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Jibankumar Singh Khuraijam & Jaideep Mazumdar

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## AN UPDATED CHECKLIST OF INDIAN WESTERN HIMALAYAN GYMNASPERMS AND LECTOTYPIFICATION OF THREE NAMES

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**Abstract:** An updated checklist of gymnosperms of the western Himalaya situated within political boundaries in India is provided along with conservation status and distribution. Lectotype for three names viz., *Cedrus deodara* (Roxb. ex Lam.) G. Don, *Pinus roxburghii* Sarg., *Picea smithiana* (Wall.) Boiss. are designated.

**Keywords:** Conservation status, distribution, habitats, herbarium studies, Himalayan region.

Living gymnosperms comprise four distinct lineages, *Ginkgo* K.Richt. (1 sp.), gnetophytes (112 spp.), cycads (355 spp.), and conifers (638 spp.) (Calonje et al. 2019; WCSP 2019). Members of gnetophytes are distributed in a wide range of vegetation ranging from desert to cold desert at high elevations while cycads are confined mainly to the tropical regions. Centres of cycad diversity occur in southern Africa, Australia, and the tropical New World (Donaldson et al. 2003). Conifers tend to dominate forests in the northern hemisphere and have a rich and diverse existence in the southern hemisphere, but are reduced in numbers in most tropical environments (Conway 2013).

In southern Asia, gymnosperms are mostly confined to the Himalayan region. Conifers and *Ephedra* L. are

found in the temperate and alpine region along the entire stretch of the Himalaya while tropical gymnosperms, namely, *Cycas* L. and *Gnetum* L., grow naturally in peninsular and northeastern India, Nepal, Bangladesh and Bhutan. In the unfinished series on gymnosperms of western Himalaya, Dar & Christensen (2003) reported seven taxa of *Juniperus*, and Srivastava (2006) listed 101 taxa (indigenous and exotic) of gymnosperms from India. Singh & Srivastava (2013) revised the checklist and reported the occurrence of 146 species and seven varieties of gymnosperms in India with extensive details of exotic/introduced species. Rana & Rawat (2017) established a database of Himalayan plants which enlisted 51 species of gymnosperms belonging to eight families and 20 genera from the Himalayan region of India, Nepal and Bhutan. Singh et al. (2018) reported 88 species of gymnosperms in the Himalayan Biodiversity Hotspot.

The Indian western Himalaya consist of three states namely Jammu & Kashmir, Himachal Pradesh and Uttarakhand. Recently, nine species and one variety of *Ephedra* were described from these states out of which five taxa were not effectively published (Sharma & Uniyal

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2009; Sharma et al. 2010; Sharma & Singh 2015, 2016; Sharma et al. 2015). The latest addition of conifers in the western Himalaya is *Juniperus chinensis* L. which was reported from Jammu & Kashmir (Singh et al. 2018). The species is previously reported to be an introduced species in India (Sood et al. 2010; Singh & Srivastava 2013).

## MATERIALS AND METHODS

Herbarium studies at Forest Research Institute, Dehradun (DD), Botanical Survey of India, Northern Regional Centre, Dehradun (BSD), National Botanical Research Institute, Lucknow (LWG), Botanical Survey of India, Howrah (CAL) and consultation of literature and virtual specimens available online at Royal Botanic Gardens, Kew (K), University of Copenhagen, Copenhagen (C), Muséum National d'Histoire Naturelle, Paris (P), Botanischer Garten und Botanisches Museum Berlin-Dahlem (B), Meise Botanic Garden, Meise (BR), and Royal Botanic Garden Edinburgh (E) provided significant information for the current investigation. While making the checklist, we followed linear sequence of extant gymnosperms by Christenhusz et al. (2011) and exotic or introduced species were excluded.

The names of three species of gymnosperms of the western Himalaya required typification since the

authors had either not designated a type or designated ambiguous specimens. In order to understand these treatments, all the protologues of the published taxa were studied.

