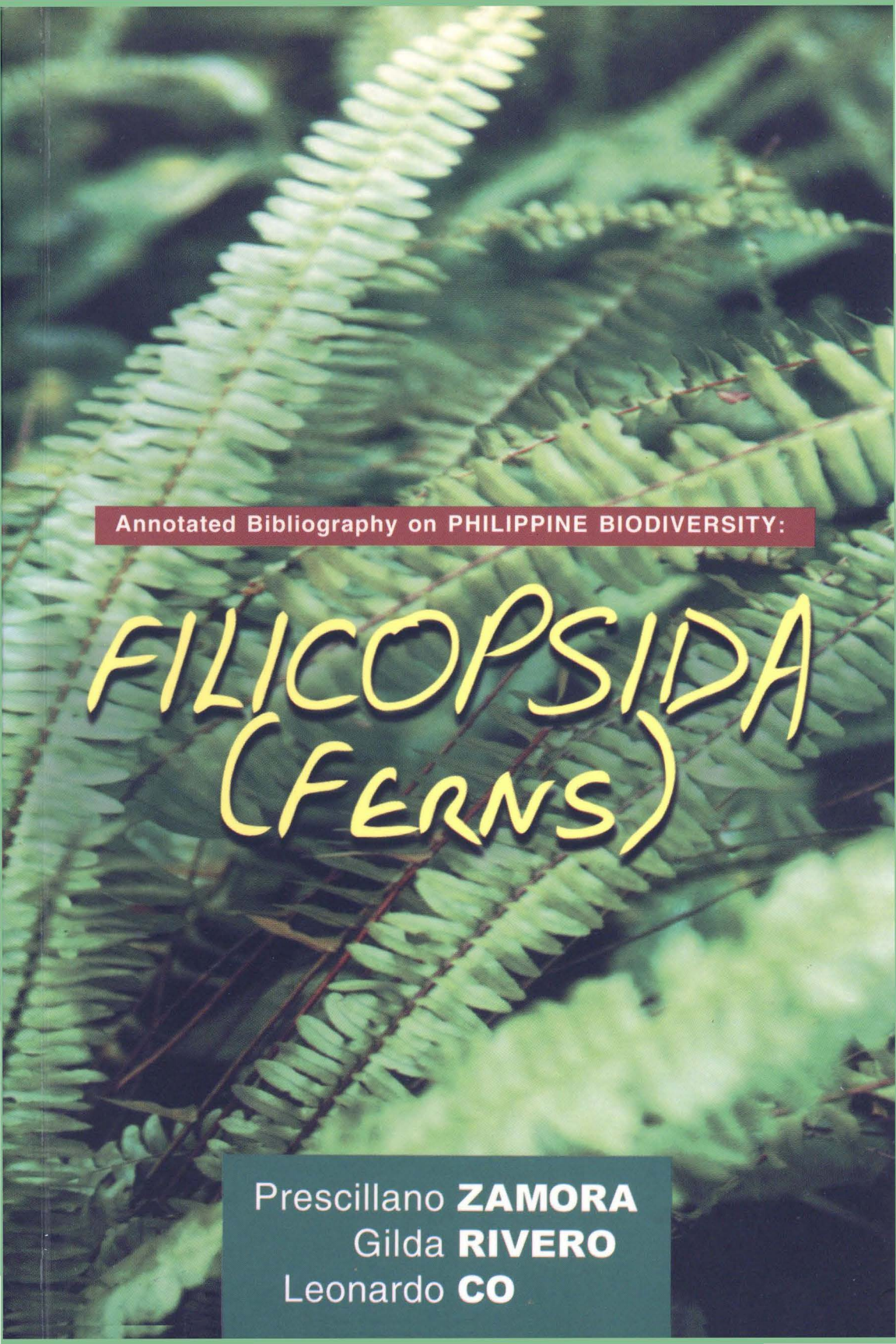




Annotated Bibliography on PHILIPPINE BIODIVERSITY:

FILICOPSIDA (FERNS)

Prescillano **ZAMORA**
Gilda **RIVERO**
Leonardo **CO**

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Introduction

This book represents the output of a year of library research on fern biodiversity as a subproject of the "Annotated Bibliography on Philippine Biological Diversity" being implemented by the University of the Philippines Center for Integrative and Development Studies-National Academy of Science and Technology Biodiversity Conservation Program (UP-CIDS NAST BCP). It includes published papers and unpublished theses and dissertations that appeared within the period of 1900 to 2000. While the present volume is exhaustive, it is possible that some publications may have been overlooked during the compilation period of one year.

At this juncture, the authors wish to thank with utmost perspicacity the UP-CIDS and NAST for unselfishly providing support for the project in terms of research fellowships (UP-CIDS Research Fellowships for G C Rivero and L Co and NAST Research Fellowships for P M Zamora). Finally, we wish to thank the former Executive Director (Dr Cynthia Rose Bauzon-Bautista) and incumbent Executive Director (Dr Ma Carmen Jimenez) of the UP-CIDS for their all out support and encouragement and the Staff of the UP-CIDS-NAST BCP and the UP-CIDS Publications Office for so ably preparing the manuscript for publication.

Alston, A. H. G. 1933. Certain ferns in Sir James Smith's herbarium. *Philippine Journal of Science* 50 (2): 175-183.

The pteridophytic genera (mostly ferns), namely, *Davallia*, *Darea*, *Hemionitis*, *Isoetes* (non-fern), *Lindsaea*, *Woodwardia*, *Aspidium*, *Acrostichum*, *Botrychium* and *Onoclea* are described. Notes and comments on Smith's species identification are provided.

Amoroso, V. B. 1983. Stipe Morphology of Philippine Ferns. PhD Dissertation. University of the Philippines, Diliman, Quezon City.

The exomorphic and endomorphic characters of the stipes of Philippine ferns belonging to 28 families represented by 148 genera and 527 species were studied and discussed relative to their importance in identification and probable relationships. The exomorphic characters include color, presence or absence of scales, stipule-like outgrowths, phyllopodium, grooves, wings, and articulation while the endomorphic characters include shape, number, arrangement and shape of vascular bundles, xylem strand configuration, distribution of sclerenchyma and phlobaphene-containing cells. These morphological stipe characters are of definite importance in generic and familial identification and in showing relationships among taxa.

Amoroso, V. B. and P. M. Zamora. 1985. Stipe morphology of Philippine ferns. *CMU Journal of Agriculture, Food and Nutrition* 6 (4): 269-281.

Based on Amoroso, V. B. 1983. Stipe Morphology of Philippine Ferns. Ph.D. Dissertation. University of the Philippines, Diliman, Quezon City.

Amoroso, V. B. 1987. Some endangered economic and endemic ferns of the Philippines. *CMU Journal of Agriculture, Food and Nutrition* 9 (1): 15-32.

Amoroso, V. B. and F. L. Macabudbud. 1988. A new record of *Ophioglossum reticulatum* L. at Fortchacu III, Kalilangan, Bukidnon. *Philippine Journal of Science* 117: 401-404.

Ophioglossum reticulatum Linn. is reported to be present in Fortchacu III, Kalilangan, Bukidnon for the first time.

Amoroso, V. B. and F. L. Macabudbud. 1990. Three Philippine endemic ferns in Calinau, Davao, Mindanao. *CMU Journal of Science* 3 (2): 13-24.

Amoroso, V. B. and H. P. Pava. 1991. Comparative morphological studies of two endemic species of *Oleandra* Cav. *Philippine Journal of Science* 120 (4): 423-435.

Two endemic species of the fern genus *Oleandra*, namely, *O. maquilingensis* Copel. and *C. nitida* Copel. of the family Oleandraceae are described morphoanatomically and reported to be present in New Calinau, Marilog District, Davao.

Amoroso, V. B. 1993. Morphosystematic studies of some pteridophytes in Mt Kitanglad, Bukidnon. *BIOTROP Special Publications* 51: 97-128.
Checklist of 88 species, descriptions, habitat and uses.

Amoroso, V. B. and F. M. Acma. 1995. Diversity, status and ecology of pteridophytes in three forests in Mindanao, Philippine. Number 4. Pteridophytes Symposium 1995 Paper and Poster Abstracts, 16-21 July 1995. Royal Botanic Garden, Kew England.

The diversity, status and ecology of pteridophytes in three forests in Mindanao, namely, Mt. Kitanglad, Mt. Apulang and Marilog Forest are studied. In terms of species diversity, Mt. Kitanglad is reported to have 275 species, Mt. Apulang 231 species, while Marilog Forest has 165 species. The status of pteridophytes assessed fall under the following categories: 1, endangered; 31, rare, 8; depleted, 82; endemic and 65, economically important. A comparison of some ecological factors of the 3 forests, i.e., % organic content, temperature and amount of rainfall is included. The relationship of these factors to the number of endemic species is discussed. The human activities which contribute to the endangerment of the pteridophytes in these forests include (1) cutting of forest trees (habitat) at an alarming rate, (2) cultivation of vegetable gardens at the foot of the mountains and (3) shifting cultivation.

Amoroso, C. B. 1995. *In vitro* culture of *Platyserium grande* (Fee) Presl. Number 55. Pteridophyte Symposium '95 and Poster Abstracts, 16-21 July 1995. Royal Botanic Garden, Kew, England.

The pattern of spore and prothallus development of *Platyserium grande*, a rare endemic fern of the Philippines is studied *in vitro*.

Azolla Notes. 1984. (Volume 1) to date (1998, Volume 15). A Quarterly Newsletter of the National Azolla Action Program. U P at Los Baños and Ministry of Agriculture and Food, Metro Manila.

This newsletter is a vehicle for disseminating information on the biology and uses of Azolla especially to farmers. Fifteen volumes have been issued since 1984 (Volume 1).

Barcellona, J. F., B. F. Hernaez and M. G. Price. 1996. Philippine *Schizaea*. *Asia Life Sciences* 5 (1): 27-34.

The four species of grass-like ferns of the genus *Schizaea* (*Pteridophyta*, *Schizaeaceae*) now known from the Philippines are treated taxonomically with detailed information. These are *Schizaea dichotoma* (Linn.) Smith, *S. digitata* (Linn.) Sw., *S. inopinata* Selling and *S. malaccana* Bak. *S. malaccana* is a new record for the Philippines.

Bosman, M. T. M. 1991. A monograph of the Fern-Genus *Microsorium* (*Polypodiaceae*). *Leiden Botanical Series* 14: 1-161.

The treatment of the fern genus *Microsorium* Link is the fourth major revision carried out in the *Polypodiaceae* Research Project supervised by Professor Dr. E. Hennipman (Utrecht). The genus is reduced to 29 species which are fully described and included in a key to the species. Additionally, a few representatives of other microsoroid genera are treated in the same way. Three new species are described and eight new combinations are made. Distribution of all described species is presented in maps and discussed in relation to habitat preferences. Morphology and anatomy of characters are discussed in detail. Special attention is given to venation and sorus distribution patterns. The taxonomic history of *Microsorium* and allied genera is very complicated. *Dendroconche*, *Diblemma*, *Lepidomicrosorium* and *Paraleptochilus* are reduced to synonyms. The remaining microsoroid genera, i.e., *Colysis*, *Leptochilus*, *Microsorium*, *Neocheiropteris*, *Phymatosorus* and *Podosorus* are characterized and included in a provisional key. With the aid of the computer programmes HENNIG86, PAUP and CAFCA, phylogenetic analysis of 46 microsoroid species has been carried out. The selection of taxa, characters and character coding is made explicit. The resulting cladograms are not accepted because they contain too many homoplasies.

Thus, the genealogical relationships among the microsoroids remain unsolved. The classification of the microsoroids is therefore mainly constructed by means of a classical approach. Also included are a discussion of taxa concepts, an informal subdivision of *Microsorium*, a list of 87 doubtful or excluded names, an identification list, a glossary of botanical terms, an index to names of taxa, a list of all literature and illustrations of all new species and important characters.

Brownsey, P. J. and A. C. Jermy. 1973. A fern collecting expedition to Crete. *British Fern Gazette* 10: 331-348.

In this paper, a new combination was proposed for a thelypterid fern whose range extends to the Philippines, viz., *Christella dentata* (Forssk.) Brownsey et Jermy (basionym: *Polypodium dentatum* Forssk., Fl. Aegypt. Arab. 185. 1775).

Brownsey, P. J. 1987. A review of the fern genus *Hypolepis* (Dennstaedtiaceae) in the Malesian and Pacific regions. *Blumea* 32: 227-276.

Fourteen species and one subspecies of the fern genus *Hypolepis* Bernh. are recognized in the Malesian and Pacific regions, excluding Australia and New Zealand. Three species, namely, *H. hawaiiensis*, *H. malesiana* and *H. scabristipes*, and one subspecies, *H. elegans* subsp. *carolinensis* are described for the first time. Two widely misapplied names, *H. punctata* (Thunb.) Mett. and *H. tenuifolia* (Forst. F.) Bernh are more clearly defined. Descriptions, distributional data and a key for identifying all fourteen species are provided. Five species, namely, *H. alpina*, *H. archboldii*, *H. bamleriana*, *H. malesiana* and *H. scabristipes* are confined to the Malesian region; four species, namely, *H. brooksiae*, *H. pallida*, *H. polypodioides* and *H. punctata* extend also to the Asian mainland; three species, namely, *H. dicksonioides*, *H. elegans* and *H. hawaiiensis* are confined to the Pacific region; and two species, namely, *H. glandulifera* and *H. tenuifolia*, have a wide distribution from mainland Asia to the Pacific. Four species, namely, *H. dicksonioides*, *H. elegans*, *H. glandulifera* and *H. tenuifolia* are shared with Australia and New Zealand where a further eight endemic species occur. The Philippines is cited in the distribution of the following species of *Hypolepis*: *H. polypodioides*

(Blume) Hook., *H. gladulifera* Brownsey et Chinnock, *H. malesiana* Brownsey (new species), *H. archboldii* Copel., *H. alpina* (Blume) Hook., *H. tenuifolia* (Forst. F.) Bernh. ex C Presl, *H. bamleriana* Rosenstock, *H. punctata* (Thunb.) Mett. ex Kuhn (doubtful), *H. pallida* (Blume) Hook (doubtful).

Chandra, S. 1977. Rhizome morphology of two *Iomariopsis* ferns endemic to the Philippines. Kalikasan: *Philippine Journal of Biology* 7 (1): 31-38.

Attributes of the rhizome indicate that *Edanyoa difformis* Copel. and *Bolbitis foxii* Copel. are not related and that the former is probably more nearly allied to *B. presliana* (Fee) Ching. *Edanyoa* can be maintained as a distinct genus, a section or a subgenus of *Bolbitis*.

Chandra, S. 1978. Morphology and Phylogeny of Philippine *Drynarioid* Ferns. PhD Dissertation, University of the Philippines, Diliman, Quezon City.

The morphological attributes of 15 species belonging to seven genera of *drynarioid* ferns are described and their significance relative to the origin, interrelationship and trend of specialization of said taxa are discussed. These are palea, rhizome, vegetative frond including epidermal cells, stomata, hypodermis, mesophyll, venation, fertile frond including sorus, sporangium and spores and gametophyte (*Drynariopsis*). Consideration of morphological characters indicate (1) that the *drynarioid* ferns apparently evolved along two main lines from their microsorioid ancestor (diphyletic in origin); (2) that the *Drynaria* Group is more primitive than the *Aglaomorpha* Group; (3) that *D. sparsisora* is more advanced than *D. quercifolia*; (4) that *D. descensa* is a reduced derivative of *D. quercifolia*; (5) the *D. rigudula* branched off from the *Drynaria* line independently of the other *Drynaria* species and is susceptible to generic separation; (6) that *Photinopteris* is probably evolved independently of *Drynaria* but is from the 'same source'; (7) that *A. splendens* is the source of both *A. meyeniana* and *A. pilosa* and evolved independently from *A. splendens*; (8) that *Merinthosorus* is probably more nearly allied to *Drynariopsis* and possibly derived from it; (9) that *Pseudodrynaria* differs markedly from the *Drynaria* Group and possibly derived from *Drynariopsis*; (10) that *Thayeria* represents the most advanced species among the *drynarioid*

evolved independently from *A. splendens*, (8) that *Merinthosorus* is more allied to *Drynariopsis* and probably derived from it, (9) that *Pseudodrynaria* differs markedly from *Drynaria* group and is probably more allied to the *Aglaomorpha* group and derived from *Drynariopsis*, (10) that *Thayeria* is the most advanced species among the *drynarioid* ferns and that the trend of evolutionary progression has been towards reduction, and (11) that in the light of phylogeny as outlined above, there is no evidence to deny that the *drynarioid* ferns are dyphyletic in origin.

Chandra, S. 1982. Structure and organization of the vascular system in the rhizome of *drynarioid* ferns. *Annals of Botany* (50): 585-598.

Form and structure of the vascular cylinder of the rhizome of 14 species belonging to six genera of *drynarioid* ferns are described. The study finds that *drynarioid* ferns fall into two categories: the *Drynarioid* group (*Drynaria*, *Photinopteris*) which is probably the more primitive and exhibits the alternate two-ranked condition occurring in the *Aglaomorpha* group (*Aglaomorpha*, *Drynariopsis*, *Pseudodrynaria*, *Merinthosorus*, *Thayeria*). It seems that rhizome morphology provides characters which help to separate different species into two distinct groups and indicates some phylogenetic trends. The most characteristic feature of the rhizome of *drynarioid* fern is seen in *Thayeria*, where some of the leaves on the dorsal surface of the rhizome are dormant, some of them developing on a prominent short, stout phyllopodium.

Chandra, S. 1982. A new concept of *drynarioid* ferns. *British Fern Gazette* 12 (4): 225-229.

Based on accumulated morpho-anatomical evidence, two new tribes of the subfamily *Drynarioideae* are proposed: *Drynarieae* with the genera *Drynaria*, *Photinopteris* and *Aglaomorpheae* with *Aglaomorpha*, *Drynariopsis*, *Holostachyum*, *Merinthosorus*, *Pseudodrynaria* and *Thayeria*.

Chandra, S. 1982. Notes on the ecological adaptations in *drynarioid* ferns. *Malayan Nature Journal* 35: 133-148.

The present communication deals briefly on the ways in which *drynarioid* ferns have adapted themselves to their environment. The adaptive nature of

structure studied are rhizome, roots, humus collectors, the vegetative fronds (including epidermal hairs, hypodermal layer, hydathodes, venation), and reproductive structures. A brief account of their geographical affinity is also discussed.

Chandra, S. 1983. A new combination in the fern genus *Tectaria*. Kalikasan: *Philippine Journal of Biology* 12 (1, 2): 156-158. (also in the *Journal of Economic and Taxonomic Botany* 5 (1984): 1085-1086) *Stenosemia aurita* (Sw.) Presl is reduced to *Tectaria aurita* (Sw.) S. Chandra.

Chandra, S. 1992. Vasculature of the rhizome in the fern genus *Dipteris*. *Indian Fern Journal* 9: 133-137.

A comparative study of the vascular organization of the rhizome in three species of *Dipteris*, viz., *D. conjugata*, *D. lobbiana* and *D. wallachii*. These species show some interesting morphological peculiarities in the vasculature of their rhizomes.

Chandra, S. and S. Kaur. 1993. Vasculature of the rhizome in the fern genus *Dipteris*. *American Fern Journal* 83 (2): 71-72.

Comparative study of the vascular organization of the rhizome of six of the eight species of *Dipteris* known in the world (*D. conjugata*, *D. lobbiana*, *D. wallachii*, *D. chinensis*, *D. nievwenhuisii* and *D. novoguineensis*). Based on the study, four species (*D. conjugata*, *D. chinensis*, *D. niewenhuissii* and *D. novoguineensis*) form one group of species where each leaf trace consists of a solitary undivided C-shaped strand indicating the relatively primitive condition of the vasculature of its axis as in *Matonia*, *Gleichenia* and *Cheiropleuria*.

Only two of the eight species of *Dipteris* occur in the Philippines, viz., *D. conjugata* and *D. lobbiana*.

Christ, H. 1907. *Cibotium baranetz* J. Sm. and related forms. *Philippine Journal of Science* 2 (2): 117-118.

Four species of the genus *Cibotium* are recognized by the author based on the examination of the specimens in his herbarium, namely, *C. baranetz*

J. Sm., *C. assamicum* Hook., *C. sumatranum* (new subspecies), and *C. cummingii* Kunze. The Philippines is cited among the habitats of the last species.

Christ, H. 1907. The Philippine species of *Dryopteris*. *Philippine Journal of Science* 2 (3): 189-217.

This paper includes descriptive notes on Philippine *Dryopteris* species. The nomenclature of *Christensen (Index Filicum)* was followed and the generic name *Dryopteris* accepted by the author (H. Christ). Discussion of the genus is given with a listing of 107 species and varieties.

Christ, H. 1907. *Spiciligium Filicum Philippinensium Aut Imperfecte Cognitarum*. *Philippine Journal of Science* 2 (3): 153-188.

This paper provides a descriptive list of the pteridophytic flora of the Philippines. Materials for this work were supplied by Loher, Copeland and Merrill. The author found and distinguished many forms of Philippine ferns not considered by Copeland. Listed were 29 genera and numerous species, including new ones. Distribution of each species is indicated.

Christ, H. 1908. *Spiciligium Filicum Philippinensium Novarum Aut Imperfecte Cognitarum, II*. *Philippine Journal of Science* 3 (5): 269-276.

Representative species of 15 genera are enumerated and described with notes on type locality.

Christ, H. 1908. *Spiciligium Filicum Philippinensium Novarum Aut Imperfecte Cognitarum, II*. *Philippine Journal of Science* 3 (5): 269-276.

Enumeration and description of 21 new or imperfectly known taxa of ferns from the Philippines, viz., *Hymenophyllum angulosum* (new species), *H. obtusum*, *Trichomanes mindorensis* (new species), *T. (Goniocormis) alagense* (new species), *Aspidium subconfluens*, *A. menyanthidis*, *Nephrolepis clementis* (new species), *Humata repens* var. *miniscula* (new variety), *Microlepis todayensis* (new species), *Athyrium loheri*, *A. halconensis* (new species), *Diplazium deltoideum*, *Hypolepis tenerifrons* (new species), *Paesia luzonica* (new species), *Vittaria elongata* var. *alpinae* (new variety),

Elaphoglossum merrillii (new species), *Azolla africana* and *Marsilea mearnsii* (new species).

Christensen, C. 1933. Report on Mt Pinatubo ferns. *Leaflets on Philippine Botany* 9 (124): 3129-3172.

Ferns collected from Mt. Pinatubo by A.D.E. Elmer were reported. A total of 95 species were found to be common in the Philippines. Nomenclature and concept of some genera follow Copeland's work. Description and habitat of each species are presented, including Elmer's general observations regarding each species. Distribution is not always indicated due to lack of information at that time.

Christensen, C. and R. C. Ching. 1935. *Pteridrys*, a new fern genus from tropical Asia. *Bulletin of Fan Memorial Institute of Biology* 5: 124-148.

Pteridrys is reported as a new genus. Of the seven species enumerated and described, the following are found in the Philippines: *P. syrmatoca* (Willd.) C. Chr. et Ching and *P. microthecia* (Fee) C. Chr. et Ching.

Chua, M. T., A. C. Santos, A. S. Maglaya and C. V. Bayquen. 1973. Chemical investigation on Philippine natural products. *National Research Council of the Philippines Research Bulletin* 28: 49-56.

This paper is a progress report embodying the results of a thin-layer chromatographic screening of sixteen Philippine pteridophytes: *Acrostichum aureum*, *Blechnum orientale*, *Ceratopteris thalictroides*, *Cheilanthes javensis* (*Cheilanthes densa*), *Pronephrium granulosum* (*Cyclosorus granulosus*), *Dicranopteris linearis*, *Diplazium esculentum*, *Drynaria sparsisora*, *Lycopodium cernuum*, *Lygodium japonicum*, *Microsorium scolopendria*, *Nephrolepis hirsutula*, *Psomiocarpa apiifolia*, *Pteris ensiformis*, *Selaginella peltata* and *Stenochlaena palustris* for steroid glycosides, sterines, sterols and flavone-like compounds.

Copeland, E. B. 1906. New Philippine ferns. *Philippine Journal of Science* 1 (suppl 2): 143-167 + 28 plates.

Enumeration and descriptions of 85 Philippine taxa of ferns 51 of which are reported as new to science: *Alsophila clementis* Copel. (new species),

Cyathea caudata (J. Sm.) Copel., *C. Christii* Copel. (new species), *Trichomanes merrillii* Copel. (new species), *Acrophorus stipellatus* (Wall.) Moore, *Polystichum Blepharistegium* Copel. (new species), *P. nudum* Copel. (new species), *Aspidium polymorphum* Wall., *A. angulatum* J. Sm., *Stenosemia pinnata* Copel. (new species), *Leptochilus hydrophyllus* Copel. (new species), *Nephrolepis glabra* Copel. (new species), *N. acutifolia* (Desv.) Christ, *Humata immersa* Mett. var. *nana* Copel. (new variety), *H. parvula* Copel. (new species), *Davallia embolostegia* Copel. (new species), *D. pallida* mettm., *Microlepia dennstaedtioides* Copel. (new species), *M. hirta* (Kaulf.) presl, *Dennstaedtia williamsii* Copel. (new species), *D. erythrorachis* (Christ) Diels, *Schizoloma ensifolium* (Sw.) J. Sm., *Lindsaya havicei* Copel. (new species), *L. cyathicola* Copel. (new species), *Loxogramme iridifolia* (Christ) Copel., *Diplazium tabacinum* Copel. (new species), *D. williamsii* Copel. (new species), *D. whitfordii* Copel. (new species), *D. fructuosum* Copel. (new species), *D. davaoense* Copel. (new species), *D. dolichosorum* Copel. (new species), *Asplenium stantoni* Copel. (new species), *A. vulcanicum* Bl., *A. horridum* Kaulf., *Scolopendrium schizocarpum* Copel. (new species), *Blechnum patersonii* (R. Br.) Mett., *B. patersonii* var. *majus* (new name), *B. vestitum* (Bl.) Kuhn, *Stenochlaena subtrifoliata* Copel. (new species), *Plagiogyria christii* Copel. (new species), *P. glauca* (Bl.) Mett., *P. tuberculata* Copel. (new species), *P. pycnophylla* (Presl) Mett., *P. pycnophylla* var. *mixta* Copel. (new variety), *P. stenoptera* (Hance) Diels, *Adiantum mindanaense* Copel. (new species), *A. spencerianum* Copel. (new species), *Schizostege pachysora* Copel. (new species), *S. calocarpa* Copel. (new species), *Pteris pluricaudata* Copel. (new species), *P. caesia* Copel. (new species), *Vittaria alternans* Copel. (new species), *V. taeniophylla* Copel. (new species), *Antrophyum latifolium* Bl., *Christiopteris sagitta* (Christ) Copel., *Prosaptia cryptocarpa* Copel. (new species), *P. toppingii* Copel. (new species), *Acrosorus* Copel. (new genus), *A. exaltata* Copel., *Polypodium dolichosorum* Copel. (new species), *P. decrescens* Christ, *P. inarticulatum* Copel., *P. pseudoarticulatum* Copel. (new species), *P. multicaudatum* Copel. (new species), *P. erythrotrichum* Copel. (new species), *P. yoderi* Copel., *P. tenuisectum* Bl., *P. (Schellolepis) pseudoconnatum* Copel. (new species), *P. argutum* Wall., *P. lineare* Thunb., *P. (Phymatodes) luzonicum* Copel. (new species), *P. (Phymatodes) dolichopterum* Copel. (new species), *P. (Phymatodes) proteus* Copel. (new species), *P. flexibum* Christ,

Dryostachyum splendens J. Sm, *D. pilosum* J. Sm., *Thayeria* Copel. (new genus), *T. cornucopia* Copel. (new species), *Elaphoglossum callaefolium* (Bl.) Moore, *Lomagramma pteroides* J. Sm. and *Gleichenia laevissima* Christ. (Summary of new taxa: 2 new genera, 46 new species, 2 new varieties and 1 new name).

Copeland, E. B. 1906. A new *Polypodium* and two varieties. *Leaflets of Philippine Botany* 1 (5): 78-79.

Descriptions of the fern *Polypodium monstrosum* Copel. and two varieties, namely, *P. monstrosum* Copel. var. *leucoplebium* Copel. and *P. monstrosum* var. *integriore* Copel. collected from Mount Banahao, Pagsanjan, Laguna, southern Luzon and from Bagner, Lepanto, northern Luzon, respectively.

Copeland, E. B. 1907. The comparative ecology of San Ramon *Polypodiaceae*. *Philippine Journal of Science* 2C (1): 1-76 + 4 plates.

In this paper, the subjects are discussed in the following order: (1) origin and geographic affinity of the San Ramon fern flora, (2) local physiography and classification by environment, (3) adaptations to common environment and to special conditions and (4) systematic application of the result. For a baseline on pteridophytic diversity, Copeland recorded a total of 184 species of ferns in the area (San Ramon is in Zamboanga del Sur, Mindanao): *Didymochlaena truncatula* J. Sm., *Cyclopeltis presliana* (J. Sm.) Berkeley, *Polystichum nudum* Copel., *P aristatum* (Sw.) Presl, *Mesochlaena polycarpa* R. Br., *Nephrodium* 1712, *Nephrodium* 1649, *Nephrodium* 1588, *Nephrodium* 1714, *Nephrodium* 1713, *Nephrodium erubescens* (Wall.) Diels, *N syrmaticum* (Willd.) Baker, *N sparsum* Don, *N intermedium* (Bl.) Baker, *N Bl.*) Baker, *N blumei* (Moore) Hook., *N setigerum* (Bl.) Baker, *N foxii* Copel., *N immersum* Hook., *N (Eunephrodium) truncatum* Presl, *N canescens* (Bl.) *nephrodiiformis* Christ, *N canescens*, *N diversifolium* Presl, *N assymmetricum* (Fee) Christ, *Nephrodium* 1617, *N lineatum* (Bl.) Presl, *N urophyllum* (Wall.) Bedd., *N aridum* (Don) J. Sm., *N cucullatum* (Bl.) Baker, *N ferox* Moore, *N pteroides* (Retz.) J. Sm., *N cyatheoides* (Kaulf.) Presl, *N procurrens* (Mett.) Baker, *Nephrodium* 1685, *Nephrodium* 1605, 1677, *Nephrodium* 11571, *N bordonii* Christ, *Meniscium triphyllum* Swartz?, *Aspidium difforme* Bl., *A decurrens* Presl, *A angulatum* J. Sm., *A leuzeanum* (Presl) Kunze, *A leuzeanum* var., *Psomiocarpa apiifolia* Presl, *Stenosemia*

aurita Presl, *S pinnata* Copel., *Leptochilus hydrophyllus* Copel., *L heteroclitus* (Presl) Chr., *L latifolius* (Meyen) Chr., *Dipteris conjugata* (Kaulf.) Reinw., *Arthropteris oblitterata* J. Sm., *Nephrolepis cordifolia* Presl, *N hirsutula* Presl, *N laurifolia* Christ, *Oleandra colubrina* var. *nitida* Copel., *O neriiformis* Cav., *Humata heterophylla* Desv., *H gaimardiana* (Gaud.) J. Sm., *H parvula* (Wall.) Mett., *Davallia brevipes* Copel., *D denticulata* (Burm.) Mett., *D pallida* Mett., *D solida* Sw., *D decurrens* Hook., *Microlepia hirsuta* (J. Sm.) Presl, *M pinnata* (Cav.) J. Sm., *M strigosa* (Thunb.) Presl, *M speluncae* (Linn.) Moore, *Odontosoria retusa* Cav., *Dennstaedtia smithii* (Hook.) Moore, *D williamsii* Copel., *D cuneata* (Hook.) Moore, *D erythrorachis* (Christ) Diels, *Lindsaya hymenophylloides* Bl., *L merrillii* Copel., *L havicei* Copel., *L scandens* Hook., *L gracilis* Blume, *L blumeana* (Hook.) Kuhn, *L decomposita* Willd., *L pulchella* (Hook.) Mett., *Coniogramme fraxinea* (Don) Diels, *C serrulata* (Bl.) Fee, *Loxogramme conferta* Copel., *L iridifolia* Christ, *L involuta* (Don) Presl, *Syngamma alismaefolia* (Presl) J. Sm., *Callipteris cordifolia* Bl., *C prolifera* Bory, *C esculenta* (Retz.) J. Sm., *Diplazium pallidum* Bl., *D* (near *tomentosum* Bl.), *D bulbiferum* Brack., *D tenrum* Presl, *D williamsii* Copel., *D dolichosorum* Copel., *D sorsogonense* Presl, *D meyenianum* Presl, *D fructuosum* Copel., *D polypodioides* Bl., *Asplenium musaefolium* Mett., *A phyllitides* Don, *A squamulatum* Bl., *A epiphyticum* Copel., *A subnormale* Copel., *A resectum* Sm., *A vulcanicum* Bl., *A tenerum* Forst., *A macrophyllum* Swartz, *A caudatus* Forst., *A cuneatum* Lam., *A affine* Sw., *A belangeri* Kze, *A scandens* J. Sm., *Athyrium sulvaticum* (Bl.) Milde, *Scolopendrium pinnatum* J. Sm., *S schizocarpum* Copel., *Stenochlaena* sp., *S subtrifoliata* Copel., *Blechnum egregium* Copel., *Adiantum Philippense* Linn., *A diaphanum* Bl., *A mindanaoense* Copel., *Schizostege calocarpa* Copel., *S pachysora* Copel., *Onychium tenue* Christ, *Pteris opaca* J. Sm., *P longifolia* Linn., *P melanocaulon* Fee, *P ensiformis* Burm., *P quadriaurita setigera*, *P pluricaudata* Copel., *P excelsa* Gaud., *P tripartita* Swartz, *Pteridium aquilinum* (Linn.) Kuhn, *Monogramma trichoidea* J. Sm., *Vittaria alternans* Copel., *V falcata* Kunze, *V minor* Fee, *Antrophyum latifolium* Bl., *A plantagineum* (Cav.) Kaulf., *A semicostatum* Bl., *A reticulatum* Kaulf., *Hymenolepis spicata* (Linn. F.) Presl, *Taenitis blechnoides* Swartz, *Nipholobolus varius* Kaulf., *N adnascens* (Sw.) Kaulf., *N lingua* (Thunb.) J. Sm., *N nummularifolius* (Sw.) J. Sm., *Prosaptia contigua* Presl, *P cryptocarpa* Copel., *Polypodium caespitosum* Mett., *P cucullatum* Nee, *P gracillimum*

Copel., *P pediculatum* Bak., *P celebicum* Bl., *P obliquatum* Bl., *P papillosum* Bl., *P (Goniophlebium) subauriculatum* Bl., *P beddomei* Bak., *P (Phymatodes) accedens* Bl., *P revolutum* (J. Sm.) Chr., *P punctatum* (Linn.) Christ, *P zippeli* Bl., *P musaefolium*, *P dolichopterum* Copel., *P incurvatum* Bl., *P commutatum* Bl., *P phymatodes* Linn., *P negriscens* Bl., *P schneideri* Christ, *P palmatum* Bl., *P angustatum* Bl., *P albido-squamatum* Bl., *P (Selligaea) caudiforme* Bl., *P macrophyllum* Mett., *P (Myrmecophila) sinuosum* Wall., *P (Drynariopsis) heracleum* Kunze, *Lecanopteris pumila* Bl., *Photinopteris speciosa* (Bl.) Presl, *Dryostachyum pilosum* J. Sm., *Thayeria cornucopia* Copel., *Drynaria quercifolia* (Linn.) J. Sm., *D rigidula* Sw., *Acrostichum aureum* Linn., *Lomagramma pteroides* J. Sm. and *Cheiropleuria bicuspis* Presl.

