



Bioactive compounds of *Carlina acanthifolia* L. roots obtained by fractional extraction and their 3D fluorescence spectra

*N. Petkova*¹, *I. Ivanov*¹, *E. Saralieva*¹, *D. Georgieva*², *K. Nikolova*², *T. Eftimov*^{3,4},
*G. Gentscheva*⁵, *L. Vladimirova – Mihaleva*⁶

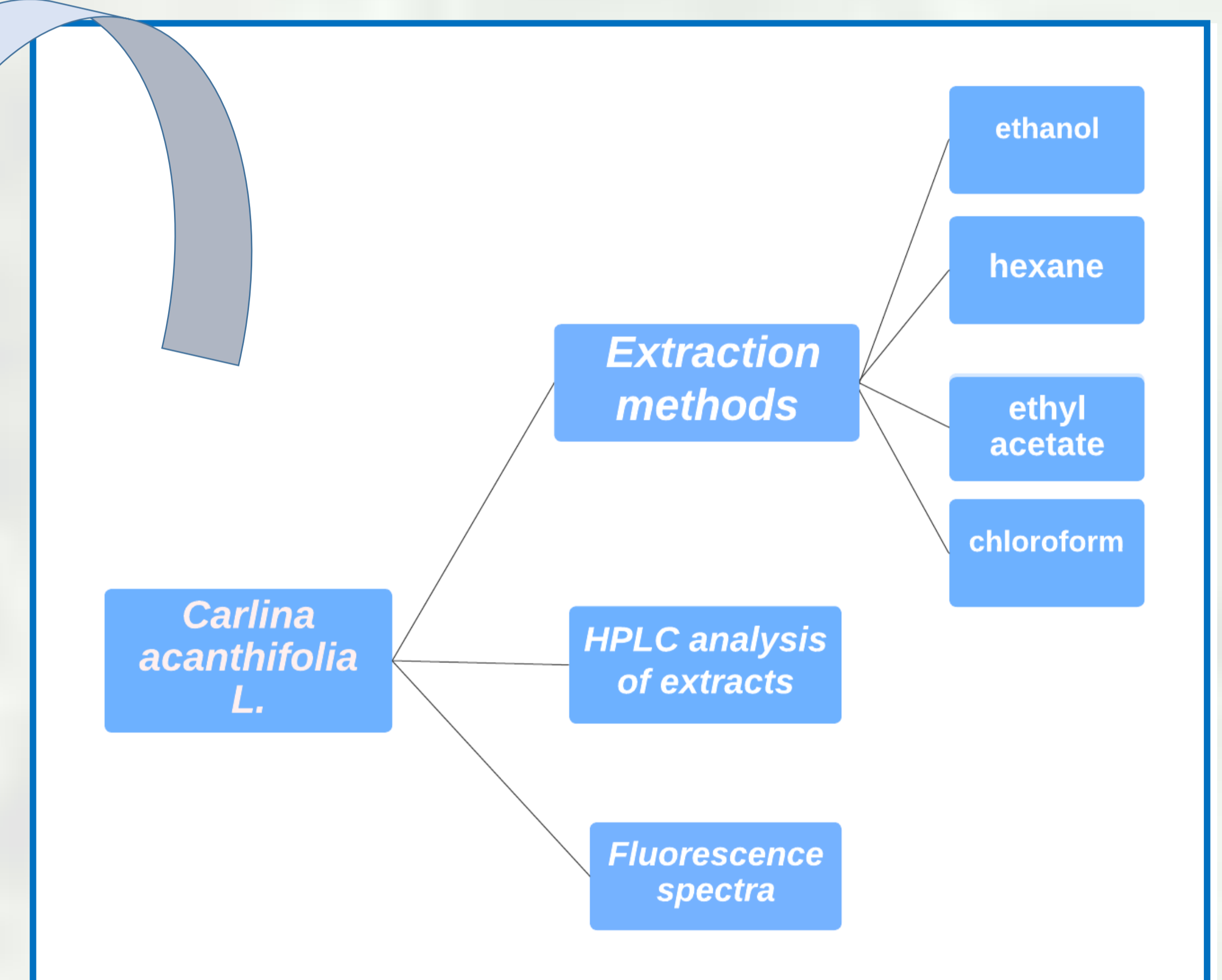
Carlina acanthifolia L. is widely used in traditional medicine due to the presence of essential oil (1-2%) in the outer part of the roots of the plant. It is mainly used for its choleric and anti-inflammatory properties, as well as for the treatment of gastrointestinal problems. We obtain the fractions by sequential extraction with different solvents (hexane, chloroform, ethyl acetate, ethanol, and water) from carline thistles (*Carlina acanthifolia* All.) roots, evaluate the phytochemical compounds and for the first time, we report here the 3D fluorescence excitation-emission spectra. The highest yield (11.02 %) was obtained by using 95% ethanol. The highest extractive content of total phenols, flavonoids, and derivatives of economic acids was found in the ethyl acetate fraction. These fractions demonstrated the highest antioxidant potential and the fluorescent properties of the roots are related to them.

