

DNA-based Identification of *Cedrus* (*Pinaceae*) Planted in Japan

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True cedars, the genus *Cedrus*, are important ornamental trees in the world. In Japan, Himalayan cedar [*C. deodara* (Roxb. ex D.Don) G.Don] with long needles was introduced in the early Meiji era and has been widely planted, but Atlas cedar [*C. atlantica* (Endl.) G.Manetti ex Carrière] and Lebanon cedar (*C. libani* A.Rich) have rarely been planted. The identification of *C. atlantica* and *C. libani* planted in Japan is often confused because both species have shorter needles. It is reported that interspecific hybrids between *C. atlantica* and *C. libani* occur in plantation forests. This study attempted to identify trees planted as *C. atlantica* and *C. libani* in Japan based on nucleotide sequences of paternally inherited chloroplast DNA and maternally inherited mitochondria DNA with reference to a previous molecular study. As a result, eight chloroplast types and three mitochondrial types were detected from 57 trees in Japan and 11 genotypes based on their combination were distinguished. Eight genotypes were identified as *C. deodara*, *C. atlantica* or *C. libani* but the others as hybrids, *C. libani* (♀) × *C. atlantica* (♂), *C. atlantica* (♀) × *C. libani* (♂), or *C. deodara* (♀) × *C. libani* (♂). The last one is considered to be *C. ×intermedia* Sénécl.

Key words: *Cedrus atlantica*, *Cedrus deodara*, *Cedrus ×intermedia*, *Cedrus libani*, chloroplast DNA, DNA-based identification, Japan, hybrid, mitochondria DNA.

True cedars, *Cedrus* Trew, a genus of evergreen coniferous trees (subfamily *Abietoideae*, *Pinaceae*), are native to the mountains of the western Himalayan and the southern and southeastern Mediterranean regions (Farjon 1990, Vidaković 1991, Earle 2020). Recently, four species were recognized (Faby et al. 2003, Qiao et al. 2007, Earle 2020): *C. deodara* (Roxb. ex D.Don) G.Don

in the western Himalaya (Himalayan cedar), *C. atlantica* (Endl.) G.Manetti ex Carrière in the Atlas Mountains of northwestern Africa (Atlas cedar), *C. libani* A.Rich in Lebanon, Turkey, and Syria (Lebanon cedar), and *C. brevifolia* Elwes & Henry, endemic to Cyprus (Cyprus cedar). The species of *Cedrus* differ in the length of needles and male strobili, in the number of leaves in pseudo-whorls, in branch feature,

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大井・東馬哲雄^{a,b}, 小牧義輝^b, 出野貴仁^b, 石原志穂子^c:
日本国内に植栽されるヒマラヤスギ属植物 (マツ科) の
DNA 同定

マツ科ヒマラヤスギ属 *Cedrus Trew* は世界的に重要な庭園樹であり, 日本では明治初期に導入されて以降, 長針葉をもつヒマラヤスギ *C. deodara* (Roxb. ex D. Don) G. Don が幅広く植栽されてきた. 国内では短針葉をもつアトラスシーダー *C. atlantica* (Endl.) G. Manetti ex Carrière やレバノンシーダー *C. libani* A. Rich はあまり植栽されていないが, 国内植栽地ではしばしば同定が混乱している. 本研究では, 国内に植栽される短針葉をもつ樹について, DNA 同定を試みた. 本属では人工林における雑種形成が知られているため, 父性遺伝する葉緑体 DNA

と母性遺伝するミトコンドリア DNA を利用した. その結果, ヒマラヤスギ, アトラスシーダーおよびレバノンシーダーとして DNA 同定できた樹の他に, 雑種の存在が明らかになった. 雑種には, アトラスシーダーとレバノンシーダーの両方向の交雑に由来する樹の他に, ヒマラヤスギ (♀) とレバノンシーダー (♂) の雑種 (アイノコシーダー *C. ×intermedia* Sénécl) が区別できた.

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