

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of *Taxus chinensis*, *T. cuspidata*, *T. fuana*, *T. sumatrana* and all infraspecific taxa of these species in Appendix II with the following annotation:

Designates all parts and derivatives, except:

- a) seeds and pollen; and
- b) finished pharmaceutical products.

in accordance with Article II, paragraph 2 (a), of the Convention, and Resolution Conf. 9.24 (Rev. CoP12), Annex 2 a, paragraph B. i).

B. Proponent

The People's Republic of China and the United States of America, in accordance with the consensus recommendation of the 12th meeting of the Plants Committee (Leiden, 2002).

C. Supporting statement1. Taxonomy

1.0 Division: Coniferophyta

1.1 Class: Pinopsida

1.2 Order: Taxales

1.3 Family: Taxaceae (yew family)

1.4 Genus: *Taxus* L.

Species: *Taxus chinensis* (Pilger) Rehder 1919
Taxus chinensis (Pilger) Rehder var. *chinensis*
Taxus chinensis (Pilger) Rehder var. *mairei* (Lemée & Lévillé)
W.C. Cheng & L. K. Fu.
Taxus cuspidata Siebold & Zuccarni 1846
Taxus cuspidata Siebold & Zuccarni var. *cuspidata*
Taxus fuana Nan Li & R. R. Mill 1997
Taxus sumatrana (Miquel) de Laubenfels 1978

1.5 Scientific synonyms: *Taxus chinensis* var. *chinensis*: *Taxus baccata* L. subsp. *cuspidata* (Sieb. & Zucc.) Pilg. var. *chinensis* Pilg. 1903; *Taxus cuspidata* Sieb. & Zucc. var. *chinensis* Pilg. C. K. Schneid 1913; *Taxus wallichiana* Zucc. var. *chinensis* (Pilg.) Florin 1948; and *Taxus baccata* L. var. *sinensis* A. Henry 1906.

Taxus chinensis var. *mairei*: *Tsuga mairei* Lemée & Lévillé 1914; *Taxus mairei* (Lemée & Lév.) S. Y. Hu ex T. S. Liu 1960; *Taxus wallichiana* Zuccarni var. *mairei* (Lemée & Lév.) L.K. Fu & Nan Li 1997; and *Taxus speciosa* Florin 1948.

Taxus cuspidata var. *cuspidata*: *Taxus baccata* L. var. *cuspidata* (Sieb. & Zucc.) Carrière 1867; *Taxus baccata* L. subsp. *cuspidata* (Sieb. & Zucc.) Pilg. 1903; *Taxus baccata* L. var. *microcarpa* Trautvetter 1859;

Taxus cuspidata Sieb. & Zucc. var. *microcarpa* (Trautv.) Kolesn. 1935; *Taxus cuspidata* Sieb. & Zucc. var. *umbraculifera* (Sieb. ex Endlicher) Makino 1862; *Cephalotaxus umbraculifera* Siebold ex Endl. 1847; *Taxus baccata* L. subsp. *cuspidata* (Sieb. & Zucc.) Pilg. var. *latifolia* Pilg. 1903; *Taxus cuspidata* Sieb. & Zucc. var. *latifolia* (Pilg.) Nakai 1938; *Taxus cuspidata* Nakai 1938; and *Taxus cuspidata* Sieb. & Zucc. var. *caespitosa* (Nakai) Q. L. Wang, Clavis Pl. 1995.

Taxus sumatrana: *Podocarpus celebicus* Hemsley 1896; *Cephalotaxus celebica* Warb. 1900; *Taxus celebica* (Warb.) H. L. Li 1963 1900; and *Cephalotaxus mannii* E. Pritzl ex Diels 1900.

