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Contents

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Editors: Keith Rushforth (England), Jeff Bisbee (USA), Thierry Lamant (France), Joey Malone (USA), Patrick Perret (Switzerland).

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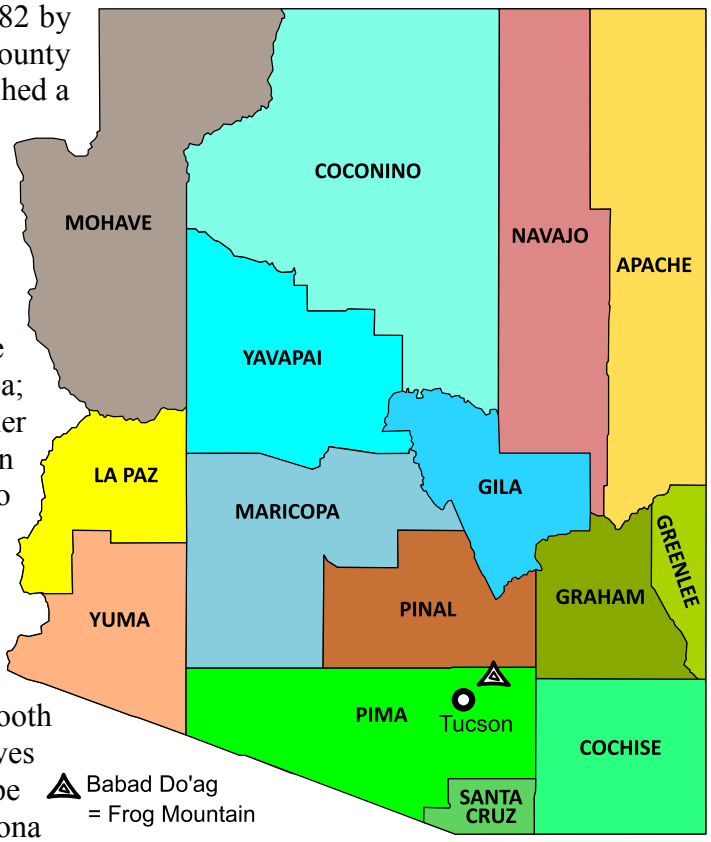
Cover photo: Seed cones of *Cupressus babaddoagae* top, *C. arizonica*, bottom; 18 months old cones. Cultivated, France. 2024.09.16. © CCP.

Cupressus babaddoagae
a new cypress species from Arizona

Introduction

Cupressus arizonica was described in 1882 by Greene from a specimen of the Greenlee County in eastern Arizona. In 1910 Sudworth published a second *Cupressus* species from Arizona: *C. glabra*. The distribution ranges of the two species do not overlap, with the former present in south-eastern counties (Pima, Santa Cruz, Cochise, Graham and Greenlee; different tones of green on Map 1) and the latter in the central part of the state (Coconino, Yavapai, Gila and Maricopa; different tones of blue on Map 1). Other populations of *C. arizonica* are recorded in New Mexico and Texas as well in Mexico (Sonora, Durango, Coahuila, Nuevo Leon and Tamaulipas). Unfortunately, those cypresses have yet to be studied in detail. The main and most obvious differences between the two species *C. glabra* and *C. arizonica* – consist in the bark (smooth *versus* fibrous), the resin dots on the leaves (present *versus* absent) and in the cone shape and sizes. In 2005, Jeff Bisbee visited Arizona and while driving in the Santa Catalina Mountains towards Mount Lemmon summit, he noted that the foliage colour of the cypresses there presented a striking whitish glaucous colour which is not usually found in the cypresses of south-eastern Arizona (see Fig. 2, p. 79). He collected seeds of this population. Several seeds were sent to the *Cupressus* Conservation Project and germinated. A grove of these cypresses was planted for further observation without the necessity to visit again the natural population. Fourteen saplings were planted between October 2005 and April 2006. One died when it was about two metres high, while the other thirteen continued their development and began to produce numerous cones. In January 2023 a snow storm hit the place and one branch was broken. All the cones on that fallen branch were collected for a statistical analysis (sample size: 32) and at the same time on a second tree all the cones on several branches were also collected (sample size: 193). This method should ensure that the cones will not be selected with any bias, such as their size (the biggest cones are usually more attractive). In July, seven cones were collected on a third tree, choosing this time the biggest ones for a new comparison. Thus the total number of collected cones amounts to 232. All cones were closed at the time of collection. It appeared that several were immature[1] and did not open fully like the older cones. Comparisons were made with seed cones collected on two *C. arizonica* planted in October 2006 and which came from seeds collected in the Chiricahua National Monument area also by Jeff Bisbee. The seed cones of those trees show the typical shape described by Greene (1882 - cf. Appendix A and cover photo). Following this comparison, it was concluded that the Mount Lemmon trees were sufficiently distinct to be described as a new species.



Map 1: Arizona county map, with Babad Do'ag = Mt Lemmon

[1] This is to be expected when collecting all cones on one branch: in February, the seed cones fertilised the previous year have not yet reached their maturity.

Cupressus babaddoagae Maerki, *spec. nov.*

Holotype: *P.C.Everett 11192*. 1957-05-30. Mt Lemmon, Catalina Mts, NE from Tucson, ca 5000 ft. (~1525 m); **E00228745**, cf. Fig. 1, p. 77.

Description: *Bark*: brown, exfoliating in stripes (Figs 17 & 18). *Foliage*: glaucous white, with or without an active resin gland (white dots) on the leaves Figs 7 & 12). *Seed cones*: globose, with bluish-white wax before maturity and with a small mucro on the scales (except the basal ones), turning to grey and dark brown at maturity and staying closed as long as they are vascularised (Fig. 11). *Scales*: 2 to 8 (see Table 2, for the details); shape: the biggest distal scales are quadrangular or pentagonal (Fig. 11). *Seeds/scale*: this number allows distinguishing easily both species (cf. Tab. 1). *Seeds*: 3 to 4 mm long and 2 to 3 mm wide when fertile and fully developed, narrow wings, with a marked tip at the extremity opposed to the hilum. *Cotyledons*: 3 and 4.

The most distinctive features to distinguish *C. babaddoagae* from *C. arizonica* are summarised in **Table 1:**

		Cupressus			
ss = sample size	*ss*	***arizonica***	***babaddoagae***	ss	
Foliage colour		green	glaucous whitish		Cf. Figs 22-23
Resin dots on leaves		absent	present or absent		Cf. Figs 7 & 12
# of scales/cone	*49*	6 to 8	2 to 8	232	Cf. Table 2
average		***6.22***	***5.16***		
# seeds/cone		26 to 66	33 to 129	219	Cf. Table 3, p.78
average		***45.81***	***67.3***		
# seeds/scale		4.33 to 10.17	8.25 to 18.25	219	Cf. Table 3, p.78
average		***7.66***	***13.16***		
Mucrones		well developed	small and short		Cf. Figs 3, 6 & 47
Scale borders		almost regular	irregular		
Scale surface		convex	± flat		
Scale surface		smooth	with bumps		Cf. Figs 6 & 11
Immature cones		glaucous-green	whitish wax		Cf. Figs 21 to 52

Distribution range: it is limited to the Bear Creek in a small area between 1200 and 1500 m altitude (cf. Map 2, p. 104-105 & Map 3, p. 114), Pima County, Arizona.

Etymology: the specific name comes from the native name of the mountain in the O'odham language (spoken by the Tohono O'odham Nation) where this species occurs, Babad Do'ag, which means "Frog Mountain".

