

The multi-seeded, entire leaf taxa of *Juniperus*, section *Sabina*: inclusion of *Juniperus microsperma***Robert P. Adams**Biology Department, Baylor University, Box 97388, Waco, TX
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ABSTRACT

A recent acquisition of a specimen of *Juniperus microsperma* from Tibet provided the opportunity to include that taxon in an analysis of the multi-seeded, entire leaf-margined taxa of *Juniperus* sect. *Sabina* based on nrDNA and four cpDNA regions. *Juniperus microsperma* was found to be very distinct, but most closely related to *J. erectopatens*. Published on-line: www.phytologia.org *Phytologia* 95(1): 118-121 (Feb. 1, 2013).

KEY WORDS: Taxonomy, *Juniperus*, section *Sabina*, nrDNA, petN-psbM, trnS-trnG, trnD-trnT, trnL-trnF, *Juniperus microsperma*, *J. erectopatens*.

Adams and Schwarzbach (2012b) presented a robust analysis of the multi-seeded, entire leaf-margined taxa of *Juniperus* sect. *Sabina* based on nrDNA and four cpDNA regions, but no materials of *Juniperus microsperma* (W. C. Cheng & L. K. Fu) R. P. Adams from the type locality (Tibet) were available to the senior author for examination. However, recently, material of *Juniperus microsperma*, from near the type locality in Tibet, has become available for analysis of its leaf essential oil composition (Adams et al. 2013). The volatile leaf oil of *J. microsperma* from Song Zong, Xizang was very distinct and was dominated by sabinene (33.9%), pregeijerene B (16.3%), elemol (14.6%) and 8- α -acetoxylemol (7.1%) with moderate amounts of terpinen-4-ol, germacrene D, and α - and β -eudesmols (Adams et al. 2013).

Previously, we have presented analyses of the serrate leaf taxa of *Juniperus*, sect. *Sabina* (Adams and Schwarzbach, 2011), all taxa of *Juniperus* sect. *Juniperus* (Adams and Schwarzbach, 2012a), the multi-seeded, smooth leaf *Juniperus* sect. *Sabina* (Adams and Schwarzbach, 2012b) and the turbinate *Juniperus* (Adams and Schwarzbach, 2012c). The purpose of the current study is to re-analyze all the multi-seeded, entire leaf-margined taxa of sect. *Sabina* using the most informative nuclear (nrDNA- ITS) and cpDNA regions (petN-psbM, trnS-trnG, trnD-trnT, trnL-trnF) to include *J. microsperma* from Tibet. The pseudo-denticulate species, *J. phoenicea* (Adams, 2011) is included, as its placement is uncertain (Mao et al. 2010).

MATERIALS AND METHODS

Specimens used in this study (species, location, collection numbers): *J. microsperma*, Song Zong, Xizang (Tibet), China, *Jian-Quan Liu QTP-2011-201(lab accession 13633)*; Voucher specimens for all collections are deposited at Baylor University Herbarium (BAYLU).

One gram (fresh weight) of the foliage was placed in 20 g of activated silica gel and transported to the lab, thence stored at -20° C until the DNA was extracted by use of a Qiagen mini-plant kit (Qiagen,

Valencia, CA) as per manufacturer's instructions. *PCR amplification, sequencing and data analyses* - see Adams and Schwarzbach (2011).

RESULTS AND DISCUSSION

A total evidence Bayesian tree, using ITS and the 4 cp DNAs, shows *J. microsperma* in a clade with *J. erectopatens* (Fig. 1) with 100% posterior probability. As found by Mao et al. (2010), *J. microsperma* (and with *J. erectopatens*, in this case) is in a large clade with sabinoid junipers of both the eastern and western hemispheres. The species in Figure 1 reflect the new nomenclature proposed by Adams and Schwarzbach (2012c), as listed in Table 1.

