THE GENERA LOMARIOPSIS, TERATOPHYLLUM, AND LOMAGRAMMA IN THE ISLANDS OF THE PACIFIC AND AUSTRALIA

R. E. HOLTTUM
Royal Botanic Gardens, Kew

A study of these three fern-genera has been undertaken for Flora Malesiana. *Teratophyllum* and *Lomagramma* have their main distribution in Malesia; *Lomariopsis* is pantropic. All three have a distribution extending to the Society and Austral Islands and to New Caledonia; all three are almost confined to the tropics, and all are found only in well-developed evergreen forest, so that in the Pacific they only occur on islands large enough to develop such forest. Only *Teratophyllum* occurs in Queensland.

These ferns have a peculiar growth-habit in common. The plants have their main root-system in the ground, but climb to a considerable height up the trunks of trees, attaching themselves by roots which grow from the ventral surface of their climbing rhizomes. The fronds are always dimorphic, fertile fronds having contracted leaflets which are covered beneath with sporangia. The only other genus all species of which have a similar growth-habit is *Stenochlaena* (with which *Lomariopsis* and *Teratophyllum* were formerly united). *Stenochlaena* differs in the following characters: the rhizome is not dorsiventral in structure, and has a quite different and very complex vascular anatomy; the fertile leaflets have a distinct thin indusium-like edge; and the spores have a strongly sculptured exine lacking perispore. There is also one species of *Blechnum* in New Zealand which has a similar habit [*B. filiforme* (A. Cunn.) Ettings.]. This also has a rhizome which is not dorsiventral, but its vascular structure is much simpler than that of *Stenochlaena*, its fertile pinnae have more conspicuous indusium-like edges, and the spores have a smooth exine covered by perispore.

Young plants of *Teratophyllum* and *Lomagramma* have distinctive fronds before their rhizomes climb to any considerable height on tree-trunks. These fronds, confined to the lowest levels of the forest, are called bathyphylls, those of higher-climbing rhizomes acrophylls. Bathyphylls of *Teratophyllum* and *Lomagramma* are of characteristic form in each species, and are in some cases more distinctive than sterile acrophylls. Young plants of *Lomariopsis* have simple fronds and there is a gradual transition from these to pinnate fronds.

The three genera have all had a complex taxonomic history, and some indication of this is given under each of them; it will be more fully discussed in Flora Malesiana.

KEY TO THE GENERA

1. Veins free; spores with folded perispore.
   2. Apical pinna jointed to rachis; stipes swollen at base and at length deciduous; fronds sometimes bipinnate. . . . . **1. Teratophyllum**
   2. Apical pinna continuous with rachis; stipes not swollen at base but gradually decurrent on rhizome; fronds always simply pinnate . . . . . **2. Lomariopsis**
1. Veins anastomosing in several series of areoles without included veinlets; spores very thin-walled, smooth. . . . . **3. Lomagramma**

TERATOPHYLLUM Mettenius

Rhizome dorsiventral, when adult (high-climbing) with two or more longitudinal rows of fronds on its dorsal surface; stipes slightly swollen at base and at length deciduous, leaving round scars; fronds simply pinnate or bipinnate, all pinnae jointed to rachis (except distal ones of fronds of young plants); spores with folded perispore.

Distribution: Malesia, tropical Pacific islands south of Equator, North Queensland.

In establishing the genus *Teratophyllum*, Mettenius recognized two species, *T. aculeatum* (Bl.) Mett. and *T. articulatum* (L. Sm.) Mett. [Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 296]. In Engler & Prantl, Pflanzenfamilien I, Abt. 4 (1899), Diels placed *T. aculeatum* in *Stenochlaena* sect. *Stenochlaena* (p. 251) and *T. articulatum* in *Polybotrya* sect. *Teratophyllum* (p. 198), where he associated it with the single bipinnate species of *Lomagramma* (the simply pinnate species of which he placed in *Gymnopteris*, p. 201). This arrangement was due to the failure of earlier taxonomists to take anatomy, scales, and spores into consideration, and to an undue emphasis on the difference between simply pinnate and bipinnate fronds.

When anatomy, scales, and spores are considered, it is seen that *Teratophyllum aculeatum* is very different from *Stenochlaena*, as I demonstrated in 1932 (Gard. Bull. S.S. 5: 245—312). A study of specimens from the whole of Malesia showed that several distinct species, allied to *T. aculeatum*, could be recognized, each with its own peculiar early stages of growth which could be correlated with differences in the adult form of the plant. I did not then study *T. articulatum*; all authors after Mettenius had placed it in a separate genus, and it clearly showed differences from *T. aculeatum* and its allies, the most conspicuous being bipinnate fronds on adult plants. However, when two other species were brought to my attention, one from Queensland and one from the islands of the Pacific, I saw that they showed conditions intermediate between *T. aculeatum* and *T. articulatum*, though more closely allied to the latter, and I proposed a sew section *Polyseriatae* of *Teratophyllum* to include *T. articulatum* and the two additional species which are described below as *T. wilkesianum* and *T. brightiae*. [Gard. Bull. S.S. 9 (1938) 355].