## The checklist

The checklist is the updated enumeration of gymnosperms of the Indian western Himalaya. Thirty species, one subspecies and two varieties belonging to nine genera of gymnosperms are enlisted along with their distribution and current conservation status (Tables 1, 2). The present checklist will serve as a base for future research on gymnosperms in the region.

Two species of *Juniperus*, namely, *polycarpus* and *macropoda*, which were listed in the previous checklists of Indian gymnosperms by Singh & Srivastava (2013) and Srivastava (2006), are now considered synonyms of *Juniperus excelsa* subsp. *polycarpus* (K. Koch) Takht. (Farjon 2017). Hence, the subspecies is incorporated in the present checklist. Likewise, *Juniperus wallichiana* which was listed in Srivastava (2006), is now considered to be a synonym of *Juniperus indica* (Farjon 2017).

Sharma et al. (2011) based on molecular studies recognized five taxa of *Ephedra* from the western Himalaya, namely, *Ephedra yurtungensis* Sharma &

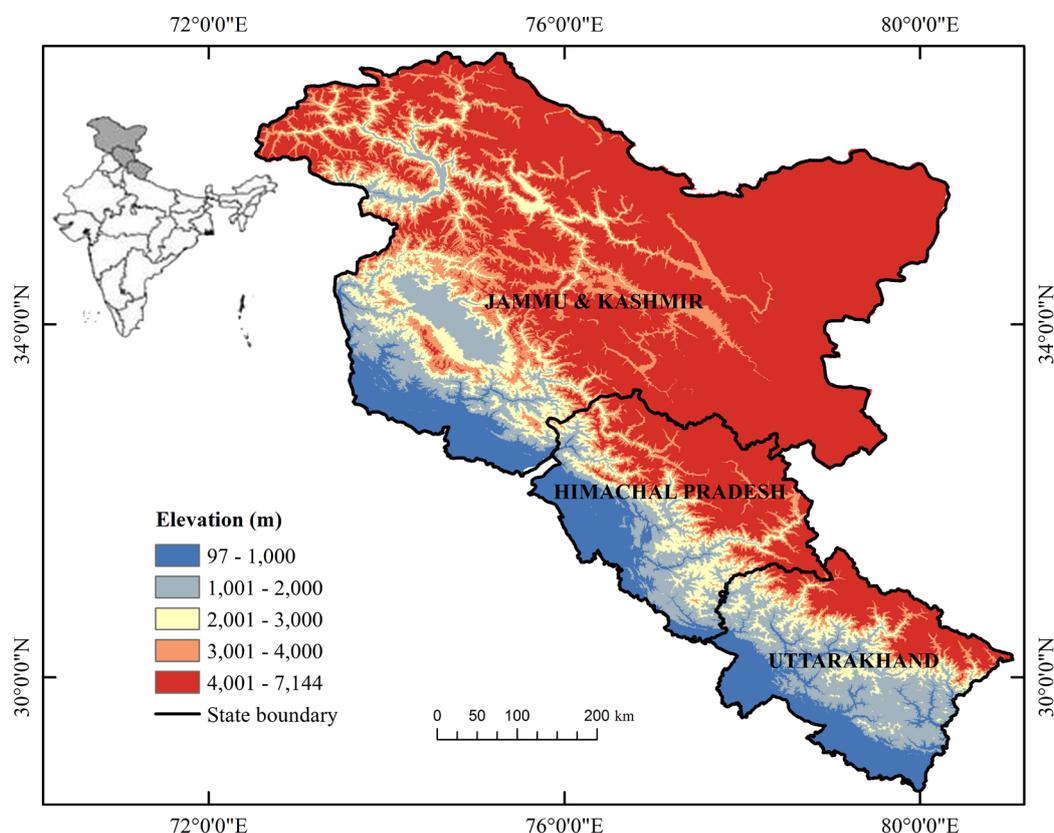


Figure 1. The Indian western Himalaya.

