EDINBURGH JOURNAL OF BOTANY 64 (1): 37–44 (2007) 

doi:10.1017/S0960428606000734

# NEW RECORDS OF CONIFERS IN CAMBODIA AND LAOS

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Thirty-three conifer species are currently recorded from Vietnam, Laos and Cambodia. All species are recorded from Vietnam but only six have been recorded from Cambodia and nine from Laos. Recent botanical surveys have recorded one additional species from Cambodia and seven from Laos. New distributions within those countries have also been recorded. This paper discusses those records.

*Keywords.* *Amentotaxus*, *Calocedrus*, Cambodia, *Cephalotaxus*, conifers, *Dacrydium*, Laos, *Nageia*, *Pinus*, *Podocarpus*.

## INTRODUCTION

Cambodia, Laos and Vietnam are poorly known botanically, mainly because of their tumultuous history of war and conflict from the end of the Second World War until the 1990s. Since then, political stability and the development of a network of protected areas has catalysed an increase in botanical research, especially in Vietnam. Conifers have been of particular interest as many protected areas are montane and the conifers form a significant part of the forests.

The most recent taxonomic account of the conifers for all three countries was published as part of the *Flore du Cambodge, du Laos et du Viêt Nam* (Aubrèville *et al.*, 1960 onwards). It recorded 29 species from 16 genera and five families (Nguyen Tien Hiêp & Vidal, 1996). Only six were recorded from Cambodia and nine from Laos. Between 1996 and 2003 there were several significant new discoveries, all from Vietnam. *Xanthocyparis vietnamensis* Farjon & T.H.Nguyen, a new genus and species, was described from northern Vietnam (Farjon *et al.*, 2002) and *Taiwania cryptomerioides* Hayata, a monotypic genus previously known only from Taiwan, Yunnan and Burma, was found in northwestern Vietnam (Nguyen Tien Hiêp *et al.*, 2002). Other species with primarily Chinese distributions such as *Pinus kwangtungensis* Chun ex Tsiang, *Pseudotsuga sinensis* Dode and *Taxus chinensis* Pilg. were found across northeastern Vietnam while more poorly known species such as *Pinus dalatensis* Ferré were found in several new localities in southern Vietnam (Businsky,

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1999). The most recent review of the Vietnamese conifers listed 33 indigenous species from 19 genera (Nguyen Tien Hiêp *et al.*, 2004).

Over the last four years botanical surveys in montane protected areas in Cambodia and Laos have collected specimens of 13 conifer species that represent new national records or new distributions within each country. This paper details those records, firstly from Cambodia and then from Laos. The taxonomy follows the account in Nguyen Tien Hiêp & Vidal (1996).

## New National Records from Cambodia

In Cambodia only six conifers are currently recorded: one pine, *Pinus merkusii* Jungh & de Vriese, and five members of the *Podocarpaceae*, *Dacrydium elatum* (Roxb.) Wall., *Dacrycarpus imbricatus* (Blume) de Laub., *Nageia wallichiana* (C.Presl) Kuntze, *Podocarpus neriifolius* D.Don and *Podocarpus pilgeri* Foxw. The low diversity may be due to the relative absence of areas with elevations above 800 m where the majority of Indo-Chinese conifers occur; it may also reflect the lack of botanical work in these areas. In southwestern Cambodia the Cardamom and Elephant Mountains reach a maximum altitude of 1771 m at Phnom Aural and are isolated from the Annamite mountain chain that dominates the rest of the Indo-Chinese area. All the conifers currently known from Cambodia occur in the southwest (Rundel, 1999). No conifers have been recorded from northeastern Cambodia although areas along the borders with Laos and Vietnam reach elevations of 1560 m and have the potential to harbour at least some of the 10 species of conifers known from adjoining areas (Thomas, 2006). In both these areas, large parts have been set aside as protected areas and preliminary biodiversity inventorying programmes have been initiated.

