules stalked, lower segments reduced — 9. *G. Norrisii.*
    *c*¹. Lower segments not reduced — 10. *G. japonica.*

3. G. VESTITA Bl.

Sarawak, North Borneo.

Malaya.

Baker has distinguished a var. *paleacea*, from North Borneo.

4. G. LAEVIGATA (Willd.) Hooker.

Common.

Malaya.

5. G. HALLIERI Christ.

Dutch Borneo.

Local.

6. G. WARBURGII Christ.

Dutch Borneo.

Celebes, Batjan.

7. G. LINEARIS (Burm.) Clarke.
   Common.
   Pantropical and subtropical.
   A very variable fern, of which there are many "varieties."

8. G. BULLATA Moore.
   Kinabalu.
   Java.

9. G. NORRISII Mett.
   Kinabalu.
   Malacca.

10. G. JAPONICA Spr.
   G. glauca Hooker.
   G. longissima Bl.
   Common.
   The Orient.

FAM. VI. HYMENOPHYLLACEÆ.

a. Involucre (indusium) distinctively two-lipped*	1. HYMENOPHYLLUM.
*a*¹. Involucre distinctively tubular or funnel-shaped, sometimes two-lipped at the apex	2. TRICHOMANES.

1. HYMENOPHYLLUM SMITH.

a. Margin entire	*EUHYMENOPHYLLUM*.
*a*¹. Margin serrate or spinulose	*LEPTOCIONUM*.

Subgenus I. *EUHYMENOPHYLLUM*.

a. Fronds glabrous.	
b. Main rachis not winged throughout	1. *H. eximium*.
*b*¹. Main rachis winged throughout.	
c. Valves of the indusium entire or nearly so.	
d. Well developed fronds over 15 cm. tall.	
e. Receptacle globose, valves not broader than long	2. *H. formosum*.
*e*¹. Receptacle mallet-shaped, valves broader than long	3. *H. Junghuhnii*.

* *Hymenophyllum Foxworthyi* is an exception and can be recognized by the involucre as described for *Trichomanes*. The frond is about 7 cm. tall, fuscous, lanceolate and thereby distinct from any species of *Trichomanes*.

*d*1. Fronds smaller.
e. Stipes not winged unless near apex.
f. Frond ovate, greenish — 7. *H. productum.*
*f*1. Frond lanceolate brownish.
g. Indusium deeply cleft — 8. *H. blumeanum.*
*g*1. Indusium not deeply cleft — 9. *H. Foxworthyi.*
*e*1. Stipe winged almost to base.
f. Valves of indusium longer than broad, acute — 10. *H. Hallierii.*
*f*1. Valves as broad as long, rounded — 6. *H. salakense.*
*c*1. Valves of indusium toothed.
d. Margin of lamina crisped — 5. *H. australe.*
*d*1. Margin not crisped — 4. *H. demissum.*
*a*1. Frond hairy, at least on veins or margin.
b. Central veins bearing wavy outgrowths (crests) — 11. *H. zollingerianum.*
*b*1. Central veins not crested.
c. Fronds about 20 cm. long, ovate — 12. *H. pachydermicum.*
*c*1. Fronds 5—10 cm. long — 13. *H. obtusum.*
*c*2. Fronds under 5 cm. long.
d. Lips of indusium ciliate — 14. *H. borneense.*
*d*1. Lips of indusium not ciliate — 15. *H. Clemensiae.*

1. H. EXIMIUM Kze.

Kinabalu, Sarawak (Mt. Murud).

Java, Sumatra, Philippines.

2. H. FORMOSUM Brack.

North Borneo (coll. Burbidge; det. Baker).

Malaya to New Zealand.

3. H. JUNGHUHNII v. d. B.

Dutch Borneo.

Malaya to Polynesia.

H. dilatatum (Forst.) Sw. is reported from Sarawak and Kinabalu. From the latter, I have eight sheets of *H. eximium*, which is usually regarded as a synonym of *H. dilatatum*. This is possibly correct. But by the three names listed above I recognize three distinct Malayan ferns, and must therefore dissent from Kew judgment as shown in the *Synopsis Filicum* where all three are listed as synonyms of *H. dilatatum*.

4. H. DEMISSUM (Forst.) Sw.
   Sarawak (Mt. Penrissen).
   Malaya to New Zealand.

5. H. AUSTRALE Willd.
   Sarawak, Dutch Borneo.
   Malaya to India and New Zealand.

6. H. SALAKENSE Racib.
   Dutch Borneo.
   Java.

7. H. PRODUCTUM Kze., var. INTEGRILOBA Rosenstock.
   Dutch Borneo.
   The variety local, the species in Java.

8. H. BLUMEANUM Spr.
   Sarawak, Dutch Borneo, and Labuan or Kinabalu.
   Malaya to India and Polynesia.
   H. integrum v. d. B., reported by Rosenstock, is usually regarded as a synonym of *H. blumeanum*.

9. H. FOXWORTHYI Copel. n. sp.
   Sarawak (Santubong mountain).
   Local.

10. H. HALLIERII Ros.
    Dutch Borneo.
    Local.

11. H. ZOLLINGERIANUM Kze.
    Dutch Borneo.
    Java.

12. H. PACHYDERMICUM Cesati.
    Sarawak (Mt. Poé).
    Local.

13. H. OBTUSUM H. and A.
    North Borneo.
    Hawaii, New Guinea, Philippines.

14. H. BORNEENSE Hooker.
    Sarawak.
    Local.

15. H. CLEMENSIÆ Copel. n. sp.
    Kinabalu.
    Local.

Subgenus II. *LEPTOCIONUM.*

a. Frond up to 1 cm. long, subflabellate — 16. *H. subflabellatum.*

*a*1. Frond larger, pinnately divided.

b. Lamina plane (margin not crisped).

c. Rachis winged throughout.

d. Rachis and its wings about as wide as the segments — 17. *H. Hosei.*

*d*1. Rachis narrowly winged.

e. Indusium cleft to near the base.

f. Lips entire — 18. *H. perfissum.*

*f*1. Lips toothed — 19. *H. Lobbii.*

*e*1. Indusium cleft half-way down.

f. Marginal teeth few and small — 20. *H. edentulum.*

*f*1. Teeth coarse, lobe-like — 21. *H. holochilum.*

*c*1. Lower part of rachis naked.

d. Lips of indusium toothed.

e. Frond over 4 cm. long — 21. *H. holochilum.*

*e*1. Frond under 4 cm. long — 22. *H. blandum.*

*d*1. Lips entire or nearly so.

e. Fronds 2—4 cm. long — 23. *H. Bakeri.*

*e*1. Fronds larger.

f. Frond very lax — 24. *H. semifissum.*

*f*1. Segments close together — 25. *H. serrulatum.*

*b*1. Margin crisped.

c. Indusium split to the base, apex of lips broad, laciniate — 26. *H. fraternum.*

*c*1. Indusium split nearly to base, valves round, slightly uneven — 27. *H. Reinwardti.*

*c*2. Indusium split 1/3 to 2/3 of the way down.

d. Back of indusium bearing teeth or toothed crests.

e. Segments cut almost to costa — 28. *H. sabinifolium.*

*e*1. Segments less deeply toothed.

f. Back of indusium bearing teeth above middle — 29. *H. Neesii.*

*f*1. Back naked above middle — 30. *H. denticulatum:*

*d*1. Back without teeth but with ridges at base — 31. *H. brachyglossum.*

16. H. SUBFLABELLATUM Cesati.

Sarawak, Dutch Borneo.

Endemic.

17. H. HOSEI Copel. n. sp.

Sarawak (Mt. Trekan, alt. 600 m).

Local.

18. H. PERFISSUM Copel. n. sp.

Kinabalu (alt. 3,700 m.).

Local.

19. H. LOBBII Moore, var. MINOR Rosenst.

Dutch Borneo (the variety).

"Malaya," Assam (the species).

20. H. EDENTULUM (v. d. B.) C. Chr.

Dutch Borneo.

Assam.

21. H. HOLOCHILUM (v. d. B.) C. Chr.

Sarawak, Dutch Borneo, Kinabalu.

Java.

H. Boschii Rosenst, of which var. *euryglossa* Rosenst. is reported from Dutch Borneo and Sumatra, is a new name for *Leptocionum affine* v. d. B., and usually regarded as identical with *H. holochilum*.

22. H. BLANDUM Racib.

Kinabalu (coll. Miss Gibbs; not in our collections).

Java.

23. H. BAKERI Copel. nom. nov.
Trichomanes denticulatum Baker.

Sarawak, North Borneo.

Endemic.

This is regarded, on Christ's authority, as identical with *H. prætervisum* Christ, of Samoa, but the descriptions differ materially; and Sarawak specimens which seem to me to represent *T. denticulatum* cannot be matched even approximately with Christ's diagnosis nor with his figure in *Farnkr. der Erde.* Christ as well had Sarawak specimens, and it is of course possible enough that they are different from mine; in that case, one of them is undescribed, or his were not *T. denticulatum*.

24. H. SEMIFISSUM Copel.

Sarawak (Mts. Merinjak and Trekan).

Endemic.

25. H. SERRULATUM (Pr.) C. Chr.

Dutch Borneo, Kinabalu.

Malacca, Philippines, New Guinea.

Kinabalu specimens are smaller than typical ones. *H. Preslii* (v. d. B.) Ros. may belong here.

26. H. FRATERNUM HARR.

Mt. Kinabalu (coll. Miss Gibbs; not in our collections).

Panay.

27. H. REINWARDTI v. d. B.

Dutch Borneo.

Java, Tidore, Sumatra.

28. H. SABINIFOLIUM Baker.

Dutch Borneo, North Borneo.

Java, Sumatra.

29. H. NEESII (Blume) Hooker.

Reported from all parts of Borneo.

Malaya, Ceylon.

30. H. DENTICULATUM Sw.

Dutch Borneo, Kinabalu.

Malaya to India.

Rosenstock distinguishes a var. *complanata* (*sic*) in Dutch Borneo.

Miss Gibbs distinguishes one Kinabalu plant as *H. aculeatum* Racib. The name does not seem valid to me, whatever the plant may be.

There has been so much confusion among the preceding two species that occurrence and range are altogether doubtful.

31. H. BRACHYGLOSSUM A. Br.

Sarawak.

Java.

2. TRICHOMANES Linnæus.

a. Frond more or less entire, minute, with oblique false veins — 1. *Hemiphlebium*.

*a*1. Frond cut, but not pinnately, minute, without false veins — 2. *Gonocormus*.

*a*2. Frond pinnately cut, false veins present, small ferns.

b. Frond not glaucous — 3. *Didymoglossum*.

*b*1. Frond glaucous — 4. *Pleuromanes*

*a*3. Frond pinnate, without false veins, not cut to the costa into very narrow segments.

b. Pinnæ equal, broad, obtuse, either subentire or cut part way to the costa between the coarse veins, which thus protrude as narrow segments, texture firm; rhizome stout, erect — 6. *Cephalomanes*.

*b*1. Texture softer, pinnæ usually unequal, and always differently cut or rhizome creeping — 5. *Eutrichomanes*.

*a*4. Frond pinnate, without false veins, cut to the costa into capillary segments — 7. *Leptomanes*.

Subgenus I. *HEMIPHLEBIUM*.

a. Frond cordate-orbicular — 1. *T. Motleyi*.

*a*1. Frond not cordate-orbicular.

b. Frond about 5 mm. long — 2. *T. beccarianum*.

*b*1. Frond 15 mm. long or more — 3. *T. sublimbatum*.

1. T. MOTLEYI v. d. B.

Labuan, Sarawak.

Malaya to India, Formosa and Queensland.

2. T. BECCARIANUM Cesati.

Sarawak.

Local.

3. T. SUBLIMBATUM K. Müll.

Sarawak.

Malaya to Khasia and New Guinea.

Subgenus II. *GONOCORMUS*.

a. Margin not ciliate.

b. Rachis of well developed plants bearing a succession of part-fronds.

c. Part-fronds round, lobes regular — 4. *T. minutum*.

*c*1. Lobes very irregular in length.

d. Cell-walls irregularly thickened — 5. *T. proliferum*.

*d*1. Cell-walls uniform	6. *T. Teysmanni.*
*b*1. Frond not a succession of part-fronds.	
c. Frond roundish, segments radiate.	
d. Segments about 1 mm. wide, numerous	7. *T. parvulum.*
*d*1. Segments about 2 mm. wide	8. *T. nitidulum.*
*c*1. Frond elongate-deltoid, central segment monopodial	9. *T. Brooksii.*
*a*1. Margin ciliate.	
b. Lips of indusium glabrous	10. *T. digitatum.*
*b*1. Lips of indusium ciliate	11. *T. palmatifidum.*

4. T. MINUTUM Bl.

Dutch Borneo.

Malaya to New Guinea.

5. T. PROLIFERUM Bl.

Sarawak, Kinabalu.

Malaya to India.

6. T. TEYSMANNI v. d. B.

Dutch Borneo (Bengkarum).

Sumatra.

7. T. PARVULUM Poir.

T. saxifragoides Presl.

Sarawak.

Range wide but uncertain.

I have followed Hooker in construing this species, and may have a form of *T. minutum* in the place of real *T. parvulum*. *T. saxifragoides* is a Philippine plant, of which the type collection cannot be distinguished by any constant character from Hooker's *T. parvulum*.

8. T. NITIDULUM v. d. B.

Kinabalu.

Java, Riouw.

9. T. BROOKSII Copel. n. sp.

Sarawak (Bungo range).

Local.

10. T. DIGITATUM Swtz.

Sarawak, North Borneo.

Malaya to Mascarenes, India, Polynesia and Australia.

11. T. PALMATIFIDUM K. Müll.

Dutch Borneo, Kinabalu.

Java.

Subgenus III. *DIDYMOGLOSSUM*.

a. False vein marginal (*Crepidomanes*).	
b. Not hairy	12. *T. humile*.
*b*1. Hairy	20. *T. vestitum*.
*a*1. With submarginal false veins.	
b. Many false veins present	13. *T. bilabiatum*.
*b*1. With very few false veins beside the broken submarginal one	14. *T. recedens*.
*b*2. Without false veins except the broken submarginal one.	
c. Rachis winged	15. *T. bipunctatum*.
*c*1. Rachis mostly terete.	
d. Lips spreading, rounded	16. *T. brevipes*.
*d*1. Apex of indusium broadly revolute	17. *T. microlirion*.

12. T. HUMILE Forst.

Sarawak, North Borneo (common).

Malaya to Formosa and New Zealand.

13. T. BILABIATUM Nees et Bl.

Common.

Malaya to Melanesia.

14. T. RECEDENS Rosenst.

Dutch Borneo (between Kundim Bharu and Batu Babi).

Local.

15. T. BIPUNCTATUM Poir.

Common.

Tropics and Subtropics of Old World.

16. T. BREVIPES (Pr.) Baker.

Sarawak.

Leyte.

17. T. MICROLIRION Copel.

Sarawak.

Endemic.

Subgenus IV. *PLEUROMANES.*

Costa bordered, and a marginal pseudo-vein present — 18. *T. pallidum.*

18. T. PALLIDUM Bl.

Probably common.

Malaya to Ceylon, Polynesia and Queensland.

Subgenus V. *EUTRICHOMANES.*

a. Rhizome filiform, fronds usually under 10 cm. long.

b. Fronds not over 3 cm. long, at most bipinnatifid.

c. Margin toothed, frond smooth — 19. *T. serrulatum.*

*c*1. Margin entire, frond hairy — 20. *T. vestitum.*

*b*1. Frond 3—4 cm. long, sparingly tripinnatifid — 21. *T. Hosei.*

*b*2. Well-developed fronds mostly 5—10 cm. long, freely tripinnatifid.

c. Indusium ending in two small erect lips — 22. *T. microchilum.**

*c*1. Mouth of indusium broadly dilated, scarcely two-lipped — 23. *T. pyxidiferum.*

*a*1. Rhizome woody, wide-creeping, fronds relatively large.

b. Fronds pinnate or bipinnatifid, slender — 24. *T. auriculatum.*

*b*1. Fronds 4—5 pinnatifid, broad — 25. *T. maximum.*

*a*2. Fronds clustered, rhizome short- creeping or erect.

b. Rachis winged throughout.

c. Froud "bipinnati-partite" — 26. *T. ignobile.*

*c*1. Frond quadripinnatifid.

d. Mouth of indusium toothed or ciliate — 27. *T. hispidulum.*

*d*1. Mouth of indusium entire and naked — 28. *T. grande.*

*b*1. Rachis not winged throughout.

c. Rachis and upper part of stipe naked.

d. Bipinnatifid with forked "pinnules" — 29. *T. racemulosum.*

*d*1. Well developed fronds quadripinnatifid — 30. *T. papillatum.*

*c*1. Stipe hairy throughout.

d. Ultimate segments broad, short and obtuse — 31. *T. saxatile.*

*d*1. Ultimate segments tooth-like, linear or setiform.

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* Look out here for *Hymenophyllum Foxworthyi*, with brownish lanceolate fronds (*vide* pp. 305—7 *antea*).

e. Fronds firm in texture.	
f. Ultimate segments tooth-like	32. *T. cupressoides*.
*f*1. Ultimate segments setiform	33. *T. setaceum*.
*e*1. Fronds herbaceous.	
f. Frond ample, segments linear	34. *T. apiifolium*.
*f*1. Frond not over 5 cm. wide, segments setiform	35. *T. Merrillii*.

19. T. SERRULATUM Baker.

"On Lobong Peak."

Local.

20. T. VESTITUM Baker.

Sarawak (Gunong Gading, Lundu).

Local.

21. T. HOSEI Baker.

Sarawak (Mt. Matang).

Local.

22. T. MICROCHILUM Baker.

Kinabalu, alt. 7,000 ft.

Local.

23. T. PYXIDIFERUM L.

Sarawak, North Borneo.

Pantropical.

Hose remarks that this name is given at Kew to three apparently distinct Bornean ferns. This and the four preceding species have the habit of *Didymoglossum*, from which they are distinguished only by the absence of false veins.

24. T. AURICULATUM Bl.

Kinabalu.

Malaya to India, China and Japan.

In form, but not in texture, the fronds resemble those of *Cephalomanes*.

25. T. MAXIMUM Bl.

Common.

Malaya to Polynesia and Queensland (?).

26. T. IGNOBILE Cesati.

Sarawak.

Local.

This fern, described from a sterile and apparently ill preserved specimen, without definite statement of locality, may as well be regarded as unknown.

27. T. HISPIDULUM.

Sarawak, Dutch Borneo, Labuan, North Borneo.

Malacca.

28. T. GRANDE Copel.?

"*T. millefolium* Pr." of Cesati.

Sarawak (Mt. Matang).

Philippines, New Guinea.

T. millefolium Presl., described with a creeping rhizome, seems to be *T. maximum* Bl. From Cesati's reference to van den Bosch, *Hymen. Javan.*, Tab. XX., the figure of a fern with an erect stem, it seems likely that his fern was *T. grande.*

29. T. RACEMULOSUM v. d. B.

"Borneo," Sarawak (Bungo range).

Endemic.

30. T. PAPILLATUM K. Müll.

Sarawak, Dutch Borneo.

Philippines.

Bornean plants determined at Kew as *T. rigidum* Sw. are likely to be either this species or *T. cupressoides.*

31. T. SAXATILE Moore.

"Borneo."

Endemic.

Brooks and Hewitt No. 27, from Bungo range, Sarawak, is possibly this species.

32. T. CUPRESSOIDES Desv.

Very common.

Oriental Tropics.

See note under *T. papillatum.* Rosenstock describes a small and narrow form as "var. *minor.*"

33. T. SETACEUM v. d. B.

Dutch Borneo, Sarawak.

Singapore, Banca.

Not sharply distinguished from *T. cupressoides.*

34. T. APIIFOLIUM Presl.

Sarawak, North Borneo.

Malaya to New Guinea.

The report of *T. bauerianum* Endl. from Dutch Borneo probably rests on the opinion that such is the proper name of *T. apiifolium.*

35. T. MERRILLII Copel.

Sarawak, Dutch Borneo, Sandakan.

Palawan.

Van Alderwerelt distinguishes the form from Dutch Borneo as "var. *borneense.*" This species approaches the subgenus *Leptomanes.*

Subgenus VI. *CEPHALOMANES.*

a.	Sori terminal on the pinnæ	36. *T. sumatranum.*
*a*1.	Sori chiefly on the upper edge of pinna.	
b.	Sori in groups	37. *T. Rosenstockii.*
*b*1.	Sori normally single on the lobes or teeth	38. *T. javanicum.*

36. T. SUMATRANUM v. A. v. R.

Boundary between Dutch and North Borneo (Amdyah), Sarawak.

Sumatra.

37. T. ROSENSTOCKII v. A. v. R.

Dutch Borneo; Sarawak (?).

Endemic.

38. T. JAVANICUM Blume.

Common.

Madagascar to India, Polynesia and Australia.

This is a variable fern, from which nearly related species, if there be such valid, are naturally difficult to distinguish.

Van Alderwerelt has described *T. borneense* from Dutch Borneo, but the diagnostic characters are not clear to me from his description.

Subgenus VII. *LEPTOMANES.*

a. Segments narrowly linear	39. *T. parviflorum*.
*a*1. Segments capillary or setiform.	
b. Stems erect, stipes densely tufted	40. *T. trichophyllum*.
*b*1. Rhizome short-creeping	41. *T. Pluma*.
*b*2. Rhizome wide-creeping	42. *T. meifolium*.

39. T. PARVIFLORUM Poir

T. fœniculaceum Bory.

Sarawak, Dutch Borneo, North Borneo.

Malaya to Madagascar and Australia.

T. gemmatum J. Sm., reported from Mt. Poé (from which place I have *T. parviflorum*) in Sarawak, and from Dutch Borneo, is supposed to be distinguished from *T. parviflorum* by having a wide-creeping, instead of a short-creeping rhizome.

40. T. TRICHOPHYLLUM Moore.

Kinabalu.

New Caledonia.

41. T. PLUMA Hooker.

Sarawak, North Borneo.

Malaya to Samoa and New Caledonia.

42. T. MEIFOLIUM Bory.

Dutch Borneo.

Reunion to Polynesia.

I have in hand a considerable number of Bornean specimens with segments reduced to bristles, and they are certainly all one species, which is *T. Pluma;* whether or not they are *T. meifolium* cannot be determined here. *T. trichophyllum* is a thoroughly distinct plant, of which I have seen no Bornean specimen.

FAM. VII. POLYPODIACEÆ.

