



New records of ferns in the flora of Laos (1)

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라오스 미기록 양치식물 (1)

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ABSTRACT: Fieldwork in Lao PDR during 2007-2008 resulted in the discovery of 15 unrecorded fern species among the flora of Lao PDR. All have been identified in other countries in southeastern Asia, as well as from other tropical areas. The species are as follows: Asplenaceae (*Asplenium delavayi*, *A. rockier*), Athyriaceae (*Anisocampium cuspidatum*), Dennstaedtiaceae (*Microlepia hookeriana*, *Pteridium revolutum*), Dryopteridaceae (*Didymochlaena truncatula*, *Dryopteris cochleata*, *Polystichum biaristatum*, *P. lindsaefolium*), Gleicheniaceae (*Dicranopteris curranii*), Hypodematiaceae (*Hypodematium crenatum*), Lindsaeaceae (*Lindsaea heterophylla*), Pteridaceae (*Pteris decrescens*), Polypodiaceae (*Pyrrosia nummularifolia*) and Thelypteridaceae (*Cyclosorus dentatus*).

Keywords: Lao PDR, new records, ferns

적 요: 2007년부터 2008년에 걸친 라오스 지역 채집을 통하여 라오스 미기록 양치식물 15종을 발견할 수 있었다. 이들은 전부 동남아시아 및 열대 지역에 분포하고 있는 것으로 나타났다. 이들의 목록은 다음과 같다. Asplenaceae (*Asplenium delavayi*, *A. rockii*), Athyriaceae (*Anisocampium cuspidatum*), Dennstaedtiaceae (*Microlepia hookeriana*, *Pteridium revolutum*), Dryopteridaceae (*Didymochlaena truncatula*, *Dryopteris cochleata*, *Polystichum biaristatum*, *P. lindsaefolium*), Gleicheniaceae (*Dicranopteris curranii*), Hypodematiaceae (*Hypodematium crenatum*), Lindsaeaceae (*Lindsaea heterophylla*), Pteridaceae (*Pteris decrescens*), Polypodiaceae (*Pyrrosia nummularifolia*) 및 Thelypteridaceae (*Cyclosorus dentatus*).

주요어: 라오스, 미기록, 양치식물

Lao People's Democratic Republic (Lao PDR, or Laos) is located inland in the center of the Indochinese peninsula facing Thailand in the west, Myanmar in the northwest, China in the

northeast, Vietnam in the east and Cambodia in the south (Fig. 1). A total of 80% of the country is covered by hilly and mountainous areas. The Mekong River runs along the Thailand border. The geography of Laos provides it with unusually rich biodiversity resources. The country straddles several biological zones and shares boundaries with the Himalayan, Indo-Malayan, and Chinese regions. There are representatives of flora and fauna from each of these regions in different parts

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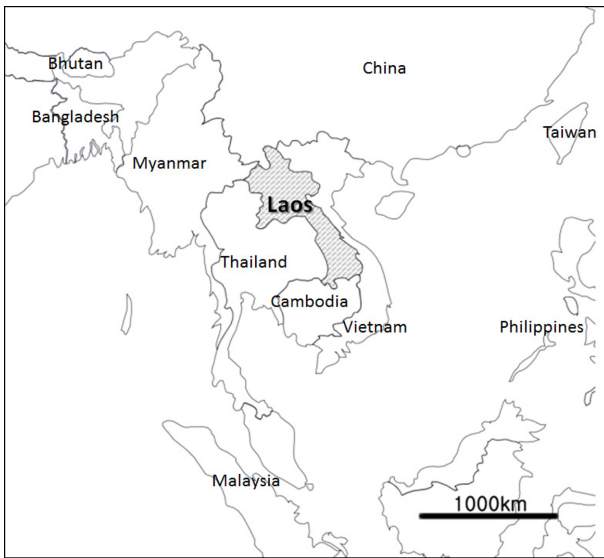


Fig. 1. Location of Laos within southeast Asia.

of the country. Laos is highly mountainous, which creates large variations in climate, soils, and ecological niches, leading to a locally adapted and diverse biota (JICA, 1999; Robichaud et al., 2001; Holmgren et al., 2003).

