

Patulin accumulation in Croatian traditional apple cultivars



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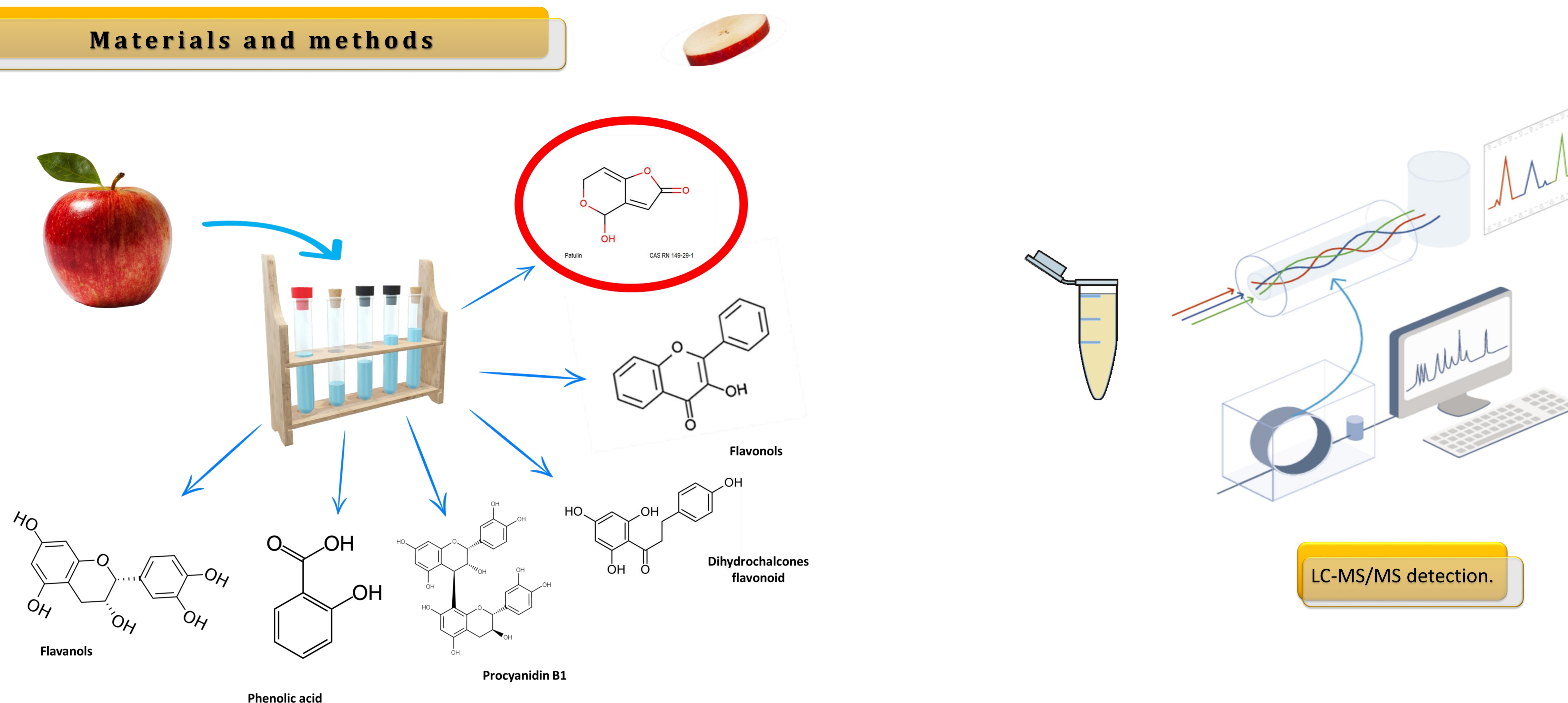
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Introduction

Penicillium expansum is the most common mold which invades wounded apples, causing blue mold decay and ensuring the production of patulin, a mycotoxin that could lead to acute subacute, and chronic toxic problems. Therefore, European Commission set strict limitations on the residual concentration of patulin in solid apples to 25 µg/kg by Commission Regulation No. 1881/2006. For this reason, the resistance of Croatian traditional apple cultivars was investigated by assessing the accumulation of patulin in *Penicillium expansum*-infected apples stored at room temperature and its relationship with the polyphenol profile of seven different Croatian traditional apple cultivars. For the research, 1 cm thick apple slices were sterilized and inoculated by 168 hours old *P. expansum* (CBS 325.48) disc grown on potato dextrose agar in Petri's dish at 29°C. Inoculated apple samples were incubated at 29°C until the *P. expansum* colony reaches the edge of the apple slice. Polyphenol profile was determined by high-performance liquid chromatography with diode-array detector. After incubation, patulin was detected in four apple cultivars, 'Ivandija', 'Srčika', 'Šampanjka' and 'Božičnica' in amounts of 35.75; 19.35; 18.70 and 18.40 µg/kg, respectively. Patulin content was negatively correlated with procyanidin B1 ($r=-0.652$, $p\leq 0.005$), 4-hydroxycinnamic acid ($r=-0.643$, $p\leq 0.005$) and procyanidin A2 ($r=-0.614$, $p\leq 0.005$). These results suggesting the protective effect of named polyphenols on patulin accumulation in apples. In investigated Croatian traditional apple cultivars, except in 'Ivandija', detected levels of patulin were below limitations (25 µg/kg) set by European Commission for solid apples.

