

AMARANTHUS AS A SOURCE OF POLYPHENOLIC COMPOUNDS AND FLAVONOIDS FOR USE IN MEDICINE

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Plants are a source of secondary metabolites. Therefore products based on medicinal plant raw materials are often used as the main or auxiliary medicinal product for the treatment of a number of diseases. *Althaea officinalis* root, *Arnica montana* in combination with *Atropa belladonna*, *Matricaria chamomilla*, *Echinacea purpurea*, *Aconitum napellus*, *Atropa belladonna* extract, grape seed extract, extract of *Zingiber officinale* and *Alpinia officinarum*, a combination of medicinal herbs (*Calamagrostis epigejos* and *Deschampsia cespitosa*), and *Plantago major* leaf extract are included in the Ukrainian National List of Basic Medicines and Medical Products [1]. Phytopreparations have a complex effect, high bioavailability, and give fewer side effects when used compared to synthetic drugs.

Currently, the creation of new natural products with a wound healing effect is topical. Plants that contain polyphenol compounds, flavonoids, alkaloids, carotenoids, saponins, steroids, terpenoids have anti-inflammatory, antimicrobial, antioxidant, collagen-stimulating effects and can also affect the wound healing process using various mechanisms. About 62 families and 109 genera are used in traditional medicine for healing and treating wounds. Some plants with wound healing activity are presented in Figure [2].

Amaranthus is a genus of herbaceous and annual plants, species of which are distributed throughout the world. *Amaranthus* is a highly nutritious multi-purpose plant, used as a cereal (superfood), medicinal, fodder, fuel and ornamental plant. *Amaranthus* has antiallergic, antitumor, antihypertensive, antioxidant, hemostatic, hepatoprotective, cardioprotective, immunostimulating, wound healing properties [3].

Aim. To study the *Amaranthus* seeds of the “Lera” and “Ultra” varieties ethanolic extracts, *Amaranthus retroflexus* leaf ethanolic extract for the content of general phenols and flavonoids for the purpose of further use in medicine.

Methods. Extracts were obtained by infusing for 7 days in 70% and 80% ethanol. Quantitative determination of polyphenols was conducted by the spectrophotometric method with the Folin-Checolteau reagent, the result is expressed in the form of gallic acid equivalent (HA) [4]. Quantitative determination of flavonoids was conducted by the spectrophotometric method, using aluminum chloride, the result was expressed in the form of rutin equivalent [5].

Results and Discussion. As a result of the conducted research, ethanolic extracts of *Amaranthus retroflexus* leaf were obtained in 70% ethanol (EAL70), *Amaranthus* seeds of the “Lera” variety (ESL70, ESL80), *Amaranthus* seeds of the “Ultra” variety (ESU70, ESU80). It was determined that EAL70 contains a significant amount of total polyphenolic compounds. More polyphenolic compounds were detected in ESL than in ESU. The concentration of the extractant did not significantly affect the amount of total phenolic compounds and flavonoids. The amount of total polyphenolic compounds in ESL80 is almost twice as large as in ESL70 (Table 1). Determination of correspondence of optical density and concentration of polyphenolic compounds was conducted according to the calibration curve of gallic acid.

The content of flavonoids in terms of rutin was calculated according to the formula. A small amount of flavonoids was detected in the extracts. The largest amount of flavonoids were found in *Amaranthus retroflexus* leaf ethanolic extract (Table 2).

