A review of the conifers in the floras of mainland Asia

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Abstract: The floras of the mainland Asia have been studied for more than three hundred years, however, they are still incomplete. Progress on the conifers floras from the mainland Asia, a relatively well studied group, is still less than expected. The major differences among the different floras in mainland Asia, especially compared with the world checklist of conifers, are analysed and discussed; and the related aspects in the traditional taxonomy from mainland Asia are also addressed.

Key words: floras; mainland Asia; conifers; review

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1 Introduction

Mainland Asia is here definited as the Asian continent, except for the area covered by Flora Malesiana (Van Steenis, 1951, i. e. southeast Asian islands). This is the largest and also the most populous continent in the world. However, its rich flora is still not catalogued well, even though its botany has been explored for more than three hundred years, both by outsiders (especially European and North American scientists) and by insiders (local scientists from different countries). In order to get a better picture of the current status of local floras, we are analyzing the general progress and situation of the conifers floras from mainland Asia, and comparing them with those in the recently published "World Checklist of Conifers" (Farjon, 1998, 2001).

As a developing region, mainland Asia is a poorly understood botanically and its floras are far away from being completely surveyed, unlike North America or Europe. It has been studied by local researchers and westerners, as well as partnerships between them in the past three hundred years. In the last century, for example, there were some famous works like Flora of British India (Hooker, 1875－1897) and Index Florae Sinensis (Forbes & Hemsley, 1886－1905) from Kew, and the floras of Chinese Manchuria from Russia (Komarov, 1901－1907) and Japan (Kitagawa, 1939, 1979). In the past half century, there were Flora Iranica from Vienna, Austria (Rechinger, 1963), and Flora of Iraq (from Kew, Townsend, 1966), and more recently the Checklist of Myanmar from Smithsonian Institution of USA (Kress *et al.*, 2003), Flore du Cambodge, du Laos et du Vietnam from Paris, France (Gagnepain, 1960), Flora of Turkey (Davis, 1965－2000), Flora of Arabian Peninsula and Socotra (Miller & Cope, 1996), and Flora of Bhutan (Gerison & Long, 1983) from Edinburgh, Scotland. Recently cooperated works between east and west have become a model, for example Flora of Thailand (cooperatively produced by Thai Forestry and Denmark, Phengklai, 1972) and Flora of China (cooperately produced by Chinese Academy of Sciences cooperated and Missouri Botanical Garden, Wu & Raven, 1994). In addition to the works mentioned above, there are also some works published by local researchers, such as Chinese Florae Reipublicae Popularis Sinicae (Wu & Chen, 2004; Polhill, 1990; Qian & Ricklefs, 1999; Ma & Clemants, 2006), the Middle East (Heller & Heyn, 1994) as well as many others from Japan

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(*Hara et al.*, 1978), Korea (Park, 2007), and India (Sharma, 1993).

The historical collections of plants specimens play very important roles in modern flora preparation (Schatz, 2002). The Mainland Asia, however, is disadvantaged in this respect because most early collections lie abroad. Examples include Kew's collections from India (Rau, 1994), Russian collections from central (Grubov, 2001), north (Krasnoborov, 2000) and east Asia (Komarov, 1901—1907), as well as the American collections (Wu & Raven, 1994) and Japanese collections (Nakai, 1952) from East Asia. In the past three hundred years, many floras for the colonized parts of mainland Asia have been published, especially in earlier years (Kaempfer, 1712; Bretschneider, 1880, 1898; Hooker, 1875 — 1897; Lecomate, 1916 — 1944; Humbert, 1938—1951). Recently more and more work has been published from local researchers (Charkevicz, 1989; Czerepanov, 1995; Grubov 2001; Hara *et al.* 1978; Heller & Heyn, 1994; Huang, 1994; Iwatsuki *et al.*, 1995; Nasir & Nasir, 1978; Ohwi, 1984; Rau, 1994; Sharma, 1993; Singh & Mudgal, 1997; Wu & Chen, 2004; Zohary, 1966). However, this vast area is still poorly understood especially when compared with floras of the developed world such as Europe and North America.

