

Paeonia beibersteiniana: is there such a species?

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The International Plant Name Index includes 173 species names for the genus *Paeonia* L. (Paeoniaceae); of these, only about 35 are currently accepted (Stern, 1946; Hong, 2010). High morphological variability, hybridization, and the presence of polyploid forms result in challenges with the species delimitation and explain existing differences in the views of authors regarding the limits of taxa. Hence species identification remains an urgent task for the study of biodiversity in *Paeonia*, while employment of molecular markers appears to be a promising approach.

Paeonia tenuifolia L. occupies an isolated position among the peony species as regards morphological characters, for its leaflets are deeply divided into linear segments. The species range includes the Balkan Peninsula, Southern and Eastern Europe, the Caucasus, and Crimea. The plant occurs in the steppe belt, occasionally en masse. Despite its isolated position in the genus, *P. tenuifolia* is known to be rather polymorphic as far as leaf segment width, extent of leaf dissection, and the overall height. This triggered descriptions of a few species: those with wider segments – *P. beibersteiniana* Rupr., *P. carthalinica* Ketzch., *P. majko* Ketzch. along with one having relatively narrower segments – *P. lithophila* Kotov. Some authors (e.g., Schipczinsky, 1937; Grossheim, 1950; Kemularia-Nathadze, 1961) considered these species to be distinct. More recently, however, *P. beibersteiniana*, *P. carthalinica*, and *P. lithophila* have been treated in the rank of forms or races of *P. tenuifolia* (e.g., Punina and Mordak, 2009; Hong and Zhou, 2003), while *P. majko* is believed to be a nothospecies formed as a result of hybridization of *P. tenuifolia* and *P. caucasica* (Schipcz.) Schipcz. (Punina *et al.*, 2010). The hybridogenic origin of *P. majko* has been further confirmed by molecular data (Punina *et al.*, 2012).

Of the *P. tenuifolia* forms mentioned above, the most widespread is var. *beibersteiniana*, which occurs around Stavropol and in the Greater and Northern Caucasus together with the typical form and is connected with the latter through a very gradual continuum of intermediate forms, differing more consistently only in its later flowering (Busch, 1903; Takhtajan, 1966).

Our goal was to determine if the observed polymorphism in morphological characters of *P. tenuifolia* correlates with the intraspecific nuclear ribosomal DNA divergence. Nucleotide ITS

sequences were obtained using the Sanger sequencing method. We sampled *P. tenuifolia* from herbarium specimens preserved in MHA, MW, and YALT and originating from different parts of the species range: Crimea, Dagestan, Stavropol Krai, as well as Ulyanovsk, Lugansk, and Volgograd oblasts.

ITS sequence analyses showed that specimens with broad leaf segments from the Crimean populations constitute hybrids between *P. tenuifolia* and *P. daurica* Andrews, while samples from other parts of the range did not exhibit any major differences between the typical and broad-leaved forms. *P. daurica* and *P. tenuifolia* co-occur in Crimea, the former being quite different from the latter in its morphology (above everything else, in having twice ternate leaves with rounded segments) as well as ecological preferences: this is a forest species. Hybridization of these two species results in plants whose habit, rather than being intermediate between the parents, is closer to *P. tenuifolia*, differing from it only in wider leaf segments. In other words, plants representing the pure broadleaf form of *P. tenuifolia* are not much different morphologically from its hybrids with *P. daurica*. Remarkably, the cultivars ‘Early Scout,’ ‘Early Bird,’ and ‘Orlenok,’ which have been produced through hybridization of *P. tenuifolia* and *P. lactiflora* Pall. (a species characterized by broad leaf segments, white flowers, and many-flowered inflorescences), also approach *P. tenuifolia* in their morphology.

The results of the study of ITS nrDNA sequences in *P. tenuifolia* justify the treatment of *P. biebersteiniana* in the rank of a form. However, morphological differences between forms of *P. tenuifolia* should not always be attributed to just phenotypic plasticity, as they may also indicate genotypic differences resulting from hybridization. Therefore, molecular data have proven to be illuminating in the course of studies in this group. Morphological similarity of interspecific hybrids to one of the parent species has highlighted a need for another round of detailed morphological studies.

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Major lineages of steppic plants inform us about the last scene in the evolution of the Eurasian steppe

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The Eurasian steppe zone is one of the largest continuous biomes on the planet: stretching from Eastern Asia to Europe, it covers about 12 million km². The Altai Mountains in