The authors wish to thank professor G. Hägg for his kind interest in the investigation and for the facilities put at our disposal. This work forms part of a research program on oxides and oxide systems financially supported by the Swedish Natural Science Research Council.


Received October 5, 1951.

On the Occurrence of Sedoheptulose in Certain Species and Genera of the Plant Family Saxifragaceae

Arnold Nørdal and Dagrun Østeth

Department of Pharmacognosy, Pharmaceutical Institute of the University of Oslo, Norway

The heptose sedoheptulose (d-altro-heptulose) had, until quite recently, been detected in only a few species and genera of the plant family Crassulaceae, and investigators were of the opinion that where this sugar occurred fermentable sugars were absent.

Nordal and Klevstrand recently demonstrated the presence of both sedoheptulose and fermentable sugars in representatives of all five sub-families of the plant family Crassulaceae.

Benson, Baesham and Calvin identified monophosphate esters of sedoheptulose in Chlorella, Scenedesmus, and Rhodospirillum rubrum, and in the leaves of barley seedlings, soybean, alfalfa, sugar beet, spinach and geranium.

The present authors succeeded in isolating sedoheptulose from the rhizome of Primula elatior (L.) Hill and more recent, unpublished results have shown that the rhizome of Primula vulgaris Huds. also contains sedoheptulose, as does Primula veris (L.) Huds. In the case of the latter plant, extracts from the flowers, leaves and rhizomes were examined separately, and it was found that the aerial portion of the plant, especially the flowers, contained considerable quantities of sedoheptulose, as well as sucrose and fructose. In the rhizome, on the other hand, the latter two sugars predominated and sedoheptulose could hardly be detected. The material was not tested for aldoses.

These results, together with others not yet published, obtained with extracts from representatives of certain other plant families lend credence to our assumption that sedoheptulose is widely distributed in the plant kingdom, and that this sugar plays a far more important part in the metabolism of plants than has been considered hitherto.

The plant family Saxifragaceae gave some of the most encouraging results in our screening investigations, and as this family is closely related to the Crassulaceae, we thought it would be worth while to examine some specimens of the family more closely.

Sedoheptulose was identified by means of paper chromatography in eight of ten species and in general as the chief component of the sugar mixture (cf. Table 1). No sedoheptulose could be detected in Ribes alpinum L. or Saxifraga stellaris L. by the method used.

Fresh plant material which was fixed with boiling alcohol was used in all the analysis, except in the case of Parnassia palustris L. and Saxifraga stellaris L., where the air dried material was extracted with water.

The aqueous extracts were purified by means of ion exchange resins. The alcohol extracts were evaporated and freed from chlorophyll after the addition of water, and then all the extracts were concentra-
Table 1. Sedoheptulose, sucrose, fructose and glucose in certain Saxifragaceaean plants. Where sedoheptulose was the predominating sugar on the chromatograms this is indicated by $(++)$.  

<table>
<thead>
<tr>
<th>Species</th>
<th>Sedoheptulose</th>
<th>Glucose</th>
<th>Fructose</th>
<th>Sucrose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrysocephalum alternifolium L.</td>
<td>$(++)$</td>
<td>(trace)</td>
<td>(trace)</td>
<td>$(++)$</td>
</tr>
<tr>
<td>Parmassia palustris L.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td>Ribes alpinum L.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td>Saxifraga decipiens Ehrh.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td><em>Saxifraga arendsii</em> Engl.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td><em>Saxifraga hypnoides</em> L.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td><em>Saxifraga umbrosa</em> L.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td><em>Saxifraga oicazon</em> Jacq.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td><em>Saxifraga cotyledon</em> L.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
<tr>
<td><em>Saxifraga stellaria</em> L.</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
<td>$(++)$</td>
</tr>
</tbody>
</table>

Crystallographic investigation gave the following data: 

“Rods showing parallel extinction, some rectangular with indices 1.614 and 1.625, some (the majority) acicular and more birefringent with the higher index, approximately 1.640.”

These values are in agreement with the constants which have previously been found for this derivative of sedoheptulose.

Besides sedoheptulose, the sugars sucrose, fructose and glucose were detected in most of the plants examined, in addition to substances with very low $R_f$-values which were not identified. In some cases more or less distinct spots, the colour of which resembled that given by sedoheptulose, appeared on development with orcinol reagent. Some had smaller, others larger $R_f$-values than sedoheptulose. We are at present engaged in identifying these and similar compounds which have appeared in the course of our work on heptoses and heptose derivatives.

The authors are indebted to Amanuensis Dr. Alf Wickström, Department of Pharmaceutical Chemistry, Pharmaceutical Institute of the University of Oslo, for the crystallographic measurements.

8. La Forge, F. B., and Hudson, C. S. J. Biol. Chem. 30 (1917) 72.

Received December 1, 1951.