Some herbal teas contain **prohibited pesticides** and some residues **exceed EU limits**.

Pesticide residues in peppermint, chamomile and bladder herbal teas sold in Estonia.

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INTRO

- The aim of this study was to determine pesticide residues in commercially sold peppermint, chamomile and bladder tea herbs.
- All samples – 11 peppermint, 12 chamomile and 6 bladder teas – were bought from local pharmacies, ecomarkets and supermarkets to include as many producers possible at given time.

METHODS

1. Peppermint and chamomile tea samples were prepared by extraction with organic solvent followed by silica gel cleaning columns. Internal standards (isotope labelled pesticides) were added before sample preparation. Internal standard calibration was used.
2. The chamomile samples in repeated analysis and bladder tea samples were prepared by standard method: „Foods of plant origin - Determination of pesticide residues using GC-MS and/or LC-MS/MS following acetonitrile extraction/partitioning and clean-up by dispersive SPE - QuEChERS-method EN 15662“.
3. The analysis was carried out with Agilent Technologies 7890B gas chromatography and Agilent Technologies 5977A mass-selective detector. Confirmatory analysis was carried out with Agilent Technologies 7890B gas chromatography and Agilent Technologies 7000 triple quadrupole mass-selective detector.
4. The qualitative analysis was carried out with Agilent MassHunter Qualitative Analysis B.07.00 and quantitative analysis with Agilent MassHunter Quantitative Analysis B.07.00 programs.
5. The pesticides were selected based on EU Pesticide Database and Statistics Estonia Database.

RESULTS

- Residues of 21 pesticides were detected in 18 samples.
- 8 samples consisted pesticide residues in amounts exceeding allowed limits.
- 11 of the pesticides found in samples are prohibited in EU and member states, one of the pesticides (Quinoxyfen) found in Estonian product has no authorisation in Estonia.
- No pesticide residues were found in 5 chamomile teas, 3 peppermint teas and 3 bladder teas.
- The tea with most residues – 13 different pesticides - was not produced in EU.

DISCUSSION

- The origin of pesticide residues in herbal teas is unclear, but the amounts are mostly in trace levels and therefore pose no substantial risk for consumers health.
- Some herbal teas exceeded EU limits for pesticides and should be avoided.
- It was not assessed how much of the residues end up in infusions, but the amounts are propably in trace levels.

Herbal teas and found pesticide residues above limit of detection (LOD).

Sample		Pesticide	Quant. Value (mg/kg)	LOQ (mg/kg)	MRL (mg/kg)
Peppermint teas (supermarkets)	MIĘTA herbatka ziołowa (PL)	Dichlofluanid**	0,03	0,01	0,01
		Fenpropimorph*	<0,01	0,01	0,05
	Piparmünditee (PL)	Dichlofluanid**	<0,01	0,01	0,01
		Fenpropimorph	<0,01	0,01	0,05
		Tolylfluanid**	<0,01	0,01	0,1
	Piparminttu Tee (DE)	Fenpropidin	<0,01	0,01	0,05
	Pfefferminze (DE)	Tolylfluanid**	0,29	0,01	0,1
	Peppermint tea (?)	Tolylfluanid**	0,15	0,01	0,1
Peppermint teas (pharmacies)	Elujõu (EE)	Tebuconazole	<0,01	0,01	0,05
	Loodusravi (EE)	Tolylfluanid**	0,23	0,01	0,1
	Vadi (EE)	Tolylfluanid**	<0,01	0,01	0,1
Camomile teas (supermarkets)	Dilmah (LKA)	Tebuconazole	<0,01	0,01	0,05
	Greenfield (RU)	Dichlofluanid**	<0,01	0,01	0,01
		Tebuconazole	<0,01	0,01	0,05
	Herba (DE)	Tebuconazole	<0,01	0,01	0,05
	Rimi (LV)	Boscalid	<0,005	0,005	0,01
Camomile teas (pharmacies)	MK Loodusravi (EE)	Tebuconazole	<0,01	0,01	0,05
		Boscalid	<0,005	0,005	0,01
	Elujõud OÜ (EE)	Quinoxyfen***	0,098	0,01	0,05
		Chlorothalonil*	<0,01	0,01	0,01
	Kubja Ürditalu (EE)	Fenpropidin	<0,01	0,01	0,05
Bladder teas (pharmacies)	Kubja Ürditalu (EE)	Metolachlor**	0,006	0,005	0,01
	MK Loodusravi (EE)	Pirimiphos-methyl	0,057	0,01	0,05
		Pentachlorobenzene**	<0,001	0,001	0,01
		Hexachlorobenzene**	<0,001	0,001	0,01
Bladder teas (ecomarkets)	Chinese Medicine Centre - Tervise Alkeemia (?)	Tebuconazole	0,18	0,01	0,05
		Chlorotoluron	<0,01	0,01	0,05
		Dichlobenil**	<0,01	0,01	0,05
		Dimethenamid**	<0,01	0,01	0,05
		Epoxiconazole	<0,01	0,01	0,05
		Fenpropimorph*	<0,01	0,01	0,05
		Fenvalerate**	<0,05	0,05	0,1
		α-Hexachlorocyclohexane **	<0,005	0,005	0,01
		γ-Hexachlorocyclohexane **	<0,005	0,005	0,01
		δ-Hexachlorocyclohexane**	<0,005	0,005	0,01
		o,p´-DDE**	<0,005	0,005	0,01
		Pentachlorobenzene	<0,001	0,001	0,01
		p,p´-DDE**	<0,005	0,005	0,01
		Prothioconazole-desthio	<0,01	0,01	0,05