Conservation status: Critically Endangered (CR). The distribution range is limited to one valley of the Santa Catalina mountains North-East of Tucson and South of Mount Lemmon summit. This presence limited to the Bear Creek small area makes it highly vulnerable to any climate change, drier or hotter periods. If other cypress species would be planted in the valley, there would be a further risk through hybridisation.

Table 2: Number of scales by cone.

Scales/cone	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
# of cones	1	2	92	24	101	2	10	232
%	**0.43%**	**0.86%**	**39.66%**	**10.34%**	**43.53%**	**0.86%**	**4.31%**	**100.0%**

Acknowledgment: It is thanks to Jeff Bisbee's observation, photos and seed collection that it was possible to cultivate, discover and describe this new species. A big thank you also to the photographers of iNaturalist whose photos were selected to illustrate this new species in its natural habitat.

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Fig. 1: Holotype of *C. babaddoagae*. *P.C.Everett 11192*. 1957-05-30. Mt Lemmon, Catalina Mts, NE from Tucson, ca 5000 ft. **E00228745** © RBGE

Table 3: *C. babaddoagae*, number of seeds/cone and seeds/scale.

	Number of seeds/cone						
Classes	33-49	50-65	66-81	82-97	98-113	114-129	
# cones	**28**	**79**	**75**	**28**	**8**	**1**	**219**
	12.79%	**36.07%**	**34.25%**	**12.79%**	**3.65%**	**0.46%**	**100.00%**

	Number of seeds/scale						
Classes	8.250-9.917	9.918-11.584	11.585-13.251	13.252-14.918	14.919-16.585	16.586-18.253	
# cones	**17**	**35**	**70**	**47**	**31**	**19**	**219**
	7.76%	**15.98%**	**31.96%**	**21.46%**	**14.16%**	**8.68%**	**100.00%**

Further research into the range of *C. babaddoagae* at nearby sites, and comparison with *C. glabra*, is ongoing.

Appendix A: Diagnosis of *C.arizonica* by Edward Lee Greene (1882: 64).

CUPRESSUS ARIZONICA.—A tall, conical tree 40-70 feet high, with horizontal branches; trunk 2-4 feet in diameter, covered with a dark red fibrous bark; bark of the branches flaking off in thin plates and leaving a smooth surface; branchlets stout and rather rigid, sharply quadrangular; leaves closely imbricated, very glaucous, neither pitted nor glandular; their margins entire, or, in the very oldest, denticulate; cones crowded on short, stout peduncles, globose, about an inch in diameter, of 6-8 very thick, and strongly bossed scales; seeds numerous, 2 lines or more wide.

This fine cypress was discovered by the writer on the mountains back of Clifton, in the extreme eastern part of Arizona, on the first day of September, 1880.

Appendix B: Diagnosis of *C.glabra* by Geo B. Sudworth (1910: 88).

Up to the present time but one cypress, *Cupressus arizonica*, has been known to inhabit Arizona. It occurs mainly on the Santa Rita, Santa Catalina, and Chiricahua mountains. It is also said to occur on the extreme eastern part of San Francisco Mountain. Careful explorations are yet required to definitely outline the range of this species, which was discovered as recently as 1882. This cypress is characterized by a rather thin, somewhat stringy, anastomosely furrowed bark of dark red-brown color.

In strong contrast with this rough-barked character, is the perfectly smooth bark of the cypress recently found by the writer on the north slope of Verde River canyon in Yavapai County, Arizona, and for which I propose the name *Cupressus glabra*. The trunks have throughout a very thin, smooth, dark purpled-red bark. Each year's growth of bark (from about one-sixteenth to one-eighth of an inch thick) breaks up into small, curling plates, which on all vigorous trees fall away during the succeeding late autumn and winter. The tree attains a height of from thirty-five to fifty feet and a diameter of eighteen to twenty inches. It is probable that considerably larger trees occur. The branches, particularly of younger trees, are strongly upright and form a compact, narrowly oval or somewhat pyramidal crown. Old trees, grown in the open, develop long lower branches which, from their great weight, are often much less upright than in old trees in a dense stand. The spherical mature fruit is from about seven-eighths to one and one-eighth inches in diameter, and composed commonly of six (exceptionally eight) scales. The scales are armed with conspicuous, incurved, somewhat flat-pointed, bosses. The matured cones are smooth, but conspicuously wrinkled and covered with a deep, blue-gray bloom which, when rubbed off, reveals a rich, dark brown color; very old cones are ashy-gray. Cones of one season's growth, also smooth, are often light reddish-brown, but with areas of pale bluish bloom. The cones are borne on stout stems from one-fourth to one-half an inch long. Ripened cones remain unopened on the branches from fourteen to eighteen years, possibly even longer, the seeds being retained during this period. To what extent the seeds preserve their vitality during this time is at present unknown to the writer, who has not yet had an opportunity of testing these old seeds. The red-brown seeds vary in form from a triangular to a rounded and somewhat rectangular shape. They are from three-sixteenths to five-sixteenths of an inch long, the larger dimensions being more common. The foliage has a bright blue-green (glaucous) aspect due to a pale bloom on the leaves. The leaves on old sprays are (about one-sixteenth of an inch long) closely pressed to the twigs, acutely pointed, thickened and keel-shaped on the back, and nearly all bear a resinous pit (gland) on the back. Young shoots bear closely pressed leaves from one-fourth to one-half an inch long, but with very keen spreading points. The leaves die during the second year, turn a bright red-brown and remain on the twigs for about four years; later the twigs and small branches become ashy-gray. Male flowers are abundant, but as yet the female flowers have not been discovered.

Fig. 2: *C. babaddoagae*, toward Mount Lemmon. 2005-03-05. © Jeff Bisbee.

Figs 2 to 20: photos taken in the wild, Bear Creek valley, Arizona.

Fig. 3: *C. babaddoagae*, immature cones. 2005-03-05. © Jeff Bisbee.

Fig. 4: *C. babaddoagae*, immature cones. 2005-03-05. © Jeff Bisbee.

Fig. 5: *C. babaddoagae*, shoot. 2005-03-05. © Jeff Bisbee.

Fig. 6: *C. babaddoagae*, maturing cones, second season, with wax partially weathered off. © Jeff Bisbee.

Fig. 7: Cones of *C. babaddoagae*. 2017-03-15. Notice the wax on the cones and the white resin dots on the leaves. Typical *C. arizonica* do not have those resin dots. © CK Kelly.

Fig. 8: Seed cone of *C. babaddoagae* with pollen cones. Note few resin spots on this specimen. 2021-08-13. © J. Baldwin.

Fig. 9: Cones of *C. babaddoagae*. 2017-03-15. © CK Kelly.

Fig. 10: Pollen cones of *C. babaddoagae* already open, observed on 2022-03-18. © M. Zappa.

Fig. 11: Typical 6-scales cone almost cubic in shape, with small mucrones. Notice the abscised shoots which bore pollen cones. 2024-05-18 © C. Nowakowski.

Fig. 12: Again a 6-scales cone with somewhat larger mucrones. Notice again the white resin dots on the leaves. 2024-05-18. © A. Wentworth.

Fig. 13: *C. babbadoagae*. Tree in poor condition. 2023-03-09. © Richard Littauer

Fig. 14: Another tree along the road. Note the number of dead trees in the background. © Coronado11.

Fig. 15: Tree on the side of the road. © CK Kelly.
"This grove starts 2 miles to the west and putters out about two miles to the east." CK.Kelly.

Fig. 16: Smaller trees are visible on the slope, but also dead ones toward the top. 2021-08-13. © J. Baldwin.

