

Metabolite profile of Helixor® A made from fir mistletoe (*Viscum album subsp. abietis*)

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Background

- Viscum album* contains a wide variety of bioactive compounds, such as carbohydrates (mono- and polysaccharides), nitrogen-containing compounds (proteins, peptides, amino acids), polyphenols (flavonoids, phenylpropanoids, other phenolic acids), terpenoids, as well as many other substances and inorganic elements.^{1,2}
- Natural growing fir mistletoe plants, like the other subspecies of *V. album*, have strong seasonal and organ-dependent variations in their metabolic profiles.³
- For the production of the Helixor® mistletoe products, four harvests are traditionally taken (winter, spring, summer, autumn) to comprise mistletoe's whole annual development cycle in the total plant extract.⁴
- Aqueous extracts from fir mistletoe (*Viscum album subsp. abietis*) are used for the production of herbal medicinal products like Helixor® A. Their qualitative and quantitative composition has not yet been described in-depth. The aim of this study was the identification and quantification of main substance classes and major constituents in Helixor® A and to discuss potential differences to the raw material.

Table 1. Quantitate and qualitative composition of substance groups in Helixor® A

Substance groups	µg/ml	%
Carbohydrates	1717	34.3
Organic acids	571	11.4
Nitrogen-containing compounds (proteins, amino acids, RNA, DNA)	481	9.6
Inorganic elements (including plant's sodium and chloride)	466	9.3
Total polyphenols (including flavonoids)	162	3.2
Sulfate	109	2.2
Phosphate	82	1.6
Sum	3588	71.6
Unidentified	1428.6	28.4
Total solid amount	5016.6	100.0