* Not Approved in EU, limited use in member states
** Prohibited in EU and member states
*** Not Approved in EU, limited use in member states, withdrawal authorisations by 20 Nov 2019
**** Not Approved in EU, limited use in member states, withdrawal authorisations by 27 Jun 2019

GC-MS and GC-MS/MS analysis m/z values and reference substance origins

Pesticide	Reference substance origin	m/z in GC-MS analysis		m/z transitions in GC-MS/MS analysis	
		Quantitative ion	Qualitative ion	Quantit. MRM transition	Qualit. MRM transition
Boscalid	Sigma -Aldrich	140	112	140,0→112,0	140,0→76,0
Chlorotalonil	Sigma -Aldrich	266	264	263,8→ 229,0	263,8→ 168
Chlorotoluron	Sigma -Aldrich	-	-	167,0→132,0	132,0→77,1
Dichlobenil	Sigma-Aldrich	-	-	171,0→100,0	171,0→136,1
Dichlofluanid	Fluka	123	167	223,9→ 123,1	123,0→ 77,1
Dimethenamid	Sigma-Aldrich	-	-	230,1→154,0	232,1→154,0
Epoxiconazole	Sigma-Aldrich	192	138	192,0→138,1	192,0→111,0
Fenpropidin	Dr Ehrenstorfer	98	145	98,0 →55,1	98,0→70,0
Fenpropimorph	Sigma-Aldrich	128	43	128,1→70,1	128,1→110,1
Fenvalerate	Sigma-Aldrich	-	-	167,0→125,0	197,1→115,2
Hexachlorobenzene	Dr Ehrenstorfer	-	-	283,8→213,9	283,8→248,8
α-Hexachlorocyclohexane	Dr Ehrenstorfer	-	-	216,9→181,0	218,9→183,0
γ-Hexachlorocyclohexane	Dr Ehrenstorfer	-	-	216,9→181,0	181,0→145,0
δ-Hexachlorocyclohexane	Dr Ehrenstorfer	-	-	217,0→181,1	181,0→145,0
Metolachlor	Sigma-Aldrich	-	-	238,0→162,2	162,2→133,2
Pentachlorobenzene	Neochema	-	-	249,9→215,0	248,0→213,0
Pirimiphos-methyl	Sigma-Aldrich	-	-	290,0→125,0	290,0→151,0
Propiconazole	Dr Ehrenstorfer	173	259	173,0→145,0	259,0→69,0
Quinoxyfen	Sigma-Aldrich	237	272	237,0→208,0	271,9→237,1
Tebuconazole	Sigma-Aldrich	125	250	250,0→125,0	252,0→127,0
Tolylfluanid	Fluka	137	238	237,9→137,0	136,9→91,1
o,p´-DDE	Dr Ehrenstorfer	-	-	246,0→176,2	248,0→176,2
p,p´-DDE	Dr Ehrenstorfer	-	-	246,1→176,2	315,8→246,0

1 Tallinn Health Care College
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2 Estonian Environmental Research Centre
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