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Research On The Classification Of The Family Thelypteridaceae Ching Ex Pic. Serm. In Vietnam

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INTRODUCTION

1. Urgency of the thesis topic

Our country is a country in the region with an average temperature of over 18oC each month, with a typical wet-dry season and rich in flora and fauna resources. Studying each group of plants, especially the Fern phylum at all levels, is an urgent task and is a fundamental and scientific basis for many professions such as Agriculture - Forestry, Medicine, Pharmacy and activities to preserve and sustainably use valuable plant genetic resources.

The family Thelypteridaceae Ching ex Pic. Serm. is a family with a growing area in the region with an average temperature of over 18oC each month in the world, including 30 genera and up to over 1000 species. Although this family has fewer members than many other families, these species have many scientific and economic values. In Vietnam, according to some research works by many authors, there are 17 genera with 69 species belonging to the family Thelypteridaceae . Species belonging to the family Thelypteridaceae have been used for a long time as medicinal herbs to treat bleeding disorders, diseases related to the stomach and bones and joints.

The first authors to conduct research on the family Thelypteridaceae in the Indochina region were Tardieu Blot and Christensen [1] in “Flore Générale de L’Indo-Chine” and edited and updated in 1941 by the authors themselves. But until now, this document has lacked practicality and there are differences in the arrangement of the genera compared to today’s studies. After that, some other authors in Vietnam published scientific works for the family Thelypteridaceae such as Pham Hoang Ho (1970 [2], 1991 [3], 1999 [4]) and some works on usage values such as Vietnamese medicinal plants and herbs, Vietnam medicinal plant dictionary.

Today, from all continents, many authors have published works on the classification of the family Thelypteridaceae . But in our country, there are still no documents that study in detail and fully the taxonomic aspect of the family Thelypteridaceae. From that perspective, we determined the thesis topic: "**Research on the classification of the family Thelypteridaceae Ching ex Pic. Serm. in Vietnam**".

The work on the classification of the family Thelypteridaceae in our country will provide a clear view of the previous and current research results on the family Thelypteridaceae , and at the same time synthesize and select new research on the family Thelypteridaceae that has been published in Vietnam as well as in the world. The product of the work is detailed data for the classification of the family Thelypteridaceae in our country, contributing to the publication of the book series Flora of Vietnam on this taxon.

2. Thesis objectives

Complete the detailed and systematic study of the classification of the Thelypteridaceae family in our country, as a basis for publishing the book series Flora of Vietnam and subsequent studies in our country.

3. Scientific and practical significance of the thesis

* *Scientific significance*: The product of this work helps update and perfect the understanding of the classification of the family Thelypteridaceae in our country, which is a practical basis for publishing the the book series Flora of Vietnam. In addition, the study of the family Thelypteridaceae also helps support research in other scientific fields such as medicinal materials and life sciences.

* *Practical significance*: The results of the thesis are the scientific basis of the fields of science and technology and in teaching.

CHAPTER 1. RESEARCH OVERVIEW

Chapter 1 consists of 18 pages, presenting an overview of documents on the research situation of the family Thelypteridaceae worldwide, works on the family Thelypteridaceae in areas neighboring Vietnam, documents on the family Thelypteridaceae in our country.

CHAPTER 2. OBJECTS, CONTENT AND METHODS OF RESEARCH

Chapter 2 consists of 4 pages, presenting the research objects, research contents and research methods. Research methods include inheritance method, sample collection investigation method, comparative morphology method, Molecular Biology method and method of use value.

CHAPTER 3. RESEARCH RESULTS

3.1. Morphological details of the family Thelypteridaceae

3.1.1. Rhizomes

The family Thelypteridaceae is usually a perennial plant. It grows on rocks or in the soil. The thick rhizome grows vertically and high (*Trigonospora, Parathelypteris, Metathelypteris, Macrothelypteris, Pneumatopteris, Pseudophegopteris, Stegnogramma, Glaphyropteridopsis, Amblovenatum*). Or the long rhizome creeps (*Thelypteris, Phegopteris, Christella, Cyclosorus, Ampelopteris, Pseudocyclosorus, Pronephrium, Cyclogramma, Mesopteris*). (Figure 3.1; Photo 3.1)

3.1.2. Fronds

Fronds grow in clusters or far apart. 1-pinnate fronds (*Ampelopteris, Pronephrium, Stegnogramma*). Pinnate-pinnatifid (*Trigonospora, Parathelypteris, Macrothelypteris, Pneumatopteris, Pseudophegopteris, Thelypteris, Phegopteris, Christella, Cyclosorus, Pseudocyclosorus, Glaphyropteridopsis, Cyclogramma, Amblovenatum, Mesopteris*). Occasionally 3- pinnate fronds (*Metathelypteris*). Frond blades with one or three pinnaes , oblong-lanceolate or obovate, sometimes ovate or ovate-trigonal, often pinnate, sometimes three or four pinnaes, rarely one. (Figure 3.2; Photo 3.2)

3.1.3. Pinnaes

Pinnaes are used to describe the pinnaes at the base or middle of the frond. Primary pinnaes are symmetrical at the base of the leaf. Primary pinnaes unlobed or very shallowly lobed, entire or wavy margin (*Ampelopteris, Pronephrium, Stegnogramma*). Primary pinnaes pinnate, segments deeply lobed (*Trigonospora, Parathelypteris, Macrothelypteris, Pneumatopteris, Pseudophegopteris, Thelypteris, Phegopteris, Christella, Cyclosorus, Pseudocyclosorus, Glaphyropteridopsis, Cyclogramma, Amblovenatum, Mesopteris*). Secondary pinnaes pinnate, segments deeply lobed (*Metathelypteris*). Primary pinnaes at the base with several pairs of abruptly changing size (*Thelypteris, Christella, Pneumatopteris*). The primary pinnaes at the base have a pair of variable sizes (*Trigonospora, Parathelypteris, Macrothelypteris, Pseudophegopteris, Phegopteris, Cyclosorus, Pseudocyclosorus*). (Figure 3.3; Photo 3.3)

3.1.4. Pinnae veins, segment veins

Segment are when the bases of the two lobes are more or less joined together, counting from the point where the lobes are.

Segments have pinnate veins (*Trigonospora, Parathelypteris, Macrothelypteris, Pneumatopteris, Pseudophegopteris, Thelypteris, Phegopteris, Christella, Cyclosorus, Pseudocyclosorus, Metathelypteris, Glaphyropteridopsis, Cyclogramma, Amblovenatum, Mesopteris*). Pinnaes with veins connecting between leaflets forming a network (*Ampelopteris, Pronephrium, Stegnogramma*). (Figures 3.4 and 3.5; Photo 3.4)

3.1.5. Soris

Soris are round, oblong or short, attached to the lateral vein of the back of the pinnaes or segments (*Trigonospora, Parathelypteris, Macrothelypteris, Pneumatopteris, Pseudophegopteris, Thelypteris, Phegopteris, Christella, Cyclosorus, Pseudocyclosorus, Metathelypteris,*

Ampelopteris, Pronephrium, Glaphyropteridopsis, Cyclogramma, Amblovenatum, Mesopteris) or in bands attached to the lateral vein of the back of the pinnaes (*Stegnogramma*). (Photo 3.5)

3.1.6. Sporangias

Spores have long or short stalks, often hairy (*Thelypteris, Trigonospora, Macrothelypteris, Phegopteris, Pneumatopteris, Pseudophegopteris, Stegnogramma, Pronephrium, Glaphyropteridopsis, Cyclogramma, Amblovenatum, Mesopteris, Metathelypteris, Pseudocyclosorus, Parathelypteris*) or glandular (*Christella, Cyclosorus, Ampelopteris*). (Figure 3.6; Photo 3.6)

3.1.7. Spores

Monolete spores has a single narrow stripe on the spores.