Fig. 17: Trunk with fibrous bark. Same tree as Fig. 15, p. 88. © CK Kelly.

Fig. 18: Trunk with fibrous bark. Same tree as Figs 16, p. 89 & 20, p. 93 (right). 2021-08-13. © J. Baldwin.

Fig. 19: Young tree. 2022-07-10. © G. Heaton.

Fig. 20: Compare with Figs 16 and 18. 2023-03-21. © M. Reala

Fig. 21: *Cupressus babaddoagae*, seed cones after fertilisation. 2025-03-27. The micropyles are still visible. Note the presence of the resin dots on the leaves. **Figs 21 to 54: cultivated, France.**

Fig. 22: *Cupressus arizonica*, source: Chiricahua National Monument. Seed cone after fertilisation. 2025-03-27. Between the scales, the micropyles have almost completely disappeared indicating pollination prior to the one of *C. babaddoagae*. Resin dots are absent.

Fig. 23: *C. babaddoagae*, seed cones, about two months after fertilisation. 2025-04-25.

Fig. 24: *C. arizonica*, seed cone, about two months after fertilisation. 2025-04-25.

Fig. 25: *C. babaddoagae*, seed cones, about two months after fertilisation. 2025-04-25.
Before three months old, *C. arizonica* mucrones are strongly reflexed, whereas the *C. babaddoagae* mucrones are not or only slightly reflexed; the difference becomes less obvious by 3 months.
Fig. 26: *C. arizonica*, seed cone, about two months after fertilisation. 2025-04-25.

Fig. 27: *C. babaddoagae*, seed cones, about three months after fertilisation. 2025-05-24.

Fig. 28: *C. arizonica*, seed cone, about three months after fertilisation. 2025-05-24.

Fig. 29: *C. babaddoagae*, seed cones, about three months after fertilisation. 2025-05-25.

Fig. 30: *C. arizonica*, seed cones, about three months after fertilisation. 2025-05-24.

Fig. 31: *C. babaddoagae*, seed cones, about four months after fertilisation. 2025-06-19.

Fig. 32: *C. arizonica*, seed cones, about four months after fertilisation. 2025-06-19.

Fig. 33: *C. babaddoagae*, seed cones, about four months after fertilisation. 2025-06-19.
Fig. 34: *C. arizonica*, seed cones, about four months after fertilisation. 2025-06-19.

Fig. 35:
C. babaddoagae, seed cones, about five months after fertilisation. 2025-07-09.

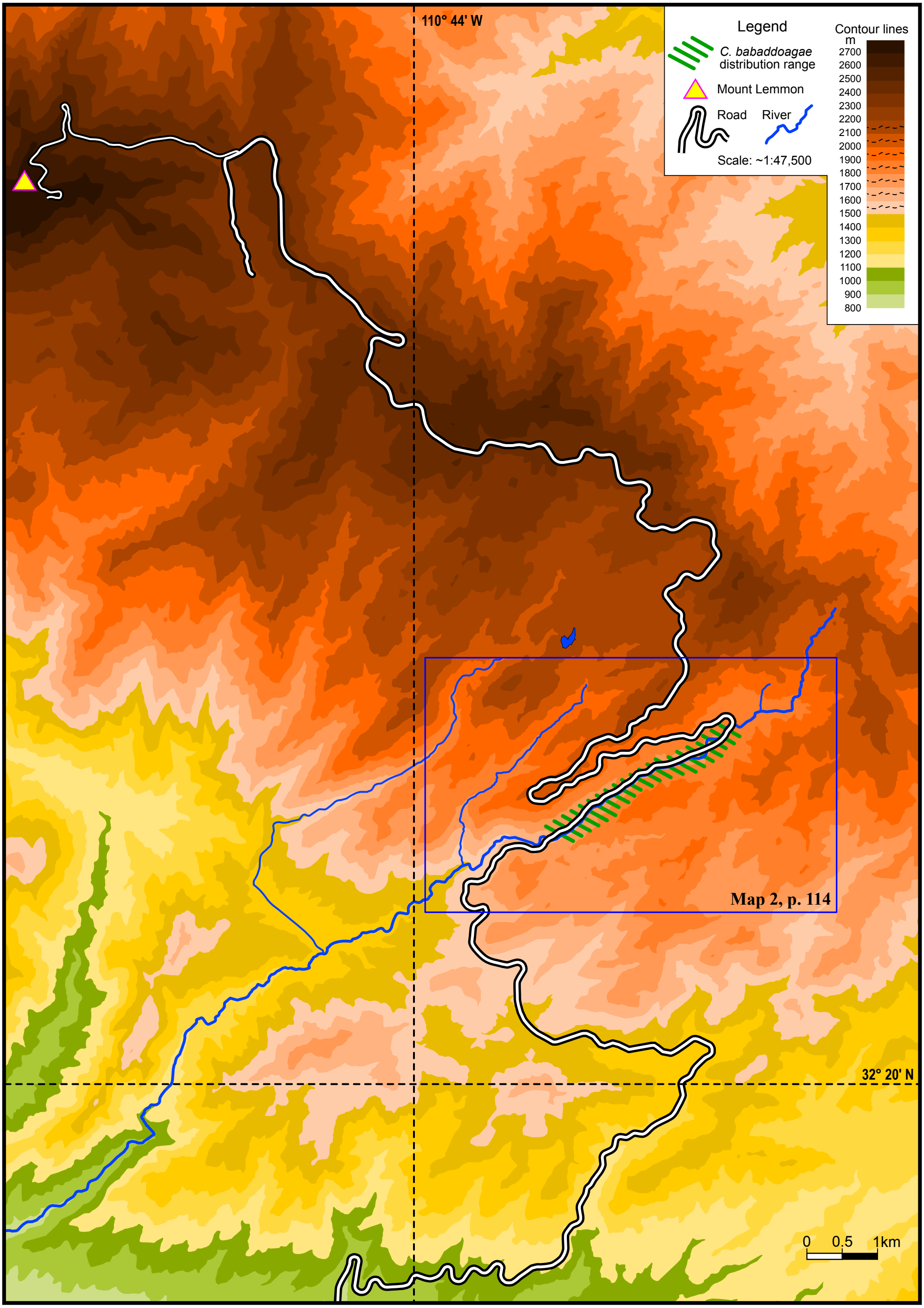
Fig. 36:
C. arizonica, seed cones, about five months after fertilisation. 2025-07-09.

Figs 37 & 38: *C. babaddoagae*, seed cones, about five and a half months after fertilisation. 2025-07-18.
While the scales are still growing, the mucrones appear smaller by comparison.
Fig. 38: The cone on the left has five scales, while the one on the right has four scales.
Cf. Fig. 35, p. 101.

Figs 39 & 40: *C. arizonica*, seed cones from two different trees, about five and a half months after fertilisation. 2025-07-18.

Fig. 41: *C. babaddoagae*, seed cones, about six months after fertilisation. 2025-08-09.

Fig. 42: *C. arizonica*, seed cones, about six months after fertilisation. 2025-08-09. **Continued p. 106.**



Map 2: Area south-east of Mount Lemmon showing the distribution range of *C. babaddoagae*.

Fig. 43: *C. babaddoagae*, seed cones, about seven months after fertilisation. 2025-08-23.
Fig. 44: *C. arizonica*, seed cones, about seven months after fertilisation. 2025-08-23.

Fig. 45: *C. babaddoagae*, seed cones, about seven months after fertilisation. 2025-08-23.
Fig. 46: *C. arizonica*, seed cones, about seven months after fertilisation. 2025-08-23.

