Macedonian pharmaceutical bulletin, 68 (Suppl 2) 59 - 60 (2022)
Online ISSN 1857 - 8969
DOI: 10.33320/maced.pharm.bull.2022.68.04.024
Short communication

Morphological diversity of natural Dalmatian pyrethrum populations

Kim Klarin[1], Filip Varga[1,2], Ana Nimac[2], Zlatko Šatović[1,2], Martina Grdiša[*1,2]

[1]*University of Zagreb Faculty of Agriculture, Department of Seed Science and Technology, Svetošimunska cesta 25, 10000, Zagreb, Croatia*
[2]*Centre of Excellence for Biodiversity and Molecular Plant Breeding, Svetošimunska cesta 25, 10000, Zagreb, Croatia*

Introduction

Dalmatian pyrethrum (*Tanacetum cinerariifolium* (Trevir.) Sch. Bip) is a plant species from Asteraceae family endemic to the coastal and peri-coastal regions of Croatia, Bosnia and Herzegovina, Montenegro and Albania (Euro+Med, 2006). It grows as an herbaceous shrub with a characteristic inflorescence at the top of a stiff and erect stem consisting of white, lance-shaped, petal-like flowers at the edges and yellow disk flowers in the center (Brewer, 1968). Dalmatian pyrethrum produces pyrethrin, a mixture of six chemical compounds found primarily in the flower heads, which has insecticidal and repellent properties (Bhat, 1995).

While the biochemical diversity of the species has been the subject of numerous studies focusing on both natural populations (Grdiša et al., 2013) and commercial varieties (Suraweera et al., 2020), few studies have reported on the morphological diversity of natural Dalmatian pyrethrum populations (Ban et al., 2019).

The aim of this study was to morphologically characterize the natural Dalmatian pyrethrum populations based on several traits potentially related to pyrethrin production.

Materials and methods

Dalmatian pyrethrum plants grown from seeds collected at six different locations along the geographic range of the species were used to establish a field experiment at the Faculty of Agriculture, University of Zagreb. Each population was represented by 10 individuals.

Measurements of morphological traits were performed in the second year of the experiment (May - June 2020). A total of six morphological traits were evaluated; shrub diameter, plant height, and number of flower heads per plant were measured in the field, while total flower area (TFA), ray floret area (RFA), and disc floret area (DFA) were measured using the CropReporter® multispectral platform (PhenoVation, Wageningen, The Netherlands) under controlled conditions.

The relationships between the measured traits were examined using the Pearson correlation coefficient. In addition, analysis of variance was performed to test for differences between populations. *Post hoc* comparisons of the means of the populations were performed using the Tukey-Kramer test. All analyses were performed using SAS statistical software.

Results and discussion

Great variability was observed in all six morphological traits of Dalmatian pyrethrum studied. Shrub diameter ranged from 35.56 cm (Vrbnik, Krk) to 106.68 cm (Srđ) with an average of 67.95 cm across all samples, slightly higher than reported by Ardelean et al. (2011) and Ban et al. (2019). The average number of flower heads per plant ranged from 126 (Korčula) to 258 (Trebinje), similar to previous studies (Ardelean et al., 2011; Ban et al., 2019). Analysis of variance revealed no significant differences between populations with respect to these two traits.

Plant height varied from 35.56 cm (Žman) to 86.42 cm (Vrbnik) with an average of 52.33 cm across all samples. These results are somewhat consistent with previous

*mgrdisa@agr.hr

studies by Ardelean et al. (2011), but slightly lower than those reported by Ban et al. (2019).

Total flower area ranged from 214.4 mm^2 (Žman) to 1197.7 mm^2 (Vrbnik) with an average of 730.4 mm^2. Disc floret area ranged from 50 mm^2 (Žman) to 159 mm^2 (Trebinje) with an average of 91.4 mm^2. Ray floret area ranged from 164.7 mm^2 (Žman) to 1054.4 mm^2 (Vrbnik) with an average of 639 mm^2.

Analysis of variance revealed significant differences among the analyzed populations based on four morphological traits. The Žman and Lovćen populations were characterized by smaller disc florets than the other populations. In addition, the Žman population was characterized by both smaller ray florets and lower plant height, while the Vrbnik population was characterized by the tallest plants and the largest flowers.

A statistically significant strong positive correlation was found between ray florets and total flower area, as well as between shrub diameter and the number of flower heads per plant (r = 0.99 and r = 0.82, respectively).

Conclusion

High morphological variability was found between six Dalmatian pyrethrum populations based on six traits. In particular, the Žman population, in contrast to the Vrbnik population, was characterized by small flower size and lower plant height. The next step is to determine a possible relationship between these morphological traits and pyrethrin content, which could be used in further breeding programs to improve the basis for commercial varieties.

Acknowledgements

This research was funded by project KK.01.1.1.01.0005 Biodiversity and Molecular Plant Breeding, Centre of Excellence for Biodiversity and Molecular Plant Breeding (CoE CroP-BioDiv), Zagreb, Croatia.

References

Ardelean, A.E., Morar, G., Matei, C.F., 2011. Aspects regarding pyrethrum plant biology in its second year of vegetation. Agricultura – Ştiinţă şi practică 3-4(79-80), 34-37.

Ban, D., Sladonja, B., Dudaš, S., Oplanić, M., Perković, J., Goreta Ban, S., 2019. Production potential and economic viability of Croatian pyrethrum ecotypes. J. Cent. Eur. Agric. 20, 598–608. https://doi.org/10.5513/JCEA01/20.2.2176.

Bhat, B.K., 1995. Breeding Methodologies Applicable to Pyrethrum, in: Casida, J.E., Quistad, G.B. (Eds.), Pyrethrum Flowers: Production, Chemistry, Toxicology, and Uses. Oxford University Press, New York, NY, USA, pp. 67–94.

Brewer J.G., 1968. Flowering and seed setting in pyrethrum (Chrysanthemum cinerariaefolium Vis.). Pyrethrum Post 9(4), 18–21.

Euro+Med, 2006. Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. Available at: https://www.emplantbase.org/home.html [Accessed 8 May 2020].

Grdiša, M., Babić, S., Periša, M., Carović-Stanko, K., Kolak, I., Liber, Z., Jug-Dujaković, M., Šatović, Z., 2013. Chemical diversity of the natural populations of Dalmatian Pyrethrum (*Tanacetum cinerariifolium* /Trevir./ Sch.Bip.) in Croatia. Chem Biodivers 10 (3), 460–472. https://doi.org/10.1002/cbdv.201200015.

Suraweera, D. D., Groom, T., Nicolas, M. E., 2017. Pattern of pyrethrin accumulation, achene and trichome development in relation to pattern of flower development in pyrethrum, in: Matsuda, K., Morimoto, M., Ihara, M. (Eds.), ISHS Acta Horticulturae 1169: II International Symposium on Pyrethrum. ISHS, Kyoto, Japan, pp. 93-100.