- 1.6 Common names:
- Taxus chinensis*: English: Chinese yew
French:
Spanish: Tejo de Asia
- Taxus cuspidata*: English: Japanese yew
French:
Spanish:
- Taxus fuana*: English: Chinese yew
French:
Spanish:
- Taxus sumatrana*: English: Chinese yew
French:
Spanish:

1.7 Code Numbers: ---

2. Biological parameters

According to Farjon (2001), the genus *Taxus* consists of 10 species and 3 infraspecific taxa. However, the total number of distinct species of *Taxus* occurring in Asia is still not unanimously accepted (Wu and Raven 1999; Farjon 2001). Species are more geographically than morphologically separable (Hills 1993). *Taxus* species are shade-tolerant small to medium-sized evergreen trees and shrubs of temperate and subtropical old-growth forests (Scher 1996). Species are extremely slow growing and long lived; it can take species 100 years or more to attain any appreciable size (Farjon 1994). The needle-like leaves are spirally arranged, irregularly 2-ranked, linear-lanceolate without resin canals. *Taxus* species are dioecious (separate sexes); their reproductive structures are axillary; ovules are solitary. The pollen cones are small, globose, with several spirally arranged peltate or flattened scales. The fleshy cup-like fruit, or aril, is open at the apex and is attached on the lower side of branches. Each fruit has one seed and turns red to orange in color when mature. The bark is reddish brown to reddish grey, thin, and papery, and exfoliates in irregular flakes and leaves scars with streaks on the trunk.

The bark, needles, twigs, and roots of *Taxus* species are the source of taxanes, a group of chemical compounds, one of which, paclitaxel, is successfully used for the treatment of certain cancers. The extract (e.g., crude, semi-purified, and active pharmaceutical ingredient) is the commodity actually exported rather than plant biomass (Shah 1994; Bertrand von Arx, personal communication, May 2002).

2.1 Distribution

The four species of Asian *Taxus* are confined to eastern Asia and Asia Minor, and southeast Russia (Farjon 2001). Species occur from lowland to montane zones in cool climates with moderate to high, evenly distributed precipitation (Farjon 2001).

Taxus chinensis: Native to China, from the east coast to Sichuan, Yunnan and southeast Xizang Zizhiqu (Farjon 2001).

Taxus chinensis var. *chinensis*: Native to China, occurs in south and north central, and southeast regions (Farjon 2001).

Taxus chinensis var. *mairei*: Native to China and Viet Nam; in China it is narrowly distributed on northern aspects at elevation between 700 m and 2500 m in Lijiang, Nujiang, Zhongdian and Dali Prefectures of northwest Yunnan, China (Xu 2000; Farjon 2001).

Taxus cuspidata and *T. cuspidata* var. *cuspidata*: Found at 500-1000 m in forests of eastern China from Shandong to Jiangsu provinces; in Korea, and Japan, and Russia Far East (Kurile and Sakhalin Islands, and Primorye) (Rushforth 1987; Wu and Raven 1999; Farjon 2001).

Taxus fuana: Native to China in southwest Xizang Zizhiqu (Farjon 2001), occurring in mixed and pine forests at 1800-3400 m, depending on locale (Wu and Raven 1999; Farjon 2001).

Taxus sumatrana: Native to the Philippines and Indonesia (Sulawesi and Sumatera) at 1400-2300 m in moist subtropical forests, tropical highland ridges and forests in the subcanopy (Farjon 2001).

2.2 Habitat availability

Taxus occurs in a wide variety of sites, from dry and rocky sites to moist depressions and ravines, in conifer and mixed-conifer moist temperate or tropical mountain forests (Farjon 2001). Habitat for these species in recent history has most likely decreased due to deforestation and land conversion for agricultural purposes.

2.3 Population status

Taxus generally occurs as scattered individuals under the canopy of other trees rather than as a dominant species (Farjon 1994).

China: Due to amount and extent of harvest of *Taxus*, current information on the size and status of populations is unavailable. Wang (1986) and Xu (1997) reported that all species of *Taxus* in China have been reduced due to over-exploitation for their medicinal properties, especially in northwest Yunnan Province. *Taxus* has been eliminated in Lidiping of Weixi County, Caojian of Yunlong County, and Rushui County (Xu 1997). All species of *Taxus* are listed as Endangered in the *China Plant Red Data Book: Rare and Endangered Plants* (Fu 1992).

Taxus cuspidata: Exploitation has rendered the species rare in much of its range (available at: <http://www.botanik.uni-onn.de/conifers/ta/ta/cuspidata.htm>. Accessed March 1, 2004). Japan does not recognize the species as endangered (Minako Takezawa, personal communication, April 2004). No information is available on the population status in Korea and Russia.

