



ORDERS AND FAMILIES OF PHILIPPINE PTERIDOPHYTES

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ABSTRACT - Currently, around 1100 species under 144 genera and 39 families of Pteridophytes have been reported to be present in the Philippines. The most recent fern classification recognizes four classes, 11 orders and 37 families of ferns. Thirty-two (32) fern families are documented in the Philippines based on published materials and herbarium specimens. Ferns have various ethno botanical uses which could either be for food consumption, aesthetic value and medicine.

Keywords: Philippine ferns, ethnobotanical uses, taxonomy, systematics

INTRODUCTION

The Philippines consists of more than 7,000 islands and due to a strong degree of isolation from both the Asian mainland and the Malesian archipelago, its flora is unique with species level endemism exceeding 60 percent (Suksthan, et. al., 2010). However, there is sustained degradation of resources, hence the Philippines is known as one of the biodiversity hotspots in the world. Several books have been published regarding Philippine Pteridophytes. Foremost is the three-volume work of Copeland (1958) entitled "Fern Flora of the Philippines". The three volume work of Copeland accounted for 20 families, 155 genera and 950 species. Copeland's pioneering work was a compilation of his works as well as the works of Cavanilles, Kaulfuss, Presl, J. Smith, Fe, Brackenridge, Hooker, Mettenius, and Christ among others. It provided keys to the different fern species.

In the year 1972, Price attempted to collate and update all important fern literature, including that of Copeland's, up to December 1972. In his paper, Price criticized Copeland's work as incomplete and poorly reviewed due to a number of typographical errors. Yet, he still

considered it as a foundation and as a frame of reference to those who are studying Philippine ferns. Price's (1972) survey followed Copeland's sequence and families. In the year 1975, Price wrote "The Pteridophytes of Mt. Makiling and Vicinity" which included keys, synonymy, original descriptions, distribution, ecology, common names, species examined, comments and an index of ferns found at Mt. Makiling and its vicinity. He accounted 31 families, 103 genera and 305 fern species.

Zamora and Co (1986) contributed the fern volume in a series entitled "Guide to Philippine Flora and Fauna". Amoroso (1993), made a checklist of Pteridophytes in Mt. Kitanglad, Bukidnon. His checklist comprised 88 species of ferns with descriptions, habitats and uses. In 1995, Amoroso and Acma (1995) studied the diversity, status and ecology of pteridophytes in three forests in Mindanao, namely; Mt. Kitanglad, Mt. Apulag and Marilog Forest. Mt. Kitanglad is reported to have 275 species, Mt. Apulag has 231 species and Marilog forest has 165 species. They further assessed the status of the fern species and categorized them into the following: endangered, 1; rare, 31; depleted, 8; endemic, 82 and 65 are economically important.

Barcelona et. al. (1996) studied four species of grass-like ferns of the genus *Schizaea*. These were *Schizaea dichotoma* (Linn.) Smith, *S. digitata* (Linn.) Sw., *S. inopinata* Selling and *S. malaccana* Bak. *Schizaea malaccana* was a new record for the Philippines. Belonias and Bañoc (1994) noted that there are a total of 93 species of Pteridophytes belonging to 24 families and 55 genera in Mt. Pangasugan in Leyte island at elevations of 5-400 meters above sea level.

In 2004, Banaticla and Buot studied Pteridophyte species diversity and patch structure along the altitudinal gradient of Mt. Banahaw de Lucban. Banaticla and Buot (2005) determined five altitudinal Pteridophyte zones along the northeastern altitudinal slopes of Mt. Banahaw de Lucban, Quezon, Luzon Is., Philippines using cluster-and ordination analysis. They found out that 33 fern species were preferential to specific microenvironments along the altitudinal gradient, thus making them effective altitudinal zone markers and biodiversity conservation indicators for the forest ecosystem of Mt. Banahaw De Lucban and delos Angeles (2011), studied the diversity and distribution of Pteridophytes along the altitudinal gradient of Mt. Makiling. The researchers reported a total of 44 fern species belonging to 22 genera and 17 families. In the Leyte Cordillera, Mt Pangasugan is situated wherein several botanical studies have been made. A study by Langenberger and Belonias (2011), presented 115 families, and 418 genera of Pteridophytes based on the present status of specimen processing and identification.