Bilateral spores has two narrow strips on the spores.

Trilete spores has three narrow strips radiating from one pole in the middle of the spores.

Bilateral spore (*Parathelypteris, Macrothelypteris, Pseudophegopteris, Thelypteris, Phegopteris, Christella, Cyclosorus, Metathelypteris, Ampelopteris, Pronephrium, Stegnogramma, Glaphyropteridopsis, Cyclogramma, Amblovenatum, Mesopteris*), rarely monolete spore (*Pseudocyclosorus, Pneumatopteris*) or trilete spore (*Trigonospora*). Spores are reticulate, hairy, crested, with spines or wings on the spore coat. (Photo 3. 7)

3.2. Results of decoding gene sequence data and constructing a diagram of possible close relationships between genera in the family Thelypteridaceae.

- The results of 18 genera created 6 separate groups with close relationships including: Group 1: genus *Pseudocyclosorus*; group 2: *Trigonospora*; group 3: *Amblovenatum*; group 4: genus *Pneumatopteris*; group 5 includes 2 genera: *Cyclosorus, Christella*; Group 6 includes 11 genera: *Mesopteris, Glaphyropteridopsis, Pronephrium, Ampelopteris, Cyclogramma, Stegnogramma, Macrothelypteris, Pseudophegopteris, Phegopteris, Metathelypteris, Parathelypteris*.

3.3. Determining the classification system of the family Thelypteridaceae

Based on the PPGI system by Schuettpelz E. et al. (2016), the thesis arranges the genera of the family Thelypteridaceae in our country as follows (Table 3.1)

Table 3.1. Taxa in the family Thelypteridaceae in our country are arranged according to the PPGI system (2016)

Subfamily	Genus
PHEGOPTERIDOIDEAE Salino, A.R.Sm. & T.E. Almeida	*Genus 1*
	Genus 2
	Genus 3
THELYPTERIDOIDEAE C.F. Reed	*Genus 4*
	Genus 5
	Genus 6
	Genus 7
	Genus 8
	Genus 9
	Genus 10
	Genus 11
	Genus 12
	Genus 13
	Genus 14
	Genus 15
	Genus 16
	Genus 17
	Genus 18

(The genus are arranged in order in the key of opposite characteristics of the genera in the family Thelypteridaceae)

3.4. Key pairs of opposite characteristics of genera in the family Thelypteridaceae in our country

1a. Stipes glabrous adaxially. Veinlets not reaching margins ……**.....SUBFAM. PHEGOPTERIDOIDEAE**

2a. Scales after fallen with remaining lunate marks, lamina 3 or 4 pinnate-pinnatifid……..….**1. Macrothelypteris**

2b. Scales after fallen notwith remaining lunate marks, lamina bipinnatifid or pinnate - pinnatifid.

3a. Pinnae connected to each other by a narrow wing along rachis; margins with long hairs…….....……**2. Phegopteris**

3b. Pinnae not connected to each other by a narrow wing along rachis; margins glabrous or short hairs.....**3. Pseudophegopteris**

1b. Stipes have groove adaxially. Veinlets reaching margins .....
……...…...……**SUBFAM. THELYPTERIDOIDEAE**
4a. Fronds 1-pinnate, pinnae entire or lobed shortten
5a. Pinna axils often with gemmae producing a 1-pinnate small lamina …….....…….……**4. Ampelopteris**
5b. Pinna axils notwith gemmae producing a 1-pinnate small lamina
6a. Sori attached to 2 lines between veinlets…...…**5. Pronephrium**
6b. Sori not attached to 2 lines between veinlets ……..... .....…….**6. Stegnogramma**
4b. Fronds 1-pinnate; pinnae with lobed lengthen
7a. Some pairs of pinnae at the base are suddenly reduced in size or change in size
8a. Costae raised on both surfaces
9a. Bilateral spore …..…...…….……**7. Cyclogramma**
9b. Monolete spore
10a. Base of abaxially pinnae each notwith a dark brown tuberculate aerophore, pinnae have lobed shortten, veinlets anastomosing…...……...**8. Pneumatopteris**
10b. Base of abaxially pinnae each usually with a dark brown tuberculate aerophore, pinnae have lobed lengthen, veinlets not anastomosing .....….. **9. Pseudocyclosorus**
8b. Costae raised abaxially
11a. Sporangia glabrousm; spores undulate... **10. Mesopteris**
11b. Sporangia with hairs or glands
12a. Sporangia with glands and long hairs on stalks; black spores, with echinate or granular …..**11. Christella**
12b. Sporangia with glandular hairs; spores with echinate…….**12. Thelypteris**
7b. One pair of pinnae at the base changes in size or the pinnae do not change
13a. Pinnae usually glandless abaxially
14a. Costae raised adaxially; spores perispores corrugate, usually foveolate; exospore with finely reticulate surfaces....**13. Metathelypteris**
14b. Costae raised on both surfaces
15a. Sori usually at middle of veinlets; Spores oblong or reniform, with wings or echinate …….....

..... **14. Cyclosorus**

15b. Sori usually at marginal; Spores elliptic and with cristate …….....……..…....**15. Amblovenatum**

13b. Pinnae notwith glandless abaxially

16a. Trilete spores..... **16. Trigonospora**

16b. Bilateral spores

17a. Spores with echinate or tuberculate on surfaces……..……**17. Glaphyropteridopsis**

17b. Spores notwith echinate or tuberculate on surfaces …….....**18. Parathelypteris**

3.5. Describe the identification details of the family Thelypteridaceae Ching ex Pic. Serm.

THE FAMILY THELYPTERIDACEAE CHING EX PIC. SERM.

Pic.-Serm. 1970. Webbia 24: 709; Ching. 1963. Acta Phytotax. Sin. Vol. VIII, No. 4, 289 – 335; Holttum, 1969. Blumea 17, 5:32.

