



The diversity in holy basil (*Ocimum tenuiflorum*) germplasm from India

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ABSTRACT

A total of one hundred and nine accessions of cultivated holy basil (*Ocimum tenuiflorum* L.) germplasm, representing different phyto-geographical regions of India were investigated for morphological characterization. Data were recorded on 32 descriptor traits (both qualitative and quantitative) using the minimal descriptors developed by the ICAR-National Bureau of Plant Genetic Resources, with minor modifications. Analysis of the data was carried out using Ward's Minimum Variance method and categorized into seven major clusters. PCA analysis revealed that the first six principal components (Eigen value greater than 1), are contributing 72.33% of the total variance which were mostly influenced by mature leaf length, leaf width, leaf petiole length, plant height, seed length, seed width, days to flower initiation, essential oil percentage, seed length/width ratio, leaf length/width ratio, number of primary branches and fresh herbage yield. All the accessions showed high degree of variation, indicating rich morphological diversity within the population.

Key words: Accessions, Diversity, India, Minimal descriptors, Morphological characterization, Principal components

Ocimum tenuiflorum L. (syn. *O. sanctum* L.), commonly known as “Tulsi” (in Hindi) and “Holy basil” (in English), is considered as the most sacred herb among the Indians. The genus *Ocimum* (family: Lamiaceae) includes about 50-150 species from the tropical regions of Asia, Africa, Central and South America (Bailey 1924; Darrah 1980; Gupta *et al.* 2002 and Devi 2001). In India, it is represented mainly by nine species (*Ocimum tenuiflorum* L., *O. basilicum* L., *O. gratissimum* L., *O. kilimandscharicum*, *O. micranthum* L., *O. campechianum* L., *O. americanum* L., *O. minimum* L. and *O. citriodorum* L.), of which last three are exotic but cultivated from long time (Willis 1919). The chromosome number of *O. tenuiflorum* is reported $2n = 36$, which is the lowest among the members of *Ocimum* genus (Carovic-Stanko 2010).

Holy basil is a native of India and has a wide range of distribution covering the entire Indian sub-continent ascending to 1800m in the Himalayas and as far as in the Andaman Nicobar Islands (Kirtikar and Basu 1984). In ancient Indian scriptures, it is valued as an important medicinal plant (Singh *et al.* 2002) and grown in temples

and courtyards for religious and medicinal purposes in India for over 3000 years; while the Chinese people use it in the natural herbal preparations as medicines (Sirkar 1989; Monga 2011). Globally it is distributed in Asia, Australia, West Africa and some of the Arab countries (Pistrick *et al.* 2001). Based on phylogenetic studies, morphological characterization and the study of variation patterns in different accessions of *Ocimum* are relevant even in the present era of molecular systematics (Scotland *et al.* 2003; Smith and Turner 2005; Lee 2006; Bruce *et al.* 2007). Evidence from phytogeography and molecular studies have indicated the north-central region in India as the center of origin (Bast *et al.* 2014; Mishra *et al.* 2014). Based on the leaf characters, mainly of two morphotypes cultivated in India with light green-leaves (Rama tulsi) and purple (Shyamatulsi) have been recognized for economic value (Kothari *et al.* 2005; Malav *et al.* 2015; Saran *et al.* 2017). Many of the *Ocimum* spp. including *O. tenuiflorum* are economically cultivated due to their high valued essential oils (Janmoni and Mohamed 2013). It is widely used in traditional, Ayurvedic, Greek, Roman and Unani systems of medicine for the treatment of various diseases (Vishwabhan 2011) due to its ethano-pharmacological properties (Joseph and Vrundha 2013; Gupta *et al.* 2002; Pattanayak *et al.* 2010; Pingale *et al.* 2012).

Despite the ancient history of cultivation of the holy basil in the Indian sub-continent and availability of rich diversity, meager efforts have been made for characterizing

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