T. articulatum has only bipinnate fronds on adult plants; *T. wilkesianum* has sometimes pinnate, sometimes bipinnate, adult fronds (with transitional forms, both sterile and fertile); *T. brightiae* has only simply pinnate fronds. The sole character in which all these three species differ from *T. aculeatum* and its allies is the anatomy of the rhizome and the arrangement of the fronds on it. In *T. aculeatum* (and all other species of sect. *Teratophyllum*) the rhizome, throughout the life of the plant, is slender, almost circular in section, and bears two longitudinal rows of fronds on its dorsal surface. The three species of sect. *Polyseriatae* have (in adult plants) a broader rhizome bearing three or more longitudinal rows of fronds on its upper surface. This does not seem to me to be a generic difference. Copeland [Gen. Fil. (1947) 118] has placed *T. articulatum* and *T. wilkesianum* in a genus *Arthrobotrya* established for the former by John Smith; but Copeland could only define that genus by ignoring *T. brightiae*.

KEY TO THE SPECIES OF TERATOPHYLLUM

1. Bipinnate fronds present on young plants and on some adult ones.
   2. Sterile pinnules distinctly auricled on acroscopic base; all adult fronds bipinnate **1. T. articulatum**
   2. Sterile pinnules not auricled; simply pinnate fronds often present on adult plants. **2. T. wilkesianum**
1. Bipinnate fronds lacking on both young and adult plants . . . . . **3. T. brightiae**

1. Teratophyllum articulatum (J. Sm. *ex* Fée) Mett. *ex* Kuhn, Ann. Mus. Bot. Lugd. — Bat. 4 (1869) 297; Holttum, Gard. Bull. S.S. 9 (1938) 356. — *Polybotrya articulata* J. Sm. *ex* Fée, Hist. Acrost. (1845) 74, t. 37; Christ, Farnkr. d. Erde (1897) 42, f. 101; Diels in E. & P. Nat. Pfl. Fam. I, Abt. 4 (1899) 198; Copel., Polypod. Philip. (1905) 40; v. A. v. R., Handb. (1908) 725. — *Acrostichum* (§ *Polybotrya*) *articulatum* Hook., Spec. Fil. 5 (1864) 247. — *Arthrobotrya articulata* J. Sm., Hist. Fil. (1875) 141; Copel., Gen. Fil. (1947) 118; Copel., Fern Fl. Philip. (1960) 272. — *Lomagramma articulata* Copel., Philip. J. Sci. Bot. 3 (1908) 32; v. A. v. R., Handb. Suppl. (1917) 437. — *Lomagramma bipinnata* Copel., Philip. J. Sci. Bot. 11 (1916) 41; v. A. v. R., Handb. Suppl. (1917) 438.

Bathyphylls at first simply pinnate (to 9 cm long), fronds with pinnate lower pinnae soon appearing, their basal pinnae often deflexed across rhizome. Adult *rhizome* somewhat flattened, to *c.* 10 mm wide, smooth. *Sterile acrophylls*: stipes 10—20 cm long, lamina to 60 cm, bipinnate; pinnae 15—24 cm long, jointed to rachis, pinnate with 20 or more pairs of jointed pinnules grading into a narrow lobed apical lamina continuous with pinna-rachis which is winged throughout; pinnules sessile, base very asymmetric, narrowly cuneate on basiscopic side, very broadly cuneate and usually with a well developed auricle acroscopically, edges crenate, apex rounded, largest 15—25 mm long, 6—8 mm wide above the basal auricle; brown bullate scales on lower surface of costules. *Fertile fronds* somewhat smaller than sterile, similarly bipinnate; pinnules distinctly stalked, 7—15 mm long, *c.* 2 mm wide when dry, distinctly auricled on acroscopic base.

Distribution: Celebes, Moluccas (Ceram, Halmaheira), Philippines, New Guinea, Solomon Islands (Bougainville, Guadalcanal).

SOLOMON Is. Bougainville: *Kajewski 1711*, in forest, common (L, MICH). — Guadalcanal: *Kajewski 2669*, 1200 m (L, MICH, GH).