Copeland, E. B. 1907. Some new and critical ferns. *Leaflets of Philippine Botany* 1 (13): 233-235.

Descriptions of new and critical ferns from the Philippines: *Dennstaedtia elmeri* Copel. (new species), *Tectaria decurrens* (Presl) Copel., *Trichomanes bauerianum* Endl., *Stenochlaena laurifolia* Presl, *Elaphoglossum luzonicum* Copel. (new species), and *Dryopteris dubia* Copel., (new species).

Copeland, E. B. 1907. The comparative ecology of San Ramon *Polypodiaceae*. *Fern Bulletin* 15: 102-119. (Cited by W H Wagner Jr. *Taxon* 14: 33-41.

See Copeland, E. B. 1907. The comparative ecology of San Ramon *Polypodiaceae*. *Philippine Journal of Science* 2C: 1-76.

Copeland, E. B. 1907. Notes on the Steere collection of Philippine ferns. *Philippine Journal of Science* 2C (6): 405-407.

Dryopteris aoristosora (Harr.) C. Chr. is related to *D. canescens* (Bl.) C. Chr. *Nephrodium Bakeri* Harr. should be *Dryopteris Bakeri* (Harr.) Copel. (new combination). *Dryopteris lueri* (Harr.) C. Chr. may not be *D. foxii sensu* Christ. *Polystichum horizontale* Presl is *Aspidium aculeatum* Swartz by Harrington. *Hemionitis zollingeri* Kurz should be *Hemigramma latifolia* (Meyen) Copel. (new combination), *Asplenium lunulatum* Swartz should be *Asplenium tenerum* Forst. *Asplenium wightianum* Wall. should be *A. vulcanicum* B1. *Asplenium steerei* Harr. is *A. laxivenum* by Copeland. *Stenochlaena areolaris*

Asplenium steerei Harr. is *A. laxivenum* by Copeland. *Stenochlaena areolaris* (Harr.) Copel. (*Lomaria* Harr.) (new combination). *Monogramme paradoxa* (Fee) Bedd. also occurs in the Philippines. *Polypodium craterisorum* Harr. is *P. celebicum* Bl. *Polypodium hamatisorum* Harr. should be *P. nummularium* Mett. *Polypodium schenkii* should be *P. obliquatum* Bl.

Copeland, E. B. 1907. A revision of *Tectaria* with special regard to the Philippine species. *Philippine Journal of Science* 2C: 409-418.

Key to and annotations or descriptions of 17 Philippine species of the fern genus *Tectaria*: *T. bryanti* Copel., *T. decurrens* (Presl) Copel., *T. grandifolia* (Presl) Copel., *T. polymorpha* (Wall.) Copel., *T. irrigua* (J. Sm.) Copel., *T. siifolia* (Willd.) Copel., *T. barberi* Copel., *T. calcarea* (J. Sm.) Copel., *T. devexa* (Kze) Copel., *T. melanocaulon* (Bl.) Copel., *T. malayensis* (Christ.) Copel., *T. christii* Copel., *T. irregularis* (Presl) Copel. With three varieties: *euirregularis*, *macrodon* and *brongniartii*, and *T. leuzeana* (Gaud.) Copel. All except *T. decurrens* and *T. crenata* are new names.

Copeland, E. B. 1908. A revision of the Philippine species of *Athyrium*. *Philippine Journal of Science* 3C: 285-300.

Key to and notes on or descriptions of 46 species of the fern genus in the Philippines. Of these, 4 are new species, 1 is a new variety and 17 are new combinations: *A. hyalostegium*, *A. loheri*, *A. halconense*, *A. japonicum* (new combination), *A. acrotis*, *A. grammintoides*, *A. anisopterum*, *A. geophilum* (new species), *A. philippinense*, *A. aristulatum*, *A. stramineum* (new species), *A. drepanopteron*, *A. elmeri* (new species), *A. brevipinnulum* (new species), *A. meyenianum*, *A. nigripes* var. *mearnsianum* (new variety), *A. atratum* (new combination), *A. oligosorum* (new combination), *A. davaoense* (new combination), *A. dolichosorum* (new combination), *A. vestitum*, *A. fructuosum* (new combination), *A. ebum*, *A. cyatheaefolium*, *A. nigripes*, *A. esculentum* (new combination), *A. brachysoroides* (new combination), *A. deltoideum*, *A. sorsogonense*, *A. whitfordii* (new combination), *A. bosteri* (new combination), *A. crenatoseratum*, *A. pinnatum*, *A. inconspicuum*, *A. pallidum*, *A. accedens*, *A. cultratum*, *A. palauanense* (new combination), *A. fraxinifolium*, *A. tabacinum* (new combination), *A. pariens* (new combination), *A. cordifolium* (new combination). *A. cumingii*, *A. merrillii* (new combination).

Copeland, E. B. 1908. Fern genera new to the Philippines. *Philippine Journal of Science* 3 (5): 301-302.

Two fern genera are reported as new to the Philippines: (1) *Balantium* Kaulf. with the species *B. copelandii* and (2) *Brainea* Hook. with the species *B. insignis* Hook.

Copeland, E. B. 1908. Pteridophytes of the Horn of Negros. *Leaflets of Philippine Botany* 2 (19): 387-426.

A catalogue of pteridophytes collected from the Horn of Negros (a mountain more than 1,800 meters above sea level). The collection includes 14 new species and 3 varieties belonging to the families *Polypodiaceae*, *Cyatheaceae*, *Hymenophyllaceae*, *Schizaeaceae*, *Gleicheniaceae*, *Osmundaceae*, *Ophioglossaceae*, *Marattiaceae* and *Lycopodiaceae*. Key to the Philippine species of *Elaphoglossum* is provided.

Copeland, E. B. 1908. New species of *Cyathea*. *Philippine Journal of Science* 3C: 353-357.

Seven species (1 Chinese, 6 Philippine) of the fern genus *Cyathea* are reported or described: *Cyathea (Alsophila) atropurpurea* Copel. (Philippine), *C. nitrata* Copel. (Philippine), *C. (Alsophila) fenicis* Copel. (Philippine), *C. foxworthyi* Copel. (Philippine), *C. chinensis* Copel. (Chinese), *C. mearnsii* Copel. (Philippine), and *C. (Alsophila) curranii* Copel. (Philippine).

Copeland, E. B. 1909. The ferns of the Malay Asiatic Region. Part 1. *Philippine Journal of Science* 4 (1): K-65.

Copeland, E. B. 1911. New or interesting Philippine ferns, V. *Philippine Journal of Science* 6C (3): 145-148.

Descriptions and annotations of 10 species of ferns from the Philippines, namely: *Cyathea robinsonii*, *Dryopteris sessilipinna*, *Polypodium pulogense*, *Dryopteris melanophlebia*, *Monogramma capillaris* (all new species), new species (new combinations) *Davallodes kingii* (Bak.) Copel. (basionym: *Davallia kingii* Bak.), *Currania oyamensis* (Bak.) Copel. (basionym: *Polypodium oyamense* Bak.) and two interesting species, *Hymenophyllum subflabellatum* Ces. and *Polypodium pteropus* Bl.

Copeland, E. B. 1911. *Cyathea* Species Novae Orientales. *Philippine Journal of Science* 6: 359-367.

Descriptions of seven new species of *Cyathea* from the Orient with one species from the Philippines, viz., *C. trichophora* Copel. (Luzon, Laguna, San Antonio). The other six new species which are non-Philippine are *Cyathea subsessilis* Copel., *C. deorsilobata* Copel., *C. polensis* Copel., *C. stipulata* Copel., *C. longipinna* Copel. and *C. auriculifera* Copel.

Copeland, E. B. 1912. The genus *Thayeria*. *Philippine Journal of Science* 7 (1): 41-43.

This is a description of the fern genus *Thayeria* collected from the mountains north of Zamboanga. Taxonomic history of the genus is presented. Listed are two known species of *Thayeria*, namely, (1) *T. cornucopia* Copel (from Mindanao and Luzon) and (2) *T. nectarifera* (Baker) Copel (from Papua New Guinea).

Copeland, E. B. 1913. Some ferns of northeastern Mindanao. *Leaflets of Philippine Botany* 5 (9): 1679-1684.

Descriptions of fifteen species of ferns collected from northeastern Mindanao six of which are new to science: *Angiopteris elmeriana* Copel., *Cyathea (Alsophila) warihon* Copel., *C. (Alsophila) dimorphotrichia* Copel., *C. cinerea* Copel., *Dryopteris urdanetensis* Copel., and *Athyrium propinquum* Copel.

Copeland, E. B. 1916. Miscellaneous new ferns. *Philippine Journal of Science* 11 (1): 39-41.

Descriptions of seven new or interesting species of ferns 5 of which are from the Philippines: *Elaphoglossum parvum* Copeland (new species), *E. macgregori* Copel. (new species), *E. basilanicum* Copel. (new species), *Lomagramma bipinnata* Copel. (new species) and *Lygodium versteegii*.

Copeland, E. B. 1916. The genus *Loxogramme*. *Philippine Journal of Science* 11 (1): 43-47.

Description of the fern genus *Loxogramme*, key to the identification and descriptions of 16 species: *L. dimorpha* Copel., *L. conferta* Copel., *L. paltonioides* Copel., *L. iridifolia* (Christ) Copel., *L. brooksii* Copel., *L.*

parallela Copel., *L. lanceolata* (Sw.) Presl, *L. fauriei* Copel. (new species, Formosa), *L. malayana* Copel. (new species, Bourbon, East Equatorial Africa), *L. salvinii* (hook.) Maxon, *L. Blumeana* presl, *L. involuta* (Bl.) Presl, *L. grandis* (Racib.) Copel. and *L. forbesii* Copel.

Copeland, E. B. 1920. Few new ferns from Mt. Bulusan. *Leaflets of Philippine Botany* 9 (122): 3107-3111.

Descriptions of seven new species of ferns collected from Mt. Bulusan, Sorsogon, southern Luzon: *Davallia elmeri*, *Dennstaedtia philippinensis*, *Cyathea bicolorana*, *Cyathea bulusanensis*, *Haplodictyum heterophyllum*, *Haplodictyum majus* and *Athyrium ebenirachis*.

Copeland, E. B. 1926. *Filices aliquot Orientalis*. *Philippine Journal of Science* 30 (3): 325-331.

Descriptions of a new fern genus and 14 fern species from the Orient (Malaya, New Britain, China and the Philippines). The new taxa from the Philippines are the genus *Tectaridium* with two species (*T. macleanii* and *T. primitivum*), *Cyathea ramosii* and *C. zamboangana*.

Copeland, E. B. 1927. *Davallodes* and related genera. *Philippine Journal of Science* 34(3): 239-256.

Enumeration of the genera *Davallodes*, *Trogostolon*, *Leucostegia*, *Humata*, *Davallia* and *Scyphularia*. Description of a new genus (*Trogostolon*). Keys to the species of *Davallodes* and *Scyphularia*. Description of new species, proposed new combination for several species. Many taxa are non-Philippines. The following species from the Philippines were included in the paper: *Davallodes membranulosum* (Wall.) Copel. (new combination, non-Philippine) *D. gymnocarpum* Copel. (Philippines), *D. laxum* Copel. (new species), *D. hirsutum* (J. Sm.: Presl) Copel. (Philippines), *D. congestum* Copel. (new species), *D. urceolatum* Copel. (new species, non-Philippine), *D. dolichosorum* Copel. (new species, non-Philippine), *D. grammatosorum* Copel. (Philippines), *D. nephrodioides* Copel. (new combination), *D. viscidulum* v A v R (non-Philippine), *D. kingii* Copel. (non-Philippine), *D. borneense* (Hook.) Copel. (non-Philippine), *Trogostolon* Copel. (new genus), *T. falcinellus* (Presl) Copel., *Leucostegia immersa* (Wall.) Presl, *L. pallida*

(Mett.) Copel. (new combination), *Humata* Cav., *Davallia* Smith, *Scyphularia* Fee (all species non-Philippine): *S. pentaphylla* (Bl.) Fee. *S. pycnocarpa* (Brack.) Copel. (new combination), *S. sinusora* Copel. (new species), *S. triphylla* (Hook.) Fee and *S. simplicifolia* Copel.

Copeland, E. B. 1927. The genus *Calymodon*. *Philippine Journal of Science* 34 (3): 259-269.

Keys to and description of 12 species of the genus *Calymodon* (only four are reported for the Philippines). The species covered are: *C cucullatus* (Nee et Bl.) Presl (non-Philippine), *C pergracillimus* (v A v R) Copel. (new combination, non-Philippine), *C hyalinis* Copel. (new species, non-Philippine), *C muscoides* Copel. (Mindanao: Mt Apo), *C latealatus* Copel. (new species, non-Philippine), *C hygrosopicus* Copel. (new species, non-Philippine), *C gracilis* (Fee) Copel. (new combination, Philippines), *C ordinatus* Copel. (new species, Luzon), *C mnioides* Copel. (new species, non-Philippine), *C clavifer* (Hook.) Moore (Mindanao: Mt Apo), and *C conduplicatum* (Brause) Copel. (new combination, non-Philippine).

Copeland, E. B. 1928. *Leptochilus* and genera confused with it. *Philippine Journal of Science* 37 (4): 333-416.

Leptochilus is a genus of polyploid ferns related to Phymatodes which has often been confused with such oriental genera as *Christiopteris*, *Lomagramma*, *Campium*, *Hemigramma* and *Querciflix* (see Christensen's Index Filicum). This paper is an attempt to provide a solution to the problem.

Copeland, E. B. 1929. The fern genus *Plagiogyria*. *Philippine Journal of Science* 38: 377-417.

This work is a compendium of information (taxonomic, morphological, geographic) on 32 species known up to 1928 of the fern genus *Plagiogyria*. Oriental species and American species are treated separately. Some species (both Oriental and American) are described as new to science. Of interest among the Oriental lifeforms (Celebes, Java, Sumatra, Borneo, Philippines, Himalaya, China, Formosa and Japan) are the five species reported for the Philippines: *P christii* (Philippine endemic), *P glauca*, *P nana* (Philippine endemic), *P adnata* and *P falcata* (Philippine endemic).

Copeland, E. B. 1929. The oriental genera of *Polypodiaceae*. University of California Publications in Botany 16 (2): 45-128.

Enumeration of 35 genera of oriental (Malaya, Formosa, Papua New Guinea, China, Borneo, Java, Celebes, the Philippines, India and Japan) ferns belonging to the family *Polypodiaceae* with information and discussion on the type, affinities, geographical distribution, etc of each genus. The genera are: *Plagiogyria*, *Cyathea*, *Matteuccia*, *Onoclea*, *Diacalpe*, *Peranema*, *Monachosorum*, *Acrophorus*, *Stenolepia*, *Cystopteris*, *Woodsia*, *Ptilopteris*, *Dryopteris*, *Currania*, *Psomiocarpa* (Philippines only), *Haplodictyum* (Philippines only), *Sphaerostephanos*, *Dictyocline*, *Heterogonium*, *Stenosemia*, *Polystichum*, *Cyrtomium*, *Egenolfia*, *Cyclopeltis*, *Didymochlaena*, *Tectaria*, *Tectaridium* (Philippines only), *Hemigramma*, *Querciflix*, *Cionidium*, *Luerssenia*, *Blechnum*, *Brainea*, *Woodwardia*, *Sadleria*, *Asplenium*, *Ceterac* or *Ceterach*, *Pleurosorus*, *Camptosorus*, *Phyllitis*, *Diplora*, *Boniniella*, *Diella*, *Stenochlaena*, *Lomagramma*, *Thysanosoria*, *Dicksonia*, *Cibotium*, *Cystodium*, *Nephrolepis*, *Orthiopteris*, *Ithcaulon* (new genus, non-Philippine), *Balantium*, *Dennstaedtia*, *Microlepia*, *Oenotrichia* (new genus, non-Philippine), *Tapeinidium*, *Sphenomeris*, *Protolindsaya*, *Lindsaya*, *Schizoloma*, *Taenitis*, *Syngamma*, *Craspedodictyum*, *Hemionitis*, *Gymnopteris*, *Aspleniopsis*, *Pityrogramma*, *Anogramme*, *Leptolepia*, *Hypolepis*, *Paesia*, *Pteridium*, *Histiopteris*, *Pteris*, *Coniogramme*, *Acrostichum*, *Schizostege*, *Cheilanthes*, *Notholaena*, *Pellaea*, *Dryopteris*, *Onychium*, *Actiniopteris*, *Neurosoria*, *Cheilanthopsis*, *Adiantum*, *Oleandra*, *Araiostegia*, *Davallodes*, *Trogostolon* (Philippines only), *Leucostegia*, *Humata*, *Davallia*, *Scyphularia*, *Arthropteris*, *Matonia*, *Phanerosorus*, *Dipteris*, *Christiopteris*, *Cheiropleuria*, *Hymenolepis*, *Neocheiropteris*, *Platynerium*, *Cyclocosorus*, *Drymoglossum*, *Elaphoglossum*, *Polypodium*, *Prosaptia*, *Grammitis*, *Oreogrammitis*, *Cochlidium*, *Calymmodon*, *Acrosorus*, *Loxogramme*, *Paltonium*, *Goniophlebium*, *Microsorium*, *Diblemma* (Philippines only), *Leptochilus*, *Dictymia*, *Selliguea*, *Campium*, *Dendroconche*, *Aglaoomorpha*, *Drynaria*, *Thayeria*, *Merinthosorus*, *Photinopteris*, *Lecanopteris*, *Phlebodium*, *Antrophyum*, *Vittaria*, *Vaginularia* and *Monogramma*.

Of the 135 genera, 2 are described as new (*Ithcaulon*, *Oenotrichia*, both non-Philippine), 84 genera (Philippine and other oriental combined); have 44

absent from the Philippines, and 5 genera occur in the Philippines only (*Psomiocarpa*, *Haplodictyum*, *Tectaridium*, *Trogostolon* and *Diblemma*).

Copeland, E. B. 1929. New or interesting ferns, VII. *Philippine Journal of Science* 46: 209-220.

The ferns described or discussed in this paper were collected from Mount Matutum (an extinct volcano standing above Sarangani Bay in southeastern Mindanao. It is the farthest south of the high mountains of the country.). Of the 33 species described, 19 are reported as new to science. These are: *Osmunda herbacea* Copel., *Gleichenia peltophora* Copel., *Dryopteris gracilis* Copel., *D elmeriorum* Copel., *D diminuta* Copel., *D matutumensis* Copel., *Athyrium oreopteris* Copel., *A tenuifolium* Copel., *A calliphyllum* Copel., *Microlepia doniana* Copel., *Pteris quinquepartita* Copel., *Campium membranaceum* Copel., *C enerve* Copel., *C subcoriacea* Copel., *Lomagramma subcoriacea* Copel., *Polypodium spongiosum* Copel., *P bulbotrichum* Copel., *P heanophyllum* Copel., *Prosaptia urceolare* (Hayata) Copel.. new combination (basonym: *Polypodium urceolare* Hayata, Ic P1 Form 5: 324. 1915) and *Vittaria stenophylla* Copel.

The remainder, which were previously known, are: *Cyathea leytenensis* Copel., *Dryopteris gymnocarpa* Copel., *D ryzalensis* Christ, *D pilosiuclula* (Zipp.) C. Chr., *D xiphioides* Christ, *D diversiloba* Christ, *Asplenium elmeri* Christ, *Coniogramme subcordata* Copel., *Microlepia trapeziformis* (Roxb.) Kuhn, *Hymenolepis callifolia* Christ, *Elaphoglossum angulatum* (Bl.) Moore, *Polypodium millefolium* Bl. and *P sumatranum* Bak.

Copeland, E. B. 1931. New or interesting oriental ferns. *Philippine Journal of Science* 46 (2): 207-220.

Enumeration and descriptions of 21 species of pteridophytes (1 lycopod and 19 species of ferns). Of the ferns, 12 are new species. Key to the 9 species of *Oleandra* of the Philippines. All but two species are Philippine lifeforms. The various species are: *Lycopodium edanoi* Copel. (new species), *Cyathea bontocensis* Copel. (new species), *C calocoma* (Christ) Copel., *C contaminans* (Wall.) Copel., *C edanoi* Copel. (new species), *C merrillii* Copel. (new species), *C pustulosa* (Christ) Copel., *C squamicosta* Copel. (new species), *Dryopteris clemensiae* Copel. (new species), *D parasitica* (Linn.) O.K., *Athyrium ophiodontum* Copel. (new species). *Asplenium*

finlaysonianum Wall., *A tripinnatifidum* Copel. (new species), *Stenochlaena Smithii* (Fee) Underw., *Lindsaya longa* Copel. (new species), *Oleandra benguetensis* Copel. (new species), *O scandens* Copel. (new species), *Grammitis limampes* Copel. (non-Philippine, new species), *G multifolia* Copel. (non-Philippine), *G stenocrypta* Copel. (new species) and *Campium subsimplex* (Fee) Copel.

Copeland, E. B. 1931. Philippine ferns collected by R S Williams. *Brittonia* 1 (2): 67-70.

The species of ferns described or noted in the paper belong to a large, well-collected, and skillfully prepared collection made during the years 1903 to 1905. This collection contained a remarkable number of species not previously known to science. The localities where R. S. Williams collected, i.e., Mount Mariveles and Lamao River, Baguio and Mount Santo Tomas, Los Baños and Mount Makiling in Luzon, Mount Apo and the Sax River region at San Ramon in Mindanao, have since become classic grounds in fern literature. The fact that he found anything which had escaped the notice of many other collectors is evidence of the thoroughness of Williams work.

Copeland, E. B. 1933. *Trichomanes*. *Philippine Journal of Science* 51 (2): 119-280.

Key to, descriptions and interpretations of the status of 112 species of *Trichomanes* and 1 species of *Cardiomanes*. This monographic work includes 24 species from the Philippines (4 described as new to science). The concerned Philippine species are: *Trichomanes pallidum* Bl. (Luzon, rare in northern Luzon), *T minutum* Bl. (not rare in the Philippines), *T diffusum* Bl. (from Mount Makiling, Laguna, Luzon), *T (Gonocormus) alagense* Christ (Mindoro, Alag River), *T digitatum* Swartz (not rare in the Philippines), *T gracillimum* Copel. (Luzon, Mindoro, Palawan), *T craspedoneurum* Copel. (southern Luzon), *T mindorenses* Christ (Mindoro), *T johntonense* Bailey (Negros, etc), *T auriculatum* Bl. (Philippines, common) *T grande* Copel. (Philippines), *T blepharistomum* Copel. (new species) (Batan Island, Luzon), *T apiifolium* Presl (Philippines), *T obscurum* Bl. (Philippines), *T extravagans* Copel. (new species) (Luzon), *T asplenioides* Presl (Batanes to Basilan, absent in Palawan), *T atrovirens* Kunze (not rare in the Philippines), *T crassum* Copel. (Leyte) (new species), *T cumingii* Chr. (Luzon to southern

Mindanao, Palawan), *T setaceum* van den Bosch (Palawan), *T meifolium* Bory (north to central Luzon), and *T gemmatum* J. Sm. (Luzon: Mount Banahao).

Copeland, E. B. 1935. New or interesting Philippine ferns, VIII. *Philippine Journal of Science* 56 (2): 97-110.

This paper covers 22 species 12 of which are new to science and 4 new combinations (new names): *Ophioglossum ramosii* Copel. (new species), *Cyathea bipinnatifida* Copel. (new species), *C umbrosa* Copel. (new species), *C pterodioides* Copel. (new species), *Dryopteris squamipes* Copel. (new species), *D. preslii* Christ, *D laserpitiifolia* (Scort.) C. Christ, *D philippinensis* (Bak.) Copel. (new combination), *D diversifolia* (presl) Christ, *D rhombea* (Christ) Copel. (new combination), *D lanceola* (Christ) Copel. (new combination), *D maquilangensis* Copel. (new species), *Athyrium elmeri* Copel., *Lomariopsis papyracea* Copel. (new species), *P pachycaulum* Copel. (new species), *Grammitis microtricha* Copel. (new species), *Loxogramme major* Copel. (new species), *Goniophlebium terrestre* Copel. (new species), *P incurvatum* Bl. and *Ceratopteris siliquosa* (Linn.) Copel. (new combination).

Copeland, E. B. 1936. The Philippine ferns collected by J B Steere. *Philippine Journal of Science* 60 (1): 19-25.

This collection was in part the subject of a paper by N W Harrington in the Journal of the Linnean Society 16 (1877) 25. Here, the species listed are: *Cyathea spinulosa* Wall. (Balabac), *Alsophila latebrosa* Hook. (Mt Banahao), *Hymenophyllum thuidium* Harr. (Panay), *H polyanthos* Swartz (Panay), *H javanicum* Spreng. (Mt Banahao), *H dilatatum* Swartz (Mt Banahao), *H tunbridgense* Smith (Mt Banahao), *H fraternum* Harr. (Panay), *H neesii* Hook. (Mt Banahao), *Trichomanes parvulum* Poir. (Mt Banahao), *T digitatum* Swartz (Mt Banahao), *T pallidum* Bl (Mt Banahao), *T auriculatum* Blume (Luzon), *T smithii* Hook. (Mt Banahao), *T. apiifolium* Presl (Mt Banahao), *T rigidum* Swartz (Panay), *Davallia pedata* Smith (Mt Banahao), *D affinis* Hook. (Mt Banahao), *D vestita* Bl. (Mt Banahao), *D puchella* Hook. (Luzon), *D repens* Desv. (Philippines), *D contigua* Swartz (Luzon), *D elegans* Swartz (Mt Banahao), *D (Microlepia) philippinensis* Harr. (Mt Banahao), *Lindsaya concinna* J. Sm. (Philippines), *L lorata* Poir. (Luzon, Balabac), *L davallioides* Bl. (Panay), *Adiantum lunulatum* Burm. (Balabac), *Cheilanthes tenuifolia*

Swartz (Balabac), *Peris incisa* Thunb. (Luzon), *Lomaria areolaris* Harr. (Mahayhay, Laguna), *Asplenium nidus* Linn., *A wightianum* Wall. (Mt Banahao), *A lunulatum* Swartz (Panay), *A steerei* Harr. (Mt Banahao), *A affine* Swartz (Mt Banahao), *A cultratum* Mett. (Mt Banahao), *A resectum* Sm. (Panay), *A bantamense* Bak. (Balabac), *Didymochlaena lunulata* Desv. (Panay), *Aspidium aculeatum* Swartz (Mt Banahao), *A aristatum* Swartz (Panay), *Nephrodium luersseni* Harr. (Philippines), *N bakeri* Harr. (Panay), *N molle* Desv. (Panay), *N truncatum* Presl (Luzon), *Nephrolepis acuta* Presl (Mahayhay, Laguna), *N ramosa* Moore (Basilan), *Polypodium urophyllum* Wall. (Balabac?), *P (Goniopteris) aoristorum* Harr. (Panay), *P hirtellum* Blume (Luzon), *P cucullatum* Nee (Luzon), *P minutum* Bl. (Luzon), *P schenkii* Harr. (Mt Banahao), *P craterisorum* Harr. (Mt Banahao), *P adnascens* Swartz. (Philippines), *P (Phymatodes) hammatorum* Harr. (Mt Banahao), *P heterocarpum* Bl. (Philippines), *P dipteris* Bl. (Mt Banahao), *P palmatum* Bl. (Mt Banahao), *P rupestre* Bl. (Mt Banahao), *Gymnogramme macrophylla* Hook. (Luzon), *Antrophyum immersum* Mett. (Philippines), *A callaeifolium* Bl. (Philippines), *A semicostatum* Bl. (Mt Banahao), *Vittaria elongata* Swartz (Balabac), *V falcata* Fee (Luzon), *Drymoglossum piloselloides* Presl (Luzon), *Hemionitis zollingeri* Kurz. (Panay), *Acrostichum latifolium* Swartz*, *A aureum* L. (Balabac), *A platyrhynchos* Hook. (Luzon), *A spicatum* Linn.*, *A axillare* Cav. (Mt Banahao), *Lygodium dichotomum* Swartz (Balabac), *L scandens* Swartz (Mahayhay, Laguna), *Angiopteris evecta* Hook. (Mahayhay, Laguna), *Helminthostachys zeylanica* Hook. (Balabac).

Copeland, E. B. and T. G. Collado. 1936. Crop ferns. *Philippine Journal of Agriculture* 7: 367-377.

See Copeland E. B. 1942. Edible ferns. *American Fern Journal* 32 (4): 121-126.

Copeland, E. B. 1937. *Hymenophyllum*. *Philippine Journal of Science* 64 (1-2): 1-88.

In this world monograph, the fern genus *Hymenophyllum* of the family *Hymenophyllaceae* is divided into nine subgenera: *Meringium* (with 45 species), *Amphipterum* (with 4 species), *Myriodon* (with 1 species), *Memicyatheon* (with 2 species), *Euhymenophyllum* (with 16 species), *Mecodium* (with 5 species), *Craspedophyllum* (with species), *Sphaerocionium* (with 11 species)

and *A teropteris* (with 1 species). Total number of species is 133 of which the most diverse are *Meringuim* and *Mecodium*.

Copeland, E. B. 1940. Notes on *Hymenophyllaceae*. *Philippine Journal of Science* 73: 457-469.

Enumeration, annotation or descriptions of 28 species (25 mostly from New Guinea and 3 from Philippines) which include 9 new species (New Guinea), 1 new species (Philippines) and 9 new combinations (New Guinea): *Mincrotrichomanes dichotomum* (Kze) Copel., *M armstrongii* (Bak.) Copel. (new combination), *Mecodium atrovirens* (Col.) Copel. (new combination), *M novoguineensis* (Ros.) Copel. (new combination), *M archboldii* Copel. (new species), *M bismarckianum* (Christ) Copel. (new combination), *M ooides* (FVM and Baker) Copel., *M badium* (H and G) Copel., *M gorgoneum* Copel., *Meringuim minimum* (A. Rich.) Copel. (new combination), *M archboldii* Copel. (new species), *M melanosorum* Copel. (new species), *M foersteri* (Ros.) Copel. (new combination), *M brassi* (C. Chr.) Copel. (new combination), *M bartlettii* Copel. (Mindanao) (new species), *Amphipterum humatiodes* Copel. (new species), *Vandenboschia schmidiana* (Zenker) Copel., *V angustata* (Carm.) Copel. (new combination), *Pleuromanens retusum* Copel. (new species), *P pallidum* (Bl.) Presl, *Crepidomanes rupiculum* (Racib.) Copel. (Mindanao), *C brevipes* (Presl) Copel., *Conocormus novoguineensis* (Brause) Copel. (new combination), *Selenodesmium obscurum* (Bl.) Copel., *Cephalomanes oblongifolium* Presl (most common species in the Philippines) and *Macroglena schlechteri* (Brause) Copel.

Copeland, E. B. 1942. Edible ferns. *American Fern Journal* 32 (4): 121-126.

Information on the salient features, mode of cultivation (in rice paddies) and harvesting of the edible ferns *Diplazium esculentum* (*Athyrium esculentum*, pako) and *Ceratopteris thalictroides* (*C siliquosa*, sungai usa) are presented. Mention is made of other edible ferns, i.e., *Helminthostachys zeylanica* (tungkod langit), *Ampelopteris prolifera* (*Dryopteris prolifera*, pakong kalabao), *Pteridium esculentum* (*Pteris*, Polynesia) and *Ceratopteris pterodoides* (American species) with comments on their respective suitabilities as food plants and their potentialities as crop plants.

Copeland, E. B. 1947. *Genera Filicum*. Chronica Botanica Company: Waltham: Massachusetts.