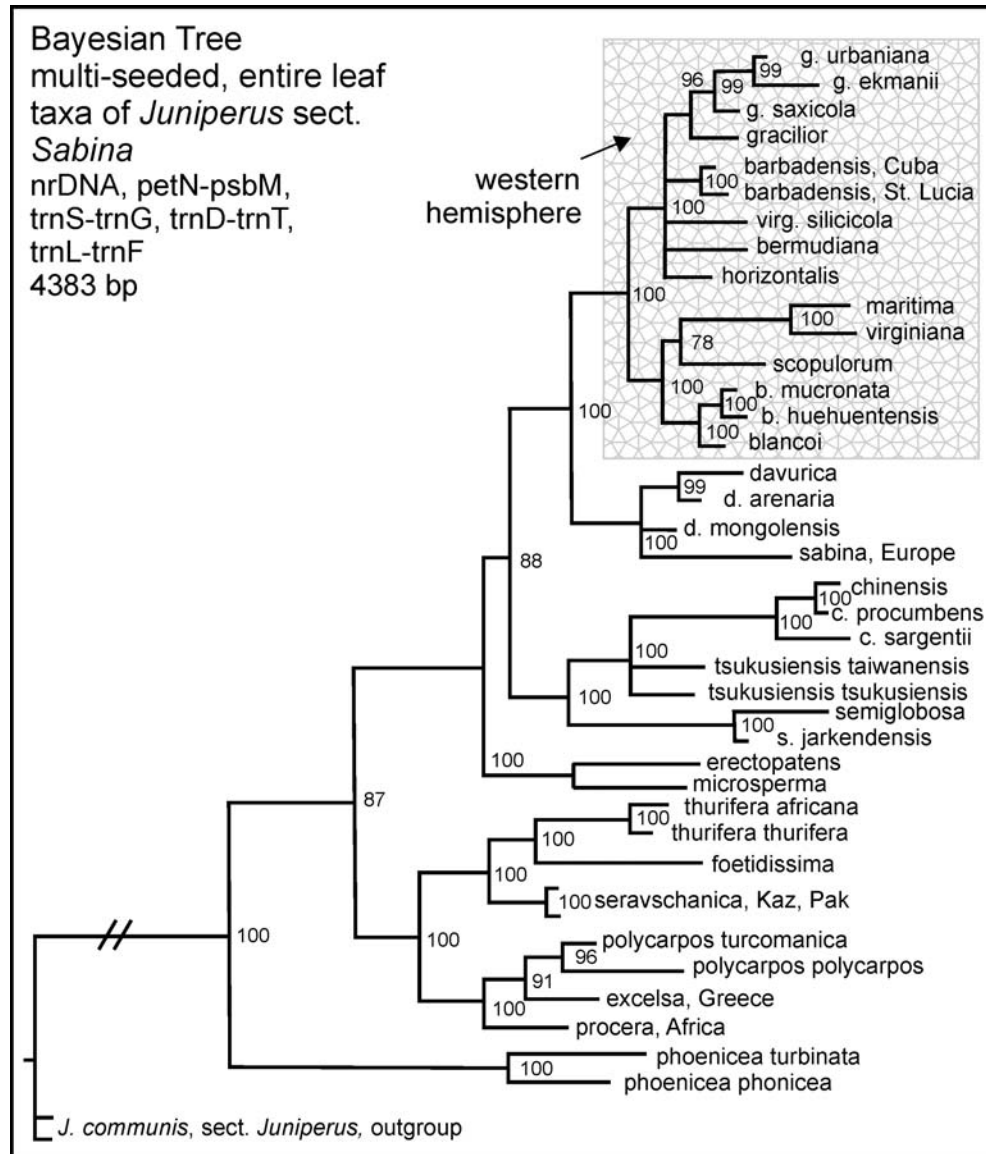


Figure 1. Bayesian tree for sect. *Sabina*, multi-seeded cone taxa. Numbers at the branch points are posterior probabilities (as percent).

Table 1. Revised nomenclature of multi-seeded, smooth leaf *Juniperus*, sect. *Sabina* (after Adams and Schwarzbach (2012c)).

