

I. Abstract

The aim of the research was to characterize the variability of a new collection of narrow-leaved lupin RILs lines (*L. angustifolius* L.) in terms of morphological traits, selected yield structure elements, and seed quality parameters (protein and fat content). In this study, 108 lines from the private collection of the Department of Plant Breeding and Seed Science were used. The lines were obtained by crossing the Lae-1 line with 'Emir', which constituted a reverse crossing scheme compared to the existing mapping population "ExL." The experiment was conducted for three growing seasons at the Stacja Howodli Roślin Smolice, Grupa IHAR, Oddział Przebędowo (Smolice Plant Breeding Station, IHAR Group, Przebędowo Branch). The obtained results were statistically analysed, and for each trait, mean, minimum, and maximum values, as well as the coefficient of variation, were calculated. Histograms of distribution were prepared, and furthermore, the correlation coefficient between the examined traits was calculated. The principal component analysis (PCA) method was also used in the study to extract the properties that contribute the most to the variability. The calculated correlation coefficients indicate significant relationships between traits such as inflorescence length and the number of whorls, inflorescence length and the number of formed pods, as well as between the height of the main stem and the overall height of the plant. The examined objects exhibited a high variability in the number of pods on the main stem (50,5%), the number of formed pods on the main stem (48,1%), and the number of formed pods on the lateral stem (49,1%). On the other hand, slight variability was observed in protein content (4,8%), fat content (5,3%), height of the main stem (4,5%), and overall plant height (4,8%). Among all the examined RILs lines derived from the Lae-1 x 'Emir' population, the following lines were selected: 332, 268, 324 and 333. From a breeding perspective, these lines may be useful due to their high protein and fat content. The data collected from this study will serve for further selection and, in the future, facilitate the creation of a new mapping population.

The aim of the second part of the study was to investigate the possibility of obtaining haploid plants through androgenesis and to utilize foreign pollen - *Lupinus luteus* L. - for the method of distant crossing. The final aspect involved obtaining several generations within one year using the Single Seed Descent (SSD) technique. Four narrow-leaved lupin varieties ('Emir', 'Graf', 'Karo' and Lae-1) were used for all experiments. Before initiating androgenesis induction, the developmental stage of randomly collected flower buds was assessed. B5 and B5 + 0.5 mg·dm⁻¹ BA media were used for microspore development induction. Observations were made every 7 days for four weeks. Based on the analysis of the research results, it was found that genotype, timing, and media significantly influenced microspore development.

Moreover, the highest number of multicellular structures was observed in 'Graf' on B5 and B5 + 0.5 mg·dm⁻¹ BA media, as well as in 'Karo' on B5 medium.

Three genotypes of yellow lupin (500, 501 and Przebędowo) were used as pollen donors for plant crossing. The obtained embryos were cultured on three different growth media (B5, NLN, ML6). Based on the collected results from the observation of embryo development, a three-factor analysis of variance was conducted. Both 'Emir' and 'Karo' exhibited the highest number of embryos with visible changes 30 days after initiating the culture.

For the SSD technique, pods were collected at two time points (14 and 28 days) and then cultured on B5 and B5 + 2.0 mg·dm⁻¹ BA + 0.1 mg·dm⁻¹ IBA media. Zygotically derived embryos collected 28 days after flowering underwent regeneration and subsequently developed into plants. The applied SSD method allowed for obtaining three generations of narrow-leafed lupin within one year.