2. Teratophyllum wilkesianum (Brack.) Holttum, Gard. Bull. S.S. 9 (1938) 359, pl. 29, 30; C. Chr., Bishop Mus. Bull. no 177 (1943) 106. — *Polybotrya wilkesiana* Brack., U.S. Expl. Exp. 16 (1854) 80, pl. 10. — *Acrostichum wilkesianum* Hook., Spec. Fil. 5 (1864) 247; Bak., Syn. Fil. (1868) 413; Drake del Castillo, Fl. Polynés. Franç. (1893) 319. — *Lomariopsis balansae* Fourn., Ann. Sci. Nat. V, 18 (1873) 271; Holttum, Gard. Bull. S.S. 9 (1938) 362. — *Acrostichum mutabile* Nadeaud, Enum. Pl. Tahit. (1873) 28. — *Lomagramma wilkesiana* Copel., Philip. J. Sci. Bot. 3 (1908) 32; Maxon, Univ. Cal. Publ. Bot. 12 (1924) 28, pl. 3, 4; Copel., Bishop Mus. Bull. no 93 (1932) 51. — *Arthrobotrya wilkesiana* Copel., Gen. Fil. (1947) 118.

Differs from *T. articulatum* as follows: *simply pinnate* acrophylls, both sterile and fertile, may be produced; sterile pinnae *c.* 12 pairs, 10—15 cm × 2 cm, on stalks to 7 mm long, fertile pinnae to 10 cm long and 5 mm wide; fronds intermediate between simply pinnate and bipinnate may also accur; *pinnules of bipinnate sterile fronds* to 20 × 5 mm, base very narrowly cuneate on basiscopic, more broadly cuneate but not auriculate on acroscopic side, edges crenulate to deeply toothed; *fertile pinnules* 15—20 mm long, 1 mm wide.

Distribution: Society Islands, Austral Islands, Cook Islands, Samoa, New Caledonia.

SOCIETY Is. Tahiti: *Brackenridge s.n.* (US, type; K); *Tilden 434* (K); *Grant 4459*, 100 ft (K, BO, US); *Grant 4613*, 1400 ft (K); *Quayle 111*, 600 m (K); *Setchell & Parks 211* (US); *294* (US); *296* (K, BO, SING, US); *315* (US); *512* (US).

AUSTRAL Is. Raivavae: *St John 16037* (K); *16335*, 300 m (K); *16004* (K).

COOK Is. Rarotonga: *Wilder 1125*, 150 ft (K); *Cheesman s.n.*, July 1899 (K).

SAMOA. Savaii: *Christophersen 738*, 1000 m (K); *Reinecke 87b* (K, BO, US).

NEW CALEDONIA. *Franc 662* (K, BO, US); *663* (K); *Balansa 1574* (P, type of *L. balansae*); *Vieillard 1534-1635* (K); *McKee 2624* (K).

Also at Kew is a specimen from Herb. Macleay labelled Fiji; but this is not the original label and is open to doubt; I know of no other record from Fiji.

3. Teratophyllum brightiae (F. v. Muell.) Holttum, Gard. Bull. S.S. 9 (1938) 358, pl. 28. — *Acrostichum brightiae* F. v. Muell., Fragmenta 7 (1870) 119. — *Lomariopsis brightiae* Bailey, Handb. Queensl. Ferns (1874) 10. — *L. sorbifolia* var. *resectum* Christ in Warb., Monsunia 1 (1900) 56. — *Stenochlaena sorbifolia* var. 13, C. Chr., Ind. Fil. (1906) 626. — *S. hugelii* [*non* (Pr.) Fée] Underw., Bull. Torr. Bot. Cl. 33 (1906) 46. — *Arthropteris prorepens* Domin, Bibl. Bot. 85 (1913) 64, f. 13; Tindale, Contr. N.S.W. Nat. Herb. 3 (1961) 88.

Bathyphylls to *c.* 20 cm long with *c.* 20 pairs of pinnae and a narrow lobed apical lamina continuous with rachis; rachis winged almost throughout; middle pinnae to 2 × 0.5 cm, acroscopic base broadly truncate, basiscopic narrowly cuneate, apex rounded to bluntly pointed, basal pinnae reduced and more widely spaced, apical ones gradually reduced and merging into apical lamina. *Sterile acrophylls*; pinnae to 12 × 1.4 cm, on stalks 2—3 mm long, edges crenulate, apex sometimes rather abruptly narrowed to a caudate tip. *Fertile pinnae* to 15 cm long, 1—2 mm wide, on stalks to 5 mm long.

Distribution: rain forest on coastal ranges of N. Queensland.

QUEENSLAND. Graham's Mt, Rockingham Bay, *Dallachy s.n.* (MEL, type; K). — Cairns Distr., *Herb. NSW P7902*; *Watts* (K).