Key to generic groups.

a. Sporangia not collected into definite sori, scattered over the back of the frond	A. **"Acrosticheæ."**
*a*1. Sporangia scattered along the veins in elongate, naked lines	B. **Vittarieæ and "Gymnogrammitideæ."**
*a*2. Sporangia gathered into definite sori which are dorsal rather than marginal.	
b. Sori more or less round, naked	C. **"Polypodieæ."**
*b*1. Sori roundish, with indusia.	

c. Indusium fixed at a point	D. **"Aspidieæ."**
*c*1. Indusium fixed by the base, or base and sides	E. **Davallieæ (Part).**
*c*2. Indusium fixed by the whole margin	F. **Cyatheeæ and Woodsieæ.**
*b*2. Sori elongate on veins, with indusia	G. **Asplenieæ.**
*a*3. Sporangia in marginal, or nearly marginal sori, indusiate.	
b. Indusium free on side facing margin	H. **Dicksonieæ and Davallieæ (Part).**
*b*1. Indusium formed by reflexed margin	I. **Pterideæ.**

A. "ACROSTICHEÆ."

Sporangia not gathered into sori, covering the back of the frond or parts of it.

a. Sporangia confined to an elongate apical segment of the entire frond; epiphytes	63. *Hymenolepis*.
*a*1. Sporangia on the back of simple entire frond.	
b. Frond coriaceous or pubescent; epiphytes	64. *Elaphoglossum*.
*b*1. Frond thinner, glabrous; mostly terrestrial.	
c. Rhizome creeping	43. *Leptochilus* (*part*).
*c*1. Rhizome suberect	41. *Hemigramma* (*part*).
*a*2. Fertile frond lanceolate, entire, sterile frond broad and forked; terrestrial	54. *Cheiropleuria*.
*a*3. Sterile green fronds repeatedly forked; nest-buildings epiphytes	55. *Platycerium*.
*a*4. Frond typically pinnatifid or pinnate.	
b. Fronds dimorphous as a whole.	
c. Rhizome high-scandent.	
d. Veins free unless near costa	48. *Stenochlæna*.
*d*1. Veins everywhere anastomosing	44. *Lomagramma*.
*c*1. Rhizome creeping or short-scandent	43. *Leptochilus* (*part*).
*c*2. Rhizome erect; terrestrial.	
d. Veins anastomosing everywhere	41. *Hemigramma* (*part*).
*d*1. Veins anastomosing near costae	42. *Stenosemia*.
*d*2. Veins free	39. *Polybotrya*.
*b*1. Sporangia on apical segments or pinnæ.	
c. Sterile part of frond pinnatifid, epiphytes	67. *Merinthosorus*.
*c*1. Frond pinnate throughout.	
d. Fertile pinnæ linear; usually epiphytic	69. *Photinopteris*.
*d*1. Fertile pinnæ broader; terrestrial in brackish marshes	56. *Acrostichum*.

B. VITTARIEÆ AND "GYMNOGRAMMITIDEÆ."

Sori elongate along veins, linear, without indusium.

a. Sorus borne on the costa; minute epiphytes 73. *Monogramma*.

*a*1. Sorus one on each side of costa.

b. Sori marginal or submarginal, immersed; epiphytes.

c. Rhizome erect 72. *Scleroglossum*.

*c*1. Rhizome creeping 71. *Vittaria* (*part*).

*b*1. Sori dorsal.

c. Veins free 59. *Oreogrammitis*.

*c*1. Veins not free.

d. Frond coriaceous; terrestrial 8. *Tænitis*.

*d*1. Frond thick and fleshy; epiphytes 62. *Drymoglossum*.

*a*2. Sori more numerous, veins free; terrestrial.

b. Frond simple 6. *Syngramma* (*part*).

*b*1. Frond compound, pinnæ broad (2 cm. or more) 9. *Coniogramme*.

*b*2. Frond compound; ultimate divisions narrow 10. *Ceropteris*.

*a*3. Sori more numerous, veins anastomosing.

b. Frond compound; terrestrial.

c. Veins uniting near margin 7. *Craspedodictyum*.

*c*1. Veins uniting everywhere 34. *Dryopteris* (*part*).

*b*1. Frond simple.

c. Free included veinlets in areolæ 57. *Polypodium* (*Selliguea*).

*c*1. Without free included veinlets.

d. Sori not anastomosing.

e Veins uniting near margin only 6. *Syngramma* (*part*).

*e*1. Veins uniting everywhere 60. *Loxogramme*.

d. Sori forming a net.

e. Stipe reddish; terrestrial 6. *Syngramma* (*part*).

*e*1. Without reddish stipe 70. *Antrophyum*.

C. POLYPODIEÆ.

Sori dorsal, round or not very elongate, without indusium.

a. Humus-collecting epiphytes.

b. Humus collected by distinct scarious fronds 68. *Drynaria*.

*b*1. Humus collected by scarious bases of fronds.

c. Sporangia restricted to modified apex 66. *Aglaomorpha*.

*c*1. Apex not modified 75. *Polypodium*.

*a*1. Rhizomes inflated and inhabited by ants.

b. Sori dorsal on frond	57. *Polypodium*. (*Myrmecophila*).
*b*1. Sori single on specialized lobes	65. *Lecanopteris*.
*a*2. Neither humus-gatherers nor myrmecophilous.	
b. Stipe not jointed.	
c. Epiphytes	57. *Polypodium* (*part*).
*c*1. Terrestrial plants.	
d. Quadripinnate with one sorus on each ultimate pinnule	33. *Monachosorum*.
*d*1. Sori not solitary on the pinnules.	
e. Veins free or uniting regularly in pairs	34. *Dryopteris* (*part*).
*e*1. Veins uniting but not regularly in pairs.	
f. Frond not dichotomous	40. *Tectaria* (*part*).
*f*1. Frond dichotomously forked	53. *Dipteris*.
*b*1. Stipe articulate, or showing traces of a joint; mostly epiphytes.	
c. Sori in deep marginal or submarginal pits	58. *Prosaptia*.
*c*1. Sori dorsal or superficial.	
d. Pubescence on frond peltate, shield-shaped or stellate	61. *Cyclophorus*.
*d*1. Pubescence on frond none or not peltate	57. *Polypodium*.

D. "ASPIDIEÆ."

Sori round, indusiate, dorsal, indusium fixed by a point.

a. Veins free.	
b. Stipe articulate to rhizome.	
c. Frond compound	19. *Davallodes* (*part*). †
*c*1. Frond simple	22. *Oleandra*.
*b*1. Stipe not articulate.	
c. Pinnae articulate to rachis.	
d. Indusium not peltate	29. *Nephrolepis* (*part*).
*d*1. Indusium peltate.	
e. Sori in one row remote from costa	29. *Nephrolepis* (*part*).
*e*1. Sori costular or in several rows	38. *Cyclopeltis*.
*c*1. Pinnae not articulate.	
d. Indusium peltate	36. *Polystichum*.
*d*1. Indusium cordate or reniform, fixed by the sinus.	
e. Indusia uniform	34. *Dryopteris* (*Lastraea*).

† *Arthropteris*, with simply pinnate fronds, will probably be found in Borneo; its number would be 29A.

*c*1. Indusia not uniform, some of them elongate on one side — 45. *Athyrium* (*part*).

*a*1. Veins not free.

b. Frond simple, or pinnate in plan.

c. Veins uniting regularly in pairs — 34. *Dryopteris* (*part*).

*c*1. Veins uniting irregularly — 40. *Tectaria* (*part*).

*b*1. First division of frond dichotomous.

c. Frond erect, fan-shaped — 51. *Matonia*.

*c*1. Frond pendent, sympodial — 52. *Phanerosorus*.

E. DAVALLIEÆ (in part).

Sori dorsal on frond, mostly terminal on veins, roundish, indusium fixed by base or by base and sides.

a. Stipe not articulate to rhizome.

b. Rhizome erect — 32. *Acrophorus*.

*b*1. Rhizome creeping.

c. Fronds less than 10 cm. long — 25. *Protolindsaya*.

*c*1. Fronds larger.

d. Frond glabrous — 4. *Tapeinidium*.

*d*1. Frond more or less hairy — 3. *Microlepia*.

*a*1. Stipe articulate to rhizome.

b. Indusia fixed by base and sides.

c. Paleae on rhizome hair-like.

d. Fronds simple, coriaceous — 24. *Scyphularia*.

*d*1. Fronds compound, thinner, hairy — 19. *Davallodes* (*part*).

*c*1. Paleae broader, scale-like — 23. *Davallia*.

*b*1. Indusia fixed by base only.

c. Frond and indusium coriaceous — 21. *Humata*.

*c*1. Frond and indusium thinner — 20. *Leucostegia*.

F. CYATHEEAE and WOODSIEÆ.

Sorus dorsal, globose †, *indusium fixed beneath or by the margin, opening at the top or irregularly.*

a. Annulus oblique, complete, mostly tree-ferns — 30. *Cyathea*.

*a*1. Annulus vertical, incomplete, caudex erect, not arborescent — 31. *Diacalpe*.

G. ASPLENIEÆ.

Sori elongate along a non-marginal vein, provided with an indusium attached to the vein and opening along the other side.

a. Sorus on a special vein parallel to costa — 49. *Blechnum*.

*a*1. Sori on ordinary oblique veinlets.

b. Veins uniting regularly in pairs; indusium glandular-hairy — 35. *Mesochlaena*.

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† *Diplaziopsis*, with oblong sori and membranaceous fronds, is likely to be found in Borneo: its number would be 45A.]

*b*1. Veins free or indusium naked.
c. Pinnules articulate to rachis, sori terminal on veins — 37. *Didymochlaena*.
*c*1. Pinnules not articulate, sori dorsal on veins.
d. Sorus double, the halves facing each other, indusium opening where the halves meet — 47. *Phyllitis*.
*d*1. Sorus simple (borne by a single vein).
e. Paleae thin, not black, roots not stout and black, sori confined to one side of vein — 46. *Asplenium*.
*e*1. Paleae usually harsh and dark, roots usually black and stout, lowest sori usually bent across vein, or on both sides of vein — 45. *Athyrium* (*part*).

H. DICKSONIEÆ, and DAVALLIEÆ in part.

Sori marginal or nearly so, with an indusium opening on the marginal side, not protected by a reflexed margin.

a. Pinnae articulate to rachis.
b. Terrestrial, small ferns — 5. *Schizoloma* (*part*).
*b*1. Epiphytes, middle-sized — 29. *Nephrolepis* (*part*).
*a*1. Pinnae not articulate to rachis.
b. Veins confluent in the sori.
c. Decompound with cuneate ultimate pinnules — 27. *Odontosoria*.
*c*1. Ultimate pinnules not cuneate.
d. Marginal sorus continuous — 5. *Schizoloma* (*part*).
*d*1. Sorus interrupted — 26. *Lindsaya* (*part*).
*b*1. Each sorus at the end of a single vein.
c. Fronds under 40 cm. long — 26. *Lindsaya* (*part*).
*c*1. Fronds over 60 cm. long.
d. Rhizome creeping, fronds scattered — 2. *Dennstædtia*.
*d*1. Rhizome erect, fronds clustered.
e. Pinnules oblique at base — 18. *Balantium*.
*e*1. Pinnules not very oblique at base.
f. Not glaucous — 28. *Cystodium*.
*f*1. Glaucous beneath, annulus complete — 1. *Cibotium*.

I. PTERIDEÆ.

Sori marginal, protected by the reflexed margin.

a. Fronds dimorphous, annulus complete — 50. *Plagiogyria*.
*a*1. Fronds uniform, linear and entire — 71. *Vittaria* (*part*).
*a*2. Fronds uniform, not simple and entire.
b. Sporangia borne on the inner face of the reflexed margin — 12. *Adiantum*.
*b*1. Sporangia not borne on reflexed margin.

c. Lowest pinnules of each pinna remote from others and stipule-like	16. *Histiopteris*.
*c*1. Lowest pinnules not stipule-like.	
d. Real (inner) indusium present, opening toward margin.	
e. Main rachis zigzag	14. *Paesia*.
*e*1. Main rachis straight	15. *Pteridium*.
*d*1. Sporangia protected only by reflexed margin.	
e. Vein-tips connected in the sorus by a marginal vein	17. *Pteris*.
*e*1. Veins free, but sori confluent at maturity	11. *Chilanthes**.
*e*2. Veins free, and sori separate and distinct.	13. *Hypolepis*.

1. CIBOTIUM Kaulfuss.

C. Barometz (L.) J Sm.

Sarawak, Kinabalu.

Malaya to Assam and China.

The Kinabalu form is the same as that found in the Philippines (*C. Cumingii* Kze).

2. DENNSTÆDTIA Bernhardi.

a. Frond tripinnate	1. *D. ampla*.
*a*1. Frond quadripinnate	
b. Frond erect or drooping	2. *D. cuneata*.
*b*1. Frond scandent or twining	2. *D. gomphophylla*.

1. D. ampla (Baker) Bedd.

Sarawak.

Malacca.

2. D. cuneata (J. Sm.) Moore.

Sarawak, Kinabalu.

Philippines.

It is not worth while to try to distinguish the "var. *obtusa*."

3. D. gomphophylla (Baker) C. Chr.

Sarawak (Mt. Matang).

Endemic.

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* *Doryopteris*, with deeply lobed simple fronds, and *Onychium*, with narrow ultimate pinnules almost covered by the indusia, are likely to be found in Borneo. Their numbers would be 11A and 17A.

3. MICROLEPIA Presl.

a. Pinnae broadly lanceolate	1. *M. speluncae*.
*a*1. Pinnae linear-lanceolate.	
b. Pinnules remote	2. *M. Hancei*.
*b*1. Pinnules contiguous	3. *M. strigosa*.

1. M. SPELUNCAE (L.) Moore.

Sarawak, British North Borneo, probably common everywhere.

Pantropical.

2. M. HANCEI Prantl.

Sarawak.

Hongkong, Khasya.

3. M. STRIGOSA (Thunb.) Presl.

Kinabalu.

Malaya to China, Japan and Polynesia.

4. TAPEINIDIUM (Presl.) Christensen.

a. Fronds 3-10 cm. tall	1. *T. oligophlebium*.
*a*1. Fronds much larger	2. *T. pinnatum*.

1. T. OLIGOPHLEBIUM (Bäker) C. Chr.

Sarawak, Dutch Borneo.

Endemic.

2. T. PINNATUM (Cav.) C. Chr.

Common.

Malaya, Polynesia.

The typical form has the pinnæ toothed or lobed. More dissected forms are commoner in Borneo, and have been given a number of names.

5. SCHIZOLOMA Gaudichaud.

a. Fronds coriaceous.	
b. Veins free.	
c. Pinnae round or oblong.	
d. Frond about 1 cm. broad.	
e. Pinnae nearly equal-sided	1. *S. jamesonioides*.
*e*1. Pinnae obliquely truncate at base	2. *S. ovatum*.
*d*1. Frond 1.5 to 2.5 cm. broad.	
e. Pinnae nearly symmetrical, costae distinct	3. *S. induratum*.
*e*1. Pinnae oblique, veins flabellate	4. *S. fuligineum*.

*c*1. Pinnae narrower.	
d. Lower pinnae horizontal or deflexed	5. *S. divergens.*
*d*1. Pinnae ascending	6. *S. Walkerae.*
*b*1. Veins anastomosing.	
c. Fronds dimorphous	7. *S. cordatum.*
*c*1. Fronds uniform	8. *S. coriaceum.*
*a*1. Fronds not coriaceous.	
b. Pinnae linear or linear-lanceolate, several, entire	9. *S. ensifolium.*
*b*1. Pinnae 1 to 3, entire	10. *S. Hosei.*
*b*2. Pinnae more numerous, usually pinnate, pinnules broad	11. *S. heterophyllum.*

1. S. JAMESONIOIDES (Baker) Copel.
   Kinabalu.
   Celebes.

2. S. OVATUM (J. Sm.) Copel.
   Sarawak (Mt. Matang).
   Philippines, Celebes.

3. S. INDURATUM (Baker) C. Chr.
   Sarawak, British North Borneo.
   Endemic.

4. S. FULIGINEUM Copel.
   Sarawak.
   Philippines.

5. S. DIVERGENS (Roxb.) Kuhn.
   Sarawak.
   Malaya.

6. S. WALKERAE (Hooker) Kuhn.
   Dutch Borneo.
   Banca, Sumatra, Ceylon.

7. S. CORDATUM Gaud.
   Sarawak.
   Malay Peninsula.

8. S. CORIACEUM v. A. v. R.
   Dutch Borneo.
   Endemic.

9. S. ENSIFOLIUM (Sw.) J. Sm.

Common.

Palaeotropic.

10. S. HOSEI (C. Chr.) comb. nova.

Lindsaya trilobata Baker, non Colenso.

Schizoloma trilobatum v. A. v. R.

Lindsaya Hosei C. Chr., Index, p. 394, 1905.

Sarawak.

Endemic.

11. S. HETEROPHYLLUM (Dry.) J. Sm.

British North Borneo.

Malaya to India and China.

This is doubtfully distinct from *Lindsaya orbiculata*, from which it may seem to be distinguished by having anastomosing veins.

6. SYNGRAMMA J. SMITH.

a. Veins free except for a submarginal connecting vein.	
b. Frond oblong	1. *S. valleculata*.
*b*1. Frond lanceolate or linear.	
c. Fronds entire or wavy.	
d. Stipe purple	5. *S. lobbiana*.
*d*1. Stipe pale	2. *S. angusta*.
*c*1. Fronds somewhat toothed.	
d. Frond coriaceous	3. *S. borneensis*.
*d*1. Frond thinnner	4. *S. cartilagidens*.
*a*1. Veins uniting to form marginal areolae.	
b. Frond linear-lanceolate	6. *S. Wallichii*.
*b*1. Frond broadly lanceolate	7. *S. alismifolia*.
*a*2. Veins anastomosiug rather freely.	
b. Base rounded	8. *S. Hosei*.
*b*1. Base acute	9. *S. Hookeri*.

1. S. VALLECULATA (Baker) C. Chr.

Sarawak (Mt. Lambir).

Local.

2. S. ANGUSTA Copel.

Sarawak (Bidi).

Local.

3. S. BORNEENSIS (Hooker) J. Sm.

Sarawak, British North Borneo.

Celebes, Amboyna, Fiji.

4. S. CARTILAGIDENS (Baker) Diels.

Sarawak.

Described from Dutch Borneo by van Alderwerelt, but as coriaceous and decidedly dimorphous, both of which are true of the preceding rather than of this species; the two are not very distinct.

Endemic.

5. S. LOBBIANA (Hooker) J. Smith.

Sarawak.

Malacca.

6. S. WALLICHII (Hooker) Bedd.

Sarawak, Labuan, Dutch Borneo.

Singapore, Malay Peninsula.

7. S. ALISMIFOLIA (Presl) J. Sm.*

Common.

Malaya.

8. S. HOSEI (Baker) Diels.

Sarawak (Mt. Matang).

Local.

9. S. HOOKERI C. Chr.

Sarawak (Mt. Poe), Dutch Borneo (Bengkarum).

New Guinea, Fiji.

I doubt the distinctness of this and the last species; if they are identical, the valid name is *S. Hosei.*

7. CRASPEDODICTYUM COPELAND.

C. QUINATUM (Hooker) Copel.

(*Syngramma quinata* (Hooker) Carr.)

Sarawak, Dutch Borneo.

Celebes to Polynesia.

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* In regard to this and the two preceding species it should be noted that *S. lobbiana* shades into *S. Wallichii*, and the latter into *S alismifolia.*

8. TÆNITIS Willdenow.

a. Fronds simple, decidedly dimorphous	1. *T. rigida*.
b. Fronds simple, not very unlike.	
*b*1. Fronds obtuse.	
c. Margin sharp	2. *T. drymoglossoides*.
*c*1. Margin thickened	3. *T. obtusa*.
*b*2. Fronds acute	4. *T. Brooksii*.
*a*1. Frond pinnate	5. *T. blechnoides*.

1. T. RIGIDA (Hooker) comb. nova.

Drymoglossum rigidum Hooker. *Icones Pl.* 10 (1854) 96.

Sarawak.

Local.

2. T. DRYMOGLOSSOIDES Copel.

Sarawak (Bungo range.).

Local.

3. T. OBTUSA Hooker.

Sarawak.

Local.

4. T. BROOKSII Copel.

Sarawak (Bungo range).

Local.

It is likely that the four species just listed are not all really distinct.

5. T. BLECHNOIDES (Willd.) Sm.

Common.

India to Fiji.

T. stenophylla Christ, is a form with very narrow pinnæ, but I cannot separate it from *T. blechnoides*.

9. CONIOGRAMME Fee.

C. FRAXINEA (Don) Diels.

Kinabalu. The only specimen is sterile, but its identification is positive.

Malaya to India and Japan.

10. CEROPTERIS Link.

C. CALOMELANOS (L.) Underwood.

Sarawak, Dutch Borneo and British North Borneo; supposed not to be native.

Native of tropical America and West Africa; now in all warm countries.

Gymnogramme chrysosora Baker (*Ceropteris*, v. A. v. R.), described as a new species from Sarawak, peculiar in having a waxy covering on the back of the fertile, but not of the sterile, frond, does not seem distinct to me. We have specimens from Sandakan with the sterile fronds not waxy, and intermediate forms from other parts of Borneo.

Prince Bonaparte also reports *C. tartarea* Link from Sarawak; it also is American in origin, but cultivated elsewhere. Its frond is bipinnatifid, while adult *C. calomelanos* is tripinnatifid.

11. CHEILANTHES Swartz.

C. TENUIFOLIA (Burm.) Sw.

Common.

Malaya to India and New Zealand.

12. ADIANTUM Linnæus.

a. Fronds simply pinnate.
  b. Densely hairy — 1. *A caudatum*.
  *b*1. Glabrous — 2. *A. philippense*.
*a*1. Well developed fronds at least bipinnate, not pedate-deltoid.
  b. Sori roundish or obversely reniform.
    c. Texture very thin.
      d. Pinnules rhomboidal — 3. *A. diaphanum*.
      *d*1. Pinnules longer and narrower — 4. *A. serratifolium*
    *c*1. Texture firm — 5. *A. pulcherrimum*.
  *b*1. Sori straight, wide but not deep.
    c. Pinnules trapeziform in plan — 6. *A. Hosei*.
    *c*1. Pinnules cuneate in plan, sometimes orbicular — 7. *A. capillus-veneris*.
*a*2. Fronds pedate-deltoid, tripinnate — 8. *A. stenochlamys*.

1. A. CAUDATUM.

Sarawak, Dutch Borneo and British North Borneo.

Palaeotropic.

2. A. PHILIPPENSE L.
   A. lunulatum Burm.
   North Borneo.
   Tropics.

3. A. DIAPHANUM Bl.
   Dutch Borneo, North Borneo.
   Malaya to India and New Zealand.

4. A. SERRATIFOLIUM v. A. v. R.
   Dutch Borneo.
   Endemic.

5. A. PULCHERRIMUM Copel.
   Sarawak (Mt. Penrissen).
   Endemic.

6. A. HOSEI Baker.
   Sarawak.
   Endemic.

7. A. CAPILLUS-VENERIS L.
   North Borneo (Kudat, Jesselton, Khota Belud).
   Cosmopolitan.

8. A. STENOCHLAMYS Baker.
   Sarawak, British North Borneo.
   Endemic.

13. HYPOLEPIS BERNHARDI.

H. TENUIFOLIA (Forst.) Bernh.
   Mt. Kinabalu, Paka cave (coll. Topping).
   Malaya to China and New Zealand.

The Kinabalu specimen is not typical *H. tenuifolia*, but is an Alpine modification, different, however, from *H. alpina* of Java.

14. PAESIA ST. HILAIRE (?)

A sterile plant, collected by Topping on the Marai-parai spur of Kinabalu, seems to be either a new species of *Pæsia* or the representative of a new genus.

15. PTERIDIUM Gleditsch.

P. AQUILINUM (L.) Kuhn.

Common.

Cosmopolitan.

16. HISTIOPTERIS (Agardh) J. Smith.

a. Pinnules ample, entire.
  b. Axillare leaflets ("stipules") none or inconspicuous — 1. *H. integrifolia*.
  *b*1. "Stipules" conspicuous — 2. *H. stipulacea*.
*a*1. Pinnules smaller, deeply lobed — 3. *H. incisa*.