Uniyal, *E. yurtungensis* var. *lutea* Sharma & Uniyal, *E. lamayuruensis* Sharma & Uniyal, *E. sheyensis* Sharma & Uniyal, *E. khardongensis* Sharma & Uniyal. However, they were not published effectively as they did not fulfill criteria (Art. 38 to 40) (Turland et al. 2018) and hence excluded from this study.

### Typification

**1. *Pinus roxburghii*** Sarg. (1897: 9) nom. nov. [Pinaceae]

*Pinus longifolia* Roxb. ex Lam. (1803: 29, t. 21) nom. illeg. non Salisb. (1796: 398).

Type (lectotype, designated here): Lambert (1803), Descr. Pinus 1: Tab. XXI “*Pinus longifolia*” [Icon]. (Fig. 1).

**Note:** Lambert (1803) validated *Pinus longifolia* Roxb. with description and illustration in his book “A description of the genus *Pinus*”; however, *Pinus longifolia* Roxb. ex Lamb. (1803) proved an illegitimate later homonym of *Pinus longifolia* Salisb. (1796). Sargent (1897), therefore, proposed the replacement name (nom. nov.) *Pinus roxburghii* Sarg. for *Pinus longifolia* Roxb. ex Lamb., in honour of Dr. William Roxburgh, the collector of this specimen.

The name *Pinus roxburghii* Sarg. is based on Roxburgh’s collection from the mountains of Nepal and “*Indie orientalis*” (an old term including the Indian subcontinent).

Farjon (2017) mentioned that holotype was not located and isotype was stored in B-W. A Roxburgh specimen exists in Herb. Willdenow (BW17762010). This specimen is composed of needles and a part of shoot. This specimen was collected by Roxburgh and locality is mentioned on the back side of this sheet as India (“*Habitat in India*”). It carries annotations “*Pinus longifolia* (Roxburgh)” and “*P. longifolia 1*”.

Another Roxburgh specimen (only needles) exists in BR (BR0000013468941) collected by Roxburgh. Locality not mentioned, but it carries an annotation “*Pinus longifolia*”.

Similar annotations indicate that both specimens were in possession of Roxburgh. As Lambert (1803) did not mention any “Type” or “Holotype”, specimens in B and BR are syntypes (Turland et al. 2018, Art. 9.6).

After the death of Lambert his herbarium was sold in parts and dispersed in many herbaria (see details in Miller 1970). It is not clear that these Roxburgh specimens at B and BR were from Lambert’s herbarium and represent original material. To avoid any conflict in future we conservatively select Lambert’s illustration Tab. 21 “*Pinus longifolia*” as lectotype which is also an original material (Turland et al. 2018, Art. 9.4.b).

Volumes and editions of Lambert’s “A description of the genus *Pinus*” has some errors during printing and binding as noted by Renkema & Ardagh (1930) and Little (1949). There is an additional plate of Tab. 21 of “*Pinus longifolia*” (Renkema & Ardagh 1930: 443) and we select one of them (Image 2).

**2. *Cedrus deodara*** (Roxb. ex Lam.) G. Don (1830: 388) [Pinaceae]

*Pinus deodara* Roxb. ex Lambert (1824: 8); *Cedrus libani* A. Rich. subsp. *deodara* (Lambert) P.D. Sell (1990: 92).

Type (lectotype, designated here): Lambert (1824), Descr. Pinus 2: Tab. “*Pinus Deodara*” [Icon]. Image 3.

**Note:** Lambert (1824) published *Pinus deodara* in his highly acclaimed book “A description of the genus *Pinus*” and in the protologue he cited Dr. William Roxburgh’s unpublished name “*Pinus Deodar*. Roxb. Fl. Ind. ined.” and also mentioned locality “*Habitat in Indiae Orientalis montibus ad urbem Rohilcund Septentrionem*. Roxburgh.” “*Rohilcund*” is now a region in Uttar Pradesh, India.