Underwood identified this species with *Lomariopsis hugelii* Presl (Epim. Bot. 263) based on a specimen at Vienna, collected by Hügel in New Zealand, to which Fée gave the MS name *Stenochlaena hugelii*. Brownlie saw this specimen, and made a note in the Kew herbarium that he found it to be *Blechnum filiforme* (A. Cunn.) Ettingsh. Presl described the rhizome and stipes as densely scaly, and the pinnae as broad at the base, neither of which statements is true of *T. brightiae*. The two species are certainly similar in habit, and *B. filiforme* even has distinctive bathyphylls (which have shorter proportionately broader pinnae than those of *T. brightiae*).

LOMARIOPSIS Fée

Rhizome of adult plant always with several longitudinal rows of fronds on its dorsal surface; bases of stipes not swollen nor constricted, gradually decurrent on rhizome; fronds simple on young plants, simply pinnate on mature high-climbing rhizomes, apical pinna always continuous with rachis, lateral pinnae jointed to rachis; veins free; spores with folded perispore.

Distribution: Thailand to S. China, Malesia, Bonin Islands, Caroline Islands, New Hebrides, New Caledonia, Fiji, Samoa, Society Islands, Austral Islands.

Young plants of this genus do not have distinctive bathyphylls. The earliest fronds are simple and entire [except in *L. variabilis* (Willd.) Fée of Mauritius in which they are more or less dissected], successive ones larger until they are larger than the terminal pinna on a adult plant; later fronds have gradually more and more lateral pinnae until they reach the adult condition. Young plants with simple fronds were described as new species of *Gymnogramme*, in two cases, from the pacific.

Fée included in *Lomariopsis* the simply pinnate (Malesian) species of *Teratophyllum* known to him. Most subsequent authors included both genera in *Stenochlaena*, and there was much confusion, partly because collectors had not associated the peculiar leaf-forms of young plants of *Teratophyllum* with the adult stage of the same plant. The first

clear distinction between the three genera was in 1932 (Holttum, Gard. Bull. S.S. 5: 245—312).

The earliest-known Pacific species were described by Brackenridge in 1854, as *Stenochlaena oleandrifolia* and *S. variabilis*. The latter was different from the true *Lomariopsis variabilis* (Willd.) Fée of Mauritius, and Carruthers provided the new name *L. brackenridgei* for it.

KEY TO THE SPECIES OF LOMARIOPSIS

1. Stalks of sterile pinnae 20—35 mm long; pinna-apex truncate with very short tip; fertile pinnae to 25 × 1 cm . . . . . **1. L. oleandrifolia**
1. Stalks of sterile pinnae not over 15 mm, in most cases much less; apex acuminate; fertile pinnae much shorter and narrower.
   2. Sterile pinnae to 2.0 cm wide; fertile 8—10 mm wide and 10 cm long **2. L. novae-caledoniae**
   2. Sterile pinnae to 2.5 cm wide; fertile longer and narrower.
      3. Fertile pinnae to 25 cm long and 3 mm wide . . . . . **3. L. boninensis**
      3. Fertile pinnae 20—40 cm long and 1½ mm wide . . . . . **4. L. brackenridgei**

1. Lomariopsis oleandrifolia (Brack.) Mett. in Kuhn, Verh. Zool. Bot. Ges. 19 (1869) 571; Holttum, Gard. Bull. S.S. 5 (1932) 275; op. cit. 9 (1937) 142. — *Stenochlaena oleandrifolia* Brack., U.S. Expl. Exp. 16 (1854) 75; Copel., Bishop Mus. Bull. no 59 (1929) 65. — *Lomariopsis seemannii* Carr. in Seem., Fl. Vit. (1873) 373. — *Gymnogramme scolopendrioides* Bak., J. Bot. 17 (1879) 299. — *Stenochlaena seemannii* Underw., Bull. Torr. Bot. Cl. 33 (1906) 119. — *Syngramma scolopendrioides* C. Chr., Ind. Fil. (1906) 629.

Sterile pinnae very firm, drying brownish, 20—25 × 2.5—3 cm, base narrowly cuneate, apex very abruptly narrowed to a narrowly triangular tip 1 cm long; stalks 20—35 mm long. *Fertile pinnae* to 25 cm long and 10 mm wide, stalked as sterile.

Distribution: Fiji, New Hebrides (Aneityum).

FIJI. *Brackenridge* (type, US); *Seemann* (type of *L. seemannii*, K); *Horne 1138* (K); *Horne s.n.*, 1877—78 (type of *G. scolopendrioides*, K).
NEW HEBRIDES, Aneityum, *Herus 74* (B).