1. H. INTEGRIFOLIA Copel.

Sarawak, North Borneo.

Endemic.

2. H. STIPULACEA (Hooker) Copel.

Sarawak.

Endemic.

3. H. INCISA (Thunb.) J. Sm.

Sarawak, North Borneo.

Tropics and beyond them.

Bonaparte mentions a var. "*aurita-integrifolia*."

17. PTERIS Linnæus.

a. Veins free.
  b. Pinnæ simple, or the lowest pair once forked.
    c. Pinnæ numerous, uniform — 1. *P. longifolia*.
    *c*1. Pinnæ few.
      d. Pinnæ thin, sterile margin wavy or toothed — 2. *P. pellucida*.
      *d*1. Pinnæ thick, entire — 3. *P. rangiferina*
  *b*1. Pinnæ not mostly simple, but not pectinate, dimorphous — 4. *P. ensiformis*.
  *b*2. Pinnæ regularly lobed or divided, chiefly on the lower side — 5. *P. semipinnata*.
  *b*3. All pinnæ pectinately divided or pinnate.
    c. Stipes not nearly black.
      d. Lateral pinnæ only one forked pair — 6. *P. grevilleana*.
      *d*1. Lateral pinnæ more numerous.

e. Segments contiguous or imbricate, 8–10 mm. wide — 12. *P. Toppingii.*
f. Pinnæ with winged stalks — 8. *P. longipinnula.*
*f*1. Pinnæ winged sessile or stalks not winged.
g. Pinnæ cut within 0.2 mm. of the costa — 9. *P. asperula.*
*g*1. Segments connected by a broader wing.
h. Lower pinnæ forked — 10. *P. quadriaurita.*
*h*1. Lowest pinnæ not forked — 11. *P. Clemensiæ.*
*c*1. Stipes maroon or nearly black.
d. Lateral pinnæ 1 or 2 pairs — 7. *P. ligulata.*
*d*1. Pinnæ more numerous.
e. Fronds about 1 m high — 13. *P. decussata.*
*e*1. Fronds much smaller.
f. Only the basal pinnæ forked — 14. *P. furcans.*
*f*1. Several pairs of pinnæ forked — 15. *P. Walkeri.*
*a*1. Veins anastomosing.
b. Lowest pinnæ not much longer than the succeeding,
c. Axes stramineous — 17. *P. biaurita.*
*c*1. Axes maroon — 16. *P. purpureorachis*
*b*1. Lowest pinnæ much enlarged.
c. Areolæ a single row — 18. *P. wallichiana.*
*c*1. Veins anastomosing more freely — 19. *P. tripartita.*

1. P. LONGIFOLIA L.

Common, though not reported from Dutch Borneo.

All warm countries.

2. P. PELLUCIDA Pr.

Sarawak.

Philippines, India (?). Credited also to Java, but this is questionable.

3. P. RANGIFERINA Pr.

Sarawak (Mt. Penrissen), Kinabalu.

Java.

P. Dalhousiæ Hooker, is reported from Kinabalu by Miss Gibbs, but I suspect that she had the fern which I distinguish as *P. rangiferina*.

4. P. ENSIFORMIS Burm.

Common.

Malaya to India, China, Polynesia and Australia.

5. P. SEMIPINNATA L.
North Borneo.
Malaya to Japan.

6. P. GREVILLEANA Wall.
Sarawak, Dutch Borneo, North Borneo.
To India. Philippines (?).

7. P. LIGULATA Gaud.
"Borneo."
Moluccas, New Guinea.
Included on the authority of Christensen's Index.

8. P. LONGIPINNULA Wall.
Sarawak.
Range doubtful, supposed to be extensive.

9. P. ASPERULA J. Sm.
Dutch Borneo, (determined by Christ).
Known only in Luzon.

10. P. QUADRIAURITA Retz. incl. P. NEMORALIS Willd.
Common.
True *P. quadriaurita* probably occurs only in and near Ceylon.
This species has been construed as including very numerous more or less distinct forms and species, so that one cannot know from its citation what fern is meant.

11. P. CLEMENSIÆ Copel. n. sp.
Kinabalu.
Local.

12. P. TOPPINGII Copel. n. sp.
Kinabalu.
Local.

13. P. DECUSSATA J. Sm.
P. furcans Hooker.
Sarawak, North Borneo.
Malaya to Ceylon and Polynesia.

14. P. FURCANS Baker.
Sarawak, Dutch Borneo.
Endemic.

15. P. WALKERI Baker.
North Borneo (Banggi island).
Local.

16. P. PURPUREORACHIS Copel. n. sp.

Kinabalu.

Local.

17. P. BIAURITA L.

North Borneo.

Distribution wide, but uncertain.

18. P. WALLICHIANA Agardh.

Sarawak.

Malaya to India and Samoa.

19. P. TRIPARTITA Sw.

Sarawak, North Borneo; probably common.

Palæotropic.

P. mertensioides Willd. is a doubtful plant, referred to Borneo, Java and Amboyna in Christensen's Index.

We have three more apparently undescribed species in this genus.

18. BALANTIUM KAULFUSS.

a. Frond very thin	1. *B. Copelandi*.
*a*1. Frond coriaceous	2. *B. pilosum*.

1. B. COPELANDI Christ.

Sarawak (Mt. Penrissen), Kinabalu.

Philippines.

2. B. PILOSUM Copel.

Sarawak (Mt. Batu Lawi).

Endemic.

19. DAVALLODES COPELAND.

a. Indusia cup shaped	1. *D. hirsutum*.
*a*1. Indusia reniform, straw-color	2. *D. viscidulum*.
*a*2. Indusia reniform, red	3. *D. borneense*.

1. D. HIRSUTUM (J. Sm.) Copel.

Sarawak, Dutch Borneo and British North Borneo.

Philippines, Celebes.

The Kinabalu specimen is not typical, and more ample collection is likely to show that it is a distinct species.

2. D. VISCIDULUM (Mett.) v. A. v. R.

Dutch Borneo.

Java.

3. D. BORNEENSE (Hooker) comb. nova.

Lastræa borneensis Hooker. ICONES Plant. 1854. Tab. 993. *Leucostegia*, J. Sm.

Sarawak, Kinabalu.

Endemic.

My specimens from Western Sarawak and from Kinabalu are quite unlike, but I judge from Hooker's descriptions that it varies considerably in Sarawak.

20. LEUCOSTEGIA PRESL.

a. Fronds bipinnate.	
b. Fronds hairy on rachises and costæ	1. *L. Hosei.*
*b*1. Fronds naked	2. *L. nephrodioides.*
*a*1. Fronds tripinnate to 5-pinnatifid.	
b. Indusia large and persistent	3. *L. immersa.*
*b*1. Indusia very small	4. *L. hymenophylloides.*

1. L. HOSEI (Baker) comb. nova.

Davallia Hosei Baker, *J. of Bot.* (1888) 323.

Sarawak (Mt. Lambir).

Local.

2. L. NEPHRODIOIDES (Baker) comb. nova.

Davallia nephrodioides Baker, *Journ. Linn. Soc.* 24 (1887) 257.

Sarawak.

Endemic.

I regret the occasion of creating new names for the two preceding ferns, having seen neither, and being in some doubt as to their real place.

3. L. IMMERSA Presl.

Sarawak; identification made from a sterile specimen.

Malaya to India.

4. L. HYMENOPHYLLOIDES (Bl.) Bedd.

Dutch Borneo, Mt. Kinabalu.

India to Polynesia.

21. HUMATA Cavanilles.

a. Fronds not deltoid.	
b. Fronds merely toothed	1. *H. angustata*.
*b*1. Fertile fronds pinnately lobed	2. *H. heterophylla*.
*b*2. Fronds pinnate.	
c. Pinnæ (unless the lowest pair) entire	3. *H. gaimardiana*.
*c*1. Pinnæ toothed or pinnatifid	4. *H. Brooksii*.
*a*1. Lowest pinnæ the largest.	
b. Ultimate segments not setiform.	
c. Fronds pinnatifid, only the lowest segments lobed	5. *H. intermedia*.
*c*1. Fronds barely pinnate, lower segments pinnatifid	6. *H. pectinata*.
*c*2. Fronds pinnate, pinnæ distinct.	
d Fronds not very unlike.	
e. Minutely ciliate	7. *H. puberula*.
*e*1. Glabrous	8. *H. repens*.
*d*1. Distinctly dimorphous.	
e. Sterile segments sharply toothed	9. *H. alpina*.
*e*1. Sterile segments entire or nearly so.	
f. Sori flanked by prominent teeth	10. *H. pusilloides*.
*f*1. Fertile lobes truncate	11. *H. kinabaluensis*.
*b*1. Ultimate segments setiform	12. *H. parvula*.

1. H. ANGUSTATA (Wall.) J. Sm.

   Sarawak, Dutch Borneo.

   Malaya.

2. H. HETEROPHYLLA (Sm.) Desv.

   Common.

   Malaya, Polynesia.

3. H. GAIMARDIANA.

   Sarawak, Dutch Borneo; probably everywhere.

   Malaya to Burma and Polynesia.

4. H. BROOKSII Copel.

   Sarawak (Mt. Poé).

   Endemic.

5. H. INTERMEDIA C. Chr.

   Sarawak.

   Perak.

6. H. PECTINATA (Sm.) Desv.

"Borneo," *teste* van Alderwerelt.

New Guinea, Polynesia.

7. H. PUBERULA Copel.

Sarawak (Mt. Penrissen).

Endemic.

8. H. REPENS (L.f.) Diels.

Common.

Malaya to the Seychelles and Japan.

9. H. ALPINA (Bl.) Moore.

Sarawak, Dutch Borneo and British North Borneo.

Malaya, Polynesia (?).

10. H. PUSILLOIDES Copel.

"Borneo," (*teste* van Alderwerelt?).

Mindanao.

What van Alderwerelt ascribes to Borneo and Mindanao is *H. pusilla* (Mett.) Carr., a fern of Western Polynesia. As *H. pusilloides* is a Mindanao fern which has been mistaken for *H. pusilla*, it seems likely that the Borneo plant is the same.

11. H. KINABALUENSIS Copel.

Kinabalu.

Local.

12. H. PARVULA (Wall.) Mett.

Sarawak (common.)

Malaya.

22. OLEANDRA Cavanilles.

a. Stipe articulate above the middle.
  b. Rhizome creeping — 1. *O. tricholepis*.
  *b*1. Rhizome erect or sprawling.
    c. Frond broadly oblanceolate, coriaceous — 2. *O. oblanceolata*.
    *c*1. Frond narrower and thinner — 3. *O. colubrina*.
*a*1. Stipe articulate below the middle.
  b. Frond narrow or coriaceous.
    c. Sori nearer to costa than to margin — 4. *O. neriiformis*.
    *c*1. Sori nearer to margin than to costa — 5. *O. coriacea*.
  *b*1. Frond broad and thin — 6. *O. musifolia*.

1. O. TRICHOLEPIS Kunze.

Borneo.

Not recognized since first collected.

2. O. OBLANCEOLATA Copel.

Sarawak, North Borneo.

Endemic.

3. O. COLUBRINA (Blanco) Copel.

Sarawak; probably elsewhere.

Philippines, Java.

4. O. NERIIFORMIS Cav.

Sarawak, Dutch Borneo.

Tropics.

This has been construed as including various species, which makes its distribution hard to determine from reports. *O. bantamensis* (Bl.) Kze. may be distinct, as Cesati thinks, but I cannot identify it, and Blume's brief description is contradictory.

5. O. CORIACEA Copel.

Sarawak (Mt. Batu Lawi).

Local.

6. O. MUSIFOLIA (Bl.) Presl.

Sarawak, Dutch Borneo.

Malaya, Ceylon.

23. DAVALLIA Smith.

a. Indusium not much longer than broad.	
b. Frond at most tripinnatifid	1. *D. lobbiana*.
b^1. Mature frond more dissected.	
c. Indusium truncate	2. *D. denticulata*.
c_1. Indusium rounded at apex	3. *D. pallida*.
a^1. Indusium distinctly longer than broad.	
b. Rhizome scales spreading, grey or slate-color when old	4. *D. bullata*.
b^1. Rhizome scales dark when old, not appressed.	
c. Frond about 15 cm. broad	5. *D. Veitchii*.
c^1. Frond more than 30 cm. broad, indusium rostrate	6. *D. embolostegia*.
b^2. Rhizome scales dark, appressed	7. *D. solida*.

1. D. LOBBIANA Moore.
   Sarawak.
   Endemic.

2. D. DENTICULATA (Burm.) Mett.
   D. elegans (Sw.)
   Sarawak, Dutch Borneo.
   Eastern Tropics.
   The description of *D. lobbiana* suggests a small form of *D. denticulata*; the latter sometimes has indusia broader than long.

3. D. PALLIDA Mett.
   Sarawak.
   Mindanao to Samoa.

4. D. BULLATA Wall.
   Sarawak.
   Ceylon to the Philippines and Japan.

5. D. VEITCHII Baker.
   Kinabalu.
   Local.

6. D. EMBOLOSTEGIA Copel.
   Kinabalu.
   Philippines.

7. D. SOLIDA Sw.
   Common.
   Malaya to Polynesia and Queensland.

24. SCYPHULARIA Fee.

S. SIMPLICIFOLIA Copel.
   Sarawak (Mt. Santubong).
   Local.

25. PROTOLINDSAYA Copeland.

P. BROOKSII Copel.
   Dutch Borneo (Bengkarum).
   Local.

26. LINDSAYA Dryander.

a. Fertile and sterile pinnules alike.	
b. Veins free (unless in sorus), fronds pinnate.	
c. Fronds rarely 1 cm. wide.	
d. Terrestrial	1. *L. concinna*.
*d*1. Scandent	4. *L. gracilis*.
*c*1. Fronds usually 2 cm. or more wide.	
d. Fronds densely clustered.	
e. Stipes stramineous	3. *L. crispa*.
*e*1. Stipes reddish, at least at base.	
f. Pinnae rounded at apex	17. *L. orbiculata*.
*f*1. Pinnae subacute	2. *L. cultrata*.
*d*1. Fronds remote or subclustered.	
e. Sori solitary on narrow lobes	5. *L. repens*.
*e*1. Sori elongate, but interrupted by incisions in margin	6. *L. pectinata*.
*e*2. Sorus continuous along upper margin	7. *L. scandens*.
*b*1. Veins free (unless in sorus), fronds bipinnate.	
c. Pinnules very numerous, hardly 5 mm. wide.	
d. Pinnules entire	11. *L. borneensis*.
*d*1. Pinnules cut	9. *L. longissima*.
*c*1. Pinnules much fewer or much larger.	
d. Main vein along lower margin	8. *L. lancea*.
*d*1. Main vein medial or none	17. *L. orbiculata*.
*b*2. Veins anastomosing	
c. Sori marginal (terminal in lobes), pinnules incised.	
d. Pinnules subequal toward apex	12. *L Sarasinorum*.
*d*1. Pinnules dimidiate throughout	16. *L. davallioides*.
*c*1. Sori marginal, pinnules nearly entire	14. *L. nitida*.
*c*2. Sori submarginal.	
d. Pinnae less than 15 mm. wide	13. *L. Hewittii*.
*d*1. Pinnae more than 20 mm. wide	15. *L. decomposita*.
*a*1. Fertile and sterile pinnules unlike	10. *L. impressa*.

1. L. CONCINNA J. Sm.

Sarawak, Dutch Borneo and British North Borneo.
Philippines.

2. L. CULTRATA.

Common.
Malaya to Queensland and Madagascar.

3. L. CRISPA Baker.

North Borneo.

Local.

4. L. GRACILIS.

Sarawak, Dutch Borneo.

Malaya to New Caledonia.

This is an epiphyte with filiform rhizome; *D. concinna* is terrestrial, with stout rhizome and clustered fronds. Because the two have been confused, statements as to occurrence and distribution are questionable.

5. L. REPENS (Bory) Bedd.

Common.

Oriental Tropics.

6. L. PECTINATA Bl.

Sarawak, British North Borneo.

Malaya.

7. L. SCANDENS Hooker.

Sarawak, British North Borneo.

Malaya.

8. L. LANCEA (L.) Bedd.

Common.

Tropics.

L. repens seems in some places to shade into *L. pectinata*; and *L. pectinata* and *L. scandens* surely blend, and may be represented by fronds on a single rhizome. Finally, the latter two species are sometimes (but rarely) bipinnate, and then develop long stipes; I cannot distinguish such fronds of *L. scandens* from ample fronds of *L. lancea*.

9. L. LONGISSIMA Christ.

Dutch Borneo, British North Borneo.

Endemic.

10. L. IMPRESSA Christ.

Dutch Borneo.

Endemic.

11. L. BORNEENSIS Hooker.
Common.
Sumatra, Malacca.

12. L. SARASINORUM Christ.
Dutch Borneo.
Celebes.

13. L. HEWITTII Copel.
Sarawak (Mt. Poé).
Endemic.

14. L. NITIDA Copel.
Sarawak (Mt. Penrissen).
Local.

15. L. DECOMPOSITA Willd.
Common.
Oriental Tropics.

16. L. DAVALLIOIDES Bl.
Common.
Malaya.

17. L. ORBICULATA (Lam.) Mett.
Common.
Oriental Tropics.

Exceedingly variable. *L. tenera* Dry. is a lax, thin, freely bipinnate or even tripinnate form with narrow or forked pinnules. Simply pinnate forms are common. *L. flabellulata* var. *gigantea* Hooker, is a form with few pinnæ, the lower ones acuminate, and only the lowest ones pinnate; there is nothing in the diagnosis of *L. gomphophylla* Baker, by which I can distinguish it from this form. Some forms are very near *Schizoloma heterophyllum.*

27. ODONTOSORIA (PRESL.) FEE.

O. CHINENSIS (L.) J. Sm.
Common.
Malaya to Madagascar, Japan and Polynesia.

28. CYSTODIUM J. Smith.

C. SORBIFOLIUM (Sm.) J. Sm. *Saccoloma*, Christ; *Dicksonia*, Sm.

Sarawak. Dutch Borneo, British North Borneo (Kinabalu).

Malaya.

The nearest relative of this fern, sometimes united with it, but in my opinion distinct, is *C. papuanum* (F. Muell.) (*Dicksonia papuana* F. Muell., Descr. Pap. Pl. 4 (1876) 76.).

Cystodium has the aspect of true *Dicksonia*, but an interrupted annulus. It is decidedly not at home in *Saccoloma*, which has the habit of *Balantium* rather than of *Dicksonia*.

29. NEPHROLEPIS Schott.

a. Sorus continuous along the margin	1. *N. acutifolia*.
*a*1. Sori separate.	
b. Sori solitary on the apices of lobes	2. *N. acuminata*.
*b*1. Sori not occupying the tips of lobes.	
c. Rhizome scandent	3. *N. radicans*.
*c*1. Rhizome not scandent.	
d. Indusium reniform with an open sinus.	
e. Indusium facing apex of pinna	4. *N. cordifolia*.
*e*1. Indusium facing margin	5. *N. exaltata*.
*d*1. Indusium roundish, sinus usually closed.	
e. Surfaces bearing fine scales	6. *N. hirsutula*.
*e*1. Surfaces bearing simple hairs	7. *N. pilosula*.
*e*2. Surfaces naked or nearly so	8. *N. biserrata*.
*d*2. Indusium attached by base, open at apex	9. *N. marginalis*.

1. N. ACUTIFOLIA (Desv.) Christ.

Sarawak.

Palæotropic.

2. N. ACUMINATA (Houtt.) Kuhn.

Dutch Borneo, British North Borneo.

Malaya, New Guinea.

3. N. RADICANS (Burm.) Kuhn.

Sarawak, Dutch Borneo.

Malaya to India.

4. N. CORDIFOLIA (L.) Presl.
   Sarawak, Dutch Borneo; probably everywhere.
   Tropics, to Japan and New Zealand.

5. N. EXALTATA (L.) Schott.
   Sarawak, Dutch Borneo.
   Pantropic, and cultivated.

6. N. HIRSUTULA (Forst.) Pr.
   Dutch Borneo, British North Borneo.
   Pantropic.

7. N. PILOSULA v. A. v. R.
   Boundary of Dutch Borneo and British North Borneo (Amdyah).
   Endemic.

8. N. BISERRATA (Sw.) Schott.
   N. acuta Presl.
   Common.
   Pantropic.

9. N.(?) MARGINALIS Copel. n. sp.
   Kinabalu.
   Local.

30. CYATHEA Smith.

a. Frond simply pinnate.
  b. Indusium persistent.
    c. Terminal pinna like the others — 1. *C. Brunonis.*
    *c*1. Terminal pinna lobed at base — 2. *C. capitata.*
  *b*1. Indusium wanting or fugacious.
    c. Base of pinnæ truncate — 3. *C. pseudobrunonis.*
    *c*1. Base of pinnæ rounded or cuneate.
      d. Scales at base of stipe fuscous — 4. *C. fuscopaleata.*
      *d*1. Scales at base of stipe tawny.
        e. Scales under 1 cm. long — 5. *C. arthropoda.*
        *e*1. Scales over 2 cm. long — 6. *C. kinabaluensis.*

*a*1. Fronds bipinnate, dimorphous, without indusia.
  b. Lobes of sterile pinnules 5 mm. wide — 10. *C. Hewittii.*
  *b*1. Lobes of sterile pinnules 2 mm. wide — 11. *C. Toppingii.*

*a*2. Fronds bipinnate, not dimorphous, pinnules entire or nearly so, indusium present.
  b. Rachis not scaly.
    c. Pinnæ lanceolate.
      d. Pinnules about 5 mm. wide — 7. *C. dulitensis.*
      *d*1. Pinnules about 1 cm. wide — 8. *C. alternans.*
    *c*1. Pinnæ broad-oblong — 9. *C. sarawakensis.*

*b*1. Rachis scaly — 26. *C. paleacea.*

*a*3. Fronds at least bipinnate, not dimorphous, pinnules at least lobed.

b. Lobes not much longer than broad.

c. Axes dark purple, indusium wanting.

d. Base of rachis brown densely scaly on the sides — 17. *C. elliptica.*

*d*1. Base of rachis not densely scaly.

e. Base of stipe not armed by abortive pinnæ.

f. Base of stipe bearing some dark scales.

g. Few scales on costæ narrow, subentire — 12. *C. glabra.*

*g*1. Few scales on costæ short, fimbriate-ciliate — 13. *C. dubia.*

*f*1. Base of stipe densely clothed with pallid scales — 14. *C. Brooksii.*

*e*1. Base of stipe armed by abortive pinnæ.

f. Pinnules cut about half-way to costa — 15. *C. recommutata.*

*f*1. Pinnules more deeply cut — 16. *C. ramispina.*

*c*1. Axes not dark purple

d. Indusium wanting or transient.

e. Pinnæ at most 30 cm long.

f. Frond blackish above — 23. *C. poiensis.*

*f*1. Light-green on both sides — 20. *C. mollis.*

*e*1. Pinnæ more than 30 cm long.

f. Pinnules neither hairy nor very scaly beneath.

g. Not coriaceous.

h. Stipe bearing narrow scales — 18. *C. squamulata.*

*h*1. Stipe naked except for broad scales at base — 19. *C. paraphysata.*

*g*1. Coriaceous — 24. *C. kemberangana.*

*f*1. Lamina hairy beneath — 22. *C. Margarethæ.*

*d*1. Indusium evident.

e. Rachis rather naked.

f. Pinnules white-scaly beneath — 25. *C. polypoda.*

*f*1. Without white scales — 21. *C. stipitulata.*

*e*1. Rachis densely scaly.

f. Subcoriaceous — 27. *C. Havilandii.*

*f*1. Rigidly coriaceous — 28. *C. rigida.*

*b*1. Lobes or secondary pinnules decidedly longer than broad.

c. Margin in most parts toothed.

d. Indusium wanting.
e. Costae moderately scaly beneath — 29. *C. inciso-serrata.*
*e*1. Costae densely scaly beneath — 37. *C. crinita.*
*d*1. Indusium present.
e. Segments (or secondary pinnules) linear.
f. Rachis smooth — 33. *C. cyclodonta.*
*f*1. Rachis prickly — 34. *C. Teysmannii.*
*e*1. Segments (or secondary pinnules) oblong.
f. Pinnae up to 30 cm. long — 30. *C. assimilis.*
*f*1. Pinnae larger.
g. Scales on costa entire — 31. *C. longipes.*
*g*1. Few costal scales ciliate — 32. *C. ampla.*
*c*1. Segments entire or finely toothed near apex.
d. Veins simple, indusium wanting.
e. Rachises densely pubescent — 35. *C. Wallacei.*
*e*1. Rachises not densely pubescent — 18. *C. squamulata.*
*d*1. Lower veins forked.
e. Costae and rachises very densely scaly; coriaceous — 36. *C. megalosora.*
*e*1. Costae covered with pale-brown scales, rachis naked — 38. *C. longipinna.*
*e*2. Costae and rachises moderately scaly — 39. *C. hemichlamydea.*
*e*3. Costae sparsely scaly, rachises fibrillose or naked beneath.
f. Segments over 3 mm. wide.
g. Stipe stout, blackish spiny — 40. *C. borneensis.*
*g*1. Stipe slender, chestnut, merely rough — 41. *C. leucocarpa.*
*f*1. Segments about 2 mm. wide — 44. *C. latebrosa.*
*e*4. Costae and secondary rachises hairy.
f. Indusium wanting — 42. *C. Burbidgei.*
*f*1. Indusium present — 43. *C. leucotricha.*
*e*5. Costae naked beneath, or very nearly so — 45. *C. contaminans.*

1. C. Brunonis Wall.

Sarawak (common), Dutch Borneo.

