

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA



Eleventh meeting of the Plants Committee
Langkawi (Malaysia), 3-7 September 2001

REVIEW OF THE GENUS *TAXUS*

1. This document has been prepared by the United States of America.

Background

2. The Scientific Authority of the United States of America submitted Doc. PC.10.13.3 at the Tenth Plants Committee meeting (PC10) in Shepherdstown. The outcome of that meeting identified two issues: 1) the United States of America, with the assistance of the Management Authority of China, would continue to review the trade in yew and identify any potential conservation issues, and 2) the Nomenclature Committee would review the taxonomic treatment of the genus *Taxus*. Each were to present their findings at the Eleventh Plants Committee meeting.
3. Due to other work priorities, the Management Authority of China was not able to contribute to this review (Yu Yongfu, *personal communication*, May 21, 2001).

Review

4. As discussed at PC10, there is an increasing amount of information available to indicate that species other than *Taxus wallichiana* are harvested from the wild to meet the growing international demand for the chemical compound paclitaxel, which has been isolated from yew trees. The international demand for the chemical compounds derived from yews is significant (Schippmann 2001). *Taxus brevifolia*, *T. baccata*, and a number of Asian species (e.g., *T. chinensis* and *T. cuspidata*) are all sources of paclitaxel (Schippmann 2001). The IUCN has reported that *Taxus wallichiana*, *T. baccata*, and *T. yunnanensis* are all harvested for the pharmaceutical market (IUCN-WCU 1994).
5. The systematics of the genus *Taxus* are controversial (Appendino 1995), and the confusion in the taxonomy is reflected in the current nomenclature (Farjon 1998, Fu *et al.* 1999, Spjut 2000). Species delimitation is confounded due to a lack of consensus in the systematics of the genus and the morphological similarities between *Taxus* species (Spjut 2000). The yews are a group of closely allied allopatric species (Rushforth 1987). Furthermore, since all yews look very similar, yew in trade is often assumed to be *Taxus baccata* (Parmar *et al.* 1999). These factors continue to create obstacles to effective regulation of trade in *Taxus wallichiana*.

6. The *Flora of China* (Fu *et al.* 1999) recognizes three species and two varietal forms of *Taxus* native to China:
 - T. wallichiana* Zucc. (*T. yunnanensis* W. C. Cheng & L. K. Fu is treated as synonym)
 - T. cuspidata* Siebold & Zucc.
 - T. fuana* Nan Li & R. R. Mill.
 - T. wallichiana* Zucc. var. *chinensis* (Lemée & Lévi) L. K. Fu & Nan Li
 - T. wallichiana* Zucc. var. *mairei* (Lemée & Lévi) L. K. Fu & Nan Li
7. Three other references for *Taxus* in China are The Forest Botany of China Supplement (Lee 1973), Resource Records of Traditional Chinese Medicinals in Yunnan (1993), and Chinese Botanical Annals (Vol. 7).
 - i) The first reference lists the following species of *Taxus* in China:
 - T. chinensis* (Pilger) Rehder
 - T. cuspidata* Siebold & Zucc.
 - T. mairei* (Lemée & Lévi) Shiu Ying ex Li
 - T. wallichiana* Zucc.
 - ii) The second reference lists the following:
 - Taxus chinensis* (Pilger) Rehder
 - Taxus chinensis* var. *mairei* (Lemée & Lévi) W. C. Cheng & L. K. Fu
 - T. yunnanensis* W. C. Cheng & L. K. Fu
 - iii) The third reference lists *T. yunnanensis* as a distinct species.
8. Cheng and Fu (1978) originally described *Taxus yunnanensis* as a distinct species; however, after conducting an extensive taxonomic review, researchers Li and Fu (1997) concluded that *T. yunnanensis* should be reduced to a synonym of *Taxus wallichiana*. They further suggested that the plants recognized by Cheng and Fu (1978) as *Taxus wallichiana* should be considered as a new species, *T. fuana* Nan Li & R. R. Mill.
9. The U.S. Scientific Authority contacted Dr. Aljos Farjon, Chairman of the IUCN-SSC Conifer Specialist Group, to inquire about the nomenclature of *Taxus*. Dr. Farjon recommended that his book, *World Checklist and Bibliography of Conifers* (Farjon 1998), should be adopted as the standard nomenclatorial reference for *Taxus*. Dr. Farjon includes five species and three varietal forms of *Taxus* in the Eastern Hemisphere:
 - T. wallichiana* Zucc. and *T. yunnanensis* W. C. Cheng & L. K. Fu are treated as synonyms.
 - T. chinensis* (Pilger) Rehder
 - T. cuspidata* Siebold & Zucc.
 - T. fuana* Nan Li & R. R. Mill.
 - T. chinensis* (Pilger) Rehder var. *chinensis*, which includes the synonym *T. wallichiana* Zucc. var. *chinensis*
 - T. chinensis* (Pilger) Rehder var. *mairei* (Lemée & Leveille) W. C. Cheng & L. K. Fu
 - T. cuspidata* Siebold & Zucc. var. *cuspidata* *T. sumatrana* (Miq.) De Laub.
10. All native species of *Taxus* in China are listed as "Class I." The "Class I" listing prohibits the collection of yew without the authorization of the Chinese Government. *Taxus wallichiana* is listed as Endangered in the *China Plant Red Data Book - Rare and Endangered Plants* (Fu 1992). The Chinese Department of Forestry does not consider *Taxus yunnanensis* to be a synonym of *Taxus wallichiana* (Wang Weisheng, personal