Farjon (2017) mentioned that type was not designated for *Pinus deodara*. We located a Roxburgh specimen in BR (BR0000013468958) carrying annotations “*Pinus Deodara* Roxb. male” and “*Herb. Roxburghii*” indicating that it was once in the possession of Roxburgh.

As mentioned above, after the death of Lambert his herbarium was sold in parts and dispersed in many herbaria (Miller 1970). It is not clear that BR0000013468958 is the same specimen which Lambert studied, that is, original material. Selection of BR0000013468958 may warrant further changes in future. Thus we conservatively select Lambert’s unnumbered Tab. “*Pinus Deodara*” (Image 1) as lectotype which is definitely studied by Lambert and original material (Turland et al. 2018, Art. 9.4.b).

**3. *Picea smithiana*** (Wall.) Boiss. Fl. Orient. [Boissier] 5(2): 700. 1884 [Pinaceae]

*Pinus smithiana* Wall. *Plantae Asiaticae Rariores* 3: 24, t. 246. 1832.

Type (lectotype, designated here):—Himalayas: Webb, Govan & Blinkworth, Catalogue no. 6063 (K001122925 [image!]). Image 4.

**Note:** Wallich (1832a) in his Numerical list first introduced the name *Pinus smithiana* Wall., but without any description (nom. nud.) and not validly published (Turland et al. 2018, Art. 38, Ex. 1). Later Wallich (1832b) validated *Pinus smithiana* in third volume of *Plantae Asiaticae rariores*, with description and a colour plate “Tab. 246” which is the original material for this name (Turland et al. 2018, Art. 9.4). As mentioned by Wallich,



Image 1. A - Coniferous forest in the western Himalaya | B - *Cedrus deodara* habit | C - *Picea smithiana* | D - *Cedrus deodara* | E - *Pinus wallichiana* | F - *Cupressus torulosa*. © J.S. Khuraijam.

Table 1. Checklist of extant gymnosperms of the Indian western Himalaya.

	Taxa	Distribution in Indian western Himalaya	Global distribution	Conservation status (IUCN 2019)
<b>Subclass: Gnetidae</b>				
<b>Order: Ephedrales</b>				
<b>Family: Ephedraceae</b>				
1	<i>Ephedra gerardiana</i> Wall. ex Klotzsch & Garcke	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, China, Nepal, Pakistan, Tajikistan	Not Evaluated
2	<i>Ephedra intermedia</i> Schrenk & C.A.Mey.	Himachal Pradesh, Jammu & Kashmir	Afghanistan, China, Iran, Islamic Republic of Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan	Least Concern
3	<i>Ephedra kardangensis</i> P.Sharma & P.L.Uniyal	Himachal Pradesh	-	Least Concern
4	<i>Ephedra khurikensis</i> P.Sharma & P.L.Uniyal	Himachal Pradesh	-	Data Deficient
5	<i>Ephedra major</i> Host	Himachal Pradesh, Jammu & Kashmir	Afghanistan, Albania, Algeria, Bosnia and Herzegovina, Cyprus, France, Greece, Iran, Italy, Lebanon, Morocco, Pakistan, Spain, Syria, Tunisia, Turkey, Turkmenistan	Least Concern
6	<i>Ephedra pachyclada</i> Boiss.	Jammu & Kashmir	Pakistan, Nepal	Least Concern
7	<i>Ephedra pangiensis</i> Rita Singh & P.Sharma	Himachal Pradesh	-	Not Evaluated
8	<i>Ephedra przewalskii</i> Stapf	Jammu & Kashmir	China, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Uzbekistan	Least Concern
9	<i>Ephedra regeliana</i> Florin	Jammu & Kashmir	Afghanistan, China, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan, Uzbekistan	Least Concern
10	<i>Ephedra saxatilis</i> (Stapf) Royle ex Florin	Himachal Pradesh, Uttarakhand	China, Nepal	Least Concern
11	<i>Ephedra sumlingensis</i> P.Sharma & P.L.Uniyal	Himachal Pradesh	-	Not Evaluated
12	<i>Ephedra yangthangensis</i> P.Sharma & Rita Singh	Himachal Pradesh	-	Not Evaluated
<b>Subclass: Pinidae</b>				
<b>Order: Pinales</b>				
<b>Family: Pinaceae</b>				
13	<i>Cedrus deodara</i> (Roxb. ex Lambert) G.Don	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, Pakistan, China, Nepal	Least Concern
14	<i>Pinus gerardiana</i> Wall. ex D.Don	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, Pakistan, China	Near Threatened
15	<i>Pinus roxburghii</i> Sarg.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Pakistan, China, Nepal, Bhutan	Least Concern
16	<i>Pinus wallichiana</i> A.B.Jacks.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, Pakistan, China	Least Concern
17	<i>Picea smithiana</i> (Wall.) Boiss.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, China, Nepal	Least Concern
18	<i>Tsuga dumosa</i> (D. Don) Eichler	Uttarakhand	China, Nepal, Bhutan, Myanmar, Vietnam	Least Concern
19	<i>Abies pindrow</i> (Royle ex D.Don) Royle	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, Nepal, Pakistan,	Least Concern
20	<i>Abies pindrow</i> var. <i>brevifolia</i> Dallim. & A.B.Jacks.	Jammu & Kashmir, Uttarakhand	-	Data Deficient
21	<i>Abies spectabilis</i> (D.Don) Mirb.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, China, Nepal	Near Threatened
<b>Order: Cupressales</b>				
<b>Family: Cupressaceae</b>				
22	<i>Cupressus torulosa</i> D. Don ex Lamb.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	China, Nepal, Bhutan	Least Concern
23	<i>Juniperus chinensis</i> L.	Jammu & Kashmir	China, Myanmar, Taiwan, Japan, Korea, Russia	Least Concern
24	<i>Juniperus communis</i> L.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	United States, Canada, Europe, central Asia, eastern Asia	Least Concern
25	<i>Juniperus communis</i> var. <i>saxatilis</i> Pall.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Europe, Caucasus, Siberia, central Asia, western Asia, Pakistan, Nepal, China, eastern Asia, East Russia, Canada, United States of America	Not evaluated