***Pinus kesiya* Royle ex Gordon (*Pinaceae*)**

In December 2004, during a survey in the Samkos Wildlife Sanctuary organized by the Cardamom Mountain Wildlife Sanctuary Project in collaboration with the Ministry of the Environment and Fauna & Flora International, a small population of *Pinus kesiya* was found on a peak (c.1078 m) in the Tumpor mountain ranges (12°25′33″N, 103°1′11″E). This is the first record of *Pinus kesiya* in Cambodia and represents an unusual occurrence as it is predominantly distributed in northern and western Thailand and Burma, with scattered populations in the highlands of Laos, Vietnam and the Philippines (Armitage & Burley, 1980).

## New Distribution Records within Cambodia

In December 2005, a team led by the first author visited Mt Yak Kham (1456 m; 14°21′1.6″N, 107°23′3.9″E), one of the highest peaks in Virachey National Park along the Vietnamese border within Ratanakiri Province. Only two conifers were

collected: *Dacrycarpus imbricatus* and *Podocarpus neriifolius*. A subsequent survey by protected area staff in the Veal Yak Yu area along the Lao border (1560 m) found both of those species along with two additional species, *Dacrydium elatum* and *Nageia wallichiana* (Thomas, 2006). Although all of these are already known from Cambodia, they have not been recorded from the northeastern provinces before.

## New National Records from Laos

Nine conifer species are currently recorded in Laos: *Calocedrus macrolepis* Kurz, *Cunninghamia konishii* Hayata, *Dacrycarpus imbricatus*, *Fokienia hodginsii* (Dunn) A.Henry & H.H.Thomas, *Keteleeria evelyniana* Mast., *Nageia wallichiana*, *Pinus kesiya*, *Pinus merkusii* and *Podocarpus neriifolius*. The relatively low number of species is almost certainly a reflection of the lack of botanical work; Laos is dominated by mountains with a highest elevation of 2819 m at Phou (Mt) Bia in Xieng Khoang in northern Laos. The Annamite ranges form the border with Vietnam and contain many areas above 2000 m. Many of these higher areas are within the extensive network of National Protected Areas (NPA) that has been established since 1993 (Robichaud *et al.*, 2001). However, before 2002, there were few botanical surveys, with most biodiversity work concentrating on mammals. Since then, botanical surveys have been carried out in key NPAs such as Nam Et - Phou Loei in Houaphan Province in northeastern Laos and Nakai Nam Theun in Bolikhamxai and Khammouan Provinces in central Laos. These surveys have been undertaken by staff from the National University of Laos (NUoL), the Forest Research Center of Laos (FRC) and the Royal Botanic Garden Edinburgh (RBGE) with funding from the IUCN and the Darwin Initiative. The surveys have recorded seven new national records and eight new provincial records. The following section discusses these records in alphabetical order.

### *Amentotaxus* (*Taxaceae*)

*Amentotaxus* is a small genus of six species that are distributed in northeast India, southern China, and Vietnam (Farjon, 2001). Four species are narrow endemics: *Amentotaxus assamica* D.K.Ferguson from Assam in northeast India and Xizang in China, *A. formosana* H.L.Li from Taiwan, *A. poilanei* (H.L.Li) D.K.Ferguson from central Vietnam, and *A. hatuyenensis* T.H.Nguyen from northern Vietnam. The other species, *Amentotaxus argotaenia* (Hance) Pilg. and *A. yunnanensis* H.L.Li, have wider distributions in southern China and northern Vietnam but occur only as small, isolated populations (Nguyen Tien Hiêp *et al.*, 2004). There have been no previous reports of this genus in Laos.

### *Amentotaxus argotaenia* (Hance) Pilg.

In 2002 a small group of unusual trees was discovered by botanists from NUoL, growing at around 1100 m in mixed evergreen and deciduous forest on limestone

soil in Nam Et - Phou Loei NPA (20°18′24″N, 103°22′21″E). Specimens were provisionally identified as *Cephalotaxus mannii* Hook.f. and lodged at the herbarium in the National University in Vientiane. No duplicates were distributed to foreign herbaria. During a conifer identification training workshop at the university in November 2005, these specimens were re-identified as *Amentotaxus argotaenia* (Hance) Pilg. after comparison with other collections of *Cephalotaxus mannii* and *Amentotaxus yunnanensis*.