Taxus fuana: Listed as endangered in China (Wu and Raven 1999), and as vulnerable (D2) by the IUCN (IUCN Red List of Threatened Species. Available at: www.redlist.org. Accessed March 1, 2003).

Taxus sumatrana: Not threatened according to Farjon (2001).

2.4 Population trends

Recent field surveys and other supporting data provide evidence that most if not all populations of *Taxus* are in decline (Farjon et al. 1993). Since the 1990s, there has been a phenomenal demand by pharmaceutical companies for paclitaxel and other taxane compounds extracted from *Taxus*. It is believed that all *Taxus* species native to China have declined drastically in northwestern Yunnan Province and have been eliminated in Lidiping of Weixi County, Caojian of Yunlong County, and Rushui County due to mass exploitation and the use of destructive harvest practices (e.g., felling of trees) (Wang 1986; Xu 1997; Schippmann 2001). Schippmann (2001) estimated that between 5,000 and 10,000 metric tons of bark and 2,000 metric tons of leaves have been harvested in Yunnan Province, China, in recent years.

In 2001, paclitaxel became the biggest-selling cancer drug in the world. According to Bedi et al. (1996) and others, a single cancer treatment requires 2.5–3 g of paclitaxel, which would require the bark of 7.5 average-sized trees. In 1996, Bedi et al. estimated the world demand for paclitaxel to be 700 kg per year. Various authors have estimated that the production of 1 kg of paclitaxel requires between 7,270 and 10,000 kg of *Taxus* bark, or approximately 3,000 *Taxus* trees (Phillips and Dwyer 1999; Schippmann 2001). Unfortunately, the yield of paclitaxel and paclitaxel-equivalent compounds is extremely small, between 0.02% and 0.1% of the dried plant material (Appendino 1995). Projected demands over the next 20 years for paclitaxel and paclitaxel-equivalent compounds could be as high as a million trees per year (Small and Catling 1999).

Based on the current levels of exploitation, populations of Asian *Taxus* species will continue to decline, and therefore, their long-term viability may be affected. *Taxus* regenerate poorly and are extremely slow growing. As populations become smaller and fragmented due to destructive harvest practices, the chance of recolonization is reduced and the length of time for recolonization is greatly extended. Furthermore, *Taxus* are dioecious; the loss of individuals and fragmentation of populations may cause genetic erosion in species and potentially affect their long-term survival.

2.5 Geographic trends

Although it does not appear that the overall geographic range of these species has changed significantly over recent history, localized land conversion and deforestation are most likely affecting the species in China, Indonesia, and the Philippines. As noted above, the life history of *Taxus* and the intense harvest pressure for these species will affect future regeneration of these species, which may reduce their geographical distribution.

2.6 Role of the species in its ecosystem

Taxus are slow-growing long-lived evergreen trees and shrubs, sensitive to fire and slow to recover from disturbance. *Taxus* species obtain their maximum size in old forests. Ungulates are known to browse small trees and shrubs. Birds and small mammals eat the fruits and disperse seeds. *Taxus* is rarely attacked by pests and diseases. Dead standing trees (snags) provide habitat for cavity-nesting birds. Trees in riparian areas provide bank stability and shade. *Taxus* are also very good indicators of environmental pollution because of their sensitivity to pollutants (Xu 2000).

2.7 Threats

Since the 1990s, *Taxus* has become an important commodity for the pharmaceutical industry, and large amounts of its constituent parts (bark, needles, roots) are currently processed to obtain paclitaxel and paclitaxel-equivalent compounds (Appendino 1995). Destructive harvest practices (i.e., felling of trees, complete removal of bark) are reducing and in some areas eliminating *Taxus* species throughout their ranges in China. Wang and Yang (1999) reported that all members of the genus *Taxus* are greatly threatened in China, and have been extirpated in some regions (e.g., Yunnan Province) due to destructive harvest for the pharmaceutical industry. Deforestation and land conversion may also affect species throughout their ranges.

3. Utilization and trade

3.1 National utilization

Traditionally, the young shoots, leaves and bark of *Taxus* have been used for their medicinal properties as an abortifascient and antidiabetic. The wood of *Taxus* is valued for its strength, durability, and decorative character, and was traditionally used in building construction, furniture manufacture, and carving.