2 Methods and Materials

In order to better understand the flora situation in the mainland Asia, we divided it into east, south, west, central and north Asia, mainly based on geographic, natural, and more especifically floristic criteria: East Asia: from Russian Far East, Japan, through Koreas to Taiwan and northeast, north, east, south and southwest China, all the way to Himalayan area (itself, sometimes called Himalayas, including Nepal, Bhutan, as well as northwest and northeast of India and north of Pakistan); South Asia: from Cambodia, Laos, Vietnam, Myanmar, Thailand to Bangladesh, India (except northeast and northwest parts), and Sri Lanka, West Asia: The Arabian Peninsula, Iran Highland, west to Middle East and Turkey as well as west of Pakistan; Central Asia: Kazakhstan, Kyrgyzstan, Turkmenistan, Tadzhikistan, Uzbekistan, Afghanistan as well as northwest China and Mongolia; and North Asia: the whole Russian Siberia. The most abundant region floristically is in east and south Asia (Qian & Eicklefs, 1999), and the most impoverished regions are in west, central as well as north Asia.

Mainland Asia includes more than 25 countries or regions, we chose all of their current floras (if not available, a checklist instead) as the basic unit for our statistics. Each of them is treated as a local flora. The conifers, as we define here, are the two classes recognized by the recent world checklist of conifers (Farjon, 1998, 2001), i. e. Coniferopsida and Taxopsida. All local floras are listed alphabetically if there are any conifers treated, and compared with the World Checklist of Conifers published recently (Farjon, 1998, 2001) in order to analyze (see Table 1, The list and comparation of the conifers in mainland Asia, for detail).

Here is listed the detailed information of each local flora used in this work alphabetically with their three-letter abbreviations, their publication introduction and brief comments:

CFO: Heller D. and C. C. Heyn. 1994, Conspectus Florae Orientalis, 9: 14 — 17, The Israel Academy of Sciences and Humanities, an annotated catalogue of the Flora of the Middle East (some part of West Asia) published by The Israel Academy of Sciences and Humanities. It covers the entire West Asia, from Turkey to Arabian Penisula, with a name list and their distribution information, completed by local scientists about fifteen years ago. It was a little out of date even though there is not much to be added. More importantly, this is the only local information for the whole area. Total, there are 7 genera, 20 species and 4 infraspecies (both subspecies, varieties and forms are treated as infraspecies, same as below).

CLM: Kress, W. J., R. A. DeFilipps, E. Farr and D. Y. Y. Kyi. 2003, A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar, Contributions from the United States National Herbarium, 45: 33 — 36, Smithsonian Institution. This is not flora, but a checklist revised for the fifth time in the past century, a long-term project of the cooperation between Myanmar and

western countries. However, not all of the information provided is complete or perfect because this country is believed to be one of poorest understandings of their own floras among all countries in mainland Asia. Total, there are 9 genera and 31 species.

CLV: Hiep & Vidal, 1996 in Morat P. (ed.), Flore du Cambodge du Laos et du Vietnam 28: 3—158, Museum National D'Historire Naturelle. This flora has been very slowly studied for a long time by the taxonomists from Paris (Gagnepain, 1960, Lecomate, 1916—1944). Even the Conifers published about 10 years ago has been changed now, and some new taxa have been described more recently from North Vietnam (Averyanov *et al.*, 2002; Bond, 2002; Farjon *et al.*, 2002; Thomas *et al.*, 2007). This work in fact is a new edition of the old one, which was published more than half a century ago. Total, there are 16 genera, 29 species and 1 infraspecies.

EPN: Hara H., W. T. Stearn, and L. H. J. Williams, 1978, An enumeration of the flowering plants of Nepal 1: 23 — 28, British Museum (Natural History). This is the cooperative work between Japanese and British scientists on their longtime study