The Nam Et locality is more than 180 km west of the nearest verified population in Pu Luong Proposed Nature Reserve (20°21′–20°34′N, 105°02′–105°20′E) in Nghe An Province in Vietnam (Nguyen Tien Hiêp *et al.*, 2004) and represents a significant westward extension of the range of this species.

***Amentotaxus yunnanensis* H.L.Li**

*Amentotaxus yunnanensis* was previously known only from a few scattered populations in southern Yunnan and Guizhou in China, as well as in northern Vietnam as far south as Pu Luong Proposed Nature Reserve (Nguyen Tien Hiêp *et al.*, 2004). In November 2005 it was discovered in Laos in Vieng Xai District (20°23′24″N, 104°38′5″E), in Houaphan Province, about 40 km to the east of Pu Luong. In this area, trees up to 20 m high with a diameter at breast height to 75 cm were found at altitudes ranging from 1100 to 1700 m in association with *Cunninghamia konishii* and *Fokienia hodginsii*.

***Cephalotaxus mannii* Hook.f. (*Cephalotaxaceae*)**

*Cephalotaxus* is a small genus with 11 species that are found mainly in the temperate areas of eastern Asia (Farjon, 2001). One species, *Cephalotaxus mannii*, has a scattered, disjunct distribution centred on southern China and in northern and southern Vietnam, although it is also known from a single locality in northeast Thailand and small areas in Burma and northeast India. It is restricted to primary evergreen forests, at altitudes ranging from 500 to 2100 m. In Laos, it has previously been known from a single collection from Nam Et - Phou Loei NPA in Houaphan Province, northeastern Laos. This collection was recently re-identified as *Amentotaxus argotaenia* (see above).

In October 2005, a small stand of trees was located on the steep northeastern slopes of Phou (Mt) Yang (17°48′36″N, 105°32′59″E) at about 1000 m in the southern section of the Nakai Nam Theun NPA close to the Vietnamese border. Since then, park patrols have found other stands scattered along the main north–south ridge at similar altitudes. The nearest locality in Vietnam for this species is 210 km to the north in Pu Luong (Nguyen Tien Hiêp *et al.*, 2004).

***Dacrydium elatum* (Roxb.) Wall. (*Podocarpaceae*)**

In the account by Nguyen Tien Hiêp & Vidal (1996) no specimens from Laos are cited for this species even though its distribution is stated to extend from southern China through southeast Asia and east to Fiji Indonesia. In Laos, specimens were

collected from the lower altitudes of the Nakai Nam Theun area by Tim Whitmore as early as 1998. Since then it has been collected from other parts of that area and from Phou Khaou Khoay NPA in Vientiane Province (18°21′6″N, 102°48′55″E). It is likely to occur in other montane areas in Laos.

***Nageia fleuryi* (Hickel) de Laub. (*Podocarpaceae*)**

The distribution of *Nageia fleuryi* in Cambodia, Laos and Vietnam is unclear. The account by Nguyen Tien Hiêp & Vidal (1996) states that it is restricted to northern Vietnam and Guangdong, southern China. The Flora of China account of the *Podocarpaceae* (Fu Li-Kuo *et al.*, 1999) and the World Checklist of Conifers (Farjon, 2001) give a wider distribution across southeastern Asia that includes Laos and Cambodia in addition to Vietnam. The sources for these records are unlikely to be verified specimens as they would have been included by Nguyen Tien Hiêp & Vidal (1996). In May 2006 male and female specimens of *Nageia fleuryi* were collected from Tha Phabat District in Bolikhamxai Province (18°23′45″N, 103°4′32″E), close to the Phou Khaou Khoay NPA. These represent the first verifiable records for Laos. *Nageia fleuryi*'s presence in Cambodia remains uncertain.