Malaya.

How far previous collections may really represent this species I do not know. I have no Bornean specimen which is like the Malacca plant.

2. C. CAPITATA Copel. n. sp.
   Kinabalu.
   Local.

3. C. PSEUDOBRUNONIS Copel. n. sp.
   Sarawak (Bidi).
   Local.

4. C. FUSCOPALEATA Copel. n. sp.
   Sarawak (Siol and elsewhere).
   Endemic.

5. C. ARTHROPODA Copel.
   Sarawak (Bungo range).
   Local.

6. C. KINABALUENSIS Copel. n. sp.
   Kinabalu.
   Local.

7. C. DULITENSIS Hooker.
   Sarawak (Mt. Matang).
   Local.

8. C. ALTERNANS (Wall.) Presl. (incl. C. LOBBIANA Hook).
   Sarawak, Dutch Borneo.
   Penang.

9. C. SARAWAKENSIS Hooker.
   Sarawak (Mt. Matang).
   Local.

10. C. HEWITTII Copel.
    Sarawak (Bungo range).
    Local.

11. C. TOPPINGII Copel. n. sp.
    Kinabalu.
    Local.

12. C. GLABRA (Blume) Copel.
    Sarawak.
    Java to India and China.

13. C. DUBIA (Bedd.) Copel. comb. nova.
Alsophila dubia Beddome. *J. of Bot.* (1888) 1.
Kinabalu.
Western Malaya.

14. C. BROOKSII Copel.
Sarawak (Mt. Penrissen).
Local.

15. C. RECOMMUTATA Copel.
Sarawak (Mt. Penrissen).
Malacca, Batjan.

16. C. RAMISPINA (Hooker) Copel.
Sarawak, Dutch Borneo.
Endemic.

17. C. ELLIPTICA Copel. n. sp.
Kinabalu.
Local.

18. C. SQUAMULATA (Blume) Copel.
Sarawak, Dutch Borneo.
Malaya.

19. C. PARAPHYSATA Copel.
Sarawak (Mt. Penrissen).
Local.

20. C. MOLLIS Copel. n. sp.
North Borneo (Sandakan).
Local.

21. C. STIPITULATA Copel.
Sarawak.
Endemic.

22. C. MARGARETHÆ (Schr.) Copel.
Dutch Borneo (Moeœ river).
Local.

23. C. POIENSIS Copel.
Sarawak (Mt. Poé).
Local.

24. C. KEMBERANGANA Copel n. sp.
North Borneo (Mt. Kinabalu, Kemberanga).
Local.

25. C. POLYPODA Baker.
Kinabalu.
Local.

26. C. PALEACEA Copel. n. sp.
Kinabalu.
Local.

27. C. HAVILANDII Bakèr.
Kinabalu.
Local.

28. C. RIGIDA Copel. n. sp.
Kinabalu.
Local.

29. C. INCISO-SERRATA Copel.
Sarawak (Mt. Singgi).
Endemic.

30. C. ASSIMILIS Hooker.
Sarawak, Dutch Borneo.
Celebes.

31. C. LONGIPES Copel. n. sp.
Kinabalu.
Local.

32. C. AMPLA Copel.
Sarawak (Mt. Singgi).
Local.

33. C. CYCLODONTA (Christ) v. A. v. R.
Dutch Borneo (Bloecœ river).
Local.

34. C. TEYSMANNII Copel.
C. celebica v. A. v. R. non Blume.
Kinabalu.
Celebes.

35. C. WALLACEI (Mett.) Copel.
Borneo.
Apparently collected but once.

36. C. MEGALOSORA Copel. n sp.
Kinabalu.
Local.
The indusium is persistent.

37. C. CRINITA (Hooker) Copel.
Kinabalu (*teste* Miss Gibbs).
Java to India.

38. C. LONGIPINNA Copel.
Sarawak (Mt. Matang).
Local.

39. C. HEMICHLAMYDEA Copel.
Dutch Borneo (Bengkarum).
Local.

40. C. BORNEENSIS Copel.
Sarawak (Mt. Penrissen).
Local.

41. C. LEUCOCARPA Copel.
Sarawak (Mt. Singgi).
Local.

42. C. BURBIDGEI (Baker) Copel.
North Borneo, Sarawak, Dutch Borneo.
Endemic.
It may be suspected that the several collections are not really identical.

43. C. LEUCOTRICHA Christ.
Dutch Borneo.
Local.

44. C. LATEBROSA (Wall.) Copel.
Sarawak, Dutch Borneo, North Borneo.
Malaya to India and Formosa.

45. C. CONTAMINANS (Wall.) Copel.

Sarawak, North Borneo; probably everywhere.

Malaya to India.

Our Bornean specimens have the costules and veins hairy beneath.

31. DIACALPE Blume.

D. ASPIDIOIDES Bl.

Kinabalu.

Malaya.

32. ACROPHORUS Presl.

A. STIPELLATUS (Wall.) Moore.

Dutch Borneo, Kinabalu.

Malaya to India.

33. MONACHOSORUM Kunze.

M. SUBDIGITATUM (Bl.) Kuhn.

Kinabalu.

Malaya to India.

34. DRYOPTERIS Adanson.

Subgenus I. *Veins free, sori roundish (Eudryopteris.)* **Lastræa.**

a. Fronds tripinnatifid at the base.

b. Rachis not naked — 1. *D. sarawakensis*.

*b*¹. Rachis naked.

c. Frond herbaceous — 2. *D. dissecta*.

*c*¹. Frond coriaceous — 3. *D. subsagenioides*.

*a*¹. Well developed fronds tripinnate.

b. Tripinnate at base only.

c. Rachis naked or nearly so.

d. Stipe naked except at very base — 4. *D. glabrior*.

*d*¹. Stipe scaly in lower part — 5. *D. sparsa*.

*c*¹. Rachis scaly — 6. *D. aciculata*.

*b*¹. More freely tripinnate or quadripinnatifid.

c. Rachis densely clothed with dark, squamose scales — 7. *D. multiseta*.

*c*¹. Rachis not densely scaly.

d. Veins not hairy.

e. Frond light-green — 8. *D. effusa.*
*e*1. Frond dark-brown-green — 9. *D. subarborea.*
*d*1. Veins bearing white hairs — 10. *D. setigera.*
*a*2. Pinnæ merely pinnatifid
b. Veinlets forked.
c. Rachis naked — 11. *D. syrmatica.*
*c*1. Rachis densely scaly — 12. *D. Filix-mas.*
*b*1. Veinlets simple.
c. Rachis naked.
d. Frond glabrous — 13. *D. beccariana.*
*d*1. Pubescent beneath — 14. *D. Creaghii.*
*c*1. Rachis hairy, not scaly.
d. Fronds large, often more than 1 m. long.
e. Indusia evident; thin — 15. *D. immersa.*
*e*1. Indusium wanting; coriaceous — 16. *D. erubescens.*
*d*1. Fronds mostly under 50 cm. long.
e. Lowest pinnæ abruptly reduced to auricles — 17. *D. inconspicua.*
*e*1. Lowest pinnæ not much reduced.
f. Texture chartaceous to coriaceous.
g. Stipe reddish.
h. Segments entire.
i. Lamina naked — 18. *D. gymnopoda.*
*i*1. Minutely ciliate and lime dotted — 19. *D. kinabaluensis.*
*h*1. Segments toothed — 20. *D. lineare.*
*g*1. Stipe not reddish.
h. Lamina naked — 21. *D. crassifolia.*
*h*1. Glandular and hairy beneath — 22. *D. Teuschri.*
*f*1. Thin in texture.
g. Stipe light-colored.
h. Veinlets pilose beneath — 23. *D. calcarata.*
*h*1. Veinlets naked — 24. *D. gracillescens.*
*g*1. Stipe dark.
h. Segments entire or crenate — 25. *D. viscosa.*
*h*1. Lower segments inciso-serrate — 26. *D. athyriocarpa.*
*c*2. Rachis bearing scales, at least in the lower part.
d. Pinnæ deeply cut.
e. Coriaceous.
f. Indusium evident — 27. *D. echinata.*
*f*1. Indusium not evident — 28. *D. Hallieri.*

*e*1. Thinner in texture.
f. Frond about 1 m. long — 29. *D. trichopoda.*
*f*1. Frond under 40 cm. long.
g. Scales on rachis few if any — 26. *D. athyriocarpa.*
*g*1. Rachis very scaly — 30. *D. paucisora.*
*d*1. Pinnae cut not over 1/3 to costa — 31. *D. hirtipes.*

Subgenus II. *Veinlets uniting in pairs; sori definite and distinct.* **Nephrodium.**

a. Only the lowest veinlets anastomosing.
b. Rhizome wide-creeping, fronds scattered.
c. Somewhat coriaceous.
d. Frond glabrous — 43. *D. gongylodes.*
*d*1. Minutely pubescent beneath — 46. *D. haenkeana.*
*c*1. Not at all coriaceous — 32. *D. procurrens.*
*b*1. Rhizome short, fronds clustered.
c. Pinnae serrate, auricled.
d. Fronds dimorphous — 33. *D. Hewittii.*
*d*1. Fronds alike — 59. *D. compacta.*
*c*1. Pinnae lobed less than 1/3 to costa — 34. *D. Brooksii.*
*c*2. Pinnae lobed more than 1/3 to costa.
d. Lower pinnae hardly reduced.
e. Subcoriaceous, lobes wide — 35. *D. motleyana.*
*e*1. Herbaceous, lobes narrow.
f. Finely hairy everywhere — 36. *D. parasitica.*
*f*1. Coarsely hairy, the indusia especially so — 37. *D. didymosora.*
*d*1. Lower pinnae reduced.
e. Indusium wanting — 56. *D. pennigera.*
*e*1. Indusium present.
f. Rachis naked beneath — 38. *D. angustipes.*
*f*1. Rachis minutely hairy — 39. *D. heterocarpa.*
*f*2. Rachis villous or setose beneath.
g. Veinlets 3 – 5 pairs — 40. *D. hispidifolia*
*g*1. Veinlets 6 – 9 pairs — 41. *D. stipellata.*
*a*1. Two or more pairs of veinlets anastomosing.
b. Rhizome creeping, íronds scattered.
c. Lower pinnae not conspicuously reduced.
d. Sori mostly subterminal on veinlets.
e. Sori submarginal in lobes — 42. *D. pteroides.*
*e*1. Sori not confined to lobes.
f. Texture coriaceous — 43. *D. gongylodes.*
*f*1. Texture papyraceous — 44. *D. Toppingii.*
*d*1. Sori medial on veinlets.
e. Indusium evident — 61. *D. oosora.*
*e*1. Indusium wanting — 45. *D. prolifera.*

*c*1. Lower pinnae conspicuously reduced.
d. Sori subterminal, lower pinnae abruptly shortened.
e. Frond over 60 cm. long — 46. *D. haenkeana*.
*e*1. Frond under 60 cm. long — 47. *D. unita*.
*d*1. Sori medial; lower pinnae gradually reduced — 48. *D. arida*.
*b*1. Rhizome short, fronds clustered.
c. Lower pinnae conspicuously reduced.
d. Indusium evident.
e. Nether surface not evidently hairy.
f. Larger pinnae over 25 mm. wide.
g. Minutely glandular beneath — 49. *D. porphyricola*.
*g*1. Minutely verruculose — 50. *D. truncata*.
*f*1. Larger pinnae under 20 mm. wide.
g. Rigidly coriaceous — 51. *D. lithophylla*.
*g*1. Not at all coriaceous — 52. *D. megaphylla*.
*e*1. Nether surface somewhat hairy.
f. Frond under 20 cm. wide — 53. *D. arbuscula*.
*f*1. Frond over 20 cm. wide — 54. *D. amboinensis*.
*e*2. Nether surface very hairy — 55. *D. sagittifolia*.
*d*1. Indusium wanting — 56. *D. pennigera*.
*b*2. Rhizome short.
c. Lower pinnæ not conspicuously reduced.
d. Rachis clothed with narrow, spreading scales — 57. *D. ferox*.
*d*1. Rachis naked beneath.
e. Pinnæ lanceolate or linear.
f. Pinnæ about 30 cm. long, toothed — 58. *D. penangiana*.
*f*1. Pinnæ about 15 cm. long, entire, red — 69. *D. rubida*.
*f*2. Pinnæ about 6 cm. long — 59. *D. compacta*.
*e*1. Pinnæ oblong or ovate.
f. Pinnæ narrowed to base — 62. *D. acanthocarpa*.
*f*1. Pinnæ truncate at base — 63. *D. labuanensis*.
*d*2. Rachis hairy.
e. Pinnæ less than 3 cm. wide, more or less cut.
f. Surfaces pubescent — 60. *D. simillima*.
*f*1. Surfaces naked — 61. *D. oosora*.
*e*1. Pinnæ 3 cm. wide, subentire, a single pair — 64. *D. mirabilis*.

Subgenus III. *I. Veins anastomosing in pairs; and the sori disposed to unite in pairs where the veinlets meet; sori often indefinitely elongate along the veins*	**Meniscium.**
a. Sori round and definite.	
b. Frond simple	65 *D. holophylla.*
*b*1. Frond pinnate.	
c. Veinlets only 3 or 4 pairs	66. *D. firmula.*
*c*1. Veinlets numerous.	
d. Pinnæ truncate at base	67. *D. lineata.*
*d*1. Pinnæ rounded or cuneate at base	68. *D. urophylla.*
*a*1. Some sori elongate and rather indefinite.	
b. Lower pinnæ not truncate or auricled at base.	
c. Lateral pinnæ normally one pair	71. *D. triphylla.*
*c*1. Lateral pinnæ more numerous.	
d. Pinnæ over 2 cm. wide	70. *D. cuspidata.*
*d*1. Pinnæ narrower.	
e. Tips of pinnæ rounded	72. *D. aquatiloides.*
*e*1. Pinnæ finely acuminate	73. *D. salicifolia.*
*b*1. All pinnæ truncate, auricled or both.	
c. Pinnæ 2 cm. or more wide.	
d. Most sori round, indusiate	67. *D. lineata.*
*d*1. Most sori elongate, exindusiate.	
e. Lateral pinnæ about one pair	74. *D. cordifolia.*
*e*1. Lateral pinnæ more numerous	77. *D. stegnogramme.*
*c*1. Pinnæ 1 cm. or less wide.	
d. Pinnæ 20 or more pairs	75. *D. brevipinna.*
*d*1. Pinnæ less numerous	76. *D. Hosei.*
Subgenus IV. *Veins anastomosing; sori elongate, naked but not fusing in pairs*	**Stegnogramma.**
a. Fronds large and very hairy	77. *D. stegnogramme.*
Subgenus V. *Veins free; sori elongate along veins, naked*	**Leptogramma.**
a. Fronds bipinnatifid, hairy	78. *D. africana.*

1. D. SARAWAKENSIS (Baker) v. A. v. R.

Probably common, but not reported from North Borneo.

Malaya to India and Japan.

This is construed as including *Aspidium intermedium* Bl., but not *D. rhodolepis* (Clarke) C. Chr. I do not understand why Christensen did not adopt "*Blumei*" as the specific name, but it is not available now.

2. D. DISSECTA (Forst.) O.K.
   Sarawak.
   Malaya to Madagascar, India and Polynesia.

3. D. SUBSAGENIOIDES v. A. v. R.
   Boundary between Dutch Borneo and North Borneo (Amdyah).
   Endemic.

4. D. GLABRIOR Copel.
   Sarawak (Bidi).
   Endemic.

5. D. SPARSA (Ham.) O.K.
   Sarawak (Mt. Dulit).
   Malaya to Mauritius, India and China.

6. D. ACICULATA (Baker) C. Chr.
   Sarawak (Mt. Matang).
   Endemic.
   A larger and scalier derivative of *D. sarawakensis*.

7. D. MULTISETA (Baker) C. Chr.
   Sarawak (Mt. Matang).
   Endemic.

8. D. EFFUSA (Sw.) Urban.
   Cultivated in Sarawak, *teste* Bonaparte.
   Native of tropical America.

9. D. SUBARBOREA (Baker) C. Chr.
   Sarawak (Sebetan River).
   Malacca, Philippines, New Guinea.

10. D. SETIGERA (Bl.) O.K.
   Probably common; not reported from Dutch Borneo.
   Malaya to India, Japan, Polynesia and Australia.

11. D. SYRMATICA (Willd.) O.K.
   Sarawak (Mt. Tringos and Mt. Merinjak).
   Malaya to India.

12. D. FILIX-MAS (L.) Schott.
Kinabalu.
Cosmopolitan.
This form occurs also in the Philippines, and probably in Celebes and India. It has been identified (by mistake) with *Aspidium parallelogrammum* Kze., of tropical America.

13. D. BECCARIANA (Ces.) C. Chr.
Sarawak (Mts. Matang and Dulit).
Endemic.

14. D. CREAGHII (Baker) C. Chr.
North Borneo.
Endemic.

15. D. IMMERSA (Bl.) O.K.
Common.
Malaya.

16. D. ERUBESCENS (Wall.) C. Chr.
Dutch Borneo.
Malaya to India and China.
The one collection from Borneo may be suspected of being *D. Hallieri*.

17. D. INCONSPICUA Copel. n. sp.
Kinabalu.
Local.

18. D. GYMNOPODA (Baker) C. Chr.
Kinabalu.
Local.

19. D. KINABALUENSIS Copel n. sp.
Kinabalu.
Local.

20. D. LINEARIS Copel. n. sp.
Kinabalu.
Local.

21. D. CRASSIFOLIA (Bl.) O.K.
Sarawak, Dutch Borneo.
Malaya to Burma.

22. D. TEUSCHERI v. A. v. R.
Dutch Borneo.
Local.

23. D. CALCARATA (Bl.) O.K.
Sarawak, Dutch Borneo.
Malaya to India and China, Samoa.

24. D. GRACILESCENS (Bl.) O.K.
Dutch Borneo.
Malaya to India.

25. D. VISCOSA (J. Sm.) O.K.
Kinabalu; also "Borneo," (*coll.* Lobb).
Malacca, Mindanao, Negros.

26. D. ATHYRIOCARPA Copel.
Sarawak.
Endemic.

27. D. ECHINATA (Mett.) O.K.
Sarawak, Dutch Borneo.
Sumatra, Celebes, New Guinea.

28. D. HALLIERI (Christ) C. Chr.
Dutch Borneo.
Endemic.

29. D. TRICHOPODA C. Chr.
Nephrodium polytrichum Baker.
Sarawak.
Endemic.
Van Alderwerelt describes also a var. *Hallieri*, from Dutch Borneo, with smaller fronds and narrower pinnæ.

30. D. PAUCISORA Copel.
Sarawak (Mt. Penrissen).
Endemic.

31. D. HIRTIPES (Bl.) O.K.

Kinabalu.

Java.

The texture of this fern is as described by Blume, "membranaceous"; I have the same species from Java, where there is also a distinct, less cut, subcoriaceous species, which is probably *Aspidium atratum* Wall: This species, whatever its name, is common in northern Luzon; and I have it from China.

32. D. PROCURRENS (Mett.) O.K.

Sarawak.

Malaya to India.

33. D. HEWITTII Copel.

Sarawak (Bungo range).

Local.

34. D. BROOKSII Copel.

Sarawak (Bidi).

Local.

35. D. MOTLEYANA (Hooker) C. Chr.

Sarawak, Dutch Borneo.

Endemic.

Veins free in the fertile frond, anastomosing in the sterile. Closely related to *D. crassifolia* (No. 21).

36. D. PARASITICA (L.) O.K.

Nephrodium molle R. Br.

Common.

Pantropical.

37. D. DIDYMOSORA (Parish) C. Chr.

Sarawak (Mt. Santubong).

Singapore to Tenasserim.

A plant from Kiau (Kinabalu) probably belongs here, but the sori are not nearly terminal.

38. D. ANGUSTIPES Copel.

Sarawak (Singgi).

Local.

39. D. HETEROCARPA (Bl.) O.K.
Sarawak, Dutch Borneo.
Malaya, Hongkong.

40. D. HISPIDIFOLIA v. A. v. R.
Dutch Borneo.
Endemic.

41. D. STIPELLATA (Bl.) O.K.
Kinabalu.
Malaya.

42. D. PTEROIDES (Retz.) O.K.
Dutch Borneo, North Borneo.
Malaya to Burma, China, Polynesia and Australia.

43. D. GONGYLODES (Schkuhr) O.K.
Common.
Palaeotropical.

44. D. TOPPINGII Copel. n. sp.
Kinabalu.
Local.

45. D. PROLIFERA (Retz.) C. Chr.
Dutch Borneo.
Tropics and subtropics of Old World.

46. D. HAENKEANA (Pr.) O. K.
Sarawak, Dutch Borneo, North Borneo.
Malaya to Polynesia.

47. D. UNITA (L.) O. K.
D. cucullata (Bl.) Christ.
Common.
Malaya to the Mascarenes, India and Polynesia.

48. D. ARIDA (Don) O. K.
Dutch Borneo, North Borneo.
Malaya to India.

49. D. PORPHYRICOLA Copel.
Sarawak (Bau).
Local.

50. D. TRUNCATA (Poir.) O. K.

Sarawak, Dutch Borneo, North Borneo.