Fig. 47: *C. babaddoagae*, first year cones, 2024-09-30.

Fig. 48: *C. arizonica*, first year cones, 2024-09-30.

Fig. 49: *C. babaddoagae*, first year cones, 2024-09-30.

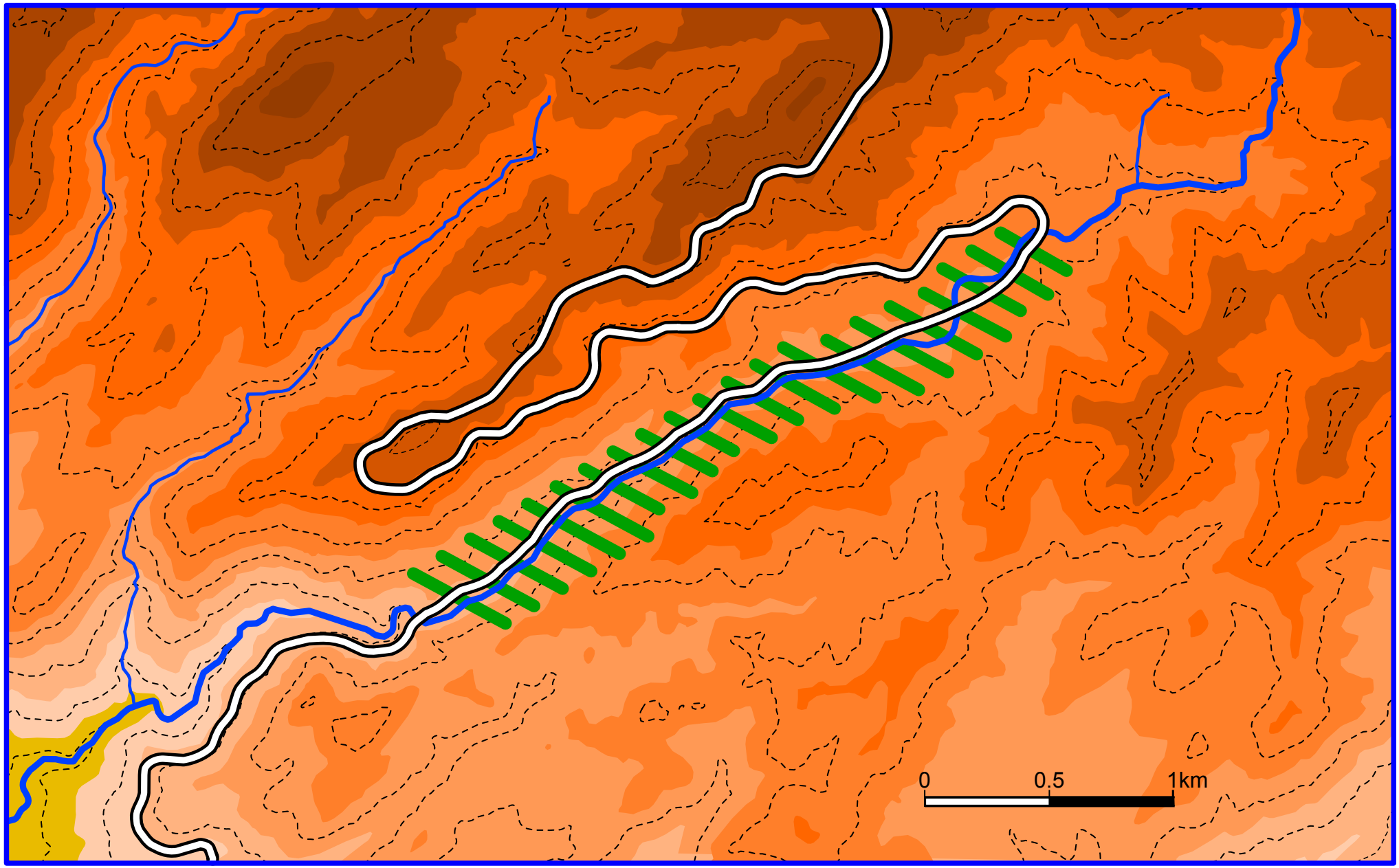
Fig. 50: *C. arizonica*, first year cones, 2024-09-30.

Fig. 51: *C. babaddoagae*, first year cones, 2024-09-30, cult. Notice the presence of resin dots on the leaves.

Fig. 52: *C. arizonica*, first year cones, 2024-09-30, cult. Leaves without any resin dots.

Fig. 53: *C. arizonica* and C. *babaddoagae* planted in the same field. 2024-01-25, 13h44. The colours are distinct.

Fig. 54: *C. babaddoagae* (left) and *C. arizonica* (right) planted in the same field. Note the different shape of the crowns, with stiffer branching in *C. babaddoagae*, more lax branching in *C. arizonica*. 2024-01-31, 14h43.



Map 3: Part of Bear Creek showing the distribution range of *C. babaddoagae*. **See legend on Map 2**, p. 104. Scale: ~1:20,800

Misidentifications of some Cupressaceae herbarium sheets

The two following herbarium sheets (Figs 1 & 2, p. 116 & 117) from RBGE Edinburgh are very interesting in more than one aspect. Essentially, they were wrongly identified – as "*Cupressus torulosa*" initially, then "*Cupressus* sp. (*funebris*?)" for the first sheet – or not specifically identified ("*Cupressus* sp.") for the second sheet. Later in 2006 they were both catalogued by D.P. Little as *C. funebris*; he is the author of a thesis on the genus *Cupressus* (2005) and of an article on *C. tonkinensis* (2011). The labels mention that both samples were collected on a wild tree or on a cultivated tree grown from a seedling collected in the wild. However, *C. funebris* is not known to grow wild in Vietnam.

Both sheets still appear as *C. funebris* in the online database of the RBGE[1]: E00160388 & E00182081.

In fact neither of these samples is *C. funebris*, and even someone with minimal experience could see that they are not that species. With some experience, it is possible to identify correctly both samples as their foliage is typical and cannot be confused with any other *Cupressus* species[2]. A comparison with other correctly named material readily confirms the following identifications:

- E00160388 is *Cupressus tonkinensis*, in Lang Son Province.
- E00182081 is *Cupressus vietnamensis*, in in Hà Giang Province.

Another interesting fact is that the collection localities of the two herbarium sheets were swapped, this verified by the collector. It is not known if the entire labels were exchanged or only the places of collection. Once the true localities are restored, it is possible to confirm the above identifications without any doubt left.

Both samples have in common one collector **Nguyễn Đức Tố Lưu**. One sample was collected on 2001-12-10 by the Vietnamese botanist alone (*sin num.*), while the other one was collected on 2002-11-05 by a team N.Đ.T.Lưu, M.F.Gardner & P.Thomas (coll. *#138*). The given geocoordinates of the latter are erroneous even for *C. tonkinensis*: they do not point as stated inside the Chi Lăng District. The mentioned plantation is some 15 km to the North in Hữu Lũng District, Hữu Liên Community. The *C. tonkinensis* sample was collected in Vạn Linh Community, Chi Lăng District at ~600 m altitude.

The specimens discussed above show misidentifications within the same genus. The next two examples are even more problematic as they display mistaken identifications between genera.

While photographing the samples of Figs 3 to 5 at the HNU Herbarium, University of Science, Hanoi, PH remarked that the foliage of those specimens were quite different. After a closer look at those images and the localities of their collection, it appeared that they belonged to three different species in two different genera.