This 247-page book is an account of the fern flora of the world in which 308 genera belonging to 22 families are described, annotated and interpreted. Of the 308 genera, 145 (47 %) are recorded as from the Philippines. These are *Ophioglossum*, *Botrychium*, *Helminthostachys*, *Angiopteris*, *Marattia*, *Christensenia*, *Osmunda*, *Schizaea*, *Gleichenia*, *Sticherus*, *Hicriopteris*, *Dicranopteris*, *Mecodium*, *Sphaerocionium*, *Microtrichomanes*, *Meringium*, *Vandenboschia*, *Pleuromanens*, *Gonocormus*, *Crepidopteris*, *Crepidomanes*, *Microgonium*, *Callistopteris*, *Nesopteris*, *Cephalomanes*, *Selenodesmium*, *Macroglena*, *Abrodictyum*, *Dicksonia*, *Cibotium*, *Culcita*, *Orthiopteris*, *Dennstaedtia*, *Microlepia*, *Monachosorum*, *Lindsaea*, *Tapeinidium*, *Sphenomeris*, *Isoloma*, *Schizoloma*, *Taenitis*, *Syngamma*, *Hypolepis*, *Paesia*, *Pteridium*, *Histiopteris*, *Pteris*, *Schizostegia*, *Coniogramme*, *Acrostichum*, *Cheilanthes*, *Aleuritopteris*, *Doryopteris*, *Onychium*, *Hemionitis*, *Pityrogramma*, *Adiantum*, *Ceratopteris*, *Araiostegia*, *Leucostegia*, *Davallodes*, *Trogostolon*, *Davallia*, *Humata*, *Oleandra*, *Nephrolepis*, *Arthropteris*, *Plagiogyria*, *Cyathea*, *Gymnosphaeria*, *Diacalpe*, *Peranema*, *Acrophorus*, *Hypodematum*, *Polystichum*, *Phanerophlebia*, *Cyclopeltis*, *Didymochlaena*, *Rumorha*, *Bolbitis*, *Edanyoa*, *Egenolfia*, *Lomariopsis*, *Teratophyllum*, *Arthrobotrys*, *Lomagramma*, *Elaphoglossum*, *Dryopteris*, *Ctenitis*, *Psomiocarpa*, *Pteridrys*, *Heterogonium*, *Stenosemia*, *Tectaria*, *Tectaridium*, *Hemigramma*, *Lastrea*, *Currania*, *Cyclosorus*, *Ampelopteris*, *Haplodictyum*, *Sphaerostephanos*, *Athyrium*, *Anisocampium*, *Callipteris*, *Diplaziopsis*, *Blechnum*, *Brainea*, *Woodwardia*, *Stenochlaena*, *Asplenium*, *Dipteris*, *Cheiropleuria*, *Christiopteris*, *Platyserium*, *Goniophlebium*, *Thylacopteris*, *Pleopeltis*, *Neocheiropteris*, *Lemmaphyllum*, *Paragramma*, *Weatherbya*, *Belvisia*, *Pyrrosia*, *Pteropsis*, *Microsorium*, *Diblemma*, *Leptochilus*, *Anapausia*, *Colysis*, *Dendroglossa*, *Drynariopsis*, *Aglaomorpha*, *Thayeria*, *Photinopteris*, *Drynaria*, *Lecanopteris*, *Crypsinus*, *Selliguea*, *Arthromeris*, *Grammitis*, *Scleroglossum*, *Xiphopteris*, *Calymmodon*, *Acrosorus*, *Ctenopteris*, *Prosaptia*, *Loxogramma*, *Antrophyum*, *Vittaria*, *Vaginularia*, *Monogramma*.

At the time the book was released, 9 endemic genera were recognized for the Philippines, namely: *Trogostolon*, *Psomiocarpa*, *Heterogonium*,

Tectaridium, *Edanyoa*, *Haplodictyum*, *Diblemma*, *Thayeria* and *Schizostege*. (This is no longer true. Most of these have been reduced to synonymy while additional new genera have been produced for the Philippines.)

Copeland, E. B. 1947. *Genera Filicum*. Chronica Botanica. Waltham: Massachusetts.

See Price, M. G. 1972. A summary of our present knowledge of the ferns of the Philippines. *Kalikasan*, Philippine Journal of Biology 1 (1): 17-53. See also Holttum R. E. 1973 Copeland's contribution to fern taxonomy. *Philippine Agriculturist* 57: 17-20.

Copeland, E. B. 1950 The origin of the Philippine fern flora. *Philippine Journal of Science* 79 (1): 1-5.

Presented before the Philippine Orchid Society on 24 May 1949, Dr. Copeland discussed the possibility that the fern flora of the Philippines owe their origin thru immigration via three possible immediate sources (routes): (1) Continental Asia, from China to northern Luzon, (2) from the southwest, immediately from Borneo and (3) from the south and southeast, immediately from Celebes and New Guinea; eventually from a source which has not until recently been obvious and not usually suspected. Considering the information presented, Dr. Copeland concluded that whatever the route, about 90 per cent of our non-endemic species are of direct or indirect New Guinea origin.

Copeland, E. B. 1952 *Grammitis*. *Philippine Journal of Science* 80 (1951, 2): 93-271.

In this work, a world monograph of the fern genus *Grammitis* is presented by geographic groups, namely: (1) Australian group of species, (2) American group of species, (3) Madagascar-African group of species, (4) Pacific Islands group of species, (5) New Guinea group of species and (6) the Malay-Asiatic group of species (the Philippine species are included here). Keys to and descriptions of the species are provided. Of interest are the 19 Philippine species included which are: *Grammitis caespitosa* Blume, *G stenocrypta* Copel., *G fasciata* Blume, *G padangensis* (Baker) Copel. (new combination: basionym: *Polypodium padangense* Baker), *G loheriana* (Chr.)

Copel. (new combination: basionym: *Polypodium loherianum* Christ), *G adspera* Blume, *G congener* Blume, *G fenicis* Copel., *G microtricha* Copel., *G sumatrana* (Baker) Copel., *G bulbotricha* Copel., *G merrillii* (Copel.) Copel. (new combination: basionym: *Polypodium merrillii* Copel.), *G jagoriana* (Mett.) Copel., *G dolichosora* (Copel.) Copel. (new combination: basionym: *Polypodium dolichosora* Copel.), *G setosa* Blume, *G knutsfordiana* (Baker) Copel., *G reinwardtii* Copel., *G fasciculata* Blume and *G marivelescencis* Copel.

Copeland, E. B. 1952 New Philippine ferns, IX. *Philippine Journal of Science* 81 (1): 1-45.

Enumeration and descriptions of 95 Philippine fern taxa: 1 new genus, 91 new species, 1 new combination and 2 previously known species: *Mecodium edanoi* Copel. (new species), *Microtrichomanes zamboanganum* Copel. (new species), *Sticherus perpaleaceus* Copel. (new species), *Dicranopteris curranii* Copel. (new species), *Hicriopteris paleacea* Copel. (new species), *Dennstaedtia macgregorii* Copel. (new species), *D fusca* Copel. (new species), *Microlepia protracta* Copel. (new species), *Lindsaya angusta* Copel. (new species), *L cultripinna* Copel. (new species), *L decrescens* Copel. (new species), *L roxasii* Copel. (new species), *Pteris brevis* Copel. (new species), *P dataensis* Copel. (new species), *P elmeri* Christ (in herb.) (new species), *P edanoi* Copel. (new species), *P loheri* Copel. (new species), *P melanorhachis* Copel., (new species), *P micronulata* Copel. (new species), *P micracantha* Copel. (new species), *P pedicellata* Copel., (new species), *P ramosii* (new species), *P rigidula* Copel. (new species), *P squamipes* Copel. (new species), *Oleandra herrei* Copel. (new species), *O clemensiae* Copel. (new species), *Nephrolepis pubescens* Copel. (new species), *Cyathea breviloba* Copel. (new species), *C dura* Copel. (new species), *C indusiosa* Copel. (new species), *C setulosa* Copel. (new species) *C acuminata* Copel. (new species), *C lobata* Copel. (new species), *C ferrugineoides* Copel. (new species), *C camaguinensis* Copel. (new species), *C lepidigera* Copel. (new species), *C masappilidensis* Copel. (new species), *C argyrolepis* Copel. (new species), *C sulitii* Copel. (new species), *C brevipes* Copel. (new species), *Gymnosphaera dinagatensis* Copel. (new species), *Polystichum pulogensis* Copel. (new species), *P aquilinum* Copel. (new species) *P fuscum* Copel.

(new species), *P elmeri* Copel. (new species), *Cyclopeltis zamboangana* Copel. (new species), *Bolbitis edanyoi* Copel. (new species), *B foxi* Copel. (new species), *Edanyoa* Copel. (new genus), *E difformis* Copel. (new species), *Lomagramma pedicellata* Copel. (new species), *Ctenitis mearnsii* Copel. (new species), *C paleolata* Copel. (new species), *C ramosii* Copel. (new species), *C wenzelii* Copel. (new species), *Tectaria loheri* Copel. (new species), *T sulitii* Copel. (new species), *Lastrea cavitensis* Copel. (new species), *Cyclosorus leucadenius* Copel. (new species), *C rigidus* Copel. (new species), *C irayensis* Copel. (new species), *C benguetensis* Copel. (new species), *C stenodontus* Copel. (new species), *C sagittifolioides* Copel. (new species), *C halconensis* Copel. (new species), *C erectus* Copel. (new species), *C magnus* Copel. (new species), *C boholensis* Copel. (new species), *C duplosetosus* Copel. (new species), *C aoristisorus* (Harr.) Copel., *C lobatus* Copel. (new species), *C glaber* Copel. (new species), *C viridis* Copel. (new species), *C samarensis* Copel. (new species), *C serratus* Copel. (new species), *C weberi* Copel. (new species), *C edanyoi* Copel. (new species), *C pustulosus* Copel. (new species), *C subdimorphus* Copel. (new species), *Athyrium irigense* Copel. (new species), *A irayense* Copel. (new species), *A magnificum* Copel. (new species), *A melanopodium* Fee, *A parvum* Copel. (new species), *A symmetricum* Copel. (new species), *Goniophlebium integrum* Copel. (new species), *Microsorium rizalense* (Merr.) Copel. (new combination), *Pyrrosia philippinensis* Copel. (new species), *Crypsinus ramosii* Copel. (new species), *C subdimorphus* Copel. (new species), *Selliguea matutumensis* Copel. (new species), *Acrosorus symmetricus* Copel. (new species), *Ctenopteris micropora* Copel. (new species), *C matutumensis* Copel. (new species) and *Vittaria hecistophylla* Copel. (new species).

Copeland, E. B. 1954. New Philippine ferns, X. *Philippine Journal of Science* 83 (2): 97-99.

Descriptions of six new species of Philippine ferns: *Asplenium subresectum* Copel., *Polystichum edanoi* Copel., *Ctenitis laxa* Copel., *Sticherus pinnatus* Copel., *Tectaria peralata* Copel. and *Cyclosorus dimorphus* Copel.

Copeland, E. B. 1955. New Philippine ferns, XI. *Philippine Journal of Science* 84 (2): 161-163.

Descriptions of six species of Philippine ferns: *Cyclosorus polypterus* Copel. (new species, Negros: Mt Canlaon), *Stenosemia dimorpha* Copel. (new species, Negros Occidental: Kinabkaban River), *Lomagramma cordata* Copel. (new species, Biliran), *Cyathea arborescens* Copel. (new species, Negros: Mt Canlaon), *C. biliranensis* Copel. (new species, Biliran), *Macroglena obtusa* Copel. (new species, Negros Occidental: Kinabkaban River).

Copeland, E. B. 1958-1960. Fern Flora of the Philippines. National Institute of Science and Technology, Manila. Volumes I-III.

See Price M G 1972 Summary of our present knowledge of the ferns of the Philippines. *Kalikasan, Philippine Journal of Biology* 1 (1): 17-53. See also Hottum R E 1973. Copeland's contribution to fern taxonomy. *Philippine Agriculturist* 57: 17-20.

Gay H. E. Hennipman, C. R. Huxley and F. J. E. Parrott 1998. The taxonomy, distribution and ecology of the epiphytic Malesian ant-fern *Lecanopteris* Reinw. (*Polypodiaceae*) *Garden's Bulletin (Singapore)* 45: 298-335.

Thirteen species, key, synonymy, diagnoses, notes.

Hennipman, E. 1969. Review: "R. E. Holttum, A revised Flora of Malaya, etc. Volume II. *Ferns of Malaya* 2nd ed. Government Printing Office, Singapore 1966. 653 pages". *Blumea* 17: 265.

Professor Holttum's book on the ferns of Malaya is regarded as a major contribution to the systematics of ferns and is the result of several decades of active study by an expert botanist. Based on both living and dried material, it goes far beyond what is generally found in flora. There is still no general agreement among pteridologists as to the division and status of the major groups, often implying original ideas are of particular interest. Detailed ecological information is provided for nearly all the species involved. It is not surprising that despite a second printing in 1960, the book is again out of print. An unchanged reprint was unsatisfactory as in recent years, several species new to Malaya were discovered (mainly thanks to Mrs. Allen) and

important new information on several groups has become available. A revision of the book seemed necessary but the author's activities seemed to leave a little time for this.

Compared with the original edition, a few errors have been corrected in the text itself, e.g., the description of *Dryopteris* and *Polystichum*, and asterisks added in the margin before several taxa, refer to appendix II (Appendix I, written by Prof. Manton and dealing with cytological aspects was already included). The new appendix includes further corrections, name changes, new records, several new keys and comments. These apply mainly to families studied recently by the author for the Flora Malesiana, and to *Ophioglossum* (based on Wieffering's studies*), *Diplazium* which was formerly united by Holttum with *Athyrium* but is now recognized as a separate genus, and *Polypodium* species which are rightly considered to be better included in *Thylacopteris* and *Goniophlebium*. The many names mentioned in the appendix can only be traced by indirect reference as they have not been included in the original index, although the appendix is placed before the index which is continuously paged. For those possessing the first edition, it would doubtless have been more practical if appendix II was (also) separately published (preferably with its own index) next to the present edition. This well-printed and illustrated book should be on the shelf of every pteridologist both professional and amateur. The price is moderate.

Hennipman, E. 1970. *Some novelties in Bolbitis from Asia and the Pacific (Filices)*. Blumea 18 (1): 147-149.

Listed are five species, two subspecies and five varieties of *Bolbitis*, together with distribution and synonyms. *B. inuata* (Presl) Hennipman are found in the Philippines with Sorsogon and Manila as type locality.

Hennipman, E. 1977. *A Monograph of the Fern Genus Bolbitis (Lomariopsidaceae)*. Leiden University Press: Leiden Bot Ser 2: xii-331.

Complete monograph with new sectional subdivisions. Key to 44 species, and a number of hybrids and dubious species. Extensive valuable introduction on morphological and other characters, chromosomes and especially the influence of neoteny in phylogeny. Two new species (one from India formerly

described as variety; one from Louisiades) and a few new varieties and forms. Identification list is given.

See Holtum R E 1978. Review: "Hennipman E A Monograph of the Fern Genus *Bolbitis* (Lomariopsidaceae), 331 pages, 87 figures (1977), Nijhoff, Box 442. The Hague, Netherlands."

Hennipman, E. 1977. A Monograph of the Fern Genus *Bolbitis* (Lomariopsidaceae). Leiden Botanical Series Number 2: 1-331.

The study deals with systematic and taxonomic problems in the acrostichoid fern genus *Bolbitis* (Lomariopsidaceae). The taxonomy of the genus *Bolbitis* was seriously misunderstood in the past – parallel evolution obscured true relationships – and a rather intricate synonymy has resulted. A brief historical sketch of its taxonomic adventures is worked out. The gross morphological criteria used for the discrimination of the species by Copeland (who revised series *Egenolfianae* in 1931) could not be applied satisfactorily to the ample material at hand. Several features of the sporophyte were analyzed in detail, including rhizome – and petiole-anatomy, venation pattern and spore morphology with morphology, the results described and discussed. The possible occurrence of hybridization and polyploidization was also investigated. For this purpose, a collection of different species was cultivated and the mitotic and/or meiotic chromosome number and behaviour recorded. A limited number of species were also studied in the field. Significant information on the morphology of the juvenile leaf stages from several species could be obtained. As demonstrated, the delimitation of the genus given especially by Ching (in Christensen, 1934) is largely correct, though he included only species with anastomosing veins. A number of Ching's species, however, are excluded and referred to as non-lomariopsidoid genera. In a few cases, species from other genera are here included in the genus for the first time. As most of the taxa under discussion were formerly included in *Leptochilus*, this genus was critically investigated as well with the results published separately. The genus *Bolbitis* as here defined and emended includes the genera *Egenolfia* and *Edanyoa*. Forty-four species (one of which is new) and 13 hybrids (12 of which new) are recognized, based on morphological criteria. The venation pattern and spores provide important

characters. In some species, infraspecific categories are listed. Identification keys to all taxa are included. The genus is subdivided into 10 series which accommodate a total of 34 species; another 10 species are separately listed, mostly in view of their suspected hybrid origin. Hybrids could be detected because of structural irregularities, especially in spores, but also usually as to other features. Putative hybrids between cytotypes of one species are not separately listed. Generic and/or specific delimitation differs considerably from that given by Ching (in Christensen, 1934). Christensen (1934), Holttum (1954), and Copeland (1960); the latter eventually recognized 97 different species in four different genera (*Stenosemia dimorpha* included). Notes are given on specific delimitation. Data are supplied which stress the evolutionary importance of polyploidization, hybridization, vegetative propagation, and the retention of juvenile characters, factors that may explain the often fascinating diversity found within many species. The study of ontogenetic leaf states (which may be very different from adult ones) has received great attention after it was understood that at least part of the variation as found in the adult sterile leaves recalls features found in the juvenile leaves. The relation between ontogeny and phylogeny is shortly discussed. Some facts are given which support the impression that the retention of juvenile characters may have played an important role during the diversification of the genus. Some general considerations about the probably great general significance of the retention of juvenile characters from the past diversification of the leptosporangiate ferns are included. It is postulated that the recognition of this neglected phenomenon may add considerably to our understanding of the larger groups of leptosporangiate ferns.

As per the monograph, the 8 species of *Bolbitis* in the Philippines are: *B. rhizophylla*, *B. appendiculata*, *B. sinuata*, *B. scalpturata*, *B. heteroclita*, *B. sinuosa*, *B. quoyana*, *B. repanda* and *B. presliana*.

Hennipman, E., G. J. Joncheere and M. G. Price. 1979. The Philippine *Platyserium grande*. *British Fern Gazette* 12 (1979) 47-49.

Observation on cultivated material. Note: M. G. Price has requested the non-inclusion of his name as an author.

Hennipman, E. and M. C. Roos. 1982. ***A Monograph of the Fern Genus Platycerium (Polypodiaceae)***. Verh. Kon. Ned. Ak. Wet. Natuurk. Ser. II, 80 (1982): 1-126.

Introductory chapters on morphology and anatomy; character states with many diagrams, affinities (with *Pyrrosia*); cladograms, phylogeny, habitat, distribution, key to the 15 species; some recent ones reduced to infraspecific rank, identification list.

See Hovenkamp, P. 1983 Review: "A Monograph of the Fern Genus *Platycerium* (Polypodiaceae). Verh. Kon. Ned. Acad. Wetensch. Afd. Natuurk. Ser. 11, vol. 80 (1982). North Holland Publ. Co. Amsterdam." Flora Malesiana Bulletin 36 (1983): 3944-3945.

Hennipman, E. 1987. ***A new species of Lecanopteris (Polypodiaceae) from the Philippines***. Blumea 32: 311-312.

Lecanopteris luzonensis Hennipman is described from the Philippines (Quezon Province, near Real, 300-500 meters altitude).

Hennipman, E. and W. L. A. Hetterscheid. 1984. ***The emendation of the fern genus Christiopteris including the transference of two taxa to the microsoroid Polypodiaceae***. Botanische Jahrbucker Bd 105: 1-10.

The genus *Christiopteris* is emended in this paper. The species *C. tricuspis* and *C. sagitta* are retained in the genus. *C. varians* proved to consist of two different species, both originally published as formas. The rank of species is given to one of this while the other remains as the typical form to *C. varians*. Furthermore, both species are transferred to the genus *Microsorium* (Polypodiaceae). Of interest for the Philippines is *Christiopteris sagitta* (Christ) Copel. which is reported to be from Luzon and Mindanao (see Copeland, E. B. 1918. The genus *Christiopteris*. The Philippine Journal of Science 12CL: 331- 336).

Hennipman, E. 1990. **The systematics and phytogeography of the Malesian ant-fern genus *Lecanopteris* (Reinw.) Blume (Filicales, Polypodiaceae)**. Proceedings of the International Symposium of Systematic Pteridology, Beijing 1988: 39-47.

Hettterscheid, W. L. A. and E. Hennipman. 1984. Venation patterns, soral characteristics, and shape of the fronds in the microsoroid Polypodiaceae. Bot. Jahr. Syst. 105: 11-47.

The paper is a detailed study of the venation, soral shape, distribution and frond shape of the microsoroid *Polypodiaceae*, including taxa generally referred to the genera *Christiopteris*, *Colysis*, *Dendroconche*, *Dendroglossa*, *Diblemma*, *Lecanopteris*, *Leptochilus*, *Microsorium*, *Neocheiropteris*, *Neolepisorus*, *Paraleptochilus*, *Phymatodes* and *Podosorus*. The fascinating diversity found in the characters studied is used to classify the taxa into 19 groups which can be arranged into two main groups, using ontogenetic data of the venation. The results suggest that the following genera can be united: *Colysis*, *Dendroglossa* and *Paraleptochilus*, whereas *Dendroconchi* and *Diblemma* should be merged with *Microsorium*. The latter genus is remarkably heterogeneous; systematic study will be conducted in the future. Among the genera selected for this study, *Podosorus* and *Diblemma* which are endemic to the Philippines are represented by one species each: *Diblemma samarensis* J. Sm. and *Podosorus angustatus* Holttum.

Holttum, R. E. 1932. On *Stenochlaena*, *Lomariopsis*, and *Teratophyllum* in the Malayan Region. Garden's Bulletin 5(9-11): 245-318.

A critical study and full account of the species of the genera *Stenochlaena*, *Lomariopsis* and *Teratophyllum* throughout the Malayan region. Among the species and varieties included, the following are found in the Philippines: (1) all the 3 species of *Stenochlaena* mentioned, i. e., *S. laurifolia*, *S. areolaris* and *S. palustris*, (2) 3 out of the 11 species of *Lomariopsis* mentioned, i. e., *L. smithii*, *L. leptocarpa* and *L. subtrifoliata*, and (3) 4 out of the 8 species of *Teratophyllum* mentioned, i. e., *T. aculeatum*, *T. williamsii*, *T. luzonicum* and *T. arthropteroides*. Also included are the following: (1) note on terminology, (2) historical summary, (3) key to the genera and species, (4) citations of specimens, (5) discussion on the phylogenetic relationships of the three genera.

Holttum, R. E. 1937. Further notes on *Stenochlaena*, *Lomariopsis* and *Teratophyllum*. Garden's Bulletin 9: 139-144.

Holttum, R. E. 1950. *Further notes on the fern genus Heterogonium Presl*. *Reinwardtia* 1(1): 27-31.

Heterogonium nieuwenhuisii and *H. stenosemioides* and also *H. saxicola* are united with *H. giganteum*. A second exindusiate species allied to *H. sagenoides* is recognized. A revised key to 8 species of the genus is presented. Two specimens are regarded as doubtful in status, one of which was collected from Sorsogon.

Holttum, R. E. 1951. *The fern genus Arcypteris Underwood (Dictyopteris Presl sensu Fee)*. *Reinwardtia* 1(2): 191-196.

The genus *Arcypteris* Underwood (*Dictyopteris* Presl sensu Fee) is maintained as different from *Tectaria* Cav and re-defined. It is instead considered to be very closely related to *Pleocnemia* Presl. Four species are recognized, two of which are found in Philippines, viz., *A. macrodonta* (Fee) Holttum and *A. brongniartii* (Bory) Holttum. The following combinations are made: *Arcypteris irregularis* (Presl) Holttum (basionym: *Polypodium irregulare* Presl), *A. macrodonta* (Fee) Holttum (basionym: *Dictyopteris macrodonta* Presl ex Fee), *A. brongniartii* (Bory) Holttum (basionym: *Polypodium brongniartii* Bory), and *A. gigantea* (Ces.) Holttum (basionym: *Neprodium giganteum* Ces.). Reductions to synonymies are: *Aspidium difforme* Blume to *Arcypteris irregularis* (Presl) Holttum and *Polypodium pteroides* Presl to *A. brongniartii* (Bory) Holttum.

Holttum, R. E. 1966. *A Revised Flora of Malaya, Vol. II. Ferns of Malaya*, 2nd ed. Singapore: Government Printing Office.

See E. Hennipman 1969 Review: "R. E. Holttum, *A Revised Flora of Malaya, Volume II. Ferns of Malaya*. 2nd ed Singapore: Government Printing Office. 1966, 653 pages." *Blumea* 17: 265.

Holttum, R. E. 1966. *The genera Lomariopsis, Teratophyllum and Lomagramma in the islands of the Pacific and Australia*. *Blumea* 14(1): 215-223.

Three genera, *Lomariopsis*, *Teratophyllum* and *Lomagramma* and their species in the islands of the Pacific and Australia are described with keys to these genera and different species. *Teratophyllum* and *Lomagramma* are

distributed in the Malesian Region which includes the Philippines: *Lomariopsis* is pantropic. All three are almost exclusively confined to the tropics and found only in well-developed evergreen forests. In the Pacific they are reported to occur only on islands with large forest areas.

Holttum, R. E. 1966. *Florae Malesianae Precursores XLIV, The fern-genus *Elaphoglossum* in Malesia, with descriptions of new species. Blumea 14: 316-326.*

Twenty-three new species of the fern genus *Elaphoglossum* are recognized and described. Two of these new species are reported to occur in the Philippines, viz., *E. apoense* Holttum with type specimens collected from Mt. Apo and deposited in the Philippine National Herbarium, and *E. negroensis* Holttum with type specimen collected from Negros Oriental.

Holttum, R. E. 1966. *The genus *Arthropteris* J. Sm. in Malesia. Blumea 14(1): 225-229.*

The genus *Arthropteris* and its six species in Malesia are described. Three species are reported to occur in the Philippines, viz., *A. palisotii*, *A. beckleri* and *A. wollastonii*. A key to the six species and a citation of synonymies are presented.

Holttum, R. E. 1966. *New ferns from Malesia. Kew Bulletin 20: 455-560.*

Podosorus, a remarkable new genus from Luzon of the *Polypodium* alliance is described and illustrated. The plant was collected from the Sierra Madre Mountains, along a creek in the dipterocarp forest and named by the author as *P. angustatus*. This paper also reports the reduction of the genera *Hemiptera* to *Pteris* and *Lepidocaulon* to *Histiopteris*, as well as descriptions of the new species of *Histiopteris* and *Taenitis*.

Holttum, R. E. 1968. *A re-definition of the fern-genus *Taenitis* Willd. Blumea 16 (1): 87-95.*

This paper includes a new definition of the genus *Taenitis*, the addition of five species to it (one of them new), the key to the 15 known species, a description of each with citation of synonymies and the more important literature reflecting Philippine sources.

Holttum, R. E. 1969. Studies in the family Thelypteridaceae, I. The genera *Phegopteris*, *Pseudophegopteris*, and *Macrothelypteris*. *Blumea* 17 (4): 5-32.

This paper is the first of an intended series (of papers) on the family Thelypteridaceae, especially in the Old World, based on the studies made in preparation for an account of the family for Flora Malesiana. Included here are (1) a discussion within Thelypteridaceae, (2) conspectus of the three genera; and (2) keys to the species. The Philippines is included in the geographic distribution of few species.

Holttum, R. E. 1971. Studies in the family Thelypteridaceae, III. A new system of genera in the Old World. *Blumea* 19(1): 17-52.

The new scheme of classification presented in this paper is based on the examination of all species in the family Thelypteridaceae which the author was able to trace in the Old World. Characters used in classification are discussed and a key to genera is presented. Described are 23 genera. The following are reported for the Philippines: *Cyclogramma*, *Mesophlebion*, *Chingia*, *Parathelypteris*, *Haplodictyum*, and *Nannothelypteris*. The total number of species are given for each genus.

Holttum, R. E. 1972. The genus *Davallodes*. *Kew Bulletin* 27 (2): 245-249.

A new description is provided for the genus *Davallodes* Copel., with a key to all known species, a full synonymy, citation of specimens seen, and critical notes on *D. hirsutum*. The geographic distribution of most of the nine known species includes the Philippines: *D. membranulosum* (Wall. ex Hook.) Copel. (*Araiostegia membranulosum* (Wall. ex Hook.) Holttum).

Holttum, R. E. 1972. Studies in the family Thelypteridaceae, IV. The genus *Pronephrium* Presl. *Blumea* 20: 105-126.

The work is a taxonomic monograph of the thelypterid genus *Pronephrium*. From the materials studied, a new species whose range extends to the Philippines was described, viz., *P. nitidum* Holtt., 16 Philippine species were transferred to the genus, viz., *P. asperum* (Presl) Holtt. (basonym: *Polypodium asperum* Presl., Rel. Haenk. 24, t. 3, f. 4 1825, non Linn.), *P. clemensiae* (Copel.) Holtt. (basonym: *Dryopteris clemensiae* Copel.,

Philipp. J. Sci. 46: 213, 1931), *P. cuspidatum* (Bl.) Holtt. (basionym: *Meniscium cuspidatum* Bl., Enum. Pl. Jav. 114. 1828), *P. diminutum* (Copel.) Holtt. (Copel.) Holtt. (basionym: *Dryopteris diminuta* Copel., Philipp. J. Sci. 40: 298. 1929), *P. elmerorum* (Copel.) Holtt. (basionym: *Dryopteris elmerorum* Copel., Philipp. J. Sci. ¹ 40: 295, pl. 2. 1929¹, *P. granulatum* (Presl) Holtt. (Basionym: *Polypodium granulatum* Presl, Rel. Haenk. 24, pl. 4, fig. 2. 1825), *P. gymnopteridifrons* (Hay.) Holtt. (basionym: *Dryopteris gymnopteridifrons* Hayata, Ic. Pl. Formos. 8: 148, fig. 75, 76. 1919), *P. hosei* (Bak.) Holtt. (basionym: *Meniscium hosei* Bak., J. Linn. Soc. Bot 22: 320, 1886), *P. melanophlebium* (Copel.) Holtt. (basionym: *Dryopteris melanophlebia* Copel., Philipp. J. Sci. 6: 147. 1911), *P. menisciicarpon* (Bl.) Holtt. (basionym: *Aspidium menisciicarpon* Bl., Enum. Pl. Jav. 142, 1828), *P. merrilli* (Chr.) Holtt. (basionym: *Dryopteris merrilli* Chr., Philipp. J. Sci. 2: 201. 1907), *P. rhombeum* (Chr.) Holtt. (basionym: *Dryopteris diversifolia* var. *rhombica* Chr., Philipp. J. Sci. 2: 200. 1907), *P. rubidium* (J. Sm. ex Hook.) Holtt. (basionym: *Polypodium rubidum* J. Sm. ex Hook., Spec. Fil. 5: 12. 1863), *P. samarense* (Copel.) Holtt. (basionym: *Cyclosorus samarensis* Copel., Philipp. J. Sci. 81: 35. 1952), *P. triphyllum* (Sw.) Holtt. (basionym: *Menisium triphyllum* Sw. in Schrad. J. Bot. 1800, 2: 16. 1801) and *P. xiphoides* (Chr.) Holtt. (basionym: *Dryopteris xiphoides* Chr., Philipp. J. Sci. 2: 201. 1907); and seven Philippine species were reduced to synonymy, viz., *Cyclosorus edanyoi* Copel. and *C. subdimorpha* Copel. to *P. granulatum*; *C. diversilobus* (Presl) Copel. and *C. lanceolus* (Christ) Copel. to *P. rhombeum*; *C. latifolius* (Presl) Copel. to *P. menisciicarpon*; *C. pustulosus* Copel. to *P. gymnopteridifrons*. All are in the genus *Cyclosorus* in Copeland's Fern Flora of the Philippines (2: 334-376. 1960).

Holttum, R. E. 1973. The family Thelypteridaceae in the Old World. In A. C. Jermy, J. A. Crabbe and B. A. Thomas (eds.). Phylogeny and Classification of Ferns, Supplement 1, Journal of the Linnean Society of Botany 67: 173-189

The paper is based on the author's new system of genera in the family published in 1971. The probable primitive characters in the family and the present genera which exhibit some of them are considered. The genus which exhibits a majority of such characters is *Coryphopteris* Holttum, now

confined to mountain ridges in the Malayan region. Distributions of the other genera and some of their characteristics are also discussed. On the whole, genera of the Old and New Worlds are distinct, but with some overlapping in Africa. The only completely pantropic group, *Cyclosorus* Link *sensu stricto*, includes a few closely allied species adapted to open freshwater swamps and cannot be considered primitive. The ancestral form of the family must have had free veins, quite probably fossils of such a form as could not be distinguished from *Cyathea*. The distinctive type of anastomosis in the family may have developed independently in Asia and America. Eocene fossils in Europe and in North America conform to this type.

As many specific epithets have not yet been transferred to the genera recognized by the author in 1971, species in the present paper are referred to by their basionyms; later synonyms can be found in Index Filicum and Supplements.

Holttum, R. E. 1973. The identity of three type specimens in the Willdenow Herbarium. *American Fern Journal* 63: 81-84.

In this paper, a new combination for a thelypterid fern whose range extends to the Philippines was proposed, i.e., *Amphineuron terminans* (Hook.) Holtt. (basionym: *Nephrodium terminans* Hook., Sp. Fil. 4: 73. 1862). *Thelypteris wagneri* Fosberg et Sacht was reduced to *Amphineuron terminans* (Hook.) Holtt. In Copeland's Fern Flora of the Philippines (2: 361. 1960), this fern is *Cyclosorus interruptus* (Willd.) Ching.

Holttum, R. E. 1973. Studies in the family Thelypteridaceae, V. The genus *Pneumatopteris* Nakai. *Blumea* 21: 293-325.

The paper is a taxonomic monograph of the thelypterid genus *Pneumatopteris*. For the Philippines, one was described as a new species, viz., *P. michaelis* Holtt., seven were transferred to the genus, viz., *P. costata* (Brack.) Holtt. (basionym: *Goniopteris costata* Brack. In Wilkes, U. S. Expl. Exp. 16: 28. 1854); *P. glabra* (Copel.) Holtt. (basionym: *Cyclosorus glaber* Copel., Philipp. J. Sci. 81: 34. 1952); *P. laevis* (Mett.) Holtt. (basionym: *Aspidium laeve* Mett., Farugatt. 4: 104. 1858); *P. ligulata* (Presl) Holtt. (basionym: *Lastrea ligulata* Presl, Epim Bot. 35. 1851); *P. microloncha* (Chr.) Holtt. (basionym: *Dryopteris microloncha* Chr., Philipp.