Malaya to Madagascar, India, Polynesia and Australia.

51. D. LITHOPHYLLA Copel. n. sp.

Kinabalu.

Local.

52. D. MEGAPHYLLA (Mett.) C. Chr.

Sarawak, North Borneo.

Malaya to Africa and India.

53. D. ARBUSCULA (Willd.) O. K.

Sarawak, North Borneo.

Malaya to the Mascarenes, India and Polynesia.

54. D. AMBOINENSIS (Willd.) O. K.

Sarawak.

Malaya to India.

55. D. SAGITTIFOLIA (Bl.) O. K.

"Borneo," *teste* van Alderwerelt.

Java, Malacca.

56. D. PENNIGERA (Forst.) C. Chr.

Dutch Borneo.

Philippines to New Zealand.

57. D. FEROX (Bl.) O. K.

Sarawak.

Malaya.

58. D. PENANGIANA (HOOKER) C. Chr. var. CALVESCENS (Christ).

Sarawak.

The species, Penang to India and China; the variety, Mindanao and Negros.

59. D. COMPACTA Copel.

Sarawak.

Endemic.

60. D. SIMILLIMA C. Chr.

N. simulans Baker, *Jo. Bot.* 26 (1888) 325.

Sarawak.

Endemic.

61. D. OOSORA (Baker) C. Chr.

Pulo Gaya (North Borneo).

Local.

62. D. ACANTHOCARPA Copel.

Sarawak (Mts. Penrissen and Merinjak).

Endemic.

I have fragmentary material of at least five more species of the *Nephrodium* group, from Sarawak and North Borneo.

63. D. LABUANENSIS C .Chr.

Polypodium borneense Hooker.

Labuan.

Local.

64. D. MIRABILIS Copel.

Sarawak (Bidi).

Local.

65. D. HOLOPHYLLA (Baker) C. Chr.

Sarawak (Niah).

Local.

66. D. FIRMULA (Baker) C. Chr.

Sarawak.

Endemic.

67. D. LINEATA (Bl.) C. Chr.

Sarawak, Dutch Borneo, North Borneo.

Malaya.

68. D. UROPHYLLA (Wall.) C. Chr.

Very common.

Malaya to India, China, Polynesia and Australia.

The *D. moulmeinensis* reported from North Borneo by Miss Gibbs is probably what I am including under *D. urophylla*.

69. D. RUBIDA (J. Sm.) C. Chr.
Borneo (?); See *Synopsis Filicum*, p. 314.
Philippines.

70. D. CUSPIDATA (Bl.) Christ.
Sarawak.
Malaya to India.

71. D. TRIPHYLLA (Sw.) C. Chr.
Sarawak, Dutch Borneo.
Malaya to India, China and Queensland.

72. D. AQUATILOIDES Copel.
Sarawak (Bungo range).
Local.

73. D. SALICIFOLIA (Wall.) C. Chr.
Sarawak (Bidi, Retuh).
Sumatra, Singapore, Penang.

74. D. CORDIFOLIA v. A. v. R.
Dutch Borneo, North Borneo boundary (Amdyah).
Local.

75. D. BREVIPINNA C. Chr.
Meniscium stenophyllum Baker.
Sarawak (Baram district, Mt. Mulu ?).
Local.

76. D. HOSEI (Baker) C. Chr.
Sarawak.
Endemic.

77. D. STEGNOGRAMME (Bl.) C. Chr.
Gymnogramme aspidioides (Bl.) Hooker.
Sarawak (Niah).
Java to India.

78. D. AFRICANA (Desv.) C. Chr.
Gymnogramme Totta (Willd.) Schlecht.
Sarawak (Quop).
Malaya to Korea and the Azores.

35. MESOCHLÆNA R. Brown.

a. Pinnæ lobed 1/4 of the way to the costa	1. *M. larutensis*.
*a*1. Pinnæ lobed half-way to the costa.	
b. Lower pinnæ broadly triangular, imbricate	2. *M. Toppingii*.
*b*1. Lower pinnæ less developed	3. *M. polycarpa*.

1. M. LARUTENSIS (Bedd.) v. A. v. R.

Dutch Borneo, Sarawak.

Perak.

Van Alderwerelt distinguishes the Dutch Borneo form, with the lamina naked above, as var. *borneensis*.

2. M. TOPPINGII Copel. n. sp.

North Borneo.

Local.

3. M. POLYCARPA (Bl.) Bedd.

Sarawak.

Malaya to Polynesia.

36. POLYSTICHUM Roth.

a. Rachis not scaly.	
b. Frond tripinnate	1. *P. aristatum*.
*b*1. Frond quadripinnate	2. *P. carvifolium*.
*a*1. Rachis scaly	3. *P. aculeatum*.

1. P. ARISTATUM (Forst.) Presl.

Sarawak, Kinabalu.

Malaya to Natal, India, Japan and Polynesia.

2. P. CARVIFOLIUM (Kze.) C. Chr.

Kinabalu.

Range of the preceding, and Australia.

The best distinction between the two preceding species is that the former has a creeping rhizome, the latter a stout, suberect one. I have seen no rhizomes from Borneo, and suspect that fronds from Sarawak as well as Kinabalu represent *P. carvifolium*. The Kinabalu specimens are identified by the dark, coarse paleæ at the base of the stipe.

3. P. ACULEATUM (L.) Schott.

Kinabalu.

Pantropic.

Our Kinabalu collections include three distinct ferns, included here under the one old name, partly in conformity to common usage, but chiefly because of the difficulty in identifying the forms already described.

37. DIDYMOCHLÆNA Desvaux.

D. TRUNCATULA (Sw.) J. Sm.

Sarawak, Kinabalu.

Pantropical.

38. CYCLOPELTIS J. Smith.

a. Pinnæ not strongly auricled	1. *C. presliana.*
*a*1. Pinnæ strongly auricled at base	2. *C. mirabilis.*

1. C. PRESLIANA (J. Sm.) Berkeley.

Common.

Malaya to Burma and New Guinea.

If *C. presliana* and *C. semicordata* are regarded as distinct species, the latter seems to be exclusively American.

2. C. MIRABILIS Copel.

Sarawak (Bidi).

Local.

39. POLYBOTRYA Humboldt and Bonpland.

a. Frond not over 30 cm. long nor over 15 cm. wide	1. *P. Nieuwenhuisii.*
*a*1. Frond larger	2. *P. stenosemioides.*

1. P. NIEUWENHUISII.

Dutch Borneo.

Endemic.

2. P. STENOSEMIOIDES (Baker) Copel.

Sarawak (Mt. Matang).

Reported from Luzon, but unknown to me.

40. TECTARIA Cavanilles.

a. Frond simple, entire, at least twice as long as wide.
  b. Frond somewhat decurrent, indusia conspicuous — 1. *T. singaporiana.*
  *b*1. Stipe conspicuously winged, indusia obscure — 2. *T. pteropoda.*
*a*1. Frond simple, broad, at least the young fronds cordate.
  b. All fronds cordate.
    c. Not deeply lobed.
      d. Frond roundish, hairy beneath — 3. *T. Labrusca.*
      *d*1. Frond ovate, naked — 4. *T. Brooksii.**
    *c*1. Palmately lobed.
      d. Sori many, scattered.
        e. Lobes triangular — 5. *T. platanifolia.*
        *e*1. Lobes lanceolate — 6. *T. tricuspis.*
      *d*1. Sori in two rows between the main veins — 7. *T. palmata.*
  *b*1. Fertile fronds not cordate — 14. *T. Barberi.*
*a*2. Fronds pinnatifid to a winged rachis.
  b. Sori scattered — 8. *T. vasta.*
  *b*1. Sori in two rows between the main veins — 9. *T. decurrens.*
*a*3. Typical fronds ternate, with large, long, entire pinnæ.
  b. Rhizome erect — 10. *T. subcaudata.*
  *b*1. Rhizome creeping.
    c. Stipe fuscous — 11. *T. murudensis.*
    *c*1. Stipe stramineous — 12. *T. ternata.*
*a*4. Typical fronds simply pinnate, pinnæ not pinnatifid.
  b. Sori scattered.
    c. Pinnæ less than 3 cm. wide.
      d. Pinnæ narrowed to base — 13. *T. subdigitata.*
      *d*1. Pinnæ broad at base — 14. *T. Barberi.*
    *c*1. Pinnæ wider.
      d. Midribs brown — 15. *T. polymorpha.*
      *d*1. Midribs blackish — 16. *T. angulata.*
  *b*1. Sori in two rows between main veins.
    c. Surfaces finely hairy — 17. *T. melanorachis.*
    *c*1. Surfaces naked.
      d. Membranaceous — 18. *T. nuda.*
      *d*1. Texture firmer — 19. *T. crenata.*

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* Juvenile *T. polymorpha* may be keyed out here; its fronds are very thin.

*a*5.	Lowest pinnæ forked to the base or ternate, pinnæ and pinnules entire.	
	b. Sori in rows	20. *T. stenophylla.*
	*b*1. Sori scattered.	
	c. Free included veinlets present	21. *T. semibipinnata.*
	*c*1. Without free included veinlets	22. *T. Lobbii.*
*a*6.	Pinnæ pinnatifid or compound.	
	b. Veins uniting freely, or areolæ several rows.	
	c. Frond herbaceous, lowest pinnæ not dilated	23. *T. gigantea.*
	*c*1. Frond firm in texture, lowest pinnæ dilated.	
	d. Indusia present	24. *T. malayensis.*
	*d*1. Indusia absent	25. *T. irregularis.*
	*b*1. Veins free except along main veins.	
	c. Usually over 1 m high, texture firm	26. *T. leuzeana.*
	*c*1. Usually under 30 cm high, membranaceous	27. *T. devexa.*

1. T. SINGAPORIANA (Wall.) Copel.

Aspidium, Wall.; Hook and Grev., *Icones Fil.* t. 29, 1827.

Sarawak (Mt. Matang), Labuan or Kinabalu.

Malaya to China.

Indusia peltate.

2. T. PTEROPODA (Baker) Copel.

Nephrodium, Baker, *J. of Bot.* 26 (1888) 325.

Sarawak, Dutch Borneo.

Endemic.

Indusia minute, obscure.

3. T. LABRUSCA (Hooker) Copel.

Sarawak, Dutch Borneo.

Endemic.

Indusium wanting.

I cannot distinguish *Sagenia vitis* Racib.

4. T. BROOKSII Copel.

Sarawak (Bidi).

Endemic.

Indusium wanting.

5. T. PLATANIFOLIA (Mett.) Copel.

Aspidium, Mett., *Ann. Mus. Bot. Lugd. Bat.* 1 (1864) 239.

Sarawak, Dutch Borneo.

Malaya.

Indusium variable or wanting.

6. T. TRICUSPIS (Bedd.) Copel.

Aspidium, Beddome, *Handbook Suppl.* p. 44, 1892.

Dutch Borneo.

Perak.

Indusium peltate.

7. T. PALMATA (Mett.) Copel.

Aspidium, Mett., *Ann. Mus. Bot. Lugd. Bat.* 1 (1864) 238.

Dutch Borneo.

Sumatra.

Indusia subpeltate.

8. T. VASTA (Bl.) Copel.

Sarawak, Dutch Borneo, North Borneo.

Malaya to India.

Indusium minute, peltate or reniform.

9. T. DECURRENS (Presl.) Copel.

Sarawak, Dutch Borneo, North Borneo.

Malaya to India, China and Polynesia.

Indusia reniform.

10. T. SUBCAUDATA v. A. v. R.

Dutch Borneo.

Endemic.

Indusia reniform, fugacious.

11. T. MURUDENSIS Copel. n. sp.

Sarawak (foot of Mt. Murud).

Endemic.

Indusia reniform and peltate.

12. T. TERNATA (Baker) Copel.
    Nephrodium, Baker. *Syn. Fil.* p. 296, 1867.
    Sarawak, North Borneo.
    Endemic.
    Indusium reniform.

13. T. SUBDIGITATA (Baker) Copel.
    Nephrodium, Baker. *Journ. Linn. Soc. Bot.* 24 (1887) 259.
    Aspidium psilopodum C. Chr.
    Sarawak (Niah).
    Endemic.
    Indusium reniform.

14. T. BARBERI (Hooker) Copel.
    Sarawak, North Borneo.
    Malaya.
    Indusia wanting.

15. T. POLYMORPHA (Wall.) Copel.
    Sarawak, Dutch Borneo, North Borneo.
    Malaya to India.
    Indusium variable, fugacious or wanting.

16. T. ANGULATA (Willd.) Copel.
    Polypodium, Willd, *Sp. Pl.* 5 (1810) 185.
    Dutch Borneo.
    Sumatra, Java, Amboyna.
    Indusia minute, fugacious.

17. T. MELANORACHIS (Baker) Copel.
    Nephrodium, Baker, *J. of Bot.* 26 (1888) 325.
    Sarawak.
    Endemic.
    Indusium reniform, small.

18. T. NUDA (Baker) Copel.
    Nephrodium, Baker, *J. of Bot.* 17 (1879) 41.
    North Borneo.
    Bismarck archipelago.
    Indusium reniform.

19. T. CRENATA Cav.
Asp. repandum Willd.
A. persoriferum Copel.
Sarawak, Dutch Borneo.
Malaya to Polynesia.
Indusia peltate and reniform.

20. T. HOSEI (Baker) Copel.
Nephrodium, Baker, *Ann. Bot.* 5 (1891) 330.
Sarawak.
Endemic.
Indusium reniform, large.

21. T. SEMIBIPINNATA (Wall.) Copel.
Aspidium, Wall., *List.* No. 388, 1829.
Sarawak (Sarawak river, at head of salt water).
Penang, Banca.
Indusia reniform.

22. T. LOBBII (Hooker) Copel.
Sarawak, North Borneo.
Endemic.
Indusia reniform.
Doubtfully distinct from the preceding species.

23. T. GIGANTEA (Bl.) Copel.
Dutch Borneo.
Java to India.
Indusium reniform.

24. T. MALAYENSIS (Christ) Copel.
Kinabalu.
Philippines, Malacca, Singapore.
Indusium peltate.
I suppose this is the "*Aspidium coadunatum*" coll. by Miss Gibbs, since Topping has found it at Kiau.

25. T. IRREGULARIS (Presl.) Copel.
Sarawak, Dutch Borneo; probably common.
Malaya to India and New Guinea.
Indusium wanting.

26. T. LEUZEANA (Gaud.) Copel.

Common.

Malaya to India, China and Polynesia.

Indusium fugacious or wanting.

27. T. DEVEXA (Kze.) Copel.

Sarawak.

Malaya to China and Formosa.

Indusium peltate.

T. Bakeri v. A. v. R., related to the preceding species, is doubtfully reported from Borneo by van Alderwerelt.

41. HEMIGRAMMA Christ.

H. LATIFOLIA (Meyen) Copel.

Dutch Borneo.

Malaya.

42. STENOSEMIA Presl.

S. AURITA (Sw.) Presl.

Sarawak, Dutch Borneo.

Malaya, Solomon Islands.

43. LEPTOCHILUS Kaulfuss.

Of the twelve species of this genus reported from Borneo, no more than four are represented in our collections. The genus as at present recognized, and as here construed, is not monophyletic, even after the exclusion of *Lomagramma* and *Hemigramma*. For present purposes, I follow van Alderwerelt in keying out the species.

a. Main veins distinct nearly or quite to the margin.
  b. Fronds typically simple and entire.
    c. Only the lowest veinlets anastomosing — 1. *L. oligodictyus*.
    *c*1. Veins anastomosing freely.
      d. Free veinlets none — 2. *L. linnæanus*.
      *d*1. Free veinlets present — 3. *L. decurrens*.
  *b*1. Fronds typically pinnate.
    c. Frond pinnately lobed above the one pair of pinnæ — 4. *L. zeylanicus*.
    *c*1. Frond at most sinuate above the few pairs of pinnæ — 5. *L. heteroclitus*.

*c*2. Pinnæ numerous.	
d. Pinnæ crenate	6. *L. exsculptus.*
*d*1. Pinnæ lobed	7. *L. cuspidatus.*
*d*2. Pinnæ entire or sinuate	8. *L. Zollingeri.*
*a*1. Main veins indistinct or none.	
b. Sterile fronds rounded at base	9. *L. antrophyoides.*
*b*1. Sterile fronds acute or decurrent at base.	
c. Sterile fronds less than 1 cm. wide	10. *L. modestus.*
*c*1. Sterile fronds more than 1 cm. wide.	
d. Rhizome scandent	11. *L. axillaris.*
*d*1. Rhizome creeping	12. *L. lanceolatus.*

1. L. OLIGODICTYUS (Baker) C. Chr.
   Sarawak (Niah).
   Local.
   Said by Hose to be near *Stenosemia aurita.*

2. L. LINNEANUS Fée.
   Dutch Borneo.
   Malaya, Annam.

3. L. DECURRENS Bl.
   Sarawak (not typical).
   Malaya to India.

4. L. ZEYLANICUS (Houtt.) C. Chr.
   Kudat, Jesselton.
   Borneo to Southern India and China.

5. L. HETEROCLITUS (Presl.) C. Chr.
   Sarawak, Dutch Borneo.
   Malaya to India and Melanesia.

6. L. EXSCULPTUS (Baker) C. Chr.
   Sarawak (Niah).
   Local.

7. L. CUSPIDATUS (Presl.) C. Chr.
   Sarawak (Bungo range).
   Malaya to the Seychelles, China, Australia and Polynesia.

8. L. ZOLLINGERI (Kze.) Fée.
   Sarawak.
   Malaya; Fiji?

9. L. ANTROPHYOIDES (Baker) C. Chr.
   Sarawak (Mt. Matang).
   Local.

10. L. MODESTUS (Baker) C. Chr.
    Sarawak (Kabo river).
    Local.

11. L. AXILLARIS (Cav.) Kaulf.
    "Borneo" (*teste* Beddome).
    Malaya to India and New Guinea.

12. L. LANCEOLATUS Fée.
    North Borneo (Khota Belud to Kebayo).
    Malaya to India.

44. LOMAGRAMMA J. SMITH.

a. Stipe of sterile frond about 5 cm long — 1. *L. Brooksii*.
*a*1. Stipe of sterile frond 15 or more cm. long — 2. *L. lomarioides*.

1. L. BROOKSII Copel.
   Sarawak (Bungo range and Bau).
   Endemic.

2. L. LOMARIOIDES (Bl.) J. Sm.
   Acrostichum blumeanum Hook.)
   Dutch Borneo; Sarawak (?).
   Malaya to Assam and Polynesia.

45. ATHYRIUM ROTH.

a. Veins free.
  b. Frond nearly or quite tripinnate.
    c. Texture not harsh.
      d. Ultimate segments less than 1 mm. wide, pinnæ acuminate — 5. *A. pulcherrimum*.
      *d*1. Less dissected, pinnæ obtuse — 3. *A. Clemensiæ*.
    *c*1. Texture harsh, though thin.
      d. Stipe purple or reddish — 4. *A. atropurpureum*.

*d*1. Stipe ebeneous — 6. *A. Moultoni.*
*d*2. Stipe neither clear-black nor reddish.
e. Paleæ black — 7. *A. atrosquamosum.*
*e*1. Paleæ brownish — 8. *A. Blumei.*
*b*1. Pinnules cut about half-way to costa.
c. Pinnules hardly 3 cm. long — 10. *A. Hewittii.*
*c*1. Pinnules more than 5 cm. long.
d. Rachis naked or nearly so — 11. *A. paripinnatum.*
*d*1. Rachis clothed with narrow scales — 12. *A. vestitum.*
*b*2. Freely bipinnate, but pinnules cut less than half way to costa.
c. Pinnules oblique at base — 13. *A. matangense.*
*c*1. Pinnules nearly equal-sided.
d. Pinnules 15-40 mm. wide — 14. *A. maximum.*
*d*1. Pinnules 6-10 mm. wide — 17. *A. sarawakense.*
*b*3. Pinnæ deeply lobed or barely pinnate at base.
c. Stipe clothed throughout with thin scales — 1. *A. biseriale.*
*c*1. Stipe naked above.
d. Pinnæ fleshy — 16. *A. carnosum.*
*d*1. Pinnæ not fleshy.
e. Lowest pinnæ short stalked (less than 1 cm.).
f. Pinnæ at most about 5 cm. long — 25. *A. tomentosum.*
*f*1. Pinnæ much longer.
g. Lobes straight, nearly horizontal — 18. *A. sorsogonense.*
*g*1. Lobes oblique, subfalcate — 19. *A. Christii.*
*e*1. Lowest pinnæ long-stalked (more than 1 cm.).
f. Lowest pinnæ not dilated — 22. *A. polycarpum.*
*f*1. Lowest pinnæ wide.
g. Stipe smooth — 20. *A. cyatheifolium.*
*g*1. Stipe muricate — 21. *A. muricatum.*
*b*4. Freely pinnate, but pinnæ not lobed beyond middle unless it be for a basal auricle.
c. Most of the sori roundish — 2. *A. macrocarpon.*
*c*1. Sori elongate, pinnæ equal-sided at base.
d. Apex pinnatifid — 24. *A. æquibasale.*
*d*1. Terminal pinna like others. — 28. *A. xiphophyllum.*
*c*2. Sori elongate, pinnæ unequal-sided at base.
d. Apex pinnatifid.
e. Pinnæ (except on young plants) toothed or lobed.
f. Sori oblique to costule — 23. *A. petiolare.*
*f*1. Sori oblique to costa — 26. *A. crenato-serratum.*

*e*1. Pinnæ entire or crenate	27. *A. confertum.*
*d*1. Terminal pinna not very different from others	29. *A. pallidum.*
*b*5. Frond pinnatifid or pinnate at base	30. *A. porphyrorachis.*
*b*6. Frond merely toothed	31. *A. subserratum.*
*a*1. Veins anastomosing.	
b. Frond bipinnate	9. *A. esculentum.*
*b*1. Frond pinnate, pinnæ cut or lobed	15. *A. accedens.*
*b*2. Frond pinnate, pinnæ entire or serrate.	
c. Pinnæ broadly lanceolate.	
d. Rachis stramineous	32. *A. fraxinifolium.*
*d*1. Rachis ebeneous	35. *A. Cumingii.*
*c*1. Pinnæ ovate, or frond simple and cordate.	
d. Pinnæ 6 to 10 pairs	33. *A. fariens.*
*d*1. Pinnæ few if any	34. *A. cordifolium.*

1. A. BISERIALE (Baker) comb. nov.

Asplenium biseriale Baker, *Trans. Linn. Soc. Bot.* II 4 (1894) 252.

Kinabalu, alt. about 1000 m.

Specimens collected by Mrs. Clemens and by Mr. Topping are intermediate between *A. japonicum* and *A. Petersenii*, which are not very distinct species. The stipe is densely chaffy-hairy, rachis less so, base of costa slightly so and lamina glabrous. This is too stout a plant, particularly as to the rhizome, well to be called *A. grammitoides.*

2. A. MACROCARPUM (Bl.) Bedd.

Kinabalu (Paka cave and Maraiparai spur).

Java, Philippines, India, China, Japan.

3. A. CLEMENSIÆ Copel. n. sp.

Summit of Kinabalu.

