Chemical analysis of the pollen of plum varieties

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Summary: The chemical composition, amino acids and carbohydrates, of the pollen has been analysed in varieties grown in Hungary during the years 1993 at Kecskemét and 1995 at Cegléd and Pomáz. The distinction of 17 amino acids and 7 carbohydrates has been achieved. The aim of the study was to find criteria for the distinction of varieties.
The total content of amino acids varied between 15.53 and 20.54 %. The highest ratios represented the asparagine and the glutamine acids. The relative content in other amino acids was between 2 and 7 % of the total. The less frequent were cysteine and valine.

Introduction

There are but a few papers dealing with the chemical composition of pollen. Some attempts aimed to explore the relation between the viability and the content of particular components being allegedly in causal relation *(Dzamic & Pejkic* 1970). The latter authors stated very large (11 to 26 fold) differences in the content of individual components as sugars and less pronounced but consistent differences in amino acids between two quince varieties.

The content of mineral elements detected by using energy dispersive detector (EDS) or X-ray analysis of fruit species is another line of research. It was particularly combined with the use of LM (light microscope) and SEM (scanning electron microscope) by *Bucsek, Nyéki, Szabó & Kádár* (1996). With this advanced method quantitative measurement of the elements Mg, P, S, Cl, K and Ca in individual pollen grains was possible.

As plums of the moderate climate belong to different species having diploid and hexaploid chromosome numbers, moreover, male sterile varieties are also represented, it was postulated that the composition of the pollen should reflect also some of that diversity.

Material and methods

For the purpose of analysis, pollen samples of plum varieties were taken at Kecskemét and also at other growing sites in 1993, 1995 and 1996 from flower buds just before blooming. Among the total of 16 samples 4 are diploid (Prunus salicina and its hybrids), 12 are European plums (P. domestica), two of them being male sterile varieties.

Samples were air dried and stored for being processed in the chemical laboratory of the Pannon Agricultural University, Magyaróvár, Department of Animal Husbandry. Pollen samples were hydrolysed in 6 M hydrochloric acid by increasing doses of energy from 250 W to 650 W in four progressive steps for 1 and 5 minute periods in a MLS 1200 Standard Microwave Digestion System, altogether for 17 minutes. Hydrolysed samples were transferred to a column chromatograph on Variochrom-9 resin filling, and the amino acids were determined in an Aminochrom-II analyser. Altogether 17 amino acids appeared distinctly, triptophane has not been considered.

For carbohydrates, the pollen samples were rubbed in 50 % alcohol, warmed at 60° C for 30 minutes, distilled, passed through membrane filters, repeatedly, For identification of components HPLC of Biotronic-2000 type was applied. Separation was achieved on a 250x4 mm Aminex HPX-87 C column. The solvent was a mixture of acetonitril-water (80:20).

On the other hand, subsamples of the same samples served for the EDS (Energy Dispersive Detector) analysis of mineral elements performed at the 2nd Dept. of Pathology, Semmelweis University, Budapest. Methodical details are presented by *Bucsek* (1994).

Results

1. Amino acids

The total content of amino acids was rather variable, but the ratio of the individual acids was similar not only in different species and varieties of plums but also in the whole genus of cultivated Prunus and pome fruits studied during this time, however, on the other hand, some seemingly consistent patterns showed up even between varieties or growing sites. In looking for differences in plums, first of all, the difference between the diploid (*P. salicina* hybrids) and hexaploid (*P. domestica*) varieties deserves attention. The difference, however, was not large enough and the values of variance were too high as to prove significance (*Table 1*). Individual samples, however, produced deviating data in Asparagine, especially, as the most abundant component of amino acids. In 1995 e.g. *Debreceni muskotály* and *Italian plum* showed extremely low values in Asparagine. As far as additional proofs are lacking we have to leave the question unsolved.

Table 1 Amino acids found in the pollen of different plum varieties

Amino acids	European plums (hexaploids)	Japanese plums (diploids)	Male sterile cv.-s (Tuleu gras & timp.)
Asp	3.35	3.47	4.57
Thr	0.77	0.55	0.60
Ser	0.82	0.60	0.54
Glu	2.53	1.72	1.56
Pro	2.09	1.53	0.76
Gly	0.92	0.88	0.80
Ala	1.19	0.98	0.86
Cys	0.22	0.15	0.12
Val	1.09	0.67	1.07
Met	0.25	0.16	0.13
Ile	0.86	0.53	0.94
Leu	1.50	1.01	1.25
Tyr	0.55	0.43	0.36
Phe	0.98	0.72	0.75
Lys	1.14	0.84	1.10
His	0.56	0.47	0.66
Arg	1.06	0.85	0.59

2. Carbohydrates

The total of carbohydrates and the five components were measured. Arabinose and Maltose were not found, except traces of the former in one sample. The low carbohydrate content of the male sterile varieties was convincing, thus starving of the pollen of male sterile varieties seems to find its explanation in those data. Low carbohydrate is mainly due to the low Fructose content, being the predominant component, in contrast to the pollen of apricots and peaches, which showed at least as much Glucose and/or Sacharose as Fructose. The ploidy level itself does not seem to influence the carbohydrate content (*Table 2*).

Table 2 Carbohydrate content in the pollen of different plums

Components	European plums	Japanese plums	Male sterile varietie
Xylose	0.16	0.48	0.56
Fructose	4.38	3.89	0.64
Glucose	1.43	1.11	0
Mannite	0.58	0.12	0.64
Sacharose	0.09	0.31	0.37
Total	6.66	5.91	2.20

3. Mineral elements

As for the mineral composition, two European and one Japanese plum variety was explored. Varietal differences were little and the comparison to other fruits did not indicate any peculiarity in the six elements (Mg, P, S, Cl, K, Ca). Plums and Japanese plums were similar except in Ca, and a comparison is possible between pollen of cherries and of the other fruit species in Bucsek et al 1996 (pages 335 and 336).

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