J. Sci. 2: 202. 1907); *P. nitidula* (Presl) Holtt. (basionym: *Nephrodium nitidulum* Presl, Epim. Bot. 46. 1851) and *P. truncata* (Poir.) Holtt. (basionym: *Polypodium truncatum* Poir., Encycl. Meth. 5: 534. 1804) and three species names were reduced to synonymy, viz., *Cyclosorus viridis* Copel. to *P. glabra*; *Lastrea cavitensis* Copel. to *P. costata*; and *L. foxii* Copel. to *P. ligulata*.

Holttum, R. E. 1973. Copeland's contribution to fern taxonomy. *Philippine Agriculturist* 57: 17-20.

The paper discussed the scientific contribution of E. B. Copeland to fern taxonomy. Copeland's prolific endeavors brought fern taxonomy many steps closer to a natural classification. Appreciation of his contributions considerably outweighs the criticisms made when his work is examined in a historical context.

Holttum, R. E. 1973. Studies in the family *Thelypteridaceae*, VI. *Haplodictyum* and *Nannothelypteris*. Kalikasan, *Philippine Journal of Biology* 2: 58-68.

The paper is a taxonomic monograph of two endemic thelypterid genera of Philippine ferns. Two new species were described, viz., *Haplodictyum bulusanicum* Holtt. and *Nannothelypteris inaeguilibata* Holtt., two new combinations were proposed, viz., *N. nervosa* (Fee) Holtt. (basionym: *Phegopteris nervosa* Fee, Gen. Fil. 244. 1852) and *N. philippina* (Presl) Holtt. (basionym: *Physematium philippinum* Presl, Epim. Bot. 192. 1851), and *Cyclosorus dimorphus* Copel. (Philippi. J. Sci. 83: 99. 1954) to *Haplodictyum major* Copel.

Holttum, R. E. 1974. Studies in the *Thelypteridaceae* VII, The genus *Chingia*. Kalikasan, *Philippine Journal of Biology* 3: 13-28.

The genus *Chingia* is described with a commentary on its status and relationships. A key to all known species is presented together with a description of each species. A complete list of synonyms is provided for each species. Four new Philippine species are described, viz., *C. urens*, *C. paucipaleata*, *C. pricei* and *C. clavipilosa*. Three new species from outside the Philippines are likewise described, viz., *C. autidens* (Celebes),

C. sambanensis (West Borneo) and *C. pseudoferox* (Thailand, Sumatra, Malaya, Borneo). New combinations for 9 other species are made: *Dryopteris armata* Rosenst. is placed as a synonym of *C. imponens*; *Dryopteris kusaiana* Hosikawa is doubtfully considered as a synonym of *C. longissima*. (Summary: 17 species of which 7 are new and 10 are new combinations).

Holttum, R. E. 1974. The fern-genus *Pleocnemia*. *Kew Bulletin* 29 (2): 341-357.

This genus (*Pleocnemia*) which was redefined by the author in 1951, is here enlarged to include *Arcypteris* Underwood. A new key is provided for all known species. Two new species from Malesia, *P. intermedia* and *P. megaphylla*, are described. The following species are reported for the Philippines: *P. irregularis* (Presl) Holttum, *P. pleiotricha* Holttum, *P. cumingiana* Presl, *P. hemiteliiformis* (Racib.) Holttum and *P. presliana* Holttum. (Summary: revision, key to 19 species range from Burma to Samoa).

Holttum, R. E. 1974. A comparative account of the fern-genera *Syngamma* J. Sm. and *Taenitis* Willd. With discussion of their relationships to each other and to other genera. *Kew Bulletin* 30(2): 327-343.

The Malesian and Pacific species of *Craspedodictyum*, *Syngamma* and *Taenitis* are discussed and new evidence presented. The species of *Craspedodictyum* is transferred to *Syngamma* involving three new combinations: *S. spathulata* (C. Chr) Holttum, *S. coriacea* (Copel.) Holttum and *S. magnifica* (Copel.) Holttum. Three species of *Syngamma*, namely, *S. boerlageana*, *S. marginata* and *S. francii* are rejected as possible species of the genus *Aspleniopsis*. *S. trichophora* (new species) is described from New Guinea. Two sections are recognized within *Syngamma*, namely *Syngamma* and *Toxopteris*, and four within *Taenitis*, namely, *Taenitis*, *Loxodictyum* (new section), *Platytaenia* (new status), and *Schizolepton* (new status). The relationship of the two genera are considered. Three species of *Syngamma*, namely, *S. alismifolia* (the type species), *S. vittaeformis* and *S. wallichii* are reported to occur in the

Philippines. *S. vittaeformis* is the endemic species. Two species of *Taenitis*, namely, *T. luzonica* (endemic) and *T. cordata* occur in the Philippines. (Summary: *Craspedodictyum* Copel. reduced to *Syngamma*. This and *Taenitis* defined anew and subdivided. Several new combinations. Relationships considered.)

Holttum, R. E. 1974. New Philippine ferns. *Kalikasan, Philippine Journal of Biology* 3: 196-197.

Described as new are *Pronephrium solsonicum* and *Elaphoglossum calanasicum*. *E. merrillii* Christ is reduced to *Acrostichum ophioglossoides* Goldm. which is transferred to *Elaphoglossum*.

Holttum, R. E. 1975. The genus *Heterogonium* Presl. *Kalikasan, Philippine Journal of Biology* 4: 205-231.

The genus *Heterogonium* Presl is presented in full taxonomic survey which includes: (1) a key to all 19 species, (2) descriptions of four new species, i.e. *H. ceramense*, *H. rufescens*, *H. pluriseriatum* and *H. novoquineense*, (3) a new description of *H. obscurum*, (4) full synonymy of all species, and (5) critical notes on most of the species listed. The occurrence of six species, namely, *H. sagenioides*, *H. obscurum*, *H. stenosemioides*, *H. aspidioides*, *H. subaequale* and *H. pinnatum* is reported for the first time in the Philippines. (Summary: revision, key to 19 species, 4 new species and some new combinations).

Holttum, R. E. 1975. Bibliography of R. E. Holttum, by himself. *Special Biographical Section, Flora Malesiana Bulletin* 28: 2477-2500.

Lists 419 publications of R. E. Holttum from 1921-1975 (span of 54 years). Of these, 95 are on ferns more than 50 of which contain information (taxonomy, morphology, cytology, phylogeny, etc.) about Philippine ferns.

Holttum, R. E. 1975. Studies in the family *Thelypteridaceae* VIII. The genera *Mesophlebion* and *Plesioneuron*. *Blumea* 22: 223-250.

Plesioneuron, originally published as a subgenus of *Mesophlebion*, is here raised to a generic rank. New descriptions of both genera are provided,

as well as keys to all known species, synonymies and descriptions for each. Some synonymies are reduced to basionyms except where the synonyms refer to important literature. The published combinations within *Thelypteris* are recorded. Type material for each basionym was examined for this study. An index of new names and of all basionyms cited is provided. *Mesophlebion*, as here arranged, is confined to Malesia (with a short extension northwards from Malaya) with Borneo as the center of distribution. It comprises 18 species the following of which are new: *M. caroli*, *M. dulitense*, *M. rufescens* and *M. arenicola*. Each of the following basionym is reduced to synonymy: *Dryopteris paleata* Copel., *D. divergens* Rosenst., *D. subdimorpha* Copel., *Aspidium latum* Mett., *Syngamma angusta* Copel. *Mesophlebion* is perhaps most nearly related to *Cyclosorus sensu* Holttum 1971. Three species of *Mesophlebion*, viz., *M. crassifolium* (Bl.) Holtt., *M. oligodictyon* (Baker) Holtt. (new combination) and *M. trichopodium* (C. Chr.) Holtt. (new combination) are reported to occur in the Philippines. *Plesioneuron* is distributed mainly in New Guinea and the Pacific, with one species in North Borneo, two in the Moluccas, and two in the Philippines. It contains 39 species, of which the following are described as new: *P. stenolobum*, *P. doctersii*, *P. dryas*, *P. fuchsii*, *P. kindipense*, *P. platylobum*, *P. pullei*, *P. rigidilobum*, *P. royenii*, *P. subglabrum*, *P. subterminale*, *P. tahitense*, *P. translucens*; also a new variety of *P. hopeanum* (Bak.) Holtt. var. *acutilobum*. The following basionyms are reduced to synonyms: *Lastrea* var. *vestita* Copel., *Dryopteris hunsteiniana* Brause, *D. ensipinna* Brause, *D. quadriaurita* Copel., *D. schlechteri* Brause, *D. schizophylla* v A v R, *Aspidium brackenridgei* Mett. and *Nephrodium inaequilaterale* Bak.

Holttum, R. E. 1975. Studies in the family Thelypteridaceae, IX. The genus *Sphaerostephanos* in the Philippines. *Kalikasan, Philippine Journal of Biology* 4: 47-68.

A key to all known species (31) of the genus *Sphaerostephanos* in the Philippines is presented, with bibliographic references and citations of type specimens. Five new species are described, viz., *S. fenixii*, *S. mindorensis*, *S. colisianus*, *S. punctatus* and *S. santomasii*. New combinations for 23 other species and a revised description of *S. ellipticus* (Rosenst.) Holttum

are presented. Two species, viz., *S. appendiculatus* (Bl.) Holttum and *S. perglanduliferus* (v A v R) Holttum are reported for the first time to occur in the Philippines. Several nomenclatural revisions of Copeland's Fern Flora of the Philippines are presented.

Holttum, R. E. 1976. Studies in the family Thelypteridaceae, X. The genus *Coryphopteris*. Blumea 23: 18-47.

This paper (revision) provides descriptions of all known species of the genus *Coryphopteris* with synonymy for each and a key for identification. Seventeen new species are described, viz., *C. andersoni*, *C. andreae*, *C. arthrotricha*, *C. atiehensis*, *C. athyrioides*, *C. borealis*, *C. brevopilosa*, *C. hubrechtensis*, *C. iwatsukii*, *C. kolombancarae*, *C. meiobasis*, *C. microlepigera*, *C. seemannii*, *C. subbipinnata*, *C. tahanensis*, *C. tanggamensis*, and *C. vitiensis*. All other species, except *C. hirsutipes*, *C. pectiniformis* and *C. viscosa* are transferred from other genera to *Coryphopteris*. The following names are reduced to synonymies: *Dryopteris magalocarpa* v A v R, *D. indochinensis* Chr., *D. subviscosa* v A v R, *D. suprabilliosa* C Chr., *D. kinabaluensis* Copel., *D. linearis* Copel., *D. villceipes* Sepp., *D. rididifolia* v A v R, *Lastrea ridleyi* Bedd., *L. robinsonii* Ridl., *Nephrodium macgregori* Bak., *Thelypteris angulariloba* Ching., *T. simozawae* Tagawa, *T. herbacea* Holttum and *T. subglandulicera* Ching. New varieties are described in *C. viscosa*, *C. gymmoloda*, *C. pectiniformis* and *C. cubirachis*. Fifteen species reported to occur in the Philippines, viz., *C. viscosa* (Baker) Holttum, *C. gymnopoda* (Baker) Holttum (new combination), *C. klosii* (Ridg.) (new combination), *C. diaphana* (Brause) Holttum (new combination), *C. habbemensis* (Copel.) Holttum (new combination), *C. squamipes* (Copel.) Holttum (new combination), *C. borealis* Holttum (new species), *C. pubirachis* (Baker) Holttum (new combination), *C. athyriocarpa* (Copel.) Holttum (new combination), *C. fasciculata* (Fourn.) Holttum (new combination), *C. coreacea* (Brause) Holttum (new combination), *C. dura* (Baker) Holttum (new combination), *C. badia* (v A v R) Holttum (new combination), *C. paltyotera* (Copel.) Holttum (new combination) and *C. subnigra* (Brause) Holttum (new combination).

Holttum, R. E. 1976. The genus *Christella* Leveille, sect. *Christella*. Studies in the family *Pthelypteridaceae*, XI. *Kew Bulletin* 31: 295-339.

Christella is described and discussed with a key to all known species, synonymy and description. New species described are: *C. adenopelta*, *C. kumaunica*, *C. minima*, *C. nana*, *C. pacifica*, *C. subdentata* and *C. timorensis*, also the new variety of *C. harveyi* (Mett.) Holttum var. *connivens*. Twenty-one new combinations are made. The following doubtful names may possibly apply to species of this genus: *Polystichum consanguineum* Gaud., *Nephrodium dicarpum* Fee, *N. griffithianum* Fee, and *Aspidium natalense* Fee, *Cyclosorus jerdonii* Ching, included in a list of species of *Christella* in 1971, is here excluded. Few species of *Christella* are found in the Philippines.

Holttum, R. E. 1976. New records of *Thelypteridaceae* from the Philippines. *Kalikasan, Philippine Journal of Biology* 5: 109-120.

All known Philippine species of the genera *Cyclogramma*, *Parathelypteris* and *Metathelypteris* are described. *Cyclogramma auriculata* (J. Sm.) Ching, *Parathelypteris glanduligera* (Kunze) Ching, *Metathelypteris uraiensis* (Rosenst.) Ching and *M. dayi* (Bedd.) Holttum are recorded for the first time from the Philippines. The new species *Nannothelypteris camarinensis* is also described. All in all, 8 species are reported: *Cyclogramma auriculata*, *Parathelypteris beddomei*, *P. glanduligera*, *P. grammitoides* (Chr.) Holtt. (new combination), *Metathelypteris gracilescens* (Bl.) Ching, *M. uraiensis* (Rosenst.) Ching, *M. dayi* (Bedd.) Holtt. and *Nannothelypteris camarinensis* Holtt. (new combination).

Holttum, R. E. 1977. Studies in the family *Thelypteridaceae*, XII. The genus *Amphineuron*. Holttum. *Blumea* 23: 205-221.

The genus is re-described and its status discussed. A key to all known species is provided and full synonymy and description for each with discussions on the complex synonymies of *A. terminans* and *A. opulentum*. Ten species are recognized and 23 basionyms reduced to synonymy. One new species, *A. tildeniae* from Tahiti, is described and the following new combinations are made: *A. tonkinense* (C. Chr.) Holttum, *A. subattenuatum*

(Rosenst.) Holttum, *A. paraphysophorum* (v A v R) Holttum, *A. attenuatum* (O. Kuntze) Holttum, *A. distinctum* (Copel.) Holttum. Six species of *Amphineuron*, viz., *A. terminans* (Hook.) Holttum, *A. immersum* (Bl) Holttum, *A. opulatum* (Kaulf.) Holttum, *A. distinctum* (Copel.) Holttum (new combination), *A. attenuatum* (Kuntze) Holttum (new combination), and *A. ceranicum* (v A v R) Holttum (new combination) are reported to occur in the Philippines.

Holttum, R. E. 1978. Review: "Hennipman, E. A monograph of the fern genus *Bolbitis* (Lomariopsidaceae), 331 pages. The Hague, Netherlands." *Flora Malesiana Bulletin* 31: 3063-3064.

REVIEWS 3063 HENNIPMAN, E., A monograph of the fern genus *Bolbitis* (Lomariopsidaceae), 331 p., 87 fig. (1977). Nijhoff, Box 442, The Hague, Netherlands. Paper, Dfl. 96.00.

This is by far the most thorough study yet made of a very interesting group of ferns which displays an intricate pattern of inter-relationships between species. This situation is made more complex by the development of hybrids, a process facilitated by the growth of prothalli in large numbers on wet rocks in stream-beds in the shade of forest, the normal habitat of most species of *Bolbitis*. The artificial classifications of the 19th century separated these species in various ways; Dr. Hennipman's index shows that one or more of them have been referred to 22 other genera. They were not recognized as one group until the 1930s and as late as 1928, they were wrongly united with some species of a different alliance.

Dr. Hennipman recognized 44 species which are distributed throughout the wetter parts of the tropics. 34 of them were divided into ten series, mainly on the basis of venation and spores. A very full and beautifully reproduced series of drawings shows the details of venation in all species, and there are excellent SEM photographs of spores, with an original discussion on the development of their perispores. An Index of Collections is given at the end. Distribution maps show that one series is pantropic; the others belong to either SE Asia and Malesia, America or

Africa, two series being distributed in both Africa and America. One species, the sole member of its series, is confined to the Seychelles Islands, and shows relationships both to Asia and America.

The ten species not allocated to series are separately described, and possible indications of their relationships are discussed. It is suggested that they are all of hybrid origin, though only one (*B. novoguineensis*) has abnormal spores (it occurs on three islands; how did it travel from one to another). In addition, twelve hybrids, all with aborted spores, are separately described, the parentage of six being considered definite. All the hybrids are considered to be between species belonging to different series within *Bolbitis*. A thirteenth hybrid, named *Leptochilus trifidus* v.A.v.R., originally described as a species from a cultivated plant at Bogor is more problematic. Dr. Hennipman identifies specimens from three localities in Sumatra with it, and suggests that their structure indicates a probable origin from hybridization between *Bolbitis sinuata* and *Leptochilus decurrens*. However, species is generally recognized as belonging to the family *Polypodiaceae* which is not considered at all to be closely related to *Bolbitis*. More evidence is needed before this parentage can be accepted and the possibility that the other parent was a *Tectaria* should be considered. Dr. Hennipman lists chromosome counts from 49 plants of *Bolbitis*, many of them his own. He shows that there is a series of hybrids, some probably autotriploids and autotetraploids; some are hybrids with irregular meiosis or a complete failure of pairing. In Malaya and the Philippines, different series of hybrids have developed within the species *B. heteroclita* which have multiplied on stream-banks, spreading by creeping rhizomes and propagated by bulbils. A full understanding of the genetic complexity shown by these plants can only come via an elaborate series of experimental crossings, in the same way that *Dryopteris*, *Asplenium*,

and North America. Meanwhile, *Edanyoa difformis* Copel. is placed as a synonym of *B. heteroclita*; it is a very distinctive and elegant little plant, easy to cultivate, and deserving a distinctive name as a cultivar. Young plants of different species of *Bolbitis* pass through various juvenile developmental stages; these are elaborately illustrated in a way never before attempted, and their significance is discussed in relation to the possible origins and relationships of the genus. Some plants develop fertile fronds at a juvenile stage. My chief criticism of this excellent work is that Dr. Hennipman does not give an adequate explanation for the basis of his subdivision of the genus into series; his discussion on the subject is brief and his diagram is not fully explanatory. I do not doubt that his arrangement is a natural one but a reader unfamiliar with the genus would need to make a very thorough study to arrive at a good understanding of the scheme. On minor points, I do not see why he fails to accord specific rank to *B. appendiculata* subsp. *vivipara*; and I cannot accept his judgment that *B. malaccensis* C.Ch. and *B. nitens* Holttum are mere "habitat forms" of *B. sinuata*, not worthy even of varietal rank. The former has the same habitat as normal *B. sinuata* but is distinct in two widely separated localities; the latter has a quite distinct habitat on dry rocks where I cannot believe that *B. sinuata* would exist. I judge that both are genetically distinct and should have names. *B. nitens* has a very restricted distribution near Kuala Lumpur. - R. E. Holttum.

Holttum, R. E. and J. W. Grime. 1980. The genus *Pseudocyclosorus* Ching (*Thelypteridaceae*). *Kew Bulletin* 34 (1980) 499-520.

Key to 12 species, some new combinations, some new species, one species in Malesia, *P. tylodes*. For the first time, characters of the reduced basal pinnae are described as distinctive for species recognition.

Holttum, R. E. 1982. *Thelypteridaceae. Flora Malesiana, series II,*

Holttum, R. E. 1982. *Thelypteridaceae. Flora Malesiana, series II, volume 1* (1982): 331-565.

A massive revision of this very difficult group; large introductory chapters, key to 22 genera, 440 species (many new), the largest genera being *Coryphopteris* (41 species), *Plesioneuron* (36 species), *Pneumatopteris* (54 species), *Sphaerostephanos* (152 species) and *Pronephrium* (56 species), a very large step forward in Malesian pteridology, probably the largest single group.

Holttum, R. E. 1984. Studies in the fern genera allied to *Tectaria*, I. A commentary on recent schemes of classification. *British Fern Gazette* 12 (1984): 313-319.

General considerations on the complexity of the generic delimitation with several suggestions for improvement.

Holttum, R. E. 1984. Studies in the fern-genera allied to *Tectaria*, III. *Aenigmopteris* and *Ataxipteris*, two new genera allied to *Tectaria* Cav., with comments on *Psomiocarpa* Presl. *Blumea* 30 (1984): 1-11.

Two new genera, *Aenigmopteris* and *Ataxipteris*, are established. *Aenigmopteris* is reported to resemble *Ctenitis* C. Chr. in its frond-form and venation but has scales and indusia similar those of *Tectaria* Cav., and in its narrowly winged pinnarachises approaches *Lastreopsis* Ching. Its type species from Luzon was originally named *Dryopteris* dubia Copel., it includes also *Dryopteris* pulchra Copel., from New Guinea and three species, viz., *Aenigmopteris* mindanaensis from Mindanao, *A. elegans* from Sabah and *A. katoi* from Indonesian Borneo. Its relationship to *Psomiocarpa* Presl is discussed. *Ataxipteris*, based on a single species of Southern China and Japan originally named *Tectaria* sinii Ching, resembles *Tectaria* in frond-form and venation but has scales like those of *Ctenitis*. In both new genera, there are thick hairs between veins on the upper surface as in many species of *Tectaria* but not in *Ctenitis*; both genera lack the cylindric glands which are characteristic of *Ctenitis*. In spore characters, *Aenigmopteris* and *Psomiocarpa* resemble some species of *Tectaria*, and *Ataxipteris* resembles some species of *Ctenitis*. Among the five species of *Aenigmopteris* reported, three are found in the Philippines, viz., (1) *A. dubia* (Copel.) Holttum (new combination), (2) *A.*

pulchra (Copel.) Holttum (new combination) and (3) *A. mindanensis* Holttum (new species).

Holttum, R. E. 1985. Studies in the fern genera applied to *Tectaria* Cav. , IV. The genus *Ctenitis* in Asia, Malesia and the Western Pacific. *Blumea* 31 (1985): 1-38.

A survey is presented of past treatment of the genus *Ctenitis* C. Chr. in the Old World, with the conclusion that the genus has not hitherto been clearly defined. A new generic description covering the species of Asia, Malesia, and the Western Pacific is presented, with a new division of the species into two subgroup of informal status, based on scales and spores, and a key to all species. Seventeen new species are described, one new name proposed and four new combinations made. A list of species in the region which, in the opinion of the author, have been wrongly included in *Ctenitis*, is appended. Among the 43 known species of this genus, 16 are reported to occur in the Philippines, viz., *C aciculata* (Bak.) Ching, *C pallens* (Brack) M G Price, *C propinqua* (Presl) Copel., *C boholensis* Holttum (new species), *C seramensis* Holttum (new species), *C bulusanica* Holttum (new species), *C salvatica* Holttum (new species), *C humilis* Holttum (new species), *C manni* (Hope) Ching, *C subobscura* (Christ Holttum), *C decurrentipinnata* (Ching) Ching, *C setosa* (Presl) Holttum, *C atrorubens* Holttum (new species), *C erythradenia* Holttum (new species), *C paleolata* Copel, and *C subglandulosa* (Hance) Ching. *Dryopteris rizalensis* Christ is listed as a doubtful species.

Holttum, R. E. 1986. Studies in the fern-genera allied to *Tectaria* Cav., VI . A conspectus of genera in the Old World regarded as related to *Tectaria*, with descriptions of two genera. *Garden's Bulletin* (Singapore) 39 (1986): 153-167.

New section in *Tectaria*, new genus *Chlamydogramme* for *Gymnopteris holhrungii*, new genus *Megalastrum* for the *Lastrea villosa* group, key to Old World genera.

Holttum, R. E. and P. J. Edwards. 1986. Studies in the fern-genera allied to *Tectaria*, II. *Dryopsis*, a new genus. *Kew Bulletin* 41 (1986): 171-204.

Set off against *Dryopteris* and *Ctenitis* 25 species, almost all from continental southeast Asia, 3 Malesian, 1 hybrid from Taiwan.

Holttum, R. E. 1991. New taxa in the *Tectaria* group (*Polypodiaceae*) from Malesia. *Blumea* 35 (2): 547-557.

The following new species and varieties are described: *Tectaria andersoni*, *T brevilobata*, *T coadunata* (J. Sm.) C. Chr. var *minor*, *T croftii*, *T curtisii* Holttum var *andersonii*, *T danfuensis*, *T devexa* (Kunze ex Mett.) Copeland var *novoguineensis*, *T exauriculata*, *T filixquamata*, *T griffithii* Baker) C. Chr. var *singaporeana* and var *amplissima*, *T inopinata*, *T jacobsonii*, *T lobbii* (Hook) Copel. var *denticulata* and var *allosora*, *T macrota*, *T microchlamys*, *T microlepis*, *T moussetti*, *T nebiensis*, *T nesiotica*, *T palmata* (Mett.) Copel. var *sumatrana* and var *dimorpha*, *T rheophytica*, *T rigida*, *T refuscens*, *T schmittii*, *T squamipes*, *T subcordata*, *T subtrilobata*, *T suluensis*, *T villosa*, *Chlamydogramme elata*, *Cyclopeltis rigida*, *Heterogonium lobulatum*, *Lastreopsis novoguineensis*. Keys to the varieties are also provided. The following new combinations are made: *Tectaria devexa* (Kunze ex Mett.) Copel var *minor* (Hook.) Holtt (new combination), *T palmata* (Mett.) Copel var *platanifolia* (Mett.) Holtt (new status). The following taxa are reported to occur in the Philippines: *T devexa* (Kunze ex Mett.) Copel. var *devexa*, *T griffithii* (Baker) C. Chr. var *griffithii*, *T lobbi* (Hook.) Copel. var *lobbii*, *T suluensis* Holtt. (new species) and *Heterogonium lobulatum* Holttum (new species).

Holttum, R. E. 1991. *Tectaria* Group. *Flora Malesiana*, series II, volume 2, part 1: 1-132.

This work is a taxonomic monograph documenting 11 genera (with 405 species worldwide) of the *Tectaria* group of ferns of which 10 genera with 119 species, 5 varieties and 1 hybrid (total of 125 taxa) are reported for the Philippines. More specifically:

GENERA	WORLD	PHILIPPINES
1 <i>Pteridrys</i>	8	2
2 <i>Pleocnemia</i>	20	6
3 <i>Ctenitis</i>	100	12 + 2 var
4 <i>Tectaria</i>	210	28 + 3 var + 1 hybrid
5 <i>Tectaridium</i>	1	1
6 <i>Chlamydogramme</i>	2	0
7 <i>Heterogonium</i>	22	6
8 <i>Aenigmopteris</i>	5	2
9 <i>Psomiocarpa</i>	1	1
10 <i>Cyclopeltis</i>	6	2
11 <i>Lastreopsis</i>	35	1
Total	405	125

The Philippine taxa are *Pteridrys syrmatica*, *P. microthecia*, *Pleocnemia irregularis*, *P. macrodonta*, *P. brongniartii*, *P. conjugata*, *P. cumingiana*, *P. presliana*, *Ctenitis aciculata*, *C. pallens*, *C. subconnexa*, var *subconnexa*, *C. subconnexa* var *alstonii*, *C. boholensis*, *C. bulusanica*, *C. silvatica*, *C. humilis*, *C. subobscura*, *C. decurrentipinnata*, *C. setosa*, *C. atrorubens*, *C. paleolata*. *Tectaridium macleanii*, *Tectaria manilensis* var *manilensis*, *T. mesodon*, *T. laxa*, *T. ramosii*, *T. ramosii* x *T. aurita*, *T. barberi*, *T. griffithii* var *griffithii*, *T. adenophora*, *T. christii*, *T. devexa* var. *devexa*, *T. melanocaula*, *T. athyriosora*, *T. calcarea*, *T. lobbi* var *lobbi*, *T. suluensis*, *T. dolichosora*, *T. repanda*, *T. crenata*, *T. tabonensis*, *T. siifolia*, *T. angustata*, *T. polymorpha*, *T. trifida*, *T. menyanthidis*, *taccifolia*, *T. decurrens*, *T. sulitii*, *T. beccariana*, *T. stalactica*, *T. hilocarpa*, *Psomiocarpa apiifolia*, *Aenigmopteris dubia*, *A. mindanensis*, *Heterogonium sagenioides*, *H. lobulatum*, *H. wenzelii*, *H. aspidioides*, *H. profereoides*, *H. pinnatum*, *Cyclopeltis crenata*, *C. presliana* and *Lastreopsis tenera*.

Hoshizake, B. I. and M. G. Price. 1990. *Platynerium* update. *American Fern Journal* 80: 53-69.

Hennipman and Roos' (1982) classification untenable. (Hennipman, E. and M. C. Roos. 1982 A Monograph of the Fern Genus *Platynerium* (*Polypodiaceae*). Verh. Kon. Ned. Ak. Wet. Afd. Natuurk. Ser. II. 80 (1982): 1-126.

Hovenkamp, P. H. 1986. *A monograph of the Fern-Genus Pyrrosia (Polypodiaceae)*. (With contributions by W. J. Ravensberg and E. Hennipman). *Leiden Bot Ser* 9 (1986) : 1-310.

Fifty seven species, no novelties, exhaustive chapters on history, infra-generic delimitation (10 informal groups + some loose species), morphology, karyology, and hybridization, cladistic phylogeny (character transformations discussed, genus paraphyletic, no synapomorphy against *Platynerium*), geography (historical, contemporary vicariance analysis), key synonymy, notes, identification list. *An exemplary treatise* (Van Steenis C G G J Flora Malesiana Bulletin 9/3 (1985) 331.)

Hovenkamp, P. H. 1987. Review: "Roos, M. C. Phylogenetic systematics of the *Drynarioideae* (*Polypodiaceae*). Verh Kon Ned Akad Wetensch., Amsterdam, The Netherlands." *Flora Malesiana Bulletin* 9 (4): 442-443.

Roos, M C *Phylogenetic systematics of the Drynarioideae (Polypodiaceae)*. Verh. Kon. Ned. Akad. Wetensch., Natuurk., II, 85. (1986). 318 pp. Edita, Kon. Ned. Akad. Van Wetensch., Postbox 19121, 1000 GC Amsterdam, The Netherlands, ISBN 0-444-85668-4. Hfl. 95.00

Slightly modified from an earlier (1985) version presented as a thesis at the University of Utrecht, The Netherlands, and also privately distributed. An important part of this book is taken up by the philosophy of systematics (Chapter 4), methodology of phylogenetic analysis (chapter 6, co-authored by M Zandee), and application of the methodology to the *Drynarioideae* (Chapter 7, co-authored by M. Zandee). The authors present a procedure that is in accordance with the stated aim (p. 20) that at every stage of the study data, the criteria applied, and the decisions are explicitly presented.

However, I have not been able to find the necessary arguments for all the decisions taken when, in Chapter 7, the phylogeny of the *Drynarioidae* is tackled. Some hopefully important but poorly augmented decisions have been taken to restrict the large number of possibilities that is the result of the large amount of data (31 taxa and 557 characters). First, the search for all possible cladograms was stopped after 416 out of an unknown number of the best resolved ones were found (p. 99). Therefore, not all of them could be evaluated as to their implications (p. 100). In both cases, the restriction has been introduced for practical reasons and introduces an unwanted element of arbitrariness. The most serious decision which appears to be inconsistent with the stated aims is the acceptance of two genera that are not a result of the cladistic analysis, but are introduced somewhere between p. 103 and 104, at a point where I would have expected to see a number of smaller groups recognized as suggested by cladograms 7.1 to 7.6. After all, one can sympathize with the authors when they seem to despair that perhaps taxonomic procedure cannot be expressed in a rigid, unambiguous way (p. 118: 'Probably, the quantitative criteria and those derived from biological theory a reconsideration of their restricted aims).

Those who are not particularly interested in the methodology of cladistics may prefer to skip some of the first chapters, or even turn to the taxonomic part directly. 32 species are here accounted for, with keys to genera and species, nomenclature, descriptions, distribution, ecology and summaries of collector's notes. The remaining notes concern infraspecific variation and some characters not mentioned elsewhere. Appendices include a tabular account of the characters used, distribution maps of all species, and histograms of altitudinal zonation. An index of collections is also included and an index to taxonomic names.

There are few changes in the delimitation of the species, but unlike most other treatments of the *drynarioid* fern, Roos distinguishes only two genera, viz., *Drynaria* and *Aglaomorpha*. I have not been able to find an argument that accounts for the recognition of only two genera. It cannot be convenience (the key to the two genera needs 10 leads, leading to either genus 5 resp. 6 times), nor is it a necessary result of the phylogenetic analysis presented in earlier chapters. Roos is certainly right in rejecting the traditional, monotypic genera. I fear, however, that with results that seem to point to a further

subdivision, a recognition of a large genus *Aglaomorpha* does not serve nomenclatural stability.

The information is not always easily accessible. Although 32 species are accounted for and described, only 31 may be keyed out. The remaining species (*A. nectarifera*) turns out to be based on a single, poorly preserved collection. Elsewhere, this is postulated to be a sister species to *A. cornucopia*, but neither in the key, nor in the notes to either species is the reader's attention drawn to this. The species are numbered and presented in an order that it is left unexplained, with no. 1-16 following no. 17-32. The descriptions are very detailed, and to be interpreted correctly; they need to be read alongside the explanatory notes on the characters in chapter 5. There are no cross-reference to some of the illustrations of characters given in chapter 5.

Is there so little to be said which is positive? Certainly not. This book presents a gallant attempt to establish a methodology for the reconstruction of phylogenies and the interpretation of phytogeographical patterns. It presents many ideas for practically the first time (a much earlier version of the same method was used by Geesink, 1984, *Scala Milletarium*). It should be studied attentively by all those interested in this subject. Those whose main interest is the classification of the *drynarioid* ferns, however, are left with a revision that leaves most specific delimitations unchanged and is difficult to use.—
P. H. Hovenkamp.

Hovenkamp, P. H. (with contributions from M. T. M. Bosman, E. Hennipman, H. P. Nooteboom, G. Rodl-Linder and M. C. Roos). 1998. *Polypodiaceae. Flora Malesiana*, series II, volume 3, pages 1-234.