Plants terrestrial or on rocks. Rhizomes stout, dictyostele radially symmetrical, branched or not, erect, ascending, or long creeping, with scales at apices; scales basiflexed, lanceolate or nearly ovate, brown, thick, luminae elongate, usually with grayish white short setae on dorsal side or ciliate along margins. Fronds clustered, approximate, or remote; stipes slender, stramineous, not articulate, with two crescentshaped vascular bundles at base, usually scaly at bases, distally with grayish white unicellular acicular hairs, rarely with multicellular long hairs or stellate hairs. Fronds oblong-lanceolate or oblanceolate, sometimes ovate or ovate-triangular, usually pinnate-pinnatifid, sometimes three or four pinnate-pinnatifid, rarely one pinnate; pinnae symmetrical at bases; costae grooved adaxially but grooves not confluent with rachial grooves, or raised and with dense grayish acicular hairs, with expanded tuberculate aerophores at bases of pinnae. Laminae herbaceous or papery, sometimes somewhat leathery, green or dark brown-green when dry, both sides (particularly rachises, costae, and main veins adaxially) with grayish white unicellular acicular hairs, rarely glabrous, usually with orange or reddish orange, stalked or sessile spherical or club-shaped glands, occasionally small scaly along rachises and costae abaxially. Sori orbicular, oblong, or shortly linear, dorsifixed on veins, indusiate or exindusiate; indusia orbicular-reniform, fixed by deep notch, most hairy, persistent or hidden in sori, caducous, or not concentrated into sori but scattered along reticulate veins

and exindusiate. Sporangia long stalked, usually with hairs or glandular hairs below annuli and at distal end of sporangial stalks. Spores bilateral, rarely tetrahedral, tuberculate, echinate, granular, or usually with a winged perispore. Prothalli green, cordate or narrowly cordate, usually with broad wings, symmetrical, usually with hairs or glands

Typus: *Thelypteris* Schimidel

SUBFAM. PHEGOPTERIDOIDEAE SALINO, A.R.SM. & T.E.ALMEIDA

Salino, A.R.Sm. & T.E.Almeida, 2016. Journ. Syst. Evol. 54(6): 584.

Stipes glabrous adaxially. Veinlets not reaching margins.

GEN. 1. MACROTHELYPTERIS (H. Itô) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 308-309; Holttum, 1981. Fl. Mal. 2(1): 347- 349

- THELYPTERIS sect. MACROTHELYPTERIS H. Itô in Nakai & Honda, 1939. Nov. Fl. Jap. 4: 141.

1.1. Macrothelypteris torresiana (Gaudich.) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 310; Holttum, 1981, Fl. Mal. 2(1): 348

– *Polystichum torresianum* Gaudich., 1828. Voy. Uranie, Bot. 8: 333.

GEN. 2. PHEGOPTERIS (C. Presl) Fée

Fée, 1852. Mém. Foug. 5: 242-243; Holttum, 1971. Blumea, 19: 26; Holttum, 1981. Fl. Mal. 2(1): 353- 354.

- POLYPODIUM sect. PHEGOPTERIS C. Presl, 1836. Tent. Pterid. 179.

2.1. Phegopteris decursive-pinnata (H.C. Hall) Fée

Fée. 1852. Mém. Foug. 5: 242

– *Aspidium decursive-pinnatum* (H.C. Hall) Kunze, 1848. Bot. Zeitung (Berlin). 6: 555.

GEN. 3. PSEUDOPHEGOPTERIS Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 313-314; Holttum, 1971. Blumea. 19: 26; Holttum, 1981. Fl. Mal. 2(1): 343- 347

3.1. Pseudophegopteris aurita (Hook.) Ching

Ching, 1963. Acta Phytotax. Sin. 8 (4): 314; Holttum, 1971. Blumea, 19: 26; id. 1981. Fl. Mal. 2(1): 345-346.

– *Aspidium auritum* (Hook.) H. Christ, 1904. Bull. Herb. Boissier. ser. 2. 4: 616.

– *Dryopteris aurita* (Hook.) C. Chr. 1905. Index Filic. 4: 253

SUBFAM. THELYPTERIDOIDEAE C.F.Reed

C.F.Reed, 1968. Phytologia 17: 254.

Stipes have groove adaxially. Veinlets reaching margins.

Typus: *Thelypteris* Schmidel

GEN. 4. AMPELOPTERIS Kunze

Kunze, 1848. Bot. Zeitung (Berlin), 6: 114-115

4.1. Ampelopteris prolifera (Retz.) Copel.

Copel. 1947. Gen. Fil. 144; Holttum, 1981. Fl. Mal. 2(1): 387.

– *Aspidium proliferum* (Retz.) Hieron., 1901. Boll. Soc. Bot. Ital.,: 295.

– *Cyclosorus prolifer* (Retz.) Tardieu, 1938. Notul. Syst. (Paris). 7(2): 76.

GEN. 5. PRONEPHRIUM C. Presl

C. Presl, 1851. Abh. Königl. Böhm. Ges. Wiss. ser. 5. 6: 618–619

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *PRONEPHRIUM*

1a. Laminae with 1-3 pinnae.

2a. Laminae with 1 pinnae …….. **1. P. simplex**

2b. Laminae with 3 pinnae ……..…… **2. P. triphyllum**

1b. Laminae pinnate.

3a. Pinnate more than 8 pairs.

4a. Veinlets raised on both surfaces, 12-15 pairs ..…… **3. P. nudatum**

4b. Veinlets raised abaxially, 8-10 pairs ....…….....**4. P. penangianum**

3b. Pinnate up to 8 pairs.

5a. Veinlets 5-7 pairs ……....…… **5. P. crenulatum**

5b. Veinlets from 10 pairs or more.

6a. Costae raised abaxially.

7a. Laminae with long acuminate at apices, pinnae pairs at the base are smaller than apical pinnae ……....……. **6. P. parishi**

7b. Laminae with acuminate at apices, pinnae pairs at the base are same size as apical pinnae ……..... **7. P. lakhimpurense**

6b. Costae raised on both surfaces

8a. Pinnae margins: half of the leaflets are whole towards the base and half are serrated towards the apex ....**8. P. repandum**

8b. Pinnae margins entire or undulate-crenate.

9a. Veinlets reaching pinnae margins …….. **9. P. cuspidatum**

9b. Veinlets not reaching pinnae margins …**10. P. megacuspe**

5.1. Pronephrium simplex (Hook.) Holttum

Holttum, 1971. Blumea, 19: 36.

– *Cyclosorus simplex* (Hook.) Copel., 1947. Ann. Cryptog. Phytopathol. 5: 143.

– *Grypothrix simplex* (Hook.) S.E.Fawc. & A.R.Sm., 2021. Sida, Bot. Misc. 59: 48.

– *Meniscium erosum* Wall., 1829. Numer. List: n.° 62, not validly puBlume

5.2. Pronephrium triphyllum (Sw.) Holttum

Holttum, 1971. Blumea, 19: 34-37; id. 1981. Fl. Mal. 2(1): 534-535.

– *Meniscium triphyllum* Sw., 1801. J. Bot. (Schrader) 1800(2): 16.

– *Abacopteris triphylla* (Sw.) Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 241.

5.3. Pronephrium nudatum (Roxb.) Holttum

Holttum, 1971. Blumea, 19: 34-37

- *Aspidium multilineatum* (Wall. ex Hook.) Christ, 1902. l. c.,: 247.

- *Cyclosorus clarkei* (Sarn.Singh & Panigrahi) Mazumdar & R. Mukhop., 2013. Bionature 33: 726, nom. illeg.

- *Thelypteris nudata* (Roxb.) C. V. Morton, 1974. Contr. U.S. Natl. Herb. 38: 352.