Endemic, but similar to other derivatives of *A. nigripes* in Celebes and Luzon.

4. A. ATROPURPUREUM Copel. n. sp.

Kinabalu, Paka cave to summit.

Endemic.

There is another quadripinnatifid *Athyrium* of which Mrs. Clemens has collected fragments on the lower slopes of Kinabalu.

5. A. PULCHERRIMUM Copel.

Kinabalu (Paka cave, *coll.* Topping).

Java (Mt. Pangeranggo.)

Pinnae less acuminate than in the type and dissection of frond slightly finer.

6. A. MOULTONI Copel.

Batu Lawi; Kinabalu below the Paka cave.

Endemic.

7. A. ATROSQUAMOSUM Copel. n. sp.

Kinabalu, on the Maraiparai spur.

Local.

8. A. BLUMEI (Bergsm.) Copel.

Aspl. polypodioides Mett.

Sarawak, Dutch Borneo.

India to Australia.

9. A. ESCULENTUM (Retz.) Copel.

Probably common, but not reported from North Borneo.

India to Polynesia.

10. A. HEWITTII Copel.

Sarawak (Matang).

Endemic.

11. A. PARIPINNATUM Copel.

Sarawak (Mt. Merinjak).

Endemic.

12. A. VESTITUM (Pr.) Milde.

Sarawak.

Samar.

I suspect that *Asplenium crinitum* Baker is a small form of this.

13. A. MATANGENSE (Hose) comb. nova.

Asplenium (Dipl.) matangense Hose, *Journ. Str. Branch Royal As. Soc.* 32 (1899) 58.

Sarawak (Mt. Matang).

Local.

14. A. MAXIMUM (Don) Copel.

A. latifolium Milde.

Sarawak, British North Borneo, Dutch Borneo.

India to Polynesia.

More than one species is included here. These are usually large ferns, and the usual collections are fragments; as a result, the group is badly confused.

Diplazium Hosei Christ is not known to me. It is supposed to be the plant described by Hose as a variety of *A. maximum*, having bipinnate fronds; but later descriptions make it simply pinnate.

15. A. ACCEDENS (Bl.) Milde.

Common.

Africa to Polynesia.

16. A. CARNOSUM Copel.

Sarawak (Mt. Matang).

Local.

17. A. SARAWAKENSE Copel.

Sarawak (Mt. Matang).

Local.

18. A. SORSOGONENSE (Pr.) Milde.

Sarawak.

India across Malaya.

The variety *poeense* is a very lax form.

19. A. CHRISTII (C. Chr.) Copel.

Sarawak, British North Borneo.

Java, Malacca.

20. A. CYATHEIFOLIUM (Rich.) Milde.

Sarawak.

Malaya, Polynesia.

21. A. MURICATUM Copel.

Sarawak, British North Borneo.

Endemic.

22. A. POLYCARPUM Copel.

Sarawak.

Endemic.

23. A. PETIOLARE (Pr.) Milde.

Sarawak (Bidi).

Philippines.

This may be the fern reported from Borneo as *Aspl. silvaticum* Presl.

24. A. ÆQUIBASALE (Baker) comb. nova.

Aspl. æquibasale Baker, *Journ. Linn. Soc.* 22 (1886) 225.

Sarawak.

Endemic.

25. A. TOMENTOSUM (Bl.) Milde.

Sarawak.

Malaya, India.

26. A. CRENATO-SERRATUM (Bl.) Milde,

Aspl. porrectum Wall.

Sarawak, British North Borneo.

Sumatra, Malacca, Philippines.

27. A. CONFERTUM (Bak.) Copel.

Sarawak.

Sumatra.

28. A. XIPHOPHYLLUM (Baker) comb. nova.

Aspl. xiphophyllum Baker, *Journ. of Bot.* (1879) 40.

North Borneo.

Malay Peninsula.

A. fraxinifolium may have free veins and be looked for here.

Its pinnæ are much more ample than those of the preceding species.

29. A. PALLIDUM (Bl.) Milde.

Dutch Borneo.

Malaya to Papua and Queensland.

30. A. PORPHYRORACHIS (Bak.) Copel.

Common.

Celebes, Malacca.

31. A. SUBSERRATUM (Bl.) Milde.

Sarawak.

Java, Malacca.

32. A. FRAXINIFOLIUM (Presl.) Milde.

Sarawak, Dutch Borneo.

Malaya to India and Japan.

33. A. PARIENS Copel.

Kinabalu (Gurulau Spur).

Mindanao, Negros, Java.

Possibly a very ample form of *A. cordifolium*.

34. A. CORDIFOLIUM (Bl.) Copel.

Common.

Malaya.

A specimen from the Maraipari spur, Kinabalu, has broadly hastate fronds.

35. A. CUMINGII (Presl.) Milde.

Sarawak (Mt. Poe).

Philippines, Celebes.

This specimen is typical, in having the stipe and rachis almost naked.

The "*Asplenium elegans*" reported from Borneo may have been this species or *A. fraxinifolium*.

4. ASPLENIUM LINNÆUS.

a. Sori not solitary on narrow segments.

b. Fronds simple.

c. Tips of veins connected by a marginal vein (*Thamnopteris*).

d. Fronds usually less than 7 cm. wide — 1. *A. Phyllitidis*.

*d*1. Fronds usually about 10 cm. wide, sori short — 2. *A. Nidus*.

*d*2. Fronds 15-35 cm. wide, sori long — 3. *A. ellipticum*.

*c*1. Tips of veins free.

d. Large ferns, usually above 5 cm. wide.

e. Coriaceous, entire or nearly so.

f. Dull-green, not proliferous — 4. *A. squamulatum*.

*f*1. Brown-green, proliferous — 5. *A. Brooksii*.

*e*1. Thin, serrate — 9. *A. trifoliatum*.

*d*1. Small ferns, usually 2-3 cm. wide.
e. Stipe long and very slender — 6. *A. filiceps*.
*e*1. Stipe stout.
f. Edge of indusium marked by a raised line on the frond — 7. *A. scolopendroides*.
*f*1. Without line at edge of indusium — 8. *A. concolor*.

*b*1. Fronds pinnate.
c. Stipes dark and polished.
d. Sori solitary in lobes — 11. *A. cheilosorum*.
*d*1. Sori on body of pinnæ.
e. Apex proliferous, pinnæ obtuse — 12. *A. normale*.
*e*1. Apex acuminate, pinnæ acute — 13. *A. unilaterale*.

*c*1. Stipes not polished.
d. Pinnæ very large, elliptic — 9. *A. trifoliatum*.
*d*1. Pinnæ narrowly linear — 10. *A. subaquatile*.
*d*2. Pinnæ intermediate between the preceding.
e. Pinnæ obtuse.
f. Stipe short, pinnæ reduced below.
g. Rachis nearly naked, pinnæ toothed — 14. *A. borneense*.
*g*1. Rachis scaly, pinnæ subentire — 15. *A. pellucidum*.
*f*1. Stipe long, lower pinnæ not reduced — 16. *A. fuliginosum*.
*e*1. Pinnæ acute or acuminate.
f. Frond linear or lanceolate.
g. Rachis nearly naked — 17. *A. longissimum*
*g*1. Rachis fibrillose-scaly — 18. *A. tenerum*.
*f*1. Frond broader.
g. Pinnæ deltoid-lanceolate.
h. Veins evident beneath — 19. *A. macrophyllum*.
*h*1. Veins inconspicuous beneath — 20. *A. paradoxum*.
*g*1. Pinnæ narrowly lanceolate, sharply toothed.
h. Sori spreading.
i. Venation close — 21. *A. falcatum*.
*i*1. Venation lax, rachis proliferous — 22. *A. acutiusculum*.
*h*1. Sori subparallel to costa — 23. *A. caudatum*.
*g*2. Pinnæ lanceolate, not sharply toothed.
h. Foliage dark-green — 24. *A. persicifolium*.
*h*1. Foliage pale-green — 25. *A. vulcanicum*.

*b*2. Frond barely bipinnate — 22. *A. acutiusculum*.
*b*3. Frond bipinnate to quadripinnate.

c.	Large ultimate segments less than 5 mm. wide.	
d.	Outer end of segments fine-toothed	26. *A. laserpitifolium.*
d_1.	Outer end of segments truncate and incised.	
e.	Segments usually separated by less than their own width	27. *A. cuneatum.*
e^1.	Segments very far apart	28. *A. Elmeri.*
c^1.	Larger segments 1 cm. wide or wider.	
d.	Sori reaching nearly to margin	29. *A. affine.*
d^1.	Sori remote from margin	30. *A. nitidum.*
a^1.	Sori solitary on narrow segments (*Darea*).	
b.	Terrestrial.	
c.	Fronds less than 15 cm. tall	31. *A. dichotomum.*
c^1.	Fronds taller	32. *A. Belangeri.*
b^1.	Scandent	33. *A. scandens.*

1. A. PHYLLITIDIS Don.

   Sarawak; probably throughout Borneo.

   India to the Philippines and New Guinea.

2. A. NIDUS L.

   Common.

   Throughout the Eastern Tropics.

3. A. ELLIPTICUM (Fee) Copel.

   A. musifolium Mett.

   Sarawak.

   Philippines.

4. A. SQUAMULATUM Bl.

   Common.

   Malaya.

5. A. BROOKSII Copel.

   Sarawak (Bau).

6. A. FILICEPS Copel.

   Sarawak (Tringos).

   Local.

7. A. SCOLOPENDROIDES J. Sm.

   A. glochidiatum Racib.

   Sarawak, Dutch Borneo.

   Philippines.

8. A. CONCOLOR Hooker.

Dutch Borneo, British North Borneo.

Sumatra, Java, Celebes.

9. A. TRIFOLIATUM Copel.

A. prolificans v. A. v. R.

Sarawak, boundary between British North Borneo and Dutch Borneo.

Endemic.

10. A. SUBAQUATILE Cesati.

Sarawak, Dutch Borneo to the British North Borneo line.

Endemic.

11. A. CHEILOSORUM Kze;

A. heterocarpum Wall.; Hook.

"Borneo."

India, China, Formosa, Philippines.

12. A. NORMALE Don.

Sarawak, British North Borneo, Dutch Borneo.

India and China to Africa and Celebes.

13. A. UNILATERALE Lam.

Sarawak, British North Borneo.

Paleotropic and to Japan.

14. A. BORNEENSE Hook.

Sarawak, British North Borneo, Dutch Borneo.

Malacca.

15. A. PELLUCIDUM Lam.

Common.

Madagascar to Polynesia.

16. A. FULIGINOSUM Hook.

Kinabalu.

Local.

17. A. LONGISSIMUM Bl.

Sarawak, Dutch Borneo.

India, Mauritius, Sumatra, Java, Mindanao.

18. A. TENERUM Forst.
    Common.
    Eastern Tropics.

19. A. MACROPHYLLUM Sw.
    Sarawak, Dutch Borneo (probably everywhere).
    India to the Comores and Polynesia.

20. A. PARADOXUM Bl.
    Dutch Borneo.
    Malacca, Sumatra, Java.
    Not very distinct from the preceding species.

21. A. FALCATUM Lam.
    A. adiantoides (L.) C. Chr. non Lam.
    Common.
    Palaeotropic.

22. A. ACUTIUSCULUM Bl.
    Dutch Borneo, British North Borneo.
    Malaya, Philippines, New Guinea, Samoa.

23. A. CAUDATUM Forst.
    British North Borneo.
    Pantropic.

24. A. PERSICIFOLIUM J. Sm.; Hook.
    British North Borneo, Dutch Borneo.
    Philippines, Celebes.

25. A. VULCANICUM Bl.
    Sarawak, British North Borneo.
    India, Malaya, Formosa.
    Related to *A. squamulatum* and *A. filiceps*.

26. A. LASERPITIFOLIUM Lam.
    Probably everywhere.
    Malaya, Polynesia.

27. A. CUNEATUM Lam.
    Dutch Borneo, Kinabalu at 3,600 m.
    Pantropic.

28. A. ELMERI Christ.

Kinabalu, below the Paka cave (*coll.* Topping).

Luzon.

29. A. AFFINE Sw.

Sarawak, British North Borneo.

Comores to Polynesia.

30. A. NITIDUM Sw.

Sarawak, Dutch Borneo.

India, Malaya.

Van Alderwerelt distinguishes, as *A. glaucophyllum*, an ample form with the upper surface said to be glaucous. I have from Sarawak specimens of similar form and size, but not glaucous.

31. A. DICHOTOMUM Hook.

Kinabalu, Dutch Borneo.

32. A. BELANGERI Kze. non Bory.

Sarawak, Dutch Borneo.

Malaya to Tonkin.

Often regarded as a mere form of *A. tenerum*, with which, in some places, it either hybridizes or intergrades.

33. A. SCANDENS J. Sm.; Hook.

Sarawak.

Philippines and Borneo to New Guinea and Fiji.

47. PHYLLITIS LUDWIG.

TRIPHLEBIA LONGIFOLIA (Presl.) Baker, better called *Phyllitis longifolia* (Presl.) O.K., is reported by Hose from Sarawak. A specimen sent me from Bidi, labelled *T. longifolia*, is *Asplenium scolopendroides*.

PHYLLITIS D'URVILLEI (Bory) O.K. is reported by van Alderwerelt van Rosenburg from the boundary between Dutch Borneo and British North Borneo, with the comment that a spurious veinlet between the sori of each pair may or may not be present.

48. STENOCHLAENA J. Smith.

a. Margin of pinna spiny	1. *S. palustris*.
*a*1. Margin not spiny	2. *S. sorbifolia*.

1. S. PALUSTRIS (Burm.) Bedd.

Common.

India to Polynesia and Australia.

2. S. SORBIFOLIA (L.) J. Sm.

Probably common.

"Pantropic."

Ferns given this name occur throughout the Tropics, and the failure to distinguish between them makes it simply impossible to state the range of various of the really good included species. Miquel cites *S. cochinchinensis* from Borneo (Dutch Borneo), Sumatra and the Moluccas; but Christensen's Index gives only Cochin China. Van Alderwerelt determines a specimen from Dutch Borneo as *S. Smithii* (Fée) Und., previously known from the Philippines. The same author describes *S. abrupta* from Dutch Borneo and Amdyah, but says nothing about the fertile fronds, which need to be taken into account in making a key for this group.

49. BLECHNUM Linnæus.

a. Fertile and sterile fronds or pinnæ similar	Eublechnum.
b. Pinnæ broad, entire, large ferns.	
c. Pinnæ narrowed to the base	1. *B. finlaysonianum*.
*c*1. Pinnæ broad at base	2. *B. orientale*.
*b*1. Pinnæ finely serrate	3. *B. serrulatum*.
*a*1. Fertile pinnæ much contracted	Lomaria.
b. Fronds simple or pinnate.	
c. Simple or with broadly adnate pinnæ	4. *B. Patersoni*.
*c*1. Pinnæ truncate or cordate at base.	
d. Rachis and stipe (except base) nearly smooth	5. *B. procerum*.
*d*1. Rachis and stipe scaly	6. *B. vestitum*.
*b*1 Fronds deeply bipinnatifid	7. *B. Fraseri*.

1. B. FINLAYSONIANUM Wall.

Common.

Penang to Basilan, New Guinea.

2. B. ORIENTALE L.

Common.

India to Polynesia and Australia.

The variety *undulatum* is also reported.

3. B. SERRULATUM Rich.

Labuan, Jesselton.

Pulu Condor (Cochin-China), Malacca, New Caledonia, Australia, Tropical America.

4. B. PATERSONI (R. Br.) Mett.

Kinabalu (*Clemens* 10352).

India to New Zealand.

5. B. PROCERUM (Forst.) Sw.

B. capense (L) Schlecht, non Burm.

Sarawak, Kinabalu.

Malaya, Polynesia, South Africa.

6. B. VESTITUM (Bl.) Kuhn.

Sarawak (Matang Road), Dutch Borneo (*Hallier.*)

Malaya.

7. B. FRASERI (Cunn.) Luerss. var. PHILIPPINENSIS Christ.

Kinabalu (*Clemens* 11032).

Philippines (the same form), New Zealand.

50. PLAGIOGYRIA (KUNZE) METTENIUS.

a. Fronds less than 10 cm. long	1. *P. minuta*.
a_1. Fronds about 15 cm. long	2. *P. egenolfioides*.
a^2. Fronds about 20 to 50 cm. long.	
b. Pinnæ not adnate.	
c. Lamina glaucous beneath	3. *P. glauca*.
c^1. Lamina not glaucous	4. *P. pycnophylla*.
b^2. Pinnæ of sterile frond adnate	5. *P. adnata*.

1. P. MINUTA Copel.

Sarawak.

Endemic.

2. P. EGENOLFIOIDES (Baker) Copel.

Sarawak.

Endemic.

3. P. GLAUCA (Bl.) Mett.
Kinabalu.
Malaya to Yunnan and India.

4. P. PYCNOPHYLLA (Kze) Mett.
Sarawak, Dutch Borneo, Kinabalu.
Malaya to Yunnan and India.
The sterile pinnæ are typically serrate. The variety *integra*, from Bengkarum mountain, has entire pinnæ.

5. P. ADNATA (Bl.) Bedd.
Kinabalu, Batu Lawi.
Malaya to Yunnan and Japan.

51. MATONIA R. Brown.

a. Segments oblique, acute	1. *M. pectinata*.
*a*1. Segments nearly horizontal, obtuse	2. *M. Foxworthyi*.

1. M. PECTINATA R. Br.
Sarawak, Dutch Borneo.
Malay Peninsula, Sumatra.
Bornean plants referred to this species were perhaps the following.

2. M. FOXWORTHYI Copel.
Sarawak (Mt. Poé).
Amboyna.

52. PHANEROSORUS Copeland.

P. SARMENTOSUS (Baker) Copel.
Matonia sarmentosa Baker.
Sarawak (Niah, Bidi).
Endemic.

53. DIPTERIS Reinwardt.

a. Sori in one row on each side of costa	1. *D. lobbiana*.
*a*1. Sori scattered.	
b. Margin entire.	
c. Frond 2-3 times forked, segments lanceolate	2. *D. Nieuwenhuisii*.
*c*1. Frond 2-5 times forked, segments linear	3. *D. quinquefurcata*.
*b*1. Margin coarsely serrate	4. *D. conjugata*.

1. D. LOBBIANA (Hooker) Moore.
   Sarawak, Dutch Borneo, North Borneo.
   Celebes, Malay Peninsula.

2. D. NIEUWENHUISII Christ.
   Dutch Borneo, Sarawak.
   Endemic.

3. D. QUINQUEFURCATA (Baker) Christ.
   Sarawak.
   Endemic.

4. D. CONJUGATA Reinw.
   Common.
   Malaya to Polynesia.

54. CHEIROPLEURIA PRESL.

C. BICUSPIS (Bl.) Presl.
   Common.
   Malaya to Liu Kiu and New Guinea.
   The forking of the sterile frond is very variable.

55. PLATYCERIUM DESVAUX.

a. Without distinct fertile segments	1. *P. grande*.
*a*1. With distinct fertile segments.	
b. Fertile segment longer than wide	2. *P. Ridleyi*.
*b*1. Fertile segment wider than long	3. *P. coronarium*.

1. P. GRANDE (A. Cunn.) J. Sm.
   North Borneo.
   Malaya, Australia.

2. P. RIDLEYI Christ.
   "Borneo."
   Lingga, Singapore.

3. P. CORONARIUM (Koenig) Desv.
   Common.
   Malaya, Siam.

56. ACROSTICHUM Linnæus.

A. AUREUM L.

Common in somewhat brackish swamps.
Pantropical.

57. POLYPODIUM Linnæus.

Key to the Subgenera.

a. Veins free	1. *EUPOLYPODIUM.*
*a*1. Veins enclosing areolæ in regular rows, each with an excurrent veinlet	2. *GONIOPHLEBIUM.*
*a*2. Veins anastomosing less regularly, or with irregular free included veinlets.	
b. Fronds not pinnatifid with separately deciduous segments.	
c. Rhizome not hollow and inhabited by ants.	
d. Sori not single and linear between the main veins, or fronds not nearly entire	3. *PHYMATODES.*
*d*1. Sori single and linear between the main veins, frond entire or nearly so	4. *SELLIGUEA.*
*c*1. Rhizome hollow and inhabited by ants	5. *MYRMECOPHILA.*
*b*1. Fronds pinnatifid, segments deciduous from costa	6. *DRYNARIOPSIS.*

Subgenus I. *EUPOLYPODIUM.*

Section 1. Leaves simple and undivided	"Grammitis."
a. Fronds not borne on hairy stipes.	
b. Frond more than 100 times as long as wide.	
c. Frond about as thick as wide	1. *P. bisulcatum.*
*c*1. Frond dorsi-ventrally flattened	2. *P. setaceum.*
*b*1. Frond roundish or broadly oblong	7. *P. flabellivenium.*
*b*2. Frond form intermediate between the preceding.	
c. Sessile or nearly so; small ferns.	
d. Sori round	3. *P. vittariifolium.*
*d*1. Sori oblong.	
e. Frond 5 mm. or more wide, subcoriaceous	4. *P. malaicum.*
*e*1. Frond narrower and thinner	5. *P. Maxwellii.*
*c*1. Stipe 1 cm. or more long.	
d. Frond under 6 cm. long	6. *P. kinabaluense.*
*d*1. Frond over 15 cm. long	8. *P. fasciatum.*
*a*1. Fronds borne on hairy stipes.	

b. Veins not more than once forked.
c. Sori round — 9. *P. sparsipilum.*
*c*1. Sori oblong.
d. Branches of vein subequal — 10. *P. hirtellum.*
*d*1. Fertile branch very short.
e. Hairs on stipe wine-colored.
f. Hairs on frond 2—3 mm. long — 11. *P. Brooksii.*
*f*1. Hairs not over 1.5 mm. long — 12. *P. Reinwardtii.*
*e*1. Hairs on stipe pale — 13. *P. Havilandii.*
*b*1. Veins with more than one branch.
c. Hairs on stipe sparse, rather short — 16. *P. congenerum.*
*c*1. Hairs on stipe decidedly long.
d. Sori in a single row on each side.
e. Subcoriaceous, with inconspicuous veins — 14. *P. setosum.*
*e*1. Coriaceous, with conspicuous veins — 15. *P. pubinerve.*
*e*2. Sori pluriseriate or scattered.
f. Sori in 1 or 2 irregular rows — 17. *P. diplosorum.*
*f*1. Sori in 3 or 4 rows or scattered.
g. Almost glabrous — 18. *P. calcipunctatum.*
*g*1. Densely hairy — 19. *P. multisorum.*
*d*1. Hairs on stipe dense, very short — 20. *P. sumatranum.*

SECTION 2. Fronds delicate, linear, pinnately lobed to pinnate, with one sorus on each segment. — "MONOSORIA."

a. Sorus more or less protected by folding of lamina — "CALYMMODON."
b. Fertile segments narrowly stalked — 22. *P. clavifer.*
*b*1. Fertile segments broad at base.
c. Fronds under 5 cm. long — 23. *P. muscoides.*
*c*1. Well developed fronds larger.
d. Sterile segments obtuse, nearly horizontal — 21. *P. streptophyllum.*
*d*1. Sterile segments at an acute angle.
e. Sterile segments tooth-like — 25. *P. cucullatum.*
*e*1. Sterile segments oblong, obtuse — 24. *P. gracillimum.*

*a*1. Fertile segments flat.
b. Frond lobed about half-way to costa, stipitate — 26. *P. subpinnatifidum.*
*b*1. Frond cut two-thirds to costa, subsessile, segments close — 27. *P. murudense.*
*b*2. Frond cut very nearly to costa, segments remote — 28. *P. alternidens.*

SECTION 3. Fronds deeply pinnatifid or pinnate; sori more than one on each segment.

a. Surfaces glandular-hairy — 29. *P. Merrittii.*

*a*1. Surfaces hairy, not glandular.

b. Sori superficial.

c. Membranaceous, with pale hairs — 30. *P. minutum.*

*c*1. Texture firmer and hairs dark — 31. *P. mollicomum.*

*b*1. Sori slightly immersed — 32. *P. subrepandulum.*

*b*2. Sori much immersed — 33. *P. cryptosorum.*

*a*2. Surfaces finely scaly — 34. *P. malaccanum.*

*a*3. Lamina glabrous or nearly so.

b. Rachis not ebeneous.

c. Pinnatifid to a broad wing — 39. *P. Burbidgei.*

*c*1. Cut within 1 mm of rachis.

d. Lower pinnae or segments not or but slightly reduced.

e. Coriaceous — 49. *P. cesatianum.*

*e*1. Very thin — 50. *P. papillosum.*

*d*1. Fronds gradually narrowed below.

e. Sori superficial.

f. Segments entire — 35. *P. nutans.*

*f*1. Segments wavy — 36. *P. subfalcatum.*

*e*1. Sori slightly immersed — 37. *P. repandulum*

*e*2. Sori decidedly immersed.

f. Sori elongate and oblique — 38. *P. obliquatum.*

*f*1. Sori roundish or not oblique.

g. Frond about 2 cm. wide — 40. *P. barathrophyllum.*

*g*1. Frond 7-8 cm. wide — 41. *P. celebicum.*

*b*1. Rachis black or nearly so.

c. Sori almost superficial.

d. Segments linear — 42. *P. pediculatum.*

*d*1. Segments broad, often deltoid — 43. *P. denticulatum*

*c*1. Sori distinctly immersed.

d. Sorus cavities not ciliate.

e. Segments about 1 mm. wide — 44. *P. Moultoni.*

*e*1. Segments about 2 mm. wide — 45. *P. blechnoides.*

*d*1. Sorus cavities ciliate — 46. *P. decorum.*

SECTION 4. Fronds at least bipinnatifid, with narrow segments.

a. Segments of pinnæ entire — 47. *P. taxodioides.*

*a*1. Segments of pinnæ coarsely toothed — 48. *P. millefolium.*

1. P. BISULCATUM Hooker.
   Sarawak.
   Endemic.

2. P. SETACEUM Copel.
   Sarawak (Tringos).
   Local.

3. P. VITTARIIFOLIUM C. Chr.
   Sarawak, North Borneo.
   Endemic.

4. P. MALAICUM v. A. v. R.
   P. sessilifolium Hooker.
   Sarawak, North Borneo.
   Malaya.

5. P. MAXWELLII Baker.
   Sarawak.
   Endemic.
   Probably only a form of the preceding, as Hose notes; *P. Maxwellii* is then the valid name.