	Taxa	Distribution in Indian western Himalaya	Global distribution	Conservation status (IUCN 2019)
26	<i>Juniperus indica</i> Bertol. (Syn.: <i>Juniperus wallichiana</i> Hook. f. & Thomson ex Parl.)	Uttarakhand	China, Nepal, Bhutan	Least Concern
27	<i>Juniperus excelsa</i> subsp. <i>polycarpus</i> (K. Koch) Takht. (Syn.: <i>Juniperus polycarpus</i> K.Koch, <i>Juniperus macropoda</i> Boiss)	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Iran, Turkey, Oman, Afghanistan, Pakistan	Least Concern
28	<i>Juniperus pseudosabina</i> Fisch. et C.A. Mey	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Uzbekistan, Pakistan	Least Concern
29	<i>Juniperus recurva</i> Buch.-Ham. ex D. Don	Himachal Pradesh, Uttarakhand	Afghanistan, Bhutan, China, Myanmar, Nepal, Pakistan	Least Concern
30	<i>Juniperus semiglobosa</i> Regel	Jammu & Kashmir, Uttarakhand	Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Afghanistan, China	Least Concern
31	<i>Juniperus squamata</i> Buch.-Ham. ex D. Don	Jammu & Kashmir, Uttarakhand	Afghanistan, China, Taiwan	Least Concern
<b>Family: Taxaceae</b>				
32	<i>Taxus contorta</i> Griff.	Himachal Pradesh, Jammu & Kashmir, Uttarakhand	Afghanistan, Pakistan, China, Nepal	Endangered
33	<i>Taxus wallichiana</i> Zucc.	Uttarakhand	Bhutan, China, Indonesia, Myanmar, Nepal, Pakistan, Philippines, Vietnam	Endangered