5.4. Pronephrium penangianum (Hook.) Holttum

Holttum, 1972. Blumea, 20: 110.

– *Polypodium penangianum* Hook., 1864. Sp. Fil. 5: 13.

– *Cyclosorus penangianus* (Hook.) Copel., 1947. Ann. Cryptog. Phytopathol. 5: 143.

5.5. Pronephrium crenulatum Holttum

Holttum, 1972. Blumea, 20: 123.

– *Thelypteris crenulata* (Holttum) Christenh., 2018. Global Fl. 4: 29.

5.6. Pronephrium parishii (Bedd.) Holttum

Holttum, 1971. Blumea, 19: 34-37; id. 1972. l. c. 20: 105-126; id. 1981. Fl. Mal. 2(1): 535.

– *Meniscium parishii* Bedd., 1866. Ferns Brit. India: t. 184.

5.7. Pronephrium lakhimpurense (Rosenst.) Holttum

Holttum, 1971. Blumea, 19: 34-37; id. 1972. l. c. 20: 105-126

– *Abacopteris rubra* var. *hirsuta* Ching, 1938. l. c. 8: 248.

5.8. Pronephrium repandum (Fée) Holttum

Holttum, 1972. Blumea, 20: 109; id. 1981. Fl. Mal. 2(1): 533- 534; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1119.

– *Goniopteris dalhousieana* Fée, 1857. Mém. Soc. Sci. Nat. Strasbourg 5: 92.
– *Goniopteris urophylla* (Mett.) C. Presl, 1836. Tent. Pterid.: 183.
– *Thelypteris repanda* (Fée) C.V. Morton, 1974. Contr. U.S. Natl. Herb. 38: 340.

5.9. Pronephrium cuspidatum (Blume) Holttum

Holttum, 1971. Blumea, 19: 34-37; id. 972. l. c. 20: 105-126; Holttum, 1981. Fl. Mal. 2(1): 536
– *Cyclosorus cuspidatus* (Blume) Copeland, 1947. Ann. Cryptog. Phytopathol. 5: 142.
– *Dryopteris amaiensis* Rosenst., 1917. Meded. Rijks-Herb. 31: 6.

5.10 Pronephrium megacuspe (Baker) Holttum

Holttum, 1971. Blumea, 19: 34-37; id. 1972. l. c. 105-126.
– *Polypodium megacuspe* Baker, 1890. Journ. Bot. 28: 266.

GEN. 6. STEGNOGRAMMA Blume

Blume, 1828. Enum. Pl. Javae. 2: 172; id. 1971. l. c. 19: 38-39; id. 1981. l. c. 540- 544

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *STEGNOGRAMMA*

1a. Pinnate up to 5 pairs
2a. Plants shorter than 50 cm, pinnae shorter than 5 cm ... **1. S. scallanii**
2b. Plants larger than 50 cm, pinnae longer than 5 cm
3a. Veinlets 4-6 pairs .....…….…..…… **2. S. dictyoclinoides**
3b. Veinlets 8 pairs
4a. Sori attached at 4-5 veinlets pairs ..……..…...**3. S. aspidioides**
4b. Sori attached at 7 veinlets pairs ……..…. **4. S. autralis**
1b. Pinnate less than 5 pairs
5a. Pinnate connected with above pair by broad wing ….....
.....…. **5. S. wilfordii**
5b. Pinnate not connected with above pair by broad wing, except apical pair ...……. **6. S. griffithii**

6.1. Stegnogramma scallanii (Christ) K. Iwats.

K. Iwatsuki., 1963. Acta Phytotax. Geobot. 19: 124;
– *Asplenium scallanii* Christ, 1901. Boll. Soc. Bot. Ital. 1901: 296.
– *Leptogramma scallanii* (Christ) Ching, 1936. Sinensia. 7: 101.

6.2. Stegnogramma dictyoclinoides Ching

Ching, 1936. Sinensia, 7(1): 92–93; Holttum, 1971. Blumea, 19: 39

– *Thelypteris dictyoclinoides* (Ching) C.M. Kuo, 1985. l. c. 60.

6.3. Stegnogramma aspidioides Blume

Blume, 1828. Enum. Pl. Javae. 2: 173; Holttum, 1981. Fl. Mal. 2(1): 541-542.

– *Gymnogramme stegnogramma* Blume, 1829. Fl. Jav. Fil. 98, t. 44.

– *Thelypteris stegnogramma* (Blume) Reed, 1968. Phytologia, 17. 466.

6.4. Stegnogramma australis C.W.Chen & L.Y.Kuo

C.W.Chen & L.Y. Kuo, 2019. Syst. Bot. 44: 771.

6.5. Stegnogramma wilfordii (Hook.) Seriz.

Seriz. 1975. Journ. Jap. Bot. 50: 17.

– *Dictyocline wilfordii* (Hook.) J. Smith, 1875. Hist. Fil. 149.

6.6. Stegnogramma griffithii (T. Moore) K. Iwats

K. Iwats, 1963. Acta Phytotax. Geobot. 19: 117

– *Dictyocline griffithii* T. Moore, 1855. Gard. Chron. 1855: 854.

GEN. 7. CYCLOGRAMMA Tagawa

Tagawa, 1938. Acta Phytotax. Geobot. 7: 52; Holttum, 1971. Blumea, 19: 28; id. 1981. Fl. Mal. 2(1): 411- 413; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1115.

7.1. Cyclogramma omeiensis (Baker) Tagawa

Tagawa, 1938. Acta Phytotax. Geobot. 7: 53-54; Phamh. 1999. Illustr. Fl. Vietn. 1: 129; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1115.

– *Polypodium omeiense* Baker, 1888. Journ. Bot. 26: 229.

– *Cyclosorus omeiensis* (Baker) C. M. Kuo, 2002. Taiwania, 47(3): 172.

GEN. 8. PNEUMATOPTERIS Nakai

Nakai, 1933. Bot. Mag. (Tokyo) 47(555): 179; Holttum, 1971. Blumea, 19: 42-43; id. 1981. Fl. Mal. 2(1): 414- 436; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1117.

8.1. Pneumatopteris truncata (Poir.) Holttum

Holttum, 1973. Blumea, 21(2): 314; id. 1981. Fl. Mal. 2(1): 429- 430; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1117.

– *Aspidium truncatum* (Poir.) Gaudich., Voy. Uranie: t. 10 (1828)

– *Cyclosorus pustulifer* Ching, 1999. Fl. Reip. Pop. Sin. 4(1): 345.

GEN. 9. PSEUDOCYCLOSORUS Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 322-324; Holttum, 1971. Blumea, 19: 26; id. 1981. Fl. Mal. 2(1): 413- 414; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1120.

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *PSEUDOCYCLOSORUS*

1a. Segments smaller than 30 pairs, less than 9 mm in length.....
.....**1. P. falcilobus**

1b. Segments larger than 30 pairs, more than 9 mm long….....
.....….**2. P. esquirolii**

9.1. Pseudocyclosorus falcilobus (Hook.) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 324; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1123

– *Dryopteris falciloba* (Hook.) C. Chr., 1931. Contr. U.S. Natl. Herb. 26(6): 274.