***Pinus dalatensis* Ferré (*Pinaceae*)**

This species was previously known from a few scattered localities stretching from the Dalat Plateau in Lam Dong Province in southern Vietnam as far north as Thua Thien Hue Province in the Central Highlands (15°02′24″N, 107°49′45″E). In these areas it is found at altitudes ranging from 1400 to 2600 m, usually in small populations of up to 100 trees. It is generally associated with other conifers such as *Fokienia hodginsii* and *Pinus krempfii* Lecomte (Businsky, 1999; Nguyen Tien Hiêp *et al.*, 2004). In Laos *Pinus dalatensis* has been reported, but not verified from specimens, at about 1300 m in the Xe Sap NPA in Xekong Province in southern Laos (Rundel, 1999). In May 2006 a botanical team from NUoL, RBGE and FRC visited the Phou Ak escarpment in Boualapha District (17°36′52″N, 105°43′15″E) at the extreme southern end of Nakai Nam Theun NPA to verify reports of a five-needle pine. Between 800 and 1100 m a population estimated to contain more than 200 trees was found scattered as emergent trees up to 30 m high in primary evergreen forest and as stunted windswept trees to 15 m high on exposed, rocky, east-facing slopes. These were identified as *Pinus dalatensis*. This locality is more than 250 km north of the Xe Sap NPA and the most northern locality in Vietnam. The Phou Ak population is unusual in terms of the associated conifers compared with those that occur in other parts of its range. At Phou Ak, specimens of *Calocedrus macrolepis*, *Dacrydium elatum*, *Keteleeria evelyniana*, *Pinus merkusii*, *Podocarpus neriifolius* and *Podocarpus pilgeri* were collected. This association has not been recorded before. The new locality also represents a considerable range extension as well as being the largest population, and at the lowest altitude currently known in either Laos or Vietnam.

***Podocarpus pilgeri* Foxw. (*Podocarpaceae*)**
*Podocarpus pilgeri* has a sporadic distribution that extends from southern China through southeast Asia and across to New Guinea. In Vietnam it is known only from the karst areas in northern Vietnam and has not been reported from the main Annamite ranges in the centre or the south (Nguyen Tien Hiêp *et al.*, 2004). In Cambodia it is known from the Kirirom plateau and other parts of the southwest, away from the Annamites (Nguyen Tien Hiêp & Vidal, 1996). It has not previously been recorded from Laos. Fertile specimens collected from the Phou Ak escarpment represent the first verified collections from Laos and from the central Annamites.

## New Distribution Records within Laos

***Calocedrus macrolepis* Kurz (*Cupressaceae*)**
*Calocedrus macrolepis* has an uncertain, sporadic and disjunct distribution. Outside Indo-China there are several small populations in southern China, a single locality in Thailand and a small area in Burma. In Vietnam it is known for certain only from small parts of the Dalat Plateau in southern Vietnam. Other records from limestone areas in the north of Vietnam are likely to represent an as yet unpublished species or refer to cultivated trees (Nguyen Tien Hiêp *et al.*, 2004). In Laos it is known from a small area of Phou Khaou Khoay NPA (18°21′6″N, 102°48′55″E) in Xiangkhoang and Vientiane Province where it is restricted to a few river banks (Nguyen Tien Hiêp & Vidal, 1996; Lehmann *et al.*, 2003). Its presence on the Phou Ak plateau with *Pinus dalatensis* represents a significant new locality at both the national and international level.

The new records mean that seven conifer species have now been recorded from Cambodia and 16 from Laos. In Cambodia further surveys in the northeastern area may find other species such as *Calocedrus macrolepis*, *Cephalotaxus mannii* and *Fokienia hodginsii*. In Laos, two other species that are currently known only from China and Vietnam are likely to occur, especially in the limestone areas shared between the northeastern Laotian province of Houaphan and the adjoining Vietnamese provinces. These are *Pinus kwangtungensis* Chun ex Tsiang and *Taxus chinensis* (Pilg.) Rehder.

## Selection of Specimens

Herbarium acronyms follow *Index Herbariorum* (Holmgren & Holmgren, 1998 onwards) except for three herbaria in Laos and Cambodia that are not currently registered with *Index Herbariorum*. The following acronyms have been used to identify these:

- FRCL: Forest Research Center, Vientiane, Laos
- NUL: National University of Laos, Vientiane, Laos
- RUPP: Royal University of Phnom Penh, Phnom Penh, Cambodia.