The herbarium sheet ***Nguyễn Nghĩa Thìn NT-1153*** **(**Fig. 3, p. 118) was identified as *Fokienia hodginsii* [3] by Farjon in 2002. It is however *Calocedrus rupestris*. Although this species was only described in 2004 by Averyanov *et al.* [41(-43; fig. 1)], the foliage is quite different from the other *Calocedrus* species and an opportunity to describe this new species thus was missed in 2002. Another sample, this time of *Calocedrus macrolepis*, ***Phan Kế Lộc P-2449*** (Fig. 4, p. 118) was also confused with *Fokienia hodginsii* by the same author. An isolated population of that species is growing in the south of Vietnam, Lâm Đồng District. A sample of *Chamaecyparis hodginsii* of the same area as the *Calocedrus macrolepis* is added for comparison: ***Phan Kế Lộc P-2444*** (Fig. 5, p. 118). Foliage details of those three Cupressaceae species are shown in Figs 6 to 13 (p. 119).

Acknowledgments

Our thanks go to Nguyễn Đức Tố Lưu who confirmed the swap of the labels and shared the Figs 14 to 27.

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[1] Both pages accessed on 2025-10-01.

[2] The high quality of the photographs of the RBGE Herbarium allows such identification.

[3] Now merged into *Chamaecyparis* by Rushforth 2007: 38.

Fig. 1: E00160388, *Cupressus tonkinensis*, wrongly identified as *C. funebris* by D.P.Little. © RBGE.

Fig. 2: E00182081, *Cupressus vietnamensis*, wrongly identified as *C. funebris* by D.P.Little. © RBGE.

Fig. 3: *Calocedrus rupestris*,
Nguyễn Nghĩa Thìn NT-1153; 1982-04-14;
Vietnam, Hà Sơn Bình, Mai Châu, Pà Cò;
ca. 1400 m. HNU Herbarium.
Labels: Large trees, occurring in very narrow pure stands, on the peak of a limestone mountain. Natural regeneration occurs, but the seedlings grow poorly.

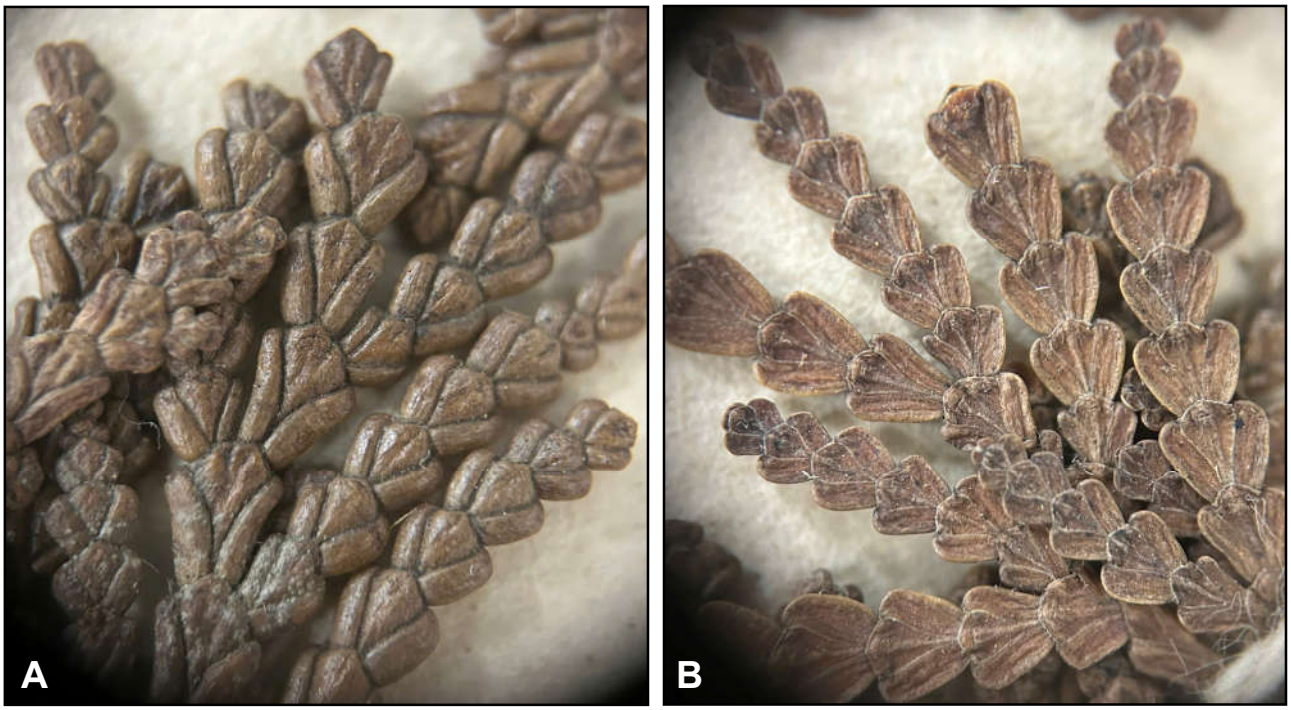
Photos Figs 3 to 13: © Phạm Hồng & Herbarium of the University of Sciences of Hanoi, HNU.
Translations of the labels by Phạm Hồng.

Fig. 4: *Calocedrus macrolepis*,
Phan Kế Lộc P-2449; 1977-05-01.
Vietnam, Đà Lạt, Lâm Đồng; Datanla waterfall, 1200 m alt. HNU Herbarium.
Labels: A large tree growing in a closed mixed coniferous and broad-leaved forest on skarn rock,

Fig. 5: *Chamaecyparus hodginsii*,
Phan Kế Lộc P-2444; 1977-04-05.
Vietnam, Đà Lạt, Lâm Đồng.
HNU Herbarium.
Label: Cultivated as an ornamental plant in Đà Lạt City, Lâm Đồng Province.

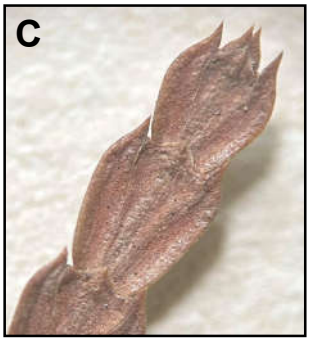
Fig. 4: *Calocedrus macrolepis*.

