The Diversity of Pteridophytes along a Natural Trial at Phu Soi Dao National Park, Phitsanulok Province, Thailand

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บทคัดย่อ

การศึกษาความหลากหลายของเทอริโดไฟต์บริเวณอุทยานแห่งชาติภูสอยดาว ทำการสำรวจตามเส้นทาง เดินป่าเป็นระยะทาง 6,500 เมตร ซึ่งมีความสูงจากระดับน้ำทะเล 500 – 1,633 เมตร เก็บตัวอย่างระหว่างเดือน ตุลาคม 2548 ถึงเดือนกันยายน 2549 จำแนกตัวอย่างเฟิร์นโดยอาศัยเอกสารและเปรียบเทียบตัวอย่างจากหอ พรรณไม้ กรมอุทยานแห่งชาติ สัตว์ป่าและพรรณพืช และหอพรรณไม้ สวนพฤกษศาสตร์สมเด็จพระนางเจ้าสิริกิติ์ จังหวัดเชียงใหม่ ผลการศึกษาสามารถจำแนกได้ 18 วงศ์ 30 สกุล 61 ชนิด ข้อมูลที่ได้สามารถใช้เป็นข้อมูลพื้น ฐานในการอนุรักษ์ความหลากหลายทางชีวภาพต่อไป

Abstract

A study of the diversity of pteridophytes at Phu Soi Dao National Park, Phitsanulok Province, was conducted from October 2005 to September 2006 at the altitudes ranging from 500 – 1,633 meters above mean sea level. The survey has been conducted along existing a 6,500 m. forest trails. The collected ferns were identified and compared with herbarium specimens and available literatures from the Forest Herbarium, National Park, Wildlife and Plant Conservation Department (BKF), Bangkok and the herbarium of Queen Sirikit Botanic Garden (QSBG), Chiangmai. The results of the study presented 18 families, 30 genera, 61 species. The data from this study can be used for the future conservation of biodiversity.

คำสำคัญ: เทอริโดไฟต์, อุทยานแห่งชาติภูสอยดาว, จังหวัดพิษณุโลก Keywords: Pteridophytes, Phu Soi Dao National Park, Phitsanulok Province

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Introduction

Phu Soi Dao National Park locateds in both Chattrakarn District of Phitsanulok Province and Nam Pad District of Uttaradit Province. It occupies a total area of 78.34 square kilometers (equivalent to 58,750 acres). The geographical features of the national park consist of hills, valleys and high mountains with the heights between 500 and 2,102 meters above mean sea level. Mountains extending eastwards are used as the boundary between Thailand and Laos. The area of mountain and forest is approximately 85 % of the total area of the National Park, with the area of flat lands is approximately 15 %. The forest area of the park consists of deciduous forest, mixed deciduous forest, evergreen forest and savannah. The field of three-leaf pines is one of the sightseeing spots on Phu Soi Dao Mountain, about 1,633 meters above mean sea level. The topography of the national park consist of beautiful virgin forests, which are the source of streams and rivers. There are many flora that can adapt by seasonal and environmental factors such as elevation, climate, humidity and soil properties. These factors were stipulated forest types. (Kimmins, 1987; Miller, 1995).

Tagawa and Iwatsuki (1979–1989), Japanese botanists from Kyoto University, studied the existing herbarium specimens of pteridophytes from Thailand and their collection. They identified 34 families, 121 genera and 630 species. Their contributions to Thai pteridophytes were published in Flora of Thailand, Vol. III, part 1–4. Boonkerd and Pollawatn (2000) compiled data from various sources as well as from their own field trips to produce a checklist of ferns and fern allies found in Thailand. A total of 671 species, 4 subspecies, and 28 varieties belonging to 139 genera and 35 families were enumerated. The aim of this study is to conduct a botanical inventory of pteridophytes at Phu Soi Dao National Park in Phitsanulok Province, Thailand.

Study site

Phu Soi Dao National Park is situated in an approximately area of 78.34 square kilometers or 48,962.5 rai, covering the areas of Pa Nampad National Conserved Forest, Tambol Muangjedton, Tambol Nakhum, Tambol Bankoak, Bankoak District, Huaimoon District, Nampad District of Uttaradit Province, and Tambol Borpak, Chattrakarn District of Phitsanulok Province. Its approximate geographical coordinates are 17° $41^{'}$ – 18° $04^{'}$ North latitude and 100° 56' -101° 09' East longitudes (Figure 1). The park includes areas of pine forest 1,253 rai, hill evergreen forest 23,770 rai, dry evergreen forest 38,784 rai, mixed deciduous forest 40,035 rai and dry dipterocarp forest 21,268 rai. One of the most distinctive features of the park is the savannah found amidst the dense pine trees.

