Abstract

The genus *Pteronia* is an example of a recently radiated and taxonomically complicated genus of the family Asteraceae (sunflower family) with endemic connection to southern Africa. Most of the species are associated with the Cape region, an area characterised by a Mediterranean type of climate, which is comparable in species richness to the flora of tropical areas, especially on smaller geographical scales. The factors behind the high diversity of the Cape are environmental heterogeneity, climatic stability (low extinction and accumulation of species) and regular disturbance by fire. Polyploidization, one of the main mechanisms of plant evolution, has been an overlooked and denied phenomenon in the Cape for a long time. Individual cases of polyploidy are being revealed, but the causes of their emergence and extent of their occurrence are unknown. The presented work focuses on polyploidization in the genus *Pteronia* from the perspective of two species with different ecological valence. On the widespread to invasive species *Pteronia incana* and, on the contrary, on the endemic species of succulent karoo and deserts, *Pteronia glabrata*.

Using flow cytometry, genome size variation was investigated and ploidy levels determined. The obtained cytometric data were used to compare climatic, topographic, pedological and vegetation data and the distribution of particular cytotypes. The use of the molecular method of restriction-site associated DNA sequencing (RADseq) allowed the investigation of genetic structure and the determination of relationships among populations.

Flow cytometry revealed the presence of polyploids and the associated heteroploid variation in genome size. Two probable ploidy levels were found for *P. incana* (2x = 9.74 ± 0.33 pg; polyploids = 14.53 ± 0.70 pg), and three ploidy levels for *P. glabrata* (2x = 9.49 ± 0.27 pg; 4x = 17.83 ± 0.21 pg; 8x = 31.33 ± 0.30 pg).

The genetic data show that *P. incana* has three major diploid lineages approximately corresponding to the different biomes (Succulent Karoo, Fynbos, Albany Thicket), at the overlap of which a polyploid cluster occurs. In contrast, *P. glabrata* contains two genetic groups defined by geographical location, distinguishing a southern diploid and a northern diploid-polyploid cluster. From environmental data of both species, there is a noticeable tendency for higher ploidy levels to occur in the more arid and warmer conditions of the Succulent Karoo, where polyploidization probably favours survival in more extreme environments, or possibly, polyploids are less able to accept the highly competitive environment of the fynbos.

Key words: Asteraceae, genome size, Greater Cape Floristic Region (GCFR), polyploidization, *Pteronia*, RADseq