THE AIM

The present study aims to examine the relationship between the chemical composition of water-ethanol extracts of roots of *Carlina acanthifolia* All and the fluorescence spectra obtained by irradiating the drug with wavelengths of light in the ultraviolet and visible range.

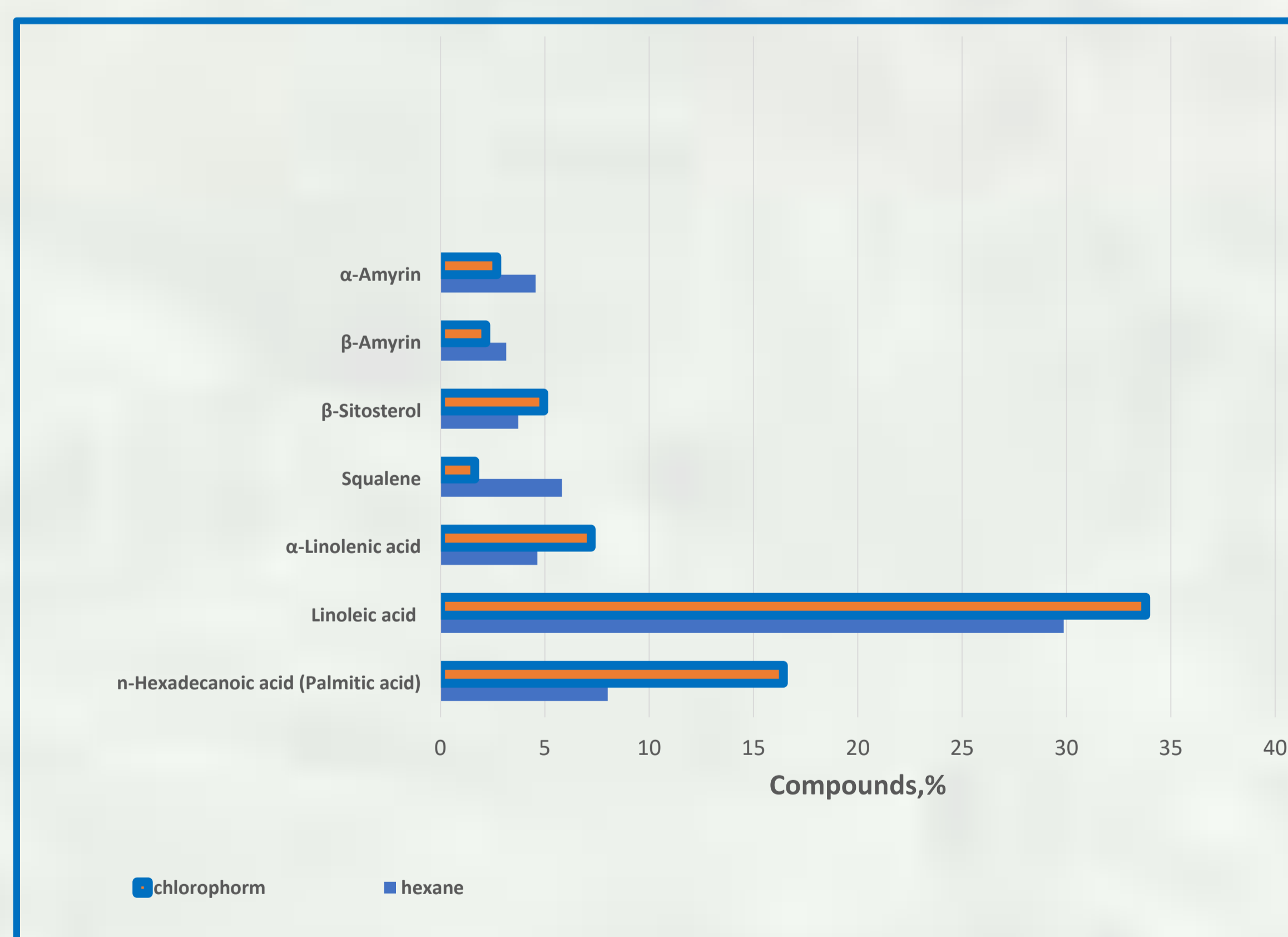


USED METHODS



RESULTS AND DISCUSSION

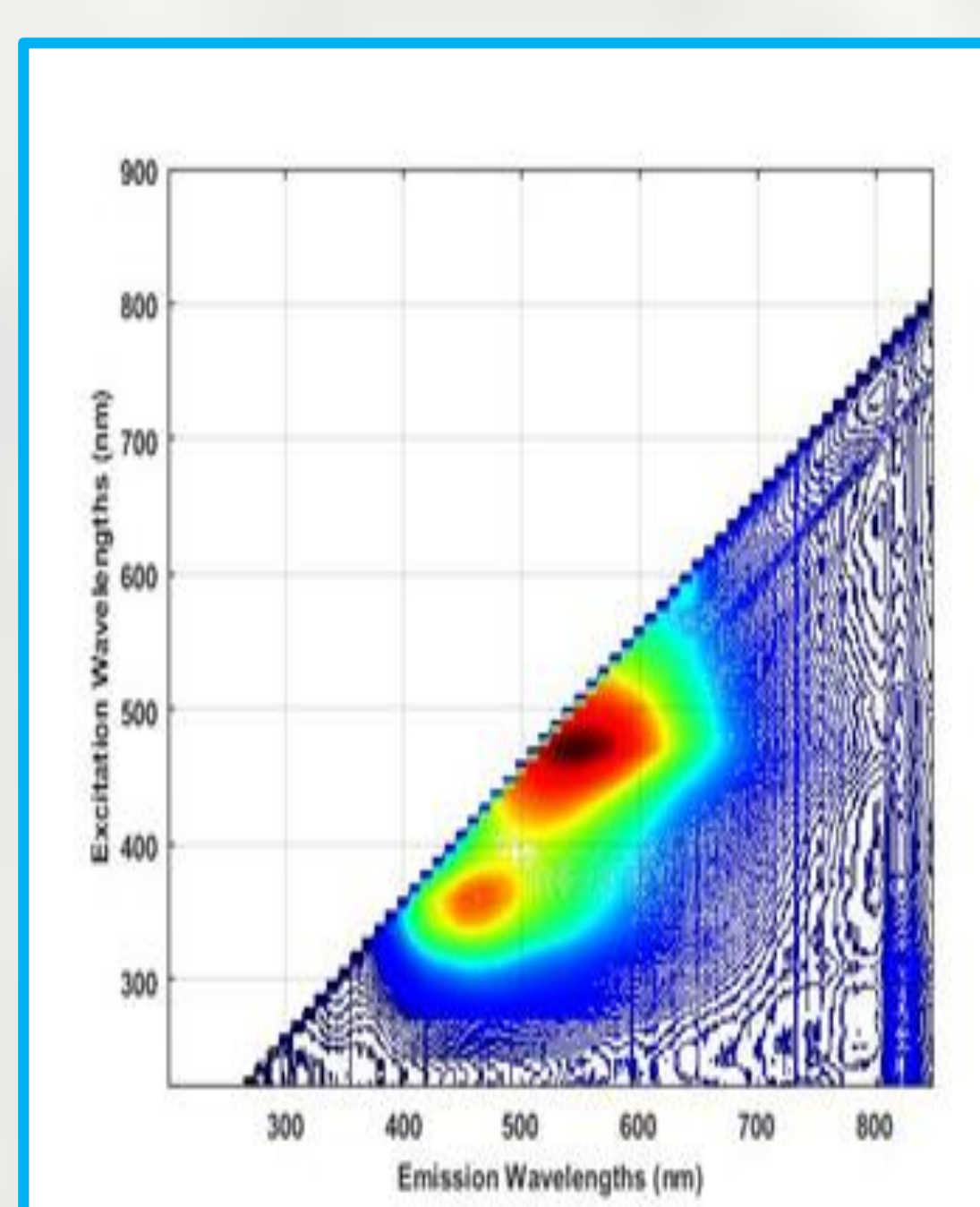
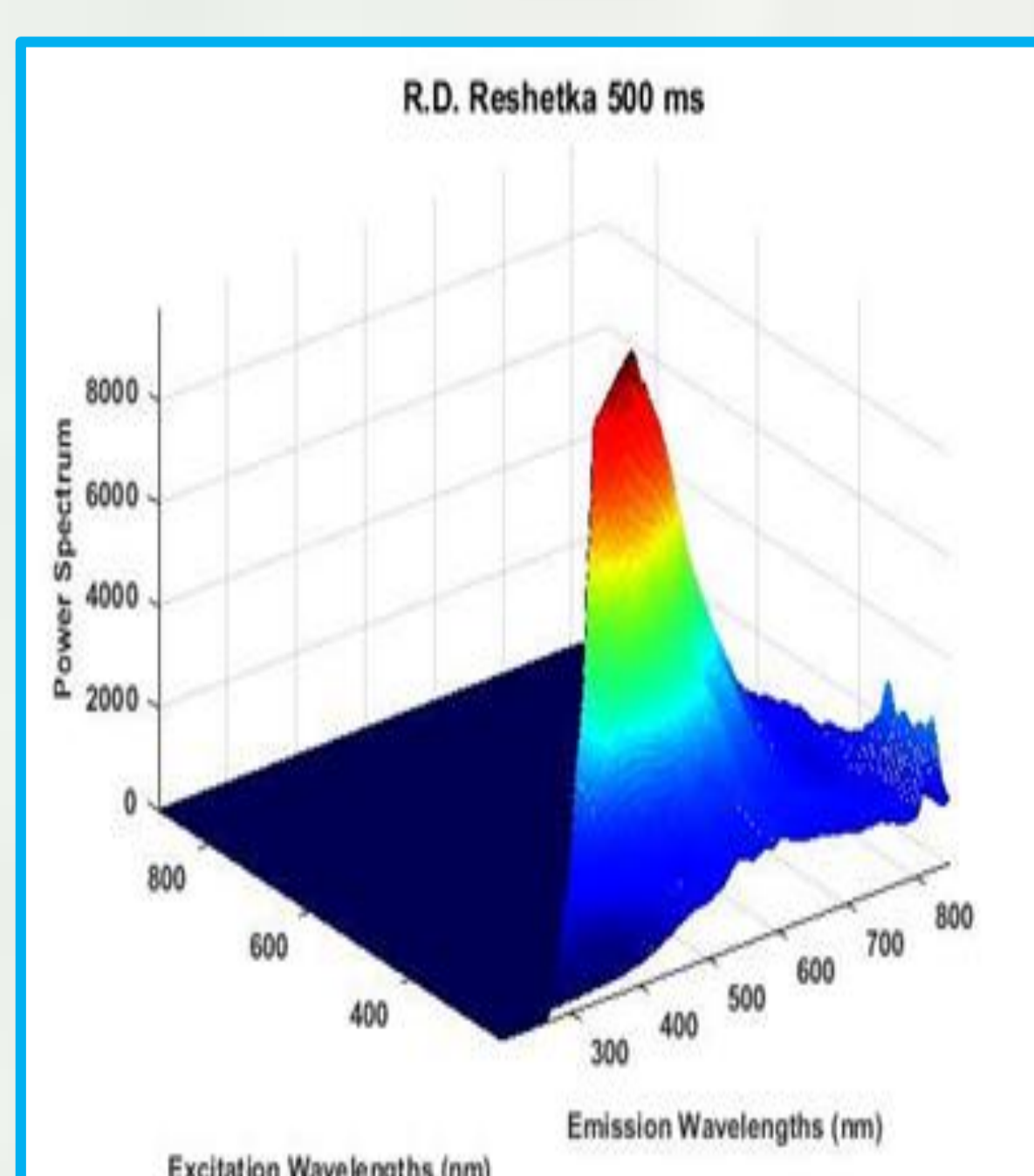
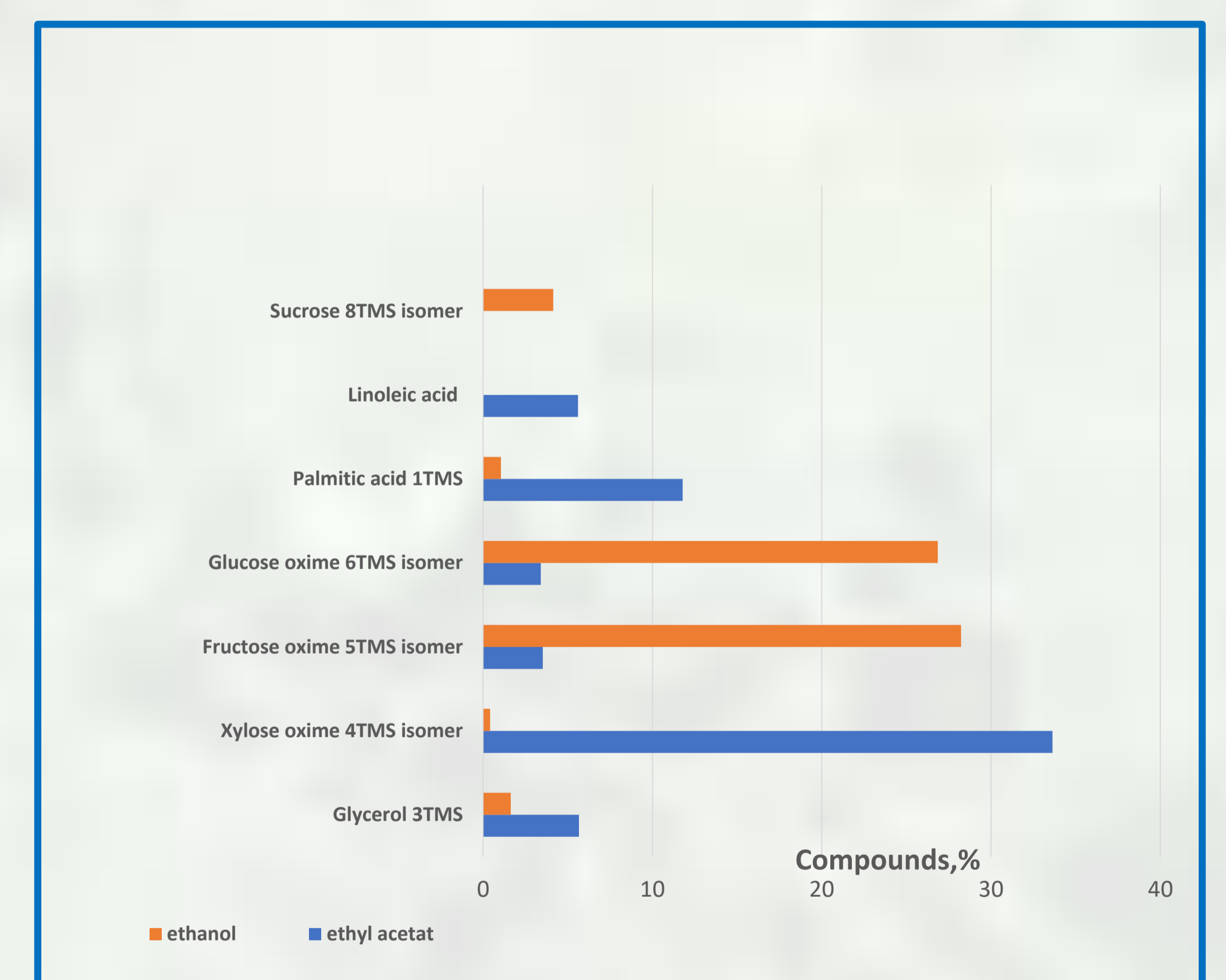
Carlina acanthifolia All. is a plant with little researched biological potential, and the data regarding the chemical composition of the root is scarce. There is data on the chemical potential of the green parts of the plant. However, the essential oil of the root is better studied. Volatile components and carline oxide predominate in it.