Methodology

Field collections of ferns were conducted from October 2005 to September 2006 at Phu Soi Dao National Park. The specimens were collected and photographs were taken for each species. Field note, ecological data, habitat and some diagnostic characters of each species were recorded. Pteridophyte specimens were identified using keys and descriptions from taxonomic literature, such as flora, manual, monograph, as well as research papers. Botanical names of each specimen were verified by comparison to the voucher herbarium specimens deposited at BKF and QSBG. KKU Res J 13 (8) : September 2008



Figure 1. Map showing the location of Phu Soi Dao National Park.

The climate of the area is very comfortable all year round. The summer season is in February – April. The rainy season is in May–October, and the winter season is in November–January. The average annual temperature was 27 °C. The average maximum temperature was 35 °C and average minimum temperature was 13 °C. The average annual rainfall was 1334.4 mm/year. The geology of the area, soil properties is sandy loam. The stone is igneous rock that cover with sedimentary rock. This area have slope around 25% – 70% (Royal Forest Department, 1990; 2002)



Figure 2. Climatological data during the period 2005-2006. (Data from the office of Phu Soi Dao National Park)

Families/Species	Elevation(m)	Habitat	Abundance
ASPLENIACEAE			
Asplenium nidus L.	800	L	С
A. pellucidum Lamk.	800	L	С
A. yoshinagae Makino	1200	L	R
ATHYRIACEAE			
Anisocampium cumingianum C. Presl	600-1000	Т	С
Diplazium esculentum (Retz.) Sw.	600	Т	С
BLECHNACEAE			
Blechnum orientale L.	1600	Т	С
CYATHEACEAE			
Cyathea gigantea (Wall. ex Hook.) Holtt.	1200	Т	С
DAVALLIACAE			
Davallia denticulata (Burm. f.) Mett.ex Kuhn	800	Е	С
D. solida (Forst.) Sw.	1200-1400	Е	С
DENNSTAEDTIACEAE			
Hypolepis punctata (Thunb.) Mett. ex Kuhn	800	Т	UC
H. beddomei Nair & Ghosh	1500	Т	С
Microlepia puberula v.A.v. Ros.	1300	Т	С
M. speluncae (L.) Moore	1300	Т	С
Pteridium aquilinum(L.) Kuhn var. wightianum (Ag.)	1400	Т	А
Tryon			
DRYOPTERIDACEAE			
Tectaria angulata (Willd.) C. Chr.	800	Т	С
T. herpetocaulos Holtt.	500-600	Т	А
T. impressa (Fee) Holtt.	900	Т	С
T. polymorpha (Wall. ex Hook.) Copel.	500-600	Т	С
LINDSAEACEAE			
Lindsaea ensifolia Sw.	1300	Т	С
MARATTIACEAE			
Angiopteris evecta (G. Forst.) Hoffm.	600-700	Т	C
OLEANDRACEAE			
Oleandra undulata (Willd.) Ching	600	Т	С

 Table 1.
 The pteridophytes of Phu Soi Dao National Park

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Table 1. The plendophyles of thu Sol Dao National tark (cont.)	Table 1.	The pteridophytes of Phu Soi Dao National Park (cont.)
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Families/Species	Elevation(m)	Habitat	Abundance
OPHIOGLOSSACEAE			
Ophioglossum petiolatum Hook.	1400	Т	R
PARKERIACEAE			
Adiantum caudatum L.	600-700	Т	С
A. philippense L.	600-1300	Т	А
A. zollingeri Mett. ex Kuhn	600-700	Т	С
Cheilanthes subrufa Bak.	1300-1500	Т	С
Hemionitis arifolia (Burm.f.) Moore.	600	Т	UC
POLYPODIACEAE			
Arthromeris amplexifolia (Christ) Ching	1100	Е	UC
Colysis pothifolia (D. Don) C. Presl	500-600	Т	С
Crypsinus oxylobus (Wall. ex Kunze) Sledge	1600	L	С
C. cruciformis (Ching) Tagawa	1600	Е	С
Drynaria rigidula (Sw.) Bedd.	700	Е	UC
Microsorum membranaceum (D. Don) Ching	800	L	С
M. musifolium Copel.	800	L	UC
Platycerium holttumii Jonch & Hennipman	800	Е	С
Polypodium subauriculatum Blume	1600	Е	UC
Pyrrosia adnascens (Sw.) Ching	800	Е	С
P. varia (Kaulf.) Farw.	800	L	С
P. nuda (Gies.) Ching	800	L	С
P. mannii (Gies.) Ching	1200	L	С
PTERIDACEAE			
Pteris asperula J. Sm. ex Hieron	1500-1600	Т	С
P. biaurita L.	800-1400	Т	С
P. cretica L.	900-1100	Т	UC
P. ensiformis Burm.f.	1300	Т	С
P. stenophyllla Wall. ex Hook.& Grev.	900	Т	С
P. venusta Kunze	900-1100	Т	С
SCHIZAEACEAE			
Lygodium flexuosum (L.) Sw.	800-1000	Т	С
L. microphyllum (Cav.) R.Br.	800-1000	Т	С
L. salicifolium Presl	800-1000	Т	С