Table 1　The list and comparison of the conifers in mainland Asia

Taxa	D/T (%)	CLV	FBT	FOP	GOI	GVK	KVM	CFO	FOI	FOY
Abies	15/76(19.7)	1+1	1	2	4	3	1	2	2	2+3(1)
Ammentaxus		4			1					
Calocedrus	1/4(25)	1								
Cathaya										
Cedrus	2/10(20)			1	1			1+2(1)	1	1+1(1)
Cephalotaxus	2/18(11.1)	1			2	1				
Chamaecyparis										
Cryptomeria	1/4(25)									
Cunninghamia	1/4(25)	2(0)								
Cupressus	4/17(23.5)	1	1(1)	1	2(1)			1+1(1)	1	1
Dacrycarpus		1								
Dacrydium	1/5(20)	1								
Fokienia		1								
Glyptostrobus		1								
Juniperus	49/134(36.6)		3	4(1)	5(1)	5+4(2)	4(1)	10(2)	8+1(2)	9+6(4)
Keteleeria	6/10(60)	1								
Larix	13/33(39.4)				1	1	2(1)			
Metasequoia										
Microbiota										
Nageia		2								
Nothotsuga	See Tsuga									
Picea	11/65(16.9)		2	1	3	3(2)	1	1	1	1
Pinus	20/124(16.1)	7(1)	4	3	8	6+1	3	5+1(1)	7(3)	3+4(1)
Platycladus						1				
Podocarpus	15/37(40.5)	2	1		3(2)					
Pseudolarix										
Pseudotaxus										
Pseudotsuga	3/5(60)									
Sciadopitys										
Taiwania										
Taxus	4/25(16)	2	1	1	1	1		1	2	1
Thuja						1				
Thujopsis										
Torreya	3/7(42.86)					1				
Tsuga	7/17(41.18)	1	1		1	1				
Total; G; Sp+Inf(D)		16; 29 +1(1)	8; 14+ 0(1)	7; 13+ 0(1)	12; 32+ 0(4)	11; 24+ 5(4)	5; 11+ 0(2)	7; 20+ 4(5)	7; 22+ 1(5)	7; 18+ 14(7)
Different/Total (%)		3.33	7.14	7.69	12.50	13.79	18.18	20.83	21.74	21.88

Continue table 1

Taxa	FOS	EPN	FOJ	CLM	FOL	PFE	FOC	VPR	Mainland Asia	World Total
Abies	1	3	4+2	6(2)		3	21+6(10)	8(2)	24+20	48+32
Ammentaxus							3+1		6+1	6+1
Calocedrus					1		1+1(1)		2+0	3+0
Cathaya							1		1+0	1+0
Cedrus		1					1		2+1	4+1
Cephalotaxus			2+1(1)	3	1		6+1(1)		11+2	11+2
Chamaecyparis			2				3+1		3+1	6+2
Cryptomeria			1+1(1)				1+1		1+0	1+0
Cunninghamia							1+1(1)		2+0	2+0
Cupressus		2(1)					5+1		6+1	16+9
Dacrycarpus							1+1		1+1	9+3
Dacrydium				1	1		2(1)		2+0	21+0
Fokienia							1		1+0	1+0
Glyptostrobus							1		1+0	1+0
Juniperus	4(1)		5+4(7)			5(3)	21+13(12)	20+3(13)	22+11	53+32
Keteleeria							5+4(6)		3+1	3+1
Larix	3(1)	2(1)	1+1	2		3(2)	9+3(5)	5(3)	7+7	11+9
Metasequoia							1		1+0	1+0
Microbiota						1		1	1+0	1+0
Nageia							3		5+0	6+0
Nothotsuga							*See Tsuga*		1+0	1+0
Picea	2(1)	1+1(1)	7+2(2)	3		4(1)	16+9(3)	7(1)	26+15	34+21
Pinus	3	2	7+1	5(1)	2	4	22+14(8)	12(5)	32+19	109+51
Platycladus							1		1+0	1+0
Podocarpus		1	2+1(2)	7(3)	6(3)		10+4(5)		9+2	107+5
Pseudolarix							1		1+0	1+0
Pseudotaxus							1		1+0	1+0
Pseudotsuga			1				3+1(3)		2+2	4+3
Sciadopitys			1						1+0	1+0
Taiwania							1		1+0	1+0
Taxus		1+1(1)	1+1	2		1	3+3(3)	2	4+2	10+2
Thuja			1				2		3+0	5+0
Thujopsis			1+1						1+1	1+1
Torreya			1+1(1)				2+2(2)		3+3	5+3
Tsuga		1	2	2(2)			4+4(5)		5+2	9+4
Total:G:Sp+Inf(D)	5:13+0(3)	9:14+2(4)	16:39+16(14)	9:31+0(8)	5:11+0(3)	7:21+0(6)	31:153+71(67)	7:55+3(24)	35:192+92	35:495+182
Different/Total(%)	23.08	25.00	25.45	25.81	27.27	28.57	29.91	41.37		

in the Himalayas. In fact, it is only a checklist with distribution information, not true flora since the Flora of Nepal project is still in preparation at this time (Noshiro & Rajbhandari, 2002; Shrestha, 2000; Watson & Blackmore, 2003). Total, there are 9 genera, 14 species and 2 infraspecies.