Recently, with the development of recent classification system such as that of Smith et.al. (2006), which is based in molecular phylogeny, many changes in fern nomenclature especially under order as well as family names are made. To date, confusion as well as the lack of an updated reference material is a dilemma to most readers who are interested in Pteridophytes.

This paper aims to provide a checklist of the orders and families of ferns in the Philippines. The present checklist that follows contains updated information on the orders and families of Philippine ferns following the nomenclature of Smith, et. al. (2006).

MATERIALS AND METHODS

Herbarium vouchers and published materials (Copeland (1958), Price (1972 and 1975), Amoroso (1987, 1990, 1993, 1995 and 1997), Barcelona (1996 and 2002), Zamora (1986 and 2007), Holttum (1959, 1963, 1978, 1981 and 1991), Smith, et.al., (2006), et.al.) were the main sources of information to come up with this checklist. Specimens at the Philippine National Herbarium (PNH) of the National Museum and the Institute of Biological Sciences (IBS) Herbarium (PBDH), Plant Biology Division, IBS, University of the Philippines Los Baños were examined. The fern family names of the vouchers and old literature were then cross-checked with the list of fern species as proposed by Smith et.al. (2006).

RESULTS AND DISCUSSION

An ongoing compilation of Hassler and Swale (2001) reported that the earth houses 3 classes, 19 orders, 58 families, 316 genera and 10614-12001 species of ferns. In the Philippines, around 1100 species under 144 genera and 39 families of pteridophytes have been recorded (Barcelona, 2002). However, in this paper 28 families are listed since some of the families accounted by Zamora (2007) and Price (1975) were transferred to existing fern families on account of the recent findings by phylogenetic studies (Smith, et.al., 2006). Families that were affected are: *Christioperidaceae* and *Loxogrammaeae* which are now lumped in *Polypodiaceae*; *Parkeriaceae* is now transferred to *Pteridaceae*; *Monachosoraceae* is now combined with *Dennstaedtiaceae*; *Azollaceae* with *Marsileaceae*; and *Cheiropleuraceae* with *Dipteridaceae*. In the Philippines there are 3 classes, 11 orders and 32 families of ferns (Table 1).

The order *Polypodiales* has 14 families which are: *Polypodiaceae*, *Davalliaceae*, *Oleandraceae*, *Tectariaceae*, *Lomariopsidaceae*, *Dryopteridaceae*, *Blechnaceae*, *Telypteridaceae*, *Woodsiaceae*, *Aspleniaceae*, *Pteridaceae*, *Dennstaedtiaceae*, *Saccolomataceae* and

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Lindsaeaceae. Grammitadaceae, which has been moved to Polypodiaceae based on Smith's (2006), classification scheme can be found in the wet tropics extending to the north and the sound temperate zones (Parris, 2007). A few species are associated with rivers in tropical lowland forests, either as epiphytes, often overhanging the water, or as facultative rheophytes on rocks in and by water. The genus *Platycterium* under the family Polypodiaceae is one of the few pantropical epiphytic fern genera (Kreier and Schneider, 2005). The family Woodsiaceae was previously thought to be endemic to Taiwan not until recently when it was found in the Philippines. The genus *Athyria* belonging to the said family is mainly distributed in temperate and tropical-subtropical regions of Asia (Liu, et. al., 2008).

