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Buddleja caryopteridifolia (Scrophulariaceae), a species to be recognized based on morphology, floral scent, and AFLP data

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Abstract

Buddleja caryopteridifolia was treated as a synonym of *B. crispa* in *Flora of China*. However, it was found that the two entities had different phenologies as well as morphology in the sympatric habitat investigated. *Buddleja crispa* flowers from mid-March to mid-May while *B. caryopteridifolia* blooms from early June to mid-September. In this study, the comprehensive comparative analyses of morphological traits, floral scent composition and amplified fragment length polymorphism (AFLP) data were utilized to determine whether *B. caryopteridifolia* should be recognized as a separate species. Among 13 morphological characters, all but calyx length were significantly different (all $p<0.05$, t-test) between the two species. Both cluster analysis and principal coordinates analysis (PCoA) of AFLP markers produced two distinct clusters for *B. crispa* and *B. caryopteridifolia*. The results of floral scent indicated several differences between *B. crispa* and *B. caryopteridifolia*. The main volatile compound of *B. crispa* was Benzaldehyde, while that of *B. caryopteridifolia* mostly consisted of trans-β-Ocimene. Therefore, all analyses supported the rehabilitation of *B. caryopteridifolia* as an independent species.

Key words: AFLP, *Buddleja*, floral scent, morphometrics, taxonomy

Introduction

The genus *Buddleja* Linnaeus (1753: 112) consists of ca. 100 species found in Asia, Africa, North and South America, and more than 20 species in China (Leeuwenberg 1979; Li & Leeuwenberg 1996; Norman 2000). *Flora Reipubulicae Popularis Sinicae* (Chang *et al.* 1992), listed 29 species in China. Leeuwenberg (1979) separated the genus into four sections: *Buddleja*, *Chillanthus* (Burchell 1822: 94) Leeuwenberg (1979: 7), *Neemda* Bentham (1846: 442), and *Nicodemia* (Tenore 1845: 88) Leeuwenberg (1979: 9). In *Flora Reipubulicae Popularis Sinicae* (Chang *et al.* 1992), the genus was divided into two subgenera: *Buddleja* and *Nicodemia* (Tenore) Leenhouts (1962: 340). *Buddleja* species usually grow as perennial shrubs and have a dense canopy of foliage and a generous display of flowers, which are arranged in long panicles. It was reported that there were intermediate characteristics existing between some species (Leeuwenberg 1979). Such circumstance would be due to several factors. First, extensive natural hybridization has probably occurred among *Buddleja* species. There are around 19 putative natural hybrids among neotropical *Buddleja* involving 24 species on the basis of morphology (Leeuwenberg 1979, Norman 2000). Secondly, polyploidy exists in over half of *Buddleja* species, especially, in the Sino-Himalayan region (Chen *et al.* 2007, Norman 2000). Thirdly, the species are widespread and have adapted to various habitats with a variety of features (Leeuwenberg 1979). So far little molecular phylogenetic work on the genus *Buddleja* has been published, and its phylogenetic framework has not yet been well established. The taxonomy of the genus has been mainly based on morphological studies, and the delimitation of *Buddleja* is still globally controversial. Consequently, the treatments of nine species—*B. adenantha* Diels (1912: 248), *B. alata* Rehder et Wilson (1913: 570), *B. caryopteridifolia* W. W. Smith (1914: 179), *B. hastata* Prain ex Marquand (1930: 197), *B. heliophila* W. W. Smith (1913: 126), *B. limitanea* W. W. Smith (1916: 86), *B. purdomii* W. W. Smith (1916: 87), *B. taliensis* W. W. Smith (1916: 87), and *B. wardii* Marquand (1929: 203) were different between *Flora Reipubulicae Popularis Sinicae* (Chang *et al.* 1992) and *Flora of China* (Li & Leeuwenberg 1996).

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