The family, worldwide in distribution, is represented in Malesia (Indonesia, Malaysia, Brunei Darussalam, Singapore, the Philippines and Papua New Guinea) by 18 genera and 183 species. Many species are epiphytic, and the family contains some of the most striking as well as some of the most abundant epiphytes of the Malesian area. Its representatives form a significant part of the vascular epiphytic flora of both the lowland and the mountain forests. *Platyserium* (staghorn ferns) is of considerable horticultural interest, and the association of ants with the genus *Lecanopteris* is ecologically

interesting. The general part of the family treatment also includes a paragraph on spore morphology by G A van Uffelen. The systematic account is to a large extent based on monographs and character analyses carried out by Hennipman and co-workers. As circumscribed here in Malesia, the following genera are represented: *Aglaomorpha* (with 14 species), *Arthromeris* (1), *Belvisia* (6), *Christiopteris* (2), *Drynaria* (7), *Goniophlebium* (13), *Lecanopteris* (13), *Lemmaphyllum* (2), *Lepisorus* (4), *Leptochilus* (6 including *Colysis*), *Microsorium* (30 including *Phymatosorus* and *Neocheiropteris*), *Paraselliguea* (1), *Platycterium* (6), *Podosorus* (1), *Polypodiopteris* (3), *Pyrrosia* (23), *Selliguea* (49), *Thylacopteris* (2). The genus *Loxogramme*, often included in *Polypodiaceae*, is here considered to belong to a separate family *Loxogrammaceae*. Family, genera and Malesian species are described and annotated, in all but few cases exclusively on the basis of Malesian material. Keys to the genera and species are given; in some cases separate regional keys are presented. One new combination is made on page 13.: *Aglaomorpha acuminata* (Willd.) Hovenkamp (basionym: *Acrostichum acuminatum* Willd.). Illustration is by 31 line drawings, 18 of which are full-page.

Listed below are 73 Philippine species and varieties of *Polypodiaceae* included in the treatment: *Aglaomorpha acuminata* (Willd.) Hovenkamp (new combination) *A cornucopia* (Copel.) Roos, *A heraclea* (Kunze) Copel., *A meyeniana* Schott, *A pilosa* (Hook. et Bauer) Copel., *Arthropteris proteus* (Copel.) Tagawa, *Belvisia platyrhynchos* (Kunze) Copel., *Christiopteris sagitta* (H. Christ) Copel., *Drynaria descensa* Copel., *D quercifolia* (Linn.) J. Sm., *D rigidula* Bedd., *D sparsisora* (Desv.) T. Moore, *Goniophlebium benguetense* (Copel.) Copel., *G mengtzeense* (H. Christ) Rodl-Linder, *G percussum* (Cav.) Wagner et Grether, *G persicifolium* (Desv.) Bedd., *G terrestre* Copel., *G pseudoconnatum* (Copel.) Copel., *G subauriculatum* (Blume) Presl, *Lecanopteris lomarioides* (Mett.) Copel., *L sinuosa* (Wall. Ex Hook.) Copel., *L carnosa* (Reinw.) Blume, *L luzonensis* Hennipman, *Lemmaphyllum carnosum* (Hook.) C Presl var *carnosum*, *Lepisorus longifolius* (Blume) Holttum, *Leptochilus decurrens* Blume, *L ellipticus* (Thunb.) Noot., *L macrophyllus* (Blume) Noot. Var *fluvialis* (Lauterb.) Noot., *L minor* Fee, *Microsorium scolopendria* (Burm. f.) Copel., *M commutatum* Copel., *M rubidium* (J. Sm.) Copel., *M membranifolium* (R. Br.) Ching, *M sarawakense*

(Baker) Ching, *M zippelii* (Blume) Ching, *M ensatum* (Thunb.) H Ito, *M pteropus* (Blume) Copel., *M punctatum* (Linn.) Copel., *M monstruosum* (Copel.) Copel., *M heterocarpum* (Blume) Ching, *M pentaphyllum* (Baker) Copel., *M samarense* (Sm.) Bosman, *M longissimum* Fee, *M heterolobum* (C. Chr.) Copel., *M insigne* (Blume) Copel., *M congregatifolium* (Alderw.) Holttum, *Platynerium coronarium* (Konig ex Muller) Desv., *P grande* (Fee) Kunze, *Podosorus angustatus*, Holttum, *Pyrrosia lanceolata* (Linn.) Farwell, *P longifolia* Burm. f.) Morton, *P mummularifolia* (Sw.) Ching, *P piloselloides* (Linn.) M G Price, *P porosa* (C Presl) Hovenkamp var *porosa*, *Prasalamae* (Racib.) Shing, *P samarensis* (C Presl) Ching, *P sphaerosticha* (Mett.) Ching, *P splendens*, (C Presl) Ching, *Selliguea taeniata* (Sw.) Parris, *S albidosquamata* (Blume) Parris, *S glauca*, (T. Moore) Hovenkamp, *S lagunensis* (. Christ) Hovenkamp, *S triloba* (Houtt.) M G Price, *S enervis* (Cav.) Ching, *S lateritia* (Baker) Hovenkamp, *S elmeri* (Copel.) Ching, *S heterocarpa* (Bl.) Bl., *S oodes* (Kunze) Hovenkamp, *S pyrolifolia* (Goldm.) Hovenkamp, *S caudiformis* (Bl.) Garruth, *S whitfordii* (Copel.) Hovenkamp, *Thylacopteris papillosa* (Bl.) J. Sm.

Hovenkamp, P. H. and J. G. de Joncheere. 1988. Additions to the fern flora of Sulawesi. Blumea 33:395-409.

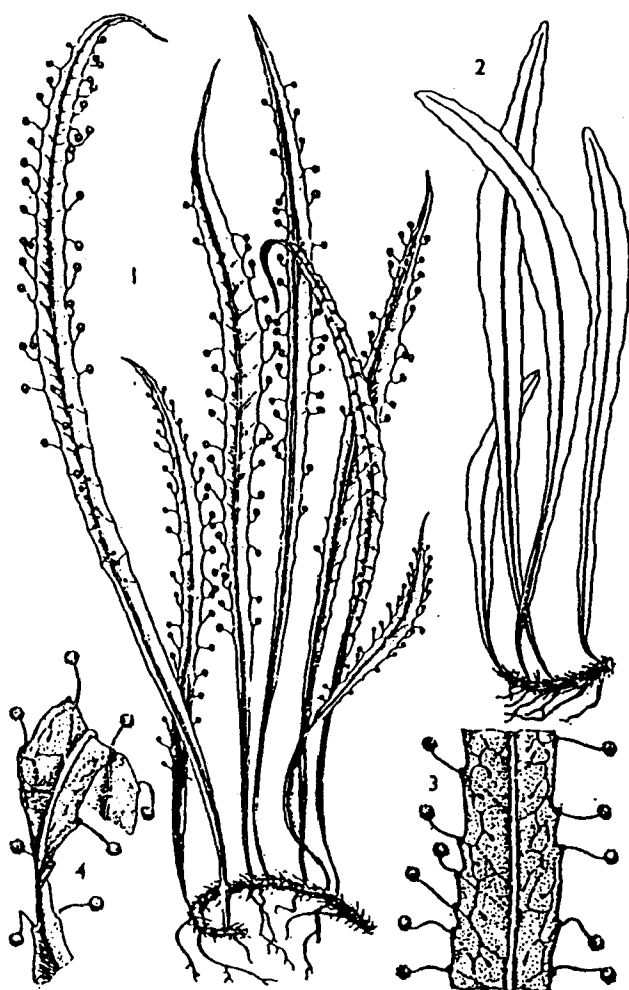
Fifteen new taxa in *Polypodiaceae*, *Cyatheaceae*, *Dennstaedtiaceae*, *Thelypteridaceae*, *Aspleniaceae* and *Davalliaceae* are described. A number of additions to the flora of Celebes are given here. The Philippines is included in the distributional range of some species of these families.

Hovenkamp, P. H. and N. A. P. Franken. 1993. An account of the fern genus *Belvisia* Mirbel (*Polypodiaceae*). Blumea 37: 511-527.

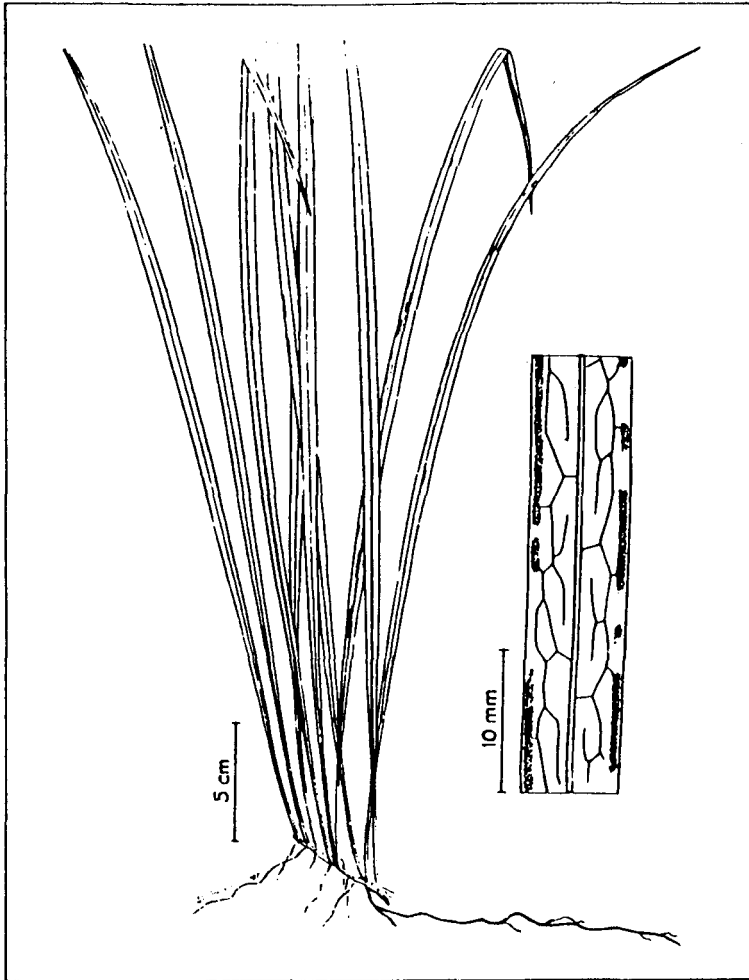
The genus *Belvisia* Mirbel is revised. Two species are transferred from *Lemmaphyllum* to *Belvisia*, and two species are reduced to varieties. As now construed, the genus includes eight species extending to tropical Africa to China, to Polynesia and Australia. In the Philippines, the genus is represented by four species. Key to the species, full synonymy, descriptions, distribution notes, list of exsiccates and three figures are given.



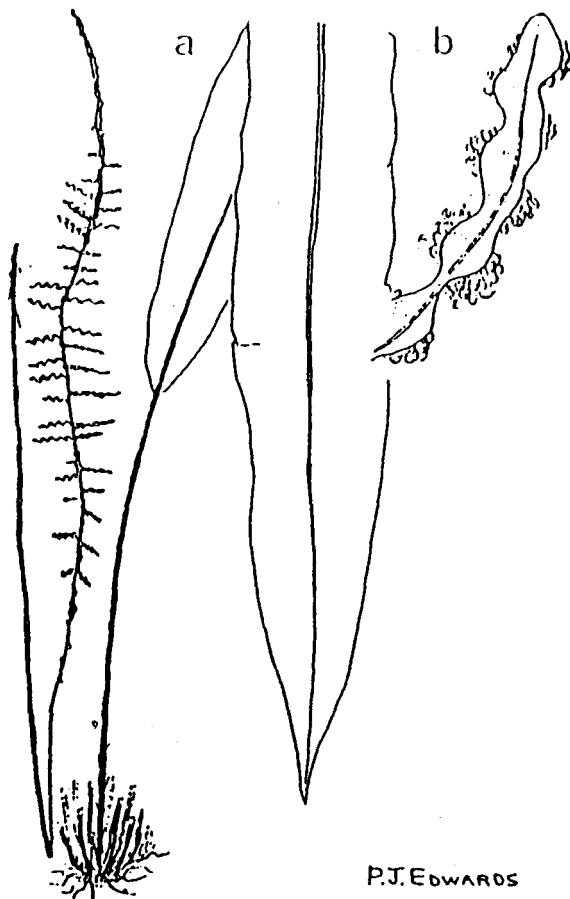
Adiantum philippense. Habit. (After Zamora, 2000)



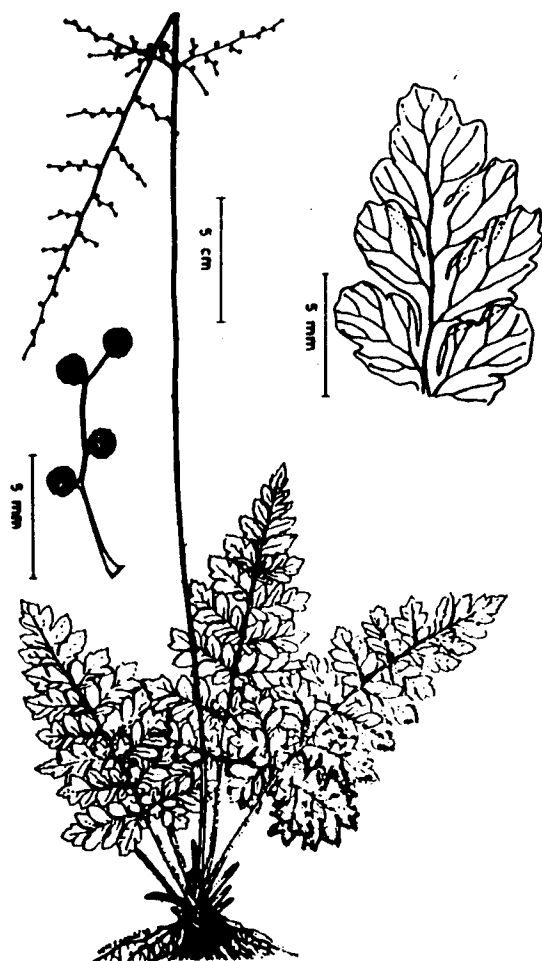
Podosorus angustatus. 1, Plant bearing fertile fronds. 2, Young plant with sterile frond. 3, Lower surface of frond showing variation and pedicellate sori. 4, Part of frond showing position of sori. (After Holttum, 1966)



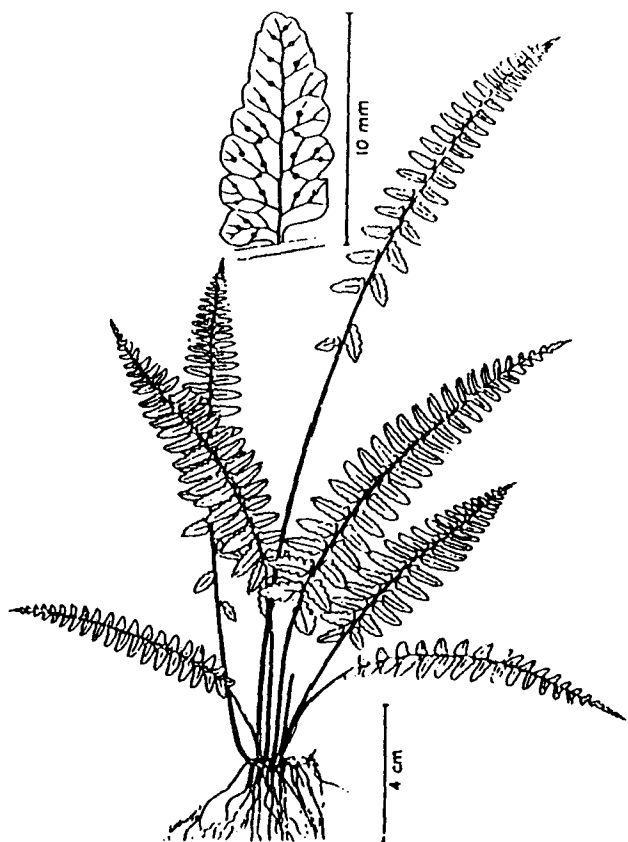
Microsorium (Diblemma) samrensis. Center, Habit. Lower right, Portion of fertile frond showing lower soriferous surface. (After Zamora and Co, 1986)



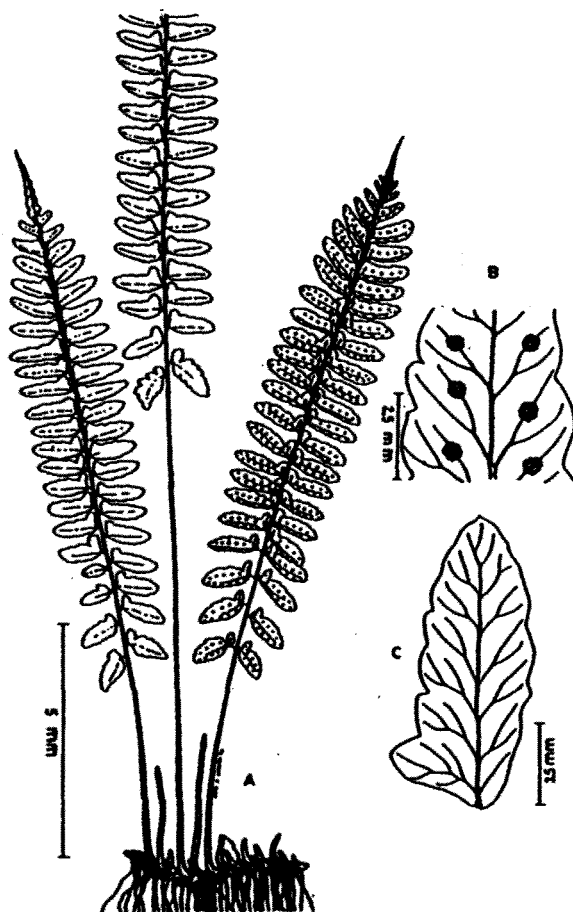
Tectaridium macleanii. a, Sterile and fertile fronds.
b, Upper surface of a fertile middle pinna. (After Holttum, 1991)



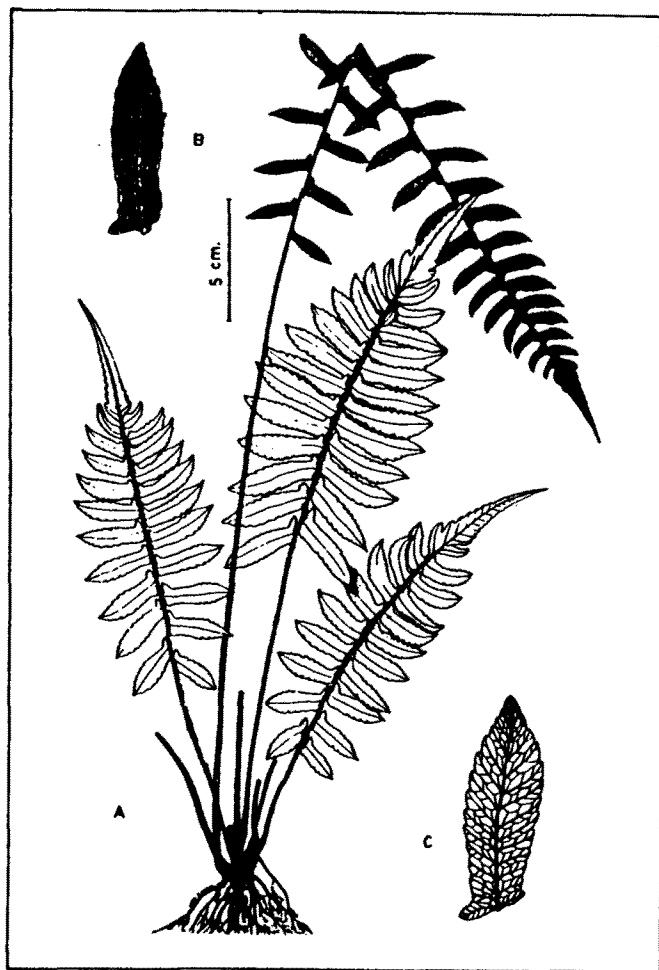
Psomiocarpa apiifolia. center, Habit. Upper right, Portion of frond showing venation. Middle left, Portion of fertile lamina. (After Zamora and Co, 1986)



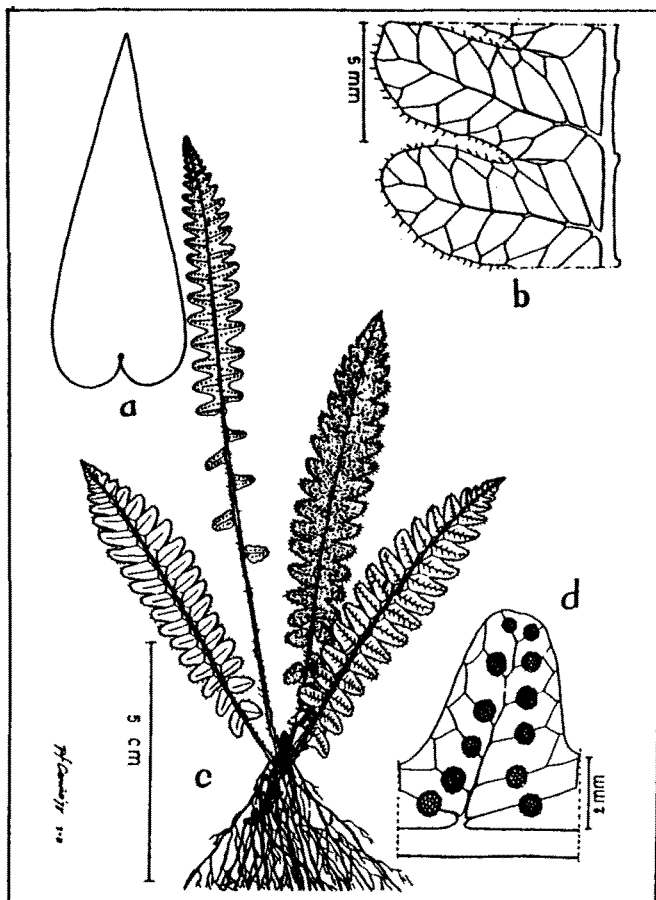
Nannothelypteris aoristisora. Center, Habit. Upper center, Venation in a pinna. (After Zamora and Co, 1986)



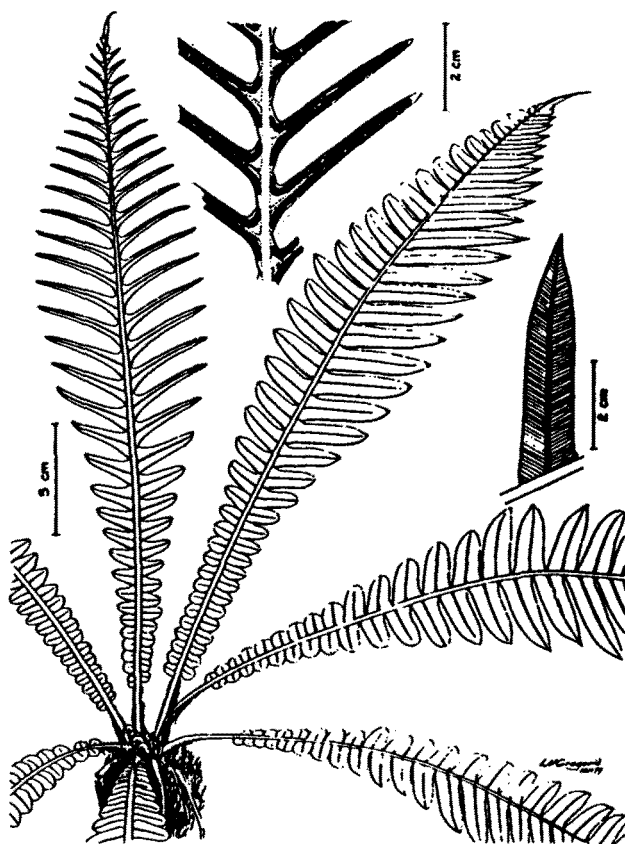
Nannothelypteris inaequilobata. A, Habit. B, Portion of pinna showing sori.
C, Complete pinna showing venation. (After Zamora and Co 1986)



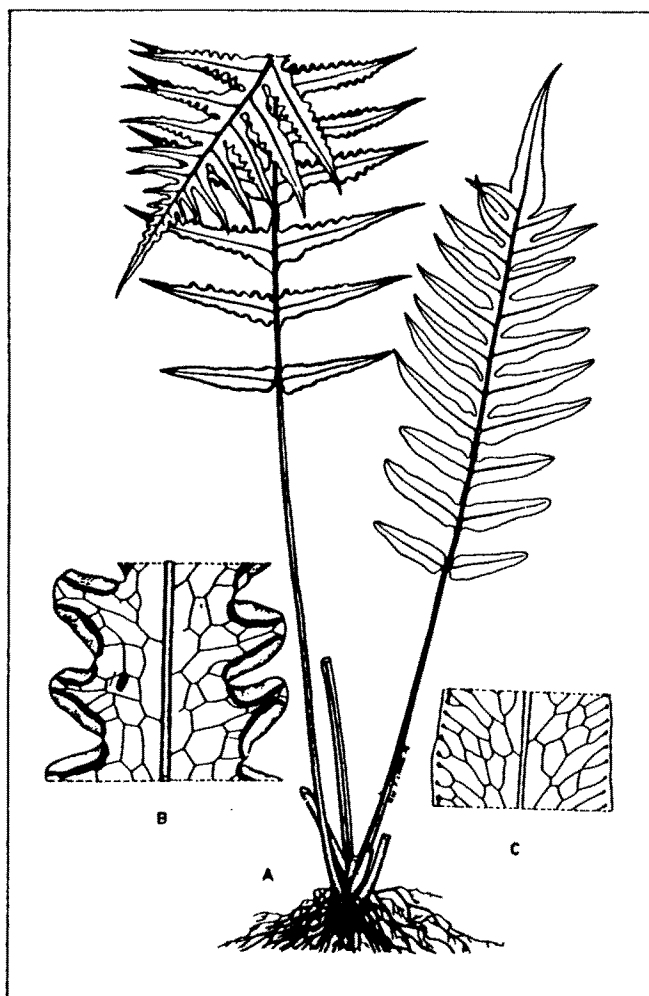
Pronephrium (Haplodictyum) balabacensis. A, Habit. B, Pinna showing disposition of sori. C, Pinna showing venation. (After Zamora and Co 1986)



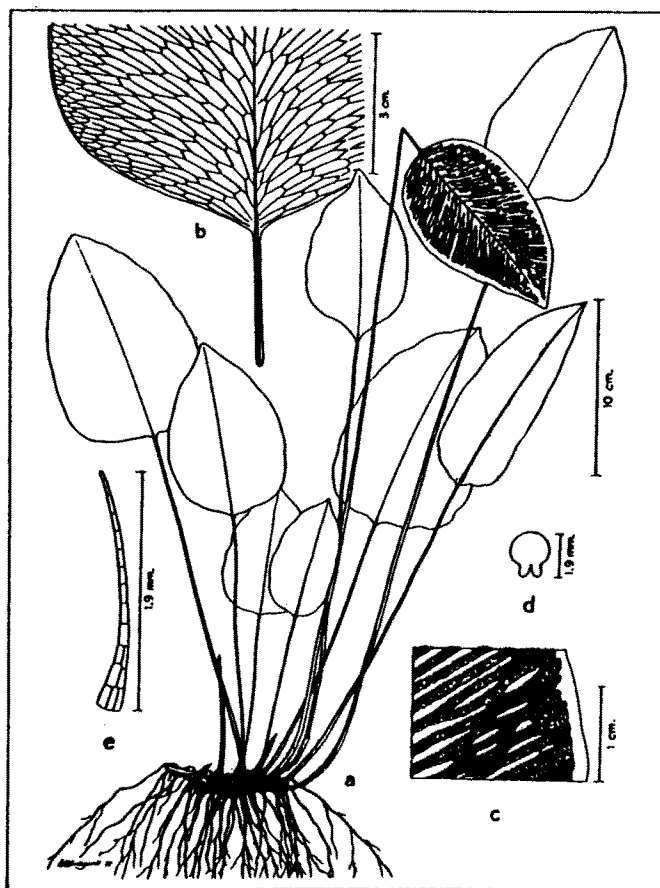
Pronephrium (Haplodictyum) heterophyllum. a, Outline of palea. b, portion of lamina showing venation. c, Habit. d, Lobe of frond showing sori. (After Zamora and Co 1986)



Blechnum egregium. Center, Habit. Right, Pinna showing venation. Upper center, Portion of fertile frond showing disposition of sori. (After Zamora and Co 1986)



Pteris endoneura. A, Habit. B, Portion of Pinna showing venation and soral disposition. C, Portion of pinna (upper side) showing venation. (Zamora and Co, 1986)



Taenitis luzonica. a, Habit. b, Lamina showing venation. c, Detail of sori.
d, Cross section of stipe. e, Palea. (Zamora and Co, 1986)

Hovenkamp, P. H. 1998. *Lepisorus* in Malesia. *Blumea* 43: 104-115.

Revision including *Paragramma*, 4 species 1 new; 1 new combination, key, synonymy, descriptions, specimens under taxa (*Polypodiaceae*).

Hugh, R. H. A. new variety of *Microsorium punctatum* (Linn.) Copel. *Pteridologist* 1 (1985): 81. 2 figures.

A monstrous dissected form found in the Philippines.

Iwatsuki, K. and M. G. Price. 1977. The pteridophytes of Mt Burnay and vicinity, Northern Luzon. *South East Asian Studies* 14 (4) : 540-572.

A brief account of the 1975 Filipino-Japanese Botanical expedition to the previously studied Mt Burnay is given, with special reference to the pteridophytes. The approximately 200 species of pteridophytes are enumerated, several reductions to synonymy newly made, and range extensions reported. A short commentary on Luzon-Taiwan phytogeography is appended.

Joaquin, C. C. and P. M. Zamora (released 1999) *Diversity of Spores in Philippine Ferns*. U P CIDS-NAST Biodiversity Conservation Project Reports 5 (1996): 1-280.

This book deals with the spore characters of 434 species belonging to 123 genera and 27 families of Philippine ferns. The spore characters include the following: symmetry, nature of the laesura, size, shape and nature of the spore wall. The nature of the laesura includes the type of scar, nature of margin and length. The nature of the spore wall includes exine ornamentation, exine thickness, exine layering and presence or apparent absence of perine.

The study demonstrated and confirmed that spore characters are useful in grouping of taxa. They may be used in taxonomic keys at various taxonomic levels, families, genera and species. At the family level, the spore characters may be useful in characterizing and segregating families into two groups (e. g. tetrahedral-trilete families, bilateral-monolete families, and both tetrahedral-trilete and bilateral-monolete families) but not in distinguishing one family from the others within the same group. At the generic level, the spore characters may not be only useful in characterizing the genera within one

family, but also in certain cases (in about 20 per cent of the 123 genera family hereby studied) in distinguishing one genus from the other genera within the same family. Examples of genera within the same family which may be distinguished from one another on the basis of spore morphology alone are the following: *Lindsaeaceae*; *Helminthostachys*, *Botrychium* and *Ophioglossum* of the *Ophioglossaceae*; and *Vittaria*, *Antrophyum* and *Vaginularia* of the *Vittariaceae*.

Spore characters appear to have their greatest value as diagnostic features at the species level where it is possible in many instances (about 72 per cent of the 435 species studied) to distinguish the species from one another under the same genus on the basis of spore morphology. Examples are the various species belonging to the genera *Adiantum*, *Asplenium*, *Bolbitis*, *Ctenitis*, *Davallia*, *Lygodium* and *Pteris*. There are however, still many cases at the species level in which the species within the same genus cannot be distinguished from one another based on spore morphology alone. Examples are the following species with their corresponding generic affiliation: *A beckleri* from *A palisotii* of the genus *Arthropteris*; *D scabra* from *D smithii* of the genus *Dennstaedtia*; *P christii* from *P glauca* of the genus *Plagiogyria*; five species under the genus *Gleichenia*; eight species under the genus *Marattia*.

Spore characters appear to be useful in reinforcing the basis for classification and reclassification of ferns, especially among those of doubtful affinities, such as the transfer of *Stenochlaena* from *Pteridaceae* to the *Blechnaceae*, and the proposed segregation and the elevation of the genera *Angiopteris*, *Christensenia* and *Marattia* previously under *Marattiaceae* to the *Angiopteridaceae*, *Christenseniaceae* and *Marattiaceae*, respectively.

Furthermore, this study has also demonstrated to a very limited extent the importance of spore morphology in fern phylogeny, particularly in reinforcing the basis for the revolutionary succession of fern families. Based alone on type of laesura exhibited by the spore, fern families may be segregated into three main groups in the following order: trilete, trilete-monolete, and monolete families. As stated previously, if the positions or locations of these three main groups of fern families were traced on the evolutionary tree of fern families constructed on the basis of gross morphology sensu Pichi-Sermolli (1973), the apparently primitive trilete families (such as *Marattiaceae* and *Ophioglossaceae*) can generally be found toward the bottom;

and more advanced trilete-monolete families (such as *Dennstaedtiaceae* and *Gleicheniaceae*) at the middle; and the most advanced monolete families (such as *Aspidiaceae* and *Thelypteridaceae*) toward the top of the evolutionary tree; thus apparently reinforcing the basis for the evolutionary succession of fern families.

This study also provides possible evidence for the apparent derivation of the monolete type of spore from the trilete type based on the morphological peculiarities of the spores of *Loxogramme parallela* and *L. subselliguea*.

In light of the foregoing findings, it is hereby recommended that the following should be the subject of future investigations: (1) Study of the spore morphology of Philippine ferns which have not been covered in this current study in order to complete the collection of data of the spore morphology of Philippine ferns. (2) Study of which apparently non-perinous fern species are actually perinous or non-perinous under the scanning electron microscope, knowledge of which is important in taxonomic and phylogenetic studies. (3) Study of the spore morphology of other fern species with doubtful affinities to reinforce the basis for their appropriate classification or reclassification. (4) In depth study regarding the morphological peculiarities of *Loxogramme parallela* and *L. subselliguea* in order to ascertain the possible evolutionary derivation of the monolete spore from the trilete spore. (5) Study of the possible correlation between spore morphology and the gross morphology of ferns. (6) Study of the developmental basis of spore patterns.