6. P. KINABALUENSE Copel. n. sp.
   Kinabalu.
   Local.

7. P. FLABELLIVENIUM Baker.
   Sarawak, North Borneo.
   Endemic.

8. P. FASCIATUM (Bl.) Presl.
   Kinabalu.
   Malaya.

9. P. SPARSIPILUM Copel.
   Dutch Borneo (Bengkarum).
   Local.

10. P. HIRTELLUM Bl.
   Reported from Mts. Penrissen and Kinabalu, probably in error.
   Java; further distribution doubtful.

11. P. Brooksii Copel. n. sp.
Bungo range.
Local.
This is one of the plants reported as *P. hirtellum*.

12. P. Reinwardtii (Blume) Presl.
Kinabalu.
Java, Philippines; probably elsewhere.
This may be the "*P. hirtellum*" of Kinabalu.

13. P. Havilandii Baker.
Kinabalu.
Local.

14. P. setosum (Blume) Presl.
Dutch Borneo.
Malaya.
Treated by Christensen as a form of *P. diplosorum*; if distinct, it must have a new name.

15. P. pubinerve (Blume) Christ.
Kinabalu.
Java, Celebes, Mindanao.

16. P. congenerum (Blume) Presl.
Sarawak (Tringos), Kinabalu.
Malaya.

17. P. diplosorum Christ.
"Borneo" in Christensen's Index.
Java, Celebes, Philippines.

18. P. calcipunctatum Copel. n. sp.
Kinabalu.
Local.

19. P. multisorum Copel. n. sp.
Kinabalu.
Local.

20. P. sumatranum Baker.
P. pleiosoroides Copel.
Kinabalu.
Sumatra, Java, Mindanao.

21. P. STREPTOPHYLLUM Baker.
Sarawak, North Borneo, Dutch Borneo.
Singapore.

22. P. CLAVIFER Hooker.
Kinabalu.
Mindanao, New Guinea.

23. P. MUSCOIDES Copel.
Kinabalu.
Mindanao.

24. P. GRACILLIMUM Copel.
Kinabalu.
Philippines, Java.

25. P. CUCULLATUM Nees et Blume.
Kinabalu.
Supposed to range from Ceylon to Fiji.

P. cucullatum has been construed as including so wide a range of forms, of which the typical was one of the least familiar, that it is not at present practicable to define the range of it or of its immediate relatives.

26. P. SUBPINNATIFIDUM Bl.
Kinabalu.
Java, Perak, Luzon.

27. P. MURUDENSE Copel. n. sp.
Sarawak (Mt. Murud).
Local.

28. P. ALTERNIDENS Cesati.
North Borneo, Sarawak.
Celebes.

29. P. MERRITTII Copel. var. POENSE.
Sarawak (Mt. Poe).
The species in Mindoro.

30. P. MINUTUM Bl.
Kinabalu.
Malaya.

31. P. MOLLICOMUM Nees et Bl.
    P. fuscatum Bl.
    North Borneo, Sarawak.
    Java, Celebes, Philippines.

32. P. SUBREPANDULUM Christ.
    Dutch Borneo.
    Endemic.

33. P. CRYPTOSORUM C. Chr.
    P. decipiens Mett.
    Dutch Borneo.
    Malaya.

34. P. MALACCANUM Baker.
    Kinabalu.
    Malacca.

35. P. NUTANS Bl.
    Sarawak, Kinabalu.
    Malaya, New Caledonia.

36. P. SUBFALCATUM.
    Kinabalu.
    Malaya to India and China.

37. P. REPANDULUM (Kze.) Mett.
    Sarawak.
    Ceylon.

38. P. OBLIQUATUM Bl.
    Sarawak, Kinabalu.
    Malaya to India.

39. P. BURBIDGEI Baker.
    Sarawak, North Borneo, Dutch Borneo;
    New Guinea, *teste* van Alderewerelt.

40. P. BARATHROPHYLLUM Baker.
    Sarawak.
    Endemic.

41. P. CELEBIEUM Bl.
    Kinabalu.
    Malaya.

42. P. PEDICULATUM Baker.

Sarawak.

Endemic.

43. P. DENTICULATUM (Bl.) Presl.

Kinabalu.

Java, Philippines.

44. P. MOULTONI Copel.

Sarawak.

Local.

45. P. BLECHNOIDES (Grev.) Hooker.

Sarawak, Kinabalu.

Malaya to Polynesia and Queensland.

46. P. DECORUM Brack.

Sarawak and Dutch Borneo, according to reports.

Polynesia, New Guinea; Ceylon and Malaya?

I have no specimen of typical *P. decorum* from West of Papua. My Bornean specimens under this name are rather to be called *P. blechnoides*.

47. P. TAXODIOIDES Baker.

Kinabalu.

Local.

48. P. MILLEFOLIUM Bl.

Kinabalu.

Java, Mindanao.

49. P. CESATIANUM Baker.

Sarawak, Dutch Borneo.

Endemic.

The original collection of this fern was never described. It may be *P. coloratum* (No. 52).

50. P. PAPILLOSUM Bl.

Common.

Malaya.

Subgenus II. *GONIOPHLEBIUM*.

a. Fronds pectinate, segments adnate or confluent.

b. Segments close.

c. Paleæ entire, rather soft — 51. *P. brachypodium*.

*c*1. Paleæ ciliate, harsh — 52. *P. coloratum*.

*b*1. Segments separated (above base) by more than their width — 53. *P. proavitum*.

*a*1. Fronds pinnate, pinnæ articulate — "SHELLOLEPIS."

b. Base of pinnæ broadly cuneate — 54. *P. verrucosum*.

*b*1. Pinnæ truncate or subauriculate — 55. *P. subauriculatum*.

51. P. BRACHYPODIUM Copel. n. sp.
Kinabalu.
Local.

52. P. COLORATUM Copel.
Sarawak (Mt. Poe.)
Local.
This may be *P. cesatianum* Baker.

53. P. PROAVITUM Copel.
Sarawak (Bungo range)
Local.

54. P. VERRUCOSUM Wall.
Common.
Malaya to Australia.

55. P. SUBAURICULATUM Bl.
Dutch Borneo, Kinabalu (probably common).
Malaya to Polynesia.

Subgenus III. *PHYMATODES*.

a. Fronds simple, entire or nearly so, thick, venation practically invisible without treatment.

b. Fronds dimorphous, sori over whole frond — 59. *P. Wrayi*.

*b*1. Fronds somewhat dimorphous, sori restricted to a modified apex.

c. Fertile apex entire — 58. *P. accedens*.

*c*1. Fertile apex wavy or crenate — 61. *P. stenopteris*.

*b*2. Fronds uniform, sori on the unmodified frond.

c. Sori superficial.
d. Sori in one row on each side — 57. *P. subecostatum*.
*d*1. Sori in plural rows or scattered.
e. Frond narrowly lanceolate — 60. *P. curtidens*.
*e*1. Frond much broader.
f. Costa conpicuous — 65. *P. sarawakense*.
*f*1. Costa inconspicuous or wanting — 66. *P. holophyllum*.
*c*1. Sori slightly immersed.
d. Frond ovate to round.
e. Entire or minutely serrate — 67. *P. oodes*.
*e*1. Crenate in the lower part — 68. *P. dulitense*.
*d*1. Frond narrowly linear — 56. *P. tæniophyllum*.
*c*2. Sori deeply immersed.
d. Sori elongate — 64. *P. revolutum*.
*d*1. Sori round.
e. Sori in close rows — 63. *P. stenophyllum*.
*e*1. Sori mostly far apart — 62. *P. soridens*.

*a*1. Frond simple, entire, membranaceous, veins indistinct — 69. *P. campyloneuroides*.

*a*2. Fronds simple, not deeply lobed, main veins or venation as a whole evident.
b. Sori in one row on each side of costa.
c. Fertile frond less than 6 mm. wide — 70. *P. costulatum*.
*c*1. Fertile frond about 1 cm. wide — 71. *P. Treubii*.
*c*2. Frond 3–5 cm. wide — 72. *P. griffithianum*.
*b*1. Sori in one row between each hair of main veins — 73 *P. platyphyllum*.
(Immature specimens of the subgenus *Selliguea* may seem to belong here.)
*b*2. Sori in two regular rows between each pair of main veins.
c. Fronds obtuse — 74. *P. occultivenium*.
*c*1. Fronds acute or acuminate.
d. Paleæ dark, small — 75. *P. rupestre*.
(*P. leucophorum*, with white spots on the upper surface may be looked for here.)
*d*1. Paleæ large, pale.
e. Sori 8 or less in a row — 76. *P. triquetrum*.
*e*1. Sori more numerous — 77. *P. albidopaleatum*.
*b*3. Sori in irregular rows or scattered.
c. Main veins approaching margin, or gradually disappearing.
d. Frond bearing lime-dots above.
e. Frond glabrous above — 78. *P. leucophorum*.
*e*1. Frond hairy on both surfaces — 79. *P. melanocaulos*.

*d*1. Frond without lime dots.
e. Main veins nowhere prominent.
f. Sori small, superficial — 80. *P. punctatum*.
*f*1. Sori large, somewhat immersed — 92. *P. phymatodes*.
*e*1. Main veins prominent.
f. Base abruptly narrowed, practically sessile — 81. *P. musifolium*.
*f*1. Base gradually narrowed to a wing.
g. Sori mostly in 2 distant irregular rows — 84. *P. Zippelii*.
*g*1. Sori numerous, scattered — 85. *P. heterocarpum*.
*c*1. Main veins prominent, but abruptly turning to cross-veins.
d. Base gradually narrowed — 83. *P. myriocarpum*.
*d*1. Base abruptly narrowed, practically sessile — 82. *P. linguæforme*.
*a*3. Fronds dichotomously lobed — 86. *P. ceratophyllum*.
*a*4. Fronds pinnately lobed or divided.
b. Sori superficial.
c. Lowest segments not reduced.
d. Margin entire or wavy.
e. Frond less than 25 cm. tall — 87. *P. paucijugum*.
*e*1. Frond over 50 cm. tall — 88. *P. commutatum*.
*d*1. Margin of lobes toothed.
e. Paleæ dark, not awned — 89. *P. ebenipes*.
*e*1. Paleæ light, hair-tipped — 90. *P. palmatum*.
*c*1. Lowest segments reduced — 93. *P. grandidentatum*.
*b*1. Sori immersed.
c. Frond not dimorphous.
d. Sori not in 1 regular row on each side — 92. *P. phymatodes*.
*d*1. Sori in 1 regular row on each side.
e. Sori slightly immersed — 91. *P. macrochasmum*.
*e*1. Sori deeply immersed, prominent above.
f. Venation obscure — 94. *P. ithycarpum*.
*f*1. Venation conspicuous.
g. Segments more than ten pairs — 95. *P. longissimum*.
*g*1. Segments less than ten pairs — 96. *P. nigrescens*.
*c*1. Fronds dimorphous — 97. *P. incurvatum*.
*a*5. Fronds pinnate.
b. Fronds without lime-dots — 90. *P. palmatum*.
*b*1. Fronds marked above with lime-dots.
c. Texture flaccid — 98. *P. subaquatile*.
*c*1. Frond coriaceous — 99. *P. albidosquamatum*.

56. P. TAENIOPHYLLUM Copel.
Sarawak.
Endemic.

57. P. SUBECOSTATUM Hooker.
Sarawak.
Endemic.

58. P. ACCEDENS Bl.
Sarawak, Dutch Borneo.
Malaya, Polynesia.

59. P. WRAYI Baker.
Sarawak.
Sumatra, Malacca.

60. P. CURTIDENS Christ.
Dutch Borneo.
Local.

61. P. STENOPTERIS Baker.
Sarawak, Dutch Borneo, North Borneo.
Endemic.

62. P. SORIDENS Hooker.
Sarawak, Dutch Borneo, North Borneo.
Endemic.

63. P. STENOPHYLLUM Bl.
Common.
Malaya to Fiji.

64. P. REVOLUTUM C. Chr.
Common.
Malaya to New Caledonia.

65. P. SARAWAKENSE Baker.
Sarawak, North Borneo.
New Guinea.

66. P. HOLOPHYLLUM Baker.
Sarawak.
Endemic.
Christensen reduces this to *P. flabellivenium*.

67. P. OODES Kze.
Sarawak, North Borneo.
Luzon.

68. P. DULITENSE Baker.
Sarawak.
Local.
Baker says this is nearly allied to *P. labrusca* which is a *Tectaria*; but the rhizome is described as creeping.

69. P. CAMPYLONEUROIDES Baker.
Sarawak.
Endemic.

70. P. COSTULATUM (Cesati) Baker.
Sarawak, Kinabalu.
Sumatra, New Guinea.

71. P. TREUBII Christ.
Dutch Borneo.
Local.

72. P. GRIFFITHIANUM Hooker var. BORNEENSE Christ.
Dutch Borneo.
The variety local; the species in northern India and China.

73. P. PLATYPHYLLUM Swtz.
Sarawak, Dutch Borneo.
Java, Perak.

74. P. OCCULTIVENIUM Copel. n. sp.
Sarawak (Bidi).
Local.

75. P. RUPESTRE Bl.
Sarawak.
Malaya.

76. P. TRIQUETRUM Bl.
Kinabalu (*coll.* Miss Gibbs.)
Malaya; Samoa.

77. P. ALBIDOPALEATUM Copel. n. sp.

Kinabalu.

Endemic.

78. P. LEUCOPHORUM Baker.

Sarawak, Dutch Borneo.

Endemic.

79. P. MELANOCAULOS v. A. v. R.

Boundary of Dutch Borneo and North Borneo (Amdyah).

Local.

80. P. PUNCTATUM (L.) Swtz.

Sarawak, Dutch Borneo; probably everywhere.

Palaeotropical.

81. P. MUSIFOLIUM Bl.

Sarawak, Dutch Borneo.

Malaya, New Guinea.

My Bornean specimens could be called *P. mindanense* Christ.

82. P. LINGUAEFORME Mett.

Sarawak.

Amboyna to Polynesia.

I have never seen real *P. linguaeforme* from Borneo or the Philippines.

83. P. MYRIOCARPUM (Presl.) Mett.

"Borneo."

Philippines, Amboyna, Cochinchina.

The Sarawak fern, which I have distinguished as *P. sablanianum* Christ, may as well be regarded as *P. myriocarpum*.

84. P. ZIPPELII Bl.

Sarawak.

Malaya to India.

85. P. HETEROCARPUM Bl.

P. zollingerianum Kze.

Sarawak.

Malaya.

86. P. CERATOPHYLLUM Copel.
Sarawak (Mt. Poe).
Local.

87. P. PAUCIJUGUM v. A. v. R.
Dutch Borneo.
Endemic.

88. P. COMMUTATUM Bl.
P. affine Bl.
Sarawak, North Borneo.
Malaya.

89. P. EBENIPES Hook.
North Borneo.
Northern India, Yunnan.

90. P. PALMATUM Bl.
Common.
Malaya.
P. angustatum Bl. is the pinnate form of this species.

91. P. MACROCHASMUM Baker.
Kinabalu.
Java, Sumatra, Perak.

92. P. PHYMATODES L.
Common.
Tropics and subtropics of the Old World.

93. P. GRANDIDENTATUM Baker.
Sarawak (Banting).
Local.

94. P. ITHYCARPUM Copel. n. sp.
Kinabalu.
Endemic.

95. P. LONGISSIMUM Bl.
Sarawak, Dutch Borneo.
Malaya to India, Formosa and Polynesia.

96. P. NIGRESCENS Bl.

Common.

Malaya to India and Polynesia.

This and the preceding species are different enough in Java, but hard to distinguish in Borneo and the Philippines.

97. P. INCURVATUM Bl.

Sarawak, Dutch Borneo, North Borneo.

Malaya.

98. P. SUBAQUATILE Christ.

Dutch Borneo.

Endemic.

99. P. ALBIDOSQUAMATUM Bl.

Sarawak, Dutch Borneo.

Malaya, New Guinea.

Subgenus IV. *SELLIGUEA*.

a. Not coriaceous in texture.
  b. Fronds less than 3 cm. wide.
    c. Rhizome covered with small scales, scandent — 100. *P. Selliguea*.
    *c*1. Rhizome nearly naked — 101. *P. fluviatile*.
  *b*1. Fronds more than 3 cm. wide.
    c. Fertile frond much shorter than sterile — 102. *P. regulare*.
    *c*1. Fertile frond not much shortened.
      d. Frond thin, stipe (at least of fertile frond) long.
        e. Paleæ blackish — 103. *P. interruptum*.
        *e*1. Paleæ brown — 104. *P. macrophyllum*.
      *d*1. Texture firm, stipe short — 105. *P. Hosei*.
*a*1. Subcoriaceous, stipe winged — 106. *P. loxogrammoides*.
*a*2. Coriaceous; stipe not winged.
  b. Sori superficial — 107. *P. Feei*.
  *b*1. Sori immersed — 108. *P. mettenianum*.

100. P. SELLIGUEA Mett.

Sarawak, Dutch Borneo.

Malaya to Queensland.

101. P. FLUVIATILE Lautbach.
Dutch Borneo.
Local.

102. P. REGULARE Mett.
Dutch Borneo.
Endemic.

103. P. INTERRUPTUM C. Chr.
Gymnogramme acuminata Baker.
Sarawak.
Endemic.

104. P. MACROPHYLLUM (Bl.) Reinw.
Sarawak, Dutch Borneo, North Borneo.
Malaya to China and New Guinea.

105. P. HOSEI C. Chr.
Gymnogramme campyloneuroides Baker.
Sarawak, Dutch Borneo.
Malacca.

106. P. LOXOGRAMMOIDES Copel.
Sarawak (Limbang).
Local.

107. P. FEEI (Bory) Mett.
Sarawak, Dutch Borneo.
Malaya, Polynesia.

108. P. METTENIANUM Cesati.
P. heterocarpum Mettnon Bl.
Common.
Malaya.

Subgenus V. *MYRMECOPHILA*.

a. Frond sinuate or shallowly lobed	109. *P. sinuosum*.
*a*1. Frond pinnatifid.	
b. Rhizome forming a single crust	110. *P. lomarioides*.
*b*1. Rhizome forming a series of crusts	111. *P. mirabile*.

109. P. SINUOSUM Wall.
Sarawak, Dutch Borneo, North Borneo.
Malaya, Melanesia.

110. P. LOMARIOIDES (J. Sm.) Kze.
Dutch Borneo.
Malaya to Formosa.

111. P. MIRABILE C. Chr.
Dutch Borneo.
Amboyna.

Subgenus VI. *DRYNARIOPSIS.*

112. P. HERACLEUM Kze.
Kinabalu (*coll.* Topping).
Malaya, New Guinea.

58. PROSAPTIA PRESL.

a.	Fronds cut almost to the costa	1. *P. contigua.*
*a*1.	Fronds cut to a wing 2 mm. or more broad	2. *P. alata.*
*a*2.	Fronds pinnate, pinnæ not in contact	3. *P. linearis.*

1. P. CONTIGUA (Forst.) Presl.
Common.
Malaya to Ceylon and Polynesia.

2. P. ALATA (Blume) Christ.
Sarawak, Dutch Borneo.
Malaya to India and Samoa.

3. P. LINEARIS Copel.
Kinabalu (Paka cave).
Luzon (Mt. Pulog).

59. OREOGRAMMITIS COPELAND.

O. CLEMENSIÆ Copel. n. sp.
Kinabalu, near the summit.
Local.

60. LOXOGRAMME (BLUME) PRESL.

a.	Fronds dimorphous.	
b.	Sterile fronds broadly elliptic	1. *L. conferta.*
*b*1.	Sterile fronds narrowly oblanceolate	2. *L. iridifolia.*
*a*1.	Fronds uniform.	

b. Fronds linear	3. *L. parallela*
*b*1. Fronds oblanceolate.	
c. Abruptly contracted to short petiole	4. *L. Forbesii*.
*c*1. Narrowed gradually to base.	
d. Costa more prominent above	5. *L. blumeana*.
*d*1. Costa more prominent below	6. *L. involuta*.

1. L. CONFERTA Copel.

Sarawak (Mt. Merinjak).

Mindanao.

2. L. IRIDIFOLIA (Christ) Copel.

L. ensifrons v. A. v. R.

Sarawak, North Borneo.