Fig. 5 (bottom): *Chamaecyparis hodginsii.*

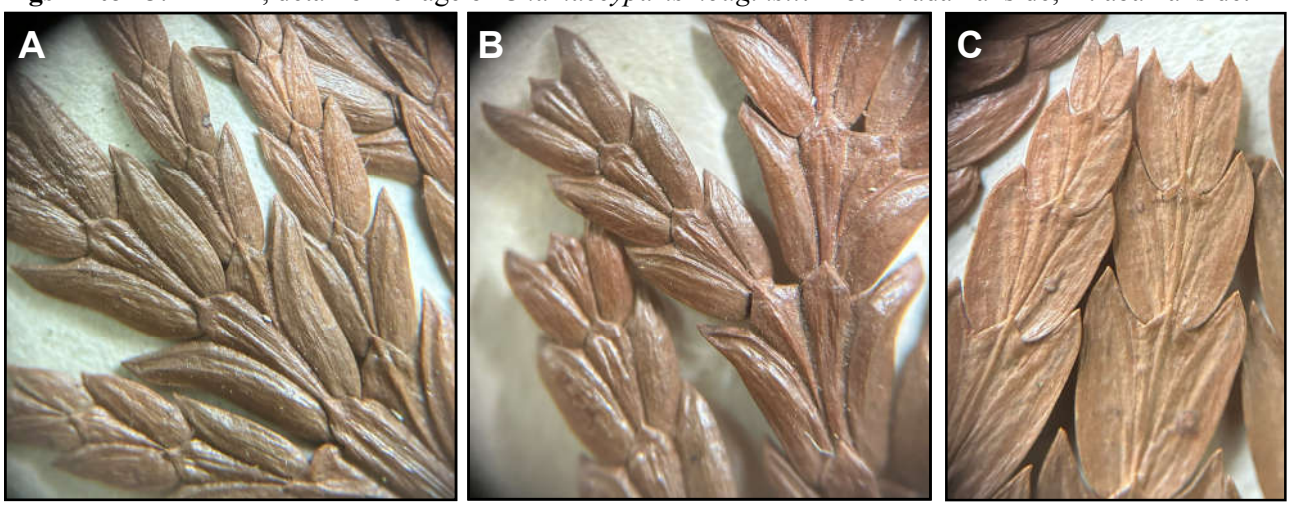


Figs 6 & 7 (top):
Calocedrus rupestris
NT-1153: detail of foliage:
A: adaxial side, **B**: abaxial side.

Figs 8 to 10:
Calocedrus macrolepis
P-2449: detail of foliage:
A: adaxial, **B** & **C**: abaxial side.



Figs 11 to 13: ***P-2444***, detail of foliage of *Chamaecyparis hodginsii*. **A** & **B**: adaxial side; **C**: abaxial side.



During the redaction of this article, PH contacted N.Đ.T. Lưu, who confirmed the swap of the labels and sent us the photos of Figs 14 to 27, photos taken during the collection trips.

Figs 14 to 27: © Nguyễn Đức Tố Lưu.

Fig. 14: Sapling of *Cupressus vietnamensis*. This cypress species was discovered in the Quản Bạ District by three Vietnamese botanists in 1999 and described by them the same year as *Thuja quanbaensis*, nom. inval.
Cf. the details of that discovery in Maerki, *Bull. Cupressus Conservation Proj.* 6: 16-19.

Fig. 15: Landscape in Hà Giang Province, Quản Bạ District, Thanh Vân Community.

Fig. 16: *Cupressus vietnamensis* tree. Notice the juvenile foliage still present on the tree. Intermediate foliage is visible on the top right quarter of the photo.
Hà Giang Province, Quản Bạ District, Thanh Vân Community.

Fig. 17: Branch 5 cm Ø, with intermediate leaves.

Fig. 18: Trunk ~25 cm DBH, with juvenile leaves.

Fig. 19: This fascinating karst landscape is the home of *Cupressus tonkinensis*.

Fig. 20: Another view of this landscape sculpted over the millions of years by erosion and covered by a subtropical evergreen rain forest. The limestone of this area is from the Middle Devonian period (~390 mya).

Fig. 21: These hills with several vertical cliffs can be very difficult to access.

Fig. 22: *Cupressus tonkinensis*. Small plant already with adult foliage. This series of photos is exceptional as this species is the most endangered cypress, with only a very few remaining in the wild.
View from above.

Fig. 23: This series of photos show the same specimen of *Cupressus tonkinensis* from different angles. Since these photos were taken, the vegetation of that area was destroyed by fire.

Fig. 24: The cypress is growing on a quasi vertical cliff with the roots going deep into the crevices of the limestone rocks.

Fig. 25: Closer view. The cypress is no more than 70 cm high.

Fig. 26: Detail of the stems.

Fig. 27: Detail of the adult foliage of *C. tonkinensis*. The leaves are displayed on a plane and are dimorphic. The shoots are not pendulous.

Typification of *Cephalotaxus fortunei* var. *alpina* H.L.Li (Cephalotaxaceae)

Abstract

H.L.Li published the name *Cephalotaxus fortunei* var. *alpina*, providing a valid Latin diagnosis, in Lloydia 16 (3): 164 (1953). The author designated a type, but omitted to cite the institution that supposedly conserved it. Consequently, the holotype is not located, and a lectotype should be designated.

Keywords

China, conifer, Cephalotaxaceae, *Cephalotaxus fortunei* var. *alpina*, typification.

Introduction

In 1952, the botanist Lǐ Huì-Lín 李惠林 (H.L.Li, 1911–2002) studied herbarium specimens of *Cephalotaxus fortunei* and annotated them 'var. alpina H.L.Li, 1952'. All of these herbarium sheets annotated by Li are found in the US herbarium 'United States National Herbarium, Smithsonian Institution, Washington, District of Columbia, U.S.A.'. In the Spring of 1951, H.L.Li was appointed associate researcher at this institution and worked there for part of 1952, before returning to the Morris Arboretum of the University of Pennsylvania. (Hui-lin Li Papers, University of Pennsylvania).

The following year, H.L.Li described *Cephalotaxus fortunei* var. *alpina* in *Lloydia* 16 (3): 164 (1953). The designated type, *J.F.Rock 11572*, and the nine paratypes cited in the protologue,[2] correspond to the specimens that Li had annotated at the US herbarium a year earlier. However, in the protologue, the institution supposed to preserve the type *J.F.Rock 11572* is not designated. Furthermore, in the US herbarium, the herbarium sheet *J.F.Rock 11572* does not bear the mention "Type". It is another sheet from the US herbarium, *J.F.Rock 8691*, that bears a label written in Li's hand: "Cephalotaxus fortuni Hook f. var. alpina var. nov. Type det. H.L.Li, 1952." [sic]. There is therefore an inconsistency between the type designated in the protologue, and the herbarium specimen annotated as type by Li.

Did Li change his mind at the time of publication? Did the printer make a mistake? There is no way of knowing. The author did not clarify the issue during his lifetime. It is therefore necessary to designate a lectotype and check what the International Code of Nomenclature says in this case.

Despite the author's intention, his indication of 'Type' on the specimen *J.F.Rock 8691* (US02062471) is in contradiction with the protologue – Recommendation 9A.3 of the Shenzhen Code. Thus the sample *J.F.Rock 8691* must be considered a paratype, as the type designated in the protologue *J.F.Rock 11572* has preeminence.

> ***9A.3.*** In choosing a lectotype, any indication of intent by the author of a name should be given preference unless such indication is contrary to the protologue. Such indications are manuscript notes, annotations on herbarium sheets, recognizable figures, and epithets such as *typicus, genuinus,* etc..

Since the institution responsible for preserving the type specimen is not designated in the protologue, it is necessary to search for all specimens from the same collection *J.F.Rock 11572* and to check whether a lectotype has already been designated by another author. Three sheets have been listed. One is in the herbarium of the Arnold Arboretum (A00003309), one in the herbarium of the Muséum national d'Histoire naturelle de Paris (MNHN) (P01585803), and one in the US herbarium, Smithsonian Institution (US02062401).

The *J.F.Rock 11572* sheet preserved at the Paris herbarium has remained as originally determined *Cephalotaxus fortunei* and is lacking any other annotation.

[1] Corresponding author: Jean Hoch, Domaine de Bonnefontaine, 67260 Altwiller, France. jean.hoch@free.fr.
[2] See Appendix A, p. 114.

The *J.F.Rock 11572* sheet preserved at the Arnold Arboretum has an annotated label: "type, Det. Shui-ying Hu[3] August 1955". But, in the result of his research "*Notes on the Flora of China* IV" in *Taiwania* 10: 27 (1964), S.Y.Hu does not designate the specimen *J.F.Rock 11572* as a type and it also does not indicate the institution in which it is kept. Therefore the validation of the lectotype is not effective. On the other hand, the specimen from the Arnold arboretum does not include the annotation: "var. *alpina* H.L.Li , 1952". There is therefore no evidence to establish that the author of the description (H.L.Li) had seen this herbarium sheet.