Conservation International has designated the Indo-Burman region, which includes Laos, as one of the world's global biodiversity hotspots (Mittermeier et al., 1998). However the biodiversity of Laos is less well known than those of neighboring Vietnam, China, and Thailand. Nevertheless, Laos clearly has outstanding biodiversity, as it is rich in both fauna and flora, and all scientific assessments of Indochina's biodiversity have concluded that it is a globally important region.

Botanical research, including taxonomic studies, began in Laos in the mid-nineteenth century. Before the foundation of the Lao PDR in 1975, the most important botanical studies were carried out as part of the flora projects: "Flore Générale de L'Indo-Chine" (1907-1951) and "Flore du Cambodge, du Laos et du Vietnam" (1960). Compared with its neighboring countries, there have been very few studies on plant taxonomy in Laos since 1975. Most of these were surveyed by untrained botanists and therefore were not comprehensive. Compared with the neotropical regions, collections from mainland southeast Asia have been poor and fewer in number, rendering botanical research and studies much more difficult and laborious (Holmgren et al., 2003).

Our knowledge of the lycophytes and ferns of Thailand and Vietnam, each of which has in excess of ca. 600-700 species (Alston et al., 1939-1951; Tagawa and Iwatsuki, 1979, 1985, 1988, 1989; Boonkerd et al., 2004), allows us to estimate that some 500 species may occur naturally in Laos. Unfortunately,

there is no list of these species. Only ca. 180 species are cited as occurring in Laos in the floras referred to above (Alston et al., 1939-1951; Newman et al., 2007a, b). More recently, some new records of ferns from Laos were published (Xiang et al., 2011; Wu et al., 2012). In the most recent and up-to-date work, Lindsay and Middleton (2013) listed 215 total taxa of lycophytes and ferns in Laos.

Materials and Methods

Field works for collecting lycophytes and ferns in montane protected areas in Laos were carried out from 19 to 31 July 2007, from 14 to 23 October 2008, and from 21 November to 2 December 2008. Each species identified was compared with the publications of Alston et al. (1939-1951), Newman et al. (2007a, b), Xiang et al. (2011), Wu et al. (2012), Lindsay and Middleton (2013) and Wu et al. (2013) to confirm new occurrences of species in Laos. The species here are arranged alphabetically by families. The voucher specimens are deposited in the herbarium of the Chonbuk National University in Korea (JNU), and duplicates are kept in the National Biological Resources Center (KB) of the National Institute of Biological Resources of the Ministry of Environment, Korea.

Results and Discussion

A total of 15 fern species representing new national records for Laos were collected. These species belong to 13 genera and 10 families and have been identified in other countries in southeastern Asia. General habits of some species are provided in Fig. 2.

Aspleniaceae

Asplenium delavayi (Franch.) Copel. Gen. Fil. (Copeland) 165. 1947. (Fig. 2A)

Specimens examined : Louang Phabang province: Nam Et NBCA, near Hatse Village, Viang Kham District, 20°10'53.3"N, 103°13'06.3"E, elevation 987 m, 28 Nov. 2008, Sun, Moon & Hwang 2518 (JNU).

Note: This species is widely distributed in the northern part of southeast Asia including southwestern China.

Asplenium rockii C. Chr., Contr. U.S. Natl. Herb. 26: 332. 1931. (Fig. 2B)

Specimens examined: Bolikhamxay province: Nam kading NBCA, Ban Khounkham village, Hinboun District, 18°11'12.5"N, 104°29'11.2"E, elevation 458 m, 20 Oct. 2008, Sun, Moon & Hwang 2251 (JNU).