Gymnogramme scolopendrioides was described from sterile young plants with simple fronds. *L. oleandrifolia* is closely related to *L. intermedia* Copel from New Guinea, but the latter has shorter-stalked pinnae, sterile ones not abruptly narrowed near the apex.

2. Lomariopsis novae-caledoniae Mett., Ann. Sci. Nat. IV, 15 (1861) 58; Holttum, Gard. Bull. S.S. 5 (1932) 274. — *Stenochlaena sorbifolia* subsp. 12 C. Chr., Ind. Fil. (1906) 626. — *S. novae-caledoniae* Underw., Bull. Torr. Bot. Cl. 33 (1906) 49.

Sterile pinnae to 17 × 2 cm, drying dark olive green above, paler beneath, edges minutely sinuate, base cuneate, 10—15 mm below apex slightly constricted; stalks to 5 mm long. *Fertile pinnae* to *c.* 10 cm long, 8—10 mm wide, similarly stalked.

Distribution: New Caledonia.

NEW CALEDONIA. *Vieillard 1529* (type, P; K); *Franc 663* (P, K).

3. Lomariopsis boninensis Nakai, Bot. Mag. Tokyo 47 (1933) 171.

In aspect rather intermediate between *L. cochinchinensis* Fée (Thailand and S. Vietnam, W. Malesia, Philippines) and *L. kingii* (Copel.) Holttum (New Guinea); *sterile pinnae* to 22 × 2.5 cm, subsessile but base unequally decurrent on costa (much less on basiscopic

side), acuminate and often somewhat abruptly narrowed towards apex; *fertile pinnae* to 22 cm × 3 mm, lower ones on stalks 7—9 mm long.

Distribution: Bonin Islands, Caroline Islands.

The following specimens from Ponape (Caroline Is) in the Berlin herbarium include fertile fronds and agree well with Nakai's description and with a specimen from the Bonin Islands in Herb. BM: *Ledermann 13401, 13767, Kubary 2.* A sterile collection from Ponape in Herb. K, MICH, also agrees (*Takamatsu 811*). At Berlin is a specimen from herb. Lübeck, collected by Amalie Dietrich, marked 'Brisbane?'. No *Lomariopsis* specimens have been collected in Queensland. Amalie Dietrich travelled back from Australia to Hamburg *via* Tonga. I can find no evidence of her subsequent journey, but it seems likely that she called at the Caroline Islands, which were then under German control. The specimen includes both sterile and fertile fronds, and agrees with the above description. One might expect this species also in the Marianna Islands, but perhaps none of them has enough forest to afford a suitable habitat.

4. Lomariopsis brackenridgei Carr. in Seem., Fl. Vit. (1873) 373; Holttum, Gard. Bull. S.S. 5 (1932) 276; op. cit. 9 (1937) 142. — *L. variabilis* (*non* Fée) Carr., l.c. — *Stenochlaena variabilis* Brack., U.S. Expl. Exp. 16 (1854) 76 [not *Lomariopsis variabilis* (Willd.) Fée, 1845]. — *Gymnogramme* ? (sect. *Syngramme* ?) *subtrifoliata* Hook., Spec. Fil. 5 (1864) 152, t. 298 [not *Lomariopsis subtrifoliata* (Copel.) Holtt., 1932]. — *Stenochlaena brackenridgei* (Carr.) Underw., Bull. Torr. Bot. Cl. 33 (1906) 45; Copel., Bishop Mus. Bull. no 59 (1929) 65. — *Acrostichum sorbifolium* (*non* L.) Rechinger, Denkschr. Akad. Wien 84 (1908) 413, fig. 4. — *Stenochlaena setchellii* Maxon, Univ. Cal. Publ. Bot. 12 (1924) 23, pl. 1; Copel., Bishop Mus. Bull. no 93 (1932) 51. — *Lomariopsis setchellii* Holttum, Gard. Bull. S.S. 5 (1932) 276; C. Chr., Bishop Mus. Bull. no 177 (1943) 104.

Sterile pinnae 15—18 cm long, 1.5—2.5 cm wide, base narrowly cuneate and decurrent on a stalk *c.* 5 mm long, apex acuminate to a very slender tip, edges minutely sinuous when dry, texture rather thin. *Fertile pinnae* 20—40 cm long, *c.* 1½ mm wide, stalks to 5 mm long.

Distribution: Fiji, Samoa, Tahiti, Austral Islands.

Fiji. *Seemann 711* (type of *L. brackenridgei* Carr., K); *Milne 308* (type of *Gymnogramme subtrifoliata* Hook., K); *Horne 552* (K); *Brackenridge* (type of *S. variabilis* Brack., US).

Samoa. *Powell 27* (K); *Whitmee 150* (K); *Vaupel 182* (K); *Christophersen 310* (K).