In the publication of the new combination *Cephalotaxus alpina* (Li) L.K.Fu (L.K.Fu 1984: 282), Fu accepts the type designated in the protologue (*J.F.Rock 11572*), but again, Fu does not designate the institution supposed to hold it.

In "A taxonomic revision of the genus *Cephalotaxus*" (Lang *et al.* 2013: 9), the authors indicate by mistake: "*J.F.Rock 11572* (holotype A!)". Did they confuse S.Y.Hu with H.L.Li? Indeed, only the author of the description can designate a holotype, S.Y.Hu could have designated only a lectotype. The indication "holotype A" is therefore an error.

In "A Handbook of the World's Conifers", vol. 2 (Farjon 263: 2017), unlike *Lang et al.* 2013, Farjon does not get tricked by the label "type" of S.Y.Hu on the sheet of the Arnold Arboretum and writes: "Type: China, Yunnan, *J.F.Rock 11572* (holotype loc. ?)". This means that in 2017 Farjon was not able to locate the type of *C. fortunei* var. *alpina*. Therefore it appears that no one has previously designated a lectotype validated by a publication.

Conclusion

There is no evidence that Li saw the *J.F.Rock 11572* sheet preserved in Paris, nor the one preserved at the Arnold Arboretum. However, it is certain that the *J.F.Rock 11572* specimen in the US herbarium is the one that Li used to establish his description as it is annotated 'var. *alpina*' in his handwriting and as he worked at that institution during that period. It is therefore the US02062401 (*J.F.Rock 11572*) sample that should be retained as the lectotype, following the recommendation given in Article 9A.4[4] of the Saint Louis Code of the IAPT (2000).

> *9A.4.* When a single collection is cited in the protologue, but a particular institution housing this is not designated, it should be assumed that the specimen housed in the institution where the author is known to have worked is the holotype, unless there is evidence that further material of the same collection was used.

Typification

Cephalotaxus fortunei var. ***alpina*** H.L.Li, Lloydia. 16: 164 (1953).

≡ *Cephalotaxus alpina* (H.L.Li) L.K.Fu, Acta Phytotax. Sin. 22(4): 282 (1984).

≡ *Cephalotaxus fortunei* subsp. *alpina* (H.L.Li) Silba, *J. Int. Conifer Preserv. Soc.* 14: 4 (2007).

Lectotype (**here designated**): China, Yunnan: Litiping Range, Mekong-Yangtze div., east of Weihsi. Slopes above Lutien. Alt. 10.000 ft., October 1923, *J.F.Rock 11572* (lectotype: US02062401: isolectotypes: A00003309, P01585803)

Updated locality

Locus classicus *J.F.Rock 11572*: (October 1923), China, Yunnan, Lijiang prefecture, Yulong Naxi Autonomous County, Mekong - Yangtze div., east of Weixi, Lidiping Range. Slopes above Ludian 鲁甸乡, alt. 3048 m. ca. 27°12'11.07"N, 99°25'32.93"E.

[3] Hú Xiù-Yīng 胡秀英 S.Y.Hu (1910 - 2012).

[4] This article was later modified.

Acknowledgments

We address our thanks to Kanchi N. Gandhi, Harvard University, for his invaluable help regarding the nomenclature, the *Cupressus* Conservation Project for its interesting propositions and his linguistic revision. We also thank an anonymous reviewer for his valuable suggestions as well as all the institutions for putting virtual herbaria online: the United States National Herbarium, Smithsonian Institution, Washington, District of Columbia, U.S.A; the Herbarium of the Arnold Arboretum, in Jamaica Plain, Massachusetts, USA; the National Museum of Natural History of Paris, France; the Royal Botanic Garden Edinburgh, Scotland U.K.; the Royal Botanic Gardens, Kew, England, U.K.; the Universität Wien, Austria; the Swedish Museum of Natural History, Stockholm, Sweden; The New York Botanical Garden, Bronx, New York, U.S.A.

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Appendix A: Protologue of *Cephalotaxus fortunei* var. *alpina* (Li 1953: 164).

[With added notes by JH..]

Cephalotaxus fortuni Hook. var. **alpina** var. nov.

Frutex 2-13 m. alta; foliis a typo speciei differt parvibus et angustibus, 4-7 cm. raro ad 8 cm. longis, 3-3.5 mm. latis; strobilis masculinis subsessilibus vel brevissime pedicellatis, pedicellis haud 2 mm. longis, maturis valde crassis, ad 4-6 mm. longis.

At altitudes of 1000-3300 meters[5], in northwestern Yunnan and Sikang.

Yunnan: Between Tengyueh and Likiang, *J. F. Rock 8150;* Likiang, *J. F. Rock 8298;* Litiping Range, east of Weihsi, *J. F. Rock 8691, 9397, 11572* (type), *11575;* near Laitoupu, *J. F. Rock 12002;* Luten, below Likiang, *J. F. Rock 18478;* Peyentsin, *S. Ten 315.*

Sikang: Between Ralapa and Sinku, *C. Schneider 7290.*[6]

This is a low growing variety with smaller leaves, found at high altitudes in northwestern Yunnan and adjacent parts of Sikang. It may eventually prove to be distinct enough from *C. fortuni* Hook. to be recognized as a separate species.

[5] JH: None of the type specimens indicates a minimum altitude of 1000 m; the lowest recorded altitude is at least 2300 m.

[6] JH: C. Schneider's handwriting is misleading and it should read: "Between Kalapa and Liuku, n° 1290."

Figs 1 to 3: *Cephalotaxus fortunei* var. *alpina*. ***J.F.Rock 11572***.

Fig. 1: **Lectotype** ♂ US02062401.
© Smithsonian, National Museum of Natural History.

Fig. 2 (bottom left):
Isolectotype ♂ A00003309.
© Harvard University Herbaria & Libraries.

Fig. 3 (bottom right):
Isolectotype ♂ P01585803
© Musée National d'Histoire Naturelle, Paris (France).

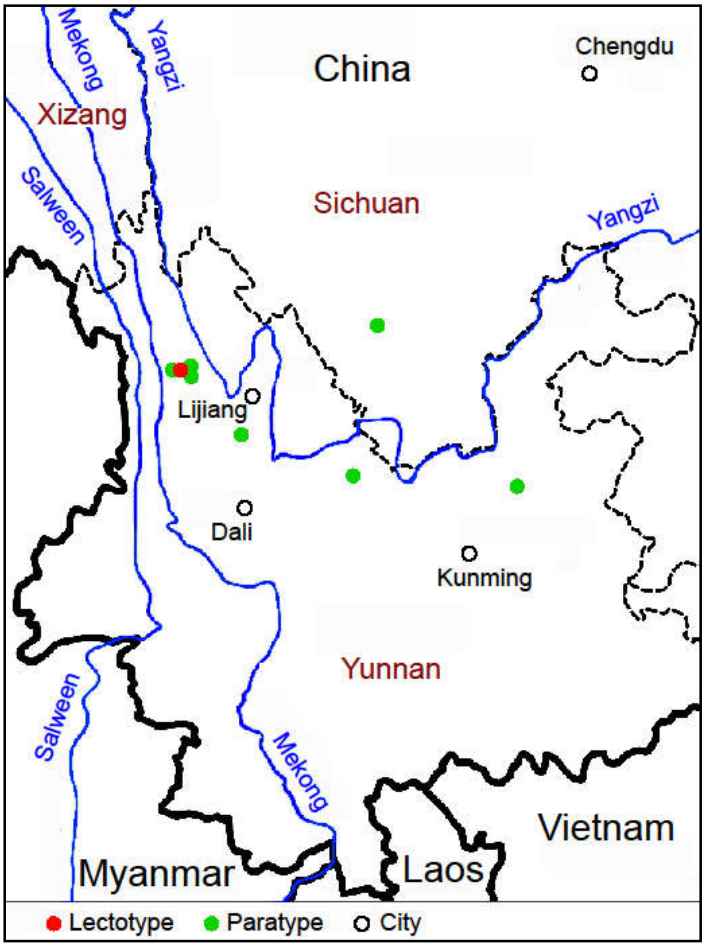
Table 1: Type of *Cephalotaxus fortunei* var. *alpina* H.L.Li