Celebes, Mindanao.

3. L. PARALLELA Copel.

Kinabalu.

Luzon.

The Kinabalu plant is exceptionally large but not otherwise distinguishable.

4. L. FORBESII.

Sarawak (foot of Mt. Murud); Kinabalu?

Sumatra.

5. L. BLUMEANA Presl.

Common.

Malaya; Japan?

6. L. INVOLUTA (Bl.) Presl.

Sarawak, Dutch Borneo; the var. *gigas* on Kinabalu.

Malaya to India, China and Melanesia; the variety, in Luzon.

61. CYCLOPHORUS DESVAUX.

a. Sori in one row on each side of costa	9. *C. angustatus*.
*a*1. Sori in plural rows or scattered.	
b. Sterile frond roundish, 1—2 cm. long	4. *C. nummularifolius*.
*b*1. Fronds longer and relatively narrower.	
c. Fronds uniform, over 30 cm. long.	
d. Fronds oblanceolate	8. *C. beddomeanus*.
*d*1. Fronds linear	3. *C. acrostichoides*.

c^1. Fronds under 30 cm long.	
d. Pubescence on nether surface scattered.	
e. Paleæ ovate-lanceolate	1. *C. adnascens*.
e^1. Paleæ linear-lanceolate	2. *C. varius*.
d^1. Pubescence covering surface, but appressed.	
e. Free veinlets all running toward margin	5. *C. Heteractis*.
e^1. Free veinlets irregular	7. *C. Christii*.
d^2. Nether surface densely felted	6. *C. borneensis*.

1. C. ADNASCENS (Sw.) Desv.

   Common.

   Palaeotropic.

2. C. VARIUS (Kaulf.) Gaud.

   Sarawak, Dutch Borneo.

   Malaya, Polynesia.

3. C. ACROSTICHOIDES (Forst.) Presl.

   Common.

   Malaya to Ceylon, Polynesia and Australia.

4. C. NUMMULARIFOLIUS (Sw.) C. Chr.

   Sarawak, Dutch Borneo; probably common.

   Malaya to India.

5. C. HETERACTIS (Mett.) C. Chr.

   Sarawak.

   Northern India.

6. C. BORNEENSIS Copel. n. sp.

   Kinabalu.

   Endemic.

7. C. CHRISTII (Gies.) C. Chr.

   Dutch Borneo.

   Endemic.

This and *C. Heteractis* are parts of the old "collective species," *C. Lingua*. I have sterile specimens of three other Bornean species of this group.

8. C. BEDDOMEANUS (Gies.) C. Chr.

Dutch Borneo.

India, China.

9. C. ANGUSTATUS (Sw.) Desv.

Sarawak, Dutch Borneo.

Malaya to India and Polynesia.

62. DRYMOGLOSSUM Presl.

D. HETEROPHYLLUM (L.) C. Chr.

Common at low altitudes.

Malaya to India and Polynesia.

63. HYMENOLEPIS Kaulfuss.

a. Frond 1-3 cm. wide	1. *H. spicata*.
*a*1. Frond about 5 cm. wide	2. *H. callifolia*.

1. H. SPICATA (L.f.) Presl.

Probably everywhere, not reported from Dutch Borneo.

Palaeotropical.

2. H. CALLIFOLIA Christ.

Dutch Borneo.

Endemic.

64. ELAPHOGLOSSUM Schott.

a. Without a cartilaginous margin	1. *E. petiolatum*.
*a*1. With a cartilaginous margin.	
b. Paleæ harsh, dark, narrow	2. *E. beccarianum*.
*b*1. Paleæ thin, light-brown, broad	3. *E. laurifolium*.

1. E. PETIOLATUM (Sw.) Urban.

Acrostichum viscosum Sw.

Dutch Borneo, North Borneo.

Almost pantropical.

2. E. BECCARIANUM (Baker) C. Chr.

Sarawak.

Endemic.

3. E. LAURIFOLIUM (Thouars) Moore.

Kinabalu.

Malaya to the Mascarenes and India.

65. LECANOPTERIS Reinwardt.

In the following key and list, I follow van Alderwerelt; it seems probable to me that too many species are recognized. On the other hand, it seems decidedly proper to maintain the genus, rather than to combine it with *Polypodium*, as many authors have done.

a. Soriferous projections reflexed.	
b. Projections folded back without twisting.	
c. Sori oblong, distant	1. *L. carnosa*.
*c*1. Sori round, close	2. *L. Nieuwenhuisii*.
*b*1. Projections twisted, facing apex	3. *L. deparioides*.
a. Soriferous projections not folded back.	
b. Glaucous beneath	4. *L. Curtisii*.
*b*1. Not glaucous	5. *L. philippinensis*.

1. L. CARNOSA (Reinw.) Blume.

Sarawak (Mts. Matang and Dulit).

Malaya, at least in Celebes, the Molluccas and the Philippines.

The Bornean plant is probably the same as that listed below as *L. philippinensis*.

2. L. NIEUWENHUISII Christ.

Dutch Borneo.

Endemic.

3. L. DEPARIOIDES (Cesati) Baker.

Sarawak. Type locality, Mt. Matang.

Sumatra, Karimata.

4. L. CURTISII Baker.

"Borneo."

Sumatra, Lingga, Celebes.

5. L. PHILIPPINENSIS v. A. v. R.

Sarawak (*coll.* Hewitt).

Philippines.

I have one frond, collected by Hewitt on Mt. Matang, which is certainly representative of *L. philippinensis*, but which exhibits also the typical sorus position of *L. Curtisii* and *L. deparioides*. My disposition is to regard all of these as *L. pumila* Blume.

66. AGLAOMORPHA Schott.

A. BROOKSII Copel.

Mts. Penrissen and Bengkarum.

Endemic.

67. MERINTHOSORUS Copeland.

M. DRYNARIOIDES (Hooker) Copel.

Acrostichum, Hooker; *Dryostachyum* Kuhn.

North Borneo.

Penang, New Guinea, Polynesia.

68. DRYNARIA (Bory) J. Smith.

a. Normal fronds deeply pinnatifid.
  b. Sori scattered — 1. *D. sparsisora*.
  *b*1. Sori in double rows between main veins.
    c. Rhizome stout, not enclosed by scale leaves — 2. *D. quercifolia*.
    *c*1. Scale leaves rolled around slender rhizome — 3. *D. involuta*.
*a*1. Normal fronds pinnate — 4. *D. rigidula*.

1. D. SPARSISORA (Desv.) Moore.

Sarawak, Dutch Borneo.

Malaya to Ceylon, Fiji and Australia.

2. D. QUERCIFOLIA (L.) J. Sm.

Sarawak, Dutch Borneo, North Borneo.

Malaya to India and Polynesia.

3. D. INVOLUTA v. A. v. R.

Dutch Borneo.

Endemic.

4. D. RIGIDULA (Sw.) Beddome.
Sarawak, Dutch Borneo.
Malaya to India and Polynesia.

69. PHOTINOPTERIS J. SMITH.

P. SPECIOSA (Bl.) Presl.
Sarawak, Dutch Borneo, North Borneo.
Malaya.

70. ANTROPHYUM KAULFUSS.

a. Paraphyses enlarged at the apex.	
b. Apex rounded	1. *A. immersum*.
*b*1. Apex acute or acuminate.	
c. Frond elongate.	
d Frond sessile or short-stalked.	
e Costa inconspicuous and only near base.	2. *A. parvulum*.
*e*1. Costa conspicuous, but only near base.	3. *A. semicostatum*.
*e*1. Costa distinct above middle of frond.	4. *A. costatum*.
*d*1 Frond long-stalked	5. *A. plantagineum*.
*c*1. Frond almost as wide as long	6. *A. latifolium*.
*a*1. Paraphyses not enlarged at apex.	
b. Fronds more than 2 cm broad.	
c. Sori anastomosing freely	7. *A. reticulatum*.
*c*1. Sori free	8. *A. callifolium*.
*b*1. Fronds 5—20 mm wide.	
c. Frond moderately thick, sori 2—3 on each side	9. *A. subfalcatum*.
*c*1. Frond very thick, sori more numerous	10. *A. coriaceum*.
*b*1. Fronds less than 5 mm wide	11. *A. vittarioides*.

1. A. IMMERSUM (Bory) Mett.
Dutch Borneo, Sarawak, North Borneo.
Malaya, Mascarenes.

2. A. PARVULUM Bl.
Sarawak, North Borneo.
Java, Penang.

3. A. SEMICOSTATUM Bl.
Sarawak.
Malaya to Ceylon and Polynesia.

4. A. COSTATUM v. A. v. R.
   Dutch Borneo.
   Endemic.

5. A. PLANTAGINEUM (Cav.) Kaulf.
   Sarawak.
   Malaya to India and Polynesia.

6. A. LATIFOLIUM Bl.
   Sarawak.
   Malaya to India and China.

7. A. RETICULATUM (Forst.) Kaulf.
   Common.
   Madagascar and India to Polynesia.

8. A. CALLIFOLIUM Bl.
   Common.
   Malaya to Polynesia.

9. A. SUBFALCATUM Brack.
   Sarawak, Dutch Borneo.
   Celebes to Polynesia.

10. A. CORIACEUM (Don) Wall.
    Dutch Borneo.
    Malaya, India.

11. A. VITTARIOIDES Baker.
    North Borneo (Amdyah).
    Tonkin.

The Bornean plant seems to me to be probably distinct, but it ought not to be described as new until it can be compared with the original.

71. VITTARIA Smith.

a. Sorus submarginal, edge of frond or outer lip of groove folded over it until maturity.
  b. Frond hairy — 1. *V. hirta*.
  *b*1. Frond naked.
    c. Frond about 2 mm. wide, over 40 cm. long — 2. *V. longicoma*.
    *c*1. Frond about 3 mm. wide, not over 5 cm. long — 3. *V. pumila*.

*c*2. Frond wider, and usually over 20 cm. long.	
d. Costa broad and black near base, not reaching apex	4. *V. scolopendrina*.
*d*1. Costa not so stout below, but running to apex	5. *V. lineata*.
*a*1. Sorus marginal, in a groove of which the lips are not very unequal.	
b. Frond short-stalked or sessile.	
c. Frond not over 1.5 mm. broad	6. *V. lloydiifolia*.
*c*1. Frond 1.5—3 mm. broad	7. *V. angustifolia*.
*c*2. Frond usually 3—10 mm. broad.	
d. Sori confined to upper part of frond	8. *V. crassifolia*.
*d*1. Sori long.	
e. Fronds narrowed immediately from the widest point to the ends	9. *V. ensiformis*.
*e*1. Sides of frond parallel for a considerable distance	10. *V. elongata*.
*b*1. Stipe usually about 10 cm. long	11. *V. zosteriofolia*.

1. V. HIRTA Fée.

"Borneo," collected by A. R. Wallace.

Endemic.

Fée's figure is a good representation of *Monogramma dareicarpa*.

2. V. LONGICOMA Christ.

Dutch Borneo, Sarawak.

Endemic.

3. V. PUMILA (Mett.) Kuhn.

"Borneo," collected by Wallace; Dutch Borneo (?) collected by Winkler.

Endemic.

4. V. SCOLOPENDRINA (Bory) Thwaites.

Sarawak, Dutch Borneo.

Africa and India to Polynesia.

5. V. "LINEATA" (L.) Smith.

Common.

"Pantropic."

This "species" has been made the waste-basket of its group. Typical *V. lineata* in an American fern.

6. V. LLOYDIIFOLIA Racib.

"Borneo," *teste* van Alderwerelt.

Sumatra, Java, Celebes.

7. V. ANGUSTIFOLIA Bl. non Baker.

Dutch Borneo.

Malacca, Sumatra, Java.

8. V. CRASSIFOLIA Baker.

Sarawak.

Banca.

The description is strongly suggestive of *Scleroglossum*.

9. V. ENSIFORMIS Sw.

Dutch Borneo?

Java, Sumatra, the Mascarenes.

10. V. ELONGATA Sw.

Common.

Malaya to India, Polynesia and Australia.

This is another group-species.

11. V. ZOSTERIFOLIA Willd.

Common.

The Comores to Polynesia.

72. SCLEROGLOSSUM V. ALD. V. ROSEN.

a. Frond about 1.5 mm. wide	1. *S. angustissimum*.
*a*1. Frond wider.	
b. Veins simple	2. *S. debile*.
*b*1. Veins forked.	
d. Edge of frond thin	3. *S. pusillum*.
*d*1. Edge of frond thick	4. *S. sulcatum*.

1. S. ANGUSTISSIMUM Copel. n. sp.

Kinabalu.

Local.

2. S. DEBILE (Mett.) v. A. v. R.

Sarawak, North Borneo, Dutch Borneo.

Endemic.

3. S. PUSILLUM (Bl.) v. A. v. R.
   Common.
   Malaya to Ceylon and Queensland.

4. S. SULCATUM (Mett.) v. A. v. R.
   Sarawak, Kinabalu.
   Malaya to Ceylon and Polynesia.

73. MONOGRAMMA SCHKUHR.

a. Sorus on one side, near apex.	1. *M. dareicarpa*.
*a*1. Sori on both sides, frond fetiform	2. *M. trichoidea*.

1. M. DAREICARPA Hooker.
   Labuan.
   Philippines, New Guinea.

2. M. TRICHOIDEA J. Sm.
   Sarawak, Dutch Borneo.
   Philippines.

FAM. VIII. PARKERIACEÆ.

CERATOPTERIS BRONGNIART.

A single species — *C. thalictroides*.

C. THALICTROIDES (L.) Brongn.
   Common, in wet, open places.
   Pantropic and to Japan.

FAM. IX. MARSILEACEÆ.

MARSILEA LINNÆUS.

A single species — *M. quadrata*.

M. QUADRATA A. Br.
   North Borneo.
   Endemic.

APPENDIX:

The following general statement regarding ferns is printed here with the idea that it will be more useful than a formal glossary as an aid to amateurs in the understanding of technical terms.

The ferns are a group of plants characterized by the absence of flowers and seeds, the production of leaves which are usually large and highly developed in proportion to the stem, and by the fact that in their life history they go through two distinct stages. One of these is called the prothallium. It is inconspicuous, never noticed by ordinary collectors, and so far as publications show, has never been noticed or collected in Borneo, except on the one visit of Professor Campbell. It reproduces sexually and the result of this reproduction is the ordinary fern plant, composed of root, stem and leaves, which reproduces itself by means of spores. When the spore germinates, it produces the prothallium.

Ferns are characteristic inhabitants of moist localities in the tropics. In such places, they grow either on the ground, in which case they are called terrestrial, or on the trunk and branches of trees, in which case, they are epiphytes. The roots of ferns present few features important in their classification, and the terms applied to them, such as coarse or fibrous, require no explanation.

The stem of ferns may be stout and erect, in which case, if it is strongly developed, it is called a trunk or

caudex; or it may be creeping or climbing, in which case, it is called the rhizome. The rhizome is in general botany restricted to prostrate under-ground stems, but in the case of ferns is applied to all stems which are not erect and conspicuous. Such expressions as "Rhizome erect" are common in systematic work on ferns. The rhizome may be short, in which case, the leaves are clustered or it may be very long, and bearing the leaves at considerable intervals. The rhizome is always provided with a coat of scales, and these scales, technically called paleae if noticeably wide, are very important in classification. They may be persistent or may be deciduous, in which case the rhizome becomes naked or glabrous, but the scales can always be found near the apex. In form, they vary from hair-like, in which case they may be spoken of as hairs, to very broad. The terms, applying to their forms, apices, bases, and margins have the same meaning that they have when applied to leaves or leaflets.

The leaf of a fern is called the frond. This word is used in two senses:—first, as applying to the entire leaf; and second, as applying to the blade, or green and expanded part of the leaf. The latter sense is preferable and is the one used in this paper. A complete leaf consists of three parts: stipules, stipe or petiole, and the frond proper. The Marattiaceae bear large, fleshy stipules; all other ferns are without them. The stipe may be wanting, in which case the frond is said to be sessile. If the green part of the frond, the lamina, runs down along the sides of the stipe, the stipe is said to be winged. The stipe may be round (terete), or is more frequently channeled on the upper side. The stipe may be glabrous, or it may bear paleae of various forms, and it may also produce true hairs. Epiphytic ferns are exposed to danger from want of water.

In time of drought, a fern retaining its leaves might be killed by the loss of water. To escape this danger, most epiphytic ferns are able to shed their leaves. In such cases, the stipe breaks automatically at joint or articulation, at or near its base. The frond is said to be deciduous in such cases. The branch of the rhizome, extending to the joint, is called a phyllopodium.

The description of the frond, or of one of its leaflets, involves statements as to the general shape, the form of apex, the form of base, the margin, the surface, texture and venation. The frond may be either simple or compound. Terms applied to its form are, linear, meaning very narrow, like a blade of grass; lanceolate, or lance-shaped, meaning broader than linear, and broader below than above the middle; oblanceolate, which differs from lanceolate in indicating greater width above the middle than below; oblong; ovate or egg-shaped; elliptical and round; setiform, or bristle like, and capillary or hair-like, signify more extreme narrowness than does linear. If the frond is broadly triangular, being very broad at the base, it is called deltoid.

The apex may be rounded, obtuse, acute, or acuminate, the last term meaning drawn out to a point of some length. If extremely drawn out, it becomes caudate. If squarely cut off, it is truncate. If indenting instead of projecting at the apex of the midrib, it is said to be notched, emarginate or retuse.

The base may be truncate, rounded, obtuse, or acute; if more drawn out, it is called cuneate or wedge-shaped, a form similar to the acuminate apex; if carried down along the stipe, it is decurrent. If the blade projects downward, past the point of insertion of the stipe, it becomes sagittate

if drawn down to sharp points, or cordate, if the downward projections are broad and rounded.

The margin may be entire, that is, an unbroken line; sinuate or wavy; crenate, meaning occasionally indented, with broad, round projections between the indentations; dentate, or toothed with equal-sided teeth; serrate, with teeth like those of a saw; lobed, if cut not more than halfway to the midrib into divisions which are separated by rounded spaces, cleft or divided if similarly cut with sharp incisions between the lobes; partite if more deeply cut by sharp incisions. If the incisions between the parts of the frond reach to the midrib, the frond becomes compound.

The surface may be smooth or glabrous; glaucous, if covered with a fine waxy or mealy substance which usually makes it bluish, but sometimes white; or it may be pubescent, which is a general term, meaning that there are scales or hairs present. The scales may be like those on the rhizome, but are usually smaller and more likely to be ciliate (finely hairy around the edge), cut or lacerate. If attached by the middle or some other point than the base, the scale is peltate. Hairs may be simple or branched, and may be glandular or not so. If colorless, they are called hyaline. If a leaf is densely hairy, it becomes velvety if the hairs are close and short; hirsute, if the hairs are long and "hairlike;" or tomentose, if woolly. These terms may be applied to the whole leaf, to one of its surfaces, or to some particular part such as the midrib or veins.

The common terms applied to the texture of leaves are membranaceous, or very thin; herbaceous, or typically leaflike; papyraceous, or paper-like; chartaceous, or like heavy paper; and coriaceous, or like leather.

The midrib of a leaf or leaflet is called the costa. The veins and veinlets may be simple or branched. If a vein or veinlet runs freely above its base and does not connect again with another vein or veinlet, it is called free. Veins which unite and thus produce a closed network are said to be anastomosing and the venation is then reticulate. A free included veinlet is one which is free in a space or an areola enclosed by anastomosing veins.

A compound frond is pinnate, if the leaflets are attached serially to a main axis called the rachis. It is palmate, or digitate, if the leaflets spring from a common point to the top of the stipe. The leaves of *Marsilea*, having four equal leaflets in the form of a Maltese cross, are called cruciform. The leaflets of a pinnate leaf are called pinnae. If these pinnae are compound, they are described with the use of the same terms applied to simply compound leaves. The leaf as a whole is then bipinnate, the ultimate divisions are called pinnules. If the pinnules in turn are compound, or twice compound, the frond is tripinnate, or quadripinnate.

There are a few terms applied to pinnae, which rarely or never apply to whole leaves. The bases of pinnae are frequently oblique; that is, the pinnae are unequal-sided at the base. The lower side is frequently cuneate, and the upper side truncate. If the base of the pinnae is widened and the dilated part grown out to a point, the pinnae is said to be auricled. If the inequality of the sides extends throughout the leaflet, the part below the costa being almost wanting, while the part above it is well developed, the leaflet is dimidiate; the upper side of a pinnae, that is the side toward the apex of the frond, is the acroscopic side, and the lower side is spoken of as basiscopic.

A leaf which produces spores is sometimes distinguished from other leaves as a sporophyll. In most ferns, the sporophylls are like the other leaves or all of the leaves of an adult fern may be spore-producing; or the sporophyll may differ from other leaves in being smaller, or more contracted, or less divided, or of different form. In such cases, the fronds are said to be dimorphous. In some cases, a part of the frond, almost always the upper part, is specialized for spore-production and differs in appearance from the rest of the frond.

The individual spores are almost invisible to the naked eye. They are produced in spore cases called sporangia. In what are known as the Eusporangiate ferns, comprising only two small families, the sporangia arise from a group of cells below the surface of the leaf. At maturity, the sporangium protrudes, but is not born on a stalk, and the cover is several layers of cell in thickness. These sporangia are rather massive structures, sometimes more than a millimeter in diameter. The overwhelming majority of ferns, constituting the group of Leptosporangiatae, have the sporangia formed from a single epidermal cell. At maturity, the sporangium is born on a stalk, and its wall is a single cell in thickness. Running around the sporangium in these ferns, or partway around it, is a specialized ring or group of cells called the annulus. These sporangia are small, but not nearly small enough to be invisible to the naked eye. Their structure, however, cannot be seen without a microscope.

The sporangia are sometimes scattered all over the dorsal or under side of the leaf; and the fructification is then said to be Acrostichoid. In other cases, the

sporangia are formed everywhere on the veins, but not on the green lamina between the veins; the fructification is in this case called Grammitoid. In most ferns, the sporangia are gathered into definitely formed and placed clusters called sori. These are born on the dorsal or under surface of the leaf, but are called marginal if produced at or very close to the margin, and dorsal if at some distance from the margin. The form of sorus is very important in classifying the ferns of the great family, Polypodiaceae. The sorus may be without special covering, in which case, it is said to be naked or "exindusiate;" or it may be provided with a covering either by the folding back of the margin over marginal sori, or by a special outgrowth of the leaf called the indusium. The indusium may be fastened by the middle, when it is said to be peltate, or it may be fastened by a point in the margin, or by a part or the whole of the margin.

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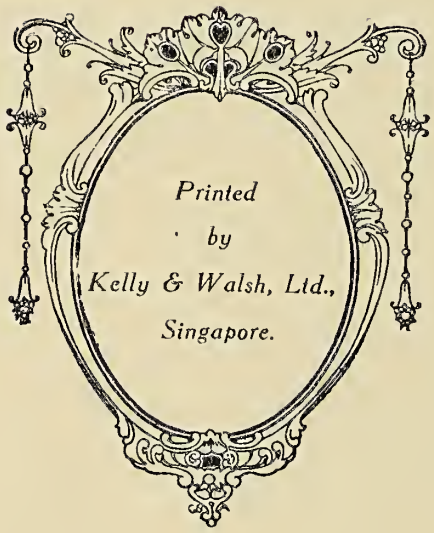
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