Jacobs, M. 1972. The plant world on Luzon's highest mountains. Leiden: Rijksherbarim. 32 pages.

The paper chronicles a Dutch-Philippine botanical exploration (Dr. M. Jacobs and Mr. D. R. Mendoza) to Mount Pulog (2880 m) and Mount Tabayoc (2819 m), Central Luzon in 1968. Of interest in the present review were pteridophytes collected from the area the author mentioned in the text of the report. These are *Asplenium elmeri*, *A. normale*, *A. unilaterale*, *Athyrium anisopterum*, *Belvisia platyrrhynchos*, *Blechnum capense*, *B. patersonii*, *B. vulcanicum*, *Cheiropleuria bicuspis*, *Crypsinus*, *Ctenopteris*, *C. yoderi*, *Cyathea* (3-4 species), *C. loheri*, *Dennstaedtia scabra*, *Diplazopsis javanica*, *Dipteris lobbiana*, *Dryopteris palacea*, *Elaphoglossum*, *E. califolium*, *Gleichenia*, *G. laevissima*, *G. loheri*, *Goniophlebium argutum*,

Grammitis bulbotricha, *Humata*, *Hymenophyllum* spp, *Lindsaeae odorata*, *Lycopodium* spp., *Polystichum nepalense*, *Pteridium aquilinum*, *Selaginella*, *Thayeria cornucopia*, *Thelypteris beddomei* 1/, *T squamipes* 2/, *Trichomanes* and *Vittaria elongata*. Holttum (Blumea 19:17-52. 1971) reported the occurrence in Luzon of *Cyclogramma* based on Jacobs 7299, Mount Pulog which species was not cited by Jacobs himself in the paper under review.

1/ *Parathelypteris beddomei* (Bak.) Ching

2/ *Coryopteris* Holttum (*Dryopteris squamipes* Copel.)

Kato, M. 1993. A taxonomic study of the genus *Matoniaceae* (*Matoniaceae*) Blumea 38: 167-172.

Morphological comparison involving 18 character states supports the view that *M. foxworthyi* Copel. is indeed distinct from *M pectinata* R. Br. Key to two species is given. Of the two, only *M foxworthyi* is known to occur in the Philippines, i. e., Mindoro; Mt Halcon and Sibuyan, Romblon.

Kato, M. 1998. *Matoniaceae Flora Malesiana*, series II, volume 3, pages 289-294.

In this family which is restricted to Malesia, two genera are distinguished, *Matonia* and *Phanesorous*, with two species each. Family, genera and species are described and annotated and keys to genera and species are included. Habitat and ecology, taxonomy and affinity, and fossils are discussed. One line drawing is given. The Philippines is represented by one species, *Matonia foxworthyi* Copel.(Mindoro, Sibuyan).

Khan, M. M. 1983. *A Primer on Azolla Production and Utilization in Agriculture*. UPLB PCARRD and SEARC, College, Laguna.

This book brings together relevant information on the production and utilization of *Azolla* (an aquatic fern) in Agriculture. The primer is divided into four sections: (1) description of the plant which covers its distribution, taxonomy, morphology, mode of reproduction and its symbiotic relationship with blue-green alga, *Anabaena azollae*, (2) chemical composition of the plant which includes its nutritive values, (3) propagation of the plant including its collection, storage, maintenance, transportation, field multiplication under different environmental conditions, cultural management and harvesting.

Also under this subject heading are the factors affecting *azolla* growth, mineral nutrient and fertilization requirements, and pest, disease and weed control and (4) utilization of the plant as a fertilizer for crops, particularly rice, as well as the upland crops, vegetables and ornamentals, and as livestock and poultry feed. The topics in this section include the different ways of using *Azolla* as organic fertilizer through soil incorporation and by composting, the different ways of using *Azolla* as feed for poultry, livestock and cultured fish including the feeding values, the various empirical evidences of the effect of *Azolla* on yield of crops, especially rice. Here, the economic dimension is given emphasis by the representation of experimental data comparing the different levels of benefit derived from using or not using *Azolla* as organic fertilizer, or using it in different combinations with conventional fertilizers. To round up the section on utilization models are described. Finally, a comprehensive list of the present-day species and strains of *Azolla* and their specific distribution and location in the world is provided. Also appended is a sample training course for technicians which indicates subject matter areas. The course was developed and has been conducted in the University of the Philippines at Los Baños by the National Azolla Action Program of the Philippines.

Kuo, C. M. and B. J. Wang. 1985. Additional knowledge for the fern flora of Taiwan. I. On the name *Bolbitis scalpturata* (Fee) Ching and its recollection after 76 years. *Yushania* 2: 1-6.

H Ito's record of the occurrence of *Bolbitis scalpturata* in Taiwan was based on a specimen collected by Mori and Shimada in 1907. Subsequent examination of the Mori and Shimada sheet at TI by K. Iwatsuki could not conclusively validate said record since the fertile lamina was missing. At any rate, even Fee's original specimen (Gaudichaud s n) is made up of three discordant elements, and no one at that time (1959) has ever clarified the typification status. For these reasons, Iwatsuki tentatively postponed judgement on Ito's determination. Because no similar material was ever collected since the time of Mori and Shimada, several authors expressed doubts on the occurrence of *B scalpturata* in Taiwan. The existence of said species was only verified when the second author finally collected specimens which matched the type in 1983-1984. *B scalpturata* occurs in

Myanmar, Thailand, Vietnam, Sumatra, Java, Bali, Sumbawa, Flores, Sulawesi and the Philippines. Occurrence in southern Taiwan was confirmed. Three figures, two of which are maps, are included.

Laferriere, J. E. 1998. *Cheiropleuriaceae*. Flora Malesiana, series II, volume 3, pages 285-286.

A description is given of the family and its only species, *Cheiropleuria bicuspis* (Blume) Presl, with a drawing of the habit of the species.

Madulid, D. A. 1995. *A Pictorial Cyclopedia of Philippine Ornamental Plants*. Makati: Bookmark Inc.

This is an easy-to-read yet comprehensive reference on the identification and description of the numerous beautiful ornamental plants of the Philippines. It presents in a systematic and pictorial form more than 1000 species and varieties of endemic, indigenous and exotic ornamental plants in the country. The plants are presented in alphabetical order according to family. Over 80 species of ferns and fern allies are listed in the book with the following number of species per family: 51 in *Polypodiaceae*, 6 in *Selaginellaceae*, 6 in *Lycopodiaceae*, 4 in *Schizaeaceae*, 2 in *Cyatheaceae*, 2 in *Gleicheniaceae*, 2 in *Marattiaceae*, 2 in *Ophioglossaceae*, 2 in *Salviniaceae*, 1 in *Davalliaceae*, 1 in *Dipteridaceae*, 1 in *Parkeriaceae* and 1 in *Psilotaceae*. The following ornamental ferns are endemic to the Philippines: *Blechnum egregium*, *Goniophlebium persicifolium*, *G. subauriculatum*, *Platynerium grande* and a number of *Cyathea* species. The endemic status of a species of *Doryopteris* is doubtful.

Mendoza, D. and R. del Rosario. 1967. Philippine Aquatic Flowering Plants and Ferns. *Philippine National Museum (Manila) Publication Number 1*: 1-53.

Included among the 154 species and 9 varieties of flowering plants belonging to 88 genera and 42 families are 4 species of aquatic ferns belonging to 4 genera and 4 families, thus: *Acrostichum aureum* (*Pteridaceae*), *Azolla pinnata* (*Azollaceae*), *Ceratopteris silliquosa* (*Parkeriaceae*) and *Marsilea crenata* (*Marsileaceae*).

Comment: Not included are aquatic ferns such as *Acrostichum speciosum* (Pteridaceae), *Stenochlaena palustris* (Blechnaceae), *Cyclosorus gongyloides* (Thelypteridaceae), species of *Bolbitis* (Lomariopsidaceae), *Salvinia molesta* (Salviniaceae).

Merrill, E. D. 1908. On a collection of plants from the Batanes and Babuyanes Islands. *Philippine Journal of Science* 3 (6): 385-442.

Enumeration of vascular plants from the Batanes and Babuyanes Islands including 53 species of ferns (pages 389-393) thus: *Hymenophyllum dilatatum* (Forst.) Sw., *H blumeana* Spreng., *Trichomanes javanicum* Bl., *T cupresoides* Desv., *Alsophila glauca* (Bl.) J. S., *Cyathea fenicis* Copel., *Dryopteris adenophora* C. Chr. *D dissecta* (Forst.) O Ktz., *D luzonica* Christ, *D microloncha* Christ, *D parasitica* (Linn.) O Ktz, *D sparsa* (Harr.) O Ktz, *D setigera* (Bl.) O Ltz., *Tectaria crenata* Cav., *T irregularis* (Presl.) Copel. var *macrodon* Copel., *Leptochilus heteroclitus* (Presl) C. Chr., *Nephrolepis biserrata* (Sw.) Schott., *N hirsutula* (Forst.) Presl, *Dipteris conjugata* Reinw., *Davallia solida* (Forst.) Sw., *Odontosoria chinensis* (Linn.) J. Sm., *Lindsaya repens* (Bory) Bedd., *L davalloides* Bl. *Athyrium jaonicum* (Thunb.) Copel., *Asplenium nidus* Linn., *A prionurus* J. Sm., *A unilaterale* Linn., *Woodwardia radicans* (Linn.) Smith var *prolifera* W & A, *Adiantum caudatum* Linn., *A capillus-veneris* Linn., *Pteris cretica* Linn., *P ensiformis* Burm., *P quadriaurita* Retz., *P tripartita* Sw., *Histiopteris incisa* (Thunb.) J. Sm., *Vittaria elongata* Sw., *antrophyum parvulum* Bl., *Polypodium hirtellum* Bl., *P palmatum* Bl., *P phymatodes* Linn., *P punctatum* (Linn.) Sw., *Cyclophorus adnascens* (Sw.) Desv., *C acrostochoides* (Forst.) Presl, *Drynaria quercifolia* (Linn.) J. Sm., *Lygodium japonicum* (Thunb. Sw., *L circinatum* (Burm.) Sw., *L mearnsii* Copel., *Angiopteris angustifolia* Presl, *Marattia ternatea* De Vr. et Hartig and *Helminthostachys zeylanica* (Linn.) Hook.

Merrill, E. D. and M. L. Merritt. 1910. The flora of Mount Pulog. *Philippine Journal of Science* 5 (4+5): 287-405.

The ecology of Mount Pulog is extensively discussed. The flora (bryophytes, pteridophytes, gymnosperms and angiosperms) is presented. A total of 41 genera and 91 species of ferns were found to occur within the locality distributed in the following seven families: Hymenophyllaceae, *Cyatheaceae*,

Polypodiaceae, *Gleicheniaceae*, *Equisetaceae*, *Lycopodiaceae* and *Selaginellaceae*. Thirty species are endemic in the area.

Merrill, E. D. 1916. New plants from Sorsogon Province, Luzon. *Philippine Journal of Science* 11 (1): 1-35.

The paper is based almost wholly on materials collected in Sorsogon Province, Luzon by Maximo Ramos from July 22, 1915 to September 14, 1915 mainly at Bulusan Volcano, Mount Kililibong, Mount Pocdal, Mount Bogacaua, Mt. Lalao, and Lake Polog. During that time, he collected a total of 400 numbers flowering plants and ferns, a number of which prove to be undescribed. In addition to the forty previously undescribed forms considered in this paper, the author indicated 19 additional sheets of this collection as representing new species, presumably where material collected by Ramos matched material collected by himself during his exploration of Sorsogon subsequent to the trip of Ramos.

Merrill, E. D. 1926. Additions to our knowledge of the Philippine flora II. *Philippine Journal of Science* 29 (4): 475-496.

This contribution enumerates and describes 28 species and 1 variety of vascular plants including 1 species of fern, namely, *Schizoloma cordatum* Gaudich from Bohol.

Monsalud, M. R., A. L. Tungacan, F. R. Lopez and M. Q. Lagrimas. 1966. Edible wild plants in Philippine forests. *Philippine Journal of Science* 95 (4): 431-561.

The term wild plants as used in the paper, means both typically wild and domesticated plants of economic importance. A total of 367 species of edible wild plants, representing 224 genera and 86 families are included in this compilation, 6 of which are ferns: (1) pako (*Athyrium esculentum*), (2) diliman (*Stenochlaena palustris*), (3) tukod-langit (*Helminthostachys zeylanica*) (4) pakong sungai (*Ceratopteris siliquosa*), (5) tree ferns (*Cyathea* spp) and alolokdo (*Nephrolepis hirsutula*). For each of the concerned species, the following information is given: (1) edible part, (2) food preparation, how used and palatability, (3) brief notes on morphological features and geographical distribution.

National Azolla Action Program. 1989. *Azolla: Its Culture, Management and Utilization in the Philippines*. University of the Philippines Los Baños, Laguna.

This book is a collection of articles on the biology and culture of *Azolla*, utilization of *Azolla* (agronomy in soil science), utilization of *azolla* (animal science) and extension and socio-communication. Foreword: Quebral, F. C. The National *Azolla* Action Program, pages 1-4. Quebral, N. C. Introduction to *Azolla* and its uses, pages 5-22. Biology and Culture of *Azolla*, pages 23-40. Calilung, V. J. Pests of *Azolla* in the Philippines, pages 41-52. Garcia, R. P. *Azolla* pathogens and their management in the Philippines, pages 53-64. Villegas, G. G. and G. O. San Valentin. Effect of *Azolla* cover on nitrogen and rice in flooded Maahas clay, pages 65-90. Lales, J. S., M. A. Lapitan and R. S. Marte. Response of *Azolla* to herbicides, pages 91-102. Alfonso, P. Rat damage in *Azolla*-fertilized rice, pages 103-108. Callo, Jr D. P. *Azolla* adaptability and utilization on farmer's fields, pages 109-128. San Valentin, G. O. Constraints on utilization of *Azolla* in lowland rice production, pages 129-138. Tilo, S. N., R. D. Boniao, G. O. San Valentin and J. S. Lales. Soil fertility assessment and fertilizer use on *Azolla*, pages 139-167. Utilization of *Azolla* (animal science): Querubin, L. J., P. F. Alcantara and A. O. Princesa. Chemical composition of three *Azolla* species (*A caroliniana*, *A microphylla* and *A pinnata*) and feeding value of *Azolla* meal (*A microphylla*) in Broiler ration II, pages 181-194.

Querubin, L. J., P. F. Alcantara, E.S. Luis, A. O. Princesa and V. O. Pagaspas *Azolla* (*A microphylla*) for growing pigs, pages 195-214. Sevilla C. C., C. B. Perez Jr., M. R. Batungbacal and H. G. Natural Jr *Azolla* as feed for goats, pages 215-220. Alejar, A. S. and M. Aragones. *Azolla* (*A microphylla*) as partial replacement for palay-snail-shrimp-based ration for mallard ducks, pages 221-242. Extension and Socio-Communication: Quebral, N. C. Communication in the National *Azolla* Action Program, a case study, pages 243-274. Badayos, R. B. Philippine *Azolla* Extension Program from 1982-1987, pages 275-294. Suva, M. M., R. M. Cardona and V. M. Novero. *Azolla* utilization in selected provinces in the Philippines, pages 295-308. Orozco, R. C. Variables in the adoption-rejection of *Azolla*, pages 309-376. Badayos, R. B. *Azolla* technology adoption in the Philippines, pages 377-380. Appendix: Utilization of *Azolla*

as organic fertilizer for lowland rice, pages 381-382. References: page 383.

Nooteboom, H. P. 1992. Notes on Davalliaceae. I. The genera *Araiostegia*, *Davallodes*, *Leucostegia* and *Gymnogrammitis*. Blume 37: 165-187.

A revision of the following genera according to Kato's (1985) delimitation: *Araiostegia* Copel. with four species (one in Malesia and the Philippines), *Davallodes* Copel. with seven (six in Malesia and one in the Philippines), *Leucostegia* Presl with two (Both in Malesia and the Philippines), and *Gymnogrammitis* *Griffithii* with one (not represented in Malesia). Several entities in *Davallodes* previously regarded by Holttum in 1972 (Kew Bulletin 27: 247-249) as distinct are now synonymized under *D. hirsutum*. Nine figures are included.

Nooteboom, H. P. 1994. Davalliaceae II, a revision of the genus *Davallia*. Blumea 39: 151-214.

Araiostegia, *Humata*, *Pachypleuria* reduced, two sections, 1 new, 34 species, 1 new, five new combinations. Keys to genera, genus (2), synonymy, descriptions, index to names.

Nooteboom, H. P. 1997. The microsorioid ferns (*Polypodiaceae*). Blumea 42: 216-395.

Leptochilus (10 species Malesian, including *Colysis*). *Microsorium* (49/33 including *Neocheiropteris*, *Phymatosorus*; regional keys), *Podosorus* (1/1) and perhaps *Lepisorus*. Many new combinations, venation and arrangement of sori, keys, indices to collections and names.

Nooteboom, H. P. 1998. Davalliaceae. Flora Malesiana, series II, volume 3, pages 235-284.

A family wherein several species are cultivated as ornamentals; short paragraphs on distribution and chromosome numbers are included. The family is represented in Malesia by three genera, *Davallia* (23 species), *Davallodes* (6), and *Leucostegia* (2). A key to the genera and for each genus, a key to species are included. SEM photographs of the sori of *Davallia* are given, as

well as photographs of a herbarium sheet of one species of each genus. Listed below are the 16 Philippine species and varieties of the *Davalliaceae* included in the treatment: *Davallia brevipes* Copel. (Mindanao), *D denticulata* (burm. F.) Kuhn var *denticulata* (throughout Malesia), *D divaricata* Bl. var *divaricata* (throughout Malesia), *D embolostegia* Copel. (Luzon, Negros, Samar, Mindoro), *D falcinella* (J. Sm.) C Presl (Luzon, Mindanao, Leyte, Negros, Samar), *D heterophylla* Sm (Balabac, Paragua, Luzon, Catandunes, Leyte, Samar, Mindanao), *D hymenophylloides* (Bl.) Kuhn, *D pectinata* Sm. (throughout the Philippines but quite rare), *D repens* (Linn. f.) Kuhn, (throughout Malesia), *D sessilifolia* Bl. (Luzon), *D solida*, (G. Forst) Sw. var *solida*, *D trichomanoides* Bl. var *lorrainii* (Hance) Holttum (Luzon, Bohol), *D wagneriana* Copel. (Luzon, Panay, Mindanao, Negros, Leyte), *Davallodes hirsutum* (C. Presl) Copel. (Luzon, Mindanao, Negros, Samar), *Leucostegia immersa* C, Presl (Luzon, Mindanao, Mindoro, Leyte, Negros, Samar) and *L pallida* (Mett.) Copel. (Luzon, Mt Bulusan).

Panigrahi. G. 1993. *Parahemionitis*, a new genus of *Pteridaceae*. *American Fern Journal* 83 (3): 90-92.

Parahemionitis is described as a new genus of *Pteridaceae*. *Hemionitis arifolia* does not fit well in any of the existing genera of *Pteridaceae*. The author has proposed a new generic name while maintaining its specific name, i. e., *Parahemionitis arifolia*. He previously published his proposal but failed to provide the required Latin description, which he thought was not necessary at that time under article 42.1 of the code. The failure is addressed in this paper.

Payawal, P. C. 1984. The water fern *Azolla*. *Philippine Biota* 17 (3): 80-84.

Presented during the NAAP sponsored Trainors Training on *Azolla* Technology at U P Los Baños, the paper discussed the following aspects of the water fern *Azolla*: taxonomy, life-cycle, *Azolla-Anabaena* relationships and some environmental constraints on the growth and development of *Azolla*. *Azolla* has a world-wide distribution indicative of its broad physiological tolerance. The six extant species are: (1) *A filiculoides*, reported throughout the American continent, Hawaii, Australia, New Zealand, England, Ireland,

Germany and Czechoslovakia, (2) *A caroliniana*, indigenous to the eastern United States, the West Indies and Mexico, introduced into eastern Spain and France. (3) *A mexicana*, from South America to British Columbia and to Illinois, (4) *A microphylla*, from South America to southern North America and the West Indies, (5) *A pinnata*, widespread in the Eastern Hemisphere, in tropical Africa, southern Africa to Madagascar, Australia, New Caledonia, Indonesia, Ceylon, India, Indo-China, China, Taiwan and Japan, and (6) *A nilotica*, in the Nile River. In the Philippines, sporadic collections of *A pinnata* are found as weeds in rice paddies. Copeland (1960) reported the fern as a sporadic weed in Bontoc while in Lanao, J V Pancho collected the fern in Palo, Leyte.

Payawal, P. C. and E. M. Paderon. 1986. Sporocarp formation and spore germination of *Azolla* strains in the Philippines. *Philippine Agriculturist* 69: 663-643.

Sporulation of *Azolla* occurred in La Union, Camarines Sur and Laguna where the following strains sporulated: *A pinnata* 5 Bangkok, *A pinnata* 42 Java, *A pinnata* 704 Australia, *A mexicana* 202 Guyana, *A caroliniana* 305 China, *A microphylla* 403 Paraguay, *A microphylla* 407 Paraguay and *A microphylla* 418 Paraguay. Sporulation started around September and continued until about May. The peak of sporulation occurred around December and January. Of the 60 *Azolla* strains artificially cultivated under greenhouse conditions in La Trinidad, Benguet, 23 strains were reported to be sporulating since September. Microspore and megaspore cultures in the greenhouse at Los Baños generated embryonic sporophytes about 45 days after inoculation.

Pipoly, J. J. III. 1994. PPI teams establishes hectare plot with high tree density. *Philippine Flora Newsletter* 7 (1994): 1, 5.

The Philippine Plant Inventory (PPI) project field team reported establishment of its first inventory plot on Mount Kinasalapi, one of the ranges of Mount Kitanglad, in Lantapan, Bukidnon, Mindanao. The team estimated that the total number of qualifying trees may reach over 1, 000, a number possibly twice that of any comparable tropical inventory in the world. The presence of a significant number of large tree ferns, notably *Cyathea* and *Dicksonia*, is reported to be among the outstanding features of the plot.

Price, M. G. 1972. Summary of our present knowledge of the ferns of the Philippines. *Kalikasan, Philippine Journal of Biology* 1: 17-53.

The paper is an attempt to collate the important taxonomic literature on Philippine ferns to December 1972, integrating new information in the framework by Copeland's Fern Flora of the Philippines (1958-1960) which had been critically reviewed. It tabulated the known species to 920, a net reduction of 30 from those accepted by Copeland in his Flora, despite the inclusion of various additional species there omitted. Three new combinations in the genus *Tectaria* were proposed, viz., *T balabacensis* (Christ) Price (basonym: *Dryopteris balabacensis* Christ, Philipp. J. Sci. 2: 213. 1907) *T laxa* (Copel.) Price (basonym: *Ctenitis laxa* Copel., Philipp. J. Sci. Philipp. J. Sci. 83: 98. 1954) and *T mesodon* (Copel.) Price (basonym: *Dryopteris mesodon* Copel., Philipp. J. Sci. 7: 54. 1912). Some adoptions to synonymy were made: *Alsophila matthewii* Christ to *Cyathea loheri* Christ, Holtum ex Price; *Cheilanthes densa* (J. Sm. Ex Kunze) Fee to *C javensis* (Willd.) Moore; *Hymenophyllum merrillii* Christ to *H holochilum* (WB) Copel. ; *Oleandra clemensiae* Copel. to *O colubrina* (Blanco) Copel. ; *Phymatopsis philippinensis* Ching to *Crypsinus whitfordii*; *Polypodium asperulum* J. Sm. ex Auctt. to *Microlepia speluncae* (Linn.) Moore; *Polypodium pseudoarticulatum* Copel. to *Ctenopteris celebica*; *Polystichum edanyoi* Copel. to *P Obtusum*; *Tectaria peralata* Copel. to *T decurrens*; *Tectaria sulitii* Copel. to *T crenata*; *Trichomanes alagensis* Christ to *T minutum* Bl. ; *Trichomanes christii* Copel. to *T brevipes* (Presl) Bak. ; *Trichomanes grande* Copel. to *T thysanostemum* Mak. Several range of extensions were reported: *Cibotium baronetz* (Linn. J. Sm., *Gleichenia microphylla* R. Br. and *Lygodium salicifolium* Presl.

Price, M. G. 1972. Notes on Philippine ferns. *British Fern Gazette* 10: 253-262.

The paper included the following items: (1) description of a new species from Mount Makiling, Luzon, i. e. *Diplazium egenolfioides* M G Price; (2) proposal for two new combinations, i. e. *Diplazium fuliginosum* (Hook.) M G Price (a non-Philippine species, basonym: *Asplenium fuliginosum* Hook., Sp. Fil. 3: 120. 1860), and *Tectaria kehdingiana* (Kuhn ex Luerssen) M G Price (a Sumatran species, basonym : *Luerssenia kehdingiana* Kuhn ex Luerssen, Bot. Centralb. 11:17. 1882); (3) reduction to synonymy of *Pteris*

asperula J. Sm. ex Christ to *P oppositi-pinnata* Fee; *Acrosorus exaltatus* (Copel.) Copel., *A. merrillii* Copel. *A. symmetricus* Copel. to *A triangularis* (Scort. Ex Bedd.) Copel. and of the genus *Lagunaea* Vidal to *Tectaria* Cav.; (4) report of new records for the Philippines of *Dipteris lobbiana* (Hook.) Moore, *Thelypteris singalanensis* (Bak.) Ching and *Pseudophegopteris aurita* (Hook.) Ching and for Luzon of *Acrosorus streptophyllus* (Bak.) Ching, *Trichomanes rupicola* Racib. and *Tectaria beccariana* (Ces. C. Chr.; confirmation of the occurrence of *Vaginularia paradoxa* (Fee) Mett. In the Philippines, i. e. Mount Banahaw, Luzon; (6) verification of the type of locality of *Ctenitis rizaliana* (Christ) Copel. to be Rizal Province, Luzon, not San Ramon, Zamboanga as Copeland (1960) had indicated; and (7) discussion on the identity of *Trichomanes millefolium* Presl.

Price, M. G. 1973. Overlooked names of the Philippine Ferns. *Kalikasan, Philippine Journal of Biology* 2: 190-213.

The paper discussed eight names based on Philippine ferns but unnoticed by recent authors. Of these, *Paltonium dubium* Rosenst. was reduced to *Doryopteris ludens* (Wall ex Hook.) J. Sm.

Price, M. G. 1973. Publications of E. B. Copeland. *Philippine Agriculturist* 57: 5-16.

A compilation of the publications of E. B. Copeland of which most dealt with ferns: 123 papers representing a little more than 56 per cent of his total number of papers.

Price, M. G. 1973. A new species of *Grammitis* from Mount Banahaw, Luzon. *Philippine Agriculturist* 57: 34-36.

In this paper, a fern from Mount Banahaw, Luzon was described as new, viz., *Grammitis alepidota* Price. The species is characterized by its lack of scales and sporangial hairs, unbranched veins, a peculiar hairiness and small size.

Price, M. G. 1973. The pteridophytes described from Mount Makiling, Luzon. *Philippine Agriculturist* 57: 37-48.

The paper discussed the name established for and permanently attached to specimens of pteridophytes on Mt. Makiling which have provided the basis

for names of 35 species and 1 variety (including *Pneumatopteris michaelis* Holtt., Blumea 21: 313. 1974, see postscript at the end of the paper), a possible 3 additional names with undetermined types and 2 nomina nuda bearing the name of the mountain that have appeared in the literature. Eleven of the ferns founded on Makiling ferns were considered to be presently correct, viz., *Asplenium cymbifolium* Christ, *Chingia urens* Holttum, *Crypsinus lagunensis* (Christ) Copeland, *Cyathea callosa* Christ, *Dennstaedtia philippinensis* Copeland, *Diplazium egenolfioides* Price, *Goniophlebium terrestre* Copeland 1/, *Lindsaea capillacea* Christ, *Oleandra maquilingensis* Copeland, *Pneumatopteris michaelis* Holttum, *Teratophyllum arthropteroides* (Christ) Holttum, with the possible addition of another, viz., *Cyathea loheri* Christ. Tree of these species have until now been found exclusively on Mount Makiling, viz., *Goniophlebium terrestre* 1/, *Diplazium egenolfioides* and *Chingia urens*. Eight taxa were newly interpreted in this paper, thus: *Aspidium trifolium* v. A. v. R. to *Tectaria angulata* (Willd.) Copel.; *Asplenium riparium* Brack. to *A. affine* Sw.; *Crypsinus subdimorphus* Copel. to *C. whitfordii* (Copel.) Copel.; *Drynaria decurrens* Brack. to *Microsorium palmatum* Fee; *Nephrodium pubescens* Brack. to *Christella parasitica*, (Linn.) Lev., *Selaginella toppingii* Hieron. to *S. jagorii* Warb.; *Trichomanes javanicum* var. *intercalatum* Christ to *T. laciniatum* Roxb.; and *Vittaria crispomarginata* Christ to *V. elongata* Sw. The name *Oleandra maquilingensis* Copel. was proposed to supplant *O. colubrina* (Blanco) Copel.

1/ *Schellolepis terrestris* (Copel.) Price, *Kalikasan*, *Philipp J Biol* : 178. 1974.

Price, M. G. 1974. A new combination in *Tectaria*. *American Fern Journal* 64: 31.

The new combination proposed for the Philippine fern in this paper is *Tectaria trifida* (Fee) Price (Basionym: *Microsorium trifidum* Fee, Gen. Fil. 269. 1832)

Price, M. G. 1974. Three new ferns for the genus *Tectaria*. *Kalikasan*, *Philippine Journal of Biology* 3: 113-120.

Three new ferns described in this paper are: *Tectaria athyrisora* Price, *T. stalactica* Price and *T. tabonensis* Price.

Price, M. G. 1974. Nine new fern names. *Kalikasan, Philippine Journal of Biology* 3: 173-178.

Three fern genera distinguished by dimorphism were united with their non-dimorphic presumed generic archetypes, thus: *Hemigramma* Christ to *Tectaria* Cav., *Dendroglossa* Presl to *Colysis* Presl and *Drymoglossum* Presl to *Pyrrosia* Mirbel. Eight new combinations were proposed in the foregoing genera, viz. : *Tectaria hilocarpa* (Fee) Price (basionym: *Leptochilus hilocarpus* Fee, Acrost. 88, pl. 49. 1845), *T taccifolius* Fee, Acrost. 89, pl. 50. 1845), *Colysis minor* (Fee) Price (basionym: *Leptochilus minor* Fee, Acrost. 87, pl. 25, f. 3. 1845) *Pyrrosia piloselloides* (Linn.) Price (basionym: *Pteris piloselloides* Linn., Sp. Pl. ed. 2: 1530. 1763), *P fallax* (v. A. v. R.) Price, *P heterophylla* (Linn.) Price, *P niphoboloides* (Bak.) and *P novo-guineae* (Christ) Price of which the last four are non-Philippine in occurrence. Added to the above new combinations for these Philippine species is an additional one, viz., *Schellolepis terrestris* (Copel.) Price (basionym: *Goniophlebium terrestre* Copel., Philipp. J. Sci. 56: 106, pl. 13, 14. 1935.

Price, M. G. 1974. A new selection and species of *Pteris*. *Kew Bulletin* 29 (4) : 725-730.

A new selection of the genus *Pteris* is established for three endemic Philippine ferns: one with free-included veinlets is described as new, *P endoneura*. The other two species, *P calocarpa* and *P pachysora* here transferred to *Pteris*, were first named in *Schizostege* and have recently provided with the generic name *Copelandiopteris*.

Price M. G. 1975. The Pteridophytes of Mount Makiling and Vicinity. M S Thesis. University of the Philippines at Los Baños, College, Laguna.

A taxonomic treatment including keys, synonymy, original descriptions, distribution, ecology, common names, specimens examined, comments and an index is presented for the pteridophytes of Mount Makiling (south-central Luzon, elevation 1, 109 meters). Altogether, 31 families, 103 genera, and 305 species, plus several varieties, hybrids and cultivars are described. The treatment includes some important cultivated species and a few others useful for instructions although neither cultivated nor indigenous. Those taxa

actually occurring naturally on Makiling include 28 families, 97 genera, and 291 species, representing almost one-third of the total number of species known to be from the Philippines.

The study was primarily based in the author's own collections made over seven years and comprising over 3000 numbers, often with many duplicates. In the course of the work, three new species were discovered in Makiling and numerous extensions of range recorded. Specimens of many other collectors were examined at UP Los Baños Herbarium (CAHP), the Philippine National Museum (PNH) and the Singapore Botanic Gardens (SING).

The systematic arrangement closely follows Holttum's work in Flora Malesiana. Full citation is given Copeland's Fern Flora of the Philippines, Holttum's Ferns of Malaya, Flora Malesiana, and to recent revisions and monographs. The style attempts to parallel Pancho's Flora of Mount Makiling and Vicinity dealing with spermatophytes.

Price, M. G. 1977. Philippine *Dryopteris*. Garden's Bulletin (Singapore) 30: 239-250.

A key to the 13 recognized Philippine species of *Dryopteris* is presented, with descriptions of two new species, i. e. , *D uropinna* and *D permagna* and four species not hitherto reported as Philippine: *D chrysocoma*, *D pulvinulifera*, *D polita* and *D formosana*. *Ctenitis mearnsii* is reduced to *Nothoperanema hendersonii*. The 13 species are *D cochleata*, *D chrysocoma*, *D hirtipes*, *D wallichiana*, *D pulvinulifera*, *D polita*, *D sparsa*, *D uropinna*, *D varia*, *D formosana*, *D subarborea*, *D purpurascens* and *D permagna*.

Price, M. G. 1982. The Ferns of Steere and Harrington. Contribution from the University of Michigan Herbarium 15: 197-204.

Of particular interest in this paper are the eleven new species of ferns described by Harrington from Steere's pteridophytes collection from the Philippines: *Hymenophyllum thuidium* Harr., *H fraternum* Harr., *Davallia philippinensis* Harr., *Lomaria areolaris* Harr., *Asplenium steerei* Harr., *Nephrodium luerksenii* Harr., *N bakeri* Harr., *Polypodium aoristorum* Harr., *P craterisorum* Harr., *P hammatisorum* Harr. The nomenclatural standings of the foregoing taxa were assessed.