FAP: Miller A. G. and T. A. Cope. 1996, Flora of Arabian Peninsula and Socotra 1: 71—80, Edinburgh University Press. This is just a reference here since only three species are listed in the area but it is not listed in the table.

FBT: Grierson A. J. C. and D. G. Long. 1983, Flora of Bhutan 1(1): 44—56, Royal Botanic Garden, Edinburgh. This is a good project from the Royal Botanical Garden, Edinburgh through their long time research and collections over several generations. Certainly, this is also the one of best floras among the region, since the works has been only finished recently. Total, there are 8 genera and 14 species.

FOA: Zohary M. 1966, Flora of Palaestiña 1: 17—23, Jerusalem Academic Press (Cis- and Transjordan, comprising Israel, Jordan and Gaza Strip). This is an-

other project from Israel for West Asia. Even though it is a little older than the former CFO, it is a true flora, which could help us in understanding the area better. However, it will not be listed in the table(See CFO for detail).

FOC: Fu, L. K, & N. Li 1999 in Wu C. Y. and P. Raven. (eds.), Flora of China 4: 1—105, Science Press & Missouri Botanical Garden. This is an updated and revised English edition based on the Chinese edition, published by Science Press in Beijing and the Missouri Botanical Garden in St. Louis since the early 1990s. The Chinese edition of Flora of China, known as FRPS, the abbreviation of Florae Reipublicae Popularis Sinicae, was the first Chinese flora in Chinese history in more than a century(Wu & Cheng, 2004). Total, there are 31 genera, 153 species and 71 infraspecies conifers in China, more than that of any other country in the world. The treatment of conifers for Flora of China English edition is a little better than that in the Chinese edition, with more broad species concept. However, many discrepancies still exist between the treatment and world checklist, such as different names for some species and infraspecies, especially in Nothotsuga(1/1, i. e. difference/total number), Pseudotsuga(3/4), Keteleeria(6/9), Tsuga (5/8), Podocarpus(5/14), Calocedrus(1/2), Taxus (3/6), and Juniperus(12/34)(see Table 1 for detail).

FOI: Riedl H. in K. H. Rechinger (ed.), 1963, 1965, 1968. Flora Iranica 3: 1—8, 12: 1—2, 14: 1—9, 50: 1 — 10, Akademische Druck-und Verlagsanstalt Garz. This flora covers not only Iran as it is today, but also neighboring areas like Afghanistan, North Iraq, West Pakistan, Azerbaijan and Turkmenistan. It is a famous taxonomic work from Vienna, Austria. Not only is detailed information provided but also the specimens are cited, which is very useful for further research work. Total, there are 7 genera, 21 species and 1 infraspecies.

FOJ: Yamazaki, T. 1995 in Iwatsuki K., T. Yamazaki, D. E. Boufford and H. Ohba(eds). Flora of Japan 1: 263—287, Kodansha Ltd. This is a new update flora in English, which has been praised very much since it was published(Ma, 2006). This flora is well updated except for the use of Sabina instead of Juniperus, the only one used today both locally and globally. Total, there are 16 genera, 39 species and 16 infraspecies.

FOK: Yi, Y. N. 2002. Flora of Korea, 2nd ed., Kyohaksa, Seul, p. 1 — 1269. There are several local floras from Korea, but all in Korean. More importantly, the taxonomic concepts used in this work is a little too narrow to accept, similar to the early works of Japanese taxonomists from east Asia(Nakai, 1952), especially when compared with neighboring countries. There are 10 genera, 24 species and 21 infraspecies, but the difference from the world checklist is up to more than half(25/24+21, 53.7%). However, this will not be lised in the table 1(See GVK for detail).

FOL: Phengklai C. 1972 & 1975 in Smitinand T. and K. Larsen(eds.), Flora of Thailand 2(2): 185—196 and 2(3): 197—210, Applied Scientific Research Corporation of Thailand. This has been treated as a good example of the cooperation flora between Thailand and Denmark, because it has been well accepted worldwide. Total, there are 5 genera and 11 species.

FOP: Nasir E. and Y. J. Nasir in E. Nasir and S. I. Ali(ed.), 1987, Flora of Pakistan 180—185: 1—35, Pakistan Agricultural Research Council. This is the best example among the local floras in the mainland Asia, not only for their quality but also for the style and amount of information provided. This is also a flora from mainland Asia produced mainly by local researchers, except for a few recent volumes. Total, there are 7 genera and 13 species.