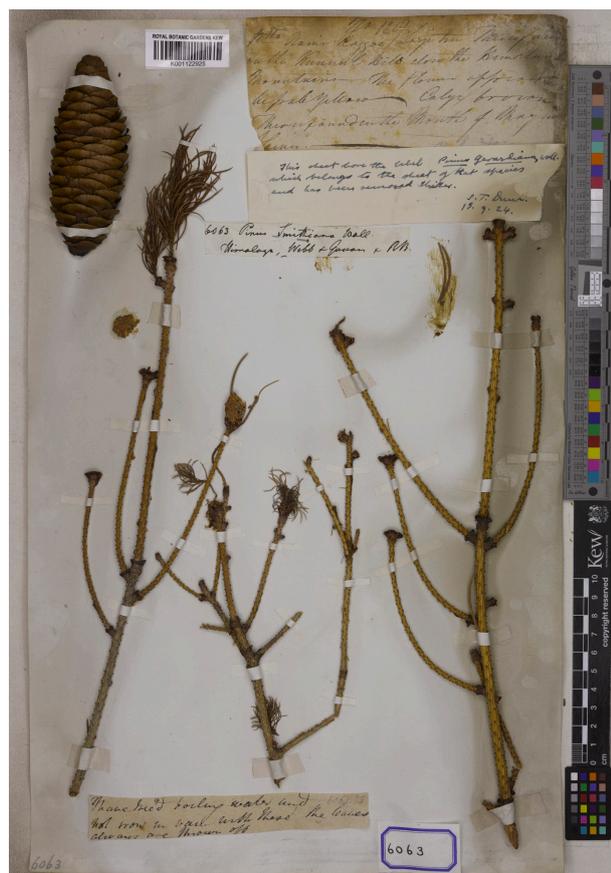
Sources: Sahní 1990; Singh & Mudgal 1997; Dogra 1999; Dar & Christensen 2003; Dar & Dar 2006; Srivastava 2006; Eckenwalder 2009; Farjon 2010, 2017; Singh & Srivastava 2013; Sharma & Singh 2015, 2016; Singh et al. 2018a, 2018b.



Image 2. Lectotype of *Pinus roxburghii*: Lambert's Tab. XXI "Pinus longifolia".



Image 3. Lectotype of *Cedrus deodara*: Lambert's Tab. "Pinus Deodara".



**Image 4.** Lectotype of *Picea smithiana* (Wall.) Boiss. (K, K001122925)  
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the epithet *smithiana* is dedicated to botanist Sir James Edward Smith (1759–1828), founder and president (during 1788–1828) of the Linnean Society, London (Stafleu & Cowan 1985).

In the protologue of *Pinus smithiana*, Wallich mentioned the locality as mountains of the Himalaya and collectors Webb, Govan and Blinkworth. Wallich's name was based on specimens "Catalogue no. 6063". Christensen & Orlova (2006) located the specimen Webb & Govan 6063 at C and designated it as lectotype. We searched for the lectotype of *Picea smithiana* at C for examination. But this lectotype was lost from C and we could not locate it at any other herbaria.

Although Christensen & Orlova (2006) did not mention about any other type specimens of *Pinus smithiana* elsewhere, collection of Webb, Govan & Blinkworth, no. 6063 exists in Herb. Wallich at K (barcode K001122925). Art. 9.11 (Turland et al. 2018) permits selection of another lectotype when previously designated lectotype is lost or destroyed. We select specimen K (original material) as lectotype of *Pinus smithiana*.

**Table 2.** Native gymnosperms of the Indian western Himalaya.

	Genera	Species	Subspecies	Variety
1	<i>Ephedra</i>	12	-	-
2	<i>Cedrus</i>	1	-	-
3	<i>Pinus</i>	3	-	-
4	<i>Picea</i>	1	-	-
5	<i>Tsuga</i>	1	-	-
6	<i>Abies</i>	2	-	1
7	<i>Cupressus</i>	1	-	-
8	<i>Juniperus</i>	7	1	1
9	<i>Taxus</i>	2	-	-
Total	9	30	1	2

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