Tahiti. *Setchell & Parks 418* (type of *S. setchellii*, US).

Austral Is. Rurutu, 275 m, *St John 16771* (K).

Maxon stated that *L. setchellii* differed from *L. brackenridgei* in having 16 pairs of sterile pinnae instead of 7—8 pairs, pinnae with stalks 5 mm instead of 10 mm and thinner in texture. When several collections from Fiji and Samoa are examined, these differences are seen not to be constant. Some Fiji specimens at Kew, including the type of *L. brackenridgei*, are from immature plants, with slender rhizomes and few pinnae.

Carruthers attempted to distinguish both *L. variabilis* (Willd.) Fée and *L. brackenridgei* in Brackenridge's Fiji collections, but the distinctions he cited are trivial. The true *L. variabilis* (Willd.) Fée occurs only in Mauritius and Réunion, and is distinguished by the deeply dissected simple fronds of young plants; the sterile fronds of adult plants are not greatly different from those of *L. brackenridgei*, but the fertile pinnae are much wider.

LOMAGRAMMA J. Sm.

Rhizome of adult plants as *Lomariopsis*; fronds pinnate or bipinnate, all pinnae jointed to rachis; veins reticulate in several series of oblique areoles lacking included veinlets and without main veins; spores thin-walled, smooth, lacking perispore.

Distribution: N.E. India to Vietnam, Malesia, Solomon Islands, New Hebrides to Tahiti (not in New Caledonia).

Apart from a bathyphyll of uncertain origin (*Aspidium sorbifolium* Willd.), the first species to be described was *Leptochilus lomarioides* Bl., from Java. Hooker included with the latter species (which he re-named *Acrostichum blumeanum* Hook.) specimens from Samoa which were recognized as a distinct species *L. cordipinna* Holttum in 1932. Specimens from Tahiti, also known as *Acrostichum blumeanum* or *Lomagramma lomarioides*, are here for the first time recognized as a further distinct species, *L. tahitensis*.

The simply pinnate species of *Lomagramma* were given various generic status by earlier taxonomists, but were by all closely associated with *Acrostichum* (*s. str.*) on account of similarity of venation and acrostichoid fertile pinnae. Later they were associated with *Leptochilus*, a genus of the *Polypodium* group, and with it were merged in *Gymnopteris* by Diels. Christensen separated *Leptochilus* (including *Lomagramma*) from *Gymnopteris*, in Index Filicum (1905—06); *Lomogramma* was recognized as a distinct genus in the first Supplement to the Index (1913).

The bipinnate species *L. polyphylla* was included by Diels in *Polybotrya*, where it became associated with the bipinnate species of *Teratophyllum*.

KEY TO THE SPECIES OF LOMAGRAMMA

1. Acrophylls, both sterile and fertile, bipinnate. . . . . **1. L. polyphylla**
1. Acrophylls, both sterile and fertile, pinnate.
   2. Pinnae deeply and irregularly lobed . . . . . **2. L. cultrata**
   2. Pinnae at most crenate-serrate.
      3. Apex of frond of acrophylls a pinna like the rest, jointed to rachis; sterile acrophyll pinnae more than 2 cm wide.
         4. Sterile acrophyll pinnae broadly cordate to subcordate at base, fertile to 11 mm wide **3. L. cordipinna**
         4. Sterile acrophyll pinnae unequally cuneate at base, fertile to 8 mm wide **4. L. sinuata**
      3. Apex of frond of acrophylls usually a lobed lamina not jointed to rachis; sterile acrophyll pinnae to 2 cm wide, not subcordate at base . . . . . **5. L. tahitensis**

1. Lomagramma polyphylla Brack., U.S. Expl. Exp. 16 (1854) 83, t. 12; Copel., Bishop Mus. Bull. no 59 (1929) 96; Holttum, Gard. Bull. S.S. 9 (1937) 212. — *Neurocallis polyphylla* (Brack.) Moore, Ind. Fil. (1857) xix. — *Acrostichum polyphyllum* Hook., Spec. Fil. 5 (1864) 269; Bak., Syn. Fil. (1868) 424. — *Lomariopsis polyphylla* Kuhn, Verh. Zool. Bot. Ges. 19 (1869) 571. — *Chrysodium polyphyllum* Luerss., Fil. Graeff. (1871) 69. — *Poecilopteris polyphylla* Carr. in Seem., Fl. Vit. (1873) 374. — *Polybotrya articulata* Fée, *p.p.*, *sensu* Diels in E. & P. Nat. Pfl. Fam. I, Abt. 4 (1899) 198. — *Polybotrya polyphylla* C. Chr., Ind. Fil. (1905) 15; op. cit. (1906) 505.