FOQ: Townsend, C. C. 1966. Conifers in Townsend, C. C. & Guest, E. (eds.), Flora of Iraq 2: 81 — 100, Ministry of Agriculture of the Republic of Iraq. Only two genera with three species were recorded in this old publication. This is not listed in the table but used only as a reference.

FOS: Krasnoborov I. M. 2000, Flora of Siberia 1: 67—77, Science Publishers, Inc. This may be the newest publication since the Komarovian era. However, most of their works are still very similar to previous Komarovian scholar concepts in this vast area. Total, there are 5 genera and 13 species.

FOT: Huang T. C. 1994, Flora of Taiwan ed. 2, 1: 545 — 595, Taipei. This was treated as a local flora in

Flora of China(FOC), because it has been covered by that project both in the Chinese edition(Wu & Chen, 2004) and in the English edition(Wu & Raven, 1994). However, it is much different from the rest of local Chinese floras because this was the only one published in English, not Chinese(Not listed in the table, but see FOC and Ma et al, 2000 for detail).

FOY: Coode, M. J. E. & J. Cullen 1965, 1988, & 2000 in Davis P. H. (ed.) Flora of Turkey and the East Aegean Islands 1: 67—85, 10: 11—12, & 11: 5—10 Edinburgh University Press. This is another good example of the cooperation between Asian and European taxonomists, even through it was from Edinburgh side only at beginning. It is also one of the best floras in the area and has been updated accordingly since then. Total, there are 7 genera, 18 species and 14 infraspecies.

GOI: Singh, K. P. and V. Mudgal 1997 Gymnosperms of India -in Mudgal V. and P. K. Hajra(eds.), Floristic Diversity and Conservation Strategies in India 1: 443 — 472, Botanical Survey of India. Since the 1840s, the time of Hooker and Bentham, there has been no official gymnosperm flora for this vast area, even though there have been many different kinds of local floras within India published since then (Sharma, 1993). This is just a list with distribution information, so modern floras are still needed. Even so, the statistics from this work show that the conifers treatment in India is much better than most of the local floras in mainland Asia. Total, there are 12 genera and 32 species.

GVK: Park, C. W. 2007. Genera of Vascular Plants of Korea, Academy Publishing Co., Seoul, p. 1—1498. This is a first completed new flora for whole Korean Peninsula in English in the history, even there were few others in Korean(Yi, 2002), and the treatments on taxa in this flora are also very good and updated greatly, especially compared with the concepts of genera and species by others(Yi, 2002). Total, there are 11 genera and 24 species and 5 varieties, and the difference from the world checklist is only a fraction(4/29, 13. 79%, difference/total taxa, see table 1 for detail).

KVM: Grubov V. I. 2001, Key to the Vascular Plants of Mongolia 1: 27—32, Science Publishers, Inc. This is a famous Russian work on the Flora of Mongolia. However, there is no official flora for this country yet, as it is another poorly understood area in mainland Asia, even though it is not a particularly abundant in flora. Total, there are 5 genera and 11 species.

PCA: Grubov, V. I., A. E. Matzenko, and M. G. Pachomova 2002, Plants of Central Asia-Plant collections from China and Mongolia 6: 10—35, Science Publishers, Inc. Northwest China (central Asian part of China) has been explored many times by Russian scientists throughout history. This is one of their many works but it is slightly out of date by concept, but not listed in the table.

PFE: Charkevicz S. S. 1989, Plantae Vasculares Orientis Extremi Sovietici 4: 10—25, Leningrad. This is another work after Komarov's Flora of USSR(Komarov, 1934—1960). With respect to the concept of species, some have been treated slightly better than those in the Komarov's edition. Total, there are 7 genera and 21 species.

VPR: Czerepanov S. K., 1995, Vascular Plants of Russia and Adjacent States(The Former USSR) 197, 220, 335—337, 489, Cambridge University Press. This is the summary of Flora of USSR(Komarov, 1934—1960) in English. The Russian concept of species has been largely influenced by Komarov and his followers in the history. Even though there are only 7 genera, 55 species and 3 infraspecies, the difference between their treatments with the world checklist has been up to 42. 1%(24/55+3).