1. Order Polypodiales (Hort. Berol. 1833)
 - Polypodiaceae (Presl, and Presl, 1822)
 - Davalliaceae (Schomb, 1848)
 - Oleandraceae (Ching, 1965)
 - Tectariaceae (Panigrahi, 1986)
 - Lomariopsidaceae (Alston, 1956)
 - Dryopteridaceae (Herter, 1949)
 - Blechnaceae (Newman, 1844)
 - Thelypteridaceae (Doweld, 2001)
 - Woodsiaceae (Herter, 1949)
 - Aspleniaceae (Newman, 1840)

Table 1. Number of fern families present in the Philippines and in the world.

Fern Taxa	Global	Philippines
Polypodiales	15	14
Cyatheales	8	5
Salviniales	2	2
Schizaeales	3	2
Gleicheniales	3	3
Hymenophyllales	1	1
Osmundales	1	1
Marattiales	1	1
Equisetales	1	1
Psilotales	1	1
Ophioglossales	1	1

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adapted from Zamora (2007) following Smith's (2006) nomenclature.

I. Class Polypodiopsida

- Pteridaceae (Kirchn, 1831)
- Dennstaedtiaceae (Doweld, 2001)
- Saccolomotaceae (Doweld, 2006)
- Lindsaeaceae (Presl, 1848)

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2. Order Cyatheaales (Frank, 1877)

Equisetaceae (Michx ex DC, 1804)

Dicksoniaceae (Schomb, Reis, 1847)

IV. Class Psilotopsida

Cyatheaaceae (Kaulf, Farrenkr, 1827)

10. Order Psilotales

Plagiogyriaceae (Bower, 1926)

Psilotaceae (Kirchin, 1831)

Culcitaceae (Serm, 1970)

11. Order Ophioglossales (Link, 1833)

Thyrsopteridaceae (Presl, 1847)

Ophioglossaceae (Martynov, 1820)

3. Order Salviniiales (Hort, 1833)

Synonyms and other names of Philippine Pteridophytes

Salviniaceae (Martynov, 1820)

Readers might be more familiar with the older names of these Pteridophyte families. In order to accommodate the updated as well as the older family names, presented hereafter is an alphabetical listing of Philippine Pteridophyte family names, other names and synonyms (=). The nomenclature follows that of Smith (2006). Names after the (=) sign are the preferred family names. The list is adapted from Smith et.al. (2006).

Marsileaceae (Lam and Mirb, 1802)

4. Order Schizaeales (Schimp and Palont, 1869)

Schizaeaceae (Kaulf and Farrenkr, 1827)

Lygodiaceae (Roem,)

5. Order Gleicheniales (Link, 1833)

Matoniaceae (Presl, 1847)

Dipteridaceae (Seward and Dale, 1901)

Acrostichaceae Mett. Ex. A.B. Frank = Pteridaceae , (Polypodiales)

Gleicheniaceae (Presl, 1825)

Actinopteridaceae Pic. Serm. = Pteridaceae, (Polypodiales)

6. Order Hymenophyllales (Frank, 1877)

Hymenophyllaceae (Mart, 1835)

Adiantaceae Newman , nom.cons. over Parkeriaceae = Pteridaceae, (Polypodiales)

II. Class Marattiopsida

7. Order Osmundales (Hort, 1833)

Alsophilaceae C. Presl = Cyatheaaceae, (Cyatheaales)

Osmundaceae (Martynov, 1820)

8. Order Marattiales (Hort, 1833)

Angiopteridaceae Fee ex. J. Bommer = Marattiaceae, (Marattiales)

Marattiaceae (Kaulf, 1822)

Anopteraceae Doweld = Pteridaceae, (Polypodiales)

III. Class Equisetopsida

9. Order Equisetales

“Aspidiaceae” Burnett, nom. Illeg. = Dryopteridaceae, (Polypodiales)