900

Families/Species	Elevation(m)	Habitat	Abundance
SELAGINELLACEAE			
Selaginella argentea (Wall.ex Hook.& Grev.) Spring	800-1300	Т	А
S. kurzii Baker	1400-1500	Т	А
S. monospora Spring	1500	Т	UC
S. minutifolia Spring	800	Т	UC
S. tenuifolia Spring	1500	Т	UC
THELYPTERIDACEAE			
Thelypteris interrupta (Willd) K. Iwats.	800-1300	Т	С
T. immerse (Blume) Ching	800-1300	Т	С
T. nudata (Roxb.) Morton	600-700	Т	А
T. parasitica (L.) Fosberg	600-800	Т	С
T. terminans (Hook.) Tagawa & K. Iwats.	800-1300	Т	С
T. truncata (Poir.) K. Iwats	800	Т	С
VITTARIACEAE			
Antrophyum callifolium Blume	900	L	UC

 Table 1.
 The pteridophytes of Phu Soi Dao National Park (cont.)

Abbreviations are as follows:

Habitat: E = epiphyte, L = lithophyte, T = terrestrial

Abundance: A = abundant, C = common, R = rarely found, UC = uncommon,

Results and Discussion

The pteridophytes specimens were identified and classified into 18 families, 30 genera and 61 species. (Table 1)

1. Habitats and diversity of Pteridophytes

Specimens were collected along existing forest trails to Phu Soi Dao. The altitude of the area ranged from 500-1,633 m. Pteridophytes identified included common families. These are as follows: Aspleniaceae 3 species, Athyriaceae 2 species, Blechnaceae 1 species, Cyatheaceae 1 species, Davalliaceae 2 species, Dennstaedtiaceae 5 species, Dryopteridaceae 4 species, Lindsaeaceae 1 species, Marattiaceae 1 species, Oleandraceae 1 species, Ophioglossaceae 1 species, Parkeriaceae 5 species, Polypodiaceae 13 species, Pteridaceae 6 species, Schizaeaceae 3 species, Selaginellaceae 5 species, Thelypteridaceae 6 species and Vittariaceae 1 species. It was found that these ferns thrive in various habitats such as terrestrial, on rock (lithophytes) and on tree-branches or tree-trunks (epiphytes).

1) Terrestrial ferns

Results showed that 43 species of ferns were terrestrial plants. Terrestrial habitat includes stream banks, shaded areas, mountain slopes and open ground. Common families of ferns such as Athyriaceae, Blechnaceae, Cyatheaceae, Dennstaedtiaceae, Dryopteridaceae, Lindsaeaceae, Marattiaceae, Oleandraceae, Ophioglossaceae, Parkeriaceae, Polypodiaceae, Pteridaceae, Schizaeaceae, Selaginellaceae and Thelypteridaceae were found. Large terrestrial ferns or tree ferns such as *Angiopteris evecta* (G. Forst.) Hoffm. and *Cyathea gigantea* (Wall. ex Hook.) Holtt. were found. On exposed ground, the most common terrestrial sun-ferns found was *Pteridium aquilinum*(L.) Kuhn var. *wightianum* (Ag.) Tryon. They form dense, long persistent thickets in open places and become weedy species.

2) Lithophytic ferns

It was found that 10 species of ferns were lithophytes. These species grow on bare rock, humus-rich rock and muddy rock. Lithophytes are confined to high humidity areas. Some lithophytes are established on moist mossy-rock, such as *Asplenium yoshinagae* Makino, *Crypsinus oxylobus* (Wall. ex Kunze) Sledge, *Microsorum membranaceum* (D. Don) Ching. and *Pyrrosia mannii* (Gies.) Ching.

3) Epiphytic ferns

8 species of ferns were identified as epiphytes. In general, these pteridophytes grow on bare and mossy tree trunks and on branches of trees. They are include common families of ferns such as Davalliacae and Polypodiaceae. Examples of common epiphyte species are *Davallia denticulata* (Burm. f.) Mett. ex Kuhn, *Davallia solida* (Forst.) Sw., *Arthromeris amplexifolia* (Christ.) Ching, *Crypsinus cruciformis* (Ching) Tagawa, *Drynaria rigidula* (Sw.) Bedd., *Platycerium holttumii* Jonch & Hennipman, *Polypodium subauriculatum* Blume, *Pyrrosia adnascens* (Sw.) Ching.

4) Unidentified species

In this study, there are four species could not be determined due to the lack of fertile structures as well as keys. They are two species of *Thelypteris*, one species of *Tactaria*, one species of *Drynaria* and one species of *Lycopodium*.

