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PRESENCE OF PESTICIDE RESIDUES IN DIFFERENT TYPES OF FRUITS AND VEGETABLES ORIGINATED FROM THE REPUBLIC OF MACEDONIA

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Introduction

Most fruits and vegetables are treated with pesticides on several occasions during the growing season. Pesticides enable farmers to produce some fruits and vegetables in areas that otherwise would not be suitable, increase their yields, preserve product quality, and extend shelf life. Without pesticides, commercial fruits and vegetables production would not be economically viable in many regions of the world.
The Republic of Macedonia is an agricultural developing country with a large production of different types of vegetables and fruits in open fields as well in greenhouses. In order to apply a National Monitoring Programme for pesticide residues control according to the recommendation of European Food Safety Authority (EFSA), the Macedonian Food Agency conducted a study on the determination of pesticide residues. The aim of this study is to investigate the occurrence and concentrations of pesticide residues in some fresh and processed vegetables and fruits from domestic producers.

Material and methods

The sampling was focused at the markets, as the end point of the food production chain. From September 2012 to June 2013, a total of 168 samples of different fresh vegetables and fruits (tomato, paprika, cucumber, potato, onion, carrot and cabbage, apple, acid cherry, table grapes and wine grapes) and processed vegetables and fruits (pasteurized paprika, ketchup, jams and canned fruits) were tested to detect the presence of residues of the 33 pesticides above indicated. Samples were taken from markets located in the regions of the country. All samples were produced in the Republic of Macedonia. Blank samples of cabbage, tomatoes and grapes were purchased from a local organic producer. These blank samples were used for preparation of matrix blanks and matrix-matched calibration standards.
The QuEChERS procedure was used for sample preparation, except for dithiocarabamates and gas chromatography – mass spectrometry (GC-MS) and liquid chromatography – tandem mass spectrometry (LC-MS/MS) techniques were applied for pesticide residues identification and determination.