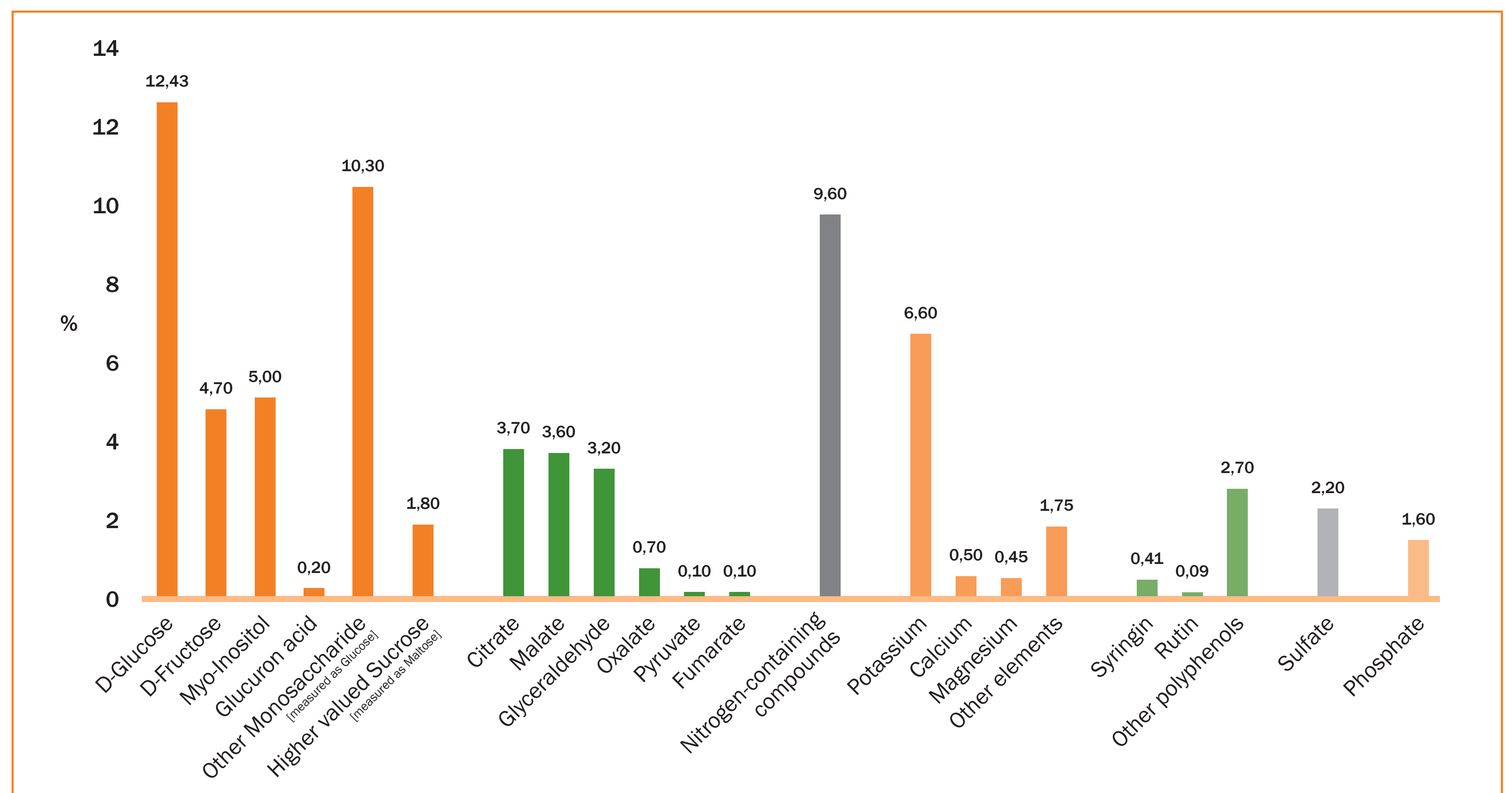
Materials and Methods

- The qualitative and quantitative composition of Helixor® A, based on the dried extract, was determined with approved methods like ICP-MS (inorganic elements), Folin-Ciocalteu method (total polyphenols), HPLC (flavonoids), as well as RP-HPLC with ELS- and UV-detection, HILIC-HPLC with ELS- and UV-detection, GC-MS-screening and TLC by two contract laboratories (Phytolab GmbH & Co. KG, Vestenbergsgreuth, Germany and Phytos-Laboratory for Analytic of pharmaceuticals GmbH & Co. KG, Neu-Ulm, Germany).