2. Elevation, distribution and diversity of pteridophytes

The elevation of Phu Soi Dao National Park range from 500 to 1,633 meters. It was found that the number of species at the elevation of 601-800m.was the highest (19 species) and the elevation of 801 - 1,000 m were 15 species. Tropical Evergreen Forest and Hill Evergreen Forest are two forest types at these elevation. Hence, the ecological factors at high elevation of Hill Evergreen Forest are suitable for growth and development of these pteridophytes. (Yuyen and Boonkerd, 2002)

3. Comparisons with pteridophytes from other areas

1) Phu Miang, Phitsanulok and Phetchabun Provinces

According to the Flora of Thailand Volume III (Tagawa and Iwatsuki, 1979; 1985; 1988; 1989) 78 species of ferns and fern allies were reported from Phu Miang. Phu Miang is located in the Phetchabun mountain range in Phitsanulok and Phetchabun Provinces. It is marked out approximately by the geographical coordinates of $16^{\circ} 51' - 17^{\circ}$ 41' North latitude and $100^{\circ} 40' - 101^{\circ} 07'$ East longitude.

2) Phu Hin Rong Kla National Park

One hundred and twelve species and 23 families and 55 genera were reported from Phu Hin Rong Kla National Park. The family Polypodiaceae is the most found around 26 species (Wilawan and Boonkerd, 2003).

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Figure 3. (A-O) Some picture of fern at Phu Soi Dao National Park

3A) Blechnum orientale L. 3B) Cheilanthes subrufa Bak. 3C) Adiantum. philippense L.
3D) Thelypteris impressa (Fee) Holtt. 3E) Adiantum caudatum L. 3F) Thelypteris terminans (Hook.) Tagawa & K. Iwats. 3G) Colysis pothifolia (D. Don) C. Presl 3H) Pteris biaurita L.
3I) Hemionnitis arifolia (Burm.f.) Moore. 3J) Polypodium subauriculatum Blume 3K) Antrophyum callifolium Blume 3L) Davallia solida (Forst.) Sw. 3M) Crypsinus oxylobus (Wall. ex Kunze) Sledge 3N) Microsorum membranaceum (D. Don) Ching and 3O) Pyrrosia nuda (Gies.) Ching





Figure 4. Diversity of pteridophytes in relation to elevations

Thung Salaeng Luang National Park,
 Phitsanulok and Phetchabun Provinces

Seventy three species, 22 families and 40 genera were reported from Thung Salaeng Luang National Park. The family Polypodiaceae is the most found around 13 species (Siridarat Jujia, 2004).

For the Phu Soi Dao National Park, 18 families and 61 species were indicated. The family Polypodiaceae is the most common with 13 species.

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References

- Boonkerd, T., and Pollawatn, R. 2000. Pteridophytes in Thailand. Bangkok: Office of Environmental Policy and Planning.
- Kimmins, J.P. 1987. Forest Ecology. New York: Macmillan Publishing Company.
- Miller, G., Tyler. 1995. Environmental Science: Working with the Earth. 4th Edt. California: Wadworth Publishing Company.
- Royal Forest Department. 1990.Basic data for management master plan of Phu Soi Dao National Park, Phitsanulok Province/ Uttaradit Province. Unpublish.
- Royal Forest Department. 2002. The National Park in Thailand. Unpublish.
- Siridarat Jujia. 2004. Taxonomic study of ferns at Thung Salaeng Luang National Park. M.S. Thesis, Kasetsart University.
- Tagawa, M., and Iwatsuki, K. 1979. Pteridophytes. In Smitinand, T. and K. Larsen (eds.), Flora of Thailand, Vol. 3 part 1. Bangkok: The Tist Press.

- Tagawa, M., and Iwatsuki, K.1985. Pteridophytes. In Smitinand, T. and K. Larsen (eds.), Flora of Thailand, Vol. 3 part 2. Bangkok: Phonphan Printing Company, Ltd.
- Tagawa, M., and Iwatsuki, K.1988. Pteridophytes. In Smitinand, T. and K. Larsen (eds.), Flora of Thailand, Vol. 3 part 3. Bangkok: The Chutima Press.
- Tagawa, M., and Iwatsuki, K.1989. Pteridophytes. In Smitinand, T. and K. Larsen (eds.), Flora of Thailand, Vol. 3 part 4. Bangkok: The Chutima Press.
- Wilawan, R., and Boonkerd, T. 2003. Taxonomy of Ferns and Fern Allies at Phu Hin Rong Kla National Park, Phitsanulok Province. BRT 2003 Research Reports, p.58–67.
- Yuyen, Y. and Boonkerd, T. 2002. Pteridophyte Flora of Huai Yang Waterfall National Park, Prachuap Khirikhan Province, Thailand. The Natural History Journal of Chulalongkorn University. 2 (1): 39-49.