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Aspleniaceae Newman; here included Polypodiales, (Polypodiales)	Dicksoniaceae M.R. Schomb., nom.cons. over Thyrsopteridaceae; included in Cyatheaales
Athyriaceae Alston = Woodsiaceae, (Polypodiales)	Dicranopteridaceae Ching ex Doweld = Gleicheniaceae, (Gleicheniales)
Azollaceae Wettst. = Salviniaceae, (Salviniales)	Dictyoxiphiaceae Ching, nom. Nud. = Tectariaceae, (Polypodiales)
Blechnaceae Newman; here included in Polypodiales	Didymochlarnaceae Ching, nom. Nud. = Dryopteridaceae, tentatively, (Polypodiales)
Bolbitidaceae Ching = Dryopteridaceae, (Polypodiales)	Dipteridaceae Seward & E. Dale; included in Gleicheniales
Botrychiaceae Horan. = Ophioglossaceae, (Ophioglossales)	Drynariaceae Ching = Polypodiaceae, (Polypodiales)
Ceratopteridaceae Underw. = Parkeriaceae = Pteridaceae, (Polypodiales)	Dryopteridaceae Herter, nom. cons. Over Peranematacae; included in Polypodiales
Cheilanthaceae B.K. Nayar = Pteridaceae, (Polypodiales)	Elaphoglossaceae Pic. Serm. = Dryopteridaceae, (Polypodiales)
Cheiropleuriaceae Nakai = Dipteridaceae, (Polypodiales)	Equisetaceae Michx. Ex. DC.; included in Equisetales
Christenseniaceae Ching = Marattiaceae, (Marattiales)	Gleicheniaceae C. Presl; included in Gleicheniales
Cibiotiaceae Korall; here included in Cyatheaales	Grammitidaceae Newman = Polypodiaceae, (Polypodiales)
Cryptogrammaceae Pic. Serm. = Pteridaceae, (Polypodiales)	Gymnogrammitidaceae Ching = Polypodiaceae, (Polypodiales)
Culcitaceae Pic. Serm.; included in Cyatheaales	Helminthostachyaceae Ching = Ophioglossaceae, (Ophioglossales)
Cystodiaceae J.R. Croft = Lindsaeaceae, (Polypodiales)	Hemionitidaceae Pic. Serm. = Pteridaceae, (Polypodiales)
Danaeaceae C. Agardh = Marattiaceae, (Marattiales)	Hymenophyllaceae Mart.; included in Hymenophyllales
Davalliaceae M.R. Schomb.; included in Polypodiales	Hymenophyllopsidaceae Pic. Serm. = Cyatheaaceae, (Cyatheaales)
Dennstaedtiaceae Lotsy; included in Polypodiales	

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- Hypodemattiaceae Ching = Dryopteridaceae temporarily, (Polypodiales)
- Hypoderrhiaceae Ching, nom. nud., used by various authors, incl. Dickason (1946) = Tectariaceae, (Polypodiales)
- Hypolepidaceae Pic. Serm. = Dennstaedtiaceae, (Polypodiales)
- Kaulfussiaceae Campb., nom. illeg. = Marattiaceae, (Marattiales)
- Lindsaeaceae C. Presl; included in Polypodiales
- Lomariopsidaceae Alston; included in Polypodiales
- Lonchitidaceae Doweld = Lindsaeaceae, (Polypodiales)
- Lophosoriaceae Pic. Serm.; included in Dicksoniaceae, (Cyatheaales)
- Lygodiaceae M. Roem.; here included in Schizaeales
- Marattiaceae Kaulf., nom. cons. prop.; here included in Marattiales antedated by Danaceae (Murdock & al., subm.), (Marattiales)
- Marsileaceae Mirb.; here included in Salviniiales
- Matoniaceae C. Presl; here included in Gleicheniales
- Monachosoraceae Ching = Dennstaedtiaceae, (Polypodiales)
- Negripteridaceae Pic. Serm. = Pteridaceae, (Polypodiales)
- Nephrolepidaceae Pic. Serm. = Lomariopsidaceae, tentatively, (Polypodiales)
- Oleandraceae Ching ex Pic. Serm.; here included in Polypodiales
- Ophioglossaceae Martynov; here included in Ophioglossales
- Osmundaceae Martyniv; here included in Osmundales
- Parkeriaceae Hook. = Pteridaceae, (Polypodiales)
- Peranemaraceae (C. Presl) Ching = Dryopteridaceae, (Polypodiales)
- Plagiogyriaceae Bower; here included in Cyatheaales
- Platyneriaceae Ching = Polypodiaceae, (Polypodiales)
- Platyzomataceae Nakai = Pteridaceae, (Polypodiales)
- Pleurosoriopsidaceae Kurita & Ikebe ex Ching = Polypodiaceae, (Polypodiales)
- Polypodiaceae J. Presl; here included in Polypodiales
- Psilotaceae J.W. Griff. & Henfr.; here included in Psilotales
- Pteridaceae E.D.M. Kirchin.; here included in Polypodiales
- Saccolomataceae Doweld; here included in Polypodiales
- Salviniaceae Martynov; here included in Salviniiales
- Schizaeaceae Kaulf.; here included in Schizaeales
- Sinopteridaceae Koidz., nom. ref. In favour of Adiantaceae = Pteridaceae, (Polypodiales)