Bathyphylls simply pinnate; pinnae to *c.* 4 × 1.2 cm, base unequally cuneate, edges crenate-serrate, apex usually rather blunt, apical pinna jointed to rachis or not; smaller bathyphylls with apical lamina continuous with rachis. *Sterile acrophylls* bipinnate, pinnae jointed to main rachis, pinnules to pinna-rachis; pinnules 2—2½ cm long, 6—8 mm wide, edges crenate. *Fertile fronds* bipinnate; pinnules distinctly stalked, 8—15 mm long, 2—2½ mm wide.

Distribution: Fiji, Tonga, New Hebrides (Banks Isl., Aneityum), Santa Cruz Is.

FIJI. *Brackenridge* (type, US; K); *Gillespie 2705* (K). — Kundavu: 200—500 m, *A. C. Smith 226* (K). — Viti Levu: 750—900 m, *Degener 14329* (K); near Suva, *Tothill 942* (K); *Seeman 713* (K); Viti Levu, 725—850 m, *A. C. Smith 5838* (K).

TONGA. *Parks 16311* (US, K).

NEW HEBRIDES. Aneityum: *Morrison s.n.*, 16-6-1896 (K); *Macgillivray 44, 881* (K). — Banks Island: *J. G. Veitch* (K).

SANTA CRUZ IS. *Comins s.n.* (K); *C. Moore* (K).

There is also in the Kew herbarium a specimen from Thomas Moore's herbarium labelled 'New Caledonia, Strange 1853'. Strange did go to New Caledonia; but it seems probable that this locality is an error, as in the case of *Cyathea leucolepis* Mett. [Holttum, Blumea 12 (1964) 272].

2. Lomagramma cultrata (Bak.) Holttum, Gard. Bull. S.S. 9 (1937) 203. — *Acrostichum* (sect. *Chrysodium*) *cultratum* Bak., Syn. Fil. ed. 2 (1874) 523. — *Leptochilus lomarioides sensu* C. Chr., Ind. Fil (1905) 386, *p.p.*

Fronds to 180 cm long (collector). *Sterile pinnae* 15—20 cm long, mostly *c.* 2.5 cm wide, lobed throughout to a narrow wing along costa or with basal part not lobed; lobes obovate with cuneate base and broadly rounded to almost truncate apex, commonly 10 mm wide, with an occasional lobe much longer than the rest (to 2.5 cm long) and almost evenly elliptic. *Fertile pinnae* similarly lobed but only half as wide, lobes widely spaced and almost circular.

SOLOMON ISLANDS. San Christoval: *H. Richards* (K).

Only known from a single specimen. The irregular lobes of the sterile pinnae indicate that the plant may have been a hybrid between a simply pinnate and a bipinnate species; if so, the bipinnate species must have been *L. polyphylla* which has not yet been found on the Solomon Islands. The simply pinnate parent might have been *L. sinuata* which is common in New Guinea and known from Bougainville. There are also probable hybrids from Fiji, where the simply pinnate parent must have been *L. cordipinna* (see below).

3. Lomagramma cordipinna Holttum, Gard. Bull. S.S. 9 (1937) 202; C. Chr., Bishop Mus. Bull. no 177 (1943) 105. — *Acrostichum blumeanum* Hook., Spec. Fil. 5 (1864) 268, *p.p.* — *Polybotrya lomarioides* [*non* (Bl.) Kuhn] Luerss. in Schenk & Luerss., Mitt. Bot. 1 (1874) 74, 359. — *Acrostichum lomarioides* [*non* (Bl.) Chr.] Christ in Engl., Bot Jahrb. 23 (1897) 361; Rechinger, Denkschr. Akad. Wiss. Wien 84 (1908) 413, t. vi.

Bathyphyll pinnae to 7 × 1.5 cm, basiscopic base broadly rounded, acroscopic broadly cuneate, apex acute, edges deeply crenate-serrate towards apices. *Sterile acrophyll* pinnae 12—17 cm long, 2—3 cm wide, basiscopic base cordate, acroscopic cordate to broadly truncate, edges entire or crenate towards apices, texture thin, veins prominent. *Fertile pinnae* to 12 × 1.1 cm, on stalks to 5 mm long.

Distribution: Samoa, Fiji.

SAMOA. *Safford s.n.*, March 1888 (US, type); *Powell 68* (P); *26* (B, K); *Vaupel 192*, Savaii, 350 m (B, P, K); *Wray Harris 2531-262* (K, large bathyphylls); *Sledge 1688*, Upolu, in forest on crater rim, 2600 ft; *Yuncker 9300*, Tutuila, 250 m (MICH); *Wray Harris 27-7-1938*, Tau, 700 ft (BO, MICH); *Reinecke 55a*, Upolu (B); *55b*, Tutuila (B).