Taxus chinensis, *Taxus cuspidata* and *Taxus fuana*: Traditionally, *Taxus* has been used as a Traditional Chinese Medicine (TCM) by local populations for centuries (Viti et al. 2001). Today, the collection of *Taxus* is prohibited without the authorization of the Chinese National Forest

Bureau. There are several extraction facilities located in China. One such facility in the Yunnan Province is reported to produce 150 kg of paclitaxel annually from the harvest of 500 metric tons of dried leaves and bark (Xu 1997; Schippmann 2001). Xu (1997) estimated that 5,000-10,000 metric tons of bark and 2,000 metric tons of leaves and branches have been harvested from forests in northwest Yunnan Province in recent years for this facility.

Taxus cuspidata: Commercial use has greatly declined in recent decades due to overexploitation (Hartzell 1991). In Japan, historically, it was used for its medicinal properties as an abortifascient and antidiabetic; the wood was used in building construction, furniture manufacture, and carving. Today, it is a common gardening plant in Japan. No information is available on its use in Korea and Russia.

Taxus sumatrana: In the Philippines and Indonesia it is used for bedsteads, poles, upholstery, clogs, whip handles, and bows; the bark is used to make a red dye.

3.2 Legal international trade

In China, there are extraction facilities for the production of paclitaxel or other taxane compounds (Xu 1997; Schippmann 2001), and China is a major exporter (e.g., 21 CEC, Kingherb International, Hande Technological Development Co. Ltd, Phytogen Life Sciences, Sigma-Aldrich Inc., SiniWest Holdings, Inc.) of *Taxus* extracts.

3.3 Illegal trade

As noted above, China is a major supplier of paclitaxel for the international pharmaceutical industry. Since 1999, the harvest of all native species of *Taxus* is prohibited without the authorization of the Chinese National Forest Bureau. The Chinese government routinely confiscates illegally harvested *Taxus* biomass (e.g., bark) (Viti et al. 2001), which is later made available to domestic extraction facilities (MacIvor and Peters 2000; Viti et al. 2001). Wang and Yang (1999) report that all species of *Taxus* in China have become scarce due to illegal harvest for domestic extraction facilities.

Although it is difficult to quantify the level and extent of illegal trade in *Taxus*, there is no doubt that unlawful activities do occur (Viti et al. 2001). In China, attempts have been made to export *Taxus* species by misdeclaration (Zhou Yafei, personal communication, August 2001). This includes illegal export of native *Taxus* species alleged to be processed material originally from North America, and illegal export of processed plant material of *Taxus* species other than *Taxus wallichiana*, which are claimed to be *Taxus wallichiana*.

No information is available on illegal trade in *Taxus* in other range states (e.g., Indonesia, Japan, Philippines and Russia).

3.4 Actual or potential trade impacts

All species of *Taxus* contain varying amounts taxanes (e.g., paclitaxel), which are extracted from the bark, needles, twigs, and roots of species. Including all Asian species of *Taxus* in Appendix II would regulate trade and help prevent unsustainable and destructive harvest of these species for the international pharmaceutical industry. To be effective, the listing must be annotated to include chemical extracts, but not finished pharmaceutical products.

3.5 Captive breeding or artificial propagation for commercial purposes (outside country of origin)

Several *Taxus* species and numerous cultivars are artificially propagated for the commercial horticultural industry. *Taxus* species are easily propagated from vegetative cuttings and by air-layering. Seeds are more difficult to propagate due to their dormancy requirement. However, in general, it is not yet feasible to plantation-cultivate wild *Taxus* species for the pharmaceutical industry because species are too slow growing (Han et al. 1999).

4. Conservation and management

4.1 Legal status

4.1.1 National

Various laws and programs are in place in some range states to conserve and protect native species of *Taxus*. Since 1999, all native species of *Taxus* have received the "National First Category Protection" status by the Chinese Government. This designation allows the National Forest Bureau (NFB) the authority to manage and conserve *Taxus* species (Maclvor and Peters 2000). Although the NFB is the government agency responsible for the management and harvest of *Taxus* in China, there are no detailed regulations concerning, for example, minimum tree trunk size or requirements to leave stumps of a specific height (for regeneration) (Maclvor and Peters 2000). All species of *Taxus* are listed as Endangered in the *China Plant Red Data Book: Rare and Endangered Plants* (Fu 1992).