Materials and methods



Results

Table 1. The amount of individual polyphenols in apples

	Catechin	Procyanidine B2	Procyanidine A2	Epicatechin	4-Hydroxycinnamic acid	2,6-dimethoxybenzoic acid	Procyanidine B1	Procyanidine derivate	Chlorogenic acid	Procyanidine derivate	Phloridzin	Myricetin	Quercetin 3-β-D-glucoside	Quercetin-3-rutinoside	Quercetine	Phloretin
PARADIJA	69.27 ± 1.02	159.23 ± 4.08	55.11 ± 1.75	208.5 ± 1.85	36.11 ± 0.35	235.42 ± 9.7	39.52 ± 1.14	28.3 ± 1.84	544.23 ± 1.87	346.27 ± 5.83	71.69 ± 3.57	23.01 ± 0.87	12 ± 0.33	16.26 ± 0.58	13.07 ± 0.36	17.07 ± 0.81
SRČIKA	46.89 ± 0.72	250.12 ± 2.93	18.53 ± 1.1	178.84 ± 1.77	39.16 ± 4.41	133.1 ± 8.63	30.48 ± 0.48	28.3 ± 0.4	1585.07 ± 23.52	974.35 ± 23.44	117.75 ± 2.06	54.68 ± 2.44	39.26 ± 2.76	41.65 ± 0.93	38 ± 1.23	48.23 ± 0.77
MAŠANKA	46.38 ± 0.99	132.93 ± 4.67	38.4 ± 1.96	118.87 ± 1.64	8.1 ± 1.62	93.39 ± 8.62	38.19 ± 2.04	29.2 ± 0.69	929.77 ± 17.46	953.07 ± 11.68	63.76 ± 1.98	11.83 ± 0.79	10.71 ± 0.87	12.55 ± 0.68	17.23 ± 1.06	19.04 ± 1.71
KANADA	67.55 ± 2.73	216.5 ± 2.06	42.55 ± 2.62	200.57 ± 1.2	54.59 ± 1.36	352.8 ± 25.55	32.96 ± 1.26	39.3 ± 2.22	1233.64 ± 11.22	281.37 ± 2.67	98.86 ± 0.16	32.22 ± 0.07	22.88 ± 2.43	24.31 ± 1.1	14.82 ± 1.18	19.89 ± 0.41
BOŽIČNICA	114.89 ± 2.6	118.47 ± 2.57	50.02 ± 2.22	229.81 ± 5.97	53.86 ± 2.09	111.09 ± 9.17	38.55 ± 1	41.63 ± 1.78	3028.78 ± 34.17	816.42 ± 34.72	77.2 ± 0.05	33.87 ± 0.25	11.39 ± 1.08	12.2 ± 1.43	18.92 ± 2.38	11.68 ± 0.8
IVANDIJA	36.94 ± 1.68	90.64 ± 3.55	19.54 ± 1.05	104.08 ± 1.48	36.64 ± 1.94	71.05 ± 5.64	28.83 ± 0.66	31.76 ± 2.66	1258.83 ± 17	693.84 ± 4.39	110.23 ± 0.7	30.22 ± 1.5	19.12 ± 2.99	20.81 ± 0.58	17.38 ± 1.21	26.39 ± 5.94
ŠAMPANJKA	50.42 ± 1.36	169.83 ± 2.03	45.46 ± 1.28	201.09 ± 5.36	30.04 ± 1.3	130.61 ± 1.71	34.76 ± 0.77	30.76 ± 0.28	1238.73 ± 39.28	874.92 ± 28.49	25.91 ± 1.14	8.19 ± 0.26	14.53 ± 0.61	9.16 ± 0.27	13.07 ± 0.36	11.66 ± 0.64

Table 1. The amount of patulin in apples

	Patulin (µg/kg)
Srčika ¹	19.35 ± 2.19
Ivandija	35.75 ± 0.35
Šampanjka	18.7 ± 2.82
Paradija 2 ¹	0
Kanada	0
Božičnica	18.4 ± 0.28
Mašenka	0

Conclusion

Patulin content was negatively correlated with procyanidin B1 ($r=-0.652$, $p\leq 0.005$), 4-hydroxycinnamic acid ($r=-0.643$, $p\leq 0.005$) and procyanidin A2 ($r=-0.614$, $p\leq 0.005$). These results suggesting the protective effect of named polyphenols on patulin accumulation in apples. In investigated Croatian traditional apple cultivars, except in 'Ivandija', detected levels of patulin were below limitations (25 µg/kg) set by European Commission for solid apples.