Price, M. G. 1983. Several unusual Malesian *Diplazia* (Athyriaceae). *Gardens Bulletin (Singapore)* 6: 25-29.

The paper discussed four small, deceptively similar species, several reductions and one new combination.

Price, M. G. 1983. Two name changes for ferns of Mount Makiling, Luzon, Philippines. Kalikasan, *Philippine Journal of Biology* 12: 155-156.

These two changes are *Ctenitis pallens* (Brack.) Price (basonym: *Lastrea pallens* Brack., U S Expl. Exped. 16 (1854) 197) and *Lastreopsis manilensis* (Presl) Price (basonym: *Lastreopsis manilensis* Presl, Epim. Bot (1851) 39).

Price, M. G. 1987. Sabah ferns collected by John H. Beaman. Contribution from the University of Michigan Herbarium. 16: 189-200

Critical notes on selected species: *Adiantum opacum*, *Tectaria balabacensis*, new records; one new species and two new combinations in *Diplazium*; one new name in *Grammitis*, one new combination in *Prosaptia*, *Selliguea*.

Price, M. G. 1990. Philippine fern notes. Contribution from the University of Michigan Herbarium 17: 267-278.

This paper reports new species, new combinations, range extensions and synonymy in the following taxa: *Adiantum*, *Arthropteris*, *Asplenium*, *Cephalomanes*, *Cyclopeltis*, *Cyrtomium*, *Davallia*, *Diplaziopsis*, *Diplazium*, *Dryopteris*, *Grammitis*, *Leucostegia*, *Microsorium*, *Monogramma*, *Prosaptia*, *Pteris*, *Selliguea*, *Sphaerostephanos* and *Vittaria*.

Price, M. G. 1990. Four New Asian *Loxogramme*. *American Fern Journal* 80 (1): 4-8.

The four new species of *Loxogramme* (*Polypodiaceae*) described in the paper are: *Loxogramme carinata* Price, *L. centicola*, *L. porcata* Price and *L. saziran* Tagawa ex Price. Although Asiatic in distribution, none occurs in the Philippines.

Price, M. G. "PHILIPPINE PTERIDOPHYTE PHYTOGEOGRAPHY." XV International Botanical Congress Yokohama, Japan, Pacifico Yokohama, 28 August-3 September 1993: 18.

The thousand species of Philippine pteridophytes are distributed according to their own peculiar histories and environmental requirements which fit neither the political boundaries inherited from colonial invasions, nor the theoretical biogeographic provinces, schema, or lines of demarcation proposed on the basis of the study of other organisms. Oceanic barriers or land bridges, recent or past, are hardly meaningful for spore dispersal in this fairly compact archipelago, where most pteridophytes are already restricted to discontinuous mountain areas. New pteridological monographs, field work in the Philippines, and publications about Sabah and Taiwan necessitate this updated analysis. The Philippines combines floristic elements of Malesia with those of China and Japan, and juxtaposes loci of long-term habitat stability with others of great geologic volatility. It has been a conduit, a recipient of, and a source for many pteridophyte migrations and has evolved noteworthy endemics.

Quisumbing, E. A. 1924. *Marsilea crenata* Presl, a noxious weed: Its eradication in rice fields. *Philippine Agriculturist* 13 (5): 209-212.

The aquatic fern *Marsilea crenata* is reported in terms of its ecology, synonymy and distribution (which includes the Philippines). Two plates with 19 figures show the structure of its leaf, leaflet, and germinating sporocarp.

Ravensberg, W. J. and E. Hennipman. 1986. The *Pyrrosia* species formerly referred to *Drymoglossum* and *Saxiglossum*. *Leiden Botanical Series* 9: 281-310.

The taxa formerly referred to *Drymoglossum* and *Saxiglossum* are part of *Pyrrosia*. Of these, taxonomy and phylogenetic relationship of six species are given and discussed. One monophyletic group could be recognized consisting of *Pyrrosia heterophylla*, *P niphoboloides*, and *P piloselloides* (*Drymoglossum* p. p.). Only one occurs in the Philippines, i. e., *P piloselloides*.

Rivero, G. C. and P. M. Zamora. 1995. The Genus *Syngamma* in the Philippines. U P CIDS NAST Biodiversity Conservation Reports 3: 1-53.

The study is an attempt to arrive at a satisfactory description of three species of ferns in the genus *Syngamma* in the Philippines, i. e. , *S alismifolia* (the type) *S vittaeformis* and *S wallichii*. From the qualitative and quantitative data, the three species were found to exhibit many common features. However, they can only be differentiated mainly on the basis of frond outline, base and tip. Of three species, *S alismifolia* alone possesses leaf buds at the base of the laminae. Thus, leaf buds have been used as a secondary key character. The quantitative morphological characters suggest that *S wallichii* may be a hybrid. However, data on its geographical distribution pattern negates the above suggestion. Abortive or misshapen spores are a common feature in all three species, suggesting apogamy.

Rodl-Linder, G. 1987. *Goniophlebium* of the Philippines (*Polypodiaceae*). *Philippine Journal of Science* 116: 151-156.

Revision of seven species, including *Polypodium mengtzeense*, key, one new combination, description.

Rodl Linder, G. 1990. A monograph of the fern genus *Goniophlebium* (*Polypodiaceae*). *Blumea* 34: 277-423.

This monographic study deals with the phylogenetic systematics of the goniophlebioid *Polypodiaceae* with special reference to the Asian representatives. It includes the recognition and description of species of *Goniophlebium*, a full synonymy, and a reconstruction of their phylogeny. This study concentrates on the analysis of 34 species earlier referred to as *Polypodium Linnaeus (sensu lato)* with a (partly) goniophlebioid venation pattern and also includes a selection of free-veined *Polypodium* species. The phylogenetic relationships within this group are discussed through the analysis of characters. Homologous character states concerning the morphology of the mature sporophyte, with respect to the rhizome, rhizomes scales, the gross morphology, the venation pattern, the indumenta, the sori, the paraphyses, the sporangia and the spores. Microscopic and submicroscopic features were included. Several of these characters were studied in detail for

this group for the first time. Observations regarding the development of the gametophytes are reported.

During the author's three years' stay in the Philippines, she was able to study complete life cycles of a greater part of the Philippine species concerned. Special emphasis is given to growth from germination until maturity as well as to the location of the indument, antheridia, and archegonia as to juvenile sporophyte; special attention is paid to the venation and indumenta. The presence, the period of development, the shape, the location and the persistence of acicular and glandular hairs as well as laminar scales were recorded. Indumenta of juvenile and adult sporophytes were compared and differences were noted. A comparison between laminar and rhizome scales showed a number of similarities. A selection of 90 character states was used in the datamatrix which served as a prerequisite for cladistic analysis. Known data from the literature about chromosome numbers were presented in the summary form. Geographical and ecological particularities were investigated. Results of transplant experiments which were undertaken in the Philippines point out that morphological characters may show great plasticity. These experiments also added important details to the author's species delineation. The phylogenetic relationships between the species were correlated with distribution areas. The biogeographical analyses suggested a close relationship among New Guinea, Celebes and the Philippine Islands. The Malay Peninsular and Sumatra appear closely related to each other as well as both these areas to mainland Asia. As a result of the morphological, cladistic, biological and geographical interpretation, the Asian genus *Goniophlebium*, comprising 23 species, is recognized.

Rodl Linder, G. 1990. Designation of a new lectotype for *Goniophlebium* (Blume) Presl (*Polypodiaceae*). *Taxon* 39: 105.

Roos, M. C. 1985. *Phylogenetic Systematics of the Drynarioideae (Polypodiaceae)*. Universiteitsdrukkerij. 301 pages.

I. INTRODUCTION AND SUMMARY.

The present monograph deals with the phylogenetic systematics of the subfamily *Drynarioideae* of the *Polypodiaceae*. It includes the recognition and description of evolutionary species and emphasizes the reconstruction of their phylogeny. The monograph is the thesis of the author,

fulfilling the requirements for a PhD in the faculty of Science, University of Utrecht. The study is carried out in the framework of the International project on the systematics of *Polypodiaceae*.

Phylogenetic systematic studies start with the selection of an inferred holophyletic group. Within the context of systematic research on a large-sized taxon, it is the best heuristic to start with the recognition of relatively small and obvious groups as a first approximation of the taxonomic structure. Later on, the monographic world should be extended to higher hierarchical levels, including groups that are "disputed" and less obviously characterized.

The holophyly of the *drynarioid* ferns is undisputed since the forties (e.g. Copeland, 1947), although it has been given formal taxonomic rank only recently (Crabbe et al., 1975: subfamily *Drynarioideae*; Ching, 1978: family *Drynariaceae*). In all recent conflicting and much disputed taxonomic systems of *Polypodiaceae*, the *drynarioids* are uniformly recognized as a natural group. This has been the main reason for selecting this group. On the other hand, all other systematic questions as regards to *drynarioids*, are highly controversial. For instance, the generic delimitation has always disputed and no consensus has been attained as yet, a situation prevalent within *Polypodiaceae* in particular (Hennipman, 1984), although the situation in this family is representative for the numerous systematic controversies in general.

The (scientifically) most important cause of these controversies is in the author's opinion due to insufficiently and/or only vaguely defined methodologies used. The author has a strong belief that the clear formulation of starting points and aims, followed by the selection of adequate (repeatable) methodologies, would greatly add to the further development of systematics as the central discipline in evolutionary and comparative biological research. Therefore, the purpose of the present monograph is twofold:

A) The explication of the author's point of view on the scientific inquiry of systematics and to outline an adequate comparative (cladistic) methodology. This has already been done before in a summarized way (Hennipman and Roos, 1983), but the present outline is more elaborated, comprising a few alterations that are aimed at elucidating problems which at the time remained. The methodology presently applied is also different from that used in the study of *Platyserium* (Hennipman and Roos, 1982). The main difference concerns the establishment of transformation series.

In the *Platyserium* monograph, transformation series were established in advance, using the sister group *Pyrrosia* as the first outgroup in outgroup comparison. In case the outgroup comparison could not be applied,

transformation series has been established using ontogenetic data. Thus, the phylogeny reconstruction in *Platyserium* was based on a priori indicated apomorphies. In this publication, transformation series are established a posteriori being read off from the cladograms that are constructed using character state distributions in the data matrix only.

A second important difference pertains to the way outgroup is applied. In the study of *Platyserium*, all transformation series have been established disregarding the hierarchical level within the genus, using *Pyrrosia* for outgroup comparison. In other words, the outgroup rule was applied in a global sense. Presently, the outgroup rule has been used in the strict, local sense (Zandee, unpubl. ms). This means that at each hierarchical level, the ingroup, sistergroup, and outgroup are unambiguously defined. The ingroup is potentially holophyletic in case it possesses common similarities that are absent in both the sister- and the outgroup. These similarities are apomorphic by definition. This interpretation of the outgroup rule is consistent with the non-absolute concept of apomorphy (and consequently, of holophyly and homology).

Phylogenetic relationships between the *drynarioids* species recognized were traced using a cladistic methodology. Under the covering ideas of the evolution as 'descent with modification, its starting points and purposes as delineated by Hennig (1966) and Wiley (1981) are superior to the other methodologies proposed by different systematic schools. Existing methods of cladistic analysis have been studied by the author. The method selected and its computer implementation (algorithm) is developed by Zandee (1985) with empirical feedback by the present author. This 4-step procedure has the following advantages.

1) transformation series are not priori established, 2) an integration of compatibility and parsimony methods is achieved, 3) no data are initially discarded or weighted otherwise a priori, 4) all possible cladogenetic relationships are unambiguously defined and presented, and 5) the systematist get the opportunity to evaluate all possible hypotheses according to several kinds of auxiliary criteria.

Furthermore, the procedure can handle the present 31 by 557 data matrix enumerating the observations made at as many structural integration levels as possible.

Before the procedure can be applied, terminal clada must be delimited, and character analyses have to be carried out. A cladon (plural: clada) is a general term for cladogenetic entity (either or not with a formal taxonomic name) that serves as a building block for cladogram construction. Terminal clada are the smallest building blocks used (e. g. species). The observations are summarized in a binary data matrix (step 1). Selected patterns are read off from this matrix, i. e. partially monothetic

sets (step 2). These sets are sets of terminal clada defined by a set of unique character states sufficient for their characterization, and also constitute clada. Among the sets themselves, three types of relations exist: inclusion exclusion, and overlap.

Subsequently, cliques are formed comprising partially monothetic sets that all mutually in- or exclude each other (step 3). The search procedure is for the largest cliques. The maximum clique size is $2N-1$, by which N is the number of the terminal clada with $N-1$ internal inclusion relations.

The largest cliques found are transformed into cladograms (step 4). These cladograms are judged according to their respective representation of the original data matrix. At first, this is done by calculating their values of 'contradiction minus support.' Support is the number of character states of which the distribution can be explained by assuming a single origin or reversal. Contradiction is the total number of origins and reversals necessary to explain the distribution patterns of the remaining character states. The supporting character states are only relevant when they present apomorphies, which is established using outgroup comparison.

Several cladograms might show comparable low values of contradiction minus support with all clada being supported by apomorphies. Eventually, one of these is chosen as the hypothesis of cladogenetic relationships among the terminal clada that is regarded biologically most plausible. This cladogram serves as the basis for further phylogenetic and evolutionary analyses.

B) The reconstruction of *Drynarioideae* using the principles and methods set forth in A, and to compare the results with those of previous authors. Presently, 30 evolutionary species are recognized. In all recently proposed classifications, 16 of these are accommodated in the genus *Drynaria*; the remaining 14 species are variously classified. In Copeland's (1947) classification, which is widely accepted, these species are accommodated in seven genera: *Aglaomorpha* (5 spec.) *Merinthosorus*, and *Thayeria* (both 2 species), *Drynariopsis*, *Holistachyum*, *Photinopteris*, and *Pseudodrynaria* (all monotypic). The phylogenetic relationship among these genera were ill-defined. Thus, transformation series could not be established. Nevertheless, Pichi Sermolli (1977) defended the monotypic genera representing distinct stages of the realization and combination of phylogenetic trends in frond dimorphism and sori shape. Chandra (1982b) proposed two tribes. This subdivision is here inferred to be based on character weighting as it is conflicting with the data he provided. Furthermore, it cannot be based on phylogenetic considerations, because the phyletic scheme presented in the same publication is incongruent with this subdivision.

These examples show the genera as far as the recognition of supraspecific taxa within the *Drynarioideae* is concerned. This confusion is further illustrated by the remark of Copeland (1947, p. 202), stating that nearly all *Aglamaorpha* (sensu lato) species has been proposed as the type of a genus. Copeland tried to explain the controversies by assuming that this is related to the relative recency and extreme plasticity of the group. But he did not provide any evidence for these postulations which are here refuted.

The present monograph also deals with the question which of the previous (generic) dissections really reflect the phylogeny or whether they are based on phenetic groups.

The first cladistic analysis of all 31 terminal clada initially recognized, resulted in cladograms showing many polytomies. Interpretation of these cladograms and their supporting characters led to the recognition of two main holophyletic groups. It appeared that the 14 (formerly variously classified) species comprise a holophyletic group which is the sister group of *Drynaria*. Therefore, the present author proposes a classification of the *Drynarioideae* comprising two genera i. e. *Aglaomorpha* and *Drynaria*, including the rejection of all other genera (also of the generally accepted *Photinopteris*). A phenetic analysis of the same data matrix yielded the same two groups. It further showed larger dissimilarities among *Drynaria* species than among *Aglaomorpha* species which is contradictory to what existing classification might suggest.

For each of these two genera, a separate cladistic analysis was carried out. These analyses resulted in the selection of a number of cladograms. The cladograms of *Drynaria* were all completely dichotomous. Those of *Aglaomorpha* showed a trichotomy of two groups of three species and a single terminal cladon. The latter is a hybrid. Next, each of these cladograms of *Aglaomorpha* was combined with each one of *Drynaria*, followed by a choice for cladogram 7.43 representing the best hypothesis of cladogenetic relationships among the *drynarioid* clada. The transformation series in frond dimorphism and sori shape, read off from this cladogram, contradict those proposed by Pichi Sermolli (1977).

A subsequent historical biogeographical analysis, based on the chosen cladogram, was carried out according to the method of component analysis as described by Nelson & Platnick (1981) starting from the distribution patterns of the *drynarioid* (and *Platyserium*) species, areas of endemism they inhabit respectively, yielding an area-cladogram. From this area-cladogram, a general areagram was derived presenting a cladistic relationships among the different areas of endemism. It appeared that

Taiwan is more related to continental Asia than Malesia, that the areas of continental Asia are mutually more related to each other than to those of Malesia, and that Borneo and the Philippines are mutually more related to each other than to the other areas of Malesia. The relations of Celebes remained uncertain.

Eventually, all data of intrinsic and extrinsic characters were used to postulate a scenario of the *drynarioid* ferns. According to the phylogeny hypothesized, the *drynarioids* show trends leading from (internal dimorphism) towards monomorphism, and from predominantly epiphytic towards more epilithic or terrestrial growth habits. Furthermore, *drynarioids* with a northern distribution in continental Asia are supposed to have been migrated towards high altitudes.

Roos, M. C. 1985. Phylogenetic Systematics of the *Drynarioideae* (*Polypodiaceae*). Thesis, Utrecht. 302 pages.

This work consists of two parts. The first one is the elaboration of cladistics for phylogenetic speculation; in the second one, *Aglaomorpha* and *Drynaria* are monographed, the first with 15 species and 1 hybrid, the second with 16 species. *Aglaomorpha* 32 has been omitted in the key. There are no new taxa or combinations here; the latter were published in Blumea 31 153 1985. Some genera proposed by Copeland have been reduced.

See Hovenkamp, P. H. 1987. Review: "Roos, M. C. Phylogenetic Systematics of the *Drynarioideae* (*Polypodiaceae*). Verh. Kon. Ned. Akad. Wetensch. Amsterdam, The Netherlands." Flora Malesian Bulletin 6 (4): 422-443.

Roos, M. C. 1985. New combinations in *Aglaomorpha* Schott (*Polypodiaceae*) Blumea 31: 153.

Six new combinations are made in the *drynarioid* genus *Aglaomorpha*. One of this involves a Philippine endemic, *Thayeria cornucopia* Copel. Philipp J Sci 1 (1906) Suppl 165, t. 28. In *Aglaomorpha*, its new name is *Aglaomorpha cornucopia* (Copel.) Roos.

Roos, M. C. 1986. *Phylogenetic Systematics of the Drynarioideae* (*Polypodiaceae*). Verh. Kon. Ned. Akad. Wetensch. Natuurk. Ser II, 85 (1986): 1-318.

See Hovenkamp P. H. 1987 Review: "Roos, M. C. 1986
Phylogenetic Systematics of the *Drynarioideae* (*Polypodiaceae*). Verh. Kon.
Ned. Akad. Wetensch. Natuurk Ser II, 85 (1986): 1-318. "Flora Malesiana
Bulletin 9/4 (1987): 442-443.

**Salgado, A. E. 1981. Venation Patterns in Philippine *Tectarioid* Ferns.
Ph D Dissertation, University of the Philippines, Diliman, Quezon
City.**

The venation of *tectarioid* ferns found in the Philippines was studied in order to determine its value as a taxonomic tool. Three basic patterns were found: free, mixed, and anastomosing. These basic patterns were in turn subdivided into eight subtypes. Leaf venation lends supporting evidence to some association of species previously established by Copeland (1906, 1960) and Holttum (1954). The venation was found to be a poor taxonomic tool and only seldom can it be used to distinguish closely related species and genera. Venation is used to distinguish the free-veined *Tectaria* from *Ctenitis*. *Tectaria barberi* is the only species with a distinctive venation pattern that can be used to distinguish it from other species of tectariid ferns. *Cyclopeltis*, *Didymochlaena*, and *Tectaridium* can readily be distinguished from other genera on the basis of venation alone, but their species cannot be differentiated with the venation pattern. Relative levels of evolution of the venation of *tectariid* ferns have been determined through comparative morphological studies of extant Philippine ferns. the general trends of specialization occurred along two lines of evolution: the *Pteridrys-Pleocnemia* line and the *Tectaria-Heterogonium* line. The evolutionary trends in *Pteridrys-Pleocnemia* line are (1) a change from free to reticulate venation without included veinlets, (2) a shift from veinlets following an irregular course to veinlets following a regular one, then changing again to an irregular path as anastomoses appear; and (3) a slight increase in the number of vein orders in the more advanced species. The trends in the *Tectaria-Heterogonium* line are: (1) a change from free to reticulate venation; (2) the progressive development of cells, perfect areoles with included veinlets from vein approximation and occasional fusions; (3) a shift from irregular venation to a regular one, giving rise to the orderly arrangement of the areoles; and (4) an increase in vein orders. Arbitrary ranks have been designated and described in

each evolutionary line to emphasize the evolutionary changes that have occurred. The changes are gradual and intermediate types can be found in both lines. Four ranks have been established in the *Pteridrys-Pleocnemia* line and five in *Tectaria-Heterogonium* line. The first rank is the most primitive and is common to both lines.

Salgado, E. 1982. Venation Patterns in Philippine *Tectarioid* Ferns. De la Salle University Monograph Number 3, Manila*

Based on Salgado, A. E. 1981. Venation Patterns in Philippine *Tectarioid* Ferns. Ph D Dissertation, University of the Philippines, Diliman, Quezon City. Fifty three species belonging to 12 genera were studied. Two lines of evolution with several trends in both were discovered. Important work. (Editor, Flora Malesiana Bulletin 36 (1983): 3973)

Salgado, A. E. and N. V. Valera. 1987. A morphoanatomical study of *Tectaria grandifolia* (Presl) Copeland. *Philippine Journal of Science* 116 (4): 377-390.

A detailed morphoanatomical study of *Tectaria grandifolia* (Presl) Copel. was conducted in order to clarify its phylogenetic relationships to members of the *Tectaria crenata* complex. The large size of the frond, its reduced division with a broadly winged rachis, slight dimorphism, very complex venation pattern, seriate soral arrangement, and the presence of perispore are evidences of close relation of *T grandifolia* to the other species of the *T crenata* complex. The radially symmetrical dictyostele, overlapping leaf gaps, many leaf traces, rachis with several vascular bundles, five vein orders, orderly arrangement of the venation, undifferentiated mesophyll with large air spaces, linear soral arrangement, and monolet spores surrounded by a perispore are considered advanced characters. *T grandifolia* probably represents a late development within *Tectaria*. A comparative study of the anatomy of the rachis of the *T crenata* complex is recommended.

Salgado, A. E. 1988. A new concept of *Tectaria taccifolia* (Fee) Price (*Aspidiaceae*) a polymorphous Philippine fern. *Philippine Journal of Science* 117 (2): 211-213.

The concept of *Tectaria taccifolia* (Fee) Price is hereby expanded to include the polymorphic *Tectaria hilocarpa* (Fee) Price. Characters used to

distinguish *Hemigramma* from *Tectaria* are discussed in the light of field observations.

Salgado, A. E. 1990. A checklist of Philippine ferns. *Philippine Journal of Science* 119 (2): 107-148.

A provisional checklist of Philippine fern taxa is provided. Thirty one families, 151 genera and 958 species are reported. An increase of 14 families, 1 genus and 15 species is recorded since the last inventory was made by Copeland in 1961. The composition of the families follows closely but not exactly that of Flora Malesiana (Holttum, 1959). Other differences from Copeland's inventory are the circumscription of genera, the addition of a substantial number of new species and the updating of the nomenclature.

Salgado, A. E. 1996. Taxonomic and nomenclatural notes on Philippine ferns, I. The identity of *Asplenium anisodontum* Presl (*Aspleniaceae*). *Edinburgh Journal of Botany*: 53: 271-274.

Salvoza, F. M. 1939. The pteridophytes in the flora of the Makiling National Park and its vicinity. *National Research Council of the Philippines Bulletin* 2 (3): 69.

The taxonomy of the flora of the Makiling National Park and its vicinity is investigated. The pteridophytes are summarized thus: 3 classes, 2 subclasses, 4 orders, 2 suborders, 12 families, 70 genera, 227 native species, 7 introduced species, 3 native varieties and 2 introduced varieties with a total of 234 species and 3 varieties.

Saunders, M. R. K. 1998. *Azollaceae. Flora Malesiana, series II, volume 3, pages 277-284.*

This nearly cosmopolitan family with only one genus and 6 or 7 species is represented in Malesia by one species, *Azolla pinnata* R. Br. The general part of the treatment includes paragraphs on reproduction, fossils, phylogeny, vegetative and reproduction structures and life cycle, chromosomes, uses, and taxonomy. The family and the Malesian species are described, and a drawing of the plant details of the reproductive structures are given.

Schelppe, E. A. C. L. E. 1979. A new name for *Blechnum capense* (Linn.) Schletend. *Journal of South African Botany* 45: 221.

Must be called *B sylvaticum* Schelppe (new name), as *B capense* Burm. F. is validly published. In the Philippines, this species occurs in Luzon (Mt Mayon), Mindoro (Mt Halcon), Negros (Cuernos de Negros), Mindanao (Mt Apo) and Palawan.

Stone, B. C. 1966. Typification of *Schizostegeopsis* Copeland. *Philippine Journal of Science* 95 (4): 425.

Two new combinations and selection of a type of species, (1) *Schizostegeopsis calocarpa* Copel.) Copel. ex Stone (basionym: *Schizostege calocarpa* (Copel.), selected as the lectotype species for the genus *Schizostegeopsis*, and (2) *Schizostegeopsis pachysora* Copel. ex Stone (basionym: *Schizostegeopsis pachysora* Copel.)

Stone, B. C. 1973. “*Copelandiopteris*”, a new genus of Philippine ferns. *Webbia* 28: 491-494.

“Much ado about nothing; the simple formal description of *Schizostegeopsis* Copel. would have surfaced to validate two specific names and the genus, its validation and typification merely a nomenclatural matter.” *Flora Malesiana Bulletin* 28 (1975): 2420.

Stone, B. C. 1976. *Copelandiopteris endoneura* (Price) Stone, comb. nov. (Pteridophyta) *Kalikasan, Philippine Journal of Biology* 5: 329-331.

The status of *Copelandiopteris* Stone (Pteridophyta) is discussed and a third species (*C endoneura* (Price) combination novum) is added to the genus. Three species, *C calocarpa* (Copel.) Stone (type species), 2 *C pachysora* (Copel.) Stone, (3) *C endoneura* (Price) Stone (combination novum) (synonym: *Pteris endoneura* Price. *Kew Bull.* 29 (727) 1974. Type: Price 760 (K, holo).

Stone, B. C. 1973. *Copelandiopteris*, a new genus of Philippine Ferns. *Webbia* 28: 491-494.

In this paper, the new generic name, *Copelandiopteris* B C Stone, was proposed for Philippine ferns previously placed in *Schizostegeopsis* Copel.

(see Stone B C Philipp J Sci 95: 425. 1966) and new combinations for the two species of the genus, viz. *C calocarpa* (Copel.) B C Stone and *C pachysora* (Copel.) B C Stone were proposed.

Tan, B. C., P. Payawal, K. Watanabe, N. Lacdan and C. Ramirez. 1986. Modern taxonomy of *Azolla*: a review. *Philippine Agriculturist* 69: 491-512.

The recent advance of species concept and taxonomy of genus *Azolla* was reviewed. Diagnostic characters for the sectional and species classification were outlined and illustrated by line drawings and photographs taken under the light compound microscope and scanning electron microscope. New sporocarpic characters such as the smooth type and the "punctured" type of float morphology were discovered to be useful taxonomic characters for some species. Field observations on the stability and unreliability of some vegetative characters employed in the traditional taxonomy of *Azolla* were discussed. A suggestion was made to discard *Azolla caroliniana* as a doubtful species since its type specimen was without sporocarp whereas the IRRI 700 series of *A pinnata* from Australia was accorded a new variety rank with a provisional name "var australiana." Errors in species identification of a handful of IRRI-NAAP collections were published, and lastly, a map showing the natural distribution of *Azolla pinnata* var *imbricata* in the Philippines was presented.

Tan, B. C. and D. B. Tolentino. 1987. Miscellaneous notes on Philippine pteridophytes. *Philippine Journal of Science* 116: 435-443.

New records in the Philippines for *Gymnopteris vestita*, *Lycopodium nummularifolium* (incl *Urostachys delbrueckii*) s s, *L selago* var *miniatus*, *Matonia foxworthii*, *Lycopodium cernuum* f *ingens*.

Van Uffelen, G. A. and E. Hennipman. 1985. The spores of *Pyrrosia Mirbel* (Polypodiaceae), a SEM study. *Pollen et Spores* (Paris) 37 (2): 155-198.

Les spores des 51 especes actuellement reconnues dans le genre Pyrrosia (Filicines isospores) ont ete etudiees au microscope electronique a balayage. Une periscope est presente dans toutes les especes. La grande diversite de l'ornementation du sporoderme trouvee dans ce genre a ete

decrete. Nour avans dsituecinq typees de spores qui sont fondees sur les carcteres de la perispore. The study includes the Philippine species: (1) *P samarensis* (Res.) Ching, (2) *P sphaerosticha* (Mett.) Ching and (3) *P splendens* (Presl) Ching.

Walker, T. G. 1973. Evidence from cytology in the classification of ferns. In A. C. Jermy, J. A. Crabbe and B. A. Thomas (eds) The Phylogeny and Classification of the Ferns. Journal of the Linnean Society (Botany) Supplement 1 67: 91-100.

Of interest to Philippine pteridology in this paper is the reported haploid chromosome number of a fern endemic to the country, i. e. *Psomiocarpa apiifolia* Presl, which is 41.

Zamora, P. M., C. V. Zamora, V. B. Bagaoisan and V. F. Guevara. 1967. Cleaning technique for botanical materials. Philippine Agriculturist 50: 977-983.

This clearing technique is highly suitable for fern leaves, both sterile and fertile. The procedure is simply as follows: (1) Extract pigments with sodium hydroxide "Superox" mixture, 2:1 ratio, (2) wash in tap water, (3) clear with concentrated chloral hydrate, (4) stain with 1% safranin O in 95% ethyl alcohol, (5) destain with 95% ethyl alcohol, (6) bathe in 95% ethyl alcohol-aniline-xylene mixture, 1: 1: 1 ratio, (7) counterstain with 0.5% fast green in 95% ethyl alcohol, (8) dehydrate in (a) 95% ethyl alcohol-aniline-xylene, 1: 1:1 ratio (b) aniline-xylene 1:1 ratio, and (c) aniline-xylene, 1: 3 ratio, (9) clear in pure xylene and (10) mount in balsam or piccolite. (This paper includes some Philippine ferns).

Zamora, P. M. and M. G. Price. 1969. Philippine Lower Vascular Plants I. Twenty common Philippine ferns. Philippine Biota 4: 25-45.

The paper provided the key to the identification and descriptions of twenty common Philippine ferns: *Acrostichum aureum*, *Adiantum philippense*, *Angiopteris evecta*, *Asplenium nidus*, *Diplazium esculentum*, *Ctenitis dissecta*, *Cyathea contaminans*, *Cyclosorus interruptus*, *Davallia solida*, *Drynaria quercifolia*, *Hemigramma latifolia*, *Lygodium japonicum*, *Marsilea crenata*, *Microsorium scolopendria*, *Nephrolepis hirsutula*, *Pityrogramma calomelanos*, *Pteris ensiformis*, *Pteris vittata*, and *Pyrrosia adnascens*.

Zamora, P. M. and C. V. Zamora. 1969. Philippine Lower Vascular Plants II. Ferns and fern allies: brief remarks. *Philippine Biota* 4: 17-22.

Explains the historico-botanical basis for the phrase ferns and fern allies vis-à-vis the terms pteridophyte in various schemes of classification.

Zamora, P. M. 1971. Ferns, pages 482-487. In : C. V. Asis (ed) *Plants of the Philippines*. Quezon City: University of the Philippines Press.

Classification, life history and descriptions of ten of the most common ferns in the Philippines: *Lygodium japonicum*, *Pteris vittata*, *Acrostichum aureum*, *Pityrogramma calomelanos*, *Adiantum philippense*, *Nephrolepis exaltata*, *Diplazium (Athyrium) esculentum*, *Asplenium nidus*, *Drynaria quercifolia* and *Marsilea crenata*.

Zamora, P. M. and N. S. Vargas. 1972. A new habitat record for *Drynaria rigidula* in the Philippines. Kalikasan, *Philippine Journal of Biology* 1: 832-835.

The paper is the report of the occurrence of *Drynaria rigidula* (Sw.) Bedd.) near the University of the Philippines campus, Quezon City, i. e. , in the Balara Parks and Filter, Rizal, Luzon, about 70 meters above sea level.

Zamora, P. M. and N. S. Vargas. 1973. A new habitat record for *Doryopteris concolor* in the Philippines. Kalikasan, *Philippine Journal of Biology* 2: 195-201.

Doryopteris concolor (Langsdorff et Fischer) Kuhn has recently been found in the Balara Filter Area, Rizal, after nearly 70 years since it was first reported from Benguet and Manila.

Zamora, P. M. and N. S. Vargas. 1973. Notable variations in leaf forms of *Drynaria*. *Philippine Agriculturist* 57: 55-71.

Among the four species of *Drynaria* examined, leaves transitional between typical, juvenile, intermediate and adult types of foliage leaves and typical nest leaves have been found with a fairly high degree of incidence in *Drynaria quercifolia* and *D. rigidula*. The significance of said transitional types relative to the postulated origin of leaf dimorphism in *Drynaria* from the *Drynariopsis* type is discussed. The transitional leaves are interpreted

as representing ontogenetic reversions of the metamorphosed nest leaves to the original form i. e. general purpose type of leaf such as that of *Drynariopsis*. It is suggested that the tendency of the fronds to revert back to their original form may have been triggered by the extreme stress of an unusual environment thereby unmasking temporarily the ancestral condition.

Zamora, P. M. and N. S. Vargas. 1973. Nectary-costule association in Philippine drynarioid ferns. *Philippine Agriculturist* 57: 72-88.