Cephalotaxus fortunei var. ***alpina*** H.L.Li, Lloydia. 16: 164 (1953).
Cephalotaxus alpina (Li) L.K.Fu, Acta Phytotax. Sin. 22(4): 282 (1984).

	C.K. Schneider 1290 *	17.05.1914	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953) * **as n° 7290**
	E00096972 ♀♂		*Setschwan, austr, inter Kalapa et Liuku, in silvis, arbuscula 2-4 m alta. Alt. circiter. 3000-3300 m*
	K000552799 ♀♂		Sichuan, Liangshan: Yanyuan County, between Kalaba 卡拉坝 and Liugu 溜姑, shrubs 2-4 m high.
	US02062475 ♀		Alt. c. **3000-3300 m.**, around **27°45'53.4"N 101°33'14.7"E**
	WU 0031061 ♀		Kalaba = 27°42'06.5"N 101°31'07.8"E / Liugu = 27°48'12.8"N 101°33'30.8"E
	S. Ten 315 ♂	16.09.1916	**Paratype** of *Cephalotaxus fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953).
	E00096973		*NW Yunnan, collectae circa Pe yen Tsin:* * *Siao mi o tsin, via Peyen Tsin ad Tatien kai.*
	US02062403		*arbor 3-5 m flor. Virid.* [*now Shiyangzhen 石羊镇] c. **26°01'41.7"N 101°25'20.5"E**
	A		N.W. Yunnan, Chuxiong: Yongren Co., Xiaomi'e Liangzi 小咪俄梁子 (mountain pic), **alt. 2300 m.**
			en route from Shiyangzhen 石羊镇 (Yunnan, Dayao Co.) to Datianzhen 大田镇 (in S. Sichuan)
	J.F. Rock 8150 ♂	14.03.1923	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953)
	US02062404		*Yunnan, Between Tengyueh and Likiangfu, via Shweshanting, Kantingai, Feilungkiao*
	S-C-1827 no photo		*Yunlung, Lanping, Chienchuan, and Likiang. 9000 ft. alt. 40 ft. hight* (12 m.)
	A		Yunnan, Between Tengyue 腾越镇 and Lijiang (266 km) **alt. 2743 m. Without specific location**: via
			"Miaoweixinxiang 苗尾新乡 (formerly *Feilungkiao*), Kongdideng 空地登, Yunlong 云龙县,
			Lanping 兰坪县, Jianchuan 剑川 etc... "
	J.F. Rock 8298 ♀	01.07.1923	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953).
	E00094612		*Yunnan, Mountains south of Likiang, Sungkwe Hochin Range, tree 25-30 ft. In forest.* (7,6 - 9 m.)
	E00094613		Yunnan, Mountains S. of Lijiang, Songgui 松桂 - Heqing 鹤庆 Range, c. **26°27'33.7"N 100°08'08.7"E,**
	US02062407		**alt. 2743 m**. Cited as Type of *C. fortunei* var. *brevifolia* by S.Y. Hu, Taiwania 10: 27 (1964).
	A		But the institution responsible for preserving the lectotype specimen is not designated
	J.F. Rock 8691 ♂	1923	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953).
	SYS00000450		*Yunnan, Litiping Range, Mekong-Yangtze divide, east of Weihsi, tree 30 ft* (9 m.); *flowers yellow.* **alt. 2743 m**.
	US02062471		Yunnan, Lìdìpíng Range 栗地坪, Mekong-Yangtze divide E. of Weixi, c. **27°12'19.6"N 99°27'04.0"E**
	NY04279297		US02062471 is annotated as **Type** of var. *alpina* by H.L.Li, 1952, but is contrary to the protologue.

	J.F. Rock 9397 ♀ US02062405 A	1923	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953). Yunnan, Litiping Range, Mekong-Yangtze divide, east of Weihsi, tree 20-25 ft high. (6 -7,5 m) Yunnan, Lìdìpíng Range 栗地坪, Mekong-Yangtze divide E. of Weixi, c. **27°12'01.1"N 99°23'50.5"E**
	J.F. Rock 11572 ♂ US02062401 **Lectotype** P01585803 **Isolectotype** A00003309 **Isolectotype**	30.10.1923	**Type** of *Cephalotaxus fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953). *Yunnan, Litiping Range, Mekong-Yangtze div., east of Weihsi* (on A, US & P) *"Slopes above Lutien, alt. 10.000 ft. Tree or small shrub, 10-20 ft.* (3-6 m) *fruits plum like."* (on US) Yunnan, Lijiang: Yulong County, E. of Weixi, Lìdìpíng Range 栗地坪, slopes above Ludian 鲁甸, ***Locus classicus*** c. **27°12'11.07"N 99°25'32.93"E; alt. 3048 m.**
	J.F. Rock 11575 ♀ US02062400	00.10.1923	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953). (topotype) *Yunnan, Slopes above Lutien. Alt. 10.000 ft. Shrub 10-20 ft.* (3-6 m.) *Fruit plume like.* Yunnan, Lijiang: Yulong Co., Slopes above Ludian, **alt. 3048 m**. c. **27°12'11.07"N 99°25'32.93"E**
	J.F. Rock 12002 ♂ US02062423 A	00.12.1924	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953). *NE Yunnan, near Lai toupu, alt 9000 ft. grassy slopes. Shrub 10 ft. tall.* (3 m.) Yunnan, Dongchuan District 东川区, near Awangzhen 阿旺镇, **alt 2743 m** near **25°55'06.9"N 103°15'18.2"E**
	J.F. Rock 18478 ♀ E00096965 US02062402 NY4279353	Sept.-Oct. 1929	**Paratype** of *C. fortunei* var. *alpina* H.L.Li, Lloydia. 16: 164 (1953). *NW Yunnan, Lütien, below* [abow] *Litiang, fruits plum like* (label E & US) Yunnan, Lijiang: Yulong County 玉龙县, Ludian 鲁甸, c. **27°11'25.9"N 99°27'47.5"E**

= Sichuan
= Yunnan



Map 1: Localities of the types of *C. fortunei* var. *alpina*.

Fig. 4: *C. fortunei* var. *alpina*.♂♀ **Paratype**. ***C.K. Schneider 1290***. K000552799. © RBG Kew

Fig 5: *C. fortunei* var. *alpina*. ♀ ***J.F.Rock 8691***. **Paratype**. US02062471 © Smithsonian NMNH. Annotated **Type** by H.L.Li.

Fig. 6: *C. fortunei* var. *alpina*.♀ ***J.F.Rock 10370***. US02062406 © Smithsonian NMNH. Annotated "var. *alpina* H.L.Li, 1952", but not mentioned in the protologue.