No information is available on the legal status of *Taxus* in other range states.

4.1.2 International

China fully supports a proposal to include the Asian species of *Taxus* in Appendix II. Including these species in Appendix II will allow range countries to better manage and conserve these species, and will improve the ability of all CITES Parties to monitor the export and import of commodities in trade.

4.2 Species management

4.2.1 Population monitoring

There is no available information on specific efforts to monitor the status of these species or the sustainability of harvest from the wild.

4.2.2 Habitat conservation

Some *Taxus* populations are within national parks and reserves. However, illegal harvesting, including felling of trees, continues to threaten species in many of the range states.

4.2.3 Management measures

The three *Taxus* species native to China (*Taxus chinensis*, *Taxus cuspidata*, and *Taxus fuana*) are listed under the National First Category Protection, which prohibits the collection of *Taxus* without the authorization of the National Forest Bureau. In addition, forestry policy and regulations under the Native Flora Protection Act of the People's Republic of China outline the rules regarding native flora protection and management. *Taxus* species are protected under this Act because of their slow rate of growth (requiring over 8 years to become established) and the threat of extinction from over-harvest for paclitaxel extraction (Maclvor and Peters 2000).

No information is available on management measures for *Taxus* in other range states.

4.3 Control measures

4.3.1 International trade

Only one *Taxus* species, *Taxus wallichiana*, is subject to the trade controls of CITES (listed in Appendix II at COP9, Fort Lauderdale, 1994).

4.3.2 Domestic measures

As stated above, in China, harvest and collection of *Taxus* species is prohibited without the authorization of the Chinese National Forest Bureau.

No information is available on domestic measures for *Taxus* in other range states.

5. Information on similar species

Since 1995, *Taxus wallichiana* has been listed in Appendix II of CITES. However, the foliage and bark of all *Taxus* species are very similar in appearance. Therefore, to better regulate the over-exploitation and often illegal harvest of all Asian *Taxus* species, it is necessary that these additional species be included in CITES Appendix II.

6. Other comments

The United States of America sent a draft proposal to all Parties within the range of these species. To date, the United States of America has only received responses from China and Japan. China fully supports a proposal to include the Asian species of *Taxus* in Appendix II. Japan indicated that they do not support the proposal generally because it lacks specific trade and scientific data, but they specifically opposed the listing of *Taxus cuspidate* in Appendix II because it is not endangered and there is no clear evidence that trade is detrimental to the survival of the species. The United States of America has sought comments in the United States on this proposal via public notice in the U.S. Federal Register Volume 69, (7): 1757-1761, January 12, 2004.

7. Additional remarks

This proposal was developed as a consequence of a review of the current listing of *Taxus wallichiana* (Appendix II, CoP9, Fort Lauderdale, 1994), which was started at the 10th meeting of the Plants Committee (Shepherdstown, 2000). At the Eleventh Meeting of the Plants Committee (Langkawi, 2001), it was determined that a thorough review of the entire genus was needed. Additionally, it was also recognized that the listing and annotation (#2) for *Taxus wallichiana* was not effective, because it exempts the commodities in trade (chemical derivatives and extracts) from CITES regulations.

In 2002, the Scientific Authority of the United States of America consulted with range countries on the proposal to include all species of *Taxus* in Appendix II. Based on trade and information on the species' status obtained from range countries and a review of the genus, *Taxus baccata* and the four North American species of *Taxus* were eliminated from further investigation. However, it was determined that the bulk of the trade is in Asian species of *Taxus*, and that listing these species in Appendix II would help regulate trade and prevent unsustainable and destructive harvest of these species for the international pharmaceutical industry.

At the 12th meeting of the Plants Committee (Leiden, 2002) it was decided that the United States of America and other potential sponsors should submit a proposal to list the remaining Asian species of *Taxus* in Appendix II at the Twelfth Meeting of the Conference of the Parties (CoP12) (Santiago, 2002). However, there was not sufficient time to prepare a proposal before the deadline for CoP12.

The *Taxus* species, varieties and synonyms included in this proposal follow the official CITES standard checklist for conifer species (Farjon 2001).

8. References

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