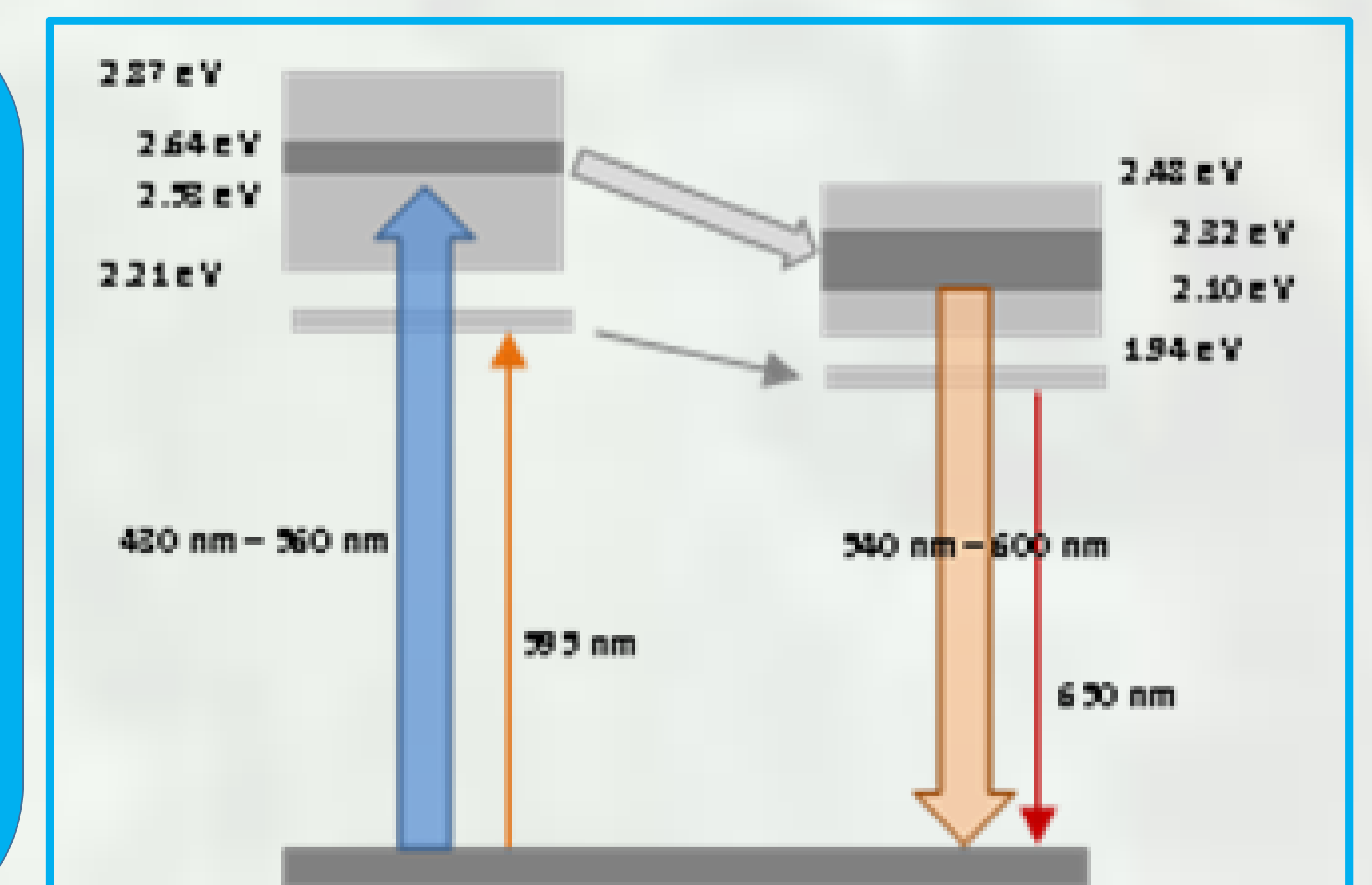
To obtain more detailed information about the chemical composition of the root, extracts with chloroform, hexane, ethyl acetate, and ethanol were prepared and chromatographically examined.