North America - Caribbean / Bermuda junipers

Bermuda

J. bermudiana

Caribbean

J. barbadensis

J. gracilior

J. g. var. ekmanii

J. g. var. saxicola

J. g. var. urbaniana

North American - mainland junipers

J. blancoi

J. b. v. huehuentensis

J. b. var. mucronata

J. horizontalis

J. maritima

J. scopulorum

J. virginiana

J. v. var. silicicola

Eastern hemisphere junipers

Japan, Taiwan

J. chinensis

J. c. var. procumbens

J. c. var. sargentii

J. tsukusiensis

J. t. var. taiwanensis

China, central Asia, Mediterranean

J. chinensis

J. davurica

J. davurica var. *arenaria*

J. davurica var. *mongolensis*

J. erectopatens

J. excelsa

J. foetidissima

J. microsperma

J. phoenicea

J. phoen. v. turbinata or *J. turbinata*

J. procera

J. polycarpos

J. poly. v. turcomanica

J. sabina

J. semiglobosa

J. semi. var. jarkendensis

J. seravschanica

J. thurifera

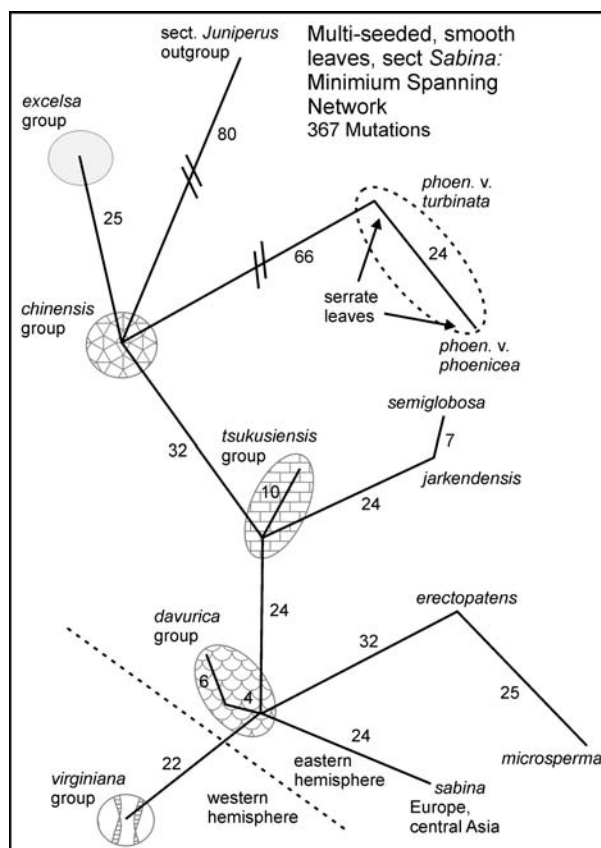
J. t. var. africana or *J. thurifera*

A minimum spanning network reveals that, although *J. microsperma* is linked to *J. erectopatens*, that linkage (25 MEs, Fig. 2, right) is very distinct and clearly in the range of other recognized species (22-32 MEs, Fig. 2, right). The second nearest link to *J. microsperma* is to *J. davurica* var. *mongolensis*, with a link of 38 MEs (not shown in Fig. 2, right).

Comparisons of the type specimen of *J. microsperma*, the new collection from Tibet (*Jian-Quan Liu QTP-2011-201*), and the putative *J. microsperma* from Sichuan (*Adams 8522*) revealed that *Adams 8522* is most likely a small-fruited variant of *J. saltuaria*. The reference to *J. microsperma* in Adams and Schwarzbach (2012c) should be changed to '*J. saltuaria*, variant'.

Juniperus microsperma is a poorly understood species and additional research is under way (Mao, personal comm.).

Figure 2. Minimum spanning network based on 367 mutations. Numbers next to lines are the number of MEs (mutational events).



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