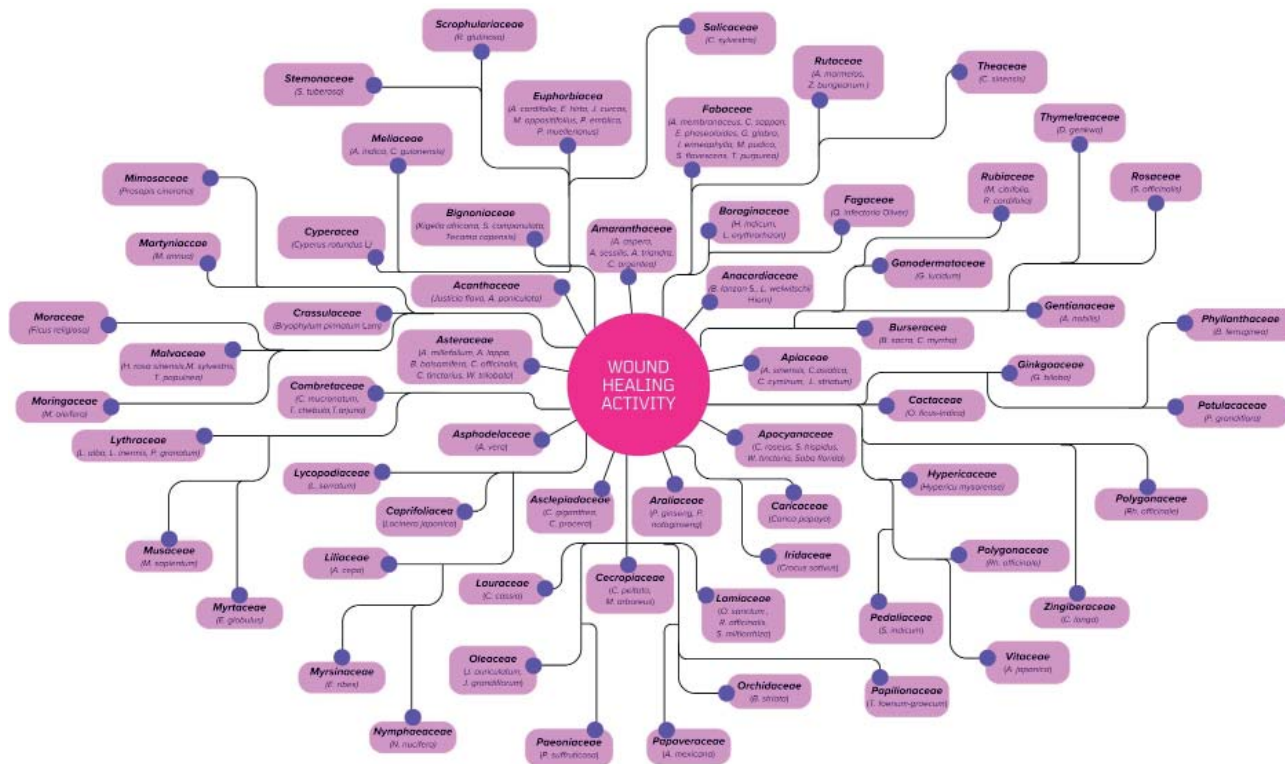


Fig. 1. Plants with wound-healing activity

Table 1. Sum of total phenolic compounds in terms of gallic acid equivalent in the studied objects

The studied extracts		The average value of the optical density	Concentration of phenolic compounds, mg/ml
<i>Amaranthus</i> seeds of the “Lera” variety ethanolic extract	ESL70	0.0272	0.04
	ESL80	0.0597	0.07
<i>Amaranthus</i> seeds of the “Ultra” variety ethanolic extract	ESU70	0.0193	0.031
	ESU80	0.0170	0.029
<i>Amaranthus retroflexus</i> leaf ethanolic extract	EAL70	0.2264	0.228

Table 2. Sum of flavonoids in terms of rutin equivalent in the studied objects

The studied extracts		Concentration of flavonoids, mg/ml
<i>Amaranthus</i> seeds of the “Lera” variety ethanolic extract	ESL70	1.55×10^{-5}
	ESL80	1.55×10^{-5}
<i>Amaranthus</i> seeds of the “Ultra” variety ethanolic extract	ESU70	0.84×10^{-5}
	ESU80	0.70×10^{-5}
<i>Amaranthus retroflexus</i> leaf ethanolic extract	EAL70	2.1×10^{-4}

Conclusions. Thus, *Amaranthus retroflexus* leaf ethanolic extract contained the largest number of studied secondary metabolites, *Amaranthus* seeds of the “Lera” variety ethanolic extract contains more polyphenolic compounds than *Amaranthus* seeds of the “Ultra” variety ethanolic extract. It was found that when using 80% alcohol as an extractant, there are more polyphenols in the *Amaranthus* seeds of the “Lera” variety ethanolic extract, and the concentration of the extractant did not affect the content of flavonoids. It was found that the *Amaranthus* seeds of the “Ultra” variety ethanolic extract (70% ethanol) contained a larger amount of flavonoids. In the future, it is worth investigating the *Amaranthus retroflexus* leaf ethanolic extract for its wound healing effect.

Key words: *Amaranthus*, phenols, flavonoids, wound healing activity.

Authors’ Contribution. K.I. Hutsko — setting the goal, obtaining extracts, carrying out experiments on the determination of common polyphenolic compounds and flavonoids, analyzing the results, writing theses. Petrina R.O. — search for methodology, analysis of results, writing theses.

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