– *Glaphyropteris falciloba* (Hook.) H. Itô, 1938. Nov. Fl. Jap. 4: 147.

– *Lastrea calcarata* var. *falciloba* (Hook.) Bedd., 1883. Handb. Ferns Brit. India: 237.

9.2. Pseudocyclosorus esquirolii (Christ) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 324; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1120.

– *Dryopteris esquirolii* Christ, 1907. Bull. Acad. Int. Géogr. Bot., sér. 3, 17: 144.

– *Christella esquirolii* (Christ) H. Lév., 1915. Fl. Kouy-Tchéou: 474-476.

– *Lastrea esquirolii* (Christ) Copel., 1947. Ann. Cryptog. Phytopathol. 5: 138.

– *Pseudocyclosorus esquirolii* monstr. *laciniatus* (Sa.Kurata) Nakaike, 1992. New Fl. Jap. Pterid.: 842.

GEN. 10. MESOPTERIS Ching

Ching, 1978. Acta Phytotax. Sin. 16(4): 21.

10.1. Mesopteris tonkinensis (C. Chr.) Ching

Ching, 1978. Acta Phytotax. Sin. 16(4): 22; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1112.

– *Lastrea tonkinensis* (C.Chr.) Copel., 1947. Ann. Cryptog. Phytopathol. 5: 140.

– *Lastrea tonkinensis* (C.Chr.) Copel., 1947. Ann. Cryptog. Phytopathol. 5: 140.

– *Thelypteris tonkinensis* (C. Chr.) Ching, 1936. Bull. Fan Mem. Inst. Biol., Bot. 6: 292.

GEN. 11. CHRISTELLA H. Lév

H. Lév. 1915. Fl. Kouy-Tchéou. 472; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1112-1114.

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *CHRISTELLA*

1a. Lobed more than 1/2 ……....……..…….. **1. C. dentata**

1b. Lobed less than 1/2

2a. Proximal 1-1,5 pairs anastomosing, next 1 pairs running to sinus membrane ..…….....……..… **2. C. balansae**

2b. Proximal 1,5-2 pairs anastomosing, next 1.5-2.5 pairs running to sinus membrane …….....…..…**3. C. calvescens**

11.1. Christella dentata (Forssk.) Brownsey & Jermy

Brownsey & Jermy, 1973. Brit. Fern Gaz. 10(6): 338; Holttum, 1981. Fl. Mal. 2(1): 557- 558.

– *Polypodium dentatum* Forssk., 1775. Fl. Aegypt.-Arab. 185.

11.2. Christella balansae (Ching) Holttum

Holttum, 1976. Kew Bull. 31: 321; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1113;

- *Thelypteris calvescens* (Ching) C. F. Reed, 1968. Phytologia 17: 262.

11.3. Christella calvescens (Ching) Holttum

Holttum, 1976. Kew Bull. 31: 328; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1113.

– *Cyclosorus sanduensis* K. H. Shing & P. S. Wang, 1999. l. c. 343.

GEN. 12. THELYPTERIS Schmidel

Schmidel, 1763. Icon. Pl., ed. Keller. 3: 45; Holttum, 1971. Blumea, 19: 28; id. 1981. Fl. Mal. 2(1): 375- 377; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1123.

12.1. Thelypteris tylodes (Kunze) Ching

Ching, 1936. Bull. Fan Mem. Inst. Biol., Bot. 6(5): 296; Holttum, 1981. Fl. Mal. 2(1): 413-414; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1120.

– *Aspidium tylodes* Kunze, 1851. Linnaea 24: 283.

– *Cyclosorus gamblei* (Holttum & Jeff W. Grimes) Panigrahi, 1995. Res. J. Pl. Environ. 17: 52.

– *Cyclosorus tibeticus* (Ching & Y.X. Lin) Mazumdar & R. Mukhop., 2013. Bionature 33: 32.

– *Cyclosorus tuberculifer* (C.Chr.) Panigrahi, 1993. Res. J. Pl. Environ. 9: 67.

– *Cyclosorus tylodes* (Kunze) Panigrahi, 1993. Res. Journal. Pl. Environ. 9: 67.

GEN. 13. METATHELYPTERIS (H. Itô) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 305-306; Holttum, 1971. Blumea, 19: 26-27; id. 1981. Fl. Mal. 2(1): 350- 353; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1116.

- *THELYPTERIS* sect. *METATHELYPTERIS* H. Itô, 1939. Nov. Fl. Jap. 4: 137.

Typus: *Metathelypteris gracilescens* (Blume) Ching

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *METATHELYPTERIS*

1a. Laminae 2 pinnate-pinnatifid, segments 5-7 pairs..**1. M. flaccida**

1b. Laminae pinnate-pinnatifid, segments 20-30 pairs.…..... .....**2. M. singalanensis**

13.1 . Metathelypteris flaccida (Blume) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 306; Holttum, 1981. Fl. Mal. 2(1): 351- 352; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1116.

– *Aspidium flaccidum* Blume, 1828. Enum. Pl. Javae 2: 161.

– *Thelypteris panigrahii* Christenh., 2018. Global Fl. 4: 35

13.2. Metathelypteris singalanensis (Baker) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 306; Holttum, 1981. Fl. Mal. 2(1): 352; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1116.

– *Nephrodium singalanense* Baker, 1880. Journ. Bot. 18: 212.

– *Dryopteris media* Alderw., 1913. Bull. Jard. Bot. Buitenzorg, sér. 2, 11: 9.

GEN. 14. CYCLOSORUS Link

Link, 1833. Hort. Berol. 2: 128; Holttum, 1971. Blumea, 19: 27-28; id. 1981. Fl. Mal. 2(1): 385- 387; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1115.

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *CYCLOSORUS*

1a. Rhizomes erect

2a. Lobed more than 1/2……..…….. **1. C. crinipes**

2b. Lobed up to 1/2.

3a. Costae raised abaxially, proximal 1-1,5 pairs anastomosing, sometimes next vein running to sinus membrane..... .....**2. C. heterocarpos**

3b. Costae raised on both surfaces, proximal pair anastomosing, next 1-1,5 pairs running to sinus membrane ……...…….. **3. C. papilio**

1b. Rhizomes short or long creeping

4a. Pinnae at bases not reduced in size

5a. Lobed up to 1/2……...……...…… **4. C. interruptus**

5b. Lobed more than 1/2

6a. Costae raised abaxially, proximal pair anastomosing, next 0,5-1,5 pairs running to sinus membrane ……...……**5. C. acuminatus**

6b. Costae raised on both surfaces, proximal pair anastomosing .....……..……...……...**6. C. parasiticus**

4b. Some pinnae at bases reduced in size

7a. Sori proximal pair usually confluent when mature

8a. Indusia with shortly hairy; Spores with irregularly small tuberculate and echinate ……..…..……**7. C. latipinnus**

8b. Indusia with acicular hairs; Spores with long fimbriate wings.…….....……...….**8. C. molliusculus**

7b. Sori proximal pair not confluent when mature

9a. Lobed 2/3-3/4 toward costae; proximal veinlets pair anastomosing and running to sinus membrane, next veinlets don't running to sinus membrane.…..….**9. C. cylindrothrix**

9b. Lobed to 1/3 toward costae; proximal one or more veinlets pairs anastomosing and running to sinus membrane, one or more veinlets pairs running to sinus membrane..