***Amentotaxus argotaenia* (Hance) Pilg.**
LAOS. HOUAPHAN: Vienthong District, 26 v 2002, *Lamxay et al.* HP*02 (E, NUL).

***Amentotaxus yunnanensis* H.L.Li**
LAOS. HOUAPHAN: Vieng Xai District, 23 xi 2005, *Newman et al.* LAO*1111, LAO*1116, LAO*1118 (E, FRCL, L, NUL, P).

***Calocedrus macrolepis* Kurz**
LAOS. KHAMMOUAN: Boualapha District, 23 v 2006, *Newman et al.* LAO*1278, LAO*1280 (E, FRCL, L, NUL, P). XAISOMBOUN SPECIAL AREA: Mai Jaam, 11 xi 2005, *Newman et al.* LAO*1101 (E, FRCL, L, NUL, P).

***Cephalotaxus mannii* Hook.f.**
LAOS. KHAMMOUAN: Nakai Nam Theun NPA, 24 x 2005, *Newman et al.* LAO*1009 (E, FRCL, L, NUL, P).

***Dacrycarpus imbricatus* (Blume) de Laub.**
CAMBODIA. RATANAKIRI: Mt Yak Kham, 14 xii 2005, *Thomas et al.* VBS*36, 40 (E, L, P, RUPP); Veal Yak Yu, iii 2006, *Thon Sokhon* s.n. (E, RUPP).

***Dacrydium elatum* Roxb.**
LAOS. KHAMMOUAN: Nakai Nam Theun NPA, 10 i 1998, *Whitmore* 3725, 3726 (E); Boualapha District, 21–25 v 2006, *Newman et al.* LAO*1310 (E, FRCL, L, NUL, P). XAISOMBOUN SPECIAL AREA: Mai Jaam, 11 xi 2005, *Newman et al.* LAO*1103, ♀, LAO*1104, ♂ (E, FRCL, L, NUL, P).
CAMBODIA. RATANAKIRI: Veal Yak Yu, iii 2006, *Thon Sokhon* s.n. (E, RUPP).

***Nageia fleuryi* (Hickel) de Laub.**
LAOS. BOLIKHAMXAI: Tha Phabat District, 31 v 2006, *Newman et al.* LAO*1534, ♂ (E, FRCL, L, NUL, P), *Newman et al.* LAO*1535, ♀ (E, FRCL, L, NUL, P).

***Nageia wallichiana* (C.Presl) Kuntze**
CAMBODIA. RATANAKIRI: Veal Yak Yu, iii 2006, *Thon Sokhon* s.n. (E, RUPP).

***Pinus dalatensis* Ferré**
LAOS. KHAMMOUAN: Boualapha District, 21–25 v 2006, *Newman et al.* LAO*1214, LAO*1311, LAO*1315, LAO*1316 (E, FRCL, L, NUL, P).

***Pinus kesiya* Royle ex Gordon**
CAMBODIA. PURSAT PROVINCE: Veal Veng District, 7 xii 2004, *Eanghourt Khou*222 (RUPP).

***Podocarpus pilgeri* Foxw.**
LAOS. KHAMMOUAN: Boualapha District, 23 v 2006, *Newman et al.* LAO*1436, LAO*1470, ♀ (E, FRCL, L, NUL, P).

***Podocarpus neriifolius* D.Don**
CAMBODIA. RATANAKIRI: Mt Yak Kham, 14 xii 2005, *Thomas et al.* VBS*35 (E, L, P, RUPP); Veal Yak Yu, iii 2006, *Thon Sokhon* s.n. (E, RUPP).

## ACKNOWLEDGEMENTS

The authors should like to acknowledge financial support from the Darwin Initiative for the Survival of Species Project 163/12/007 for field work in Laos. The first author would also like to acknowledge the logistical and financial support provided by the Biodiversity and Protected Areas Management Project, Ministry of the

Environment, Phnom Penh and the advice and logistical assistance provided by the staff of Virachey National Park during field work in that area. The authors would also like to thank two anonymous reviewers for their constructive comments.

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*Received 7 November 2006; accepted for publication 28 November 2006*