41 chemical compounds were found: carbohydrates, terpenes, carboxylic acids, amino acids, alcohols, vitamins, alkanes, and organic acids in extracts with ethyl acetate and ethanol.

39 components were identified in extracts with chloroform and hexane as belonging to different chemical classes: phenolic and carboxylic acids, alcohols, sterols, terpenes, and vitamins.



For the first time, the fluorescence spectra of the root of *Carlina acanthifolia* All. is observed. The sample was excited with wavelengths from 220 nm to 900 nm. Figures 1, 2, and 3 show the excitation-radiation matrix, the topographical fingerprint, and the energy diagram, respectively. Excitation of the sample with wavelength of 370 nm and the observed emission around 450nm can be associated with flavonoids and phenolic acids with solid antioxidant effect. The presence of vitamin E and fatty acids explains the second peak ($\lambda_{em} = 570$ nm for $\lambda_{exc} = 470$ nm). The former fluorescence maximum according to the data in the literature is explained by the presence of pigments close to those of chlorophyll.



The phytochemical composition of the Bulgarian roots of *Carlina acanthifolia* was determined as a result of extractions with different solvents - hexane, chloroform, ethyl acetate, ethanol, and water. The highest extractable content of total phenols, flavonoids, and derivatives was found in the ethyl acetate fraction. These fractions demonstrate the highest antioxidant potential and the fluorescent properties of the roots are related to them. 3D fluorescence emission spectra of this plant and its topographic view are reported for the first time.