10a. Pinnae abaxially without glands, aerophores beneath pinna bases slightly swollen .....…….. **10. C. articulatus**

10b. Pinnae abaxially with glands

11a. Pinnae with apices acuminate …….. **11. C. fukienensis**

11b. Pinnae with apices long acuminate

12a. Spores shortly cristate and echinate ...**12. C. jaculosus**

12b. Spore with long wings or ridged folds .....**13. C. aridus**

14.1. Cyclosorus crinipes (Hooker) Ching

Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 179.

– *Nephrodium crinipes* Hook., 1862. Sp. Fil. 4: 71.

14.2. Cyclosorus heterocarpos (Blume) Ching

Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 180; Holttum, 1981. Fl. Mal. 2(1): 457- 458; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1121-1122.

– *Cyclosorus suprastrigosus* (Rosenst.) Copel., 1947. Ann. Cryptog. Phytopathol. 5: 143.
– *Nephrodium heterocarpon* (Blume) T. Moore, 1858. Index Fil.: 93.
– *Sphaerostephanos heterocarpos* (Blume) Holttum, 1974. Companion Handb. Ferns Brit. India: 209.
– *Thelypteris mixta* (Rosenst.) C.F. Reed, 1968. l. c. 293.

14.3. Cyclosorus papilio (C. Hope) Ching

Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 196; Holttum, 1981. Fl. Mal. 2(1): 556.
– *Cyclosorus dentatus* var. *glaber* (Punetha & Kholia) Mazumdar & R. Mukhop., 2013. Bionature, 33(1): 18.
– *Cyclosorus papilio* (C. Hope) Ching, 1938. l. c. 214.
– *Cyclosorus papilio* (C. Hope) Ching, 1938. l. c. 214.
– *Thelypteris papilio* (C. Hope) K. Iwats., 1965. Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol. 31: 175

14.4. Cyclosorus interruptus (Willd.) H. Itô

H. Itô, 1937. Bot. Mag. (Tokyo). 51: 714; Holttum, 1981. Fl. Mal. 2(1): 386-387; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1115.
– *Pteris interrupta* Willd., 1794. Phytographia, 13.
– *Aspidium gongylodes* Schkuhr, 1809. 24. Kl. Linn. Pfl.-Syst.: 193.
– *Aspidium venulosum* Blume, 1828. Enum. Pl. Javae 2: 151.

***14.5.* Cyclosorus acuminatus** (Houtt.) Nakai

Nakai, *1935. Misc. Pap. Reg. Jap. Pl. Thunb. tab. 15*; Holttum, 1981. Fl. Mal. 2(1): 560-561; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1112.
– *Cyclosorus sophoroides* (Thunb.) Tardieu, 1938. Notul. Syst. (Paris) 7: 76.
– *Dryopteris acuminata* (Houtt.) Nakai, 1928. Bot. Mag. (Tokyo) 42(496): 217.
– *Dryopteris sinica* Christ, 1909. Not. Syst. (Paris) 1: 38.

14.6. Cyclosorus parasiticus (L.) Farw.

Farwell, 1931. Amer. Midl. Naturalist. 12(8): 259; Holttum, 1981. Fl. Mal. 2(1): 559-560; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1113-1114.
– *Aspidium parasiticum* (L.) Swartz, 1801. J. Bot. (Schrader) 1800(2): 35.
– *Dryopteris eriochlamys* Christ, 1908. Journ. Bot. (Morot), sér. 2, 1: 230, 261.
– *Dryopteris parasitica* var. *didymosora* (Bedd.) Domin, 1914. Biblioth. Bot. 20: 50.

14.7. Cyclosorus latipinnus (Benth.) Tardieu

Tardieu, 1938. Not. Syst. (Paris). 7: 73; Holttum, 1981. Fl. Mal. 2(1): 558-559; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1114

– *Cyclosorus nanpingensis* Ching, 1982. l. c. 597.

– *Cyclosorus oblanceolatus* K.H. Shing & Z.F. Zhang, 1999. l. c. 331.

– *Cyclosorus papilionaceus* K.H. Shing & C.F. Zhang, 1999. l. c. 331.

14.8. Cyclosorus molliusculus (Wallich ex Kuhn) Ching

Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 196.

– *Christella cana* (J.Sm.) H. Lév., 1915. Fl. Kouy-Tchéou: 474-476.

– *Cyclosorus acutilobus* Ching, 1999. l. c. 335.

– *Cyclosorus canus* (J.Sm.) S. Linds., 2009. Edinb. Journ. Bot. 66: 359.

– *Cyclosorus densissimus* Ching, 1999. l. c. 334.

– *Lastrea cana* J.Sm., 1857. Cat. Cult. Ferns: 57.

14.9. Cyclosorus cylindrothrix (Rosenst.) Ching

Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 199; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1113.

– *Christella cylindrothrix* (Rosenst.) Holttum, 1974. l. c. 208.

– *Cyclosorus parasiticus* (L) Farw. var. *cylindrothrix* (Rosenst.) Tardieu & C.

14.10. Cyclosorus articulatus (Houlston & T. Moore) Panigrahi

Panigrahi, 1993. Res. J. Pl. Environ. 9: 66; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1113.

– *Aspidium eminens* Bedd., 1888. Journ. Bot. 26: 4.

– *Christella euphlebia* (Ching) Holttum, 1976. Kew Bull. 31: 328.

– *Cyclosorus euphlebius* Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8: 226.

– *Cyclosorus indicus* (Alderw.) Ching, 1941. l. c. 10: 245.

– *Cyclosorus laete-strigosus* (C.B. Clarke) Ching, 1938. l. c. 227.

14.11. Cyclosorus fukienensis Ching

Ching, 1938. Bull. Fan Mem. Inst. Biol., Bot. 8(4): 209-210; Son D. H. et al., 2020, TNU Journal of Science and Technology, 225(05): 52-54.

– *Cyclosorus fraxinifolius* Ching & K.H. Shing, 1982. l. c. 599.

– *Cyclosorus luoqingensis* Ching & C.F. Zhang, 1983. Bull. Bot. Res. Harbin 3(3): 6.

– *Cyclosorus nanlingensis* Ching ex K.H. Shing & J.F. Cheng, 1990. Jiangxi Sci. 8(3): 46.

– *Cyclosorus paucipinnus* Ching & C.F. Zhang, 1999. l. c. 349.

14.12. Cyclosorus jaculosus (Christ) H. Itô

H. Itô, 1937. Bot. Mag. (Tokyo). 51: 725.

– *Aspidium jaculosum* Christ, 1904. Bull. Herb. Boissier, sér. 2, 4: 615.

– *Christella jaculosa* (Christ) Holttum, 1976. Webbia, 30: 193.

– *Christella subarida* (Tatew. & Tagawa) Holttum, 1975. Fl. Taiwan, 1: 408.