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Sphaerostephanaceae Ching, nom. nud. =
Thelypteridaceae, (Polypodiales)

Thelypteridaceae Pic. Serm.; here included in
Polypodiales

Stenochlaenaceae Ching = Blechnaceae,
(Polypodiales)

Thyrsopteridaceae C. Presl; here included in
Cyatheales

Stromatopteridaceae Bierh. = Gleicheniaceae,
(Gleicheniales)

Tmesipteridaceae Nakai = Psilotaceae, (Psilotales)

Taenitidaceae Pic. Serm. = Pteridaceae,
(Polypodiales)

Trichomanaceae Burmeist. = Hymenophyllaceae,
(Hymenophyllales)

Tectariaceae Panigrahi; here included in
Polypodiales

Vittariaceae Ching = Pteridaceae, (Polypodiales)

Woodsiaceae herter: here included in Polypodiales

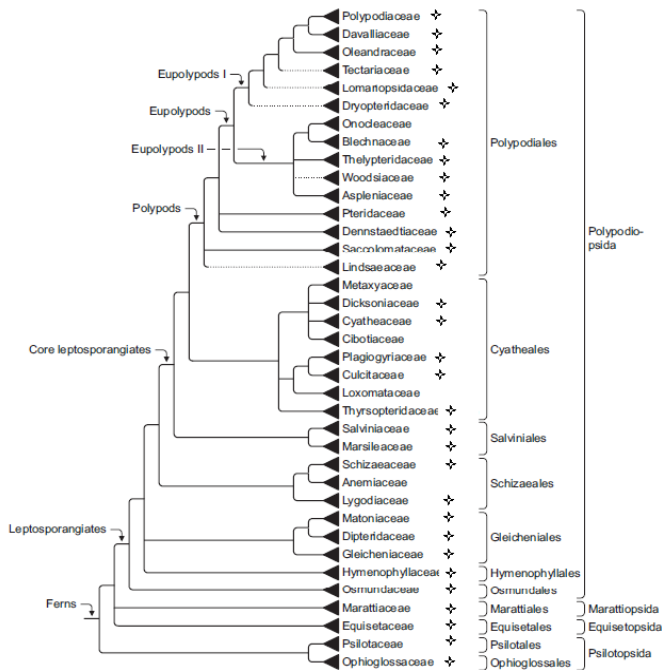


Figure 1. Phylogenetic relationships of the orders and families of pteridophytes showing global and Philippine fern families - ✦ families of ferns found in the Philippines; modified from Smith, 2006).