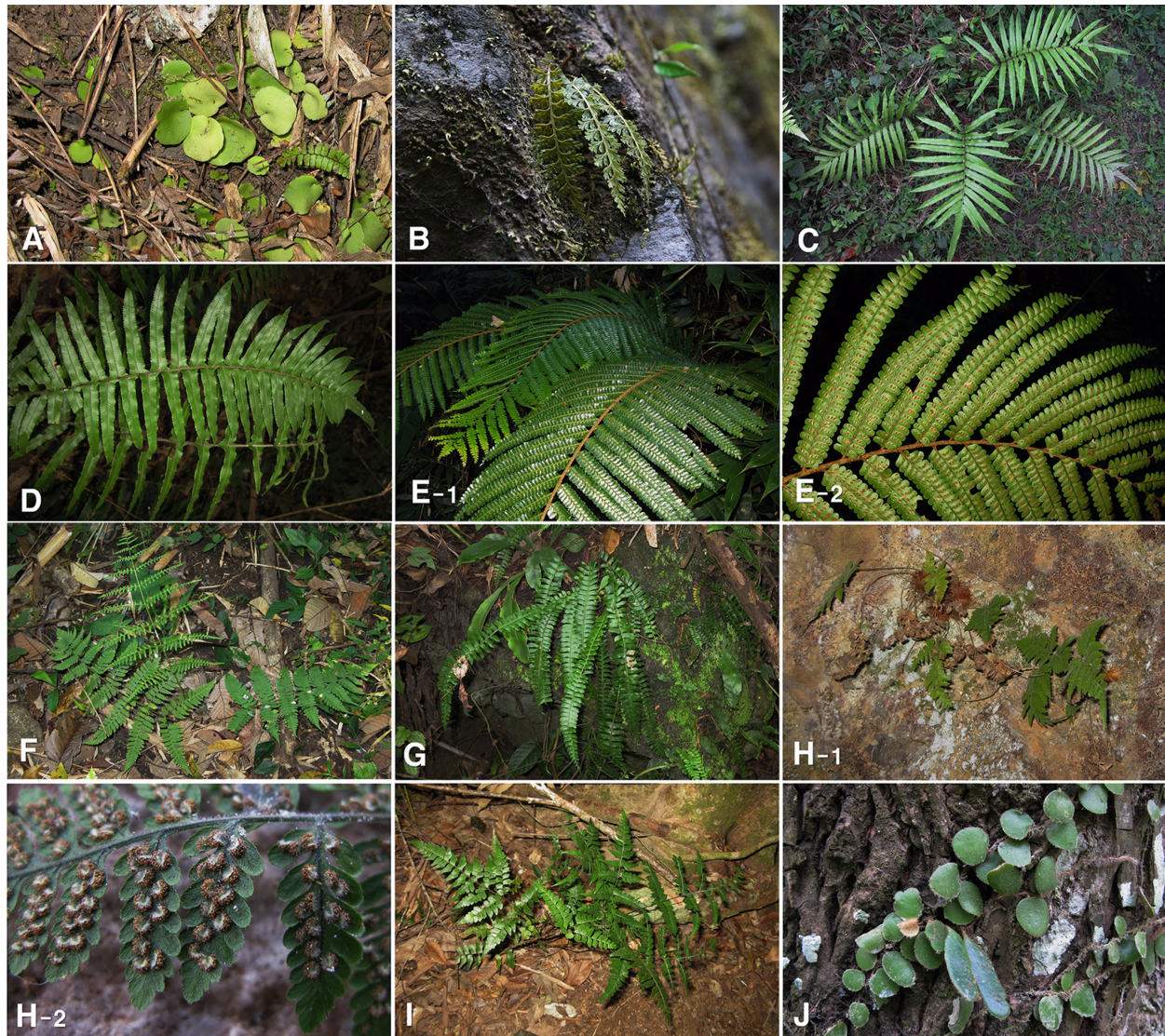


Fig. 2. General habits of ferns new to Laos. A. *Asplenium delavayi*, B. *Asplenium rockii*, C. *Anisocampium cuspidate*, D. *Microlepia hookeriana*, E. *Didymochlaena truncatula*, F. *Dryopteris cochleata*, G. *Polystichum lindsaeifolium*, H. *Hypodematium crenatum*, I. *Lindsaea heterophylla*, J. *Pyrrhosia nummulariifolia* (1. Habit, 2. Sori on lower surface of pinna).