Results and Discussion

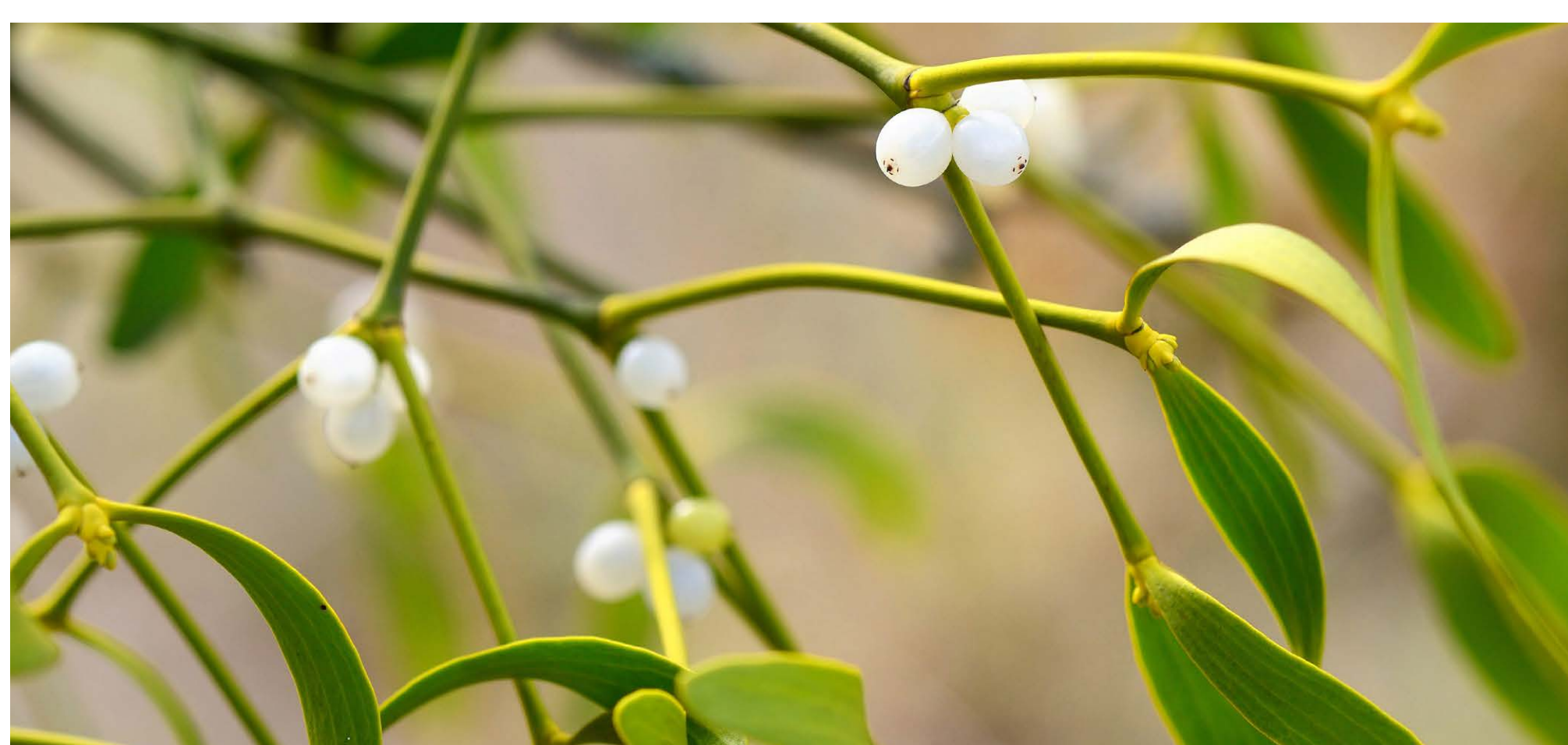
- It can be seen from Table 1 that 71.6 % of the contained substance groups in Helixor® A could be identified as carbohydrates (34.3 %), organic acids (11.4 %), nitrogen-containing compounds (9.6 %) and inorganic elements (7.7 %) being the major substance groups.
- It was shown that the main carbohydrates in Helixor® A are monosaccharides like D-Glucose (12.3 %), Myo-Inositol (5.0 %) and D-Fructose (4.7 %), while citrate (3.7 %), malate (3.6 %) and glyceraldehyde (3.2 %) were found as the major identified organic acids in Helixor® A. Furthermore, potassium (6.6 %) was identified as the main inorganic element in Helixor® A and syringin (0.41 %) was the major flavonoid (Figure 1).
- The details to the percentage of different carbohydrates and nitrogen-containing compounds (proteins) in raw plant material of fir mistletoes vary greatly in available scientific literature. The content of polysaccharides was found to be in the range of 9 – 25 %,³ while the glucose content in fir mistletoe was up to 29 % and inositol stands at a maximum of 21 %.⁵ The content of proteins in fir mistletoe was found to be in the range of 8 – 21 % depending on the season of the year and plant organs.³ The content of major flavonoid syringin in *V. album* was in the range of 0.14 – 0.24 %.⁶

Figure 1. Main identified metabolites and inorganic elements in Helixor® A



Conclusion

Metabolite profile of Helixor® A showed the nature of structurally complex bioactive compounds of medical interest in this unique aqueous extract. The quantity and quality of main substance groups, as well as some of the identified major chemical constituents in Helixor® A mainly correspond to the same parameters found in raw plant material of fir mistletoe, which can be seen as quality feature for Helixor-specific vortex process to produce Helixor mixture.



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