temperature modification of tantalum pentoxide.

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

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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 [1].

Nordal and Klevstrand [2, 3] recently demonstrated the presence of both sedoheptulose and fermentable sugars in representatives of all the five sub-families of the plant family *Crassulaceae*.

Benson, Bassham and Calvin [4] 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authors succeeded in isolating sedoheptulose from the rhizome of *Primula elatior* (L.) Hill.[5] and more recent, unpublished results have shown that the rhizome of *Primula vulgaris* Huds.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 Saxifragaceaen plants. Where sedoheptulose was the predominating sugar on the chromatograms this is indicated by (++).

Species	Sedo-heptulose	Glucose	Fructose	Sucrose
Chrysosplenium alternifolium L.	++	–	(trace)	(trace)
Parnassia palustris L.	++	+	+	+
Ribes alpinum L.	–		+	+
Saxifraga decipiens Ehrh.	++	+	+	+
×*Saxifraga arendsii* Engl.	++	+	+	+
Saxifraga hypnoides L.	++	+	+	+
Saxifraga umbrosa L.	+	+	+	+
Saxifraga aizoon Jacq.	+	+	+	+
Saxifraga cotyledon L.	+	+	+	+
Saxifraga stellaris L.	–		+	+

ted at temperatures not exceeding 40°, and subjected to paper chromatographic examination.

Ethyl acetate – acetic acid – water [6] was used as solvent, and the chromatograms were run for about forty eight hours, concurrently with pure sedoheptulose, fructose, sucrose and glucose. For detection of the ketoses, orcinol-trichloroacetic acid reagent [7] was used. This reagent gives a brownish green colour with fructose and sucrose, and a bluish green colour with sedoheptulose. The latter colour is very stable and characteristic, and we are of opinion that, in conjunction with the position of the spot on the chromatogram, this gives sufficient certainty to the identification. For the identification of glucose we used *m*-phenylenediamine hydrochloride.

In order to isolate and characterize the sugar, a sirup was prepared from fixed *Chrysosplenium alternifolium* L., and purified by ion exchange. The dibenzylidene derivative of sedoheptulosan [8] was prepared from 1.5 g of the sirup: m.p. (micro) 244–245°.

Crystallographic investigation gave the following data [9]:

"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 sedoheptulosan.

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.

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