

RUTIN IN SOME CULTIVATED PLANTS

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One of us has established previously that rutin may accumulate in considerable amounts in the buds of the Japanese pagoda tree (*Sophora japonica*) (26%) and in the flowers of border forsythia (*Forsythia intermedia*) and Chinese forsythia (*F. suspensa*) (6 and 5%, respectively) [1, 2, 4]. A large amount of rutin has also been found in the wild pansy (*Viola tricolor*) [3], and some varieties of dahlias and tulips. Later, Polish workers found a large amount of rutin in garden forms of *V. tricolor* [11]. In the present communication we give the results of a quantitative determination of rutin in various varieties of pansy (*Viola tricolor* L. var. *maxima*) and potato (*Solanum tuberosum* L.) cultivated in the Northern Caucasus.

In view of the fact that at the present time various isomers of rutin [5] have been described [5-9], in each individual case we separated the glycoside and studied its physicochemical properties. To isolate rutin from the pansies, the freshly gathered flowers were extracted three times with acetone, the extracts were concentrated to half-volume, and benzene was added until phase separation had been achieved. At the boundary of separation a precipitate of flavonoids was formed, from which rutin was isolated by a fractional crystallization or by chromatography on Kapron. The isolation of rutin from the epigeal part of the potato (flowers or leaves) was performed by extraction with 96% ethanol. In all cases the compound obtained corresponded to the rutin isolated from the Japanese pagoda tree.

The melting points of our samples of rutin were 182-189°C and 186-191°C, the melting points of the acetates 124.5-125.5°C, λ_{\max} 362, 256 nm; $[\alpha]_D^{20}$ -34, -39°. Acid hydrolysis with 0.5% H₂SO₄ for 1 h gave rutinose and an aglycone identical with quercetin. The melting point of the aglycone was 310-314°C, λ_{\max} 375, 256 nm. Alkaline degradation of the aglycone gave phloroglucinol and protocatechuic acid; hydrolysis of separate samples of rutin with more concentrated acids yielded quercetin, glucose, and rhamnose. According to UV-spectroscopic analysis with ionizing and complex-forming additives, the rutinose was present at C₃. Mixtures of the individual samples of rutin with an authentic sample of rutin (or the rutin from *Sophora*) showed no depression of the melting point.

Quantitative determination was performed by photolorimetric and spectrophotometric methods [3, 4, 10]. The greatest amount of rutin (10-20%) was found in the white and yellow leaves of the pansy [the varieties Aiskening, Jol'dkraun (Gold Crown), Vinterzonne, and some others] and the smallest amounts in the petals with a blue or violet coloration (7-8% and 2-3%, respectively).

In the flowers of the potato plant, the amount of rutin was 5-10%. In 1972, a dry year, we observed an increase in the amount of rutin in the flowers to 16%, and the total amount of flavonoids reached 33%. The smallest amount of rutin was found in the tops of the potato plants before the beginning of budding (about 2%). In the budding phase it rose by a factor of about 1.5, and it fell again in the flowering phase. The amount of rutin in the leaves was 1.5 times that in the stems. The variety richest in rutin was Rannyaya roza [early pink], cultivated in the foothill regions of the Northern Caucasus. Thus, the petals of the varieties of pansy mentioned and potato stems can be used as sources of rutin.

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