Athyriaceae

Anisocampium cuspidatum (Bedd.) Yea C. Liu, W. L. Chiou & M. Kato, *Taxon* 60: 829. 2011. (Fig. 2C)

Specimens examined: Houa Phan province: Nam Et NBCA, near Sappakha Village, Viang Thong District, 20°19'41.5"N, 103°21'49.9"E, elevation 1,003 m, 26 Nov. 2008, *Sun, Moon & Hwang* 2435 (JNU, KB).

Dennstaedtiaceae

Microlepia hookeriana (Wall. ex Hook.) C. Presl, *Abh. Königl. Böhm. Ges. Wiss.*, ser. 5, 6: 455. 1851. (Fig. 2D).

Specimens examined: Houa Phan province: Nam Et NBCA, mountain, near Nampoung Village, Viang Thong District,

20°11'35.2"N, 103°16'13.3"E, elevation 1,147 m, 24 Nov. 2008, *Sun, Moon & Hwang* 2377 (JNU, KB).

Pteridium revolutum (Blume) Nakai, *Bot. Mag. (Tokyo)* 39: 109. 1925.

Specimens examined: Champassak province: Kongtoon village, Parksong District, 15°17'54.4"N, 106°19'58.2"E, elevation 1,120–1,300 m, 28 Jul. 2007, *Sun & Choi* 2106 (JNU)

Dryopteridaceae

Didymochlaena truncatula (Sw.) J. Sm., *J. Bot. (Hooker)* 4: 196. 1841. (Fig. 2E).

Specimens examined: Louang Phabang province: Nam Et NBCA, near Hatse Village, Viang Kham District, 20°10'19.4"N, 103°14'27.0"E, elevation 1,300 m, 28 Nov. 2008, *Sun, Moon & Hwang 2547* (JNU, KB, PE).

***Dryopteris cochleata* (Buch.-Ham. ex D. Don) C. Chr.**, Index Filic. 5: 258. 1905. (Fig. 2F).

Specimens examined: Louang Phabang province: Nam Et NBCA, near Hatse Village, Viang Kham District, 20°10'53.3"N, 103°13'06.3"E, elevation 987 m, 28 Nov. 2008, *Sun, Moon & Hwang 2510* (JNU, KB).

***Polystichum biaristatum* (Blume) T. Moore**, Index Fil. (T. Moore). 86. 1858.

Specimens examined: Champassak province: Sci mountain, Dart tood village, Xay setha District (near the border line of Vietnam), 14°48'32.4"N, 107°23'07.5"E, elevation 550–700 m, 26 Jul. 2007, *Sun & Choi 2065* (JNU, KB).

***Polystichum lindsaeifolium* Scort. ex Ridl.** J. Malayan Branch Roy. Asiat. Soc. 4: 61. 1926. (Fig. 2G).

Specimens examined: Houa Phan province: Nam Et NBCA, near Sappakha Village, Viang Thong District, 20°19'39.6"N, 103°22'00.1"E, elevation 978 m, 26 Nov. 2008, *Sun, Moon & Hwang 2419* (JNU, KB).

Gleicheniaceae

***Dicranopteris curranii* Copel.**, Philipp. J. Sci. 81: 4. 1952.

Specimens examined: Champassak province: Along the stream, Xay setha District, (near the border of Vietnam), 14°48'34.4"N, 107°23'04.6"E, elevation 780 m, 27 Jul. 2007, *Sun & Choi 2090* (JNU, KB); Louang Phabang province: Road No.1, near Pak Xeng Village, Viang Thong District, 20°11'50.6"N, 103°04'43.8"E, elevation 557 m, 23 Nov. 2008, *Sun, Moon & Hwang 2332* (JNU); Nam Et NBCA, near Hatse Village, Viang Kham District, 20°10'57.3"N, 103°13'06.3"E, elevation 935 m, 28 Nov. 2008, *Sun, Moon & Hwang 2493* (JNU, KB).