Endemism

Zamora (2007) reported 899 species of ferns in the Philippines 275 or 31% of which are endemic (Table 2). Among the genera, 4 are endemic as well: *Podosorus*, *Psomiocarpa*, *Tectarium* and *Nannothelypteris*. All are found in Luzon.

Ethno-botanical uses of Ferns

These spore-bearing plants are usually utilized as ornamentals (Zamora and Co, 1986; Buot, 1999; Banaticla and Buot, 2006) and in handicraft manufacture (Zamora and Co, 1986), though many of them have been found to have medicinal properties (Amoroso, 1987b; Zamora

Table 2. Biodiversity and Endemism in Philippine Ferns (adapted from Zamora, 2007; following Smith, et.al. (2006) nomenclature).

Families	Genera	Species	Varieties	Endemic
Polypodiaceae	18	81	5	23
Grammitidaceae	7	68	0	7
Davalliaceae	3	10	5	0
Oleandraceae	3	22	1	7
Tectariaceae	10	70	0	8
Lomariopsidaceae	5	34	7	16
Dryopteridaceae	10	36	0	6
Blechnaceae	4	14	1	1
Thelypteridaceae	19	117	7	58
Woodsiaceae	7	75	0	36
Aspleniaceae	1	43	0	8
Pteridaceae	13	89	1	29
Vittariaceae	4	22	0	7
Dennstaedtiaceae	8	33	0	11
Lindsaeaceae	3	25	13	4
Dicksoniaceae	3	5	0	0
Cyatheaceae	1	38	0	25
Plagiogyriaceae	1	7	3	1
Salviniaceae	1	1	0	0
Marsileaceae	2	2	0	0
Schizaeaceae	2	13	0	0
Matoniaceae	1	1	0	0
Dipteridaceae	2	3	0	0
Gleicheniaceae	2	13	9	0
Hymenophyllaceae	2	61	0	17
Osmundaceae	1	3	0	1
Marattiaceae	3	5	1	0
Ophioglossaceae	3	5	10	0
Total	140	899	63	275

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and Co 1986) and some are even edible (Amoroso, 1990; Zamora and Co, 1986). Many species can also be harvested as sources of organic fertilizer, building materials, and potting (Zamora et.al., 1986; Amoroso, 1997). Table 3 presents the ethnobotanical uses of ferns. Some representative species that are used by humans in the course of their interaction with nature are shown in Figures 2, 3 and 4.

Table 3. The different ethnobotanical and horticultural uses of ferns.

Fern	Uses	Reference
<i>Achrostichum aureum</i>	It is used as an ornament. The paste created from its rhizome heals wounds and boils. It is also used as anthelmintic. Fertile fronds are used to treat syphilitic ulcers in Borneo. Fronds are used as an antifungal agent.	Wiersema and Leon, 1999; Benjamin and Manickam, 2007
<i>Adiantum caudatum</i>	Its frond extracts are effective in wound healing.	Benjamin and Manickam, 2007
<i>Adiantum tenerum</i>	It is used as an ornament.	Wiersema and Leon, 1999
<i>Adiantum trapeziforme</i>	It is used as an ornament.	Wiersema and Leon, 1999
<i>Asplenium nidus</i>	It is used as an ornament. Its rootstock is good for fever and elephantiasis. It is also used as an emollient, in cough and chest disease.	Upreti, 2009; Wiersema and Leon, 1999; Benjamin and Manickam, 2007
<i>Asplenium unilaterale</i>	It is used as an ornament.	Wiersema and Leon, 1999
<i>Blechnum orientale</i>	It is used as poultice in boils and its rhizomes are used as anthelmintic.	Upreti, 2009
<i>Christella parasitica</i>	It is used in treatment of gout and rheumatism.	Benjamin and Manickam, 2007
<i>Davallia pectinata</i>	It is used as an ornament.	Wiersema and Leon, 1999
<i>Dicranopteris linearis</i>	The fronds are used to treat asthma. The fronds are used as decorations.	Perumal, 2010
<i>Diplazium esculentum</i>	The arising young fronds are eaten. They are usually used in fresh salads or cooked in certain meals.	Upreti, 2009