The paper records the occurrence, number and position of nectaries on the fronds of ten *drynarioid* species found in the Philippines, viz. , *Aglaomorpha meyeriana* Schott, *A pilosa* (J. Sm.) Copel. , *A splendens* Copel. , *Drynaria descensa* Copel. , *D quercifolia* (Linn.) J. Sm. , *D rigidula* (Sw.) Bedd., *D sparsisora* (Desv.) Moore, *Drynariopsis heraclea* (Kunze) Copel. , *Photinopteris acuminata* (Willd.) Mort. and *Thayeria cornucopia* Copel. Two types of patterns or associations based on the position of these structures relative to the costae and costules are distinguished, i. e. Type I or hypo-epicostular nectary type and Type II with two subtypes, thus, IIa or hypocostular nectary type and IIb or epicostular nectary type, and their systematic and evolutionary significance and interrelationships discussed. The hypo-epicostular nectary is interpreted as the basic nectary type from which the hypocostular and epicostular nectary conditions may have been derived. The hypocostular type is characteristic of *Drynariopsis*, *Aglaomorpha*, *Photinopteris*, *Thayeria* and *Drynaria rigidula*, while the epicostular type is characteristic of *D descensa*, *D quercifolia* and *D sparsisora*. It is suggested that the foregoing difference in nectary conditions in addition to several other morphological differences between *D rigidula* and the other species render *D rigidula* susceptible to separation from *Drynaria*.

Zamora, P. M. and N. S. Vargas. 1973. A note on the unusual nest leaf of *Drynaria*. *Philippine Agriculturist* 57: 89-91.

A soriferous nest leaf in *Drynaria sparsisora* (Desv) Moore is reported. Such a leaf is unusual in that it is normally non-soriferous.

Zamora, P. M. 1973. Botany of Philippine Lower Vascular Plants. Volume II. *The Fern World*. Mimeographed Edition. Quezon City.

A book briefly characterizing the families of ferns that occur in the Philippines: *Ophioglossaceae*, *Marattiaceae*, *Osmundaceae*, *Schizaeaceae*, *Gleicheniaceae*, *Hymenophyllaceae*, *Plagiogyriaceae*, *Cyatheaceae*, *Polypodiaceae*, *Dipteridaceae*, *Cheiropleuriaceae*, *Grammitidaceae*, *Thelypteridaceae*, *Dennstaedtiaceae*, *Lindsaeaceae*, *Davalliaceae*, *Nephrolepis Group*, *Pteridaceae*, *Aspleniaceae*, *Blechnaceae*, *Lomariopsidaceae*, *Dryopteridaceae*, *Tectariaceae*, *Athyriaceae*, *Adiantaceae*, *Parkeriaceae*, and *Vittariaceae*. *Marsileaceae*, *Azollaceae*, *Salviniaceae*.

Zamora, P. M. 1973. Drynarioid Ferns of the Philippines. Jose Vera Santos Lecture Series, Department of Botany, University of the Philippines, Diliman, Quezon City.

The paper is a review of the taxonomy and morphology of the *drynarioid* ferns of the Philippines with some additional notes. The following conclusions were distilled: (1) Pteridologists are not agreed regarding the systematic disposition of the *drynarioid* ferns at the generic level as well as their interrelationships. A monographic study will clarify the foregoing problem. (2) Three *drynarioids* are endemic or at least have not yet been reported outside the Philippines. These are: *Aglaomorpha pilosa* (J. Sm.) Copel., *Drynaria descensa* Copel., and *Thayeria cornucopia* Copel. (3) Most pteridologists are agreed that *Microsorium musifolium* presumably represents the approximate ancestor of the *drynarioid* ferns, that *Drynariopsis heraclea* is a primitive member of the group exemplifying the ancestral attributes, and that *D. heraclea* gave rise to the rest of the *drynarioid* genera directly or indirectly. (4) At least four major types of morphological trends can be recognized among *drynarioid* ferns, viz. , (a) reduction tendency, e. g. , reduction in the dimensions of the rhizome, fertile segment, frond, quantity of sori, loss of lamina, loss of nectary, (b) fusion tendency, e. g. union of sori, (c) change in symmetry, e. g. pattern distribution of sori, and (d) the elaboration tendency , e. g. perfection of the humus-gathering habit. (4) Nectary position may serve as an important guide at attempts to outline the major lines of evolution among *drynarioid* ferns.

Zamora, P. M. and N. S. Vargas. 1974. Preliminary checklist of the University of the Philippines campus and vicinity pteridophytes, Quezon City. UPNSRC Technical Report 21: 1-11.

The checklist enumerates seven varieties or cultivars and 65 species belonging to 34 genera, 19 families or groups, 7 orders and three classes. These represent all the pteridophytes seen or collected or both from the University of the Philippines campus and immediate vicinities; the entire area covers approximately 2, 500 hectares. Of the total number of species, 32 are naturally occurring and 33 are cultivated. Of the naturally occurring ones, 9 are reported for the first time from the area, one of which is described as new to science (see Zamora, P. M. 1974. *Kalikasan* 3: 193-195).

Zamora, P. M. and N. S. Vargas. 1974. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: Thelypteridaceae. UPNSR Technical Report 25: 1-11.

Five species belonging to four genera of the family Thelypteridaceae are reported from the university area and vicinity. These are *Macrothelypteris torresiana* (Gaud.) Ching; *Pneumatopteris ligulata* (J. Sm. ex Presl) Holttum, *Christella dentata* (Forssk.) Brownsey et Jermy, *C parasitica* (Linn.) Lev. and *Sphaeropterophanos unitus* (Linn.) Holttum. Keys to and descriptions of the genera and species are provided.

Zamora, P. M. 1974. A new species of *Cheilanthes*. *Kalikasan, Philippine Journal of Biology* 3: 193-195.

The new species of ferns described from a highly urbanized area in the Philippines, i. e., Diliman, Quezon City, Luzon, is *Cheilanthes dilimanensis* Zamora.

Zamora, P. M. 1974. Sporangial types in three species of *Cheilanthes* from the Philippines. UPNSRC Technical Report 23: 1-9.

Cheilanthes tenuifolia was found to produce only 32-sporate sporangial type; this is consistent with its reportedly apogamous character. *C dilimanensis* and *C javensis* and the occurrence of the normal type of cytological compensating mechanism in all three are inferred based on evidence from the sporangial type and spore structure and the high correlative relationship

of spore number and type of reproduction earlier workers found in other species of *Cheilanthes*.

Zamora, P. M. and N. S. Vargas. 1974. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Tectaria* Group. *UPNSRC Technical Report* 26: 1-8.

Three species belonging to three genera of the *Tectaria* Group of ferns are reported to be found in the university area and vicinity. These are *Hemigramma latifolia* (Meyen) Copel. (This species has been transferred to *Tectaria hilocarpa* (Fee.) Price: *Kalikasan* 3: 175. 1974), *Pleconemia presliana* Holttum and *Tectaria dissecta* (Forst.) Lellinger. Keys to and descriptions of the genera and species are provided.

Zamora, P. M. 1975. Sporangial types in three species of *Cheilanthes*. *Kalikasan, Philippine Journal of Biology* 4: 106-112.

Cheilanthes tenuifolia was found to produce only 32-sporate sporangial type; this is consistent with its reportedly apogamous character. *C dilimanensis* and *C javensis* produce only 16-sporate sporangial type. The spores produced are uniform and trilete in all three species. The apogamous nature of *C dilimanensis* and *C javensis* and the occurrence of the normal type of cytological compensating mechanism in all three are inferred based on evidence from sporangial type and spore structure and the high correlative relationship of spore number and type of reproduction earlier workers found in other species of *Cheilanthes*.

Zamora, P. M. 1975. Leaf buds in Philippine Ferns. *U S T Journal of Graduate Research* 4: 26-30.

Forty species of Philippine ferns with naturally leaf bud-forming fronds belonging to 13 genera and 9 families or groups are enumerated. These species showed variabilities in the locus of origin, degree of development and subsequent behavior of their leaf buds.

Zamora, P. M. 1975. Additional notes on the nectary-costule associations in drynarioid ferns. *U S T Journal of Graduate Research* 4: 31-34.

The occurrence of the hypo-costular nectary association type is reported in six non-Philippine species of ferns belonging to the genera *Drynaria*,

Holostachyum and *Merinthosorus*. The bearing of the types of the nectary-costule association on a certain postulate regarding the general evolutionary relationship of the *drynarioid* ferns is indicated.

Zamora, P. M. 1975. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Polypodiaceae*. UPNSRC Technical Report 35: 1-10.

Eight species of ferns belonging to six genera of the family *Polypodiaceae*, s. str. are reported to be in the university area and vicinity. Descriptions of the family, genera and species and keys to the genera and species are provided.

Zamora, P. M. 1975. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Nephrolepis* Group. UPNSRC Technical Report 33: 1-6.

Three species and a new cultivar or varieties of these and the so-called Boston Fern of the genus *Nephrolepis* belonging to the *Nephrolepis* Group of ferns are reported in the university area and vicinity. Descriptions of the group, genus, species, and a key to the species and cultivars or varieties are provided.

Zamora, P. M. and N. S. Vargas. 1975. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Pteris* Group. UPNSRC Technical Report 34: 1-9.

Seven species and one variety of ferns belonging to the two genera of *Pteris* Group are reported from the university area and vicinity. Descriptions of the group, genera and species and keys to the genera and species are provided.

Zamora, P. M. and N. S. Vargas. 1975. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Adiantum* Group. UPNSRC Technical Report 29: 1-18.

Six genera and twelve species belonging to the *Adiantum* group of ferns are reported from the university area and vicinity. Descriptions of the group, genera and species and keys to the genera and species are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: Key to the families or groups. *UPNSRC Technical Report 50*: 1-3.

A key to the families or groups of pteridophytes of the university area and vicinity is presented.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Ophioglossaceae*. *UPNSRC Technical Report 36*: 1-4.

The typical forms of two species of *Ophioglossum* are reported from the university area and vicinity. Descriptions of them as well as the family and genus to which they belong are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Marattiaceae*. *UPNSRC Technical Report 38*: 1-4.

Angiopteris palmiformis (Cav.) Chr. is reported from the university area and vicinity. Descriptions of them as well as the family and genus to which they belong are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Schizaeaceae*. *UPNSRC Technical Report 39*: 1-5.

Two species belonging to the genus *Lygodium* of the family *Schizaeaceae* are reported from the university area and vicinity. Descriptions of the family, genus and a key to the species are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Cyatheaceae*. *UPNSRC Technical Report 40*: 1-4.

Cyathea contaminans (Hook.) Copel. is reported from the university area and vicinity. Descriptions of the species and genus and the family to which it belong are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Davalliaceae*. *UPNSRC Technical Report 41*: 1-5.

The species belonging to the genus *Davallia* of the family *Davalliaceae* are reported from the university area and vicinity. Descriptions of the family, genus and species and keys to the species are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Dennstaedtia* Group. *UPNSRC Technical Report 42*: 1-3.

Microlepia speluncae (Linn.) Moore is reported from the university area and vicinity. Descriptions of the species and genus and the group to which it belong are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Aspleniaceae*. *UPNSRC Technical Report 43*: 1-4.

The bird's nest fern, *Asplenium nidus* Linn. , is described from the university area and vicinity. Descriptions of the genus and family to which it belongs are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Athyrium* Group. *UPNSRC Technical Report 44*: 1-5.

Diplazium esculentum (Retz.) Sw. is reported from the university area and vicinity. Descriptions of the species and genus and the group to which it belong are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Parkeriaceae*. *UPNSRC Technical Report 14*: 1-3.

Ceratopteris thalictroides (Linn.) Brongn. is reported from the university area and vicinity. Descriptions of the species and genus and the family to which it belong are provided.

Zamora, P. M. and N. S. Vargas. 1976. Pteridophytes of the University of the Philippines campus and vicinity, Quezon City: *Marsileaceae*. UPNSRC Technical Report 49: 1-4.

Marsilea crenata Presl is reported from the university area and vicinity. Descriptions of the family and genus to which it belong are provided.

Zamora, P. M. and S. Chandra. 1977. Morphology of the sporophyte of *Psomiocarpa* (Aspidiaceae). Kalikasan, *Philippine Journal of Biology* 6 (3): 217-228.

Psomiocarpa Presl exhibits all the characteristics of *Tectariodeae* and has several characters in common with *Tectaria* Cav. and *Camptodium* Fee. Based on the morphoanatomical evidence presented, it is suggested that *Psomiocarpa* is probably more nearly allied to *Tectaria* and *Camptodium* than *Ctenitis* and is possibly derived from a group of free-veined species of *Tectaria*.

Zamora, P. M. and S. Chandra. 1978. Sporophyte morphology of the fern genus *Podosorus* (Aspidiaceae). Kalikasan, *Philippine Journal of Biology* 7 (1): 31-38.

The Philippine endemic and monotypic fern genus *Podosorus* exhibits more features of the pleopeltoid than the microsorioid ferns such as *Microsorium tenuilore* and *Diblemma* and for this reason is here considered more nearly allied to the pleopeltoid group.

Zamora, P. M. and L. Co. 1980. New species of ferns (Filicopsida) from Palawan, Philippines. *Natural and Applied Science Bulletin* 32 (1-4): 43-52.

Four new species of ferns, viz. , *Sphaerostephanos cartilagens*, *Pronephrium balabacensis*, *Acrosorus nudicarpus* and *Asplenium mantalingahanum* are described.

Zamora, P. M. and L. Co. 1980. Economic ferns, pages 1-72. In: *Guide to Philippine Flora and Fauna*, Volume II. Manila. Goodwill Bookstore.

Section 1 of Volume II documents 54 economically important species of Philippine ferns. These are grouped into several categories, viz., (1)

edible ferns, (2) handicraft ferns, (3) medicinal ferns, (4) ornamental ferns, (5) ferns for build-materials, (6) ferns as organic fertilizer, (7) ferns as source of non-nuclear fuel, (8) ferns for biological pest control, (9) ferns for biogeochemical prospecting and (10) ferns as pernicious weeds.

Zamora, P. M. and L. Co. 1986. Endemic ferns, pages 73-210. In *Guide to Philippine Flora and Fauna*. Volume II. Manila; Goodwill Bookstore.

Section 2 of Volume II documents 276 of the known 298 species of ferns of the Philippines. To be specially noted are the five endemic genera, viz., *Psomiocarpa*, *Thayeria*, *Tectaridium*, *Podosorus* and *Nannothelypteris* of which *Podosorus* and *Thayeria* are considered most unexampled in the sense that each exhibits attributes unmatched by any other fern.

Zamora, P. M. 1988. *Urban Fern and Fern Allies*. Quezon City: Kalikasan Press.

This book documents 62 species and 7 varieties or cultivars belonging to 34 genera in 19 families occurring in an area approximately 2, 500 hectares with the University of the Philippines campus, Quezon City as the nucleus. Most of the species discovered in this book also occur in urban or urbanizing areas around the country from Batanes in the north to the Sulu Archipelago in the south.

Zamora, P. M. 1989. Economic Ferns of the Philippines. Proceedings of the First PROSEA International Symposium, Jakarta, Indonesia 1989: 315-316.

The paper is an attempt to present a review of the available information on the 54 economically important species of ferns from the Philippines relative to the objectives of the PROSEA Project. The 54 species fall into several categories, thus: (1) edible ferns, (2) handicraft ferns, (3) medicinal ferns, (4) ornamental ferns, (5) ferns for build-materials, (6) ferns as organic fertilizer, (7) ferns as source of non-nuclear fuel, (8) ferns for biological pest control, (9) ferns for biogeochemical prospecting and (10) ferns as pernicious weeds. The 54 species belong to 33 genera in 19 families, thus: *Helminthostachys*, *Ophioglossum* (2 species *Ophioglossaceae*), *Angiopteris* (*Marattiaceae*), *Lygodium* (5 species, *Schizaeaceae*), *Dicranopteris* (1 species,

Gleicheniaceae), *Cibotium*, *Cyathea*, (2 species, *Cyatheaceae*), *Drynaria*, *Phymatopteris*, *Phymatosorus*, *Platynerium*, *Pyrrosia*, (7 species, *Polypodiaceae*), *Ampelopteris*, *Amphineuron*, *Christella*, *Sphaerostephanos*, (6 species *Thelypteridaceae*), *Pteridium* (1 species, *Dennstaedtiaceae*), *Sphenomeris* (1 species *Lindsaeaceae*), *Davallia*, *Nephrolepis*, *Oleandra* (4 species, *Davalliaceae*), *Acrostichum*, *Pteris* (5 species, *Pteridaceae*), *Asplenium* (3 species, *Aspleniaceae*), *Blechnum*, *Stenochlaena* (3 species, *Blechnaceae*), *Pleocnemia* (3 species, *Aspidiaceae*), *Diplazium* (1 species, *Athyriaceae*), *Adiantum*, *Onychium*, *Pityrogramma* (6 species, *Sinopteridaceae*), *Ceratopteris* (1 species, *Parkeriaceae*), *Marsilea* (1 species, *Marsileaceae*) and *Azolla* (1 species, *Salviniaceae*)

Zamora, P. M. and M. G. Price. 1990. *Cheilanthes* of the Philippines. International Association of Pteridologists Conference on Progress in Pteridology, University of Michigan, Ann Arbor, Michigan, U S A 1990: 29.

In the tropical wet Southeast Asia, members of the genus *Cheilanthes* are atypical of the flora in general. The taxonomy and ecology of the eight Philippine species are presented with nomenclatural adjustments, morphological peculiarities and habitat data. Extrasoral vegetative proliferation is reported in the genus for the first time.

Zamora, P. M. (released 1991) Ferns, pages 297-307. In C. C. Velasquez (ed) 1983 *Philippine Science Encyclopedia*. Volume V Biological Sciences. Metro Manila: Research Council of the Philippines.

General morphology and the various types of life cycles in ferns with special consideration for Philippine fern diversity.

Zamora, P. M. C Beltran-Amoroso S. Chaimongkol and M. Marzan. 1992. Structure and development of the gametophytes of Philippine cheilanthoid ferns, II. *Cheilanthes javanensis* (Willd.) Moore. *Asia Life Sciences* 1 (1-2): 127-142.

The paper describes for the first time the structure and development of the gametophyte of *Cheilanthes javensis* (Willd.) Moore and brings out the notable similarities and differences of the morphologies of the gametophytes

and sporophytes of this species and those of *C dilimanensis* Zamora. Based on these results, the reduction of *C dilimanensis* as a variety of *C javensis* is recommended.

Zamora, P. M., C. Beltran-Amoroso, S. Chaimongkol and M. Marzan. 1993. Structure and development of the gametophytes of Philippine cheilanthoid ferns, IV. *Cheilanthes tenuifolia* (Burm.) Sw. *Asia Life Sciences* 2 (1): 88-98.

The gametophyte (prothali) of *Cheilanthes tenuifolia* (Burm.) Sw. from the Philippines (1) are no different in morphology from those in India and Australia, (2) exhibit a *Ceratopteris* type of prothallial development (in contrast to those from India which exhibit *Adiantum* type of prothallial development) and (3) follow an obligate type of apogamous reproduction (inferred for the Australian plants).

Zamora, P. M., C. Beltran-Amoroso, S. Chaimongkol and M. Marzan. 1993. Structure and development of the gametophytes of Philippine cheilanthoid ferns, II. *Cheilanthes dilimanensis* Zamora. *Philippine Journal of Science* 122 (3) 233-253.

The paper reports for the first time (1) the structure and development of laboratory-grown (primary) gametophytes, (2) the regular production of apogamous sporophytes directly from primary gametophytes and (3) the frequent production from their basal regions of secondary gametophytes similar in morphology from the laboratory-grown ones in the endemic Philippine fern, *Cheilanthes dilimanensis* Zamora. The phenomena of (1) obligate apogamy and (2) vegetative reproduction are proposed as significant strategies by the hostile environment (climate type I) in their habitat (Diliman area, Quezon City, Luzon).

Zamora, P. M. 1993. Biogeography and seasonality of occurrence of Philippine cheilanthoid ferns. XV International Botanical Congress, Pacifico YOKOHAMA, Japan. Abstracts 1993: 222.

Eight of the nine species of Philippine cheilanthoid ferns under report thrive in parts of the country with Type I climate (i. e. with two pronounced seasons: wet from May to October and dry from November to April). These species are

Cheilanthes dubia, *C. anceps*, *C. agetae*, *C. concolor*, *C. belangeri*, *C. javensis* (including *C. dilimanensis*), *C. tenuifolia*, and *Doryopteris ludens*. One species is exceptional in that it thrives in parts of the country with Type 4 climate (i. e. , in which rainfall is more or less distributed throughout the year), a circumstance which does not normally support cheilanthoid ferns. This species is *C. mysurensis*. Most species are probably above ground only during the wet season and are in rhizomic perennation during the dry season; this adaptive strategy (i. e., annual alternation of active growth and development and perennation) confers to said species the capacity to survive in ecological niches that are usually inhospitable to ferns.

Zamora, P. M., S. Chaimongkol and M. Marzan. 1995. Structure and development of the gametophytes of Philippine *Cheilanthes concolor* (Langsdorff et Fischer) R Tryon. *Science Diliman* 5 (1992, 2): 1-7.

The gametophytes of *Cheilanthes concolor* (Langsdorff et Fischer) R Tryon from the Philippines (Quezon City) are no different in pattern of development and in morphology from those from India with one possible notable difference, which is that the gametophytes under report (which were grown from spores produced from 32-sporate sporangia) are apogamous while those from India (sporangial type source was not stated) are sexual.

Zamora, P. M. 1998. Contribution to Knowledge of the Biodiversity and Biology of Philippine Pteridophytes. Plenary Lecture delivered during the Fourth NSRI Research Symposium, NSRI Conference Room, University of the Philippines campus, Diliman, Quezon City.

The paper is a brief review of the results of research done on the biodiversity and biology of Philippine pteridophytes (the ferns and the so-called fern allies) within the period from 1972-1998 (span of 25 years). In the field of biodiversity , the contributions are in the terms of (1) new species described, (2) new nomenclatural changes, and (3) extension of the ranges in geographical distribution of species. In the field of biology, the contributions are in the form of (1) new information and (2) new interpretations resulting from biogeographical, ecological, developmental and structural studies on various aspects of the (a) sporophyte including (i) rhizome anatomy, (ii) stipe

morphology, (iii) shoot apical meristem, (iv) leaf epidermal elements, (v) venation patterns, (vi) strobilar patterns, (vii) sporangial and (viii) spore morphology of numerous species belonging to various groups or families and (b) gametophytes of such species as (i) *Selaginella philippina* (endemic), (ii) *Cheilanthes concolor*, (iii) *C dilimanensis* (endemic), (iv) *C javensis*, (v) *C tenuifolia*, (vi) *Blechnum egregium* (endemic), (vii) *B orientale*, (viii) *Aglaiomorpha heraclea* and (ix) *Azolla pinnata*.

Zamora, P. M. 1972. Some comments on the pteridophytes in Merrill's Flora of Manila. Mimeographed Edition

The paper embodies comments centering on the known changes in names, changes in authorities in of these names and some general miscellaneous information about the pteridophytes in Merrill's Flora of Manila (1912). Of these 45 species in the flora, the names of sixteen were found to have been reduced to synonymy by various pteridologists, viz. : *Asplenium macrophyllum* Sw. to *A. polyodon* Forst. In Morton, Contrib. U S Nat. Herb. 38: 40. 1967; *Ceratopteris calomelanos* (Linn.) is Underw. to *Pityrogramma calomelanos* (Linn.) Link, Handb. 3: 20. 1833; *Cyclophorus adnascens* (Sw.) Desv. to *Pyrrosia adnascens* (Sw.) Ching, Bull. Chinese Bot. Soc. 1: 45. 1935; *Dryopteris basilaris* (Presl) C. Chr. to *Sphaerostephanos productus* (Kaulkff.) Holtt. , Kalikasan 4: 59. 1975; *Dryopteris dissecta* (Forst.) O. Ktze to *Tectaria dissecta* (Forst.) Lellinger, Amer. Fern J. 58: 156. 1968; *Dryopteris luerksenii* (Harr.) C. Chr. to *Pneumatopteris ligulata* (Presl) Holtt. , Blumea 21: 320. 1973; *Dryopteris parasitica* (Linn.) O. Ktze. to *Christella parasitica* (Linn.) Lev. in Holttum, Blumea 19: 44. 1971; *Dryopteris setigera* (Bl.) O. Ktze. to *Macrothelypteris torresiana* (Gaud.) Ching, Acta Phytotax. Sinica 8: 310. 1963; *Polypodium phymatodes* Linn. to *Microsorium scolopendria* (Burm.) Copel., Univ. Calif. Publ. Bot. 16-112. 1929; *Pteris longifolia* Linn. to *Pteris vittata* Linn. in Copeland, Fern, FI Philipp. 1: 128. 1958. *P quadriaurita* Retz. to *P. glaucovirens* Goldm. , see Copeland, Fern F1. Philipp. 1: 134. 1958. *Nephrolepis duffii* Moore to *N cordifolia* (Linn.) Presl cv. *Duffii* in Morton, Amer. Fern J. 48: 22. 1958; *N floccigera* (Bl.) Moore var. *mostruosa* Hort. to *N. hirsutula* (Forst.) Presl cv. *Superba* in Morton, Amer. Fern J. 48: 20. 1958; *Notholaena hirsuta* (Poir.) Desv. to *Cheilanthes javensis* (Willd.) Moore in Price, Kalikasan 1: 29. 1972; *Selaginella barbata* Spring to *S. repanda*

(Desv) Spring in Alston, Philipp. J. Sci. 58: 363. 1935; and *S. belangeri* (Bory) Spring to *S. ciliaris* (Retz.) Spring in Alston, Philipp. J. Sci. 58: 370. 1935.

Zamora, P. M. 1977. Inventory of important species, Annex 3: Pteridophytic Diversity pages 133-135. In *Celebrating Mount Apo, The Living Mountain*. Manila: PNOC-EDC.

Enumeration of the 204 species of ferns and fern allies recorded for Mount Apo: *Acrophorus nodosus*, *Acrosorus triangularis*, *Aglaomorpha pilosa*, *A cornucopia*, *Antrophyum of ledermanni*, *A latifolium*, *Arachniodes amabilis*, *A aristata*, *A hasseltii*, *A tripinnata*, *Araiostegia hymenophylloides*, *Asplenium decorum*, *A elmeri*, *A haenkei*, *A lepturus*, *A normale*, *A yoshinagae* var *planicaule*, *Athyrium puncticaule*, *Belvisia mucronata*, *B spicata*, *B validinervis*, *blechnium egregium*, *B orientale*, *B vulcanicum*, *Botrychium daucifolium* *Calymmodon cf clavifer*, *C cucullatus*, *Cephalomanes cumingii*, *C obscurum* var *obscurum*, *Cheiropleuria bicuspis*, *Chingi ferox*, *Christella arida*, *C dentata*, *C parasitica*, *Christiopteris sagitta*, *Colysis pothifolia*, *Coniogramme macrophylla*, *Cornopteris (Athyrium) gymnocarpum*, *C banahaoensis*, *Coryphopteris dura*, *C pubirachis* var *philippensis*, *C squamipes*, *Crepidomanes brevipes*, *C humile*, *C johnstonense*, *C minutum*, *Crypsinus albido-squamatus*, *C inervis*, *C taeniatus*, *C codes*, *Ctenopteris celebeca*, *C curtisii*, *C macra*, *C multicaudata*, *C nutans*, *C pachycaula*, *C solida*, *C yoderi*, *Cyathea apoensis*, *C chrisitii*, *C contaminans*, *C fulginosa*, *C integra*, *D trichomanoides*, *D wagneriana*, *Davallodes hirsutum*, *Dennstaedtia philippensis*, *D dennstaedtioides*, *D hooveri*, *D scabra*, *D scandens*, *Diacalpe aspidioides*, *Dicksonia mollis*, *Dicranopteris linearis*, *Diplaziopsis javanica*, *Diplazium bantamense*, *D dilatatum*, *D cf propinquum*, *D deltoideum*, *D magnificum*, *D pariens*, *D polydoides*, *D sorzogonense*, *Dipteris conjugata*, *Drynariopsis heraclea*, *Dryopteris hirtipes*, *D subarborea*, *Elaphoglossum angulatum*, *E blumeum* var *blumeum*, *E callifolium*, *Gleichenia hispida*, *G longissima*, *G truncata*, *Goniophlebium subauriculatum*, *G of mengtzeense*, *Grammitis caespitosa*, *G scabristipes*, *G congener*, *G dolichosora*, *G fasciata*, *G intramissa*, *G knustfordiana*, *G terrecillana*, *G reindwardii*, *G sumatrana* *Histiopteris incisa*, *Humata*

vestita, *Hymenophyllum acanthoides*, *H badium*, *H blandum*, *H denticulatum*, *H imbricatum*, *H polyanthos*, *H pulchrum*, *H reinwardtii*, *Hypolepsis tenuifolia*, *Lecanopteris carnosa* var *pumila*, *Lemmaphyllum accedens*, *Leucostegia immersa*, *Lindsaea apoensis*, *L doryphora*, *L pulchella* var *pulchella*, *Loxogramme avenia*, *L dimorpha*, *L subselliguea*, *Lunathyrium japonicum*, *Lycopodium cernuum*, *L clavatum*, *L multispectatum*, *L nummularifolium*, *L salvinoides*, *L squarrosum*, *L volubile*, *Marattia pelucida*, *Methathelypteris gracilenscens*, *Microlepia* cf *strigosa*, *M todayensis*, *Microsorium phanerophlebium*, *Monachosorum subdigitatum*, *Oleandra* cf *colubrina*, *O herrei*, *Ophioglossum pendulum*, *O reticulatum*, *Orthiopteris campylura*, *Osmunda banksiifolia*, *Paesia elmeri*, *Parathelypteris beddome*, *Plagiogyria christii*, *P* cf *falcata*, *P glauca*, *P pycnophylla*, *P tuberculata*, *Platynerium grande*, *Pneumatopteris laevis*, *P nitidula*, *Polystichum elmeri*, *P horizontale*, *Pronephrium asperum*, *Prosaptia configua*, *Pseudopgeopteris paludosa*, *Pteridium aquilinum* var *wigthianum*, *Pteris* aff *schlechteri*, *P mertensioides*, *P oppositipinnata*, *Pyrrosia lanceolata*, (*P adnascens*), *Selaginella alligans*, *S apoensis*, *S ascendens*, *S cupressina*, *S delicatula*, *engleri*, *S eschscholzii*, *S gastrophylla*, *S involvens*, *S negrosensis*, *S philippina*, *S usteri*, *Selliguea feei* var *elmerii*, *S triloba*, *Sphaerostephanos heterocarpus*, *S hirsutus*, *S latebrosus*, *S productus*, *S sessilipinna*, *S todayensis*, *S unitus*, *Sphenomeris chinensis*, *S retusa*, *Tapeinidium pinnatum*, *Tectaria dissecta*, *Tmesipteris* aff *lanceolata*, *Cephalomanes cumingii*, *C minutum*, *Vittaria alternans*, *Xiphopteris apoensis*.

Zamora, Prescillano M. "Contribution to Knowledge of the Biodiversity and Biology of Philippine Pteridophytes". Plenary lecture delivered during the Fourth NSRI Research Symposium held on March 12, 1998 at the NSRI Conference Room, U P campus, Diliman, Quezon City 1101.

The paper is a brief review of the results of the research done on the biodiversity and biology of Philippine pteridophytes (the ferns and the so-called fern allies) within the period from 1972 to 1998 (span of 25 years).

In the field of *biodiversity*, the contributions are in the form of (1) new species described, (2) nomenclatural changes, and (3) extension of the ranges in geographical distribution of species.

In the field of biology, the contributions are in the form of (1) new information and (2) new interpretations resulting from biogeographical, ecological, developmental, and structural studies on various aspects of the (a) *sporophyte* including (i) rhizome anatomy, (ii) stipe morphology, (iii) shoot apical meristem (iv) leaf epidermal elements, (v) venation pattern, (vi) sporangial patterns and (vii) spore morphology of numerous species belonging to various groups or families and (b) *gametophyte* of such species as (1) *Selaginella philippina* (endemic), (ii) *Cheilanthes concolor*, (iii) *C dilimanensis*, (iv) *C javensis*, (v) *C tenuifolia*, (vi) *Blechnum egregium* (endemic), (vii) *B orientale*, (viii) *Aglaomorpha heraclea* and (ix) *Azolla pinnata*.

Much of the data accumulated during the period under consideration are noteworthy additions to those that were accumulated during the period from 1898-1971 (span of 75 years).

Zhang, Z. C. and H. P. Nootboom. 1998. *Plagiogyriaceae. Flora Malesiana Series II, volume 3, pages 295-316.*

A description is given of a family which has only one genus, Plagiogyria, with 11 species. Seven species occur in Malesia, one of which *P egenolfioides* (Baker.) Copel. has 4 varieties. The general part of the treatment covers 4 pages and includes paragraphs on distribution, ecology and morphology. The family, its species and varieties are described and annotated. A key to the species is included. Four paragraphs of herbarium sheets have been reproduced. All the seven Malesian species occur in the Philippines: *P adnata* (Bl.) Bedd. (Luzon), *P egenolfioides* (Baker.) Copel. var *latipinna* (Copel.) X C Chang et Noot (Philippines), *P euphlebia* (Kunze) Mett. (Philippines), *P falcata* Copel. (Philippines), *P glauca* (Bl.) Mett. (Luzon, Mindanao), *P pycnophylla* (Kunze) Mett. (Luzon) and *P stenoptera* (Hance) Diels (Luzon).

Annotated Bibliography
on Philippine Biodiversity:

FILICOPSIDA (FERNS)

The book covers a broad spectrum of the various aspects of biodiversity and biology of Philippine ferns such as taxonomy, morphology, physiology, biogeography, ecology, etc. of both the sporophyte and gametophyte generations of these concerned life-forms. It is thus an important source of information and reference on the biodiversity and biology of ferns for researchers, horticulturists and teachers in various research and academic institutions in the country, for persons engaged in the conservation of fern resources and in the preparation of management plans for protected areas and red list of Philippine ferns.