Results

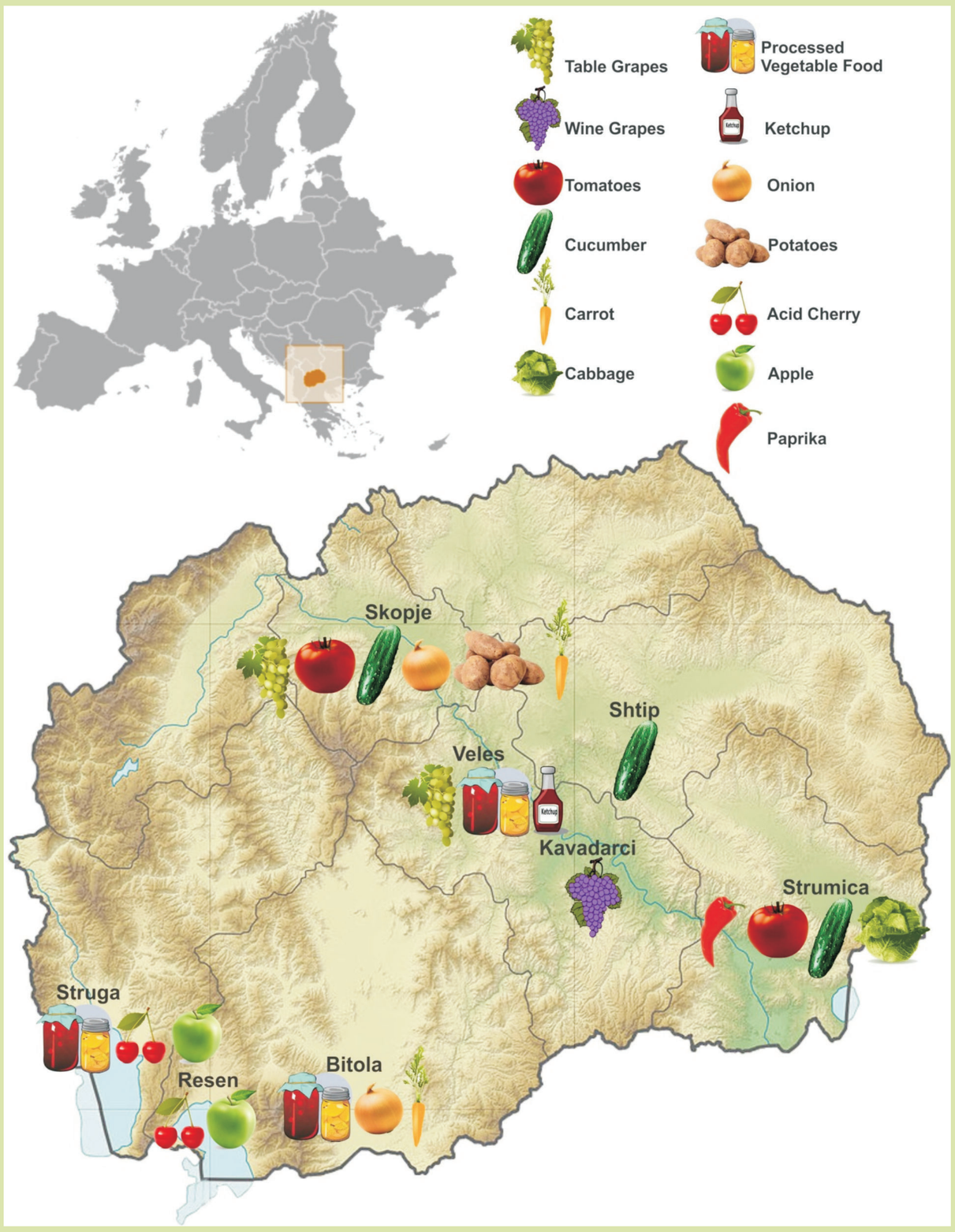

Figure 1. Regions of food sampling

Results

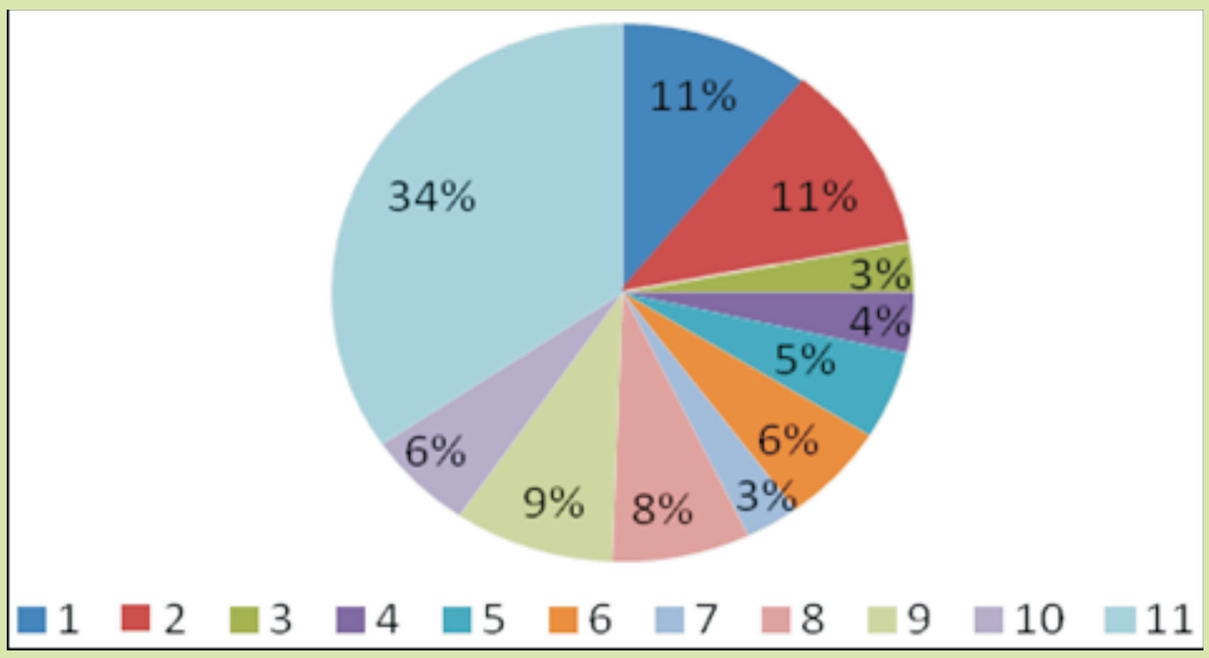

Figure 2. The percentage (%) of each food commodity (total of 168) included in the 2012-2013 study (1-cucumbers; 2-grapes; 3-tomatoes; 4-carrots; 5-potatoes; 6-acid cherries; 7-apples; 8-onion; 9-paprika;10-cabbage; 11-processed vegetables and fruits)

Pesticide	Number of positive samples (n)	Range (mg/kg)	Mean ± SD (mg/kg)	MRL (mg/kg)
Boscalid	3	0.04-0.09	0.067 ±0.025	3
Chlorpyrifos	3	0.021-0.04	0.030 ± 0.01	0.05
Cyprodinil	3	0.05-0.32	0.168 ± 0.138	0.5
Fenhexamid	3	0.035-0.09	0.059 ± 0.028	1.0
Imidacloprid	6	0.017-0.036	0.024 ± 0.008	1.0
Metalaxyl and Metalaxyl M (sum of isomers)	6	0.04-0.16	0.073 ± 0.044	0.5
Methomyl and Thiodicarb (sum of isomers expressed as Methomyl)	7	0.015-0.21	0.058 ± 0.049	0.02
Tebuconazole	3	0.023-0.05	0.034 ± 0.014	0.5

Table 1. Pesticides residues found in cucumbers

Pesticide	Number of positive samples (n)	Range (mg/kg)	Mean ± SD (mg/kg)	MRL (mg/kg)
Boscalid	4	0.06-0.12	0.092 ±0.027	5
Cyprodinil	3	0.014-0.018	0.017± 0.003	5
Metalaxyl and Metalaxyl M (sum of isomers)	3	0.067-0.010	0.082 ±0.017	2

Table 2. Pesticides residues found in grapes

Discussion

Crops with no detectable pesticide residues were: onion, potato, paprika, cabbage and acid cherry. In our study, 58 samples of processed vegetables: fried and pasteurized paprika (25), ketchup (12); processed fruits: processed fruits: plum jams (11) and canned apricots (10), were tested on the presence of 33 pesticide residues. No pesticide residues were detected in any of the samples of processed vegetables and fruits. This could be due to the pesticide degradation during the processing of the crops.
The results of the investigations showed that in 79.76% of the surveillance samples (vegetables, fruits and processed vegetables and fruits) no pesticide residues could be detected. 20.24% of the samples had residues under or at the (MRL) [18]. Only 2 samples (1.19% of the total samples) contained one pesticide above the MRL (methomyl in cucumber, and chlorpyrifos in carrot) and were therefore considered to be not-compliant.

Conclusion

The results of the current study showed that the 98.8% of the samples that were found to contain residues well below the relevant MRLs. Our investigations showed that cucumber contained the highest number of pesticides residues with a predominance of methomyl. The other pesticide residues found in cucumber samples were boscalid, chlorpyrifos, cyprodinil, fenhexamid, imidacloprid, metalaxyl and tebuconazole. Table grapes showed a predominance of boscalid residues, but all were below the MRL. Only two samples (1.19% of the total samples) contained one pesticide residue above the MRL (methomyl in cucumber, and chlorpyrifos in carrot). No pesticide residues were detected in any of the samples of processed vegetables and fruits.