**Morphological evaluation and essential oil composition of *Achillea millefolium* from Eest Azerbaijan province of Iran**

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**Abstract**

*Achillea millefolium* L. is a well-known species among the members of Achillea genus (Asteraceae) which consists of about 110-130 species, from which nineteen species grow naturally in Iran of which seven species are endemic. In present study, seven populations of *Achillea millefolium,* growing wild in East Azerbaijan province in northwest of Iran, including Zonoz, Basmenj, Pirbala, Bonab, Shabestar, Kondlaj and Jolfa were collected in May and June 2011. The evaluation of vegetative and reproductive characters and morphological variation in 35 genotypes of seven populations was carried out to determine superior characters for future breeding programs and medicinal purposes. Chemical composition of their essential oils was also investigated for their aerial parts during the flowering period. The essential oils were obtained by hydrodistillation method and analyzed by combination of GC-FID and GC-MS methods. Results were analyzed using cluster analysis with SPSS software. Populations were clustered based on vegetative and reproductive characters and the amount of essential oil. The results of simple correlation analysis showed the existence of significant, positive and negative correlations among some important characters. The results showed that mean essential oil yield was calculated to be 0.1%, 0.4%,0.1%,0.2%, 0.1%, 0.25% and 0.4% (w/w) for Zonoz, Basmenj, Pirbala, Bonab, Shabestar, Kondlaj and Jolfa, respectively. Overall, 35, 38, 48, 43, 45, 37 and 42 compounds were identified from Zonoz, Basmenj, Pirbala, Bonab, Shabestar, Kondlaj and Jolfa, respectively. According to the factor analysis, flowering stem length, internode length and leaf width constituted the main factors. The populations of *Achillea millefolium* L. were separated into four groups by cluster analysis using Ward method. The most similar populations were Pirbala, Kondlaj and Jolfa, while Shabestar and Zonoz were separated from other populations. Also populations of Bonab and Basmenj were clustered as a separate group. In conclusion, in this study from all populations, Basmanj and Jolfa populations due to higher yield of essential oil as well as higher adaptability to region climatic conditions are recommended for further physiological and breeding studies, while regarding extraction of 1,8-cineol and δ-cadinol, Basmenj and Zonoz were the two suitable regions.

**Keywords:** *Achillea millefolium* L., population, morphological variation, essential oil composition