Hypodematiaceae

***Hypodematium crenatum* (Forssk.) Kuhn & Decken**, Reisen. Ost-Afr. 3(3): 37, f. a. 1879. (Fig. 2H).

Specimens examined: Houa Phan province: Nam Et NBCA, near Nanom Village, Viang Thong District, 20°27'16.5"N, 103°21'33.0"E, elevation 947 m, 27 Nov. 2008, *Sun, Moon & Hwang 2473* (JNU, KB); Xieng Khouang province: Plain of Jars, Muang Khoun Town, Phonsavan District, 19°25'49.9"N, 103°09'11.6"E, elevation 1,078 m, 29 Nov. 2008, *Sun, Moon & Hwang 2568* (JNU, KB).

Lindsaeaceae

***Lindsaea heterophylla* Dryand.**, Trans. Linn. Soc. London 3: 41, pl. 8. 1797. (Fig. 2I).

Specimens examined: Houa Phan province: Nam Et NBCA, mountain, near Nampoung Village, Viang Thong District, 20°11'35.2"N, 103°16'13.3"E, elevation 1,147 m, 24 Nov. 2008, *Sun, Moon & Hwang 2373, 2378* (JNU, KB).

Polypodiaceae

***Pyrrhosia nummulariifolia* (Sw.) Ching**, Bull. Chin. Bot. Soc. 1: 47. 1935. (Fig. 2J).

Specimens examined: Houa Phan province: Nam Et NBCA, near Nanom Village, Viang Thong District, 20°26'54.9"N, 103°23'35.7"E, elevation 807 m, 27 Nov. 2008, *Sun, Moon & Hwang 2487* (JNU, KB).

Pteridaceae

***Pteris decrescens* Christ**, Bull. Acad. Int. Gogr. Bot. 16(205-206): 244-245. 1906.

Specimens examined: Champasak province: Bam Kiat Nagang village, Phou Asha Mountain, 14°46'26.6"N, 106°01'44.6"E, elevation 150–300 m, 24 Jul. 2007, *Sun & Choi 2023* (JNU, KB); Bolikhamxay province: Nam kading NBCA, Ban Khounkham village, Hinboun District, 18°11'12.5"N, 104°28'50.8"E, elevation 760 m, 20 Oct. 2008, *Sun, Moon & Hwang 2266* (JNU, KB); Houa Phan province: Nam Et NBCA, near Nanom Village, Viang Thong District, 20°26'36.2"N, 103°22'24.4"E, elevation 859 m, 27 Nov. 2008, *Sun, Moon & Hwang 2462* (JNU, KB); Louang Phabang province: Nam Et NBCA, near Hatse Village, Viang Kham District, 20°10'53.3"N, 103°13'06.3"E, elevation 987 m, 28 Nov. 2008, *Sun, Moon & Hwang 2509* (JNU, KB).

Thelypteridaceae

***Cyclosorus dentatus* (Forssk.) Ching**, Bull. Fan Mem. Inst. Biol., Bot. 8:206-209. 1938.

Specimens examined: Bolikhamxay province: Phou petka mountain, Nam kading NBCA, Pakkading District, 18°18'24.9"N, 104°10'57.5"E–18°18'58.0"N, 104°11'16.7"E, elevation 231–349 m, 18 Oct. 2008, *Sun, Moon & Hwang 2191* (JNU, KB); Nam kading NBCA, Ban Khounkham village, Hinboun District, 18°15'30.6"N, 104°33'37.1"E, elevation 395 m, 19 Oct. 2008, *Sun, Moon & Hwang 2206* (JNU, KB); Louang Phabang province: Road No.13, near Paknga Village, Nong Khiaw District, 20°21'34.4"N, 102°23'47.0"E, elevation 322 m, 23 Nov. 2008, *Sun, Moon & Hwang 2298* (JNU, KB); Philipsok guest house, Viangkham Village, Viang Kham District, 20°34'18.7"N, 102°36'54.2"E, elevation 341 m, 23 Nov. 2008, *Sun, Moon &*

Hwang 2317 (JNU, KB); Houa Phan province: Nam Et NBCA, near Nampoung Village, Viang Thong District, 20°10'26.3"N, 103°15'50.7"E–20°11'26.4"N, 103°15'54.5"E, elevation 904–962 m, 24 Nov. 2008, *Sun, Moon & Hwang 2345* (JNU).

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