14.13. Cyclosorus aridus (D.Don) Tagawa

Tagawa, 1938. Acta Phytotax. Geobot. 7: 78; Holttum, 1981. Fl. Mal. 2(1): 555-556; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1112-1113.

– *Aspidium aridum* D. Don, 1825. Prodr. Fl. Nep. 4.

– *Aspidium obscurum* Blume in Enum, 1828. Pl. Javae 2: 150.

– *Cyclosorus papyraceus* (Bedd.) Ching, 1938. l. c. 196.

– *Dryopteris arida* (D. Don) Kuntze, 1891. Revis. Gen. Pl. 2: 812.

– *Nephrodium aridum* (D. Don) J. Smith, 1841. Journ. Bot. (Hook.) 4: 188.

GEN. 15. AMBLOVENATUM J.P. Roux

J.P. Roux, 2009. Strelitzia. 23. 200-201; Mazumdar, 2017. Int. Journ. Adv. Res. Innov. Ideas Educ. 3(2): 5060.

- *AMPHINEURON* Holttum, 1971. Blumea, 19: 45; id. 1977. l. c. 23: 205-218; id. 1981. Fl. Mal. 2(1): 544- 550.

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *AMBLOVENATUM*

1a. Plants taller than 150 cm, lobed up to 1 mm towards costae or more …….....……..….**1. A. immersum**

1b. Plants shorter than 150 cm, lobed up to 1/2 towards costae

2a. Segments middle triangular, next 1-1,5 pairs running to sinus membrane .....…….....…...**2. A. terminans**

2b. Segments middle subfalcate, next 0,5-1 pairs running to sinus membrane……...…….. **3. A. opulentum**

15.1. Amblovenatum immersum (Blume) Mazumdar

Mazumdar, 2017. Int. Journ. Adv. Res. Innov. Ideas Educ. 3(2): 5060; Holttum, 1981. Fl. Mal. 2(1): 547.

– *Aspidium immersum* Blume, 1828. Enum. Pl. Javae 2: 156.

– *Thelypteris immerse* (Blume) Ching, 1936. Bull. Fan Mem. Inst. Biol. Bot. 6: 306.

15.2. Amblovenatum terminans *(*Hook.) J.P. Roux.

J.P. Roux, 2009. Strelitzia, 23: 201; Holttum, 1981. Fl. Mal. 2(1): 545-547.

– *Nephrodium terminans* Hook., 1862. Sp. Fil. 4: 73.
– *Amphineuron terminans* (J.Sm. ex Hook.) Holttum, 1974. Journ. South. African Bot. 40(2) :162.
– *Dryopteris interrupta* sensu Ching, 1933. Lingnan Sci. J. 12: 565-570.

15.3. Amblovenatum opulentum (Kaulf.) J.P.Roux

J.P. Roux, 2009. Strelitzia, 23: 201; Holttum, 1981. Fl. Mal. 2(1): 548; Mazumdar, 2017. Int. J. Adv.Res. Innov. Ideas Educ. 3: 5960.
– *Aspidium extensum* Blume, 1828. Enum. Pl. Javae 2: 156.
– *Aspidium hookeri* Baker in W.J. Hooker & J.G. Baker, 1867. Syn. Fil.: 257, nom. illeg.
– *Aspidium malaccense* Fée, 1852. Mém. Foug., 5. Gen. Filic.: 292.
– *Aspidium multijugum* Wall., 1829. Numer. List: n.° 348.
– *Cyclosorus incertus* (Domin ex C.Chr.) Ching, 1941. Bull. Fan Mem. Inst. Biol., Bot. 10: 245.

GEN. 16. TRIGONOSPORA Holttum

Holttum, 1971. Blumea, 19(1): 29; id. 1981. Fl. Mal. 2(1): 373- 375.

16.1. Trigonospora ciliata (Wall. ex Benth.) Holttum

Holttum, 1981. Fl. Mal. 2(1): 375.
– *Aspidium ciliatum* Wall. ex Benth., 1861. Fl. Hongk.: 455.
– *Cyclosorus sericeus* (J. Scott ex Bedd.) Panigrahi, 1993. l. c. 66.
– *Dryopteris pinnata* Copel., 1929. Univ. Calif. Pub. Bot. 14: 373.
– *Dryopteris pseudocalcarata* C.Chr., 1934. Index Filic., Suppl. Tert.: 95.

GEN. 17. GLAPHYROPTERIDOPSIS Ching

Ching, 1963. Acta Phytotax. Sin. 8: 320; Holttum, 1971. Blumea, 19: 31; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1115.

17.1. Glaphyropteridopsis erubescens (Wall. ex Hook.) Ching

Ching, 1963. Acta Phytotax. Sin. 8: 320; Holttum, 1971. Blumea, 19: 31; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1115.
– *Dryopteris braineoides* (Baker) C. Chr., 1905. Index Filic. 4: 255.
– *Glaphyropteris erubescens* (Wall. ex Hook.) Fée, 1872. Crypt. Vasc. Brésil. 2: 41.
– *Lastrea erubescens* (Wall. ex Hook.) Copeland, 1947. Gen. Fil. (Copeland). 138.

GEN. 18. PARATHELYPTERIS (H.Itô) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 300-301; Holttum, 1971. Blumea, 19: 32-33; id. 1981. Fl. Mal. 2(1): 370- 373; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1116.

- *THELYPTERIS* sect. *PARATHELYPTERIS* H. Itô, 1939. Nov. Fl. Jap. 4: 127

KEY PAIRS OF OPPOSING CHARACTERISTICS OF THE SPECIES OF THE GENUS *PARATHELYPTERIS*

1a. Pinnae at bases not reduced in size ……..**1. P. angulariloba**

1b. Pinnae at bases reduced in size

2a. Veinlets arise from base of segments veins ….**2. P. petelotii**

2b. Veinlets arise not from base of segments veins.....

.....**3. P. glanduligera**

18.1. Parathelypteris angulariloba (Ching) Ching

Ching, 1963. Acta Phytotax. Sin. 8: 304.

– *Thelypteris angulariloba* Ching, 1936. Bull. Fan Mem. Inst. Biol., Bot. 6: 323.

– *Lastrea simozawae* (Tagawa) Tagawa, 1953. Acta Phytotax. Geobot. 15: 14.

– *Parathelypteris caoshanensis* Ching ex K.H. Shing, 1999. Fl. Reip. Pop. Sin. 4(1): 321.

– *Parathelypteris simozawae* (Tagawa) Ching, 1963. Acta Phytotax. Sin. 8: 304.

18.2. Parathelypteris petelotii (Ching) Ching

Ching, 1963. Acta Phytotax. Sin. 8(4): 303; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1114.

– *Lastrea petelotii* (Ching) Tagawa, 1956. Acta Phytotax. Geobot. 16: 78.

18.3. Parathelypteris glanduligera (Kunze) Ching

Ching, 1963. Acta Phytotax. Sin. 8: 301; Holttum, 1981. Fl. Mal. 2(1): 373; P. K. Loc, 2001. Checkl. Pl. Sp. Vietn. 1: 1116.

– *Christella glanduligera* (Kunze) H. Lév., 1915. Fl. Kouy-Tchéou: 474.