3 Discussion

The concepts of plant taxa used by the different authors from different institutions or countries, are still very different from each other, even simply within conifers from mainland Asia. At the family level, Taxodiaceae and Cupressaceae have been merged since the 1970s (Eckenwalder, 1976; Farjon, 1998, 2001), but the merge has never been accepted in any local floras in mainland Asia. No statement or proposal about the disagreement has been made from any local works among more than

20 local floras in mainland Asia mentioned in this work. The only feasible reason for this is that some traditional works, which we have cited here, are too familiar with their old concepts of separation between these two families so they do not want to change it, especially since most genera of Taxodiaceae are mainly from Asia. Evidently, further work regarding this should be reconsidered since foreign and local taxonomists have not reached an agreement. At the genus level, problem concerning concepts are also unresolved. In fact, they are even worse than those at the family level. There were many disagreement at this level, such as *Platycladus* (Fu & Li, 1999), an endemic genus from China, which has been used as *Thuja*, even under cultivation (Grubov *et al.*, 2002; Czerepanov, 1995; Hiep & Vidal, 1996). Another example is Sabina, synonymus under *Juniperus* (Farjon, 2001), used in mordern Japanese Flora (Yamazaki, 1995). The same situation is faced in Nageia (Farjon, 2001; Fu & Li, 1999), which some have put it under *Podocarpus* (Yamazaki, 1995; Phengklai, 1975). Finally, Nothotsuga (Farjon, 1998, 2001), an endemic genus to China, has never been accepted in FOC itself, but under Tsuga (Fu & Li, 1999). These issues of splits or merges have been debated for a long time by different authors, especially from different countries.

At the species level, we need much more work on the concept of 'senso. lato.' to 'senso. striato.', the most disputed point worldwide in taxonomy. In some parts, this is even worse than the above discussions at the family and genus levels since it frequently happens. Examples of these arguments can be found among following taxa: 1, *Keteleeria*, with 3 species and 1 variety recognized by Farjon, but 5 species and 4 varieties recorded from China alone by FOC (Fu & Li, 1999), and disagreement rate up to 66% (6 difference among 9 entirely accepted both species and infraspecies by local floras, see table 1 for detail); 2, *Pseudotsuga*, with 2 species and 2 varieties from mainland Asia, but 3 species and 1 variety recorded in FOC (Fu & Li, 1999), and disagreement rate up to 75% (3 to 4); 3, *Torreya*, with 3 species and 3 varieties in mainland Asia, but disagreement rate up to 42.86% (3 to 7); 4, *Tsuga*, only 5 species and 2 varieties in mainland Asia, but disagreement rate up to 41.18% (7 to 17); 5, *Podocarpus*, with 9 species and 2 varieties from mainland Asia, but disagreement rate up to 40.5% (15 to 37); and 6, *Larix*, with 7 species and 7 varieties from mainland Asia, but disagreement rate up to 39.4% (13 to 33). The most interesting thing is that all these disagreement are mainly from east Asia, i. e., from FOC, FOJ as well as VPR, the most conifer-rich region in the world.

4 Summary

Mainland Asian floras have been explored for a long time; however, we still do not know them very well, even some of the best known taxa, Conifers. In fact, the following countries are without any flora at all in their history: Myanmar, Mongolia, and Nepal. Some have no modern floras, or at least no complete flora yet, such as India, even they have tried several times but no published so far for this vast country (Jain, 1978—1999; Sharma, 1993). From the financial point of view, they do not have the proper resources, but India also lacks a kind of comprehensive ability to produce its own floras without any help from the outside. Flora of India has been begun several times, even though started several times since Bentham and Hooker era (Jain, 1978—1999; Sharma, 1993). However, no one could finish the whole project. The same goes for the Flora du Cambodge, Laos et Vietnam (Morat, 1960) from Museum National d'Histoire Naturelle, Paris, which has been studied for more than a century. Unfortunately, it will take another century to treat all remaining taxa at the current rate. In the north, much area has been covered by the Flora U. S. S. R as well as the replacement floras of the former Soviet Republic such as Flora of Siberia (Krasnoborov, 2000), and Plantae Vasculares Orientis Extremi Sovietici (Charkevicz, 1989), but their concepts are mainly from the Komarovian scholars. Thus, it is still far away from a complete understanding and a worldwide acceptance in the taxonomic field. In the west and central Asia, it is so varied in topography, geography and politics that no complete attempt has been made yet, only a small area, formerly Russian part, has been covered (Czerepanow, 1995), or Iran *et al.*, by Flora Iranica (Rechinger, 1963).