FIJI. Viti Levu, 750—900 m, *Degener 14565* (GH); Korumbamba, *Meebold 16856* (BM); *A. Corrie* (*HMS Pearl*) *s.n.*, 1874 (bathphylls, K); *Horne 807* (K).

4. Lomagramma sinuata C. Chr., Svensk Bot. Tidskr. 16 (1922) 98, fig. 5; Holttum, Gard. Bull. S.S. 9 (1937) 215; C. Chr., Brittonia 2 (1937) 302; Backer & Posth., Varenfl.

Java (1939) 153; Copel., Philip. J. Sci. 78 (1949) 401. — *Leptochilus cuneatus* R. Bonap., Notes Pterid. 14 (1923) 453.

Bathyphylls: fronds with 10—12 pairs of pinnae have apical pinna jointed to rachis; middle pinnae to 9 × 2 cm with broadly cuneate acroscopic base and narrowly cuneate to slightly rounded basiscopic base, edges shallowly crenately lobed (more deeply towards apex), apex rounded to bluntly pointed, texture very thin. *Sterile acrophylls* to 100 cm long with many pinnae; middle pinnae 11 × 2 to 20 × 4 cm, more or less stalked, acroscopic base broadly cuneate, its edge forming a distinct S-curve, basiscopic base narrowly cuneate, edges almost entire on larger fronds, slightly and irregularly toothed towards apex on smaller ones, texture thin, veins raised on both surfaces. *Fertile pinnae* 10—15 cm long, 5—8 mm wide, on stalks 2—8 mm long.

Distribution: Malesia, Solomon Islands (Bougainville and New Georgia).

SOLOMON IS. Bougainville: *Waterhouse 583* (K, sterile). — New Georgia: *Waterhouse 80* (K, sterile).

5. Lomagramma tahitensis Holttum, *sp. nov.* — *Acrostichum blumeanum sensu* Nadeaud, Enum. Pl. Tahiti (1873) 29; Drake del Castillo, Fl. Polynés. Franç. (1893) 321. — *Lomagramma lomarioides sensu* Copel., Bishop Mus. Bull. no 93 (1932) 52.

Rhizoma alte scandens, *c.* 12 mm diametro, paleis rufo-brunneis 5 × 1 mm vestitum. *Frondes* 80 cm vel ultra longae, stipite 15—20 cm incluso; pinnae infimae leviter reductae, superiores sensim decrescentes; lamina terminalis profunde lobata, basi non articulata. *Pinnae steriles* maximae 14 × 2 cm, sessiles, basi acroscopice cuneatae, basiscopice rotundatae, apice acuminatae, marginibus apicem versus grosse serratae, textura tenues, venulis tenuibus leviter prominentibus. *Pinnae fertiles* maximae 14 cm longae, 7—10 mm latae, basi asymmetricae, apice anguste rotundatae, stipitibus 2—5 mm longis sustentae.

TAHITI. *M. Vesco s.n.*, 1847 (type, P; dupl. at K, B); *Nadeaud 196*; *Lépine 94, 95* (P).

Bathyphylls of this species are not represented in collections. The acrophylls of *L. tahitensis* have a lobed apical lamina like that of larger bathyphylls of *L. sumatrana*, *L. lomarioides*, *L. pteroides*, and *L. novoguineensis*, but in these species (except sometimes in *L. novoguineensis*) acrophylls have an apical pinna jointed to the rachis in place of the lobed apical lamina (vestiges of which can sometimes be seen); in other species of the genus only the earliest bathyphylls have a apical lamina continuous with the rachis. In its broad fertile pinnae this species resembles *L. cordipinna*, but the shape of the sterile pinnae is very different.

POSSIBLE HYBRIDS FROM FIJI

In the Kew herbarium is a sheet bearing fragments of a single large bipinnate sterile frond, the pinnules of which are much larger than those of *L. polyphylla*; in size and shape they are more like pinnae of bathyphylls of *L. cordipinna* (*J. Horne s.n.*, 1877—78).

This specimen might represent a hybrid between *L. polyphylla* and *L. cordipinna*. One would, however, expect such a hybrid to be more like *L. cultrata* as above described, imperfectly bipinnate, and one would expect the hybrid to be sterile. If, however, a hybrid plant of this parentage should by chance produce a good spore, the result might well be a plant with fully pinnate fronds such as that of Horne's specimen.

There is another Fiji specimen at Kew, also collected by Horne, which is like *L. cordipinna* apart from one pinna, which is partly lobed as in *L. cultrata*. This looks as if it might be a hybrid between *L. cordipinna* and *L. cultrata*.