communication, 2001). *Taxus yunnanensis* is classified as a specially protected species managed by the Department of Forestry. It is the Department of Forestry that regulates the collection and export of *T. yunnanensis* through the issuance of permits (Baker Norton Pharmaceuticals, Inc. 2001). Although the genus *Taxus* is strictly regulated by the Chinese Government, there are reports of illegal harvest (Baker Norton Pharmaceuticals, Inc. 2001) and over-exploitation of yew in Northwest Yunnan, and its extinction in Lidiping of Weixi County, Caojian of Yunlong County, and Rushui County (Xu Jianchu 2000). Several Chinese paclitaxel suppliers, (e.g., 9Top Natural Pharmaceutical Co., Kingherb International, Sigma-Aldrich, SiniWest Holdings, Inc., and Yunnan Hande Technological Development Co. Ltd.) advertise on the world wide web that they utilize *Taxus yunnanensis* and *T. chinensis* to manufacture paclitaxel.

11. All native species of *Taxus* in China are included in The Manual of the Monitored and Administered Species of Wild Fauna and Flora for Import and Export of the People's Republic of China (CITES 1980, Part I. Plants). The Management Authority of China has informed the Scientific Authority of the United States of America that there are no records on file for the export of *Taxus* (Yu Yongfu, *personal communication*, May 21, 2001).
12. In Nepal, *Taxus wallichiana* clippings are being collected in five provinces (Schippmann 2001). Since the ban of *T. wallichiana* exports from India in 1994, Nepal has increased their exports from 60 tonnes in 1995 to 360 tonnes in 1997 (Phillips and Dwyer 1999).
13. Furthermore, according to CITES trade data there are no records for commercial quantities of *Taxus wallichiana*. There are, however, two consignments between Chile and the Scientific Authority of Germany for 200 grams of material traded in 1997 (Schippmann 2001).

Note Secretariat: these were materials used in a training seminar held before PC8.

14. In the Western Hemisphere, there are two species of *Taxus* that are or may become a source of paclitaxel. *Taxus canadensis* in Canada is currently under clinical research (Baker Norton Pharmaceuticals, Inc. 2001), and the status of the Mexican yew, *Taxus globosa*, of Mexico and Honduras may be of concern due to over-harvesting (Anonymous 1995).
15. There is growing conservation concern about the status of wild *Taxus* species due to their medicinal value (Wang Siyu 1999; Xu Jianchu 2000; Schippmann 2001). It is currently known that all species of the genus *Taxus* have been subjected to some chemical investigation (Appendino 1995). There are over 300 chemical compounds that have been isolated from different *Taxus* species (Parmar *et al.* 1999). Nonetheless, confusion also exists in the phytochemical literature on the taxonomic status of Himalayan and Chinese yews, making it difficult to assess the taxonomic relevance of the scientific data (Appendino 1995).

Conclusion

16. Species delimitation in *Taxus* is controversial; moreover, there are several authoritative taxonomic references that can be used, such as the *World Checklist and Bibliography of Conifers* (Farjon 1998), *The Flora of China* (1999), *Handbuch der Nadelgehölze* (Krussmann 1983), *Conifers* (K. Rushforth 1987), and *Conifers* (M. Vidakovic 1991). Furthermore, the current confusion of the nomenclature of the various species or synonymies has created uncertainty in the treatment of species in the phytochemical literature.
17. The Himalayan yew, *Taxus wallichiana* Zucc., was proposed and subsequently listed in Appendix II of CITES; *Taxus yunnanensis* was not included as a synonym. However,

several taxonomic references treat *Taxus yunnanensis* as a synonym, and therefore trade in the CITES-listed taxon may be occurring outside of CITES controls.

18. There is evidence to indicate that several wild species of *Taxus* are harvested for the international market, and the sustainability of their removal from the wild should be examined.

Recommendations

19. Due to the inconsistencies that exist in the nomenclature of *Taxus* (Appendino 1995; Parmar *et al.* 1999; Fu *et al.* 1999; Spjut 2000; Farjon, *personal communication*, April 23, 2001), and the general consensus that the systematics of the genus are uncertain (Appendino 1995; Spjut 2000), the Plants Committee should review the status in trade of *Taxus*, with emphasis on the Asian species. Furthermore, we recommend that the Nomenclature Committee recommend a standard reference for the genus *Taxus* for adoption by the Conferences of the Parties.
20. The Plants Committee should examine the trade in all species of *Taxus*, to determine if additional species should be included in Appendix II under the provisions of Article II.2(a), or whether effective control of trade in *Taxus wallichiana* would be improved through the listing of additional species in Appendix II under the provisions of Article II.2(b) due to similarity of appearance.
21. The Plants Committee should examine whether traded commodities derived from *Taxus* species are readily recognizable, and whether they should be subject to CITES control, including through annotation of listings.
22. Identification materials should be developed for distinguishing species in trade, in unprocessed form, at least for distinguishing *T. wallichiana* from other species.

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