The best case in mainland Asia is east Asia, which has been covered very well in the past few decades, by their works such as Flora of Japan (Iwatsuki *et al.*, 1995), Flora of China (Wu & Raven, 1994), Flora of Taiwan (Huang, 1994), Flora of Bhutan (Grierson & Long, 1983), Florae Reipublicae Popularis Sinicae (Flora of China, Chinese Edition, Ma & Clemants, 2006) and many local floras within China (Ma *et al.*, 2000; Liu *et al.*, 2007) and Japan (Editorial Committee of The Journal of Phytogeography and Taxonomy, 2002). Also, there are some new floras from this area in preparation, such as Flora of Korea (Im, 1999; Park, 2007) and Flora of Nepal (Watson & Blackmore, 2003).

Mainland Asia is the modern distribution center of Conifers (Contreas-Medina & Vega, 2002; Farjon, 1998, 2001). There are 8 families, 69 genera, 653 species and 187 infraspecies of conifers in the world (Farjon, 2001), 6 families, 35 genera, 192 species and 92 infraspecies are distributed in mainland Asia, and 17 genera are endemic to this area: *Ammentaxus*, *Cathaya*, *Cephalotaxus*, *Cryptomeria*, *Cunninghamia*, *Fokienia*, *Glyptostrobus*, *Keteleeria*, *Metasequoia*, *Microbiota*, *Nothotsuga*, *Platycladus*, *Pseudolarix*, *Pseudotaxus*, *Sciadopitys*, *Taiwania* and *Thujopsis*-almost half of the total genera from mainland Asia (represented by 48. 57%), the highest percentage of endemic conifer genera in the world. In fact, most of them are endemic to the region of east Asia, which has been recognized as the richest floras in the world (Wu & Raven, 1994). Besides this, six genera are also shared between east Asia and north America: *Calocedrus*, *Chamaecyparis*, *Pseudotsuga*, *Thuja*, *Torreya* and *Tsuga*, which represents a great floristic diversity and close affinity between these two continents. The most poorly understood floras from mainland Asia are those of less developed areas, according to their different percentages (see table 1 for detail) compared with the world checklists of Conifers (Farjon, 1998, 2001), such as Russia (41. 37%, 24 to 58), China (29. 91%, 67 to 224), Myanmar (25. 81%, 8 to 31), Japan (25. 45%, 14 to 55), and Nepal (25%, 4 to 16). In fact, some different percentages may be even higher than those above since they do not have complete information. For example, Calocedrus and Dacrycarpus are not recorded in CLM (Kress *et al.* 2002) even though these have been recognized worldwide (Farjon, 2001; Fu & Li, 1999).

In short, the mainland Asian flora is still under development. The basic resources needed for flora preparation, such as herbarium collections, library accumulations and trained taxonomists, are still far behind their modern counterparts in North America or Europe. There is still a long way to go even in the new century for the taxonomists from mainland Asia. Currently, only Israel and Japan can afford to go further beyond their own boundaries in preparing floras or for further plant exploration. There is not enough solid financial support or cooperation between even the closest neighbors, such as China, India and Indochina. Evidently, taxonomic work of mainland Asia by western countries will continue to play a major role in the flora preparation and production by helping them to finish their floras. More cooperation from Europe and North America with mainland Asia is greatly appreciated, expected and encouraged, not only because of their history, but also for the information we share in the future in order to under our floras better than before (Orchard, 1999).

Last, but not least, the situation of traditional taxonomy in Asia is facing a very serious challenge today. Some cases are even worse than what one can image or expect. Recently, traditional taxonomy has lost their priority to the molecular works worldwide. Basic herbarium facilities have lost their solid support in comparison with the past, and even the largest herbaria and best institutes in Asia are no exception, such as TI and PE. Without that priority and support, we cannot hope to complete the basic information of the biodiversity and conservation worldwide.

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亚洲大陆植物志中的针叶树评述

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摘 要：以比较清楚的针叶树类为例，同时参考世界性的专著，对亚洲大陆各地的植物志进行了系统的比较研究，发现尽管亚洲大陆的经典植物分类已经进行了三百多年的长期而且广泛的研究，仍然有很长的路要走，特别是经典分类受到严重挑战的今天。

关键词：植物志；亚洲大陆；针叶树；综述

（上接第 740 页 Continue from page 740）

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