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Diplazium polypoides	It is used as green vegetable.	Wiersema and Leon, 1999
Drynaria quercifolia	It is used as an ornament. The paste created from its rhizome heals wounds and boils. It is also used as anthelmintic. Fertile fronds are used for syphilitic ulcers in Borneo. Fronds are used as an antifungal agent. Its rhizome is antibacterial, anodyne, constipating, anti-inflammatory, tonic, and in the treatment of typhoid fever among others.	Wiersema and Leon, 1999; Benjamin and Manickam, 2007
Lygodium circinnatum	Used as a protective medicine after childbirth and to cure wounds.	Eswani, Kudus, Nazre and Awang Noor, 2010.
Lygodium japonicum	It is usually used in basket weaving in Oriental Mindoro.	Novellino, 2006
Microlepia speluncae	It is used an ornamental plant.	Wiersema and Leon, 1999
Microsorium punctatum	It is used as an ornament. Its leaf and juice are purgative, diuretic and for healing wounds.	Wiersema and Leon, 1999; Benjamin and Manickam, 2007
Nephrolepis biserrata	It is used as an ornament.	Wiersema and Leon, 1999
Nephrolepis cordifolia	Its paste is used as an anti-inflammatory in wounds.	Upreti, 2009
Nephrolepis exaltata	It is used as an ornament.	Wiersema and Leon, 1999
Nephrolepis hirsutula	It is used as an ornament.	Wiersema and Leon, 1999
Ophioglossum reticulatum L.	It is used as a cooling agent on burns as well as a remedy for burns.	Upreti, 2009
Platycterium coronarium	It is used as an ornament.	Wiersema and Leon, 1999
Pteridium aquilinum	Its rhizome is an astringent, anthelmintic and it is useful in diarrhea and for inflammations in the gastric and intestinal mucous membranes.	Benjamin and Manickam, 2007
Pteris cretica	Its fronds have an antibacterial property and its paste is applied to wounds.	Benjamin and Manickam, 2007

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Pteris vittata	The plant extract is a demulcent.	Benjamin and Manickam, 2007
Pyrosia piloselloides	It is used to treat cough, diarrhea, and gonorrhoea.	Hanum and Hamzah, 1999
Schizaea dichotoma L.	Relieves cough and throat infection since its expectorant property is useful in exuding mucus from the respiratory organs, lungs.	Gogoi, et.al., 2010; Mannan, Maridass and Victor, 2008
Sphaerostephanos unitus	Its rhizome extract has antibacterial properties.	Benjamin and Manickam, 2007
Stenochlaena palustris	Its fronds have an antibacterial property. It is also given for treatment for fever, skin disease, throat and gastric ulcers. Leaves and rhizomes are used as cooling agent in treating burns and ulcers.	Benjamin and Manickam, 2007
Tectaria crenata	It is used to treat venereal diseases such as gonorrhoea.	Hanum and Hamzah, 1999



Figure 2. *Christella parasitica* (L.) H. Lev.



Figure 3. *Diplazium esculentum* (Retz.) Sw.



Figure 4. *Lygodium circinnatum* (Burm.) Sw.

Statement of Authorship

Marjorie D. delos Angeles is the main author of this article. Ms. delos Angeles gathered data and consolidated numerous reference materials for the writing of the paper. As the main author, Ms. delos Angeles finalized the writing of this paper for publication.

Dr. Inocencio E. Buot Jr. is the co-author of this article. He has been part of this study since the inception up to the writing for publication. He gave major contributions in designing the objectives, methodology, structure and discussion flow that greatly improved this work.

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JOURNAL OF NATURE STUDIES
(formerly Nature's Bulletin)
ISSN: 1655-3179