– *Dryopteris glanduligera* (Kunze) Christ, 1908. J. Bot. (Morot), sér. 2, 1: 231.

– *Dryopteris gracilescens* (Blume) Kuntze var. *glanduligera* (Kunze) C. Chr., 1913, Bot. Gaz. 56: 332.

3.6. The value of the family Thelypteridaceae Ching ex Pic. Serm.

3.6.1. Scientific value: Discovered and published 2 new record species for the flora of our country (*Amblovenatum immersum* (Blume) Mazumdar, *Amblovenatum opulentum* (Kaulf.) J.P.Roux.); updated new scientific names of 2 genera (*Amblovenatum* J.P. Roux, *Mesopteris* Ching); updated new scientific name of 1 species (*Mesopteris tonkinensis*

(C. Chr.) Ching); recorded the new habitat of 1 species (*Amblovenatum terminans* (Hook.) J.P. Roux).

3.6.2. Use value

From the medicinal values used to treat diseases and compared with many works of authors such as Vo Van Chi (2012) [63], Do Huy Bich et al. (2004) [60], Institute of Medicinal Materials (2016) [68] identified 12 species and 9 uses.

3.7. Some comments and discussions on the relationship and evolutionary trends of taxa in the family Thelypteridaceae

The results of decoding the chloroplast gene sequence (rbcL) of 4 species of the family Thelypteridaceae in our country, combined with the sequence on Genbank to build a possible close relationship between the genera of the family Thelypteridaceae, some studies on molecular biological evolution such as Li J.H and Xian C.Z. (2012) [41] and other studies have shown that the subfamily *Phegopteridoideae* and the subfamily *Thelypteridoideae* are closely related to each other. The level of homology of the subfamilies is extremely high, many characteristics are commonly used to identify such as leaf vein type, sporangial hairs, etc.

In the family Thelypteridaceae, the leaf vein type is often used to identify morphological characteristics. Free veins that do not reach the pseudoleaflet margin are the primitive state of the family Thelypteridaceae. This vein type appears in the genera *Macrothelypteris, Pseudophegopteris, Phegopteris* and *Metathelypteris*. In the thesis, these 4 genera are also closely related to each other, so it can be predicted that this group of 4 genera is the most primitive.

Based on the research of Li J.H and Xian C.Z. (2012) [41], the family Thelypteridaceae has a tendency to evolve hairs on the sporangium. The genera including *Cyclogramma, Phegopteris, Pseudophegopteris* and *Stegnogramma* often possess non-glandular hairs on the sporangium. This makes the phenomenon of sporangia changing shape more likely to occur. But with glands and glandular hairs, the phenomenon of sporangia changing shape does not occur. From the phenomenon of sporangia changing shape, the non-glandular hairs on the sporangia will help protect the sporangia from external conditions better.

CONCLUSION AND RECOMMENDATIONS

Conclusion:

1. The PPGI system of Schuettpelz E. et al. (2016) [43] was chosen to arrange the taxa of the family Thelypteridaceae Ching ex Pic. Serm. in our country because this is the system based on the most detailed and reasonable studies. On this basis, the family Thelypteridaceae is recorded to have 18 genera and 52 species. Including 2 new record species for the flora of our country (*Amblovenatum immersum* (Blume) Mazumdar, *Amblovenatum opulentum* (Kaulf.) J.P. Roux.); updated new scientific names of 2 genera (*Amblovenatum* J.P. Roux, Mesopteris Ching); updated new scientific name of 1 species (*Mesopteris tonkinensis* (C. Chr.) Ching); recorded new habitat of 1 species (*Amblovenatum terminans* (Hook.) J.P. Roux).

2. Built a key for pairs of opposite characteristics and provided full information for taxa belonging to the family Rạng thư dư in our country including: scientific name, Vietnamese name, document citation, shape, ecological biological standard sample, habitat, illustration, research photo. Some taxa were edited and recorded again.

3. From the DNA data of species belonging to the family Thelypteridaceae and applying the Paulp 4.0 computer program, presenting the results using Mega, Treeview to create a chart of the close relationships of 18 genera of the family Rạng thư dốc. In the 18 genera, 6 groups of genera are formed that are closely related to each other.

4. From the collected data, it is shown that the family Thelypteridaceae in our country has 7 genera and 12 species recorded for medicinal use. The parts of the plant used include: the whole plant has 6 species, rhizomes: 3 species, leaves: 3 species.

Recommendations:

The family Thelypteridaceae needs to be further studied on spore characteristics, PCR and evolutionary trends to complete the database for publishing the Flora of Vietnam and other works. In addition, it is necessary to learn more about the species that are still suspected and have not been sampled, to have more accurate and specific information..

NEW POINTS OF THE THESIS

Up to now, this is the most detailed, systematic and accurate scientific work on the classification of the family Thelypteridaceae in our country, including 18 genera and 52 species. Information on the taxa has been edited and supplemented with scientific names, Vietnam names, document citations, research specimens, shape descriptions, illustrations and photos of life forms.

Successfully announced 2 new record species to the flora of Vietnam; updated the new scientific names of 2 genera; updated the new scientific name of 1 species; recorded the new habitat of 1 species.

Based on the DNA data of species belonging to the Thelypteridaceae family and applying the Paulp 4.0 computer program, displaying the results in Mega, Treeview has created a chart of the close relationships of the genera of the Thelypteridaceae family in Vietnam.

LIST OF THE PUBLICATIONS RELATED TO THE DISSERTATION

1. Doan Hoang Son, Do Van Hai, Tran The Bach, Chen Cheng Wei, La Anh Duong, Trinh Van Hieu, Ha Huy Nhat and Ngo Van Tung (2021), "Update name of Amblovenatum J.P.Roux genus (Thelypteridaceae) and received new distribution of Amblovetatum terminans in Vietnam", *HNUE Journal of Science, Natural Sciences 2021*, Volume 66, Issue 4F, pp. 41-46.

2. Doan Hoang Son, Do Van Hai, Tran The Bach, Bui Hong Quang, Le Ngoc Han, Tran Duc Binh, La Anh Duong, Vu Thi Dung (2021), "Study on Thelypteridaceae Ching Ex pic. Serm. in the Phia Oac - Phia Den National Park, Cao Bang province", *HNUE Journal of Science, Natural Sciences 2021*, Volume 66, Issue 4F, pp. 116-127.

3. **Doan Hoang Son**, Do Van Hai, Bui Hong Quang, Cheng Wei Chen, La Anh Duong, Trinh Van Hieu, Ritesh Kumar Choudhary and Joongku Lee (2022), "*Amblovenatum immersum* (Thelypteridaceae): A new record for the flora of Vietnam", *Korean J. PI. Taxon*. 52(2): 108-113.

4. Cheng-Wei Chen, Tian-Chuan Hsu, **Hoang Son Doan**, Van Hai Do, Hong Truong Luu, Van Son Le, Yea-Chen Liu, Chia-Wei Li, Yao-Moan Huang, and Kuo-Fang Chung (2023), "Studies of Vietnamese Pteridophyte Flora 2", *Systematic Botany*, 48(2) : 159-172